ESL-TR-09-12-02

ENERGY EFFICIENCY/RENEWABLE ENERGY IMPACT IN THE TEXAS EMISSIONS REDUCTION PLAN (TERP)

VOLUME II—TECHNICAL REPORT

Annual Report to the
Texas Commission on Environmental Quality
January 2008-December 2008

TCEQ

Jeff Haberl, Ph.D., P.E.; Charles Culp, Ph.D., P.E.
Bahman Yazdani, P.E.; Don Gilman, P.E.
Shirley Muns, C.B.O
Zi Liu, Ph.D., Juan-Carlos Baltazar-Cervantes, Ph.D.,
Jaya Mukhopadhyay, Larry Degelman, P.E., David Claridge, Ph.D., P.E.

December 2009

ENERGY SYSTEMS LABORATORY

Texas Engineering Experiment Station
Texas A&M University System

ENERGY SYSTEMS LABORATORY
Texas Engineering Experiment Station
Texas A&M University System
3581 TAMU
College Station, Texas 77843-3581

December 18, 2009

Chairman Bryan W. Shaw
Texas Council on Environmental Quality
P. O. Box 13087
Austin, TX 78711-3087

Dear Chairman Shaw:

The Energy Systems Laboratory (Laboratory) at the Texas Engineering Experiment Station of the Texas A&M University System is pleased to provide its seventh annual report, "Energy Efficiency/Renewable Energy Impact in the Texas Emissions Reduction Plan (TERP)," as required under Texas Health and Safety Code Ann. § 388.003 (e), Vernon Supp. 2002 (Senate Bill 5, 77R as amended 78 R & 78S).

The Laboratory is required to annually report the energy savings from statewide adoption of the Texas Building Energy Performance Standards in Senate Bill 5 (SB 5), as amended, and the relative impact of proposed local energy code amendments in the Texas non-attainment and near-non-attainment counties as part of the Texas Emissions Reduction Plan (TERP).

Please contact me at (979) 845-1280 should you or any of the TCEQ staff have any questions concerning this report or any of the work presently being done to quantify emissions reduction from energy efficiency and renewable energy measures as a result of the TERP implementation.

Sincerely,

David E. Claridge

David E. Claridge, Ph.D., P.E.
Director

Enclosure

cc: Commissioner Carlos Rubinstein
Commissioner Buddy Garcia
Executive Director Mark Vickery

Disclaimer

This report is provided by the Texas Engineering Experiment Station (TEES) as required under Section 388.003 (e) of the Texas Health and Safety Code and is distributed for purposes of public information. The information provided in this report is intended to be the best available information at the time of publication. TEES makes no claim or warranty, express or implied, that the report or data herein is necessarily error-free. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not constitute or imply its endorsement, recommendation, or favoring by the Energy Systems Laboratory or any of its employees. The views and opinions of authors expressed herein do not necessarily state or reflect those of the Texas Engineering Experiment Station or the Energy Systems Laboratory.

VOLUME II – TECHNICAL REPORT

Energy Efficiency / Renewable Energy Impact
In The Texas Emissions Reduction Plan

1 EXECUTIVE SUMMARY

The Energy Systems Laboratory (Laboratory), at the Texas Engineering Experiment Station of the Texas A&M University System, in fulfillment of its responsibilities under Texas Health and Safety Code Ann. § 388.003 (e), Vernon Supp. 2002, submits its seventh annual report, Energy Efficiency/Renewable Energy (EE/RE) Impact in the Texas Emissions Reduction Plan to the Texas Commission on Environmental Quality.

The report is organized in three volumes.

- Volume I – Summary Report – provides an executive summary and overview;
- Volume II – Technical Report – provides a detailed report of activities, methodologies and findings;
- Volume III – Technical Appendix – contains detailed data from simulations for each of the counties included in the analysis.

Accomplishments:

1. Energy Code Amendments

The Laboratory was requested by several Council of Governments (COGs) and municipalities to analyze the stringency of several proposed residential and commercial energy code amendments, including: the 2003 and 2006 IECC and the ASHRAE Standards 90.1-2001 and 90.1-2004. Results of the analysis are included in the Volume II—Technical Report.

2. Technical Assistance

The Laboratory provided technical assistance to the TCEQ, PUCT, SECO, ERCOT, and several political subdivisions, as well as Stakeholders participating in improving the compliance of the Texas Building Energy Performance Standards (TBEPS). The Laboratory also worked closely with the TCEQ to refine the integrated NOx emissions reduction calculation procedures that provide the TCEQ with a standardized, creditable NOx emissions reduction from energy efficiency and renewable energy (EE/RE) programs, which are acceptable to the US EPA. These activities have improved the accuracy of the creditable NOx emissions reduction from EE/RE initiatives contained in the TERP and have assisted the TCEQ, local governments, and the building industry with effective, standardized implementation and reporting.

3. NOx Emissions Reduction

Under the TERP legislation, the Laboratory must determine the energy savings from energy code adoption and, when applicable, from more stringent local codes or above-code performance ratings, and must report these reductions annually to the TCEQ.

Figure 1 shows the cumulative NOx emissions reduction through 2020 for the electricity and natural gas savings from the various EE/RE programs.

In 2008, the OSD NOx emissions reduction from code-compliant residential and commercial construction is calculated to be 6 tons-NOx/day (19.2%), savings from retrofits to Federal buildings is 0.42 tons-NOx/day (1.3%), savings from furnace pilot light retrofits is 0.32 tons-NOx/day (1.0%), savings from the PUC's Senate Bill 5 and Senate Bill 7 programs is 3.82 tons-NOx/day (12.1%), savings from SECO's Senate Bill 5 program is 0.92 tons-NOx/day (2.9%), electricity savings from green power purchases (wind) are 15.13 tons-NOx/day (48.2%), and savings from residential air conditioner retrofits are 4.77 tons-NOx/day (15.2%). The total NOx emissions reduction from all programs is 31.38 tons-NOx/day.

By 2013, the NOx emissions reduction from code-compliant residential and commercial construction is calculated to be 1,435 tons-NOx/year (7% of the total NOx savings), savings from retrofits to Federal buildings will be 308 tons-NOx/year (1.5%), savings from furnace pilot light retrofits will be 117 tons-NOx/year (0.6%), savings from the PUC's Senate Bill 5 and Senate Bill 7 programs will be 2,495 tons-NOx/year (12.2%), savings from SECO's Senate Bill 5 program will be 373 tons-NOx/year (1.8%), electricity savings from green power purchases (wind) will be 14,092 tons-NOx/year (69.1%), and savings from residential air conditioner retrofits will be 1,574 tons-NOx/year (7.7%). The total NOx emissions reduction from all programs will be 20,395 tons-NOx/year.

By 2013, the OSD NOx emissions reduction from code-compliant residential and commercial construction is calculated to be 8.32 tons-NOx/day (15.9%), savings from retrofits to Federal buildings will be 0.81 tons-NOx/day (1.6%), savings from furnace pilot light retrofits will be 0.32 tons-NOx/day (0.6%), savings from the PUC's Senate Bill 5 and Senate Bill 7 programs will be 6.69 tons-NOx/day (12.8%), savings from SECO's Senate Bill 5 program will be 1.01 tons-NOx/day (1.9%), electricity savings from green power purchases (wind) will be 23.92 tons-NOx/day (45.9%), and savings from residential air conditioner retrofits will be 11.03 tons-NOx/day (21.2%). The total NOx emissions reduction from all programs will be 52.10 tons-NOx/day.

4. Technology Transfer

The Laboratory, along with the TCEQ, is host to the annual Clean Air Through Energy Efficiency (CATEE) conference, which is attended by top experts and policy makers in Texas and from around the country. At the conference the latest educational programs and technology is presented and discussed, including efforts by the Laboratory, and others, to reduce air pollution in Texas through energy efficiency and renewable energy. These efforts have produced significant success in bringing EE/RE closer to US EPA acceptance in the Texas SIP. The Laboratory will continue to provide superior technology to the State of Texas through such efforts with the TCEQ and the US EPA.

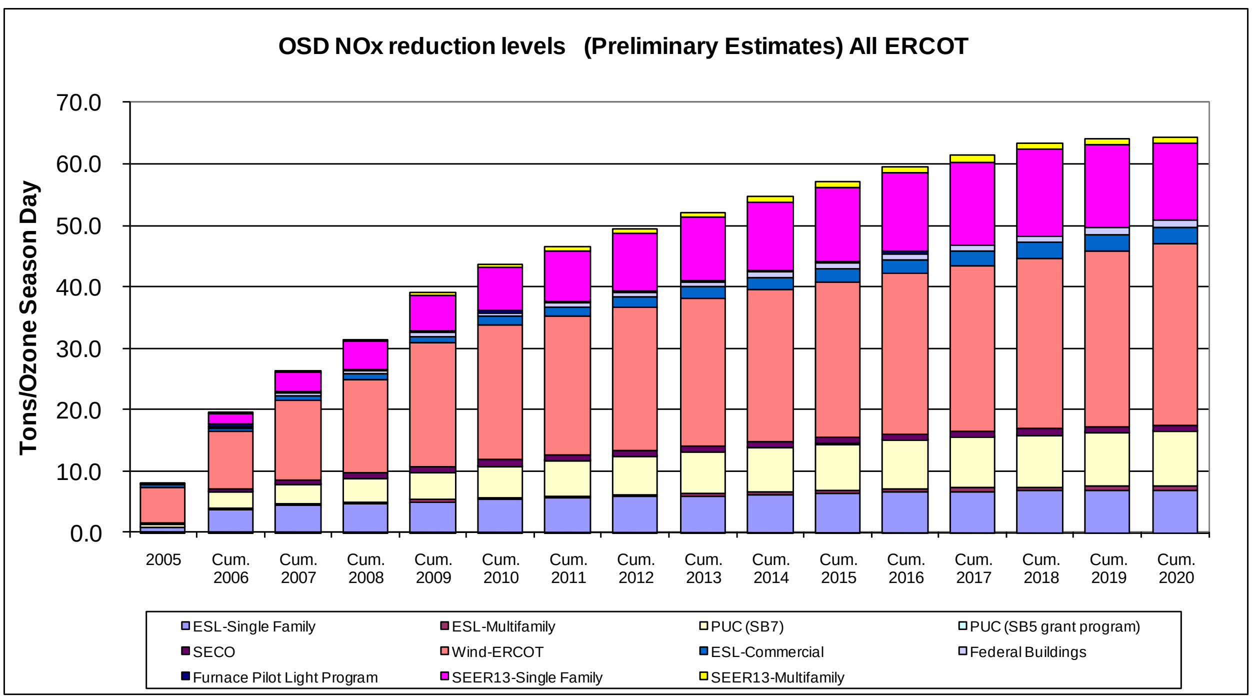


Figure 1: OSD NOx Emissions Reduction Projections through 2020

To accelerate the transfer of technology developed as part of the TERP, the Laboratory has also made presentations at national, state and local meetings and conferences, which includes the publication of peer-reviewed papers. The Laboratory will continue to provide technical assistance to the TCEQ, counties and communities working toward obtaining full SIP credit for the energy efficiency and renewable energy projects that are lowering emissions and improving the air quality for all Texans.

These efforts have been recognized nationally by the US EPA. In 2007, the Laboratory was awarded a National Center of Excellence on Displaced Emissions Reduction (CEDER) by the US EPA so that these accomplishments could be rapidly disseminated to other states for their use. The benefits of CEDER include: reducing the financial, technical, and administrative costs of determining the emissions reduction from EE/RE measures; continuing to accelerate implementation of EE/RE strategies as a viable clean air effort in Texas and other states; helping other states better identify and prioritize cost-effective clean air strategies from EE/RE, and communicating the results of quantification efforts through case-studies and a clearinghouse of information.

The Energy Systems Laboratory provides the seventh annual report, Energy Efficiency/Renewable Energy (EE/RE) Impact in the Texas Emissions Reduction Plan (TERP), to the Texas Commission on Environmental Quality (TCEQ) in fulfillment of its responsibilities under Texas Health and Safety Code Ann. § 388.003 (e), Vernon Supp. 2002.

If any questions arise, please contact us by phone at 979-862-2804, or by email at terpinfo@tees.tamus.edu.

2 ACKNOWLEDGEMENTS

This work has been completed as a fulfillment of the requirements in Texas Health Code, Senate Bill 5, Section 388.003, and through Senate Bill 20, House Bill 2481 and House Bill 2129, which requires the Laboratory to assist TCEQ in quantifying emissions reductions credits from energy efficiency and renewable energy programs, through a contract with the Texas Environmental Research Consortium (TERC). Similarly, selected Code training workshops were funded by the US DOE through the Texas State Energy Conservation Office (SECO). Partial funding on the Texas Climate Vision project, a joint project with the City of Austin was also provided by the US DOE through SECO.

The authors are also grateful for the timely input provided by the following individuals, and agencies: Mr. Art Diem, US EPA, for providing the eGRID database and Dr.Akin Olubiyi.

Numerous additional individuals at the Laboratory contributed significantly to this report, including: Dr. Dan Turner, Kyle Marshall, Robert Stackhouse, Jason Cordes, Sherrie Hughes, Stephen O’Neal, Piljae Im, Soolyeon Cho, Mini Malhotra, and Sarah Phinney.

TABLE OF CONTENTS

1 EXECUTIVE SUMMARY 3

2 ACKNOWLEDGEMENTS 5

3 OVERVIEW 15

3.1 Legislative Background 15

3.2 Laboratory Funding for the TERP 17

3.3 Accomplishments since January 2008 17

3.4 Technology Transfer 18

3.5 Energy and NOx Reductions from New Residential and Commercial Construction, including furnace pilot light savings and residential air conditioner retrofits 20

3.6 Integrated NOx Emissions Reductions Reporting Across State Agencies 21

3.7 Technology for Calculating and Verifying Emissions Reduction from Energy Used in Buildings 24

3.8 Code Adoption 26

3.8.1 Technology for Calculation and Verifying Emissions Reductions from Energy Used in Buildings 26

3.8.2 Evaluation of Additional Technologies for Reducing Energy Use in Existing Buildings 27

3.9 Planned Focus for 2008/2009 27

4 INTRODUCTION 28

4.1 Background 28

4.2 Energy Systems Laboratory's Responsibilities in the TERP 31

4.2.1 (SB 5) Section 386.205. Evaluation of State Energy Efficiency Programs (w/PUCT) 31

4.2.2 (SB 5) Sec. 388.003. Adoption of Building Energy Efficiency Performance Standards. 31

4.2.3 (SB 5) Sec. 388.004. Enforcement of Energy Standards Outside of Municipality 32

4.2.4 (SB 5) Sec. 388.007. Distribution of Information and Technical Assistance 32

4.2.5 (SB 5) Sec. 388.008. Development of Home Energy Ratings. 32

4.2.6 (HB 1365) Sec. 388.004. Enforcement of Energy Standards Outside of Municipality 32

4.2.7 (HB 1365) Sec. 388.009. Energy-Efficient Building Program 32

4.2.8 (HB 3235) Sec. 388.009. Certification of Municipal Inspectors 33

4.2.9 (SB 20, HB 2481, HB 2129). Additional Energy-Efficiency Initiatives 33

4.2.10 (SB 12, HB 3693). Additional Energy-Efficiency Initiatives 33

5 PROGRESS: JANUARY 2008 through DECEMBER 2008 35

5.1 (SB 5) Section 386.205. Evaluation of State Energy-Efficiency Programs (w/PUCT) 35

5.1.1 Implemented Procedures for Evaluating State Energy-Efficiency Programs 35

5.2 (SB 5) Sec. 388.003. Adoption of Building Energy-Efficiency Performance Standards 35

5.2.1 Provide Code Training Sessions 35

5.2.2 Summary of ASHRAE Standard 90.1 Standards Committee Activities during 2008, and Ongoing Subcommittee Actions 37

5.2.2.1 From the Envelope Subcommittee 37

5.2.2.2 From the Lighting Subcomittee 38

5.2.2.3 Options for Hotel Systems 40

5.2.2.4 Efficiency Compliance Requirements for Standard 90.1 2004 41

5.2.2.5 Intermittent Ignition Device for Unit Heaters 41

5.2.2.6 Efficiency and Certification Requirements for Open Cooling Towers 41

5.2.2.7 Compliance with Fan Power Limitations Requirement 42

5.2.2.8 Incorporating the Energy-Saving Potential of DDC Controls 42

5.2.2.9 Updating Mechanical Test Procedures and References 43

5.2.2.10 Warm Air Furnaces 43
5.2.3 Laboratory's TERP Web Site "eslsb5.tamu.edu" 43
5.2.4 Provide Technical Assistance to the TCEQ 58
5.2.5 Delivered "Statewide Air Emissions Calculations from Wind and Other Renewables: Summary Report September 2007 – August 2008," to the Texas Commission on Environmental Quality in August 2008. 58
5.2.5.1 Analysis of wind farms using improved method and 2007 data 58
5.2.5.2 Analysis of emissions reductions from wind farms 59
5.2.5.3 Preliminary reporting of NOx emissions savings in the 2008 Integrated Savings report to TCEQ 59
5.2.5.4 Development of a degradation analysis 59
5.2.5.5 Analysis of other renewable sources 60
5.2.5.6 Review of electricity savings and transmission planning study reported by ERCOT ..60
5.2.5.7 Review of Combined Heat and Power Projects in Texas 60
5.2.5.8 Estimation of hourly solar radiation from limited data sets. 60
5.2.6 Technical Assistance 62
5.2.6.1 Presentation to the TCEQ, Austin, (March 2008) 63
5.2.6.2 Presentation to the Texas Clean Air Working Group, Austin (May 2008) 74
5.2.6.3 May 2008 EPA Technical Forum conference call 76
5.2.6.4 Presentation to the University of Texas Department of Agriculture (September 2008) 78
5.2.6.5 Presentation to the EPA, Kansas City, Missouri (September 2008) 90
5.2.6.6 Presentation to the Texas Senate Natural Resources Committee, Austin (September 2008) 97
5.2.7 Presented Two Papers at the 2008 ICEBO Conference in Germany, October 2008. 99
5.2.8 Presented Sixteen Papers at the 2008 Hot and Humid Conference in Plano, Texas, December 2008. 99

6 CALCULATED NOx REDUCTION POTENTIAL FROM IMPLEMENTATION OF THE IECC/IRC103

6.1 Calculated 2008 Electricity and Natural Gas Savings Due to the Implementation of the IECC/IRC to New Residential Construction (Single-family and Multi-family), and Commercial Buildings Using Code-traceable, Fuel-Neutral Simulation.................... 103
6.1.1 2008 Results for New Single-family Residential Construction 103
6.1.2 2008 Results for New Multi-family Residential Construction 116
6.1.3 2008 Results for New Residential Construction (Single-family and Multi-family), using 1999 Base Year and 2007 eGRID 126
6.1.4 2008 Results for Commercial Construction 135
6.1.5 2008 Results for New Residential (Single-family and Multi-family), and Commercial Construction using 2007 eGRID 136
6.1.6 2008 Results for New Residential (Single-family and Multi-family), and Commercial Construction using 2007 eGRID. 180

7 COMPARISON OF 2008 EMISSIONS REDUCTIONS VS 2007 EMISSIONS REDUCTIONS.......... 188

8 CALCULATION OF INTEGRATED NOx EMISSIONS REDUCTIONS FROM MULTIPLE STATE AGENCIES PARTICIPATING IN THE TEXAS EMISSIONS REDUCTION PLAN (TERP).................... 192

8.1 Background.................... 192

8.2 Description of the Analysis Method 193

8.3 Calculation Procedure.................... 194

8.4 Results 196

8.5 Weather Data 204

9 PLANNED VERIFICATION TO THE EMISSIONS CALCULATOR (eCALC).................... 213

9.1 On-site Inspections 213
9.2 Calibrated Simulations 213
9.2.1 Standard Office building 213
9.2.2 Soolyeon Cho's Thesis 213
9.2.3 K-12 Elementary School 218
9.2.4 Solar Test Bench 222
10 REFERENCES 225
11 BIBLIOGRAPHY 226

TABLE OF FIGURES

Figure 1: OSD NOx Emissions Reduction Projections through 2020 4
Figure 2: Cumulative OSD NOx Emissions Reduction Projected through 2020 24
Figure 3: US EPA Nonattainment and Near Nonattainment 29
Figure 4: Available NWS, TMY2 and WYEC2 weather files compared to IECC/IRC weather zones for Texas 30
Figure 5: Lighting Power Densities Using the Space-by-Space Method 38
Figure 6: Warm Air Furnaces and Combinations Warm Air Furnaces/Air-Conditioning Units, Warm Air Duct Furnaces and Unit Heaters 41
Figure 7: Performance Requirements for Heat Rejection Equipment 42
Figure 8: The Laboratory's Senate Bill 5 Web Site (main page) 45
Figure 9: Opening Page for the Laboratory's eCALC Energy and Emissions Toolkit 46
Figure 10: Web Page Providing Access to the Laboratory's eCALC Energy and Emissions Calculator 47
Figure 11: Web Page Providing Access to the Laboratory's Synchronous Emissions Calculator 48
Figure 12: Web Page Providing Access to the Laboratory's International Code Compliance Calculator (ICCC) 48
Figure 13: Web Page Providing Information about the Laboratory's Senate Bill Responsibilities 49
Figure 14: SB5 Public opening page for the Laboratory TERP Effort 50
Figure 15: Web Page Providing Information about the Laboratory's 2008 Clean Air Through Energy Efficiency (CATEE) Conference 51
Figure 16: Web Page Providing Information about the Laboratory's 16th Annual Hot and Humid (H&H) Conference 51
Figure 17: Web Page Providing Additional Information about the Laboratory's TERP Program 52
Figure 18: Web Page Providing Information about the Laboratory's TERP Testimony to the Senate Natural Resources Committee 52
Figure 19: Web Page Providing Information about the Laboratory's Links to Other Government Agencies 53
Figure 20: Web Page Providing Information about the Laboratory's TERP Weather Data Collection Effort 53
Figure 21: Web Page Providing Site-by-Site Weather Date from the Laboratory's TERP Effort 54
Figure 22: Spreadsheet Showing Daily Weather Date for Abilene, 1999 54
Figure 23: Spreadsheet Showing Hourly Weather Date for Abilene, 1999 55
Figure 24: Time Series Graphs Showing Daily Weather Data for Abilene, 1999 56
Figure 25: Time Series Graphs Showing Hourly Weather Data for Abilene, 1999 57
Figure 26: Cover Page of "Energy Efficiency/Renewable Energy Impact in the Texas Emissions Reduction Plan (TERP)," August 2008 61
Figure 27: Slides Presented to the TCEQ (March 2008) 63
Figure 28: Slides Presented to the TCEQ (March 2008) 64
Figure 29: Slides Presented to the TCEQ (March 2008) 65
Figure 30: Slides Presented to the TCEQ (March 2008) 66
Figure 31: Slides Presented to the TCEQ (March 2008) 67
Figure 32: Slides Presented to the TCEQ (March 2008) 68
Figure 33: Slides Presented to the TCEQ (March 2008) 69
Figure 34: Slides Presented to the TCEQ (March 2008) 70
Figure 35: Slides Presented to the TCEQ (March 2008) 71
Figure 36: Slides Presented to the TCEQ (March 2008) 72
Figure 37: Slides Presented to the TCEQ (March 2008) 73
Figure 38: Slides Presented to the Texas Clean Air Working Group (May 2008) 74
Figure 39: Slides Presented to the Texas Clean Air Working Group (May 2008) 75
Figure 40: Slides Presented to the EPA Technical Forum (May 2008) 76
Figure 41: Slides Presented to the EPA Technical Forum (May 2008) 77
Figure 42: Slides Presented to the University of Texas (September 2008) 78
Figure 43: Slides Presented to the University of Texas (September 2008) 79
Figure 44: Slides Presented to the University of Texas (September 2008) 80
Figure 45: Slides Presented to the University of Texas (September 2008) 81
Figure 46: Slides Presented to the University of Texas (September 2008) 82

Figure 47: Slides Presented to the University of Texas (September 2008) 83
Figure 48: Slides Presented to the University of Texas (September 2008) 84
Figure 49: Slides Presented to the University of Texas (September 2008) 85
Figure 50: Slides Presented to the University of Texas (September 2008) 86
Figure 51: Slides Presented to the University of Texas (September 2008) 87
Figure 52: Slides Presented to the University of Texas (September 2008) 88
Figure 53: Slides Presented to the University of Texas (September 2008) 89
Figure 54: Slides Presented to the EPA (September 2008) 90
Figure 55: Slides Presented to the EPA (September 2008) 91
Figure 56: Slides Presented to the EPA (September 2008) 92
Figure 57: Slides Presented to the EPA (September 2008) 93
Figure 58: Slides Presented to the EPA (September 2008) 94
Figure 59: Slides Presented to the EPA (September 2008) 95
Figure 60: Slides Presented to the EPA (September 2008) 96
Figure 61: Slides Presented to the Texas Senate Natural Resources Committee (September 2008) 97
Figure 62: Slides Presented to the Texas Senate Natural Resources Committee (September 2008) 98
Figure 63: 2008 Annual Electricity Reductions from IECC/IRC by PCA for Single-family and Multi-family Residences by County 129
Figure 64: 2008 Annual Electricity Reductions from IECC/IRC by PCA for Single-family and Multi-family Residences by County 130
Figure 65: 2008 Annual and OSD Electricity Reductions from IECC/IRC by PCA for Single-family and Multi-family Residences by County 131
Figure 66: 2008 Annual NOx Reductions from Electricity and Natural Gas Savings due to the IECC/IRC for Single-family and Multi-family Residences by County (using 1999 Base Year and 2007 eGRID) 132
Figure 67: 2008 OSD NOx Reductions from Electricity and Natural Gas Savings due to the IECC/IRC for Single-family and Multi-family Residences by County (using 1999 Base Year and 2007 eGRID) 133
Figure 68: 2008 Annual and OSD NOx Reductions from Electricity and Natural Gas Savings Due to the IECC/IRC for Single-family and Multi-family Residences by County (Using 1999 Base Year and 2007 eGRID) 134
Figure 69: Analysis Method for Calculating the 2008 Energy and Emissions Savings from Commercial Buildings (Updated) 137
Figure 70: 2008 New Commercial Building Construction (sq. ft. x 1000), Part 1 (Dodge 2007) 144
Figure 71: 2008 New Commercial Building Construction (sq. ft. x 1000), Part 2 (Dodge 2007) 145
Figure 72: 2008 New Commercial Building Construction (sq. ft. x 1000), Part 3 (Dodge 2007) 146
Figure 73: 2008 New Commercial Building Construction (sq. ft. x 1000), Part 4 (Dodge 2007) 147
Figure 74: Typical Office Building Used for Annual to OSD calculation (3-story shown) 165
Figure 75: Comparison of Annual Energy Use ASHRAE Standard 90.1-1989 vs 90.1-1999 168
Figure 76: Simulated Electricity and Natural Gas for Building Built to 90.1-1989 Standard for OSD (07/15 – 09/15) 169
Figure 77: Simulated Electricity and Natural Gas for Building Built to 90.1-1989 Standard for OSD (07/15 – 09/15) 169
Figure 78: 2008 Annual Electricity Reductions from IECC/IRC by PCA for Commercial Buildings with 7% T&D losses 176
Figure 79: 2008 OSD Electricity Reductions from IECC/IRC by PCA for Commercial Buildings with 7% T&D losses 177
Figure 80: 2006 OSD NOx Reductions from Electricity Savings from the IECC/IRC by PCA for Commercial Buildings by County using 2007 eGRID with 7% T&D losses 178
Figure 81: 2008 OSD NOx Reductions from Electricity Savings from the IECC/IRC by PCA for Commercial Buildings by County using 2007 eGRID with 7% T&D losses 179
Figure 82: 2008 Annual Electricity Reductions from IECC/IRC by PCA for Single-family and Multi-family Residences and for Commercial Buildings by County 182
Figure 83: 2008 OSD Electricity Reductions from IECC/IRC by PCA for Single-family and Multi-family Residences and for Commercial Buildings by County 183
Figure 84: 2008 Annual and OSD Electricity Reductions from IECC/IRC by PCA for Single-family and Multi-family Residences and for Commercial Buildings by County 184

Figure 85: 2008 Annual NOx Reductions from Electricity and Natural Gas Savings Due to the IECC/IRC for Single-family and Multi-family Residences and for Commercial Buildings by County (using 1999 eGRID)....185
Figure 86: 2008 OSD NOx Reductions from Electricity and Natural Gas Savings Due to the IECC/IRC for Single-family and Multi-family Residences and for Commercial Buildings by County (using 2007 eGRID)....186
Figure 87: 2008 Annual and OSD NOx Reductions from Electricity and Natural Gas Savings Due to the IECC/IRC for Single-family and Multi-family Residences and for Commercial Buildings by County (using 2007 eGRID)....187
Figure 88: 2007 Annual NOx Reductions from Electricity and Natural Gas Savings Due to the IECC/IRC for Single-family, Multi-family Residences, and Commercial Buildings by County (using 2007 eGRID)....188
Figure 89: 2007 OSD NOx Reductions from Electricity and Natural Gas Savings Due to the IECC/IRC for Single-family, Multi-family Residences, and Commercial Buildings by County (Using 2007 eGRID) 189
Figure 90: 2008 Annual NOx Reductions from Electricity and Natural Gas Savings Due to the IECC/IRC for Single-family and Multi-family Residences and for Commercial Buildings by County (using 1999 eGRID)....190
Figure 91: 2008 OSD NOx Reductions from Electricity and Natural Gas Savings Due to the IECC/IRC for Single-family and Multi-family Residences and for Commercial Buildings by County (using 2007 eGRID)....191
Figure 92: Process Flow Diagram of the NOx Emissions Reduction Calculations....199
Figure 93: Cumulative OSD NOx Emissions Reduction Projections through 2020 203
Figure 94: Cumulative OSD NOx Emissions Reduction Projections through 2020 203
Figure 95: Available Weather Stations in Texas for 41 Non-attainment and Affected Counties....205
Figure 96: List of Available Weather Files in Texas (Listed by Symbol)....205
Figure 97: Available Weather Stations in Texas for all ERCOT Counties....211
Figure 98: Grouping of Weather Stations in Texas for all ERCOT Counties 211
Figure 99: Available Weather Stations in Texas for all ERCOT Counties Showing 2000/2001 and 2006 Climate Zones....212
Figure 100: List of Available Weather Files in Texas (Listed by Symbol)....212
Figure 101: Standard Office Building (Texas A&M University Systems Building, College Station, Texas) 213
Figure 102: Standard Office Building (Texas A&M University Systems Building, College Station, Texas) 214
Figure 103: Computer Simulation (DOE-2.1E) of Case Study Office Building 215
Figure 104: Computer Simulation (DOE-2.1E) of Base Case Office Building....215
Figure 105: Air Handling Unit in the 5th Floor of the John Connally Building....216
Figure 106: Installation of a Portable Logger to Measure the Return Air Temperature of an AHU on the 5th Floor....216
Figure 107: 2008 Scatter Plots from the Data logger Installed in the Case Study Office Building....217
Figure 109: Photo of Case Study Elementary School....218
Figure 110: Computer Simulation (DOE-2.1E) of Case Study Elementary School....219
Figure 111: Computer Simulation (DOE-2.1E) of Base Case School Building....219
Figure 112: Concept of Base Case School Building....220
Figure 113: Inspection plots for elementary school....220
Figure 115: Analysis of data from K-12 school 221
Figure 116: Photos of the Laboratory’s Solar Test Bench....222
Figure 117: 2008 Weekly Inspection Plots from the Laboratory’s Solar Test Bench 223
Figure 118: 2008 Weekly Inspection Plots from the Laboratory’s Solar Test Bench 224

TABLE OF TABLES

Table 1: Adjustment Factors used for the Calculation of the Annual and OSD NOx Savings for the Different Programs....23
Table 2: eCalc Traffic Details--January 2008 through December 2008....25
Table 3: IC3 Details--August 2008 through December 2008....26
Table 4: 1999 and IECC/IRC Code-complaint Building Characteristics used in the DOE-2 Simulator for Single-family Residential (1)....106
Table 5: 1999 and IECC/IRC Code-compliant Characteristics used in the DOE-2 Simulator for Single-family Residential (2)....107
Table 6: 2008 Annual and Peak-day Electricity Savings from Implementation of the IECC/IRC for Single-family Residences Using 1999 Base Year (1)....108
Table 7: 2008 Annual and Peak-day Electricity Savings from Implementation of the IECC/IRC for Single-family Residences Using 1999 Base Year (2)....109
Table 8: 2007 Allocation of PCA for each of 41 Non-attainment and Affected Counties, and ERCOT Counties (1)....110
Table 9: 2006 Allocation of PCA for each of 41 Non-attainment and Affected Counties, and ERCOT Counties (2)....111
Table 10: 2008 Totalized Annual Electricity Savings from IECC/IRC by PCA for Single-family Residences Using 1999 Base Year....112
Table 11: 2008 Annual NOx Reductions from IECC/IRC by PCA for Single-family Residences by County Using 2007 eGRID....113
Table 12: 2008 Totalized OSD Electricity Savings from IECC/IRC by PCA for Single-family Residences....114
Table 13: 2008 OSD NOx Reductions from IECC/IRC by PCA for Single-family Residences by County Using 2007 eGRID....115
Table 14: 1999 and IECC/IRC Code-compliant Building Characteristics used in the DOE-2 Simulations for Multi-family Residential (1)....118
Table 15: 1999 and IECC/IRC Code-compliant Building Characteristics used in the DOE-2 Simulation for Multi-family Residential (2)....119
Table 16: 2008 Annual and OSD Electricity and Natural Gas Savings from Implementation of the IECC/IRC for Multi-family Residences (1)....120
Table 18: 2008 Total Annual Electricity Savings from IECC/IRC by PCA for Multi-family Residences..122
Table 19: 2008 Annual NOx Reductions from IECC/IRC by PCA for Multi-family Residences by County using 2007 eGRID....123
Table 20: 2008 Total OSD Electricity Savings from IECC/IRC by PCA for Multi-family Residences....124
Table 21: 2008 OSD NOx Reductions from IECC/IRC by PCA for Multi-family Residences by County using 2007 eGRID....125
Table 22: 2008 Annual and OSD NOx Reductions from Electricity and Natural Gas Savings Due to the IECC/IRC for Single-family and Multi-family Residences by county (Using 1999 Base year and 2007 eGRID)(1)....127
Table 23: 2008 Annual and OSD NOx Reductions from Electricity and Natural Gas Savings Due to the IECC/IRC for Single-family and Multi-family Residences by County (Using 1999 Base year and 2007 eGRID)(2)....128
Table 24: Commercial Building Descriptions from USDOE (2004) Report and Dodge (2005)....138
Table 25: Floor Area from CBEC (1999, 2003) Database for Retail and Food Type Commercial Buildings....138
Table 26: 2008 New Commercial Building Construction (sq. ft. x 1000)....139
Table 27: 2008 New Commercial Building Construction (sq. ft. x 1000)....140
Table 28: 2008 New Commercial Building Construction (sq. ft. x 1000)....141
Table 29: 2008 New Commercial Building Construction (sq. ft. x 1000)....142
Table 30: 2008 New Commercial Building Construction (sq. ft. x 1000)....143
Table 31: Calculated ASHRAE Standard 90.1-1989 and 1999 Energy Use for Assembly, Education, and Retail Building Types (USEDOE 2004) (Part 1)....148
Table 32: Calculated ASHRAE Standard 90.1-1989 and 1999 Energy Use for Assembly, Education, and Retail Building Types (USDOE 2004) (Part 2)....149

Table 33: Calculated ASHRAE Standard 90.1-1989 and 1999 Energy Use for Assembly, Education, and Retail Building Types (USDOE 2004) (Part 3) 150
Table 34: Calculated ASHRAE Standard 90.1-1989 and 1999 Energy Use for Food and Lodging Building Types (USDOE 2004) (Part 1)....151
Table 35: Calculated ASHRAE Standard 90.1-1989 and 1999 Energy Use for Food and Lodging Building Types (USDOE 2004) (Part 2)....152
Table 36: Calculated ASHRAE Standard 90.1-1989 and 1999 Energy Use for Food and Lodging Building Types (USDOE 2004) (Part 3)....153
Table 37: Calculated ASHRAE Standard 90.1-1989 and 1999 Energy Use for Office and Warehouse Building Types (USDOE 2004) (Part 1)....154
Table 38: Calculated ASHRAE Standard 90.1-1989 and 1999 Energy Use for Office and Warehouse Building Types (USDOE 2004) (Part 2)....155
Table 39: Calculated ASHRAE Standard 90.1-1989 and 1999 Energy Use for Office and Warehouse Building Types (USDOE 2004) (Part 3)....156
Table 40: Calculated ASHRAE Standard 90.1-1989 and 1999 Annual Electricity and Natural Gas Savings (USDOE 2004). A decrease in energy use is negative (i.e., savings); a positive value represents an energy use increase (+) (Part 1) 157
Table 41: Calculated ASHRAE Standard 90.1-1989 and 1999 Annual Electricity and Natural Gas Savings (USDOE 2004). A decrease in energy use is negative (i.e., savings); a positive value represents an energy use increase (+) (Part 2) 158
Table 42: Calculated ASHRAE Standard 90.1-1989 and 1999 Annual Electricity and Natural Gas Savings (USDOE 2004). A decrease in energy use is negative (i.e., savings); a positive value represents an energy use increase (+) (Part 3) 159
Table 43: Calculated ASHRAE Standard 90.1-1989 and 1999 Annual Electricity and Natural Gas Savings (USDOE 2004). A decrease in energy use is negative (i.e., savings); a positive value represents an energy use increase (+) (Part 4) 160
Table 44: Calculated ASHRAE Standard 90.1-1989 and 1999 OSD Electricity and Natural Gas Savings (USDOE 2004). A decrease in energy use is negative (i.e., savings); a positive value represents an energy use increase (+) (Part 1) 161
Table 45: Calculated ASHRAE Standard 90.1-1989 and 1999 OSD Electricity and Natural Gas Savings (USDOE 2004). A decrease in energy use is negative (i.e., savings); a positive value represents an energy use increase (+) (Part 2) 162
Table 46: Calculated ASHRAE Standard 90.1-1989 and 1999 OSD Electricity and Natural Gas Savings (USDOE 2004). A decrease in energy use is negative (i.e., savings); a positive value represents an energy use increase (+) (Part 3) 163
Table 47: Calculated ASHRAE Standard 90.1-1989 and 1999 OSD Electricity and Natural Gas Savings (USDOE 2004). A decrease in energy use is negative (i.e., savings); a positive value represents an energy use increase (+) (Part 4) 164
Table 48: Office/Retail Simulation Input Parameters (LOADS)....166
Table 49: Office/Retail Simulation Input Parameters (SYSTEMS and PLANT)....167
Table 50: Simulated Electricity and Natural Gas for Building Built to 90.1-1989 Standard for Annual and OSD (07/15 – 09/15)....170
Table 51: Totalized Annual Electricity Savings from 90.1-1999 by PCA for Commercial Buildings....170
Table 52: 2008 Annual NOx Reductions from IECC / IRC by PCA for Commercial Buildings by County using 2007 eGRID 171
Table 53: 2008 Totalized OSD Electricity Savings from IECC/IRC by PCA for Commercial Buildings (w/7% T&D)....172
Table 54: 2008 OSD NOx Reductions from Electricity Savings from the IECC/IRC by PCA for Commercial Buildings by County using 2007 eGRID (w/7% T&D) 173
Table 55: 2008 Annual and OSD NOx Reductions from IECC/IRC by PCA for Commercial Buildings by County using 2007 eGRID (w/7% T&D) (1)....174
Table 56: 2008 Annual and OSD NOx Reductions from IECC / IRC by PCA for Commercial Buildings by County using 2007 eGRID (w/7% T&D) (2)....175
Table 57: 2008 Annual and OSD NOx Reductions from Electricity and Natural Gas Savings Due to the IECC / IRC for Single-family and Multi-family Residences and for Commercial Buildings by County (using 2008 eGRID) (Part 1)....180

Table 58: 2008 Annual and OSD NOx Reductions from Electricity and Natural Gas Savings Due to the IECC / IRC for Single-family and Multi-family Residences and for Commercial Buildings by County (using 2007 eGRID) (Part 2) 181
Table 59: Final Adjustment Factors used for the Calculation of the Annual and OSD NOx Savings for the Different Programs 199
Table 60: Example of NOx Emissions Reduction Calculations using eGRID 200
Table 61: Annual and OSD Electricity Savings for the Different Programs 201
Table 62: Annual and OSD NOx Emissions Reduction Values for the Different Programs 202
Table 63: Assignment of Weather Stations for 41 Non-attainment and Affected Counties (NOAA, TMY2, F-CHART, PV F-CHART, NAHB, Climate Zone, HDD, CDD, 90.1-1989, 90.1-1999) 206
Table 64: Availability of Weather Data for 41 Non-attainment and Affected County (NOAA, NREL, TCEQ, ESL) 207
Table 65: Main NOAA Weather Stations used in eCALC 208
Table 66: Summary of Weather Data Assignments for ERCOT Counties 209
Table 67: Assignment of NWS Weather Stations for all ERCOT Counties 210

3 OVERVIEW

The Energy Systems Laboratory (Laboratory), at the Texas Engineering Experiment Station of the Texas A&M University System, is pleased to provide our seventh annual report, Energy Efficiency/Renewable Energy Impact in the Texas Emissions Reduction Plan (TERP), to the Texas Commission on Environmental Quality (TCEQ) in fulfillment of its responsibilities under Texas Health and Safety Code Ann. § 388.003 (e), Vernon Supp. 2002. This annual report:

- Provides an estimate of the energy savings and NOx reductions from energy code compliance in new residential construction in all ERCOT counties;
- Provides an estimate of the standardized, cumulative, integrated energy savings and NOx reductions from the TERP programs implemented by the Laboratory, SECO, the PUC and ERCOT in all ERCOT Texas;
- Describes the technology developed to enable the TCEQ to substantiate energy and emissions reduction credits from energy efficiency and renewable energy initiatives (EE/RE) to the U.S. Environmental Protection Agency (US EPA), including the development of a web-based emissions reduction calculator; and
- Outlines progress in advancing EE/RE strategies for credit in the Texas State Implementation Plan (SIP).

The report is organized in three volumes.

Volume I – Summary Report – provides an executive summary and overview;
Volume II – Technical Report – provides a detailed report of activities, methodologies and findings;
Volume III – Technical Appendix – contains detailed data from code-compliant energy simulations for all ERCOT counties in Texas included in the analysis.

3.1 Legislative Background

The TERP was established in 2001 by the 77th Legislature through the enactment of Senate Bill 5 to:

- Ensure that Texas air meets the Federal Clean Air Act requirements (Section 707, Title 42, United States Code); and
- Reduce NOx emissions in non-attainment and near-non-attainment counties through mandatory and voluntary programs, including the implementation of energy efficiency and renewable energy programs (EE/RE).

To achieve the clean air and emissions reduction goals of the TERP, Senate Bill 5 created a number of EE/RE programs for credit in the SIP:

- Adopts statewide Texas Building Energy Performance Standards (TBEPS) as the building energy code for all residential and commercial buildings;
- Provides that a municipality or county may request the Laboratory to determine the energy impact of proposed energy code changes;
- Provides for an annual evaluation by the Public Utility Commission of Texas (PUCT), in cooperation with the Laboratory, of the emissions reduction of energy demand, peak electric loads and the associated air contaminant reductions from utility-sponsored programs established under Senate Bill 5 and utility-sponsored programs established under the electric utility restructuring act (Section 39.905 Utilities Code);
- Establishes a 5% per year electricity reduction goal each year for facilities of political subdivisions in non-attainment and near-non-attainment counties from 2002 through 2008; and
- Requires the Laboratory to report annually to the TCEQ the energy savings (and resultant emissions reduction) from implementation of building energy codes and to identify the municipalities and counties whose codes are more or less stringent than the un-amended code.

The 78th Legislature (2003), through HB 1365 and HB 3235, amended TERP to enhance its effectiveness with additional energy efficiency initiatives, and includes:

- Requires the TCEQ to conduct outreach to non-attainment and near-non-attainment counties on the benefits of implementing energy efficiency measures as a way to meet the air quality goals under the federal Clean Air Act;
- Requires the TCEQ develop a methodology for computing emissions reduction from energy efficiency initiatives;
- Authorized a voluntary Energy-Efficient Building Program at the General Land Office (GLO), in consultation with the Laboratory, for the accreditation of buildings that exceed the state energy code requirements by 15% or more;
- Authorizes municipalities to adopt an optional, alternate energy code compliance mechanism through the use of accredited energy efficiency programs determined to be code-compliant by the Laboratory, as well as the US EPA's Energy Star New Homes program; and
- Requires the Laboratory to develop and administer a statewide training program for municipal building inspectors seeking to become code-certified inspectors for enforcement of energy codes.

The 79th Legislature (2005), through SB 20, HB 2481 and HB 2129, amended Senate Bill 5 to enhance its effectiveness by adding the following additional energy efficiency initiatives:

- Requires 5,880 MW of generating capacity from renewable energy technologies by 2015;
- Includes 500 MW from non-wind renewables;
- Requires the PUCT to establish a target of 10,000 megawatts of installed renewable capacity by 2025;
- Requires the TCEQ to develop methodology for computing emissions reduction from renewable energy initiatives and the associated credits;
- Requires the Laboratory to assist the TCEQ in quantifying emissions reduction credits from energy efficiency and renewable energy programs;
- Requires the Texas Environmental Research Consortium (TERC) to contract with the Laboratory to develop and annually calculate creditable emissions reduction from wind and other renewable energy resources for the state's SIP; and
- Requires the Laboratory to develop at least three alternative methods for achieving a 15 % greater potential energy savings in residential, commercial and industrial construction.

The 80th Legislature (2007), through SB 12, and HB 3693 amended Senate Bill 5 to enhance its effectiveness by adding the following additional energy efficiency initiatives:

- Requires the Laboratory to provide written recommendations to the State Energy Conservation Office (SECO) about whether or not the energy efficiency provisions of latest published edition of the International Residential Code (IRC) or the International Energy Conservation Code (IECC) are equivalent to or better than the energy efficiency and air quality achievable under the editions adopted under the 2001 IRC/IECC. The Laboratory shall make its recommendations no later than six months after publication of new editions at the end of each three-year code development cycle of the International Residential Code and the International Energy Conservation Code.
- Requires the Laboratory to consider comments made by persons who have an interest in the adoption of the energy codes in the recommendations made to SECO.
- Requires the Laboratory to develop a standardized report format to be used by providers of home energy ratings, including different report formats for rating newly constructed residences from those for existing residences. The form must be designed to give potential buyers information on a structure's energy performance, including: insulation; types of windows; heating and cooling equipment; water heating equipment; additional energy conserving features, if any; results of performance measurements of building tightness and forced air distribution; and an overall rating of probable energy efficiency relative to the minimum requirements of the International Energy Conservation Code or the energy efficiency chapter of the International Residential Code, as appropriate.
- Encourages the Laboratory to cooperate with an industry organization or trade association to: develop guidelines for home energy ratings; provide training for individuals performing home energy ratings and providers of home energy ratings; and provide a registry of completed ratings for newly constructed residences and residential improvement projects for the purpose of

computing the energy savings and emissions reduction benefits of the home energy ratings program.
- Requires the Laboratory to include information on the benefits attained from this program in an annual report to the commission.

3.2 Laboratory Funding for the TERP

The Laboratory received $182,000 in FY 2002; $285,000 in FY 2003; $950,421 in FY 2004; $952,019 in FY 2005, FY 2006, FY 2007 and FY 2008. The Laboratory has also supplemented these funds with competitively awarded Federal grants to provide the needed statewide training for the new mandatory energy codes and to provide technical assistance to cities and counties in helping them implement adoption of the legislated energy efficiency codes, and an award from the US EPA in the spring of 2007 to establish a Center of Excellence for the Determination of Emissions Reduction (CEDER) which will help to enhance the EE/RE emissions calculations.

3.3 Accomplishments since January 2008

Since January of 2008, the Laboratory has accomplished the following:
- Calculated energy and resultant NOx reductions from implementation of the Texas Building Energy Performance Standards (IECC/IRC codes) to new residential and commercial construction for all non-attainment and near-non-attainment counties;
- Enhanced the web-based "Emissions Reduction Calculator - eCalc" for determining emissions reduction from energy efficiency improvements in residential and commercial construction, municipal projects and renewable energy projects;
- Enhanced the Laboratory's IECC/IRC Code-Traceable Test Suite for determining emissions reduction due to code and above-code programs;
- Developed the IC3 calculator, which is energy code compliance software based on the Texas Building Energy Performance Standards;
- Continued development and testing of key procedures for validating simulations of building energy performance;
- Provided energy code training workshops, including: residential, commercial IECC/IRC energy code training sessions, code-compliant software sessions throughout the State of Texas;
- Maintained and updated the Laboratory's Texas Emissions Reduction Plan (TERP) website;
- Maintained a builder's residential energy code Self-Certification Form (Ver.1.3) for use by builders outside municipalities;
- Responded to thousands of phone and email inquiries on code implementation and verification issues;
- Analyzed the stringency of several residential and commercial energy codes, including the 2006 IECC and ASHRAE Standard 90.1-2001 and Standard 90.1-2004;
- Hosted the Clean Air Through Energy Efficiency (CATEE) Conference in December 2008, in Dallas, Texas. Conference sessions included key talks by the TCEQ, EPA, DOE and the Laboratory about quantifying emissions reduction from EE/RE opportunities and guidance on key energy efficiency and renewable energy topics;
- Provided technical assistance to the TCEQ regarding specific issues, including:
    - Enhancement of the standardized, integrated NOx emissions reduction reporting procedures[1] to the TCEQ for ESL, PUCT, SECO and ERCOT EE/RE projects;
    - Enhancement of the procedures for weather normalizing NOx emissions reduction from power provided by wind energy providers to base-year calculations;
- Enhanced the web-based emissions reduction calculator, including:
    - Expanded emissions reduction to include SEER 13 air conditioners;
    - Continued the enhancement of the new computer architecture to allow for synchronous calculations, user accounts, and code-compliance;
- Developed 15% above code recommendations for residential buildings for Houston, Texas;

[1] These procedures are currently under review by the USDOE, through the National Renewable Energy Laboratory (NREL).

- Continued the development of verification procedures, including:
    - Completed a calibrated simulation of an office building;
    - Worked towards a calibrated simulation of a K-12 school; and
    - Completed the calibrated simulation of a Habitat for Humanity's residence.

3.4 Technology Transfer

To accelerate the transfer of technology developed as part of the TERP program, the Laboratory:

- Delivered "Statewide Air Emissions Calculations from Wind and Other Renewables," to the Texas Commission on Environmental Quality in August 2008.
- Continued development of a method to predict on-site wind speeds using Artificial Neural Networks (ANN) and developed improvements to the daily modeling procedures using ANN-derived hourly wind speeds.
- Updated previously developed degradation analysis to determine if degradation could be observed in the measured power from Texas wind farms.
- Updated previously developed empirical curtailment analysis of the measured power production from a wind farm and applied to the Indian Mesa wind farm.
- Updated previously developed database of other renewable projects in Texas, including: solar photovoltaic, geothermal, hydroelectric, and Landfill Gas-fired Power Plants.
- Applied previously developed estimation techniques for hourly solar radiation from limited data sets.
- Along with the TCEQ and the US EPA, is host to the annual Clean Air Through Energy Efficiency (CATEE) Conference attended by top Texas experts and policy makers and national experts.
- Continued the National Center of Excellence on Displaced Emissions Reduction (CEDER) by the US EPA. The benefits of CEDER include:
    - reducing the financial, technical, and administrative costs of determining the emissions reduction from EE/RE measures;
    - continuing to accelerate implementation of EE/RE strategies as a viable clean air effort in Texas and other states;
    - helping other states identify and prioritize cost-effective clean air strategies from EE/RE, and;
    - communicating the results of quantification efforts through case-studies and a clearinghouse of information.

In addition to the tasks listed above, the Laboratory delivered presentations regarding the TERP related work, including:

- Presentation to the TCEQ, Austin, Texas, March 2008
- Presentation to the Texas Clean Air Working Group, Austin, Texas, May 2008
- Presentation to the EPA Technical Forum, May 2008 (by phone)
- Presentation to the University of Texas Department of Architecture, Austin, Texas, September 2008
- Presentation to the EPA Blue Skyways conference, Kansas City, Missouri, September 2008
- Presentation to the Texas Senate Natural Resources Committee, Austin, Texas, September 2008

Presentation of fifteen papers at the 16th Symposium on Improving Building Systems in Hot and Humid Climates, in Dallas, Texas, December 2008, including:

- Liu, Z.; Mukhopadhyay, J.; Malhotra, M.; Haberl, J.; Gilman, D.; Montgomery, C.; McKelvey, K.; Culp, C.; Yazdani, B. 2008. "Methodology for Residential Building Energy Simulations Implemented in the International Code Compliance Calculator (IC3)", *Proceedings of the 16th Symposium on Improving Building Systems in Hot and Humid Climates*, Texas A&M University, Dallas, Texas.

- Gilman, D.; Marshall, K.; Liu, Z.; Mukhopadhyay, J.; Stackhouse, R.; Cordes, J.; Montgomery, C.; McKelvey, K.; O'Neal, S.; Culp, C.; Haberl, J.; Yazdani, B. 2008. "Development of a Residential Code-compliant Web-based Calculator for Texas", *Proceedings of the 16th Symposium on Improving Building Systems in Hot and Humid Climates,* Texas A&M University, Dallas, Texas
- Mukhopadhyay, J.; Liu, Z.; Malhotra, M.; Haberl, J.; Gilman, D.; Montgomery, C.; Culp, C.; Yazdani, B.. 2008. "An Analysis of the Residential Energy Savings from the Implementation of the 2001 IECC and 2006 NAECA Appliance Standards in the State of Texas", *Proceedings of the 16th Symposium on Improving Building Systems in Hot and Humid Climates,* Texas A&M University, Dallas, Texas
- Martinez, J. T.; Verdict, M.; Baltazar-Cervantes, J. C.; Strybos, J. 2008. "Continuous Commissioning® and Energy Management Control Strategies at Alamo Community College District", *Proceedings of the 16th Symposium on Improving Building Systems in Hot and Humid Climates,* Texas A&M University, Dallas, Texas
- Kim, S.; Haberl, J. 2008. "Development of an ASHRAE 152-2004 Duct Model for the Single-Family Residential House", *Proceedings of the 16th Symposium on Improving Building Systems in Hot and Humid Climates,* Texas A&M University, Dallas, Texas
- Nelson, I. C.; Culp, C.; Graves, R. D. 2008. "Semi-Empirical Screw Compressor Chiller Model", *Proceedings of the 16th Symposium on Improving Building Systems in Hot and Humid Climates,* Texas A&M University, Dallas, Texas
- Ugursal, A.; Culp, C. 2008. "The Effects of Geometry on Flexible Duct CFD Simulations", *Proceedings of the 16th Symposium on Improving Building Systems in Hot and Humid Climates,* Texas A&M University, Dallas, Texas
- Liu, Z.; Haberl, J. S.; Baltazar, J. C.; Culp, C.; Yazdani, B.; Chandrasekaran, V. 2008. "Calculating Emissions Reductions from Renewable Energy Programs and Its Application to the Wind Farms in the Texas ERCOT Region", *Proceedings of the 16th Symposium on Improving Building Systems in Hot and Humid Climates,* Texas A&M University, Dallas, Texas
- Malhotra, M.; Haberl, J. 2008. "Analysis of Off-Grid, Off-Pipe Housing for Hot-Humid and Hot-Arid Climates", *Proceedings of the 16th Symposium on Improving Building Systems in Hot and Humid Climates*, Texas A&M University, Dallas, Texas
- Im, P.; Haberl, J. S. 2008. "Detailed Analysis of Thermal Mass Credits in a Code-Traceable DOE-2 Simulation of the 2001 IECC for a Single-Family Residence in Texas", *Proceedings of the 16th Symposium on Improving Building Systems in Hot and Humid Climates,* Texas A&M University, Dallas, Texas
- Cho, S.; Haberl, J. S. 2008. "Validation of the eCALC Commercial Code-Compliant Simulation Versus Measured Data from an Office Building in a Hot and Humid Climate", *Proceedings of the 16th Symposium on Improving Building Systems in Hot and Humid Climates,* Texas A&M University, Dallas, Texas
- Andolsun, S.; Culp, C. 2008. "A Comparison of EnergyPlus to DOE-2.1E: Multiple Cases Ranging from a Sealed Box to a Residential Building", *Proceedings of the 16th Symposium on Improving Building Systems in Hot and Humid Climates,* Texas A&M University, Dallas, Texas
- Masuda, H.; Baltazar, J. C.; Ji, J.; Claridge, D. E. 2008. "Development of Data Quality Control Limits for Data Screening Through the 'Energy Balance' Method", *Proceedings of the 16th Symposium on Improving Building Systems in Hot and Humid Climates,* Texas A&M University, Dallas, Texas
- Malhotra, M.; Im, P.; Haberl, J.; Ramirez, E.; Cho, S.; Canez, J.; Schaider, N.; Fisk, P.; Feigenbaum, L. 2008. "Design, Construction, Transportation, Operation and Post-Occupancy Analysis for the Texas A&M Solar Decathlon House", *Proceedings of the 16th Symposium on Improving Building Systems in Hot and Humid Climates,* Texas A&M University, Dallas, Texas
- Ji, J.; Baltazar, J. C.; Claridge, D. E. 2008. "Study of the Outside Air Enthalpy Effects in the Screening of Metered Building Energy Data", *Proceedings of the 1th Symposium on Improving Building Systems in Hot and Humid Climates,* Texas A&M University, Dallas, Texas

Presentation of two papers at the International Conference for Enhanced Building Operation, Berlin, Germany, October 2008, including:

- Haberl, J. S.; Davies, H.; Owens, B.; Hunn, B. 2008. “ASHRAE’s New Performance Measurement Protocols for Commercial Buildings”, *Proceedings of the 8th International Conference for Enhanced Building Operation*, Berlin, Germany.
- Dennis, J. R.; Hodapp, R. T.; Kramer, L.; Deng, S.; Wei, G.; Turner, W. D.; Yazdani, B.; Baltazar, J. C.; Henson, R.; Schroeder, F. 2008. “Continuous Commissioning® of Dallas/Fort Worth International Airport”, *Proceedings of the 8th International Conference for Enhanced Building Operation*, Berlin, Germany.

The Laboratory has and will continue to provide leading-edge technical assistance to the TCEQ, counties and communities working toward obtaining full SIP credit for the energy efficiency and renewable energy projects that are lowering emissions and improving the air quality for all Texans. The Laboratory will continue to provide superior technology to the State of Texas through efforts with the TCEQ and US EPA. The efforts taken by the Laboratory have produced significant success in bringing EE/RE closer to US EPA acceptance in the SIP. These activities were designed to more accurately calculate the creditable NOx emissions reduction from EE/RE initiatives contained in the TERP and to assist the TCEQ, local governments, and the building industry with standardized, effective implementation and reporting.

3.5 Energy and NOx Reductions from New Residential and Commercial Construction, including furnace pilot light savings and residential air conditioner retrofits

State adoption of the energy efficiency provisions of the International Residential Code (IRC) and International Energy Conservation Code (IECC) became effective September 1, 2001. The Laboratory has developed and delivered training to assist municipal inspectors to become certified energy inspectors. The Laboratory also supported code officials with guidance on interpretations as needed. This effort, based on a requirement of HB 3235, 78th Texas Legislature, supports a more uniform interpretation and application of energy codes throughout the state. In general, the State is experiencing a true market transformation from low energy efficiency products to high energy efficiency products. These include: low solar heat gain windows, higher efficiency appliances, high efficiency air conditioners and heat pumps, increased insulation, lower thermal loss ducts and in builder participation in “above-code” code programs such as Energy Star New Homes, which previously had no state baseline and almost no participation.

In 2008, the annual electricity savings[2] from code-compliant residential and commercial construction is calculated to be 1,551,569 MWh/year (6.8% of the total electricity savings), savings from furnace pilot light retrofits is 2,548,904 MBtu/year, and savings from residential air conditioner retrofits[3] is 989,385 MWh/year (4.3%).

In 2008, the OSD electricity savings from code-compliant residential and commercial construction is calculated to be 6,904 MWh/day (14.2%), savings from furnace pilot light retrofits is 6,983 MBtu/day, and savings from residential air conditioner retrofits are 7,017 MWh/day (14.5%).

By 2013, the annual electricity savings from code-compliant residential and commercial construction is calculated to be 2,045,171 MWh/year (5.8% of the total electricity savings), savings from furnace pilot light retrofits will remain at 2,548,904 MBtu/year, and savings from residential air conditioner retrofits[4] will be 2,286,233 MWh/year (6.5%).

---

[2] This includes the savings from 2001 through 2008.
[3] This assumes air conditioners in existing homes are replaced with the more efficient SEER 13 units, versus an average of SEER 11, which is slightly more efficient than the previous minimum standard of SEER 10.
[4] This assumes air conditioners in existing homes are replaced with the more efficient SEER 13 units, versus an average of SEER 11, which is slightly more efficient than the previous minimum standard of SEER 10.

By 2013, the OSD electricity savings from code-compliant residential and commercial construction is calculated to be 12,110 MWh/day (15%), savings from furnace pilot light retrofits will remain at 6,893 MBtu/day, and savings from residential air conditioner retrofits will be 16,216 MWh/day (20%).

In 2008, the annual NOx emissions reduction[5] from code-compliant residential and commercial construction is calculated to be 1,091 tons-NOx/year (8.6% of the total NOx savings), savings from furnace pilot light retrofits is 117 tons-NOx/year (0.9%), and savings from residential air conditioner retrofits is 682 tons-NOx/year (5.3%).

In 2008, the OSD NOx emissions reduction from code-compliant residential and commercial construction is calculated to be 6.0 tons-NOx/day (19.2%), savings from furnace pilot light retrofits is 0.32 tons-NOx/day (1.0%), and savings from residential air conditioner retrofits are 4.77 tons-NOx/day (15.2%).

By 2013, the NOx emissions reduction from code-compliant residential and commercial construction is calculated to be 1,435 tons-NOx/year (7% of the total NOx savings), savings from furnace pilot light retrofits will be 117 tons-NOx/year (0.6%), and savings from residential air conditioner retrofits will be 1,574 tons-NOx/year (7.7%).

By 2013, the OSD NOx emissions reduction from code-compliant residential and commercial construction is calculated to be 8.32 tons-NOx/day (15.9%), savings from furnace pilot light retrofits will be 0.32 tons-NOx/day (0.6 %), and savings from residential air conditioner retrofits will be 11.03 tons-NOx/day (21.2%).

3.6 Integrated NOx Emissions Reductions Reporting Across State Agencies

Beginning in 2005, the Laboratory worked with the TCEQ to develop a standardized, integrated NOx emissions reduction across state agencies implementing EE/RE programs so that the results can be evaluated consistently. As required by the legislation, the TCEQ receives reports: from the Laboratory on savings from code compliance and renewables; from the Laboratory, in cooperation with the Electric Reliability Council of Texas (ERCOT), on the savings from electricity generated from wind power; from the Public Utilities Commission of Texas (PUCT) on the impacts of the utility-administered programs designed to meet the mandated energy efficiency goals of SB7 and SB5; and from the State Energy Conservation Office (SECO) on the impacts of energy conservation in state agencies and political subdivisions.

The total annual and OSD electricity savings for all the different programs in the integrated format was calculated using the adjustment factors for 2001 through 2020. NOx emissions reduction from the electricity and natural gas savings for the annual and OSD for all the programs in the integrated format were calculated.

In 2008, the annual electricity savings from code-compliant residential and commercial construction is calculated to be 1,551,569 MWh/year (6.8% of the total electricity savings), savings from retrofits to Federal buildings is 206,960 MWh/year (0.9%), savings from furnace pilot light retrofits is 2,548,904 MBtu/year, savings from the PUC's Senate Bill 5 and Senate Bill 7 programs is 2,015,453 MWh/year (8.8%), savings from SECO's Senate Bill 5 program is 445,357 MWh/year (1.9%), electricity savings from green power purchases (wind) is 15,171,518 MWh/year (66.2%), and savings from residential air conditioner retrofits[6] is 989,385 MWh/year (4.3%). The total savings from all programs is 22,929,144 MWh/year.

In 2008, the OSD electricity savings from code-compliant residential and commercial construction is calculated to be 6,904 MWh/day (14.2%), savings from retrofits to Federal buildings is 567 MWh/day

[5] These NOx emissions reduction were calculated with the US EPA's 2007 eGRID for annual (25% capacity factor) and Ozone Season Day OSD.

[6] This assumes air conditioners in existing homes are replaced with the more efficient SEER 13 units, versus an average of SEER 11, which is slightly more efficient than the previous minimum standard of SEER 10.

(1.2%), savings from furnace pilot light retrofits is 6,983 MBtu/day, savings from the PUC's Senate Bill 5 and Senate Bill 7 programs is 5,522 MWh/day (11.4%), savings from SECO's Senate Bill 5 program is 1,220 MWh/day (2.5%), electricity savings from green power purchases (wind) are 25,575 MWh/day (52.6%), and savings from residential air conditioner retrofits are 7,017 MWh/day (14.5%). The total savings from all programs is 48,602 MWh/day, which would be a 2,025 MW average hourly load reduction during the OSD period.

By 2013, the annual electricity savings from code-compliant residential and commercial construction is calculated to be 2,045,171 MWh/year (5.8% of the total electricity savings), savings from retrofits to Federal buildings will be 402,732 MWh/year (1.1%), savings from furnace pilot light retrofits will remain at 2,548,904 MBtu/year, savings from the PUC's Senate Bill 5 and Senate Bill 7 programs will be 3,527,334 MWh/year (10.0%), savings from SECO's Senate Bill 5 program will be 489,440 MWh/year (1.4%), electricity savings from green power purchases (wind) will be 23,985,240 MWh/year (68.0%), and savings from residential air conditioner retrofits[7] will be 2,286,233 MWh/year (6.5%). The total savings from all programs will be 35,285,055 MWh/year.

By 2013, the OSD electricity savings from code-compliant residential and commercial construction is calculated to be 12,110 MWh/day (15%), savings from retrofits to Federal buildings will be 1,103 MWh/day (1.4%), savings from furnace pilot light retrofits will remain at 6,983 MBtu/day, savings from the PUC's Senate Bill 5 and Senate Bill 7 programs will be 9,664 MWh/day (11.9%), savings from SECO's Senate Bill 5 program will be 1,341 MWh/day (1.7%), electricity savings from green power purchases (wind) will be 40,432 MWh/day (50.0%), and savings from residential air conditioner retrofits will be 16,216 MWh/day (20%). The total savings from all programs will be 80,866 MWh/day, which would be a 3,369 MW average hourly load reduction during the OSD period.

In 2008, the annual NOx emissions reduction[8] from code-compliant residential and commercial construction is calculated to be 1,091 tons-NOx/year (8.6% of the total NOx savings), savings from retrofits to Federal buildings is 158 tons-NOx/year (1.2%), savings from furnace pilot light retrofits is 117 tons-NOx/year (0.9%), savings from the PUC's Senate Bill 5 and Senate Bill 7 programs is 1,426 tons-NOx/year (11.2%), savings from SECO's Senate Bill 5 program is 340 tons-NOx/year (2.7%), electricity savings from green power purchases (wind) is 8,914 tons-NOx/year (70.0%), and savings from residential air conditioner retrofits is 682 tons-NOx/year (5.3%). The total NOx emissions reduction from all programs is 12,727 tons-NOx/year.

In 2008, the OSD NOx emissions reduction from code-compliant residential and commercial construction is calculated to be 6 tons-NOx/day (19.2%), savings from retrofits to Federal buildings is 0.42 tons-NOx/day (1.3%), savings from furnace pilot light retrofits is 0.32 tons-NOx/day (1.0%), savings from the PUC's Senate Bill 5 and Senate Bill 7 programs is 3.82 tons-NOx/day (12.1%), savings from SECO's Senate Bill 5 program is 0.92 tons-NOx/day (2.9%), electricity savings from green power purchases (wind) are 15.13 tons-NOx/day (48.2%), and savings from residential air conditioner retrofits are 4.77 tons-NOx/day (15.2%). The total NOx emissions reduction from all programs is 31.38 tons-NOx/day.

By 2013, the NOx emissions reduction from code-compliant residential and commercial construction is calculated to be 1,435 tons-NOx/year (7% of the total NOx savings), savings from retrofits to Federal buildings will be 308 tons-NOx/year (1.5%), savings from furnace pilot light retrofits will be 117 tons-NOx/year (0.6%), savings from the PUC's Senate Bill 5 and Senate Bill 7 programs will be 2,495 tons-NOx/year (12.2%), savings from SECO's Senate Bill 5 program will be 373 tons-NOx/year (1.8%), electricity savings from green power purchases (wind) will be 14,092 tons-NOx/year (69.1%), and savings from residential air conditioner retrofits will be 1,574 tons-NOx/year (7.7%). The total NOx emissions reduction from all programs will be 20,395 tons-NOx/year.

---

[7] This assumes air conditioners in existing homes are replaced with the more efficient SEER 13 units, versus an average of SEER 11, which is slightly more efficient than the previous minimum standard of SEER 10.

[8] These NOx emissions reductions were calculated with the US EPA's 2007 eGRID for annual (25% capacity factor) and Ozone Season Day OSD.

By 2013, the OSD NOx emissions reduction from code-compliant residential and commercial construction is calculated to be 8.32 tons-NOx/day (15.9%), savings from retrofits to Federal buildings will be 0.81 tons-NOx/day (1.6%), savings from furnace pilot light retrofits will be 0.32 tons-NOx/day (0.6%), savings from the PUC's Senate Bill 5 and Senate Bill 7 programs will be 6.69 tons-NOx/day (12.8%), savings from SECO's Senate Bill 5 program will be 1.01 tons-NOx/day (1.9%), electricity savings from green power purchases (wind) will be 23.92 tons-NOx/day (45.9%), and savings from residential air conditioner retrofits will be 11.03 tons-NOx/day (21.2%). The total NOx emissions reduction from all programs will be 52.10 tons-NOx/day.

Figure 2 shows the NOx emissions reduction through 2020 for the electricity and natural gas savings from all TERP programs reporting to the TCEQ. Table 1 provides the details regarding the annual degradation, transmission and distribution losses, discount factors and growth factors that were used in the analysis[9]. Additional details of the analysis are reported in Volume III of this report.

Table 1: Adjustment Factors used for the Calculation of the Annual and OSD NOx Savings for the Different Programs

	ESL-Single Family[16]	ESL-Multifamily[16]	ESL-Commercial[16]	Federal Buildings[15]	Furnace Pilot Light Program[15]	PUC (SB7)[15]	PUC (SB5 Grant Program)[15]	SECO[15]	Wind-ERCOT[8]	SEER13 Single Family	SEER13 Multifamily
Annual Degradation Factor [11]	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	0.00%	5.00%	5.00%
T&D Loss [9]	7.00%	7.00%	7.00%	7.00%	0.00%	7.00%	7.00%	7.00%	0.00%	7.00%	7.00%
Initial Discount Factor [12]	20.00%	20.00%	20.00%	20.00%	20.00%	25.00%	25.00%	60.00%	25.00%	20.00%	20.00%
Growth Factor	3.25%	1.54%	3.25%	0.00%	0.00%	0.00%	0.00%	0.00%	Actual Rates	N.A.	N.A.
Weather Normalized	Yes	Yes	Yes	No	No	No	No	No	See note 7	Yes	Yes

[9] These factors were determined by TCEQ.

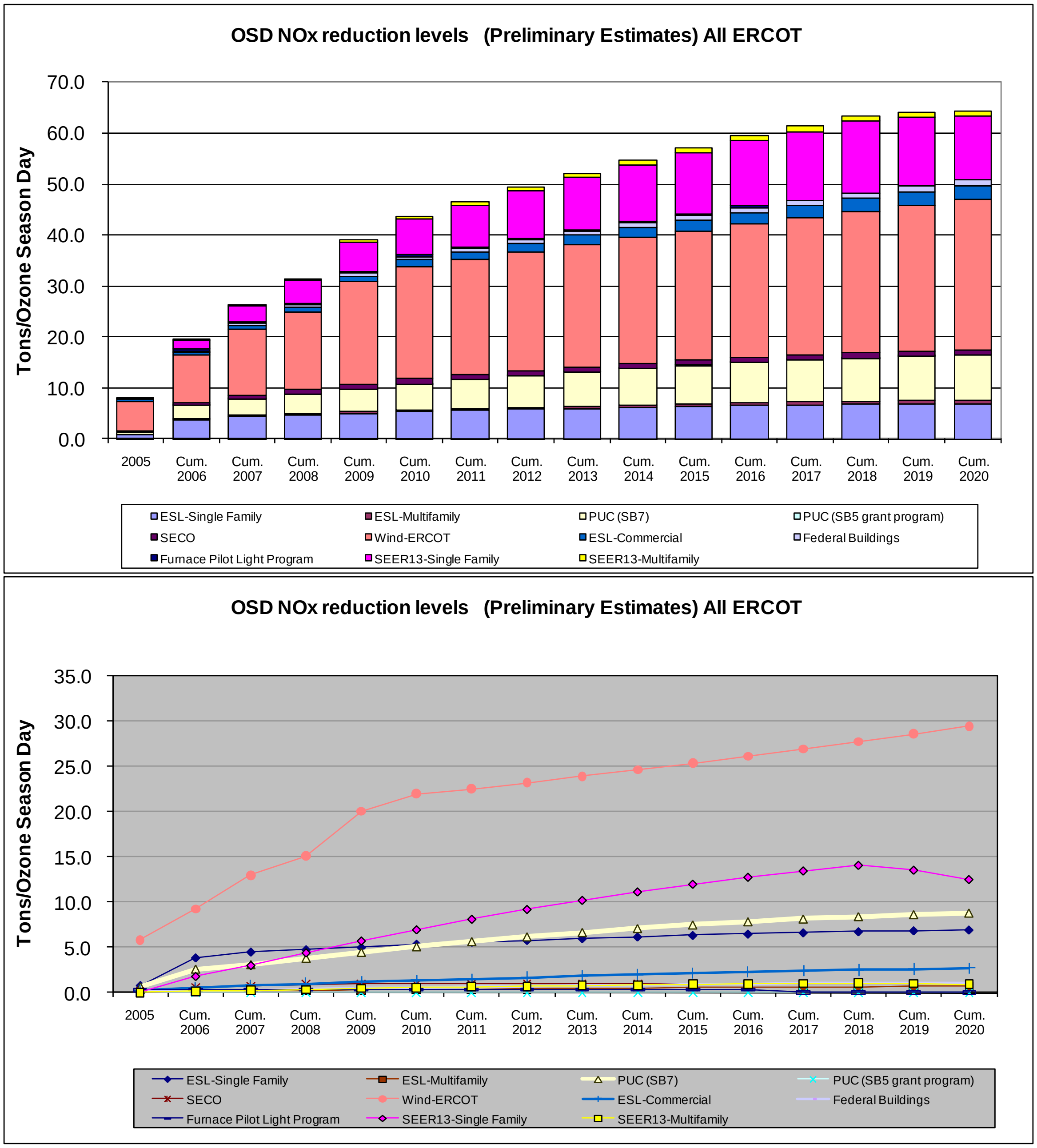


Figure 2: Cumulative OSD NOx Emissions Reduction Projected through 2020

3.7 Technology for Calculating and Verifying Emissions Reduction from Energy Used in Buildings

In 2004 and 2005, the Laboratory developed a web-based Emissions Reduction Calculator, known as "*eCalc*," which contains the underlying technology for determining NOx emissions reduction from power plants that generate the electricity for the user[10]. The emissions reduction calculator is being used to calculate emissions reduction for consideration for SIP credits from energy efficiency and renewable energy programs in the TERP.

[10] eCalc reports NOx, SOx and CO2 emissions reduction from the US EPA eGRID database for power providers in the ERCOT region.

In 2007, the Laboratory enhanced the calculator to provide additional functions and usability, including:

- Renaming the product IC3 v2.0
- Enhanced the Laboratory's IECC/IRC Code-Traceable Test Suite for determining emissions reduction due to code and above-code programs;
- Enhanced web-based emissions calculator, including:
    - Use of the calculator to determine 15% above code residential and commercial options.
    - Gathered, cleaned and posted weather data archive for 17 NOAA stations;
    - Performed comparative testing of the calculator vs. other, non-web-based simulation programs;
    - Developed and tested radiant barrier simulation;
    - Using the web-based emissions calculator, started development of the derivative version Texas Climate Vision calculator for the City of Austin;
- Continued the development of verification procedures, including:
    - Completed the calibrated simulation of a high-efficiency office building in Austin, Texas;
    - Continued work to develop a calibrated simulation of an office building in College Station; and
    - Continued work to develop a calibrated simulation of a K-12 school in College Station;

In 2008, work on both web based calculators continued;

- Deployed IC3 v3.2 to handle a wider selection of single family building configurations (http://ic3.tamu.edu);
- Delivered TCV v1.0 to the City of Austin for their testing;
- Continued to operate the original eCalc;
- Supported modeling efforts by building enhanced tools for batch simulation;
- Provided training on both IC3 and TCV.

Below are tables with the traffic details of eCalc and IC3. A 'Visit' is a metric counting the complete sets of requests from individual web client sessions with the web site. A session is considered complete and unique after thirty minutes of inactivity from the web clients IP address. A 'Page' is a metric that shows that our web server sent a complete webpage with all its files to a web client. A 'File' is when the ESL web server sends a completed request to a web client. A 'hit' is any time a web client sends any request to a web server.

Table 2: eCalc Traffic Details--January 2008 through December 2008

Summary by Month				
Month				
	Visits	**Pages**	**Files**	**Hits**
Dec-08	1,660	1,067	17,650	29,452
Nov-08	1,625	686	23,188	32,868
Oct-08	1,982	1,612	35,210	73,988
Sep-08	1,503	596	18,019	29,005
Aug-08	2,300	752	25,109	42,571
Jul-08	2,246	913	23,597	36,932
Jun-08	2,337	816	23,206	35,867
May-08	2,326	844	22,212	31,864
Apr-08	2,348	797	460,670	1,955,840
Mar-08	2,114	835	440,248	1,381,368
Feb-08	2,061	1,302	28,297	45,772
Jan-08	2,377	2,294	18,245	29,201
Totals	24,879	12,514	1,135,651	2,345,109

Table 3: IC3 Details--August 2008 through December 2008

Summary by Month				
Month	Visits	Pages	Files	Hits
Dec-08	756	8,280	30,195	30,804
Nov-08	683	8,421	30,832	31,541
Oct-08	1,020	9,720	36,213	37,164
Sep-08	709	11,440	42,472	43,615
Aug-08	518	7,619	28,996	29,889
Totals	3,686	45,480	168,708	173,013

3.8 Code Adoption

State adoption of the Residential Code energy provisions and International Energy Conservation Code became effective September 1, 2001, although anecdotal evidence in the form of telephone queries reported observations and training workshop interactions through 2002 and, to a lesser extent, 2003, indicated a rolling start rather than an overnight implementation.

Our emphasis in 2008 has been on the continued delivery of training aimed at assisting municipal inspectors to become certified energy inspectors (in one of several designations maintained by the International Energy Code Council) and supporting code officials with guidance on interpretations as needed. This effort, begun in 2003 and based on a requirement of HB 3235 of the 78th Texas Legislature, is designed to support a more uniform interpretation and application of energy codes throughout the state. In general, the State has enjoyed a true market transformation in the supply of certain products, such as Low Solar Gain windows, and in builder participation in “above-code” code programs, which previously had no state baseline and almost no participation.

3.8.1 Technology for Calculation and Verifying Emissions Reductions from Energy Used in Buildings

In 2004, the Laboratory developed a web-based Emissions Reduction Calculator, know as “eCalc,” which contains the underlying technology for determining emissions reductions from power plants that generate the electricity for the user. The Emissions Reduction Calculator is being used to calculate emissions reductions for consideration for SIP credits from energy efficiency programs in the TERP. The TCEQ and the US EPA continue to review the Laboratory’s technology and recent refinements for estimating NOx emissions reductions from additional energy efficiency and renewable energy (EE/RE) measures.

In 2007, the Laboratory continued to enhance the calculator to provide additional functions and usability. This enhanced engineering analysis software addressed major challenges:

- How to quantify and validate the persistence of energy savings from EE/RE energy measures.
- How to transform electricity reductions into spatial (location) and temporal (time-of-day) distributions of emissions reductions from electric utility power plants.
- How to quantify cumulative, multi-year emissions reductions that account for reduced emissions from the associated power plants according to the US EPA’s eGRID database using the specially prepared 2007 version of eGRID.
- How to weather-normalize NOx emissions estimates for renewable sources, such as wind and solar.

In 2007, the Laboratory’s Emissions Reduction Calculator used a specially prepared 2007 version of the US EPA’s eGRID database to identify where emissions are produced. To date, the Laboratory has enhanced the emissions calculator by:

- expanding the capabilities to include all counties in ERCOT; including the collection and assembly of weather from 1999 to the present from 17 NOAA weather stations;
- initiating the expansion of the calculator to be able to analyze energy efficiency improvement to K-12 schools;
- enhancing the underlying computer platform for the calculator;
- verifying the calculator against other RESNET certified calculators;
- adding a radiant barrier and duct model to the calculator;
- added calculations to account for the increased energy savings from the new SEER 13 air conditioners, introduced in 2006 as part of the new Federal regulations, and
- developing verification procedures for the savings currently calculated and reported by the Laboratory, including calibrated simulations for a two office buildings, one residence and one K-12 school.

In 2008, the Laboratory:

- continued the collection and assembly of weather from 1999 to the present from 17 NOAA weather stations;
- continued the analysis of energy efficiency improvement to K-12 schools;
- continued the enhancement of the underlying computer platform for the calculator;
- continued the verification of the calculator against other RESNET certified calculators;
- continued with the addition of the radiant barrier and duct models to the calculator, including testing;
- tested the new SEER 13 air conditioner procedures, introduced in 2006 as part of the new Federal regulations, and
- continued developing verification procedures for the savings currently calculated and reported by the Laboratory, including calibrated simulations for a two office buildings, one residence and one K-12 school.

3.8.2 Evaluation of Additional Technologies for Reducing Energy Use in Existing Buildings

The Laboratory provided technical assistance to the TCEQ, the PUCT, SECO and ERCOT, as well as Stakeholders participating in the Energy Code and Renewables programs.

- In 2008, the Laboratory continued to work with the TCEQ to develop an integrated NOx emissions reductions calculation that provided the TCEQ with a creditable NOx emissions reductions from energy efficiency and renewable energy (EE/RE) programs reported to the TCEQ in 2008 by the Laboratory, PUCT, SECO, and ERCOT (i.e., wind).
- At the request of the TCEQ, the Laboratory has continued the development of procedures for quantifying NOx emissions reductions from wind turbines that includes weather normalization and the quantification of NOx emissions reductions from the new Federal regulations for SEER 13 air conditioners.

3.9 Planned Focus for 2008/2009

In FY 2008, the Energy Systems Laboratory will continue in its cooperative efforts with the TCEQ, PUCT, SECO, US EPA and others to ensure EE/RE measures remain a cost-effective solution to clean air, and continue to support the energy efficiency and renewable energy opportunities of the TERP. The Laboratory team will:

- Assist the TCEQ to obtain SIP credits from energy efficiency and renewable energy using the Laboratory's Emissions Reduction Calculator technology;
- Verify, document and report energy efficiency and renewable energy savings in all TERP EE/RE programs for the SIP in each non-attainment and affected county using the TCEQ/US EPA approved technology;

- Assist the PUCT with determining emissions reductions credits from energy efficiency programs funded by SB 7 and SB 5;
- Assist political subdivisions and Councils of Governments with calculating emissions reductions from local code changes and voluntary EE/RE programs for SIP inclusion;
- Continue to refine the cost-effective techniques to implement 15% above code energy efficiency in low-priced and moderately-priced residential housing;
- Continue to refine the cost-effective methods and techniques to implement 15% above code energy efficiency in low-priced and moderately-priced commercial buildings;
- Continue to develop creditable procedures for calculating NOx emissions reductions from green renewable technologies, including wind power, solar energy and geothermal energy systems;
- Continue development of well-documented, integrated Nox emissions reductions methodologies for calculating and reporting NOx reductions, including a unified database framework for required reporting to TCEQ of potentially creditable measures from the ESL, PUCT, and SECO SB 5 initiatives;
- Upon request, provide written recommendations to the State Energy Conservation Office (SECO) about whether or not the energy efficiency provisions of latest published edition of the International Residential Code (IRC), or the International Energy Conservation Code (IECC), are equivalent to or better than the energy efficiency and air quality achievable under the editions adopted under the 2001 IRC/IECC. This will consider comments made by persons who have an interest in the adoption of the energy codes in the recommendations made to SECO.
- Develop a standardized report format to be used by providers of home energy ratings, including different report formats for rating newly constructed residences from those for existing residences.
- Continue to cooperate with an industry organization or trade association to: develop guidelines for home energy ratings; provide training for individuals performing home energy ratings and providers of home energy ratings; and provide a registry of completed ratings for newly constructed residences and residential improvement projects for the purpose of computing the energy savings and emissions reductions benefits of the home energy ratings program.
- Include all benefits attained from this program in an annual report to the commission.

The Laboratory has and will continue to provide leading-edge technical assistance to counties and communities working toward obtaining full SIP credit for the energy efficiency and renewable energy projects that are lowering emissions and improving the air for all Texans. The Laboratory will continue to provide superior technology to the State of Texas through efforts with the TCEQ and US EPA. The efforts taken by the Laboratory have produced significant success in bringing EE/RE closer to US EPA acceptance in the SIP.

4 INTRODUCTION

4.1 Background

In 2001, the Texas Legislature adopted the Texas Emissions Reduction Plan, identifying thirty-eight counties in Texas where a focus on air quality improvements was deemed critical to public health and economic growth. These areas are shown on the map in Figure 3 as non-attainment and near nonattainment. In 2008, the twenty counties designated as nonattainment counties include: Brazoria, Chambers, Collin, Dallas, Denton, Ellis, Fort Bend, Hardin, Harris, Jefferson, Galveston, Johnson, Kaufman, Liberty, Montgomery, Orange, Parker, Rockwall, Tarrant, and Waller Counties. The fourteen counties designated as Ozone Early Action Compact counties include: Bastrop, Bexar, Caldwell, Comal, Gregg, Guadalupe, Harrison, Hays, Rusk, Smith, Travis, Upshur, Williamson, and Wilson County.

These counties represent several geographic areas of the state, which have been assigned to different climate zones by the 2001 IECC[11] as shown in Figure 4, based primarily on Heating Degree Days (HDD). These include climate zone 5 or 6 (i.e., 2,000 to 2,999 HDD_{65}) for the Dallas-Ft. Worth and El Paso areas, and climate zones 3 and 4 (i.e., 1,000 to 1,999 HDD_{65}) for the Houston-Galveston-Beaumont-Port Arthur-Brazoria areas. Also shown in Figure 4 are the locations of the various weather data sources, including the Typical Meteorological Year (TMY2) (NREL 1995) stations, the Weather Year for Energy Calculations (WYEC2) (Stoffel 1995) weather stations, the National Weather Service weather stations, (NWS) (NOAA 1993) weather stations, the ASHRAE 90.1 1989 weather locations[12], the ASHRAE 90.1 1999 weather locations, the solar stations measured by the National Renewable Energy Laboratory (NREL)[13], the solar stations measured by the TCEQ[14], and F-CHART and PV F-CHART weather locations[15].

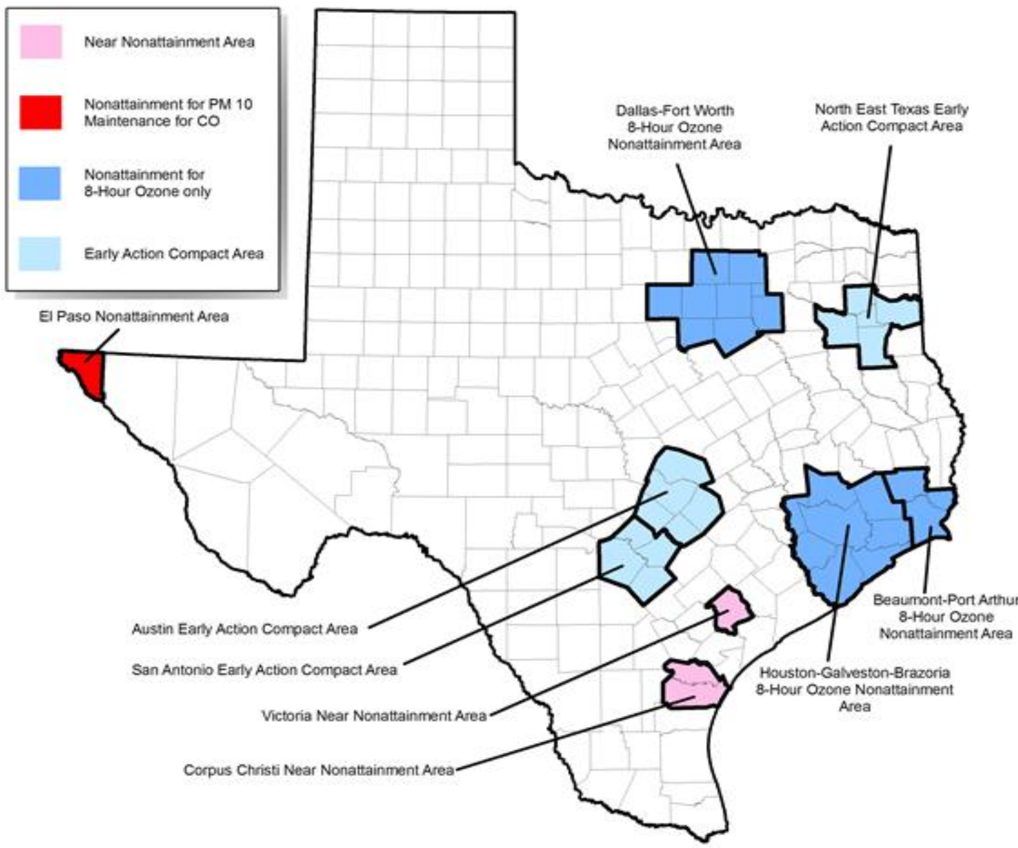


Figure 3: US EPA Nonattainment and Near Nonattainment

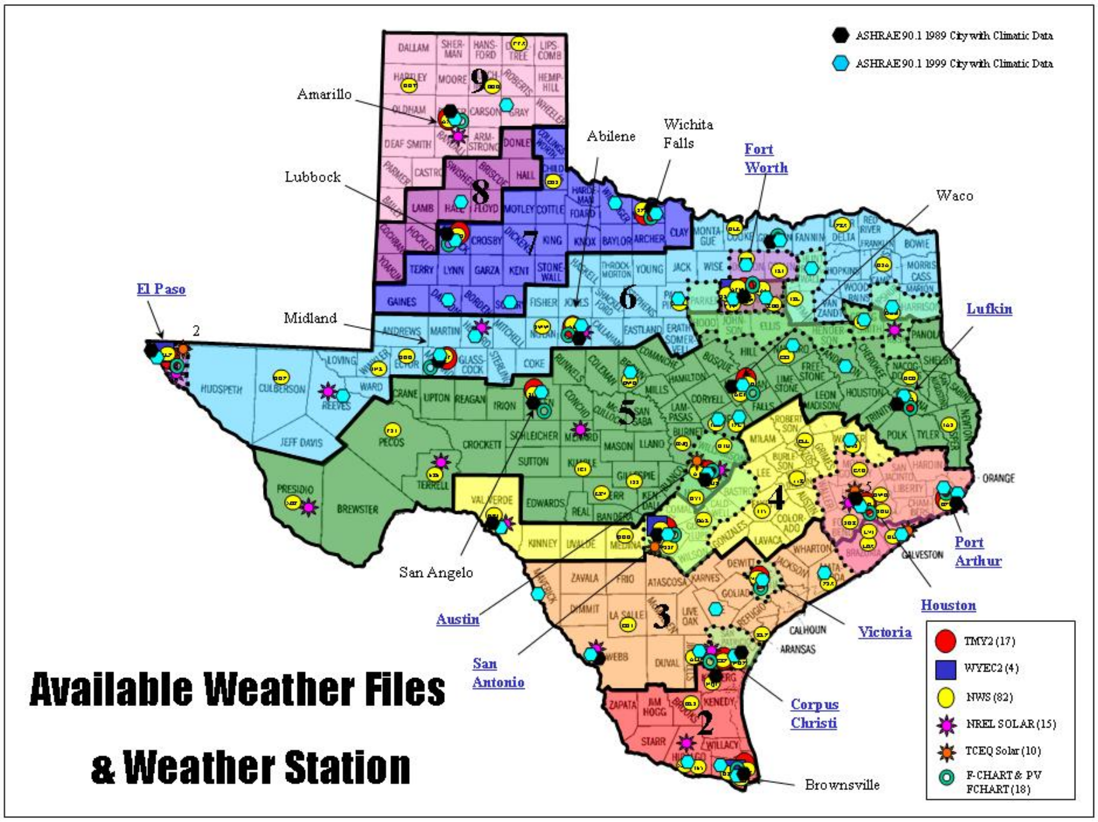
[11] The “2000 IECC” notation is used to signify the 2000 International Residential Code (IRC), which includes the International Energy Conservation Code (IECC) as modified by the 2001 Supplement (IECC 2001), published by the ICC in March of 2001, as required by Senate Bill 5.

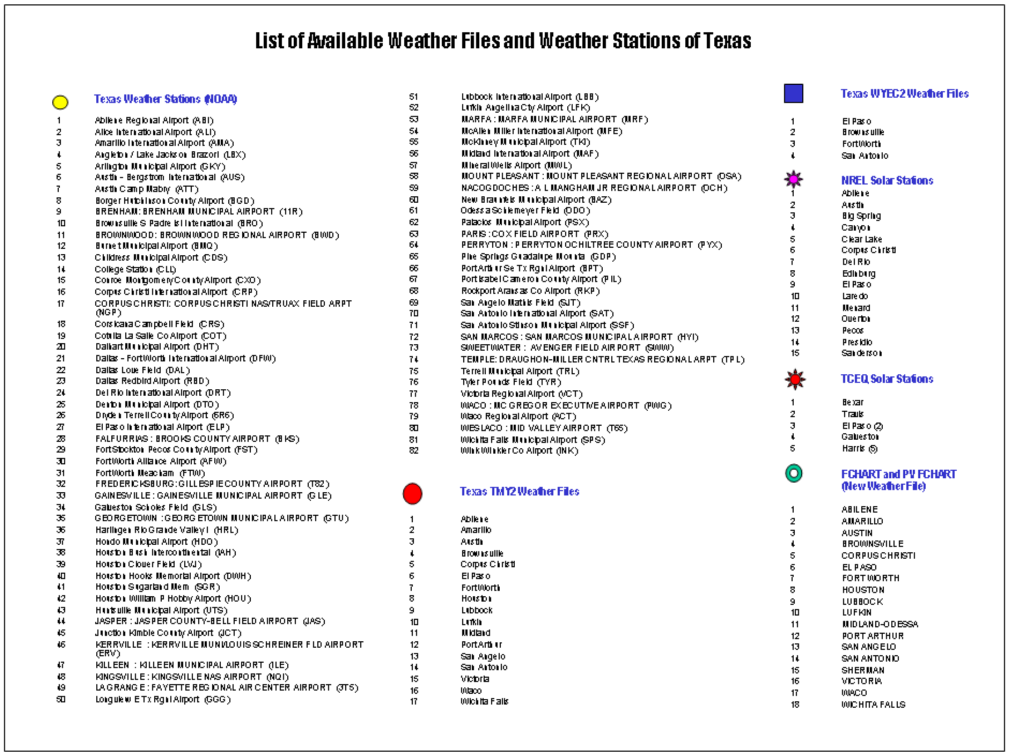
[12] The ASHRAE 90.1-1989 and 90.1-1999 weather stations are used in the emissions calculator for determining the building characteristics.

[13] The NREL stations were the primary source of the 1999 global horizontal, direct normal and diffuse solar radiation used to determine the 1999 peak-day and annual emissions for the DOE-2 simulations for code-compliant housing and commercial buildings.

[14] The TCEQ stations were used as the secondary source for global horizontal solar radiation when the NREL sites were missing data or no NREL site was nearby.

[15] The F-Chart and PV F-Chart weather locations are used to determine the solar thermal or electricity produced by the systems specified by the use in the emissions calculation. The monthly energy or electricity production from F-Chart or PV F-Chart is then weather-normalized using ASHRAE’s Inverse Model Toolkit to develop coefficients that are then used to determine the 1999 annual and peak day energy or electricity production for emissions calculations.





List of Available Weather Files and Weather Stations of Texas

Texas Weather Stations (NOAA)

1	Abilene Regional Airport (ABI)
2	Alice International Airport (ALI)
3	Amarillo International Airport (AMA)
4	Angleton / Lake Jackson Brazori (LBX)
5	Arlington Municipal Airport (GKY)
6	Austin - Bergstrom International (AUS)
7	Austin Camp Mabry (ATT)
8	Borger Hutchinson County Airport (BGD)
9	BRENHAM: BRENHAM MUNICIPAL AIRPORT (11R)
10	Brownsville S Padre Isl International (BRO)
11	BROWNWOOD: BROWNWOOD REGIONAL AIRPORT (BWD)
12	Burnet Municipal Airport (BMQ)
13	Childress Municipal Airport (CDS)
14	College Station (CLL)
15	Conroe Montgomery County Airport (CXO)
16	Corpus Christi International Airport (CRP)
17	CORPUS CHRISTI: CORPUS CHRISTI NAS/TRUAX FIELD ARPT (NGP)
18	Corsicana Campbell Field (CRS)
19	Cotulla La Salle Co Airport (COT)
20	Dalhart Municipal Airport (DHT)
21	Dallas - Fort Worth International Airport (DFW)
22	Dallas Love Field (DAL)
23	Dallas Redbird Airport (RBD)
24	Del Rio International Airport (DRT)
25	Denton Municipal Airport (DTO)
26	Dryden Terrell County Airport (6R6)
27	El Paso International Airport (ELP)
28	FALFURRIAS : BROOKS COUNTY AIRPORT (BKS)
29	Fort Stockton Pecos County Airport (FST)
30	Fort Worth Alliance Airport (AFW)
31	Fort Worth Meacham (FTW)
32	FREDERICKSBURG: GILLESPIE COUNTY AIRPORT (T82)
33	GAINESVILLE : GAINESVILLE MUNICIPAL AIRPORT (GLE)
34	Galveston Scholes Field (GLS)
35	GEORGETOWN : GEORGETOWN MUNICIPAL AIRPORT (GTU)
36	Harlingen Rio Grande Valley I (HRL)
37	Hondo Municipal Airport (HDO)
38	Houston Bush Intercontinental (IAH)
39	Houston Clover Field (LVJ)
40	Houston Hooks Memorial Airport (DWH)
41	Houston Sugarland Mem (SGR)
42	Houston William P Hobby Airport (HOU)
43	Huntsville Municipal Airport (UTS)
44	JASPER : JASPER COUNTY-BELL FIELD AIRPORT (JAS)
45	Junction Kimble County Airport (JCT)
46	KERRVILLE : KERRVILLE MUNI/LOUIS SCHREINER FLD AIRPORT (ERV)
47	KILLEEN : KILLEEN MUNICIPAL AIRPORT (ILE)
48	KINGSVILLE : KINGSVILLE NAS AIRPORT (NQI)
49	LA GRANGE : FAYETTE REGIONAL AIR CENTER AIRPORT (3T5)
50	Longview E Tx Rgnl Airport (GGG)
51	Lubbock International Airport (LBB)
52	Lufkin Angelina Cty Airport (LFK)
53	MARFA : MARFA MUNICIPAL AIRPORT (MRF)
54	McAllen Miller International Airport (MFE)
55	McKinney Municipal Airport (TKI)
56	Midland International Airport (MAF)
57	Mineral Wells Airport (MWL)
58	MOUNT PLEASANT : MOUNT PLEASANT REGIONAL AIRPORT (OSA)
59	NACOGDOCHES : A L MANGHAM JR REGIONAL AIRPORT (OCH)
60	New Braunfels Municipal Airport (BAZ)
61	Odessa Schlemeyer Field (ODO)
62	Palacios Municipal Airport (PSX)
63	PARIS : COX FIELD AIRPORT (PRX)
64	PERRYTON : PERRYTON OCHILTREE COUNTY AIRPORT (PYX)
65	Pine Springs Guadalupe Mounta (GDP)
66	Port Arthur Se Tx Rgnl Airport (BPT)
67	Port Isabel Cameron County Airport (PIL)
68	Rockport Aransas Co Airport (RKP)
69	San Angelo Mathis Field (SJT)
70	San Antonio International Airport (SAT)
71	San Antonio Stinson Municipal Airport (SSF)
72	SAN MARCOS : SAN MARCOS MUNICIPAL AIRPORT (HYI)
73	SWEETWATER : AVENGER FIELD AIRPORT (SWW)
74	TEMPLE: DRAUGHON-MILLER CNTRL TEXAS REGIONAL ARPT (TPL)
75	Terrell Municipal Airport (TRL)
76	Tyler Pounds Field (TYR)
77	Victoria Regional Airport (VCT)
78	WACO : MC GREGOR EXECUTIVE AIRPORT (PWG)
79	Waco Regional Airport (ACT)
80	WESLACO : MID VALLEY AIRPORT (T65)
81	Wichita Falls Municipal Airport (SPS)
82	Wink Winkler Co Airport (INK)

Texas TMY2 Weather Files

1	Abilene
2	Amarillo
3	Austin
4	Brownsville
5	Corpus Christi
6	El Paso
7	Fort Worth
8	Houston
9	Lubbock
10	Lufkin
11	Midland
12	Port Arthur
13	San Angelo
14	San Antonio
15	Victoria
16	Waco
17	Wichita Falls

Texas WYEC2 Weather Files

1	El Paso
2	Brownsville
3	Fort Worth
4	San Antonio

NREL Solar Stations

1	Abilene
2	Austin
3	Big Spring
4	Canyon
5	Clear Lake
6	Corpus Christi
7	Del Rio
8	Edinburg
9	El Paso
10	Laredo
11	Menard
12	Overton
13	Pecos
14	Presidio
15	Sanderson

TCEQ Solar Stations

1	Bexar
2	Travis
3	El Paso (2)
4	Galveston
5	Harris (5)

FCHART and PV FCHART (New Weather File)

1	ABILENE
2	AMARILLO
3	AUSTIN
4	BROWNSVILLE
5	CORPUS CHRISTI
6	EL PASO
7	FORT WORTH
8	HOUSTON
9	LUBBOCK
10	LUFKIN
11	MIDLAND-ODESSA
12	PORT ARTHUR
13	SAN ANGELO
14	SAN ANTONIO
15	SHERMAN
16	VICTORIA
17	WACO
18	WICHITA FALLS

Figure 4: Available NWS, TMY2 and WYEC2 weather files compared to IECC/IRC weather zones for Texas

4.2 Energy Systems Laboratory's Responsibilities in the TERP

In 2001, Texas Senate Bill 5 outlined the following responsibilities for the Energy Systems Laboratory (ESL) within the TERP:

- Sec. 386.205. Evaluation of State Energy Efficiency Programs.
- Sec. 388.003. Adoption of Building Energy Efficiency Performance Standards.
- Sec. 388.004. Enforcement of Energy Standards Outside of Municipality.
- Sec. 388.007. Distribution of Information and Technical Assistance.
- Sec. 388.008. Development of Home Energy Ratings.

These responsibilities were updated in 2003:
1) with House Bill 1365, including modifications to:

- Sec. 388.004. Enforcement of Energy Standards Outside of Municipality.
- Sec. 388.009. Energy-Efficient Building Program.

2) with House Bill 3235, including modifications to:

- Sec. 388.009. Certification of Municipal Building Inspectors.

These responsibilities were further updated in 2005:

- with Senate Bill 20, House Bill 2481, and 2129.

These responsibilities were further updated in 2007:

- with Senate Bill 12 and House Bill 3693.

These responsibilities were further updated in 2007:

- with Senate Bill 12 and House Bill 3693.

In the following sections each of these tasks is further described.

4.2.1 (SB 5) Section 386.205. Evaluation of State Energy Efficiency Programs (w/PUCT)

The Laboratory is instructed to assist the Public Utility Commission of Texas (PUCT) and provide an annual report that quantifies by county the reductions of energy demand, peak loads, and associated emissions of air contaminants achieved from the programs implemented under this subchapter and from those implemented under Section 39.905, Utilities Code (i.e., Senate Bill 7).(SB 5) Sec. 388.003. Adoption of Building Energy Efficiency Performance Standards.

TERP adopts the energy efficiency chapter of the 2001 International Residential Code (2001 IRC) as an energy code for single-family residential construction, and the 2001 International Energy Conservation Code (2001 IECC) for all other residential, commercial and industrial construction in the state. It requires that municipalities establish procedures for administration and enforcement, and ensure that code-certified inspectors perform inspections.

TERP provides that local amendments, in non-attainment areas and affected counties, may not result in less stringent energy efficiency requirements. The Laboratory is to review local amendments, if requested, and submit an annual report of savings impacts to the TCEQ. The Laboratory is also authorized to collect fees for certain of its tasks in Sections 388.004, 388.007 and 388.008.

4.2.3 (SB 5) Sec. 388.004. Enforcement of Energy Standards Outside of Municipality

For construction outside of the local jurisdiction of a municipality, TERP provides for a building to comply if:

a) a building certified by a national, state, or local accredited energy efficiency program shall be considered in compliance;
b) a building with inspections from private code-certified inspectors using the energy efficiency chapter of the International Residential Code or International Energy Conservation Code shall be considered in compliance; and
c) a builder who does not have access to either of the above methods for a building shall certify compliance using a form provided by the Laboratory, enumerating the code-compliance features of the building.

4.2.4 (SB 5) Sec. 388.007. Distribution of Information and Technical Assistance

The Laboratory is required to make available to builders, designers, engineers, and architects code implementation materials that explain the requirements of the International Energy Conservation Code and the energy efficiency chapter of the International Residential Code. TERP authorizes the Laboratory to develop simplified materials to be designed for projects in which a design professional is not involved. It also authorizes the Laboratory to provide local jurisdictions with technical assistance concerning implementation and enforcement of the International Energy Conservation Code and the energy efficiency chapter of the International Residential Code.(SB 5) Sec. 388.008. Development of Home Energy Ratings.

TERP requires the Laboratory to develop a standardized report format to be used by providers of home energy ratings (HERs). The form must be designed to give potential buyers information on a structure's energy performance, including certain equipment. TERP requires the Laboratory to establish a public information program to inform homeowners, sellers, buyers, and others regarding home energy ratings.

4.2.6 (HB 1365) Sec. 388.004. Enforcement of Energy Standards Outside of Municipality

In 2003, House Bill 1365 modified Section 388.004 of The TERP to include the following new requirements:

- That builders shall retain for three years documentation which shows their building is in compliance with the Texas Building Energy Performance Standards, and that builders shall provide a copy of the compliance documentation to homeowners.
- That single-family residences built in unincorporated areas of counties, which were completed on or after September 1, 2001, but not later than August 31, 2003, are considered in compliance with the Texas Building Energy Performance Standards.

To help builders comply with these requirements, the Laboratory will enhance the current form, which is posted on the Laboratory’s The TERP website.

4.2.7 (HB 1365) Sec. 388.009. Energy-Efficient Building Program

In 2003, House Bill 1365 modified the TERP, adding a new Section 388.009. In this section the General Land Office, the TCEQ and the Laboratory, working with an advisory committee, may develop an energy-efficient building accreditation program for buildings that exceed the building energy performance standards under Section 388.003 by 15% or more. This program shall be updated annually to include best available energy-efficient building practices. This program shall use a checklist system to produce an energy-efficient building scorecard to help: (1) home buyers compare potential homes and, by providing a copy of the completed scorecard to a mortgage lender, qualify for energy-efficient mortgages under the National Housing Act; and (2) communities qualify for emissions reduction credits by adopting codes that meet or exceed the energy-efficient building or energy performance standards established under this chapter. This effort may include a public information program to inform homeowners, sellers, buyers, and others regarding energy-efficient building ratings. The Laboratory shall establish a system to measure the reduction in energy and emissions produced under the energy-efficient building program and report those savings to the commission.

4.2.8 (HB 3235) Sec. 388.009. Certification of Municipal Inspectors

Also in 2003, House Bill 3235 modified the TERP to add the new Section 388.009. In this section the Laboratory is required to develop and administer a state-wide training program for municipal building inspectors who seek to become code-certified inspectors. To accomplish this, the Laboratory will work with national code organizations to assist participants in the certification program and is allowed to collect a reasonable fee from participants in the program to pay for the costs of administering the program. This program is required to be developed no later than January 1, 2004, with state-wide training sessions starting no later than March 1, 2004.

4.2.9 (SB 20, HB 2481, HB 2129). Additional Energy-Efficiency Initiatives

The 79th Legislature, through SB 20, HB 2481 and HB 2129, amended SB 5 to enhance its effectiveness by adding the following additional energy-efficiency initiatives, including requiring 5,880 MW of generating capacity from renewable energy technologies by 2015, and 500 MW from non-wind renewables.

This legislation also requires PUCT to establish a target of 10,000 MW of installed renewable capacity by 2025, and requires TCEQ to develop a methodology for computing emissions reductions from renewable energy initiatives and the associated credits. The Laboratory is to assist TCEQ in quantifying emissions reductions credits from energy-efficiency and renewable-energy programs, through a contract with the Texas Environmental Research Consortium (TERC) to develop and annually calculate creditable emissions reductions from wind and other renewable energy resources for the state's SIP.

Finally, this legislation requires the Laboratory to develop at least 3 alternative methods for achieving a 15 % greater potential energy savings in residential, commercial and industrial construction. To accomplish this, the Laboratory will be using the code-compliance calculator to ascertain which measures are best suited for reducing energy use without requiring substantial investments.

4.2.10 (SB 12, HB 3693). Additional Energy-Efficiency Initiatives

The 80th Legislature (2007), through SB 12, and HB 3693 amended SB 5 to enhance its effectiveness by adding several new energy efficiency initiatives. First, it requires the Laboratory to provide written recommendations to the State Energy Conservation Office (SECO) about whether or not the energy efficiency provisions of latest published edition of the International Residential Code (IRC), or the International Energy Conservation Code (IECC), are equivalent to or better than the energy efficiency and air quality achievable under the editions adopted under the 2001 IRC/IECC. The laboratory shall make its recommendations not later than six months after publication of new editions at the end of each three-year code development cycle of the International Residential Code and the International Energy Conservation Code. As part of this work with SECO, the Laboratory is required to consider comments made by persons who have an interest in the adoption of the energy codes in the recommendations made to SECO.

In addition, it requires the Laboratory to develop a standardized report format to be used by providers of home energy ratings, including different report formats for rating newly constructed residences from those for existing residences. The form must be designed to give potential buyers information on a structure's energy performance, including: insulation; types of windows; heating and cooling equipment; water heating equipment; additional energy conserving features, if any; results of performance measurements of building tightness and forced air distribution; and an overall rating of probable energy efficiency relative to the minimum requirements of the International Energy Conservation Code or the energy efficiency chapter of the International Residential Code, as appropriate.

It also encourages the Laboratory to cooperate with an industry organization or trade association to: develop guidelines for home energy ratings; provide training for individuals performing home energy ratings and providers of home energy ratings; and provide a registry of completed ratings for newly constructed residences and residential improvement projects for the purpose of computing the energy savings and emissions reductions benefits of the home energy ratings program. Finally, it requires the Laboratory shall to include information on the benefits attained from this program in an annual report to the commission.

5 PROGRESS: JANUARY 2008 through DECEMBER 2008

5.1 (SB 5) Section 386.205. Evaluation of State Energy-Efficiency Programs (w/PUCT)

5.1.1 Implemented Procedures for Evaluating State Energy-Efficiency Programs

In 2004 the Laboratory held several meetings with the Public Utility Commission of Texas to discuss the development of a framework for reporting emissions reduction from the State Energy Efficiency Programs administered by the PUCT. The State Energy-Efficiency Programs administered by the PUCT include programs under Senate Bill 7 (i.e., Section 39.905 Utilities Code) and Senate Bill 5.

In 2003 and 2004, the Laboratory worked with the TCEQ to identify a method to help the PUCT more accurately report their deemed savings as peak-day savings in 1999, using the Laboratory's new emissions reductions calculator. In 2005, this method was implemented in the TCEQ's Integrated Emissions Calculations, which was reported in the 2005, 2006, 2007 and 2008 annual report.

5.2 (SB 5) Sec. 388.003. Adoption of Building Energy-Efficiency Performance Standards

5.2.1 Provide Code Training Sessions

During the 77th Legislature, Senate Bill 5 (SB 5) adopted the 2000 International Residential Code (IRC) as the energy code for single-family residential construction and the 2000 edition of the International Energy Conservation Code (IECC), with the 2001 Supplement for all other residential, commercial and industrial construction in the state. It requires that municipalities establish procedures for administration and enforcement, and ensure that code-certified inspectors perform inspections.

These codes are published by the International Code Council (ICC), which publishes a new edition every three years and a supplement in the intervening years. The 2003 Codes have been reviewed and determined to be no less stringent than the editions currently adopted by SB 5. Transition to the 2003 IRC and IECC can be easily accomplished.

Section 388.009 requires the Laboratory to develop and administer a state-wide training program for municipal building inspectors who seek to become code-certified inspectors. To accomplish this, the Laboratory developed the Energy Code Workshops which are based on the 2003 International Energy Conservation Code (IECC) as published by the International Code Council (ICC) for residential and commercial buildings. In addition, three more workshops were developed that offered software training, ASHRAE Standard 62.1 and ASHRAE Standard 90.1.

The Residential Energy Code Training Workshop and Commercial Requirements of the International Energy Conservation Workshop both include an overview of the TERP program and extensive instruction on all chapters of the IECC, which include the general requirements, definitions, and design conditions. The Residential Workshop also includes detailed instruction on Chapters 4, 5 and 6, which are the specific regulations relating to residential construction, in addition to a comparison of the IECC and the energy provisions of the International Residential Code (IRC). The Commercial Workshop includes detailed instruction on Chapters 7 and 8, which relate to commercial regulations and a summary of the relationship between ASHRAE 90.1 and the commercial provisions of the IECC.

The ASHRAE 90.1 Workshop includes a brief overview of SB 5 and a summary of the relationship between ASHRAE 90.1 and the Commercial provisions of the IECC. ASHRAE Standard 62.1 workshops provide training concerning ASHRAE commercial building ventilation rates. Software workshops were also developed to begin the training of the use of software for calculating code compliance.

In 2008 the TERP group prepared for the trainings that were to be offered in 2009.

- January 17-20: Gathering of 90.1 updated materials from the ASHRAE 90.1 Standards committee meetings in New York City. These were organized into workshop presentation materials for workshops offered in 2009.
- June 20-23: Participation in the ASHRAE 90.1 Standards committee meetings in Salt Lake City, to obtain critical updates for the offering of 90.1 training workshops, which came later in 2009.

5.2.2 Summary of ASHRAE Standard 90.1 Standards Committee Activities during 2008, and Ongoing Subcommittee Actions

The following paragraphs summarize discussions at the ASHRAE Standards Committee meetings at New York, January 2008 and Salt Lake City, June 2008 and other subcommittee actions.

5.2.2.1 From the Envelope Subcommittee

Two changes were proposed to ASHRAE 90.1 2004. These are provisions for high albedo roof and a proposal for a rating system for cool roofs:

The high albedo roof provisions of Standard 90.1-2004 were reviewed with the intent of coordinating with Standard 90.2-2004. It was recommended to modify the exception to Section 5.5.3.1 by adding the ASTM test method E 1980-Standard Practice for Calculating Solar Reflectance Index (SRI) of Horizontal and Low Sloped Opaque Surfaces. This test method employs the use of the solar reflectance and thermal emittance values of a roof product in the ASTM E1980 calculation to derive the SRI. The SRI minimum value of 82 was chosen as it represents the rounded value when applying the two current minimum values, solar reflectance of 0.70 and thermal emittance of 0.75, when applied to the calculation at medium wind speed condition. The reasons for this are twofold. First, this is another test method that will allow additional roof products to meet the high albedo roof requirements of Standard 90.1 and in our view more paths toward compliance will encourage energy efficiency. Second, Standard 90.2-2004 contains this test method; therefore, there is an attempt to bring both standards into near agreement on the subject of high albedo roof provisions. It is proposed to modify Chapter 12, “Normative References” to introduce ASTM E1980 in the listing of ASTM references. See Addendum y to 90.1-2004[16].

The second addendum for the envelope section of the ASHRAE 90.1 code proposes a rating system for cool roofs. The Cool Roof Rating Council CRRC program is identified as a way to establish a common and uniform evaluation to determine compliance with the standard. Verification of a roofing product is available through two means: (1) a “label” that may be placed directly on the product, on the wrapping or container, or on the manufacturer’s technical literature and (2) the Cool Roof Rating Council’s Web site directory[17]. This addendum also deletes two of the ASTM standard test methods. The basis for this is that the CRRC determined through its development of the product rating program that, although those two test methods (ASTM C835 and E1175) were recognized as opportunities for compliance, the availability of these test methods (e.g., the number of testing laboratories open to the general public) is restricted. The new test method (ASTM C1549) recognizes a test procedure that is considered comparable to the ASTM solar reflectance test methods currently cited. Although CRRC-1 cites its own testing procedure, it is effectively identical to the ASTM test. The reason for two test standards is directly related to the date of publication for each document. The CRRC-1 document was produced prior to ASTM producing their document. (Addendum ad to 90.1 – 2004).

The following paragraphs describe the proposed changes to the Envelope section in ASHRAE 90.1 2007:

Proposed changes to vestibule requirements were finalized in Addendum q. The exterior envelope of conditioned vestibules shall comply with the requirements for a conditioned space. The interior and exterior envelope of unconditioned vestibules shall comply with the requirements for a semi-heated space. Zonal criteria have been added for zones 3 and 4 depending on the size of the building. Currently addendum be is up for public review. The proposed language provides for more vestibules in climate zone 3 for buildings less than 10,000 sq feet and is more consistent with the IECC. This language has been revised to reflect addendum q to ASHRAE 90.1-2007.

The performance of cool roofs was assessed. Impact of ambient conditions such as snow cover and rain on degradation of cool roof performance overtime was discussed. Currently, environmental conditions

[16] All Addendums may be found in the Appendix of the most recent code revision. http://www.ashrae.org/technology/page/132
[17] http://www.coolroofs.org

regarding particulate accumulation and adhesion are not taken into account in the savings calculations. Also factors such as snow accumulation could play a significant role in energy assessment calculations.

Addendum to 90.1-2007 proposes a provision for air leakage testing. The ISC allows additional options for air leakage testing for fenestration and doors, e.g. either AAMA/WDMA/CSA 101/I.S.2/A440 or NFRC 400 for air leakage testing (similar approach to the IECC); both methods reference ASTM E283 and proposes values for air leakage of different types of windows and doors, which would include an improvement in the air leakage for curtain wall, as well as an opportunity to improve air leakage for all other products. Addendum bf proposes installing performance requirements for air leakage of the opaque envelope. Performance requirements have existed on fenestration and door products to date, but evidence suggests that the opaque envelope is the source of the majority of air leakage in buildings, and that the cause is the lack of attention in the design, construction and enforcement process due to the absence of performance criteria.

Requirements for high albedo roofs (Addendum f) is a revision in response to public comments to addenda f, requiring high albedo roofs in certain climate zones. Several suggested improvements to the text have been incorporated including aged reflectance values, (paralleling title 24 languages) exceptions for climate zones and construction types not deemed to be cost effective, and clarity for exceptions for ballasted roofs, vegetative roofs and shaded roofs.

5.2.2.2 From the Lighting Subcomittee

Retail lighting allowances and display lighting were addressed in the addenda to ASHRAE 90.1 2004. The additional allowances in Addendum p to Standard 90.1-2004 for retail lighting clarifies the intent of the “sales area” space type and the appropriate application of the retail additional lighting power allowances. The inclusion of “sales area” in the common column confirms that sales areas can occur in many building types. The relocation of the reference note in the retail building type section confirms that the retail additional allowances are meant to be applied to sales areas regardless of what building type they exist in.

TABLE 9.6.1 (*continued*) Lighting Power Densities Using the Space-by-Space Method

Common Space Types[a]	LPD (W/ft^2)	Building Specific Space Types	LPD (W/ft^2)
Electrical/Mechanical	1.5	Bank/Office—Banking Activity Area	1.5
Workshop	1.9	Religious Buildings	
Sales Area [For accent lighting, see 9.6.2 (b)]	1.7	Worship Pulpit, Choir	2.4
		Fellowship Hall	0.9
		Retail ~~[For accent lighting, see 9.3.1.2.1(e)]~~	
		Sales Area [For accent lighting, see 9.6.2 (b)]	1.7
		Mall Concourse	1.7

Figure 5: Lighting Power Densities Using the Space-by-Space Method

The existing additional lighting power allowances for retail display lighting have proven to be problematic from an application and compliance standpoint. The categories have been found to be too arbitrary for many applications leading to potential gaming and at a minimum confusion on the part of designers as well as building officials. These revised allowances in Addendum ai are based more specifically on the values. The additional allowances has a base of 1000 watts that is intended to help smaller spaces meet the power requirements where it is more difficult because of the higher wall-to-floor ratio (more potential wall display and light absorption by walls).

The allowance for visual display terminals is being removed because it is an obsolete application given widespread use of flatter screen and lower glare computer terminals.

The next paragraphs describe the changes proposed to the lighting section in ASHRAE 90.1 2007. As of August 2009, all the changes listed are in the process of public review and are yet to be finalized.

The changes to the requirement of controls for lighting system retrofits in Addendum av clarify when controls are required to comply when lighting systems are retrofit. The original required that only controls that are replaced must meet specific requirements for that type of control. The new proposal requires that controls be changed or added to meet the primary 90.1 lighting control requirement of auto control when the lighting fixtures in the space are retrofit. This is simpler, makes spaces comply more completely with 90.1 and will save additional energy.

The changes to the functional testing requirements in Addendum az clarify the intent of the functional testing requirements by adding more specific instruction and application details in section 9.4.6 which states requirements of lighting controls. The section also insures that the control elements are calibrated, adjusted and in proper working condition in accordance with relevant documentation and instructions.

Requiring 50% automatic control of lighting in Addendum bp allows the use of control that provides automatic 50% auto on with the capability to manually activate the remaining 50% and has full auto-off. This type of control was excluded from use in the existing language and only full manual on was allowed. Recent provided test case data shows that this control can save approximately 6% more of the lighting that is required to be occupancy sensor controlled.

The retail lighting models used by the 90.1 Lighting Subcommittee were modified in Addendum bq to make use of more recent lamp technology that is readily available including high performance T8s and ceramic metal halides. Analysis indicated that use of these technologies allowed for the lower values proposed here while still meeting IESNA recommended light levels.
For Retail type “a” the existing LPD was based on 100% fluorescent (94% of the foot-candles) for the “general” and 100% Halogen IR (6% of the foot-candles) for the “feature” displays. For this CMP the fluorescent was increased to “high-performance T8”, and the “feature” display was changed to 100% CMH.

For Retail type “b” the existing LPD was based on 100% Metal Halide (77% of the foot-candles) for the “general” and 100% Halogen IR (23% of the foot-candles) for the “feature” display. For this CMP the Metal Halide was changed to 80% “high-performance T8” + 20% CMH accent, and the “feature” display was changed to 100% CMH.

For Retail type “c” the existing LPD was based on 50% halogen IR and 50% CFL (85% of the foot-candles) for the “general” and 100% Halogen IR (15% of the foot-candles) for the “feature” displays. For this CMP the Halogen IR was changed to CMH for the “general”, and the “feature” display was changed to 40% Halogen IR and 60% CMH.

For Retail type “d” the existing LPD was based on 100% halogen IR (80% of the foot-candles) for the “general” and 100% Halogen IR (20% of the foot-candles) for the “feature” displays. For this CMP, it was calculated by providing 40% of the foot-candles from Halogen IR and 60% from CMH for both the “general” and “feature” displays.

The change proposed in Addendum br to adds an exterior zone 0 to cover very low light requirement areas. This will help eliminate excessive use of light in areas where none is needed other than for location marking type. Prior to this, the choices for users were zone 1 or 3 which both have higher than needed allowances. The single 60 W luminaries per location allows the use of small HID from higher pole locations (i.e. at parking) and would allow incandescent in locations where cold weather inhibits the use of CFL technology.

5.2.2.3 Options for Hotel Systems

As proposed in Addendum q there are several different kinds of systems available to hoteliers that will set back temperature during periods that a room is unsold or unoccupied. Each gives a different amount of control to the hotelier. The simplest system is a stand-alone unit that resets temperature and fan levels on the HVAC unit when the guest leaves the room. There are three main components to this system: a door switch, a “people detector,” and a relay. The people detector is both an occupancy sensor and logic device. In combination with the door switch, it runs through a protocol after a delay to evaluate whether someone had left the room. If so, then it resets the temperature to a preset level. This level is determined by management and preprogrammed into the control at installation time. The intermediate system combines the simple system with a new room thermostat. The thermostats may feature a large temperature display of current temperature enabling the quest to read the current temperature as well as to more accurately set the desired temperature. The savings from this system are greater than that of the simple system but are dependent upon the type of system they are replacing. In the case of advanced system, a control system configured to take action based upon occupancy or opening and closure of doors can offer hoteliers a wide array of options. As an energy management control system, it can employ the simple system as part of its inputs. It then also monitors or controls guestroom locks and mini bar access and enables remote central control for reprogramming, as well as HVAC and lighting operation during unoccupied times.

Installation of room occupancy controls in each guestroom can enable facility engineers to remotely monitor actual room temperatures. Temperature set points can also be monitored and adjusted remotely by the facility engineer. Occupancy patterns will be established and recorded. Energy savings will be achieved through automated setbacks based on real-time monitoring of the rooms’ occupancy.

Advanced system cost budgets were established using data provided by vendors. Savings are based on real occupancy patterns and are representative of guestroom HVAC controls. Using an unoccupied setback of 6°F, 12% of the uncontrolled costs can be avoided. At lower occupancy rates, the savings increase as the duration of the setback also increases.

5.2.2.4 Efficiency Compliance Requirements for Standard 90.1 2004

The current version of Standard 90.1-2004 is inconsistent with regard to efficiency compliance levels. There are “steps” in efficiency compliance due to nominal motor hp size jumps. This results in cases where poor design practices comply while good design practices do not (a function of nominal motor hp steps). Additionally, the current standard does not adequately address complex exhaust systems associated with hospitals and laboratories—facilities typically associated with 24-hour operation and high airflow volume (relatively high hp or kW required). This results in such users taking exception to the fan power limitations entirely, citing “health and safety” compromise (high static pressure associated with exhaust of contaminated air volume) or submitting an interpretation request or change proposal to the 90.1 committee. This change proposal (Addendum ac) (a) improves compliance consistency, (b) expands application coverage to properly address complex systems, and (c) strengthens stringency for simple systems with an easy-to-use format/structure. a. Proposed compliance structure determines compliance based on a continuous curve and eliminates the nominal motor hp steps. b. Proposed structure provides system static pressure allowances associated with specialized equipment required for hospitals, laboratories, vivariums, and other applications with filtration and other air quality control devices needed for health, safety, or specific environmental control and adding significant static pressure to the air distribution design. c. Proposed structure offers an alternative compliance for simple (typically low static pressure systems) to comply by nameplate hp or kW measures. The stringency for this compliance has been slightly increased based on low static pressure associated with these systems and ease of compliance with the published standard. The result is a more flexible standard with consistent compliance requirements (design fan system bhp or kW) while maintaining a nameplate hp or kW approach allowing simple demonstration of compliance (typical rooftop package applications).

5.2.2.5 Intermittent Ignition Device for Unit Heaters

Under the Energy Policy Act of 2005, Section 135 (aa), all unit heaters manufactured on and after August 8, 2008, for use in the United States must be equipped with an intermittent ignition device and have power venting or an automatic flue damper. This footnote proposed in Addendum ao would help to update the ASHRAE standard so that users are aware of the new federal law. Also, as is done for other products in Standard 90.1, the acceptability of vent dampers on units installed in the conditioned space should be recognized. Also, there is a precedent for this type of footnote in the standard. In footnotes c and f for Table 6.8.1E in 90.1-2004, the wording is “units must also include an interrupted or intermittent ignition device (IID) ... and have either power venting or a flue damper.” In addition, footnotes c and f state “A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.”

TABLE 6.8.1E Warm Air Furnaces and Combination Warm Air Furnaces/Air-Conditioning Units, Warm Air Duct Furnaces and Unit Heaters

Warm Air Unit Heaters, Gas-Fired	All Capacities	Maximum Capacity[e]	80% E_c[g,h]	ANSI Z83.8
Warm Air Unit Heaters, Oil-Fired	All Capacities	Maximum Capacity[e]	80% E_c[g,h]	UL 731

h. As of August 8, 2008, per the Energy Policy Act of 2005, units must also include an interrupted or intermittent ignition device (IID) and have either power venting or an automatic flue damper. A vent damper is an acceptable alternative to a flue damper for those unit heaters where combustion air is drawn from the conditioned space.

Figure 6: Warm Air Furnaces and Combinations Warm Air Furnaces/Air-Conditioning Units, Warm Air Duct Furnaces and Unit Heaters

5.2.2.6 Efficiency and Certification Requirements for Open Cooling Towers

Efficiency and certification requirements for open cooling towers were first incorporated into the 2001 edition of Standard 90.1. At the time, closed circuit cooling towers were known as “fluid coolers” with no established certification program and were not covered by these requirements. Since then, however, fluid coolers have become known as "closed circuit cooling towers" and the Cooling Technology Institute adopted a certification standard that covers this equipment. This has led to confusion in the industry with consulting engineers and inspectors on occasion trying to apply the current open circuit cooling tower requirements in the standard to closed circuit cooling towers. Addendum a seeks to clarify that the current cooling tower requirements in the standard apply to open circuit cooling towers only, until such time that separate requirements for closed circuit cooling towers are established in the standard.

TABLE 6.8.1G Performance Requirements for Heat Rejection Equipment

Equipment Type [d]	Total System Heat Rejection Capacity at Rated Conditions	Subcategory or Rating Condition	Performance Required[a,b]	Test Procedure[c]
Propeller or Axial Fan Open Cooling Towers	All	95°F Entering Water 85°F Leaving Water 75°F wb *Outdoor air*	38.2 gpm/hp	CTI ATC-105 and CTI STD-201
Centrifugal Fan Open Cooling Towers	All	95°F Entering Water 85°F Leaving Water 75°F wb *Outdoor air*	20.0 gpm/hp	CTI ATC-105 and CTI STD-201
Air-Cooled Condensers	All	125°F Condensing Temperature R-22 Test Fluid 190°F Entering Gas Temperature 15°F Subcooling 95°F Entering db	176,000 Btu/h·hp	ARI 460

[a] For purposes of this table, *open cooling tower performance* is defined as the ~~maximum~~ flow rating of the tower at the thermal rating condition listed in Table 6.8.1G divided by the fan nameplate rated motor power.

[b] For purposes of this table, *air-cooled condenser performance* is defined as the heat rejected from the refrigerant divided by the fan nameplate rated motor power.

[c] Section 12 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

[d] The efficiencies for open cooling towers listed in Table 6.8.1G are not applicable for closed-circuit cooling towers.

Figure 7: Performance Requirements for Heat Rejection Equipment

5.2.2.7 Compliance with Fan Power Limitations Requirement

Some facilities covered by Standard 90.1 are challenged to demonstrate compliance with fan power limitations requirements of Standard 90.1 while including design features protecting the safety of inhabitants and compliance of other applicable standards, codes, laws, or regulations. These facilities often require compliance with NIH, NFPA, and other standards with air control and conditioning more stringent than Standard 90.1 and 62.1 requirements. An example of these facilities is vivariums. In exception section 6.5.2.3 (a) of Standard 90.1-2004, the reference to the requirements of Standard 62.1 as the minimum ventilation required is an example of this conflict. Addendum b corrects the reference by eliminating the specific section and denoting only Standard 62.1 and allows for another, higher outdoor ventilation rate to be set by the regulating body for these specific applications. Addendum c adds vivariums to the list of spaces that require specific humidity levels to satisfy process needs.

5.2.2.8 Incorporating the Energy-Saving Potential of DDC Controls

Addressing the conflict between Standards 55, 62.1, and 90.1, Addendum h to Standard 90.1-2007 includes a new exception to Section 6.5.2.1 that is geared toward zones with direct digital controls (DDC). The new exception (exception b) largely addresses the apparent conflict between Standards 55, 62.1, and 90.1, and also takes advantage of the energy-saving potential of DDC controls in order to save about $0.20/ft2/yr with a simple payback of less than two years. The apparent conflict is that the current 30% reheat maximum typically requires very high supply air temperatures (e.g., >100°F) to meet peak heating load. High supply air temperatures result in poor comfort per Standard 55 and poor ventilation effectiveness per Standard 62.1. The new exception allows reheat to increase from 30% to 50%, which means lower supply air temperatures and better comfort and ventilation effectiveness. The energy savings come from the fact that maximum airflow in dead band is being lowered from 30% to 20%. This saves fan energy and cooling energy in dead band, and also reduces the amount of time when the zone will be overcooled in dead band and forced into reheat.

This new exception will also alleviate a common problem where engineers feel compelled to violate the current 30% exception in order to provide adequate heating. In addition to poor comfort and ventilation effectiveness, high supply air temperatures also lead to short-circuiting. When hot supply air short circuits directly from the supply to the return, the space takes longer to warm up and may not warm up at all. Therefore, it is very common for designers and contractors to disregard the current 30% requirement and use 40% or 50% minimum flow set points to ensure adequate heating. No one likes to disregard the code, but if the choice is between code and comfort, comfort wins. The new exception allows users to achieve comfort, meet the code, and save energy at minimal cost.

Because not all zones have DDC controls and because this is a fairly significant shift in zone controls, the existing 30% exception is left in the standard. However, two clauses from the existing exception are deleted. The 0.4 cfm/ft2 exception is deleted because it implies that a minimum air speed in the occupied space is required for comfort. ASHRAE Standard 55, however, indicates that no minimum air speed is required for comfort. Furthermore, 0.4 cfm/ft2 does not guarantee any particular air speed because 0.4 cfm/ft2 can be a small fraction (e.g., 10%) or a large fraction (e.g., 50%) of the design flow rate and, thus, can result in a low or high air speed. The 300 cfm exception is deleted because the situation that it was intended to address has been largely eliminated by the new 50% exception described above. This criterion was intended to address the following applications: the occasional small zone in a VAV reheat system for which 30% is insufficient to handle heating loads, such as spaces with large north facing glass areas.

5.2.2.9 Updating Mechanical Test Procedures and References

Addendum j is intended to update the mechanical test procedures and references in ANSI/ASHRAE/IESNA Standard 90.1-2007. The changes modify a reference in Table 6.8.1E, the normative references in Chapter 12, and the informative references in Informative Appendix E.

5.2.2.10 Warm Air Furnaces

This addendum revises Tables 6.8.1E and 7.8 in ANSI/ASHRAE/IESNA Standard 90.1-2007, identifying the specific sections of the referenced standards. Table 7.8 is also updated to reflect the current federal efficiency levels for residential water heaters. Additionally, a requirement in Table 7.8 for electric table top water heaters has been added.

5.2.3 Laboratory's TERP Web Site "eslsb5.tamu.edu"

Since the fall of 2001, the Laboratory has maintained a TERP webpage (Figure 8), where information is provided to builders, code officials, the design community and homeowners about TERP. This information includes:

- The Emissions calculator
  - Opening page: this page directs the visitor to four choices, including:
    - The calculator: This is the emissions calculator that the Laboratory developed for the State of Texas, which contains procedures for calculating NOx, Sox and CO2 emissions calculations from new building models, community projects, and renewables.
    - The kWh-NOx emissions calculator: This is the synchronous NOx emissions calculator for projects where the kWh savings are known for a particular county.
    - The ICCC: This is the entry page for the Laboratory's International Code Compliance Calculator, which was developed at the request of several

        - municipalities for calculating code compliance with the 2000/2001 IECC with SEER 13.
        - The TERP Main page: This is the main page for the TERP project.
- The TERP Main Page
    - Navigation: This page contains general information about the project.
        - Code Compliance Calculator
        - SB5 reports: this contains the Laboratory's reports to the TCEQ and the Legislature since 2001, as well as conference paper and other presentations about the effort.
        - Testimony: The ESL's Legislative testimony
        - About: general information about the Laboratory's SB5 responsibilities
        - More about TERP
        - Role
        - Links
        - Weather data page: this page is the link to the Laboratory's on-line weather data depository for the hourly/daily weather data gathered as part of the TERP program. This is the main navigation page for find different types of weather data for the 17 sites listed, including:
            - Daily spreadsheet format example
            - Hourly spreadsheet format example
            - Example daily weather data graphs
            - Example hourly weather data graphs
    - Global:
        - Links
        - Search
        - Contact Us
        - Administrator
    - Login Form –where users can login to the web site
    - Quick Links
        - TERP Stakeholder's Letter
        - Building EQ Symposium in Germany
        - Comptroller's energy report
        - IC3 calculator
        - Legacy eCalc calculator
        - Building Code Workshops
    - Upcoming conferences
        - ICEBO
    - Past conferences
        - CATEE conference
        - Hot and Humid conference
        - IETC conference

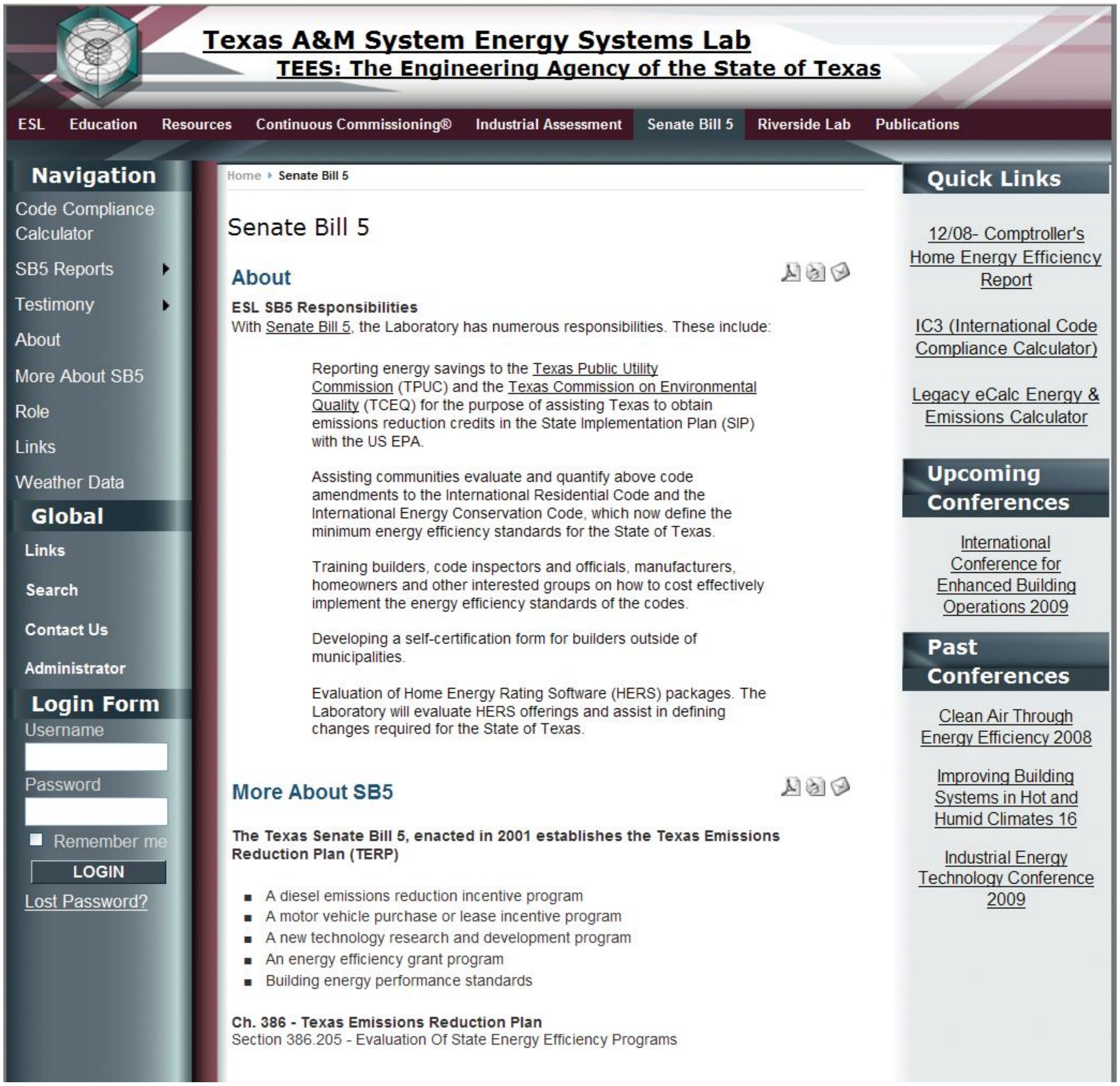


Figure 8: The Laboratory's Senate Bill 5 Web Site (main page)

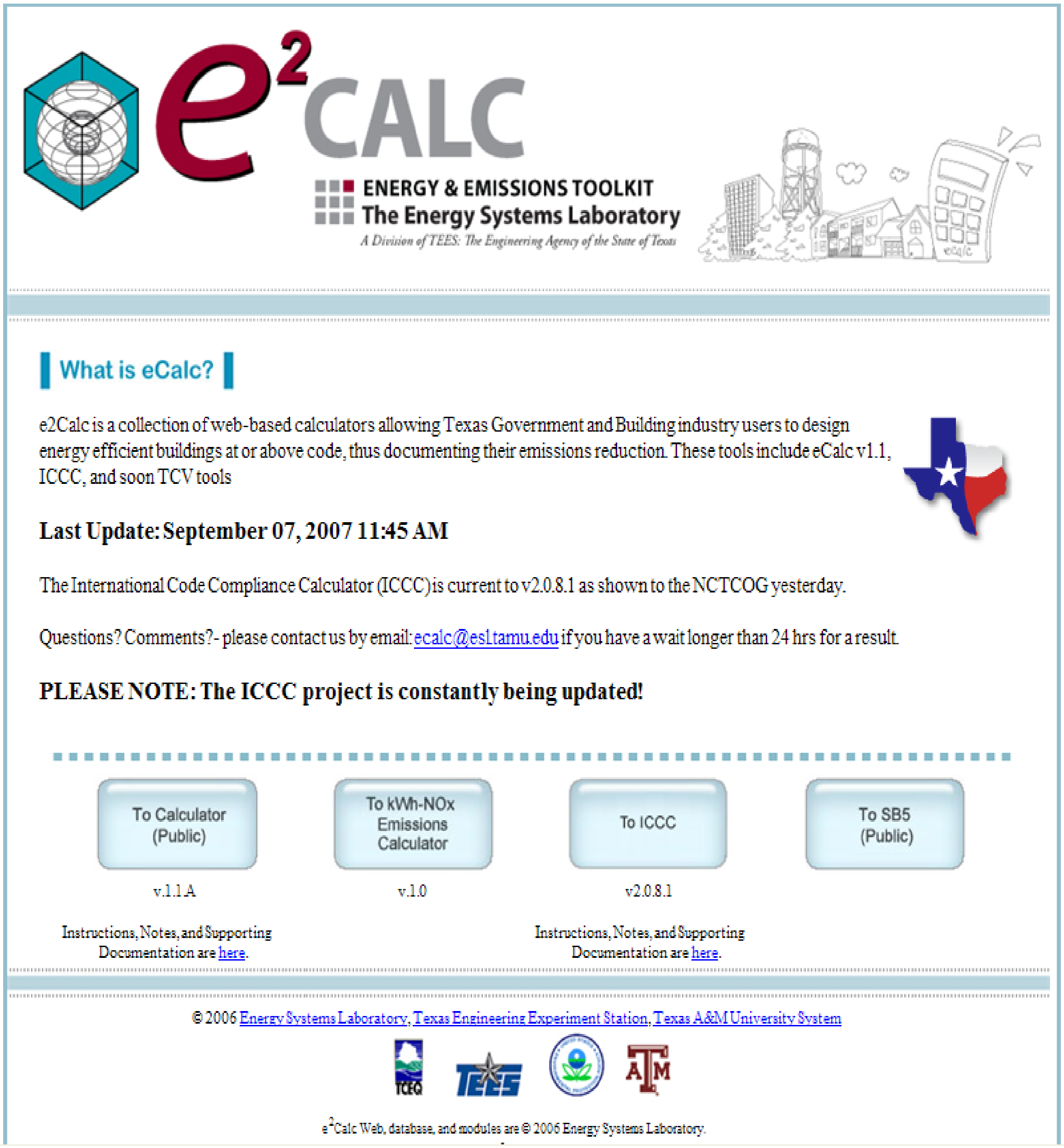


Figure 9: Opening Page for the Laboratory's eCALC Energy and Emissions Toolkit

Figure 10: Web Page Providing Access to the Laboratory's eCALC Energy and Emissions Calculator

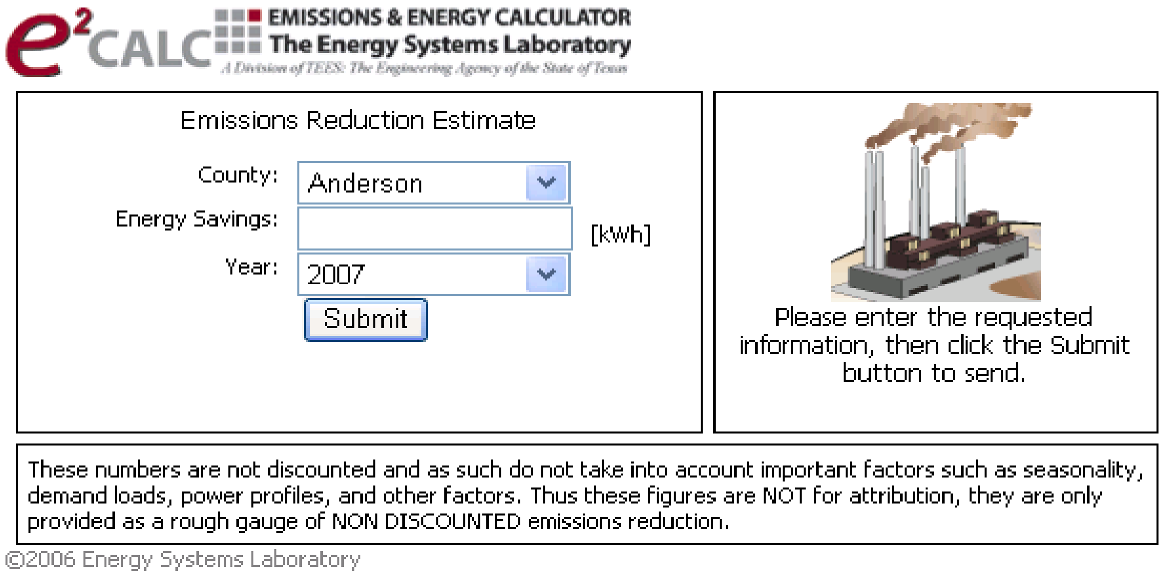


Figure 11: Web Page Providing Access to the Laboratory's Synchronous Emissions Calculator

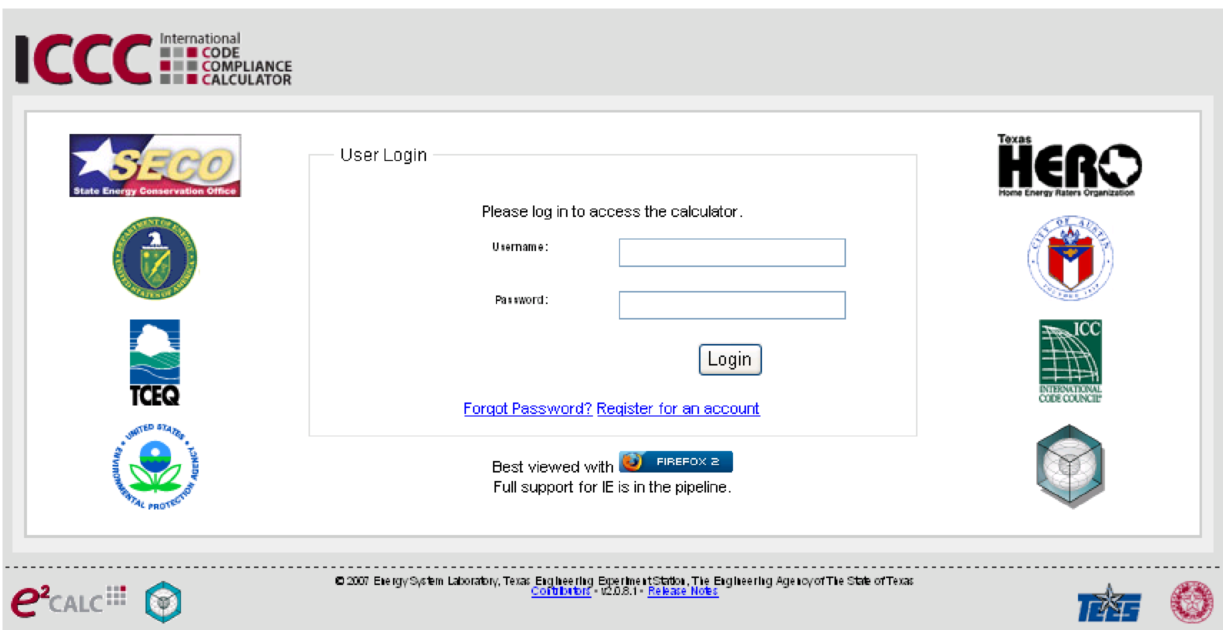


Figure 12: Web Page Providing Access to the Laboratory's International Code Compliance Calculator (ICCC)

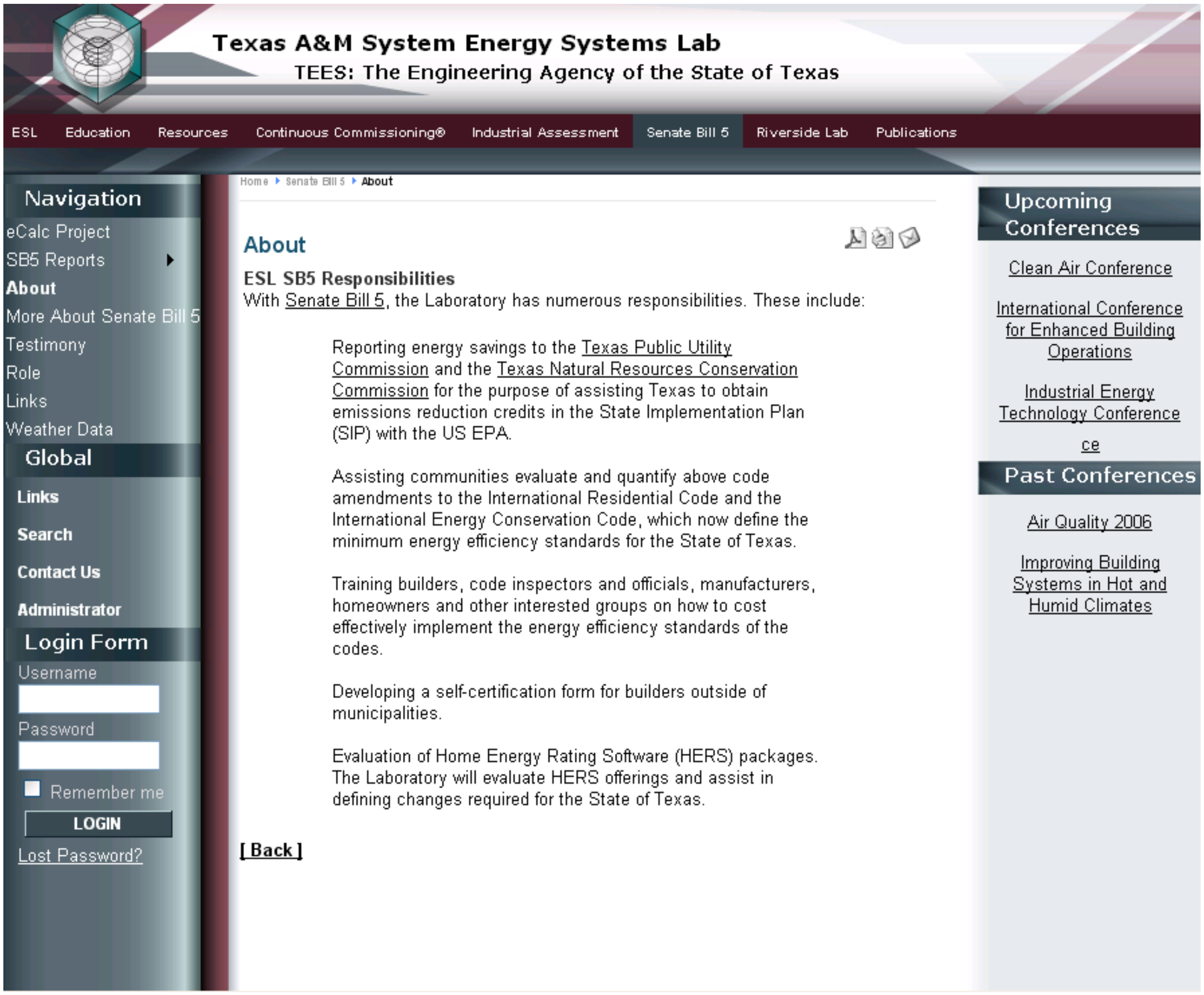


Figure 13: Web Page Providing Information about the Laboratory's Senate Bill Responsibilities

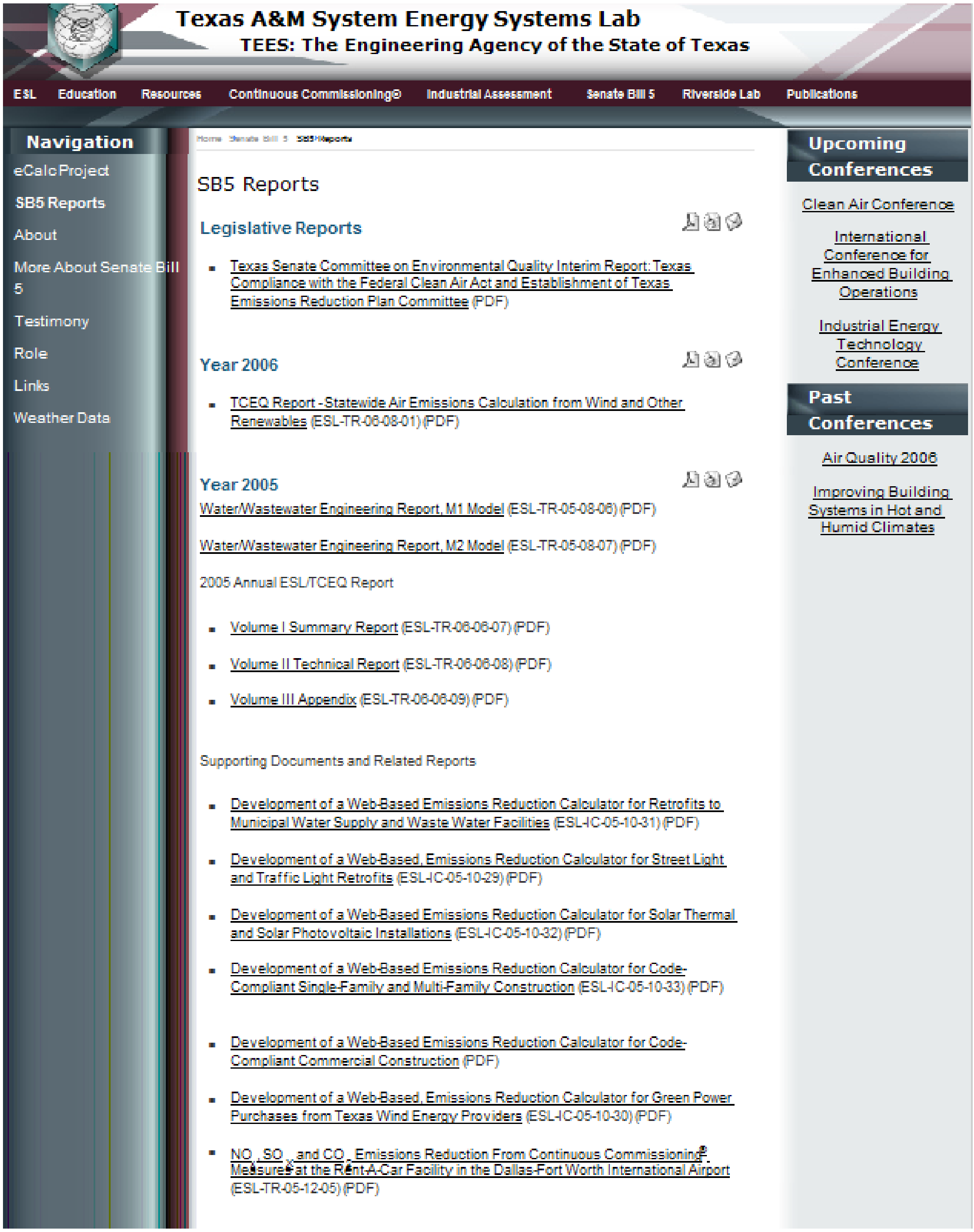


Figure 14: SB5 Public opening page for the Laboratory TERP Effort

Figure 15: Web Page Providing Information about the Laboratory's 2008 Clean Air Through Energy Efficiency (CATEE) Conference

Figure 16: Web Page Providing Information about the Laboratory's 16th Annual Hot and Humid (H&H) Conference

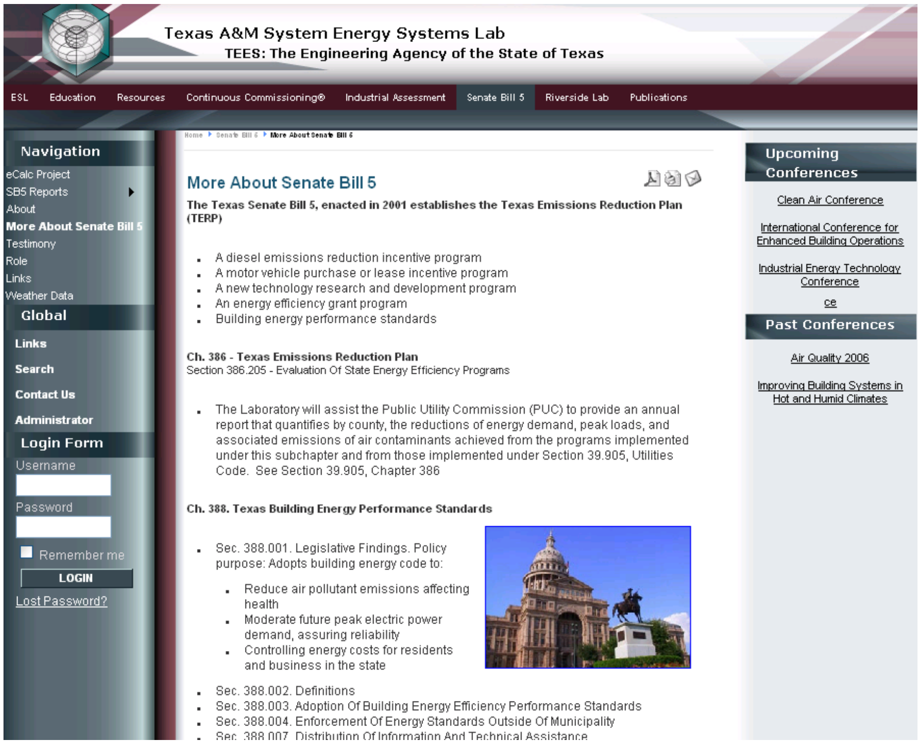


Figure 17: Web Page Providing Additional Information about the Laboratory's TERP Program

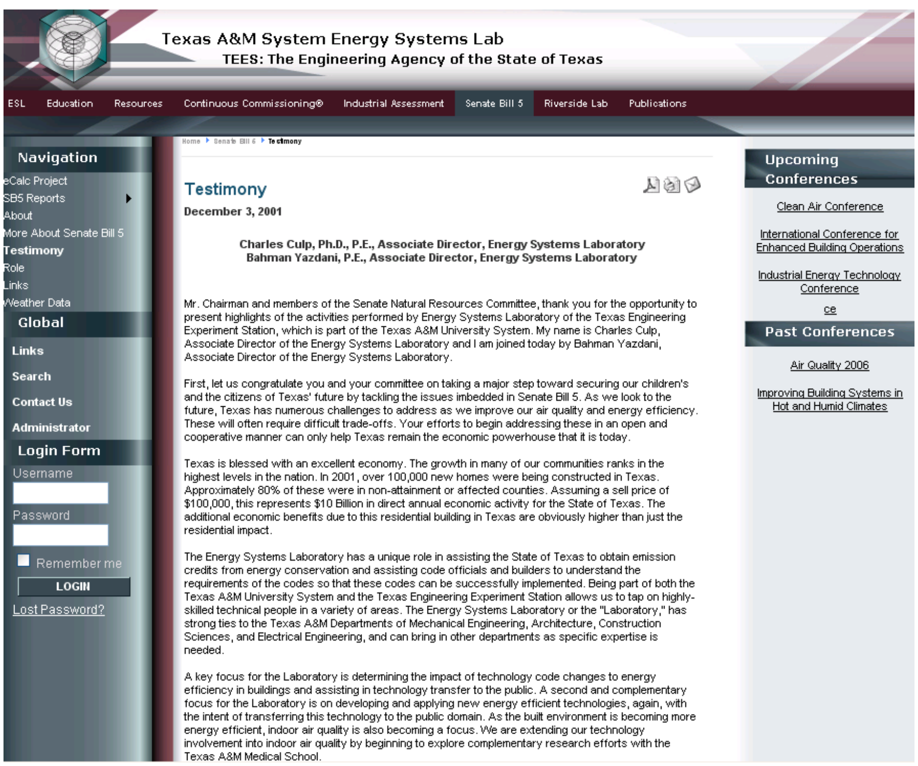


Figure 18: Web Page Providing Information about the Laboratory's TERP Testimony to the Senate Natural Resources Committee

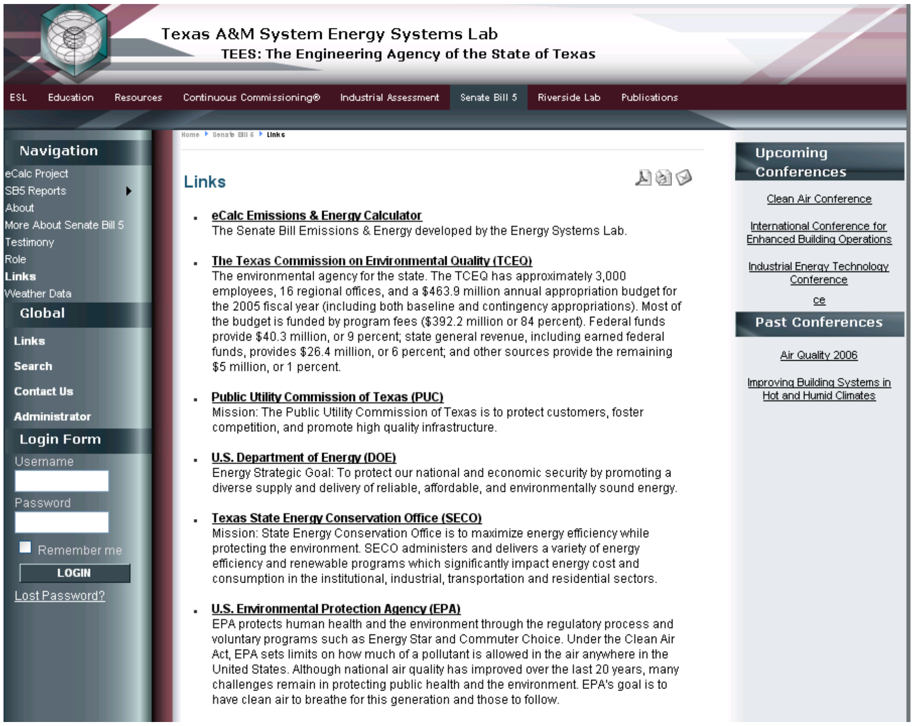


Figure 19: Web Page Providing Information about the Laboratory's Links to Other Government Agencies

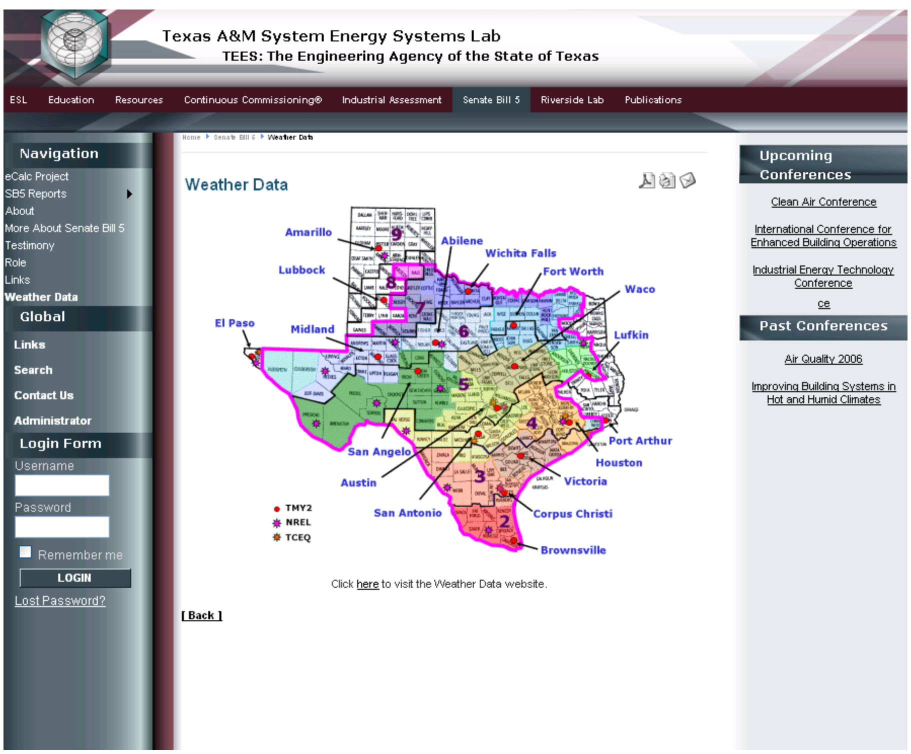


Figure 20: Web Page Providing Information about the Laboratory's TERP Weather Data Collection Effort

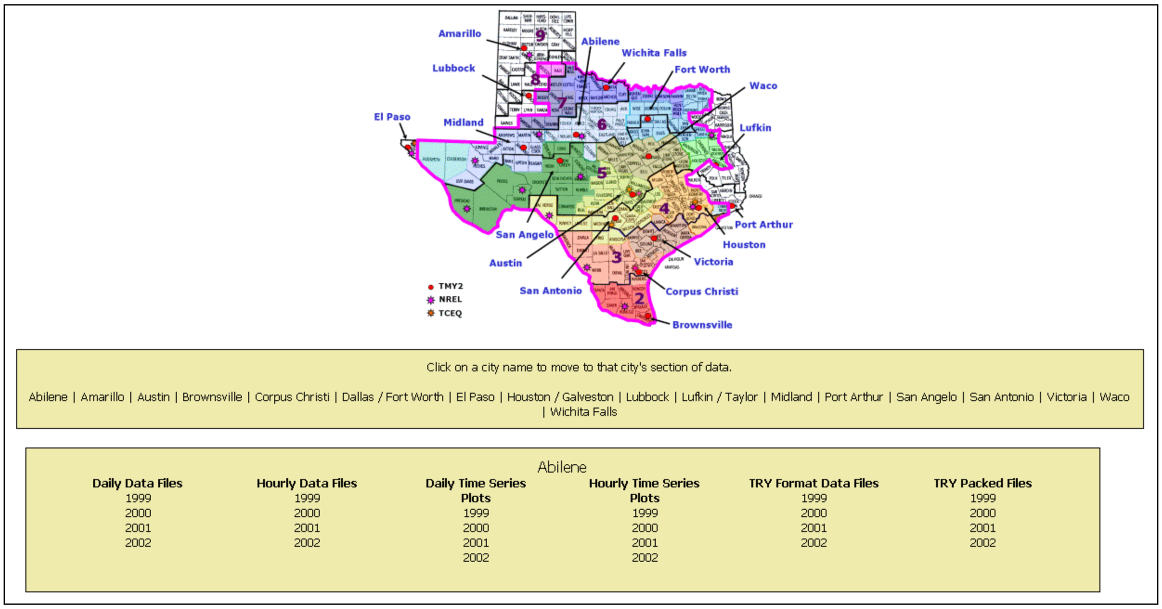


Figure 21: Web Page Providing Site-by-Site Weather Date from the Laboratory's TERP Effort

	A	B	C	D	E	F	G	H	I
1	Date	Average Di	Average W	Average D	Average W	Total Glob	Total Norm	Total Precipitation (in)	
2	1/1/1999	55.8	49.8	44.4	14.8	505.4	62.1	0	
3	1/2/1999	35.3	29.3	18	14.1	986.1	1428.1	0	
4	1/3/1999	26.4	20.6	4.6	10.6	1022.2	1509.9	0	
5	1/4/1999	29.8	23.3	8.7	7.7	1179.2	2503.3	0	
6	1/5/1999	45.8	34.9	17.5	14.4	1185.2	2581.3	0	
7	1/6/1999	45.5	36.3	23.3	5	1179.5	2591.4	0	
8	1/7/1999	44.3	40.6	36.3	5.2	1181.4	2548.9	0	
9	1/8/1999	32.1	30.8	28.4	11.3	266.7	2.5	0	
10	1/9/1999	27.8	23.4	14.3	8.4	1203.3	2522.6	0	
11	1/10/1999	42.8	33.9	19.9	8.7	1197.9	2534	0	
12	1/11/1999	48.5	39.9	29.4	14.2	1191.9	2391	0	
13	1/12/1999	58.9	48.5	37.8	12.8	827.5	665.2	0	
14	1/13/1999	39.5	35.2	29.1	8	845	952.8	0	
15	1/14/1999	35.4	30.3	21.9	7.4	1225.2	2519.7	0	
16	1/15/1999	52.1	40	24.3	14.3	1263.5	2728.7	0	
17	1/16/1999	52.5	41.3	26.6	9.3	1232.4	2434.8	0	
18	1/17/1999	59.5	43.6	23	10.6	1225.5	2434.4	0	
19	1/18/1999	50.2	39	22.7	6.3	1222.9	2420.8	0	
20	1/19/1999	63.4	47.6	30.5	11.2	1239.1	2334.6	0	
21	1/20/1999	62.8	49.4	35.5	8.1	1123.7	1800.9	0	
22	1/21/1999	61.1	48.4	35	12.6	924.3	1174.1	0	
23	1/22/1999	42.3	38.2	32.3	13	153.1	3.8	0.1	
24	1/23/1999	45.8	38.9	30.3	7.2	1352	2865.3	0	
25	1/24/1999	60.3	45.3	27.8	9.2	1227.7	2216.6	0	
26	1/25/1999	48.1	41.2	32.9	6.2	1350.4	2326.6	0	
27	1/26/1999	60.3	51	42.5	16.9	1256.9	2140.8	0	
28	1/27/1999	59.9	53.9	49	10.5	817.7	650.3	0	
29	1/28/1999	54.1	50.9	48.3	10.8	587.5	162	0	
30	1/29/1999	37	36.9	36	10.2	116	0.6	1.8	
31	1/30/1999	40.2	37.6	34.4	11.8	595.1	236.2	0	

Figure 22: Spreadsheet Showing Daily Weather Date for Abilene, 1999

	A	B	C	D	E	F	G	H
1	Date time	Dry-Bulb T	Wet-Bulb T	Dew-Point	Wind Spee	Global Sol	Normal Dre	Precipitatio
2	1/1/1999 0:00	47	43	39	9	0	0	0
3	1/1/1999 1:00	47	45	43	16	0	0	0
4	1/1/1999 2:00	48	47	46	11	0	0	0
5	1/1/1999 3:00	49	48	48	14	0	0	0
6	1/1/1999 4:00	49	48	48	9	0	0	0
7	1/1/1999 5:00	49	48	48	11	0	0	0
8	1/1/1999 6:00	51	50	50	11	0	0	0
9	1/1/1999 7:00	54	53	52	15	0	0	0
10	1/1/1999 8:00	56	54	53	15	0.3	0	0
11	1/1/1999 9:00	60	56	53	15	13	1.3	0
12	1/1/1999 10:00	61	57	54	14	69.4	42.8	0
13	1/1/1999 11:00	62	57	54	19	53	0.6	0
14	1/1/1999 12:00	68	59	52	22	57.7	1.3	0
15	1/1/1999 13:00	68	58	50	19	95.4	7	0
16	1/1/1999 14:00	71	58	48	16	84.3	1.9	0
17	1/1/1999 15:00	71	56	44	7	73.2	0.6	0
18	1/1/1999 16:00	69	51	32	5	35.2	0.3	0
19	1/1/1999 17:00	64	49	33	6	20.6	6	0
20	1/1/1999 18:00	67	48	26	14	3.2	0.3	0
21	1/1/1999 19:00	56	50	44	25	0	0	0
22	1/1/1999 20:00	49	45	41	16	0	0	0
23	1/1/1999 21:00	45	43	41	23	0	0	0
24	1/1/1999 22:00	40	38	35	21	0	0	0
25	1/1/1999 23:00	38	35	31	23	0	0	0
26	1/2/1999 0:00	37	34	30	15	0	0	0
27	1/2/1999 1:00	35	32	27	22	0	0	0
28	1/2/1999 2:00	34	31	26	22	0	0	0
29	1/2/1999 3:00	33	30	24	26	0	0	0
30	1/2/1999 4:00	31	28	22	25	0	0	0
31	1/2/1999 5:00	30	27	21	22	0	0	0
32	1/2/1999 6:00	30	27	21	23	0	0	0
33	1/2/1999 7:00	29	26	21	16	0	0	0
34	1/2/1999 8:00	32	28	20	14	1.6	5.7	0
35	1/2/1999 9:00	33	28	18	16	38	176.9	0
36	1/2/1999 10:00	37	30	18	17	81.8	165.8	0
37	1/2/1999 11:00	39	31	17	19	140.5	282.8	0
38	1/2/1999 12:00	42	33	16	16	176.3	296.8	0
39	1/2/1999 13:00	43	33	17	16	179.8	257.1	0

Figure 23: Spreadsheet Showing Hourly Weather Date for Abilene, 1999

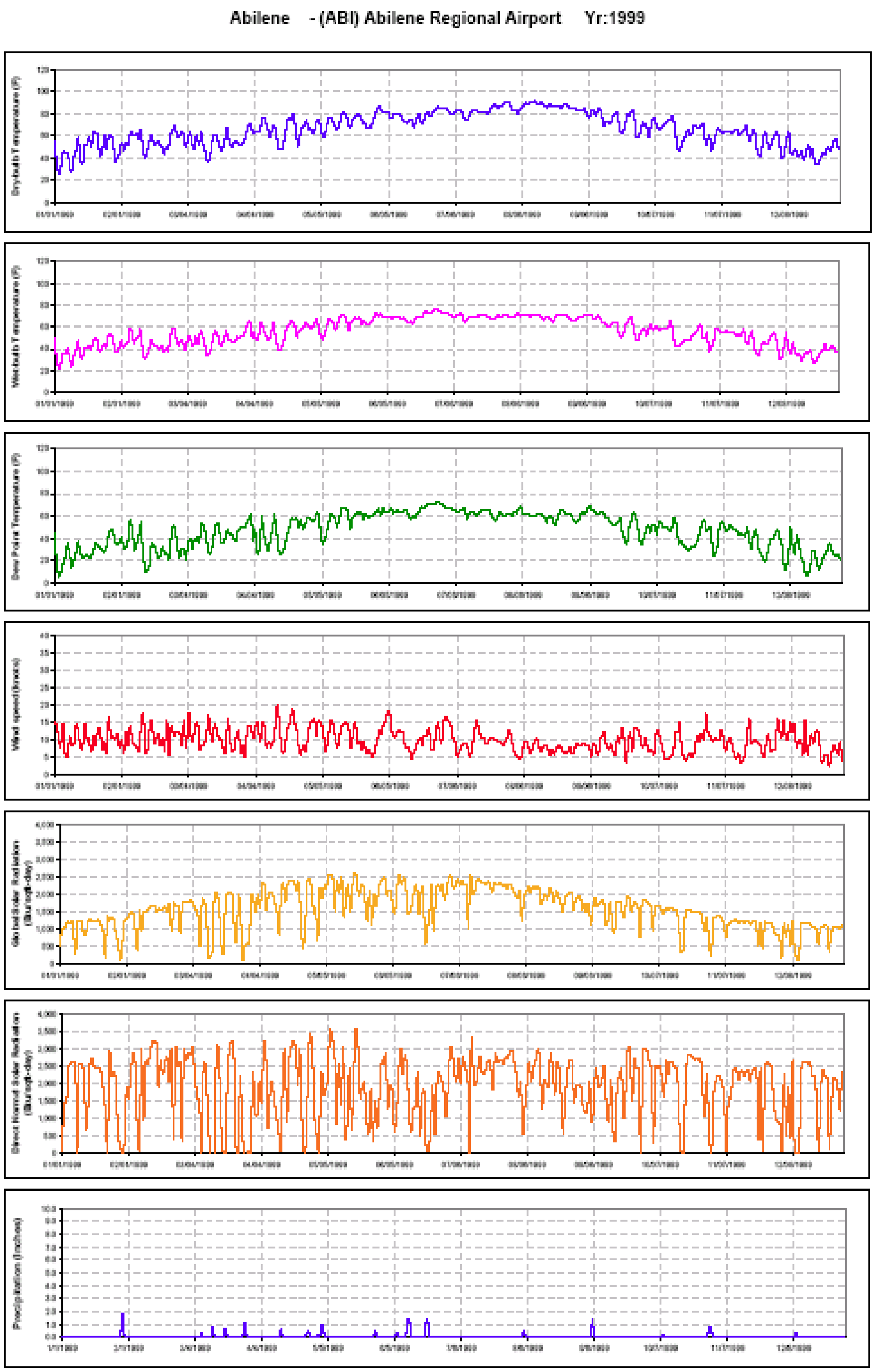


Figure 24: Time Series Graphs Showing Daily Weather Data for Abilene, 1999

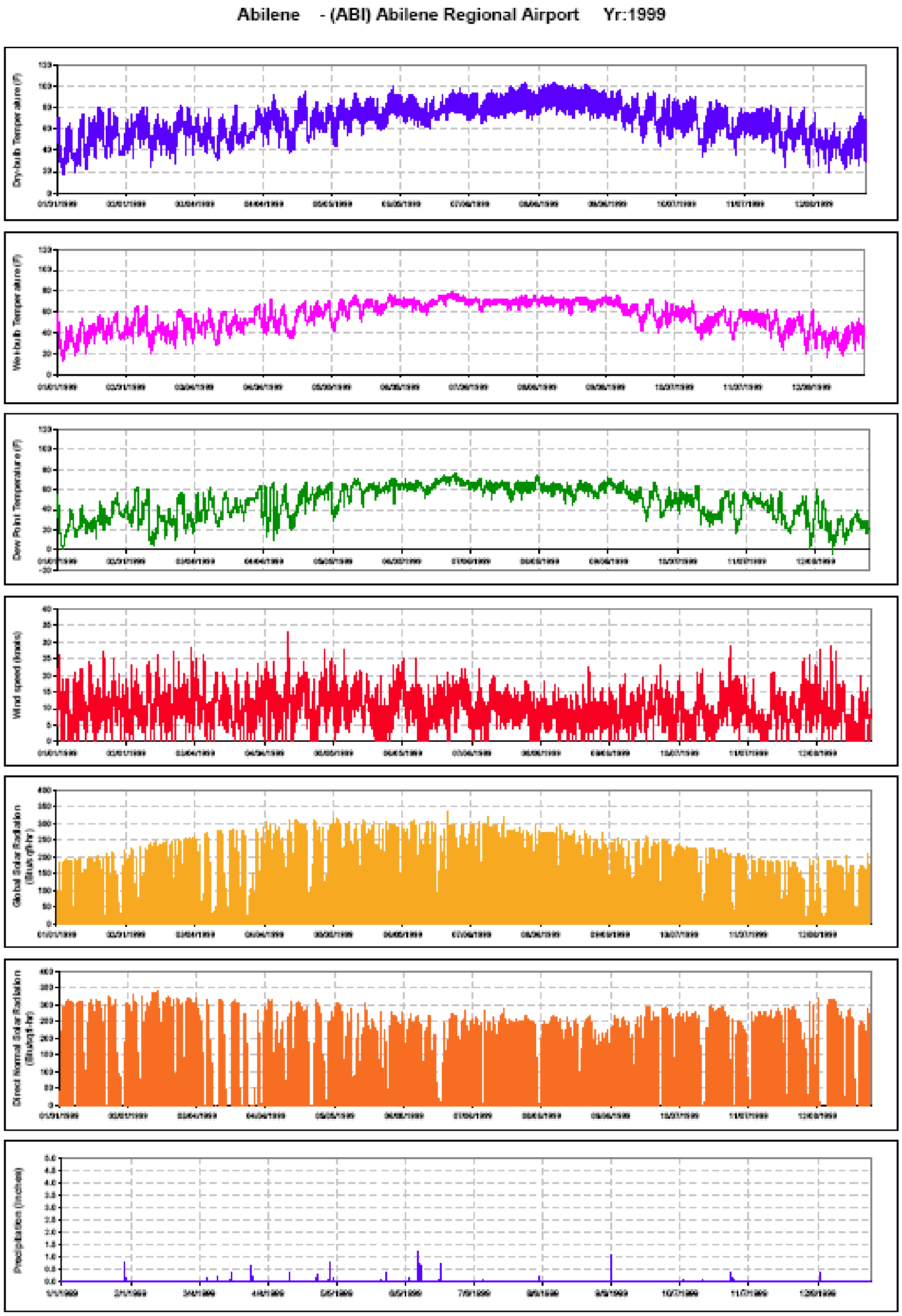


Figure 25: Time Series Graphs Showing Hourly Weather Data for Abilene, 1999

5.2.4 Provide Technical Assistance to the TCEQ

The Laboratory received dozens of calls per week from code officials, builders, home owners and municipal officials regarding the building code and emissions calculations. A complete file of these transactions is maintained at the Laboratory. Specific Technical Assistance responses are contained in the related sections of this report.

5.2.5 Delivered "Statewide Air Emissions Calculations from Wind and Other Renewables: Summary Report September 2007 – August 2008," to the Texas Commission on Environmental Quality in August 2008.

The Energy Systems Laboratory, in fulfillment of its responsibilities under this Legislation, submits its third annual report, "Statewide Air Emissions Calculations from Wind and Other Renewables," to the Texas Commission on Environmental Quality.

The report is organized in several deliverables:

- A Summary Report, which details the key areas of work;
- Supporting Documentation;
- Supporting data files, including weather data, and wind production data, which have been assembled as part of the third year's effort.

This executive summary provides summaries of the key areas of accomplishment this year, including:

- continuation of stakeholder's meetings;
- analysis of power generation from wind farms using improved method and 2006 data;
- analysis of emissions reduction from wind farms;
- updates on degredation analysis;
- analysis of other renewable, including: PV, solar thermal, hydroelectric, geothermal and landfill gas;
- review of electricity generation by renewable sources and transmission planning study reported by ERCOT;
- review of combined heat and power projects in Texas; and
- preliminary reporting of NOx emissions savings in the 2008 Integrated Savings report to the TCEQ.

5.2.5.1 Analysis of wind farms using improved method and 2007 data

In this report, the weather normalization procedures developed together with the Stakeholders were presented and applied to all the wind farms that reported their data to ERCOT during the 2007 measurement period, together with wind data from the nearby NOAA weather stations. In the 2008 Wind and Renewables report to the TCEQ (Haberl et al. 2008), weather normalization analysis methods were reviewed; an analysis was shown for the Sweetwater I wind farm in Nolan, Texas, and then applied to all the wind farms in the ERCOT region.

The wind farm (Sweetwater III) was used as an example in this report to present the same weather normalization procedure, including the processing of weather and power generation data, modeling of daily power generation versus daily wind speed using the ASHRAE Inverse Model Toolkit (IMT) (Haberl et al. 2003; Kissock et al. 2003) for two separate periods, i.e., Ozone Season Days period (OSP), from July 15 to September 15, and Non-Ozone Season days period (Non-OSP); prediction of 1999 wind power generation using developed coefficients from 2007 daily OSP and Non-OSP models; and the analysis on monthly capacity factors generated using the models.

Finally, a summary of total predicted wind power production in the base year (1999) for all of the wind farms in the ERCOT region using the developed procedure is presented and the new wind farms which started operation in 2007 were added. This report also includes an uncertainty analysis that was performed on all the daily regression models for annual and OSD period. The detailed analysis for each wind farm is provided in the Appendix B to this report. The original data used in the analysis is included in the accompanying CD-ROM with this report.

5.2.5.2 Analysis of emissions reductions from wind farms

In this report, the procedure for calculating annual and peak-day, county-wide NOx reductions from electricity savings from wind projects implemented in the Power Control Areas in ERCOT listed in the EPA's eGRID was presented, including assigning the wind farms to PCA based on the information provided by the PUCT, and calculating the NOx emission reductions based on the special version of 2007 eGRID developed by the EPA for the TCEQ. According to the developed models, the total MWh savings in the base year 1999 for the wind farms within the ERCOT region are10,226,401 MWh and 25,152 MWh/day in the Ozone Season Period. The total NOx emissions reductions across all the counties amount to 6,051 tons/yr and 15 tons/day for the Ozone Season Period.

The ESL has been working with the EPA and TCEQ regarding a new version of eGRID for all ERCOT counties in Texas. A new version of eGRID was developed, which is based on the ERCOT congestion management zones. As the TCEQ moves the base year to more recent years and ERCOT is in the process of moving toward the Nodal market, this updated version of eGRID, representing the current Texas market, may be used to estimate the emissions reduction from wind power in the next year's report.

5.2.5.3 Preliminary reporting of NOx emissions savings in the 2008 Integrated Savings report to TCEQ

In this preliminary report, the NOx emissions savings from the energy-efficiency programs from multiple Texas State Agencies working under Senate Bill 5 and Senate Bill 7 in a uniform format allowed the TCEQ to consider the combined savings for Texas' State Implementation Plan (SIP) planning purposes. This required that the analysis included the cumulative savings estimates from all projects projected through 2020 for both the annual and Ozone Season Day[18] (OSD) NOx reductions. The NOx emissions reduction from all these programs was calculated using estimated emissions factors for 2007 from the US Environmental Protection Agency (US EPA) eGRID database, which were specially prepared for this purpose.

5.2.5.4 Development of a degradation analysis

This report contains an updated analysis to determine what amounts of degradation could be observed in the measured power from Texas wind farms. Currently, the TCEQ uses a very conservative 5% degradation per year for the power output from a wind farm when making future projections from existing wind farms. Accordingly, the TCEQ asked the ESL to evaluate any observed degradation from the measured data for Texas wind farms. To accomplish this, nine wind farms (12 sites) from 2002 to 2007 and two wind farms (Brazos wind ranch and Sweetwater) from 2004 to 2007 were evaluated with a total capacity of 1208 MW.

In this analysis, a sliding statistical index was established for each site that uses 10^{th}, 25^{th}, 50^{th}, 75^{th}, 90^{th}, and 99^{th} percentiles of the hourly power generation over a 12-month sliding period, as well as mean, minimum and maximum hourly power generation of the same 12-month period. These indices are then displayed using one data symbol for each 12-month slide, beginning from the first 12-month period until the last 12-month period for each of the wind farms.

Of the 14 sites analyzed, ten sites showed an increase when one compares the 90^{th} percentile of whole period to the 90^{th} percentile of the first 12-month period, ranging from 3.5% to 23.7%. The remaining four sites showed a decrease from -3.2% to -18.1%. The weighted average of this increase across all wind farms studied is 8.7% (positive), which indicates that no degradation was observed from the aggregate energy production from these wind farms over the studied operation period.

[18] An ozone season day (OSD) represents the daily average emissions during the period that runs from mid-July to mid -September.

5.2.5.5 Analysis of other renewable sources

Other renewable energy projects throughout the state of Texas were located to determine NOx emissions reduction and are included in this section. Searches were conducted on five specific categories which include solar photovoltaic, solar thermal, geothermal, hydroelectric, and Landfill Gas-Fired Power Plants. Many newly located renewable energy projects are assembled for inclusion in this report.

5.2.5.6 Review of electricity savings and transmission planning study reported by ERCOT

In this report, the information posted on ERCOT's Renewable Energy Credit Program site www.texasrenewables.com is reviewed. In particular, information posted under the "Public Reports" tab was downloaded and assembled into an appropriate format for review. This includes ERCOT's 2001 through 2008 reports to the Legislature and information from ERCOT's listing of REC generators.

5.2.5.7 Review of Combined Heat and Power Projects in Texas

A summary of all the Combined Heat and Power (CHP) applications in Texas and analysis on how it can impact the NOx emissions was provided in this section. The complications involved in developing a methodology for calculating the emissions reduction from CHP were analyzed and presented.

5.2.5.8 Estimation of hourly solar radiation from limited data sets.

One of the important tasks performed as part of the Laboratory's Senate Bill 5 effort has been the assembly and use of measured weather data for all Texas NOAA sites that correspond to the TMY2 sites for the years 1999 to 2006. Unfortunately, many of these sites have had discontinuous solar data, which requires the use of synthetic solar radiation to fill-in missing records. Therefore, this report contains information about the synthesis procedures used to generate the solar radiation data for those sites where data are missing.

ESL-TR-08-08-01

ENERGY EFFICIENCY/RENEWABLE ENERGY IMPACT IN THE TEXAS EMISSIONS REDUCTION PLAN (TERP)

PRELIMINARY REPORT: INTEGRATED NOX EMISSIONS SAVINGS FROM EE/RE PROGRAMS STATEWIDE

Annual Report to the
Texas Commission on Environmental Quality
January 2007 – December 2007

TCEQ

Jeff Haberl, Ph.D., P.E.; Charles Culp, Ph.D., P.E.
Bahman Yazdani, P.E.; Don Gilman, P.E.
Zi Liu, Ph.D.; Juan Carlos Baltazar-Cervantes, Ph.D.
Cynthia Montgomery; Kathy McKelvey
Jaya Mukhopadhyay; Larry Degelman, P.E.

August 2008

ENERGY SYSTEMS LABORATORY

Texas Engineering Experiment Station
Texas A&M University System

Figure 26: Cover Page of "Energy Efficiency/Renewable Energy Impact in the Texas Emissions Reduction Plan (TERP)," August 2008

5.2.6 Technical Assistance

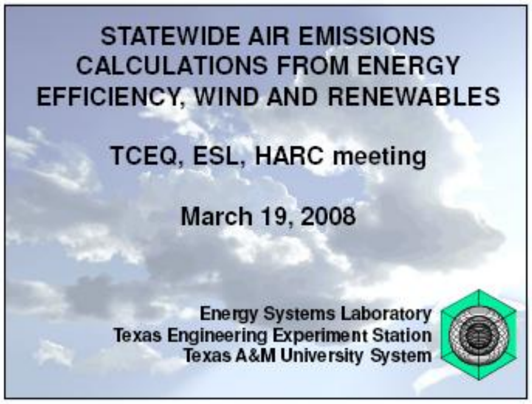
The Laboratory provided technical assistance to the TCEQ, the PUC, SECO and ERCOT, as well as Stakeholders participating in a number of conferences and presentations. In 2008, the Laboratory continued to work closely with the TCEQ to develop an integrated emissions calculation, which provided the TCEQ with a creditable NOx emissions reduction from energy efficiency and renewable energy (EE/RE) programs reported to the TCEQ in 2005, 2006 and 2007 by the Laboratory, PUC, SECO, and Wind-ERCOT.

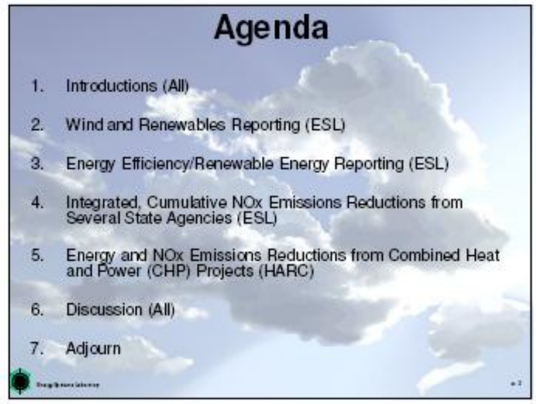
The Laboratory has also enhanced the previously developed emissions calculator by: expanding the capabilities to include all counties in ERCOT; including the collection and assembly of weather from 1999 to the present from 17 NOAA weather stations; and enhancing the underlying computer platform for the calculator.

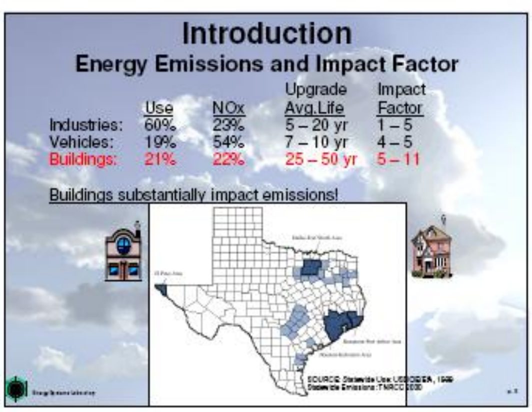
The Laboratory has and will continue to provide leading edge technical assistance to counties and communities working toward obtaining full SIP credit for the energy efficiency and renewable energy projects that are lowering the emissions and improving the air for all Texans. The Laboratory will continue to provide superior technology to the State of Texas through efforts with the TCEQ and US EPA. The efforts taken by the Laboratory have produced significant success in bringing EE/RE closer to US EPA acceptance in the SIP.

5.2.6.1 Presentation to the TCEQ, Austin, (March 2008)

In March of 2008, the Energy Systems Lab made a presentation to the TCEQ about the calculation of NOx emissions reductions from energy efficiency and renewable energy in Austin, Texas.







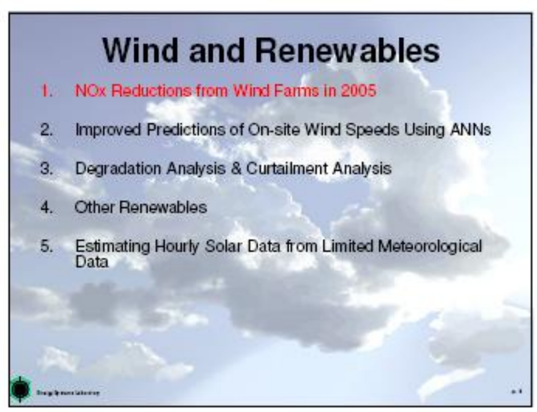
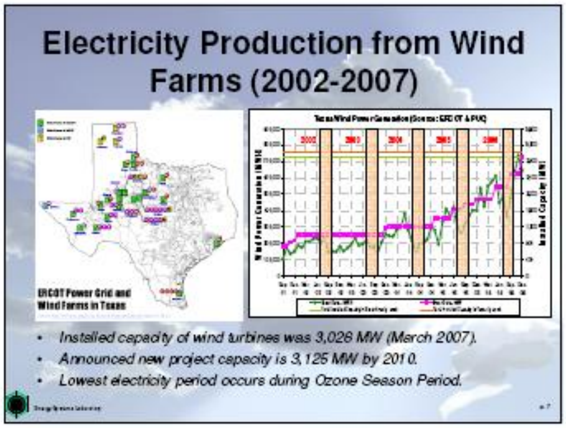
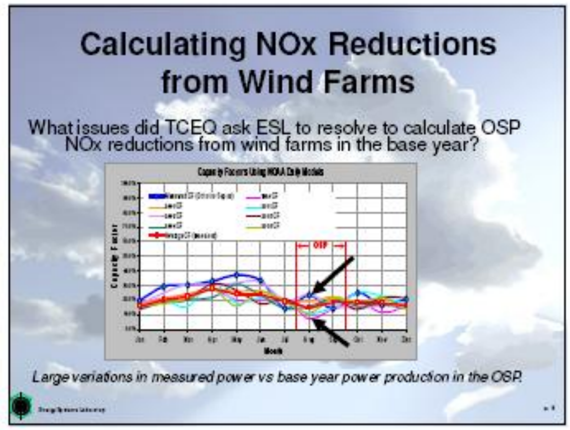
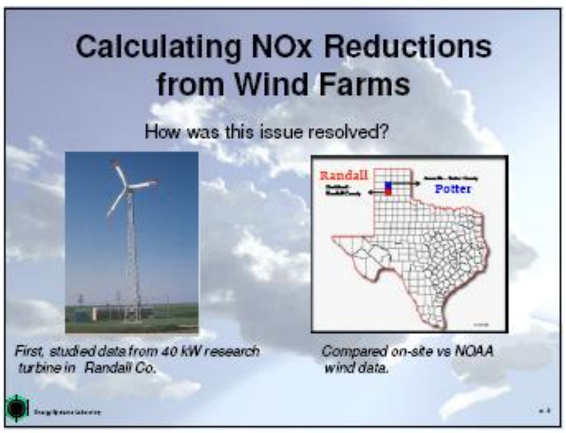
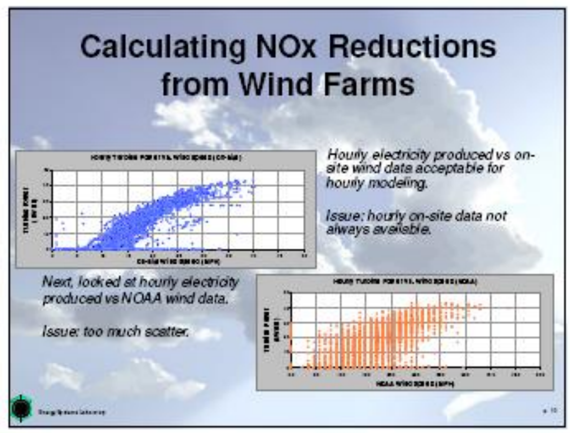


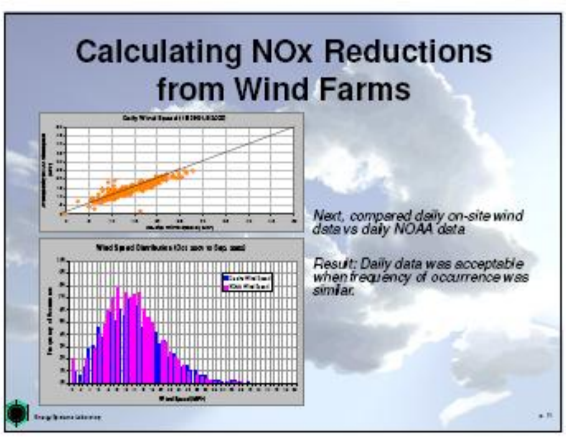
Figure 27: Slides Presented to the TCEQ (March 2008)











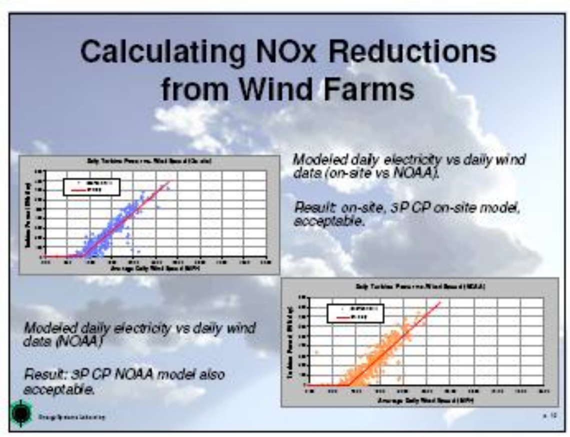
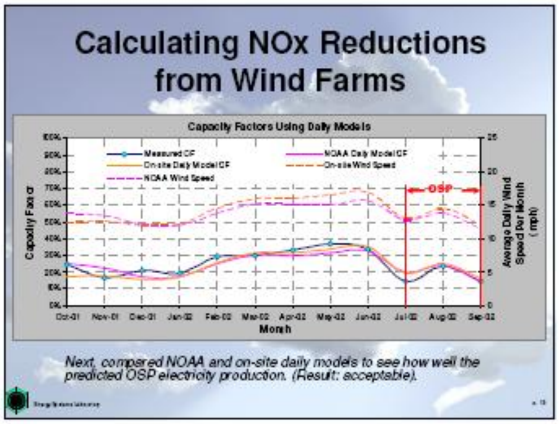
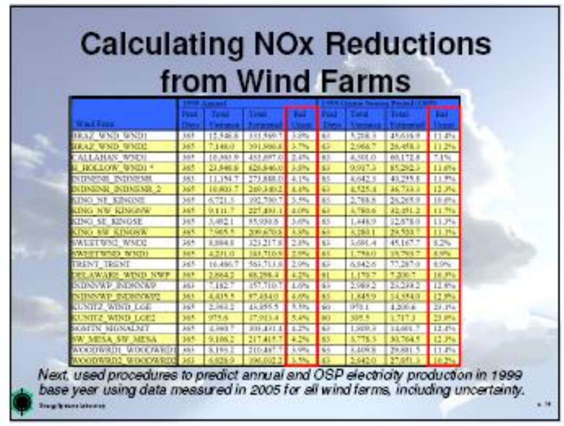
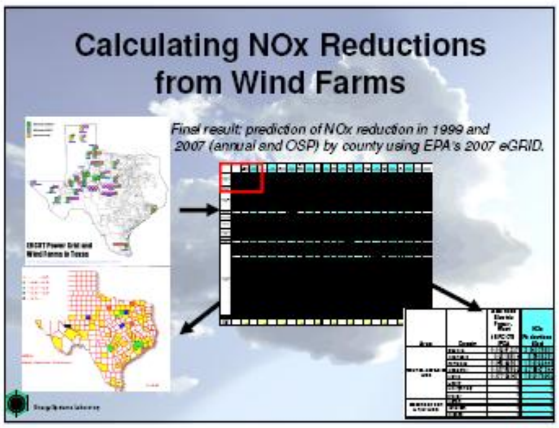
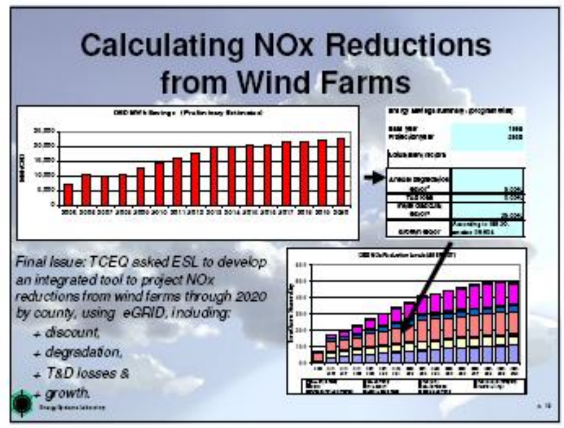


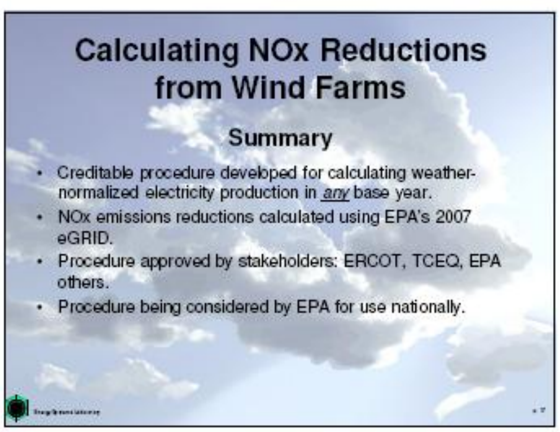
Figure 28: Slides Presented to the TCEQ (March 2008)











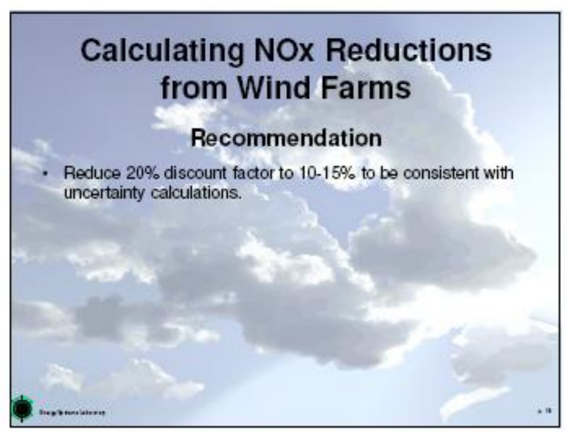
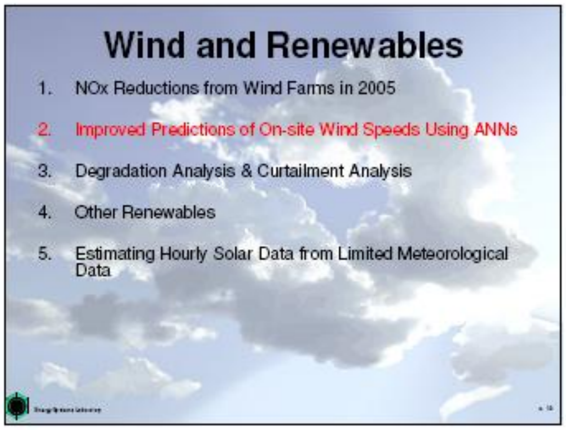
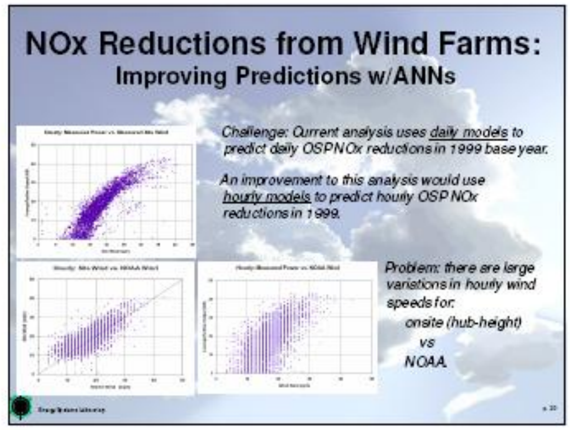
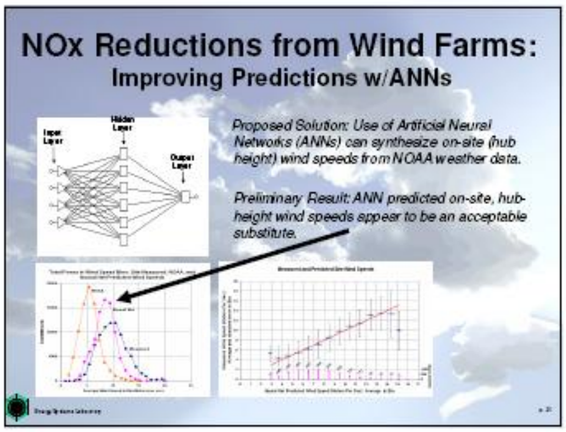
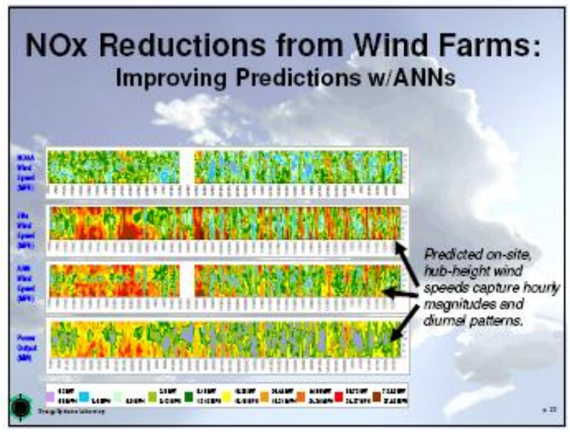


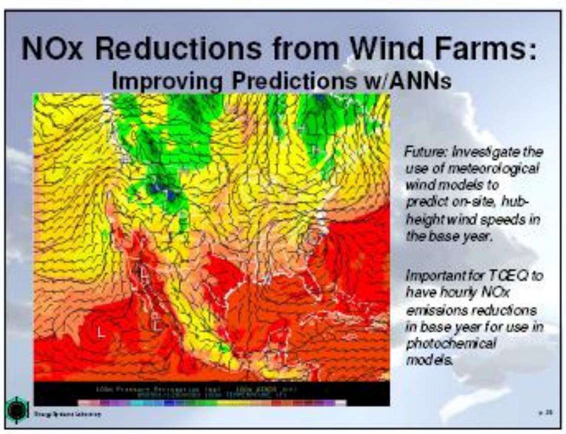
Figure 29: Slides Presented to the TCEQ (March 2008)











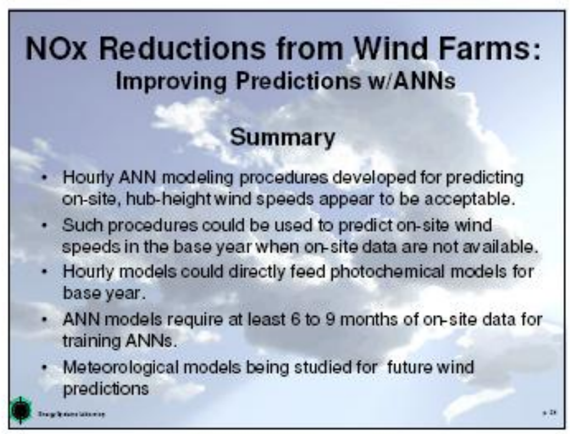
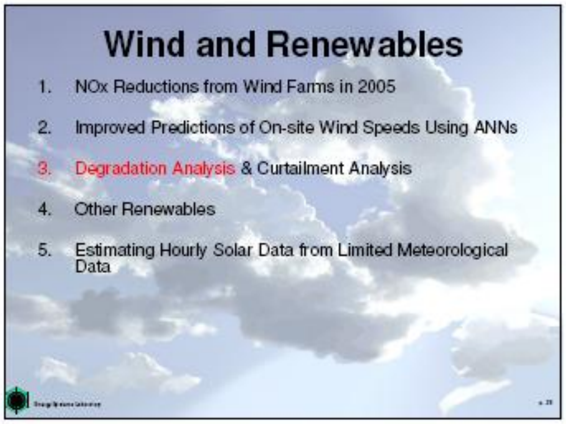
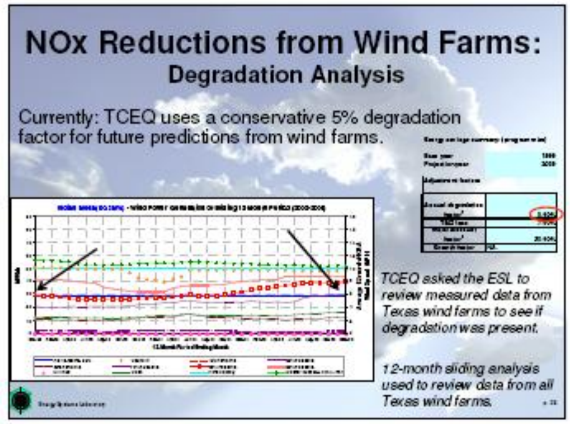
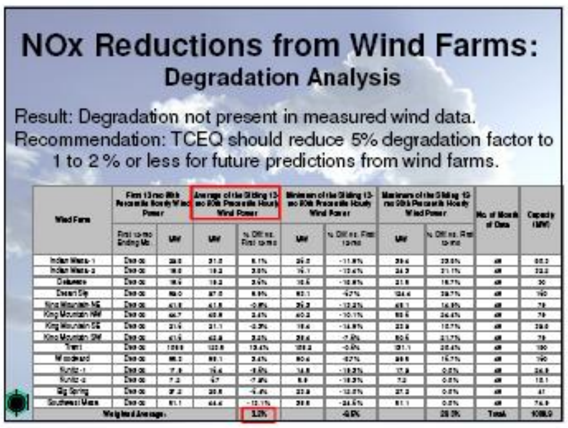
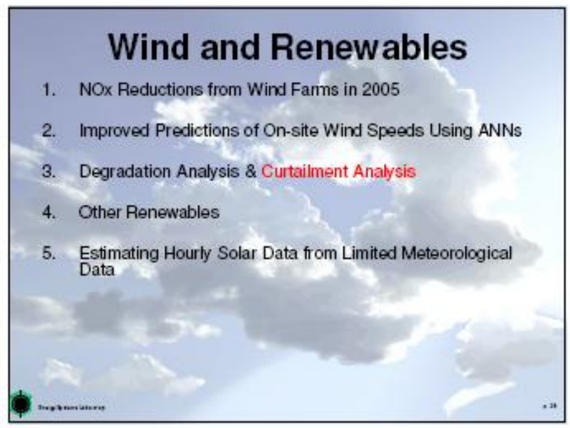


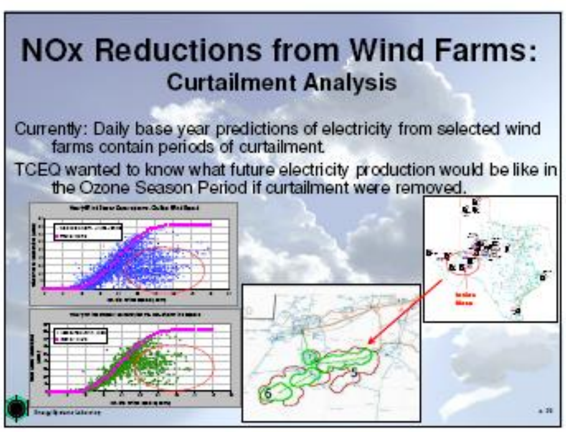
Figure 30: Slides Presented to the TCEQ (March 2008)











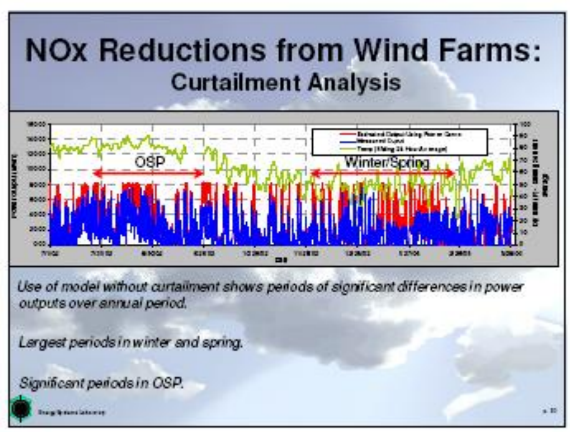
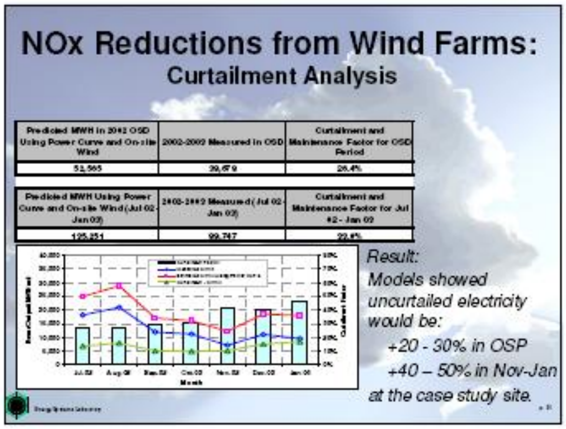
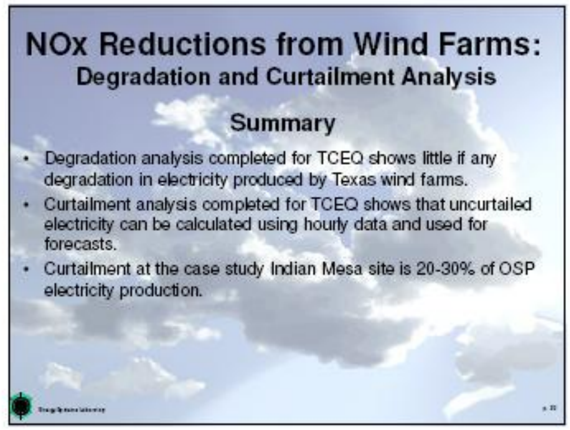
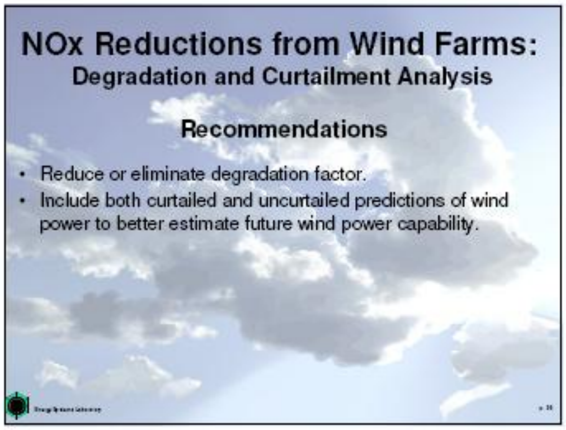
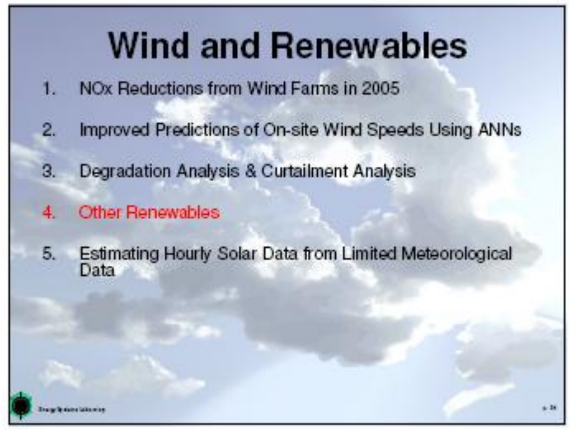


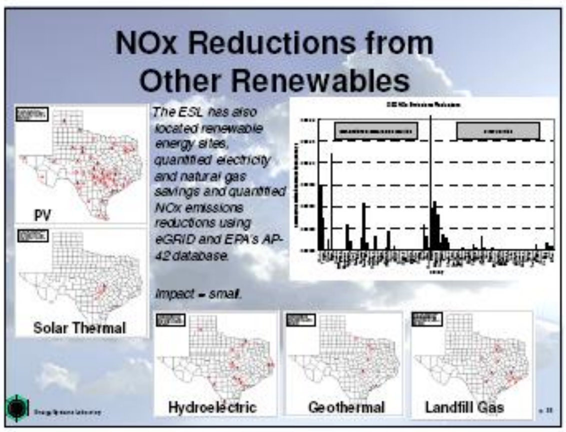
Figure 31: Slides Presented to the TCEQ (March 2008)











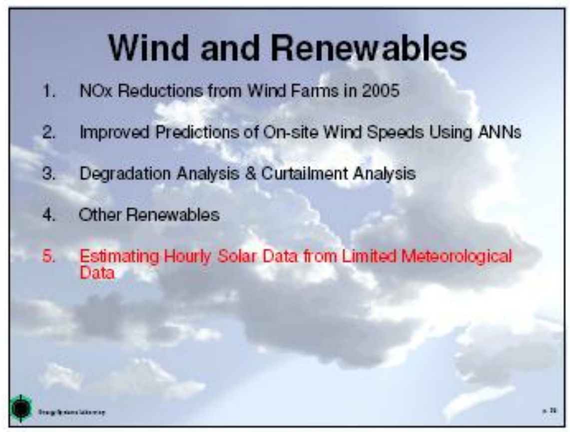
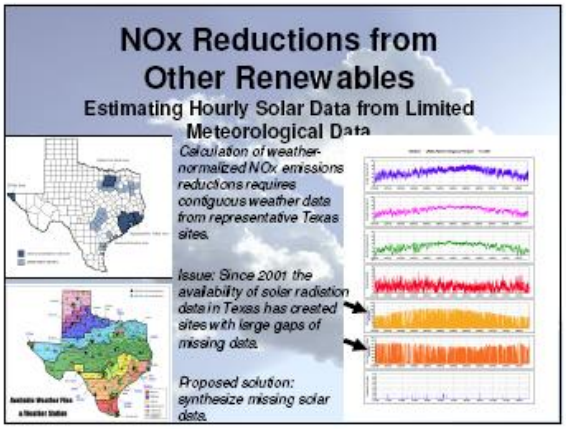
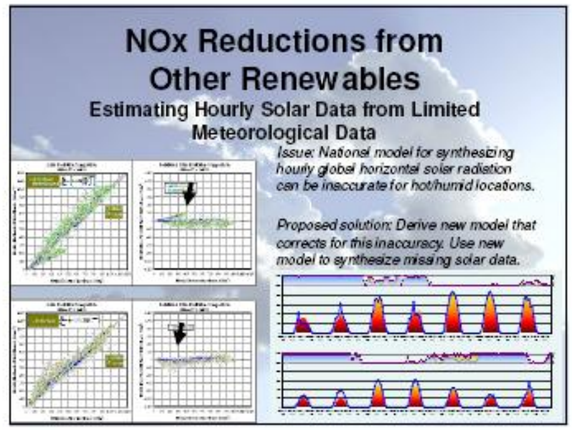
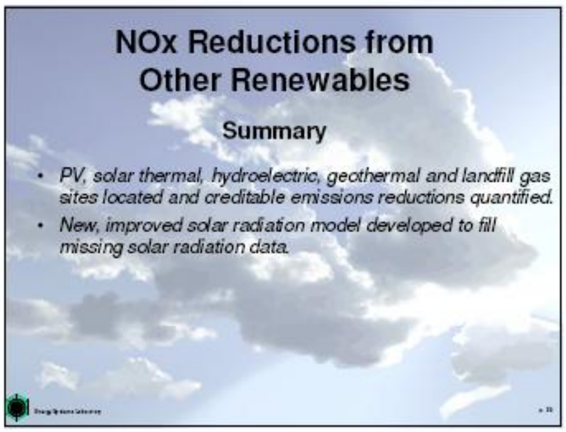
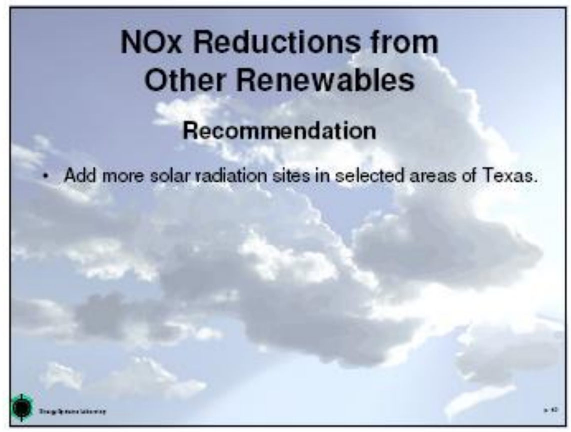


Figure 32: Slides Presented to the TCEQ (March 2008)









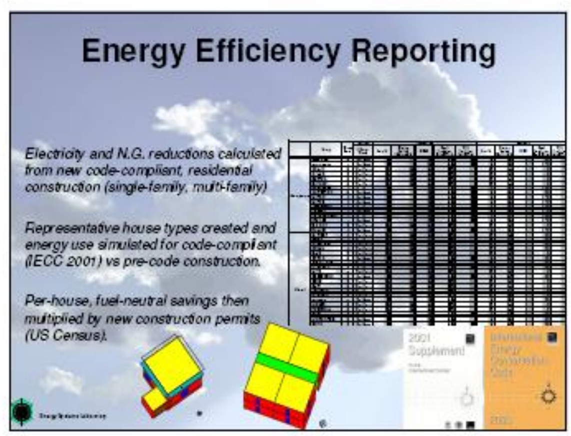
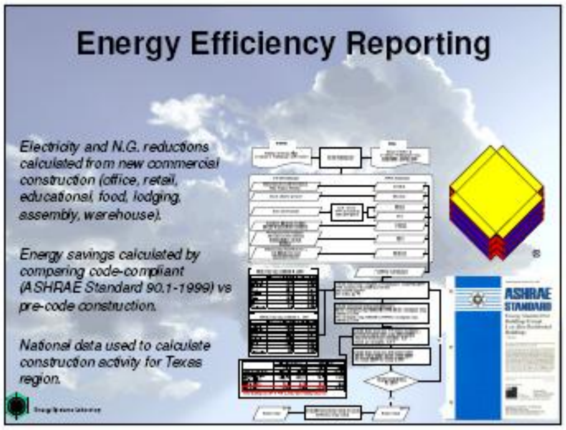
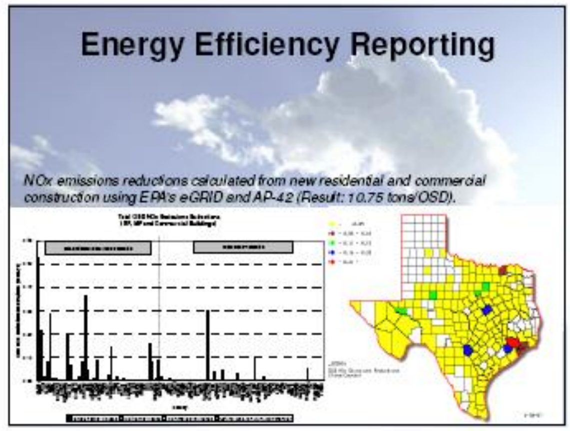
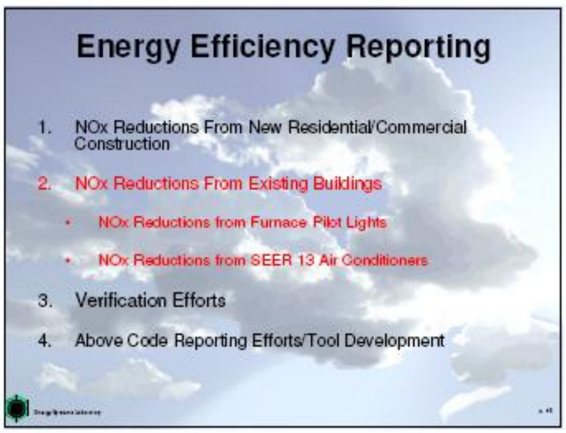
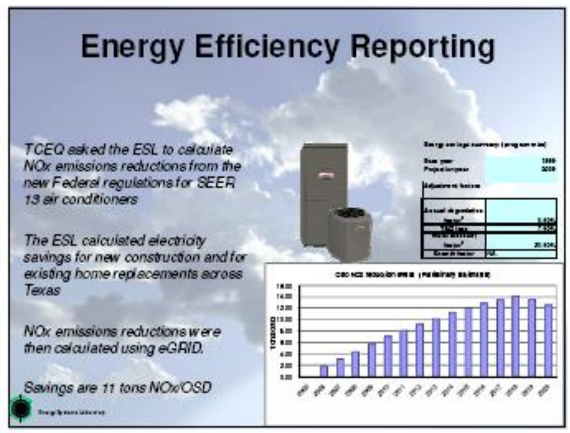


Figure 33: Slides Presented to the TCEQ (March 2008)









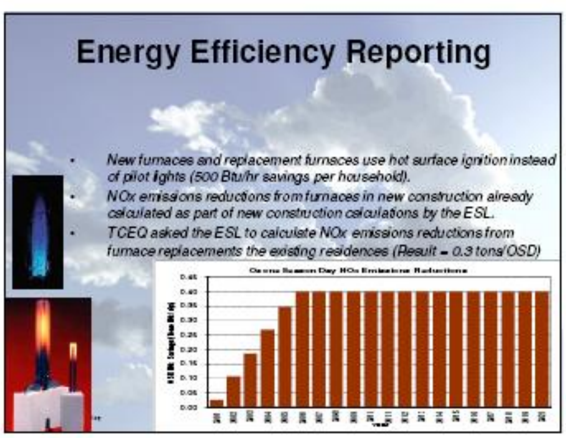
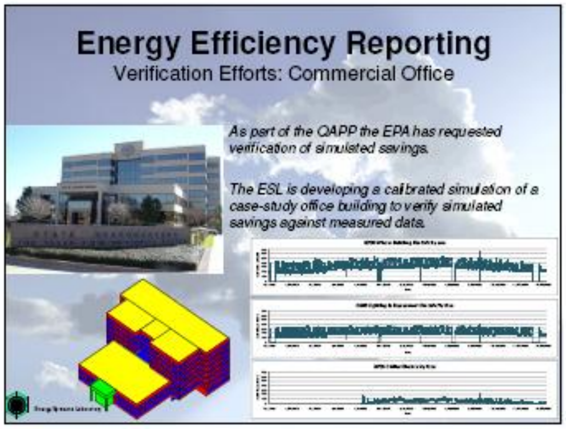
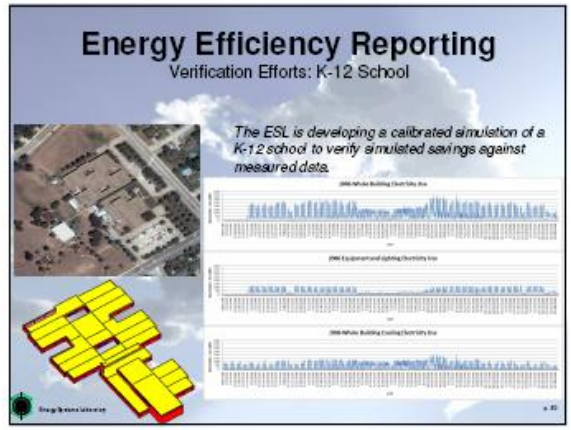
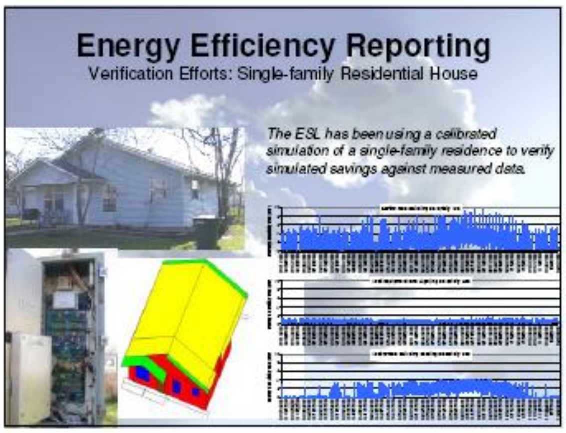
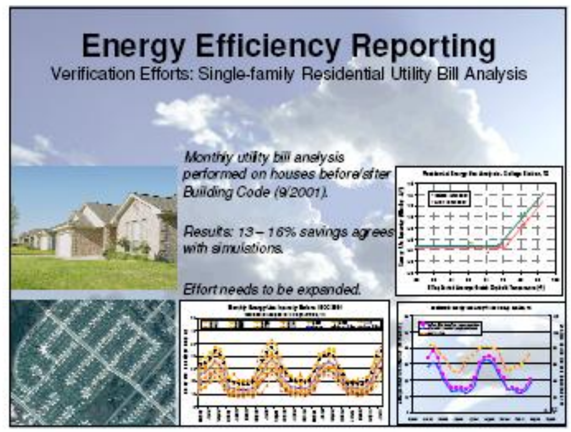


Figure 34: Slides Presented to the TCEQ (March 2008)









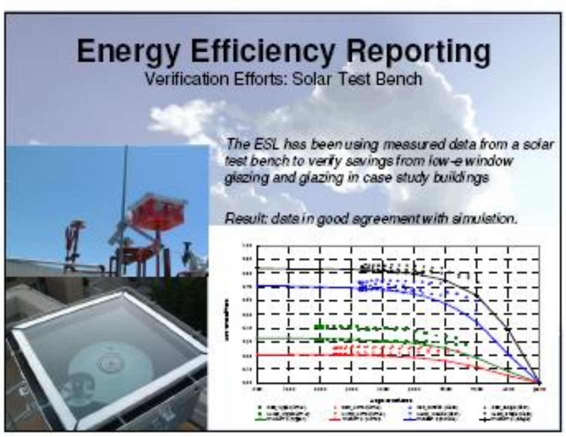
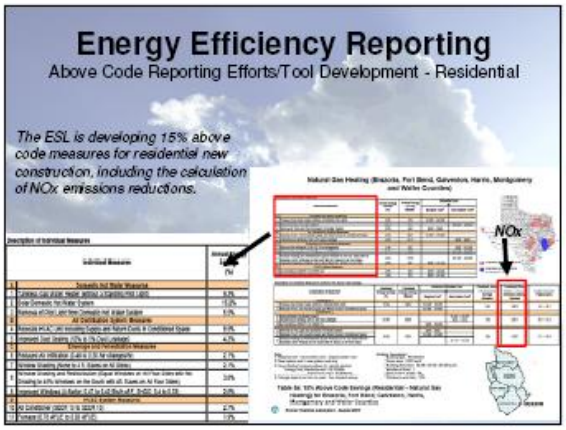
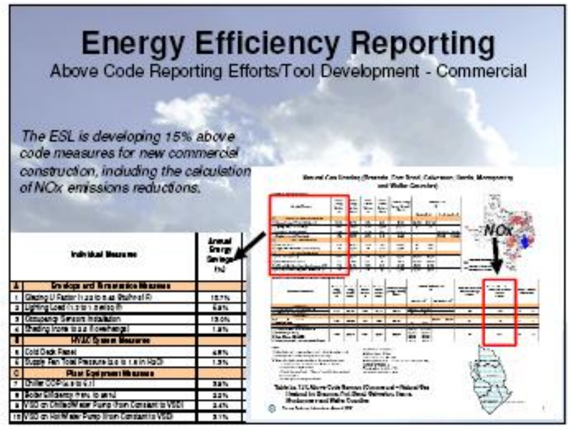
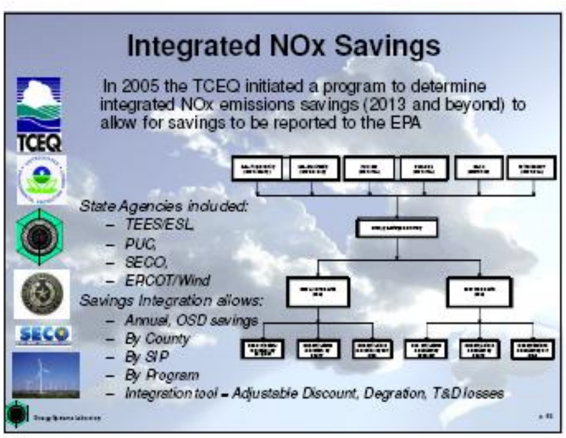


Figure 35: Slides Presented to the TCEQ (March 2008)







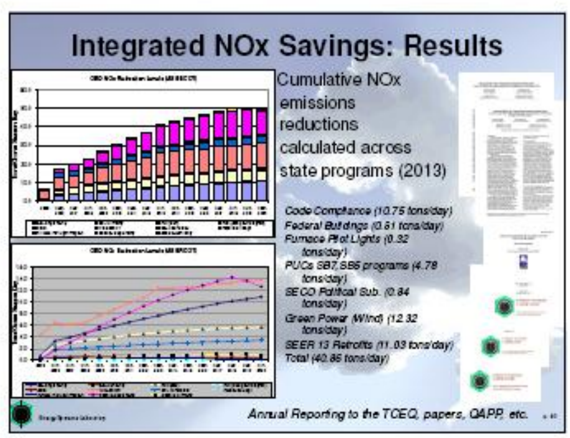
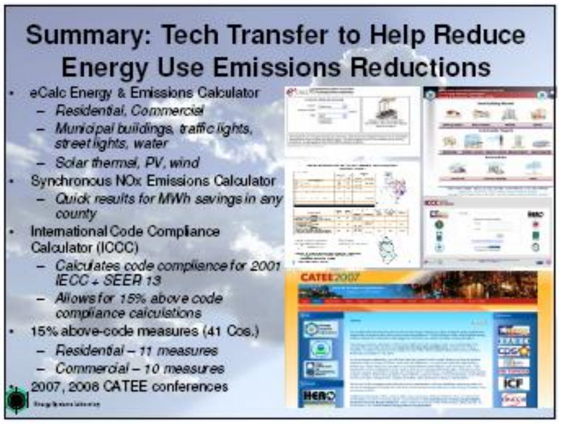
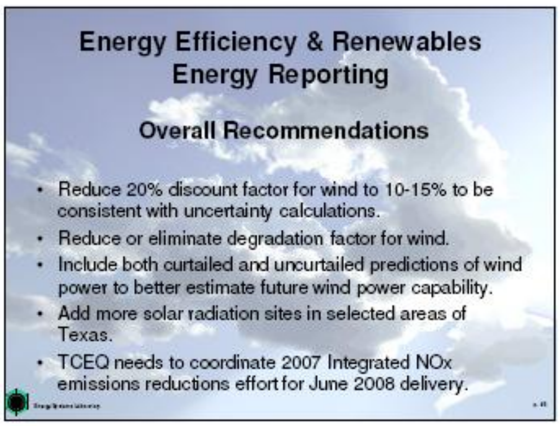


Figure 36: Slides Presented to the TCEQ (March 2008)





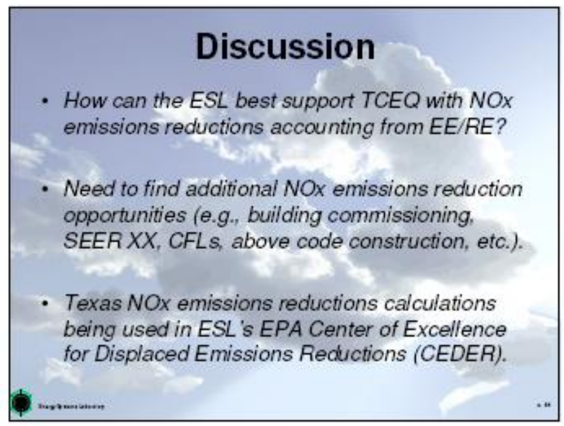
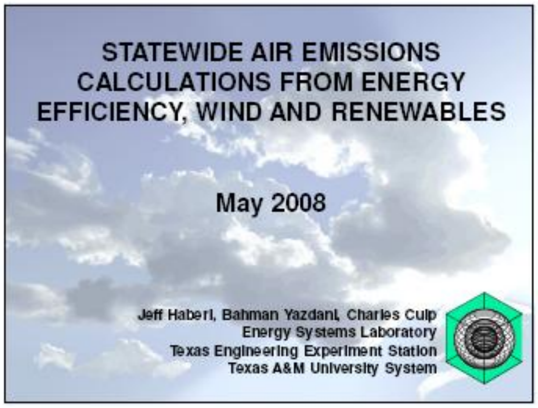
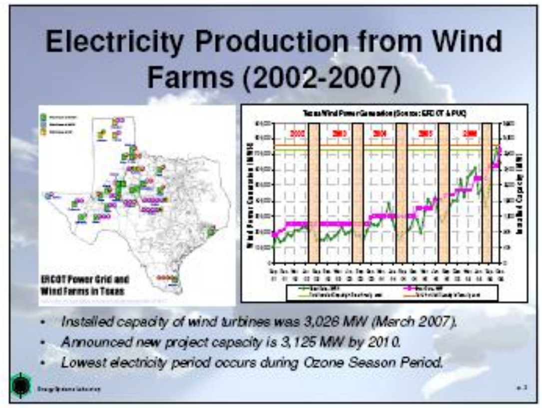


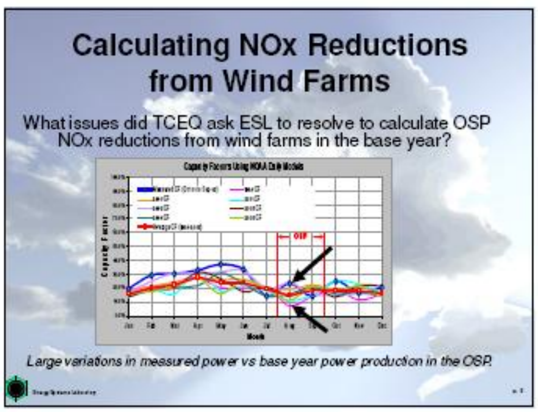
Figure 37: Slides Presented to the TCEQ (March 2008)

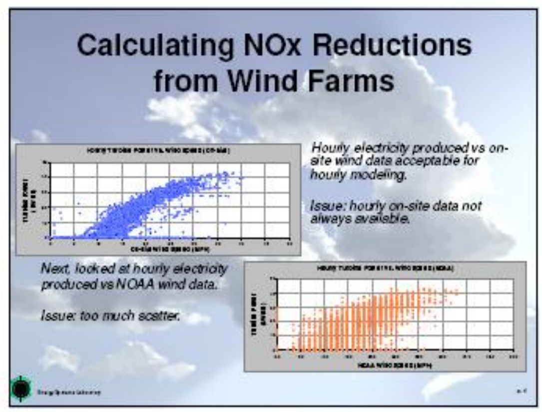
5.2.6.2 Presentation to the Texas Clean Air Working Group, Austin (May 2008)

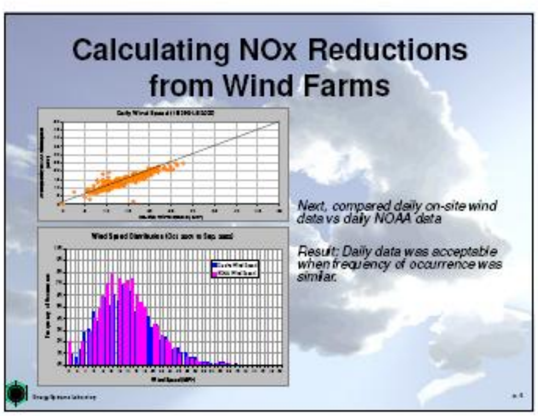
In May 2008, the Energy Systems Laboratory presented to the Texas Clean Air Working Group about the calculation of NOx emissions reductions from energy efficiency and renewable energy in Austin, Texas.











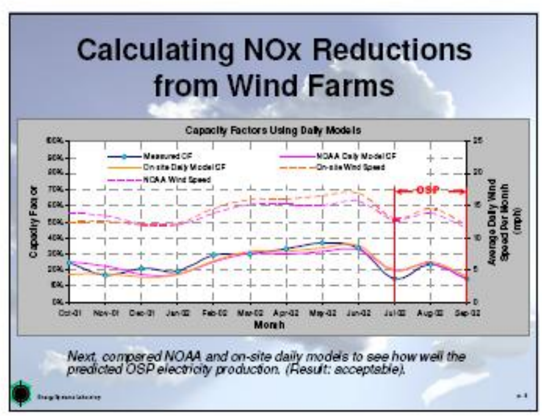
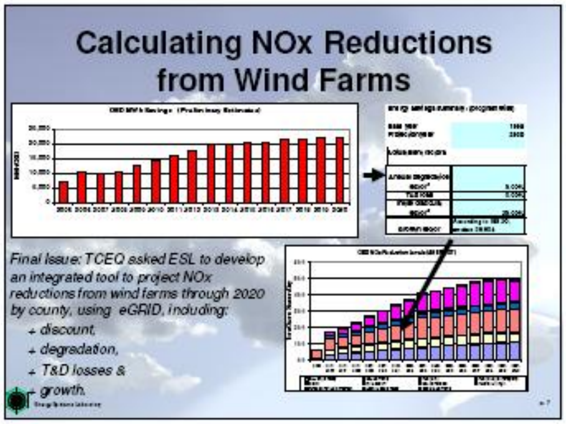
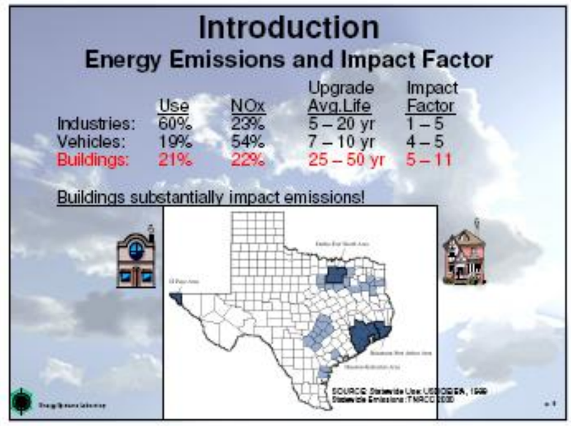
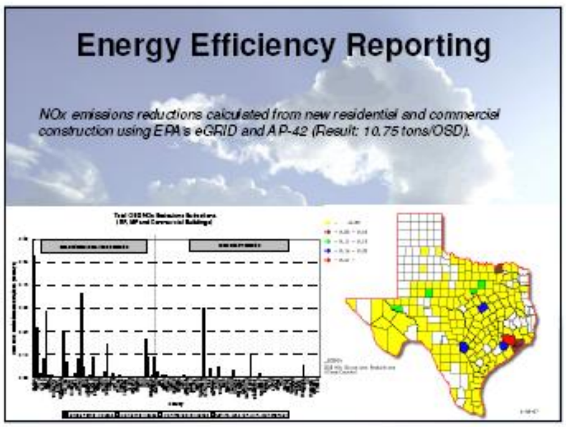
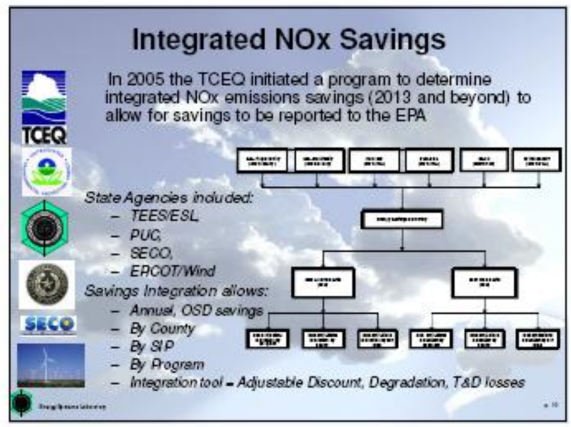


Figure 38: Slides Presented to the Texas Clean Air Working Group (May 2008)









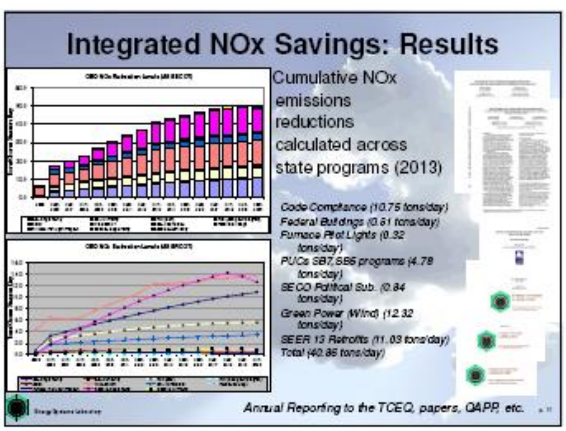
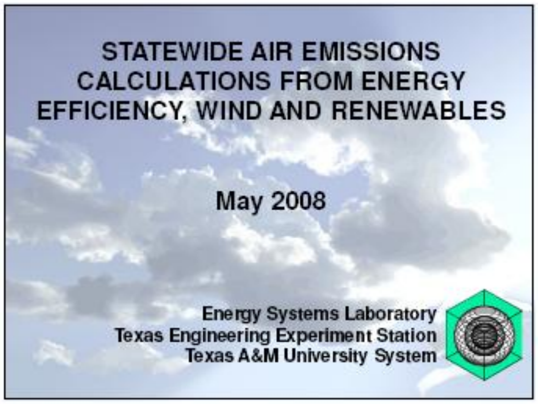
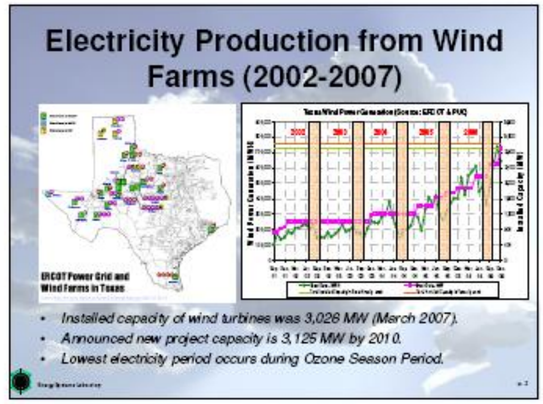


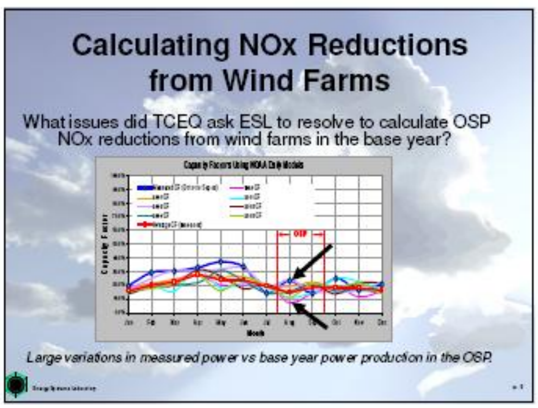
Figure 39: Slides Presented to the Texas Clean Air Working Group (May 2008)

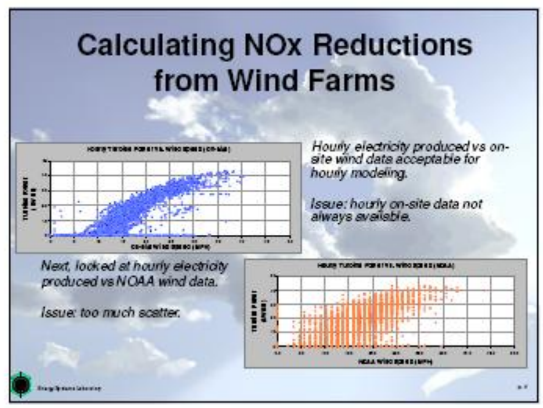
5.2.6.3 May 2008 EPA Technical Forum conference call

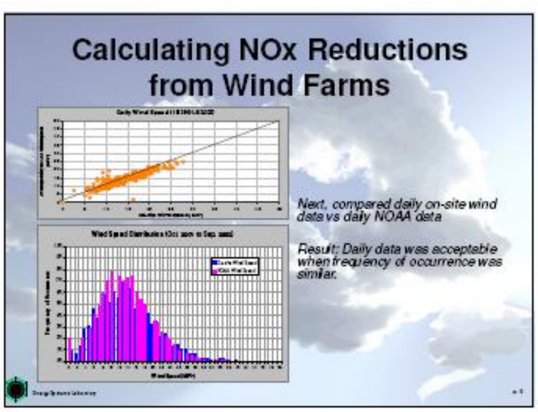
On May 22, 2008, the Energy Systems Laboratory presented to the EPA Technical Forum about calculation of NOx emissions reductions from energy efficiency and renewable energy. this was a conference call.











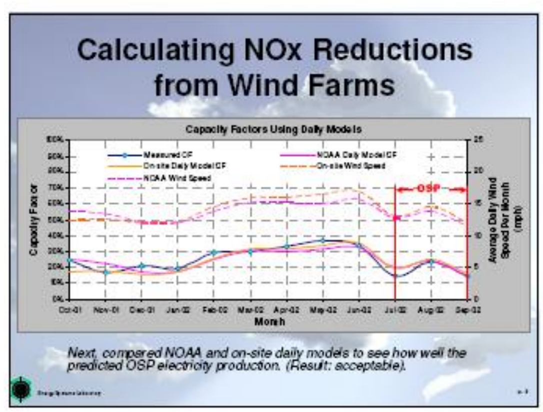
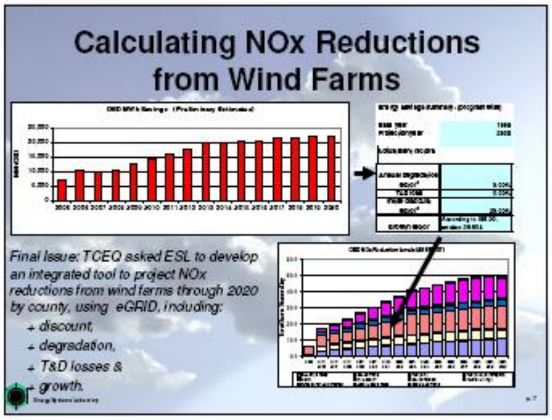
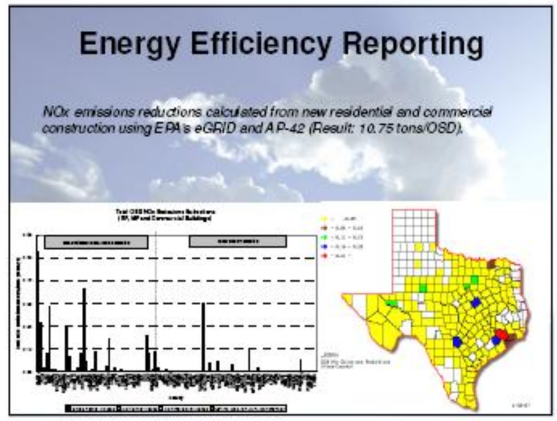
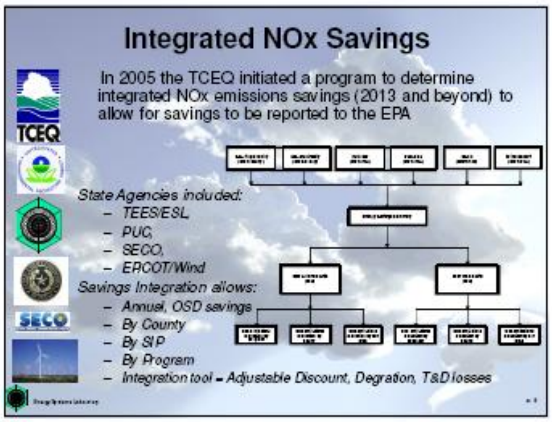


Figure 40: Slides Presented to the EPA Technical Forum (May 2008)







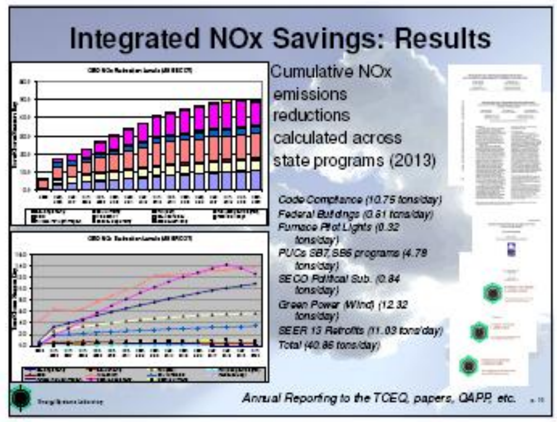
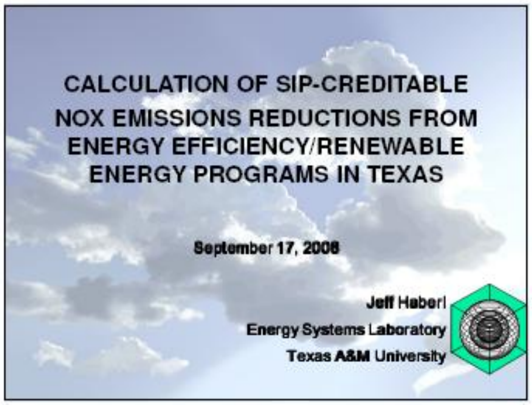
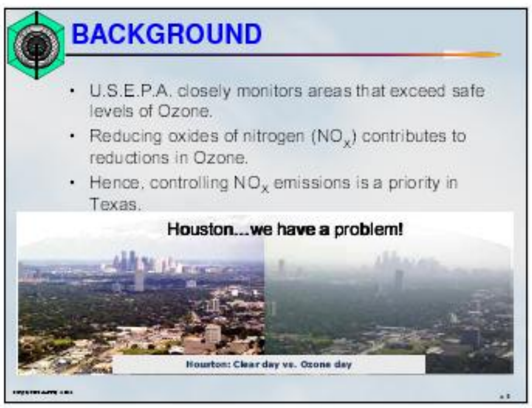


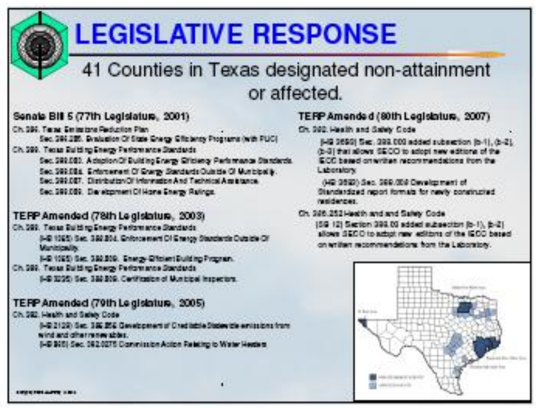
Figure 41: Slides Presented to the EPA Technical Forum (May 2008)

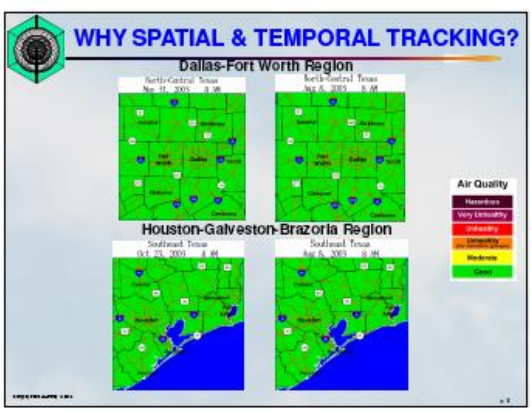
5.2.6.4 Presentation to the University of Texas Department of Agriculture (September 2008)

On September 17, 2008, the Energy Systems Laboratory made a presentation to the University of Texas Department of Agriculture about the calculation of NOx emissions reductions from energy efficiency and renewable energy in Austin, Texas.









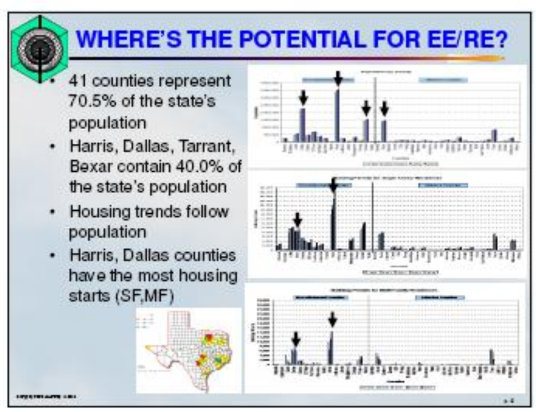
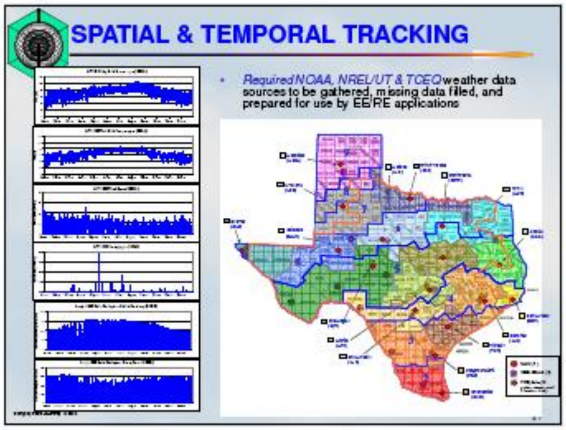
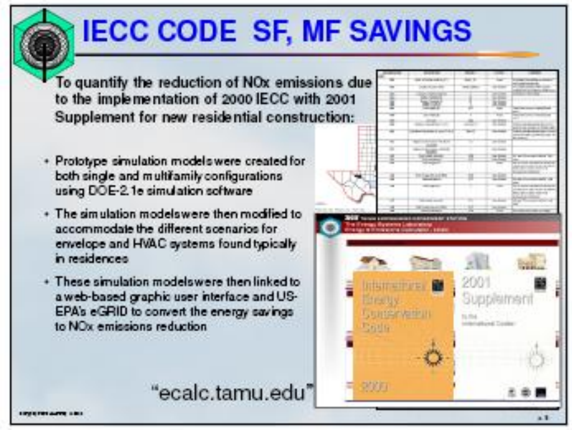
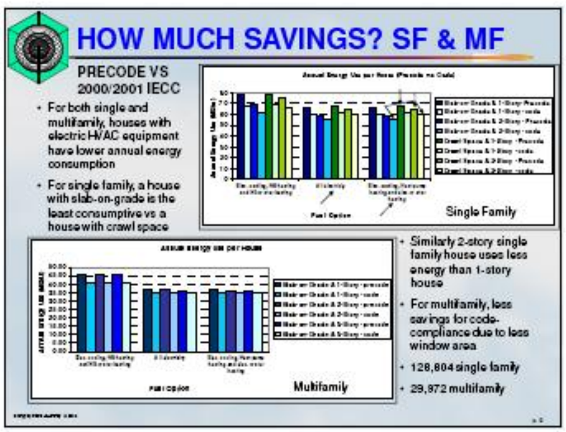
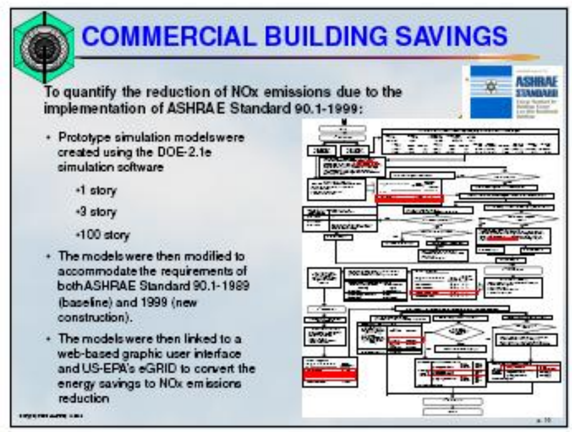


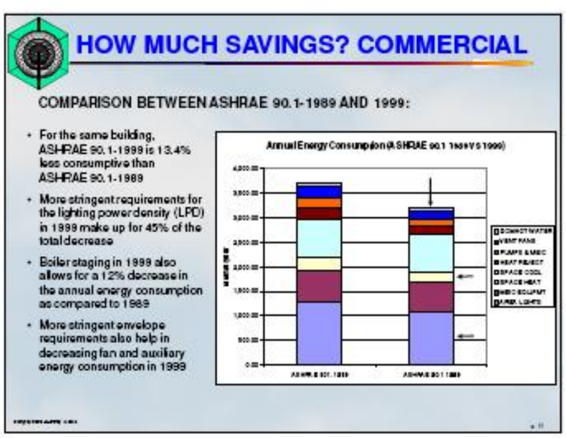
Figure 42: Slides Presented to the University of Texas (September 2008)











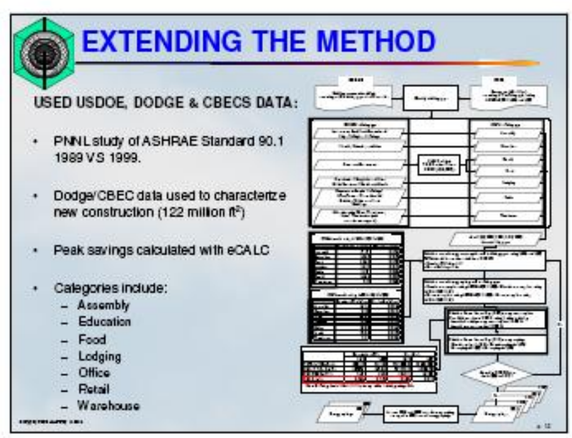
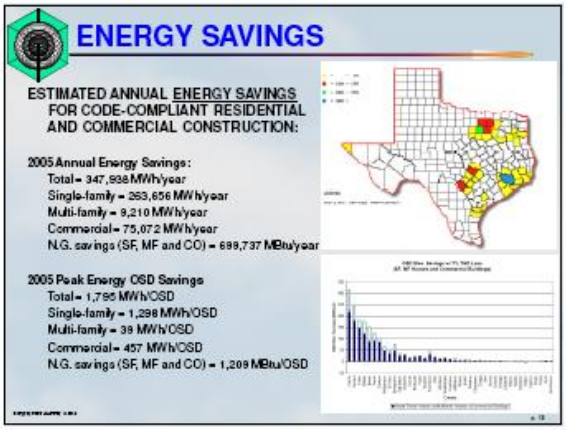
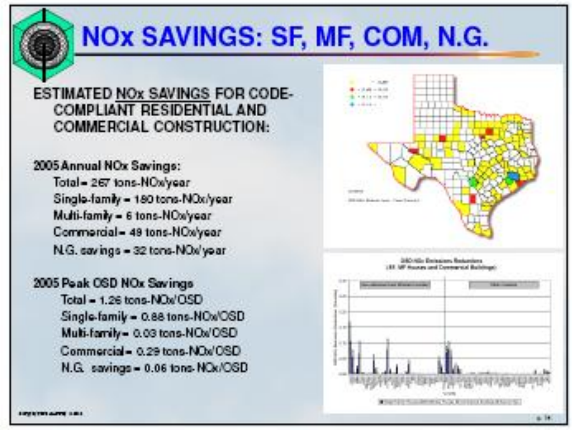
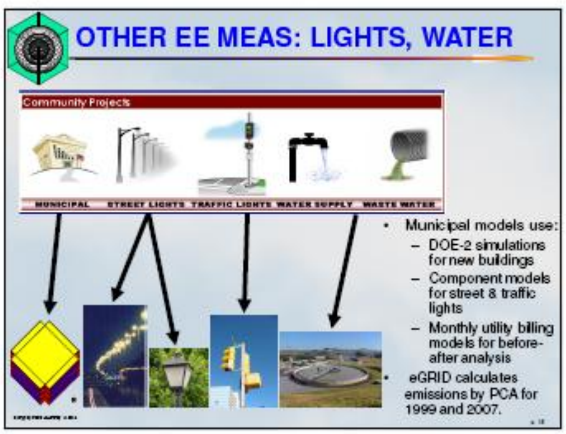
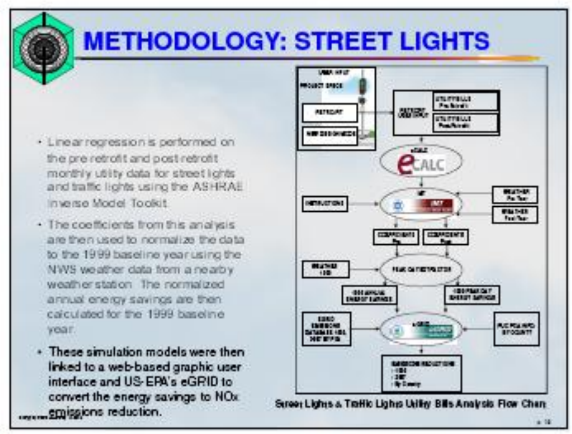


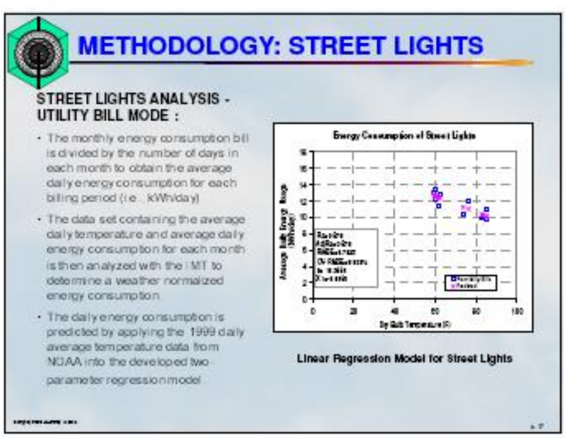
Figure 43: Slides Presented to the University of Texas (September 2008)











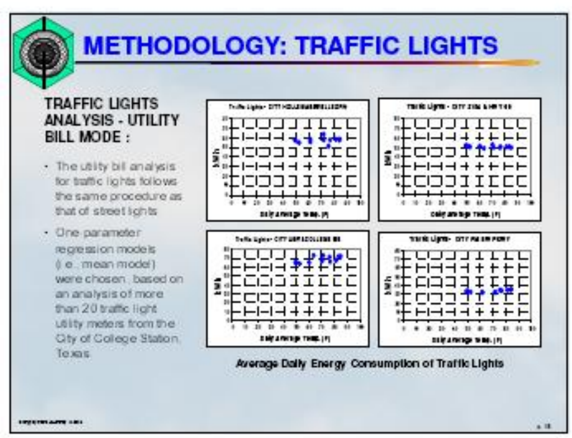
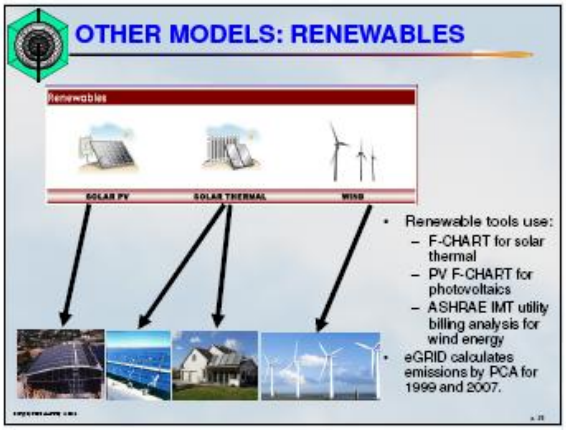
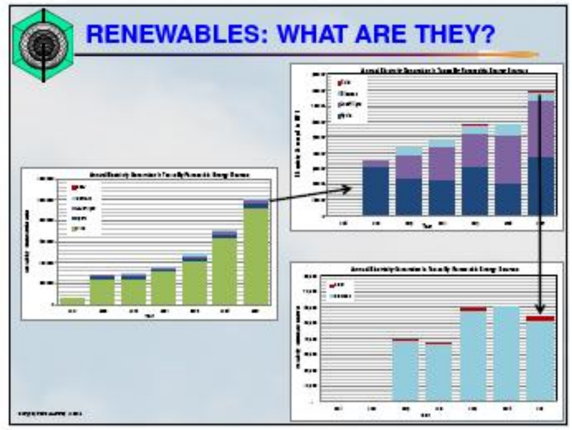
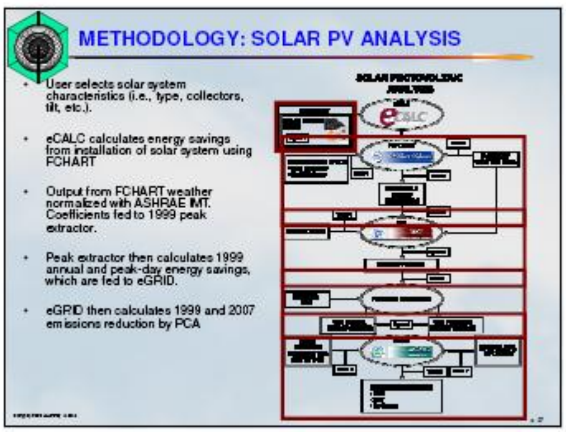


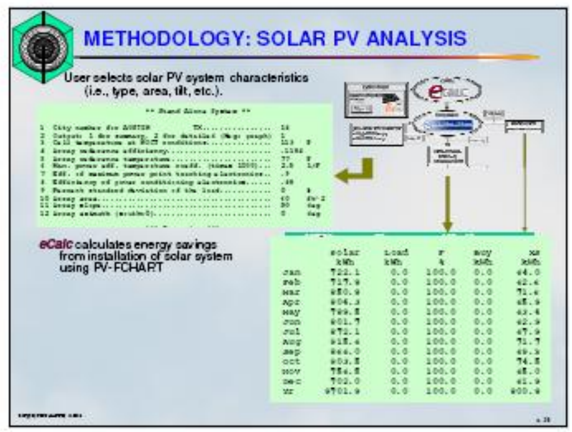
Figure 44: Slides Presented to the University of Texas (September 2008)

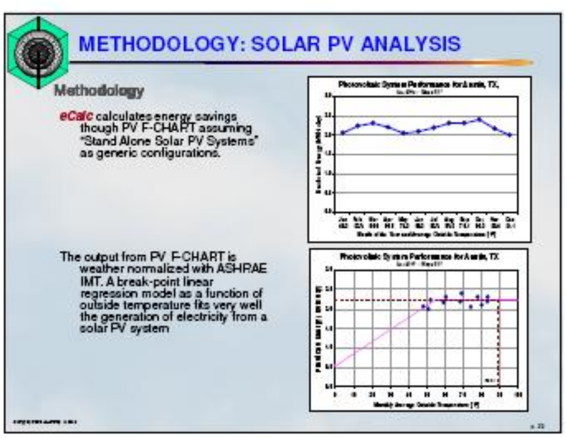
Figure 45: Slides Presented to the University of Texas (September 2008)











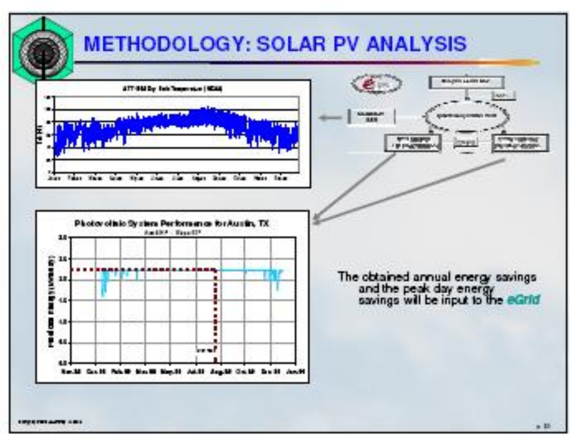
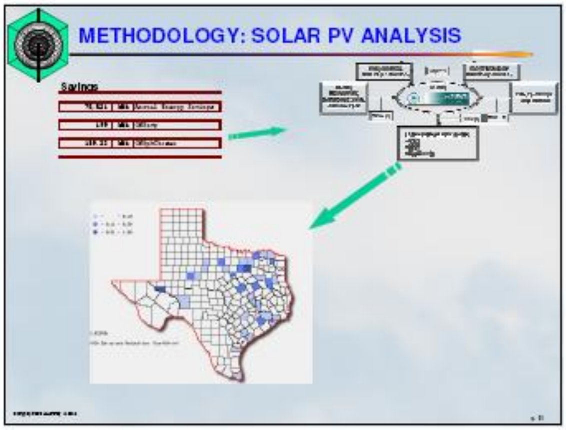
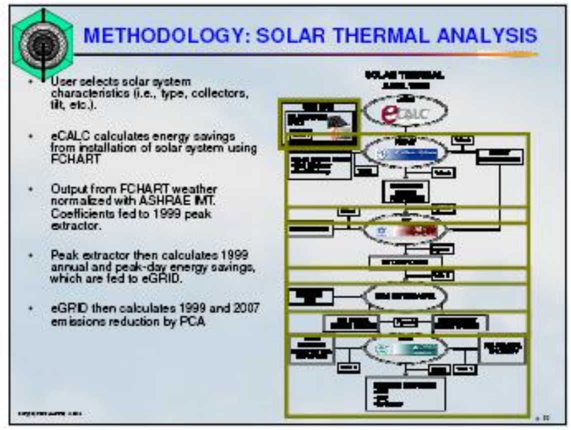
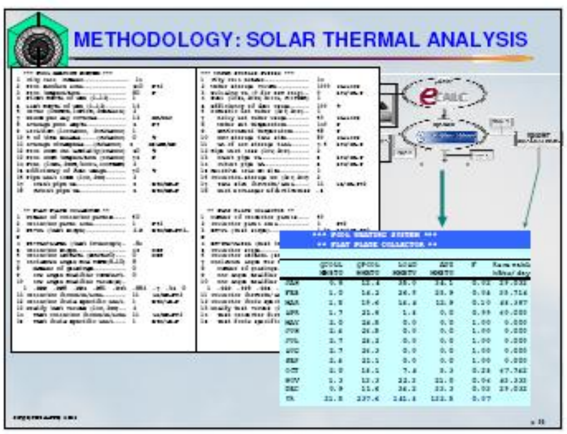
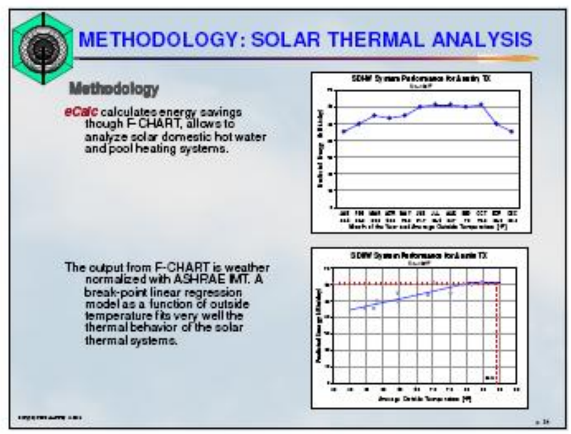


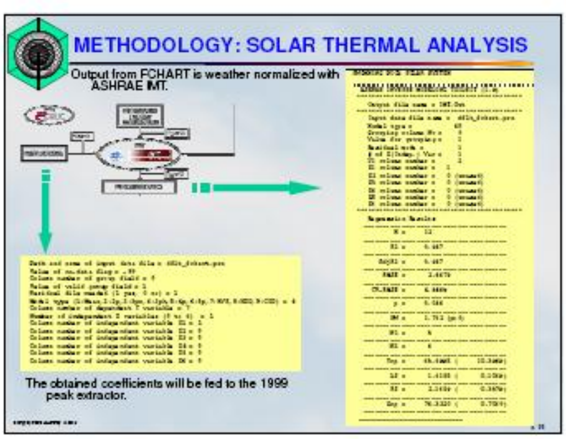
Figure 46: Slides Presented to the University of Texas (September 2008)











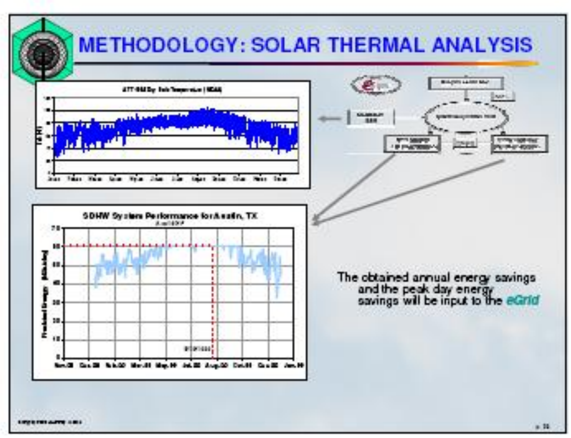
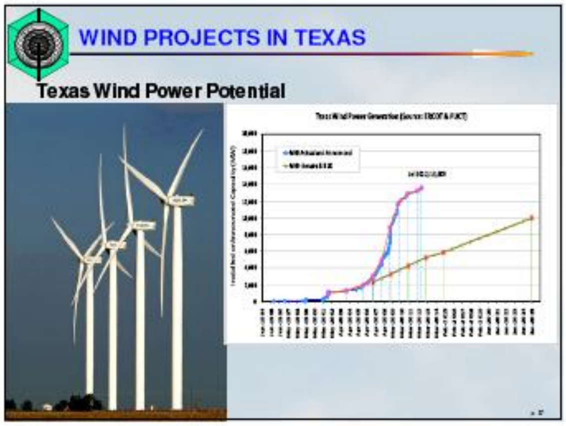
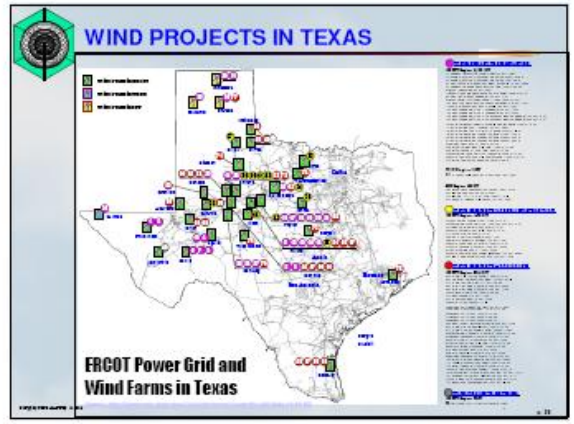
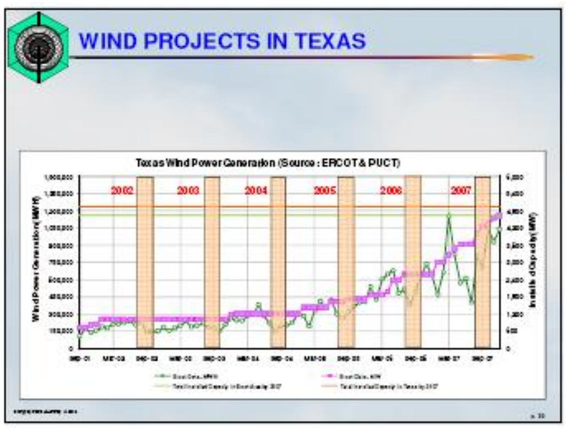
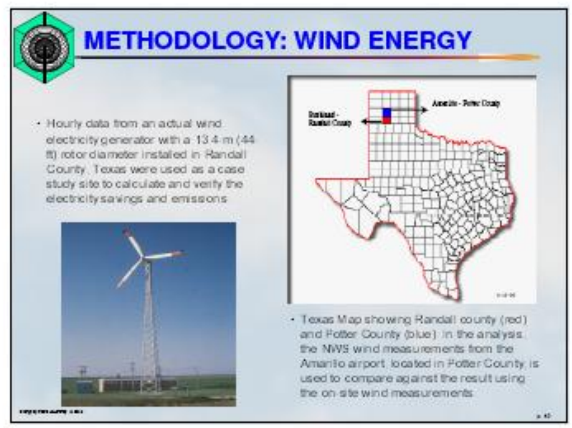


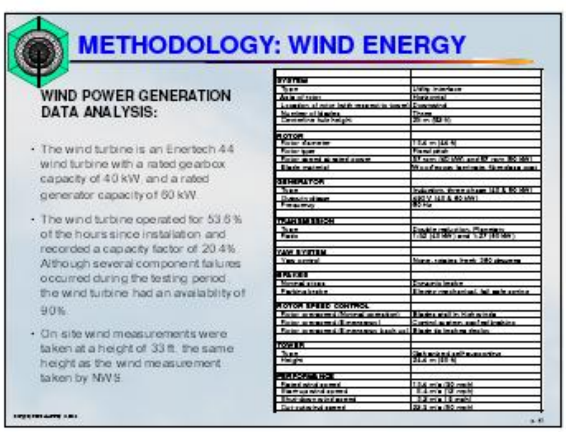
Figure 47: Slides Presented to the University of Texas (September 2008)











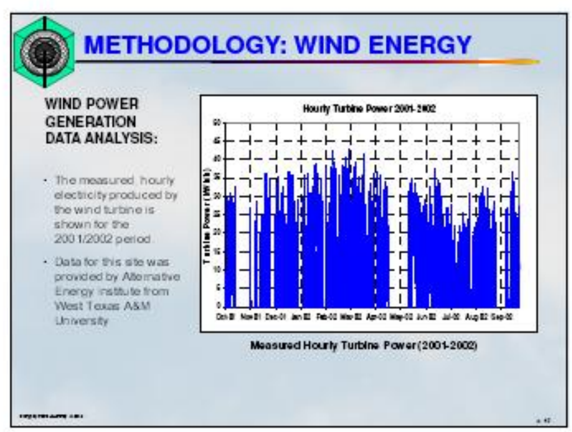


Figure 48: Slides Presented to the University of Texas (September 2008)

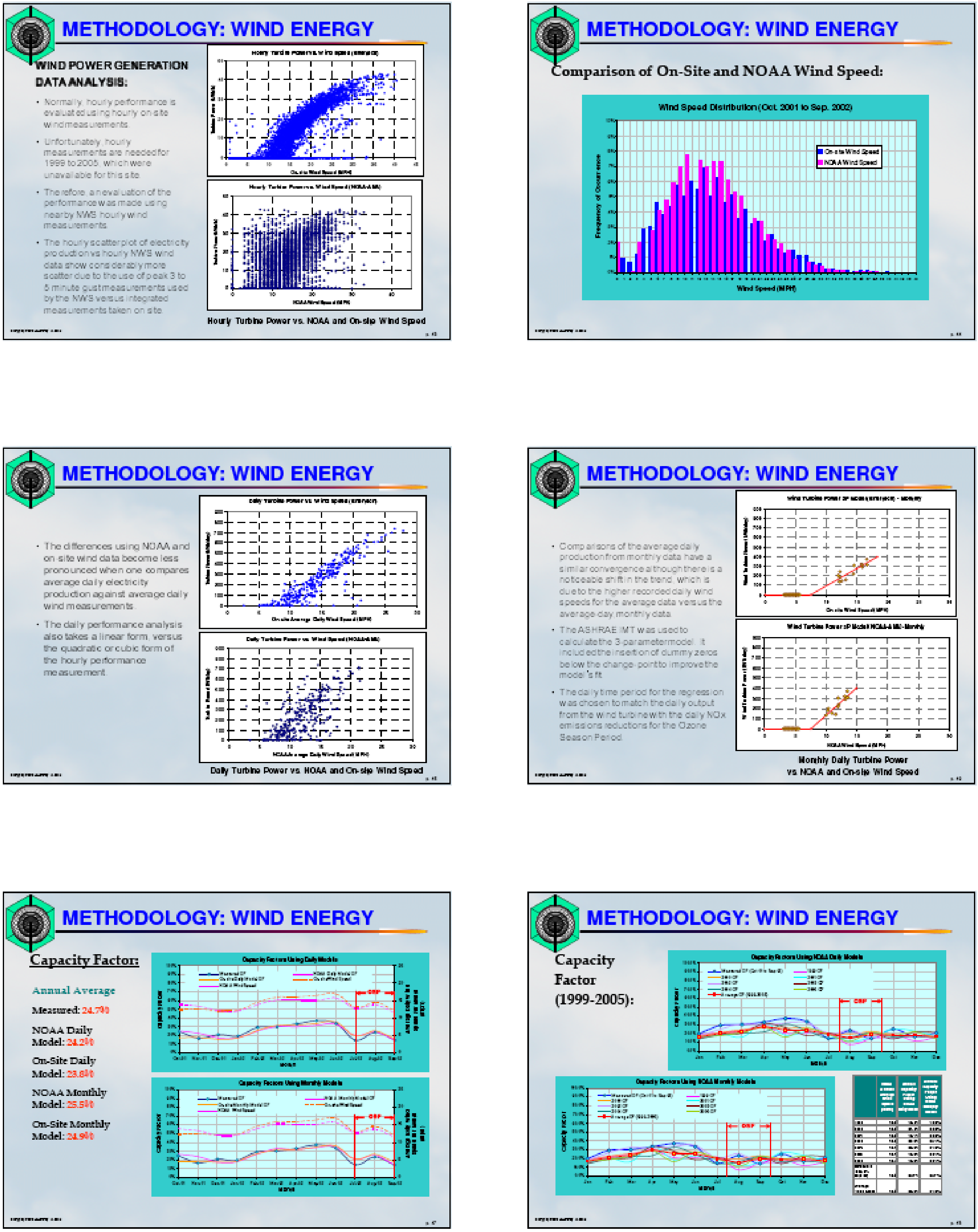
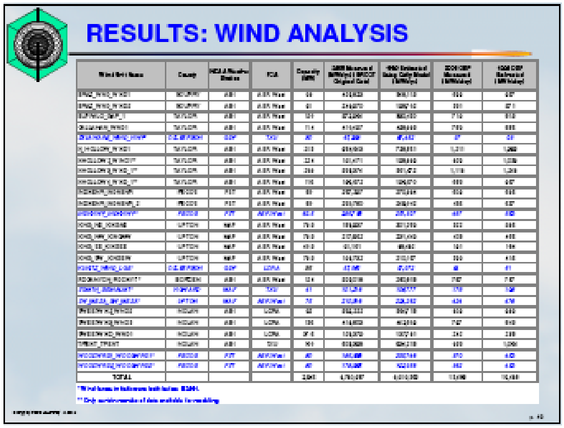
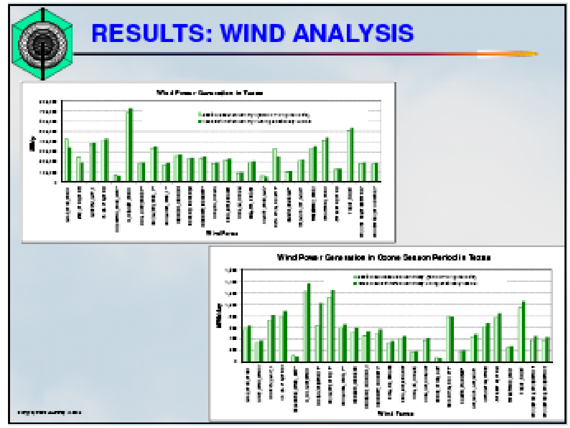
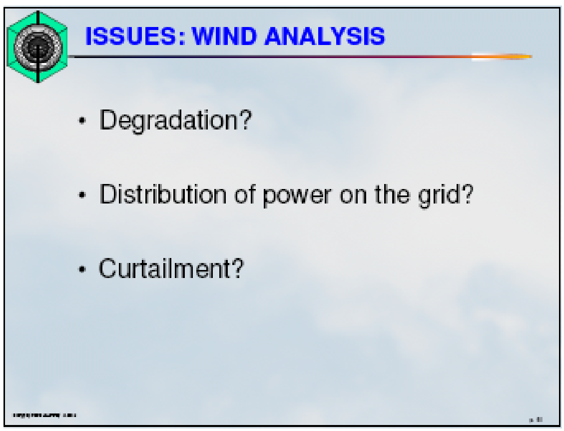
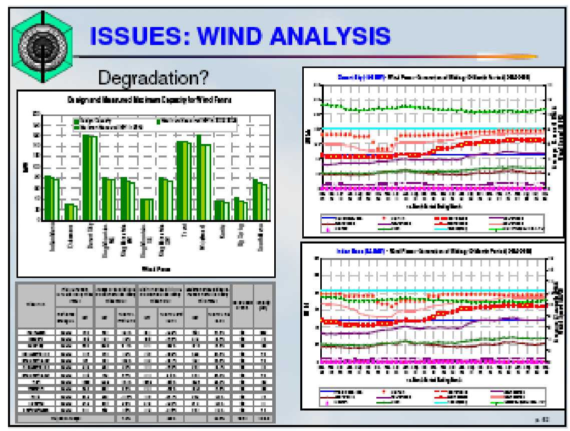


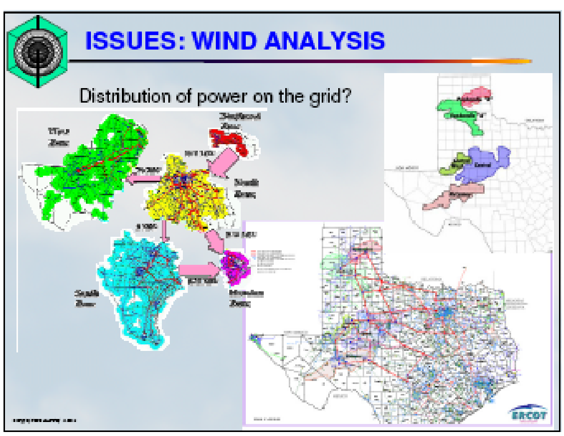
Figure 49: Slides Presented to the University of Texas (September 2008)











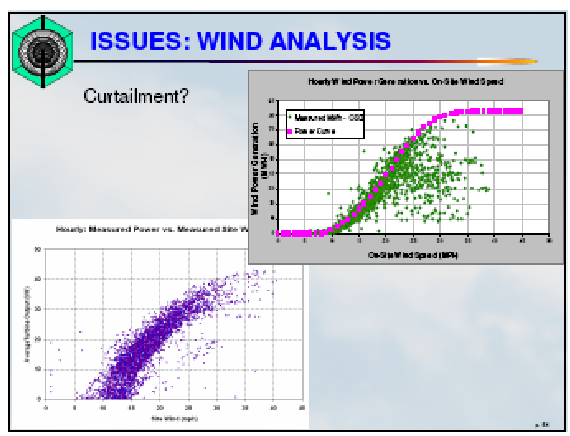
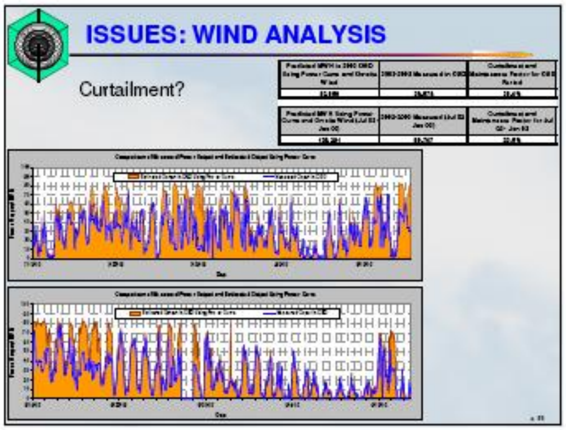
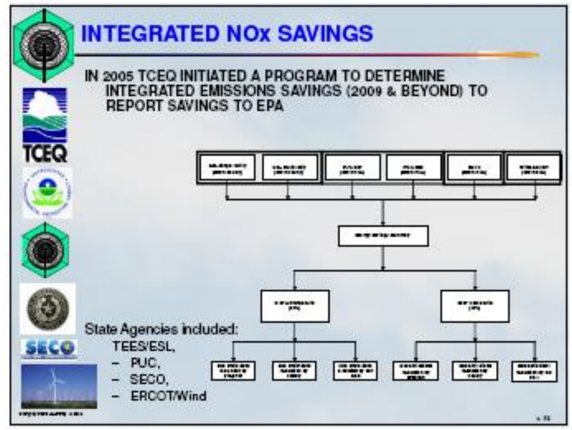
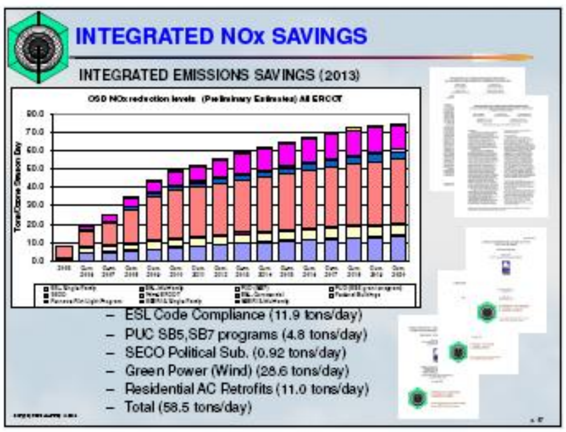
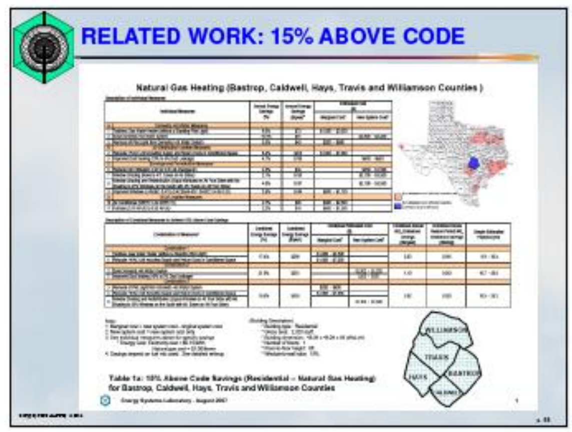


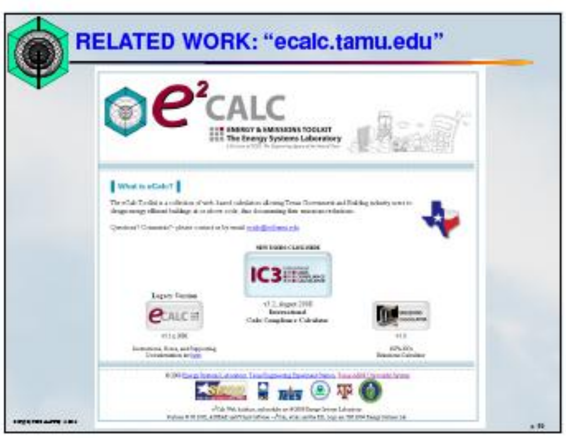
Figure 50: Slides Presented to the University of Texas (September 2008)











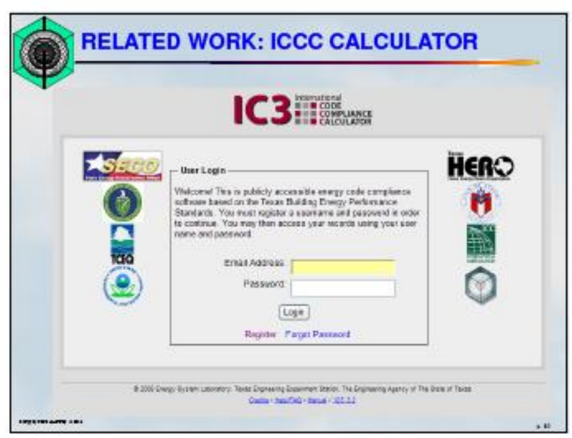
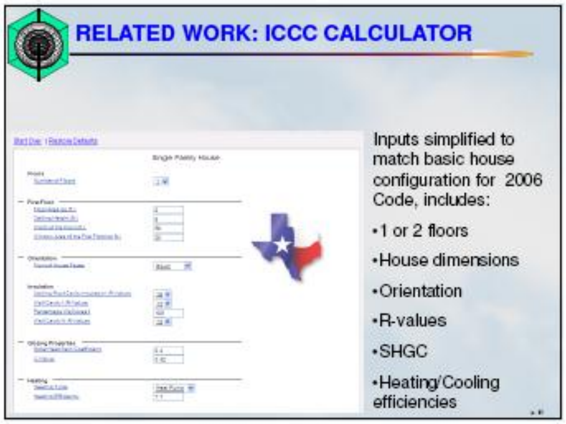
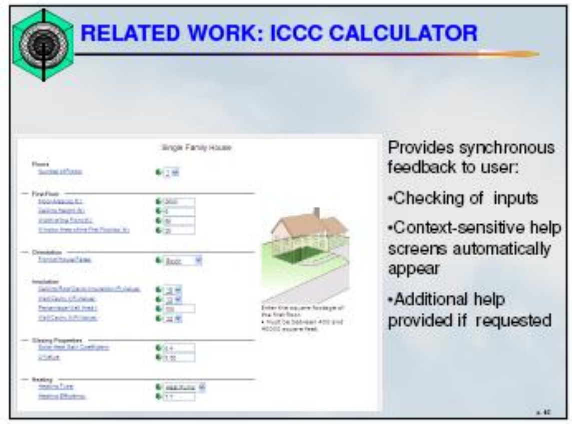
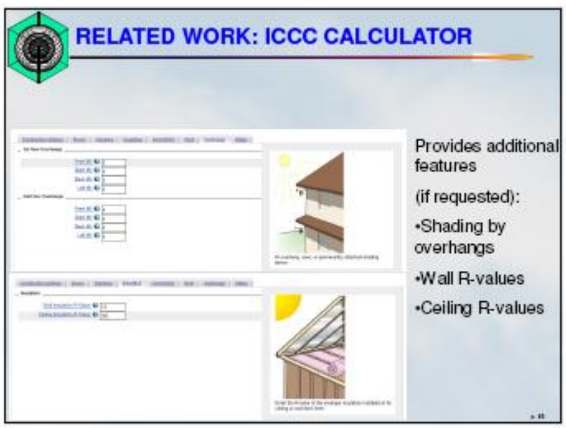
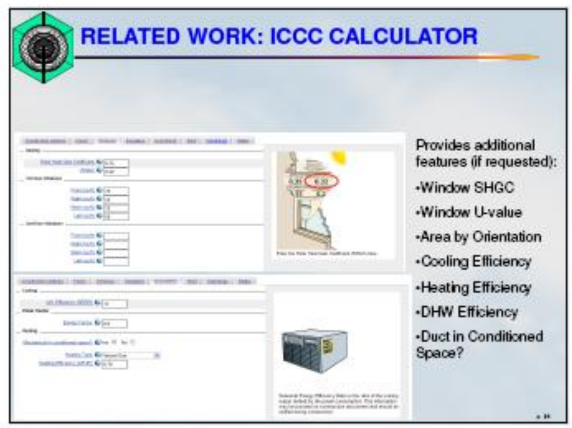


Figure 51: Slides Presented to the University of Texas (September 2008)









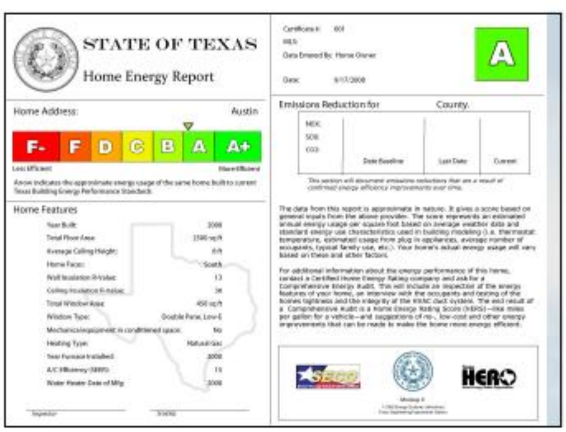


Figure 52: Slides Presented to the University of Texas (September 2008)

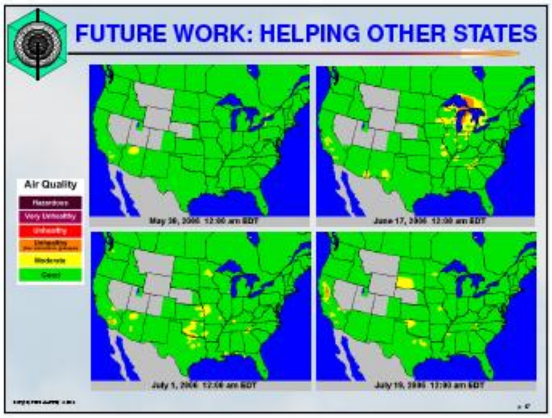
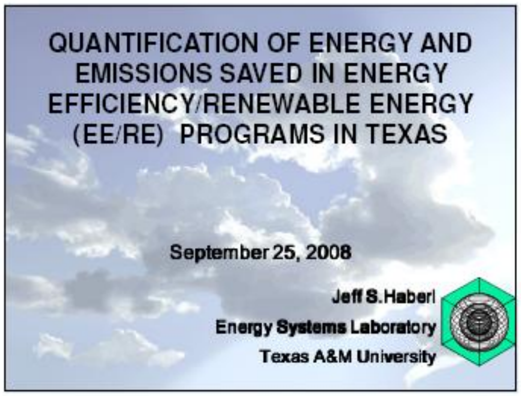
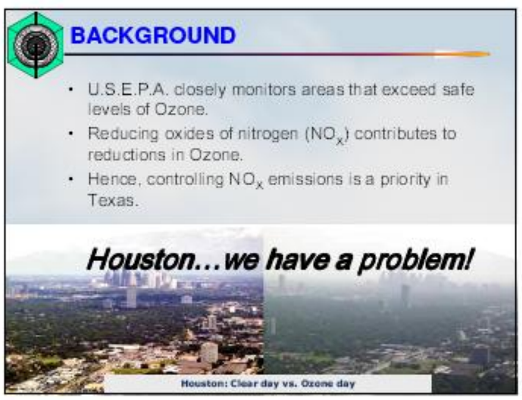


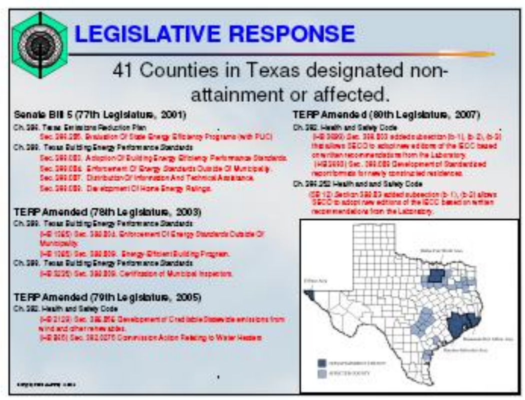
Figure 53: Slides Presented to the University of Texas (September 2008)

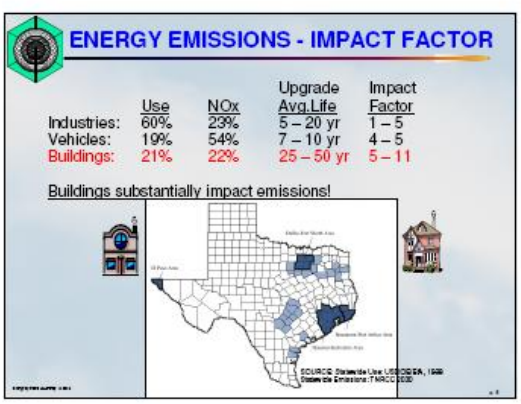
5.2.6.5 Presentation to the EPA, Kansas City, Missouri (September 2008)

On September 25, 2008, the Energy Systems Laboratory presented to the EPA Blue Skyways conference about calculation of NOx emissions reductions from energy efficiency and renewable energy in Kansas City, Missouri.









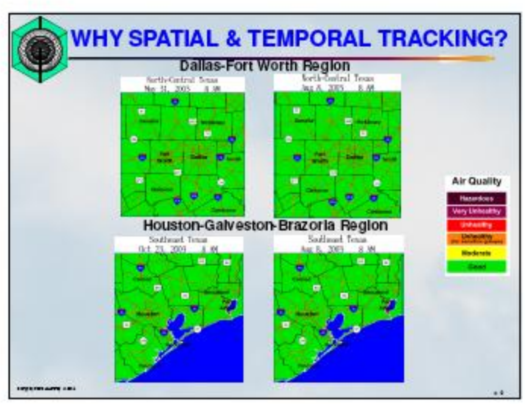
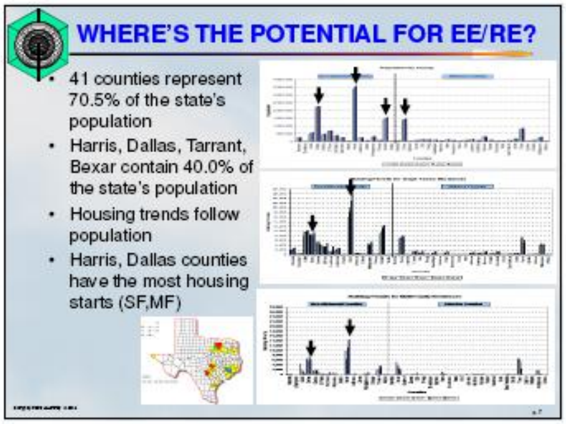
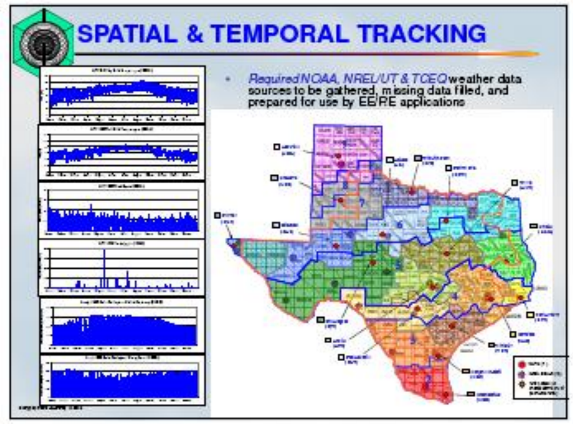
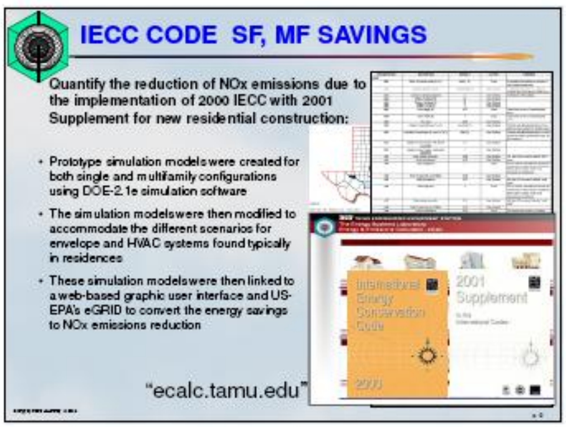
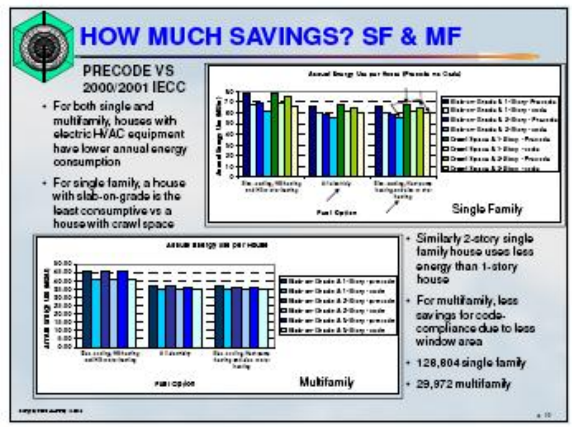


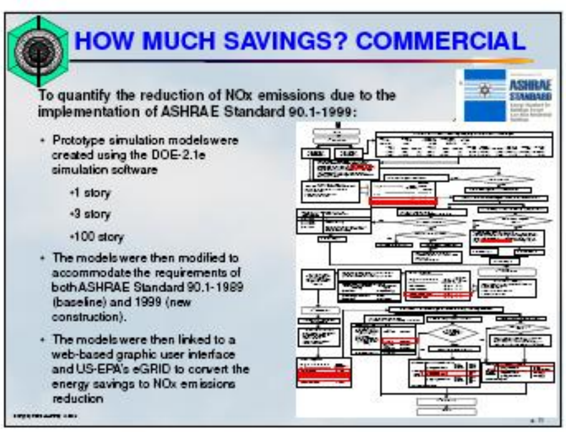
Figure 54: Slides Presented to the EPA (September 2008)











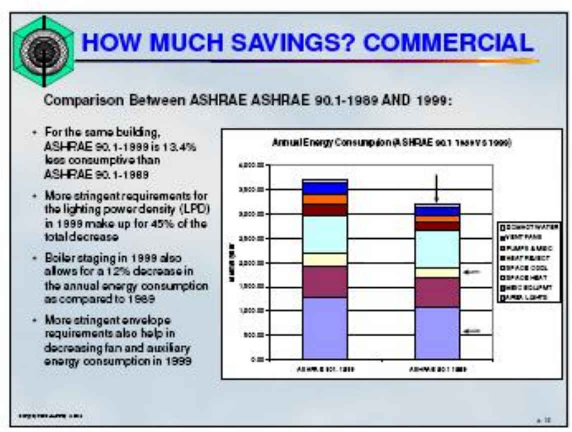
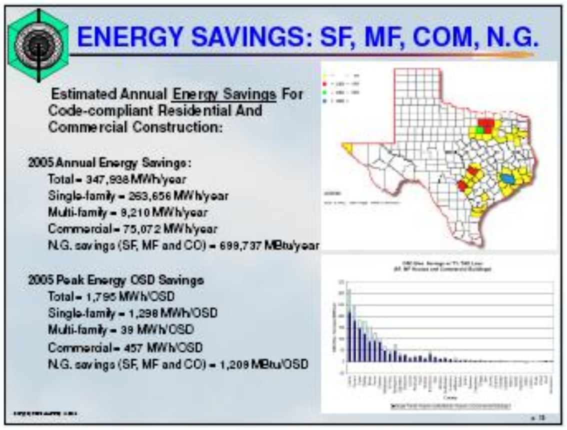
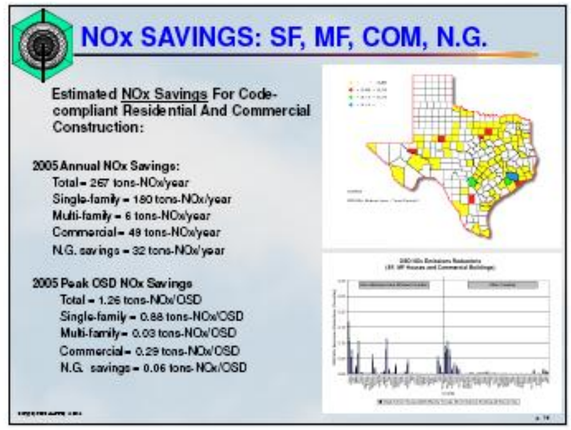
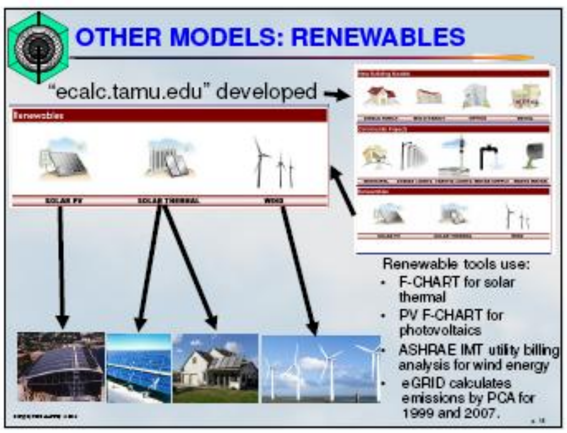
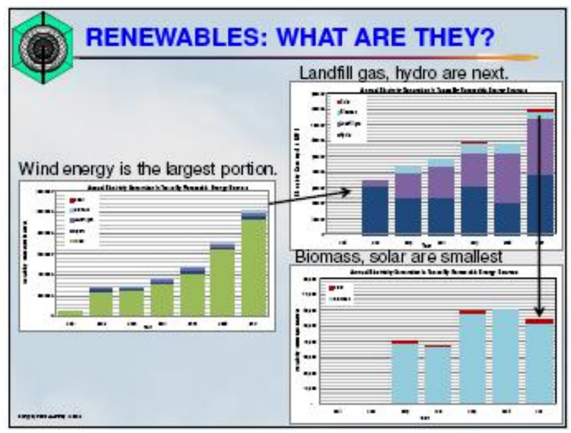


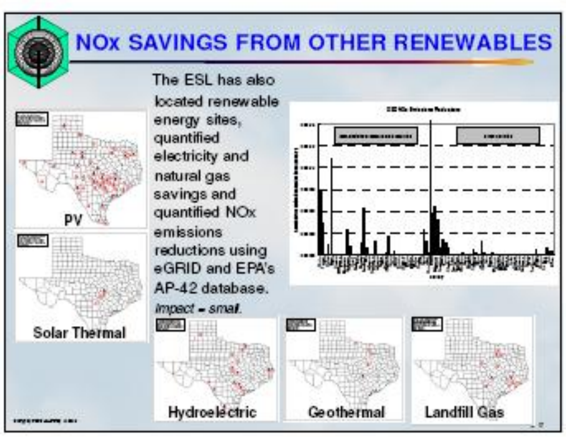
Figure 55: Slides Presented to the EPA (September 2008)











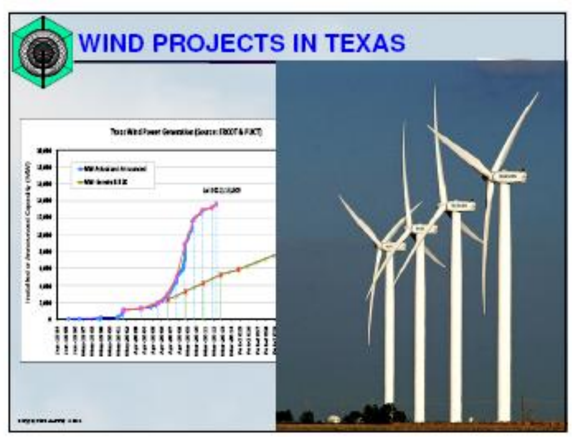
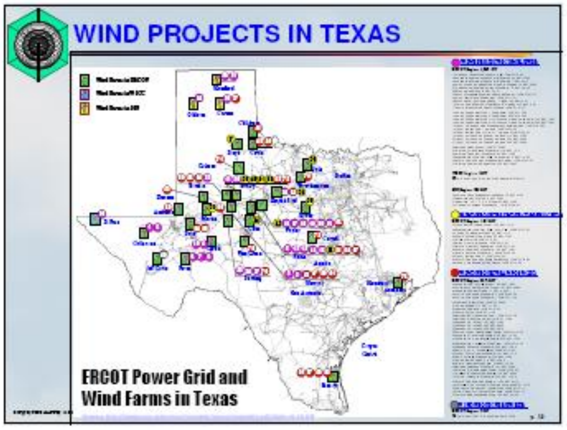
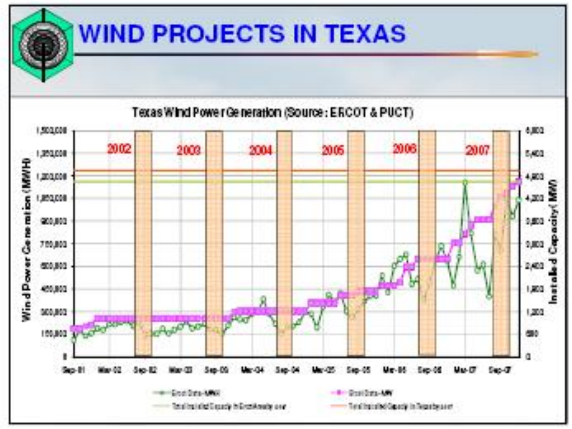
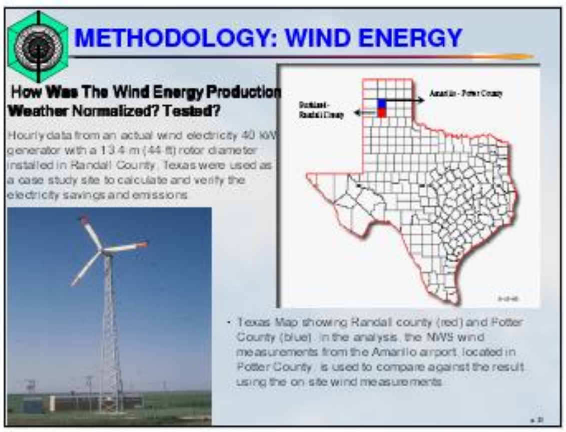
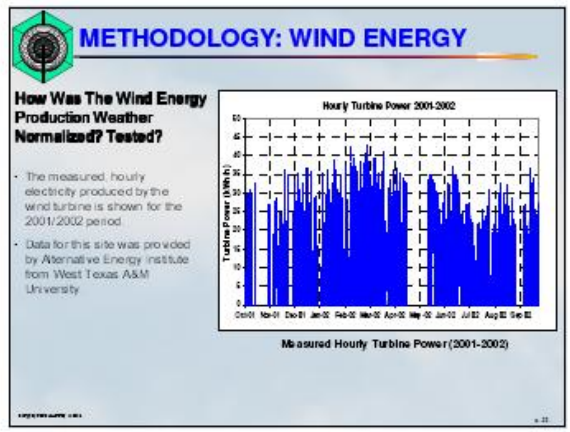


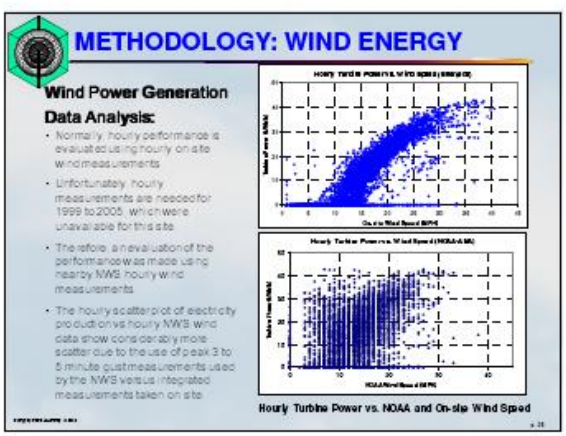
Figure 56: Slides Presented to the EPA (September 2008)











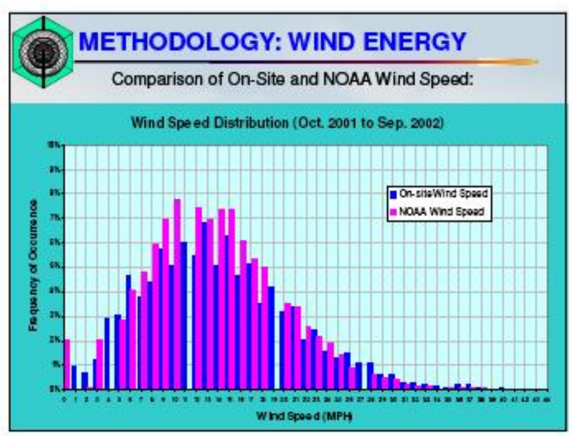


Figure 57: Slides Presented to the EPA (September 2008)

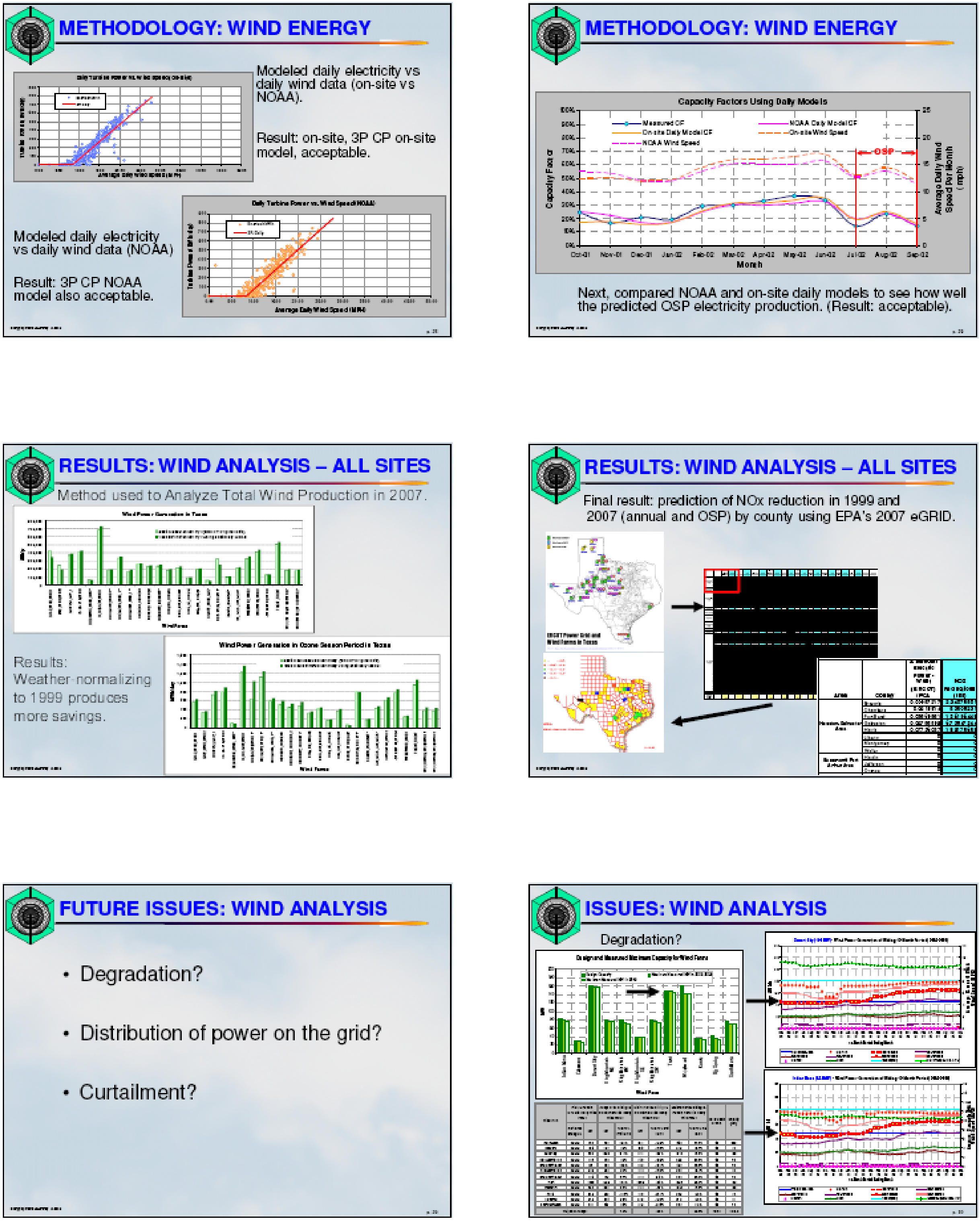
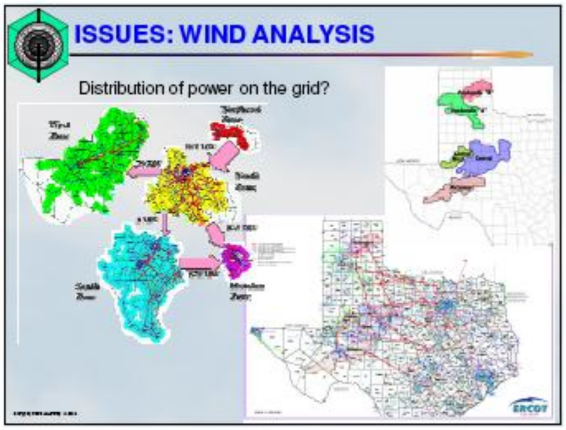
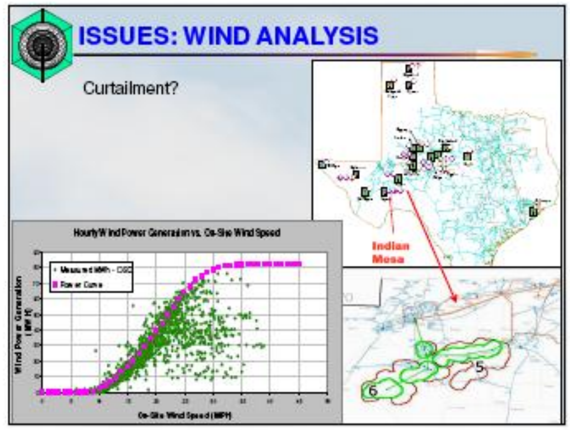
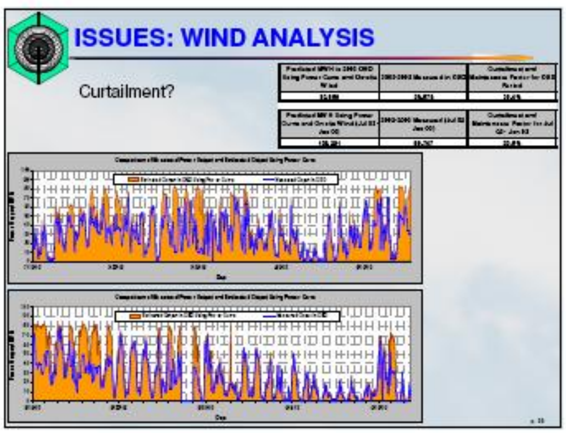
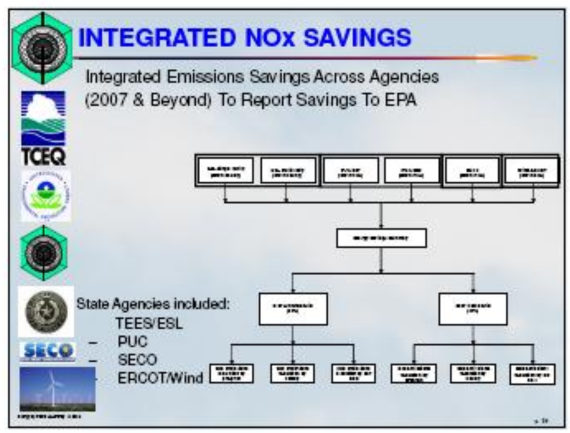


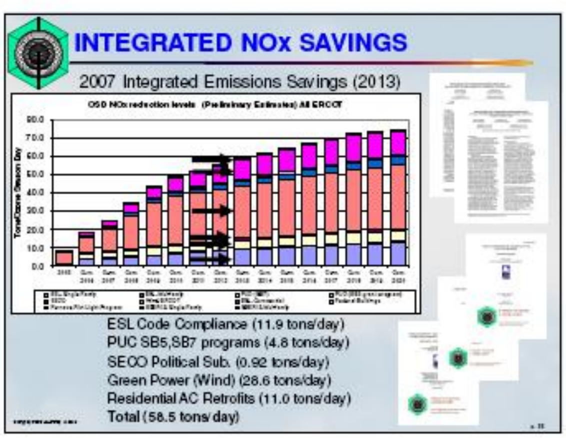
Figure 58: Slides Presented to the EPA (September 2008)











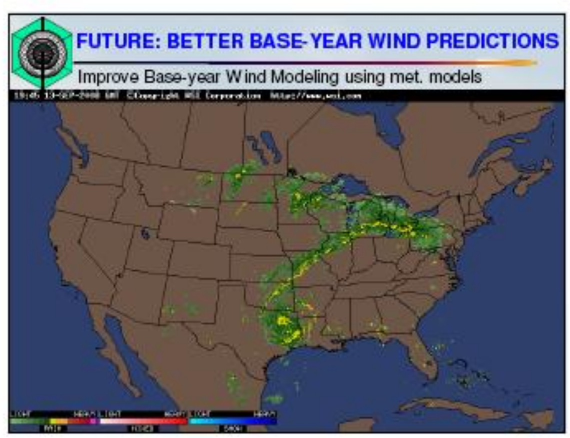


Figure 59: Slides Presented to the EPA (September 2008)

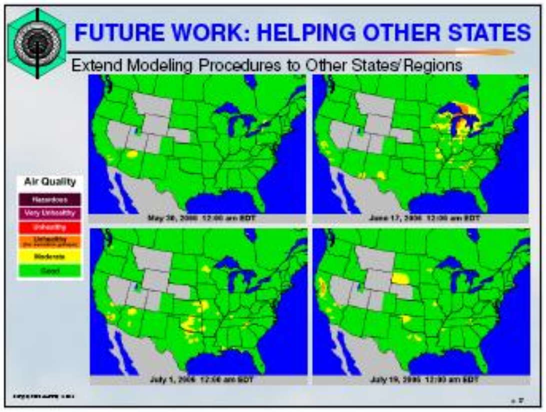
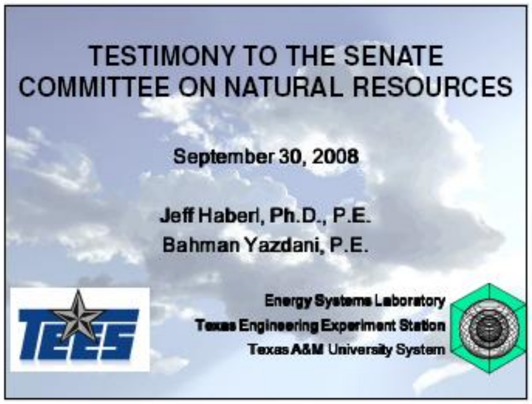
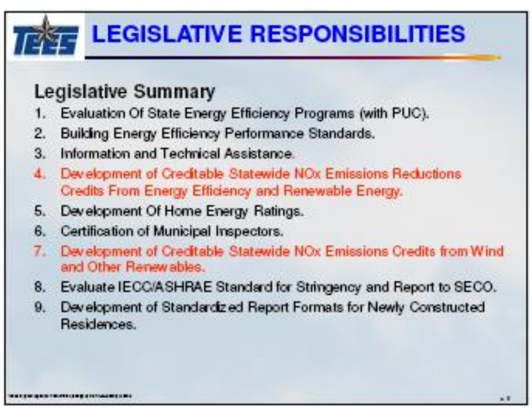


Figure 60: Slides Presented to the EPA (September 2008)

5.2.6.6 Presentation to the Texas Senate Natural Resources Committee, Austin (September 2008)

In September 2008, the Energy Systems Laboartory made a presentation to the Texas Senate Natural Resources Committee about the calculation of NOx emissions reductions from energy efficiency and renewable energy in Austin, Texas.





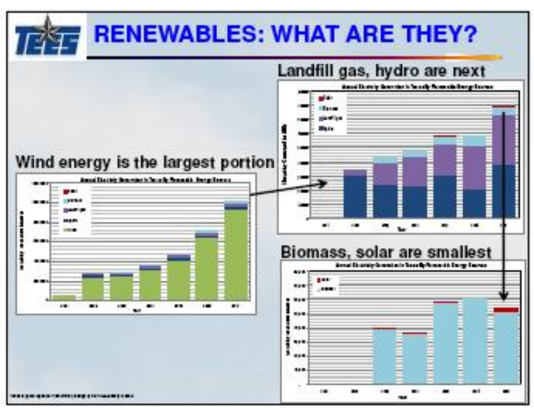
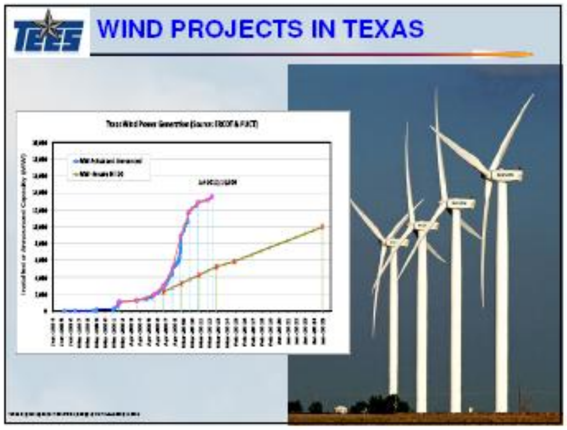
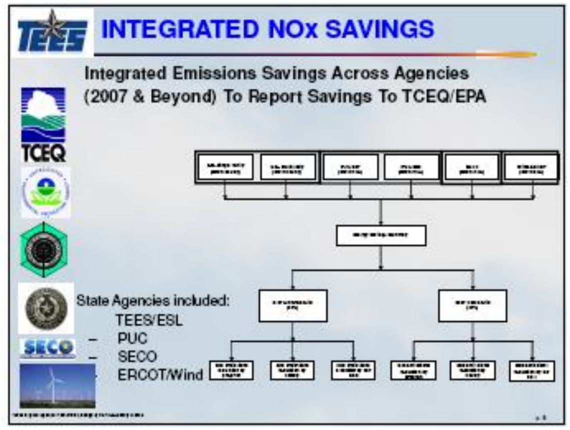
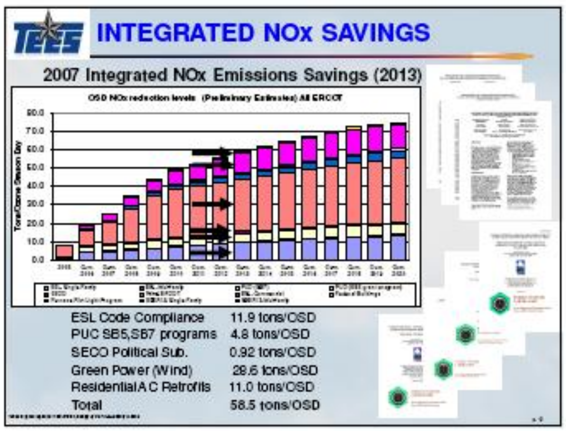
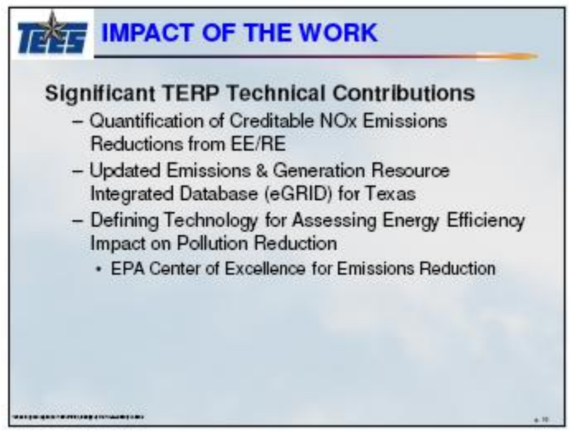


Figure 61: Slides Presented to the Texas Senate Natural Resources Committee (September 2008)









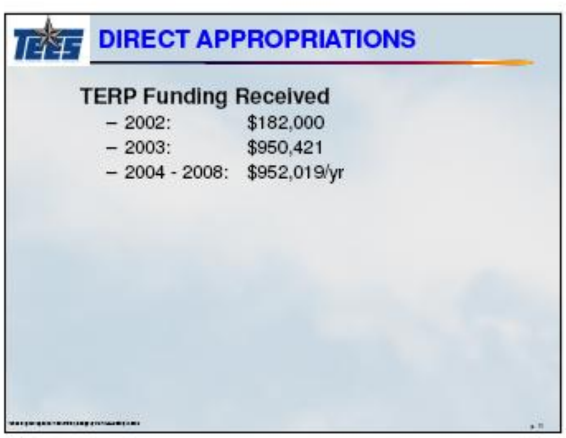


Figure 62: Slides Presented to the Texas Senate Natural Resources Committee (September 2008)

5.2.7 Presented Two Papers at the 2008 ICEBO Conference in Germany, October 2008.

Two papers were prepared and presented at the 2008 ICEBO conference in Berlin, Germany, in October 2008. Copies of these papers have been posted on the Laboratory's TERP web page. Titles and abstracts for each of the papers are as follows.

- Haberl, J. S., Davies, H., Owens, B., Hunn, B. 2008. "ASHRAE's New Performance Measurement Protocols for Commercial Buildings", *Proceedings of the Eighth International Conference for Enhanced Building Operations*, Berlin, Germany, October 20-22.

ASHRAE, CIBSE and USGBC are developing a standardized, consistent set of protocols to facilitate the comparison of the measured performance of buildings, especially those claimed to be green, sustainable, and/or high performance. The protocols will identify what is to be measured, how it is to be measured (instrumentation and spatial resolution), and how often it is to be measured.

- Dennis, J. R., Hodapp, R. T., Kramer, L., Deng, S., Wei, G., Turner, W. D., Yazdani, B., Baltazar, J. C., Henson, R., Schroeder, F. 2008. "Continuous Commissioning® of Dallas/Fort Worth International Airport", *Proceedings of the Eighth International Conference for Enhanced Building Operations*, Berlin, Germany, October 20-22.

The Energy Systems Laboratory was hired to apply the Continuous Commissioning® (CC®) process at The DFW International Airport. Five projects have been identified to date. This paper will focus on the completed projects: the Consolidated Rent-A-Car Center, the Airport Administration Building, and the major on-going projects, CC of Terminal D and Energy Plaza.

5.2.8 Presented Sixteen Papers at the 2008 Hot and Humid Conference in Plano, Texas, December 2008.

Sixteen papers were prepared and presented at the 2008 Hot and Humid conference in Plano, Texas, in December 2008. Copies of these papers have been posted on the Laboratory's TERP web page. Titles and abstracts for each of the papers are as follows.

- Liu, Z., Mukhopadhyay, J., Malhotra, M., Haberl, J., Gilman, D., Montgomery, C., McKelvey, K., Culp, C., Yazdani, B. 2008. "Methodology for Residential Building Energy Simulations Implemented in the International Code Compliance Calculator (IC3)", *Proceedings of the Sixteenth Symposium on Improving Building Systems in Hot and Humid Climates*, Plano, TX, December 15-17, 2008.

This paper presents the methodology for calculating the energy usage from a proposed residential house and the corresponding 2001 International Energy Conservation Code baseline house. This methodology is applied in the International Code Compliance Calculator, which is a publicly accessible web-based energy code compliance software developed by the Energy Systems Laboratory based on the Texas Building Energy Performance Standards.

- Gilman, D. R., Marshall, K., Liu, Z., Mukhopadhyay, J., Stackhouse, R., Cordes, J., Montgomery, C., McKelvey, K., O'Neil, S., Culp, C., Haberl, J., Yazdani, B. 2008. "Development of a Residential Code-compliant Web-based Calculator for Texas", *Proceedings of the Sixteenth Symposium on Improving Building Systems in Hot and Humid Climates*, Plano, TX, December 15-17, 2008.

Texas, as part of the TERP, proposed calculating creditable Nitrogen Oxides emissions reduction credits for energy efficiency and renewable energy through the State Implementation Plan under the Federal Clean Air Act. However, several obstacles remain to realizing a total market transformation: the market value of energy efficiency is not uniformly assigned, and there is a lack of consumer awareness to achieve market transformation.

- Mukhopadhyay, J., Liu, Z., Malhotra, M., Haberl, J., Gilman, D., Montgomery, C., Culp, C., Yazdani, B. 2008. "An Analysis of the Residential Energy Savings from the Implementation of the 2001 IECC and 2006 NAECA Appliance Standards in the State of Texas", *Proceedings of the Sixteenth Symposium on Improving Building Systems in Hot and Humid Climates*, Plano, TX, December 15-17, 2008.

This paper presents results of an analysis of the annual electricity and natural gas savings from implementation of the 2001 International Energy Conservation Code (IECC) specifications with updated 2006 specifications for mechanical systems to new single-family residential construction, using a code-traceable DOE-2 simulation for two locations in Texas.

- Martinez, J. T., Verdict, M., Baltazar-Cervantes, J. C., Strybos, J. 2008. "Continuous Commissioning® and Energy Management Control Strategies at Alamo Community College District", *Proceedings of the Sixteenth Symposium on Improving Building Systems in Hot and Humid Climates,* Plano, TX, December 15-17, 2008.

This paper presents an overview of energy savings through the optimization of facility Heating, Ventilation, and Air Conditioning (HVAC) systems for the college campuses of the Alamo Community College District. This Continuous Commissioning® process includes energy management control strategies that focus on utility rate structures. Detailed commissioning activities of the College district and Central Plants are discussed and documented, and overall savings are provided.

- Kim, S., Haberl, J. S. 2008. "Development of an ASHRAE 152-2004 Duct Model for the Single-Family Residential House", *Proceedings of the Sixteenth Symposium on Improving Building Systems in Hot and Humid Climates,* Plano, TX, December 15-17, 2008.

This paper presents the results of the development of the duct model based on ASHRAE standard 152-2004 (ASHRAE, 2004) using the DOE-2.1e building energy simulation program. To accomplish this, FUNCTION commands for DOE-2 were used to develop the duct model and provide the improved predictions of the duct heat loss or gain from the unconditioned space as well as supply or return duct leakage.

- Nelson, I. C., Culp, C., Graves, R. D. 2008. "Semi-Empirical Screw Compressor Chiller Model", *Proceedings of the Sixteenth Symposium on Improving Building Systems in Hot and Humid Climates,* Plano, TX, December 15-17, 2008.

A screw chiller model which is based on first principles, semi-empirical analysis that describes the system performance based on observations of the thermodynamic processes is developed. This model is a modified method to empirically derive the system irreversibilities of the Gordon-Ng first principles approach and is applied to a screw chiller.

- Ugursal, A., Culp, C. 2008. "The Effects of Geometry on Flexible Duct CFD Simulations", *Proceedings of the Sixteenth Symposium on Improving Building Systems in Hot and Humid Climates,* Plano, TX, December 15-17, 2008.

Flexible ducts have been widely used in the building industry due to low cost and ease of installation. In this study, five 8" diameter 15% compressed duct geometries were modeled including: periodic-triangular (PT), helix-triangular (HT), periodic-circular (PC), helix-circular (HC), and periodic-double-triangular (P2T). These modeled duct shapes were compared to determine the complexity of modeling and computational requirements.

- Liu, Z., Haberl, J. S., Baltazar, J. C., Culp, C., Yazdani, B., Chandrasekaran, V. 2008. "Calcuating Emissions Reductions from Renewable Energy Programs and Its Application to the Wind Farms in the Texas ERCOT Region", *Proceedings of the Sixteenth Symposium on Improving Building Systems in Hot and Humid Climates*, Plano, TX, December 15-17, 2008.

This paper provides a detailed description of an improved methodology developed to calculate the emissions reductions from electricity provided by a wind farm. Details are presented for the wind farm Sweetwater I (Abilene) as well as results from the application of this procedure to all the wind energy providers in the Texas ERCOT region in 2006.

- Malhotra, M., Haberl, J. S. 2008. "Analysis of Off-Grid, Off-Pipe Housing for Hot-Humid and Hot-Arid Cimates", *Proceedings of the Sixteenth Symposium on Improving Building Systems in Hot and Humid Climates*, Plano, TX, December 15-17, 2008.

This paper investigates the feasibility of off-grid, off-pipe housing in hot-humid and hot-arid climates in the U.S. The study aims to eliminate the need for non-renewable sources of energy and municipal water in residences by using off-grid, off-pipe design approach. To accomplish this, a 2001 International Energy Conservation Code compliant house in Houston, TX and Phoenix, AZ was simulated to determine the base-case energy and water use.

- Im, P., Haberl, J. S. 2008. "Analysis of the Energy Savings Potential in K-5 Schools in Hot and Humid Climates", *Proceedings of the Sixteenth Symposium on Improving Building Systems in Hot and Humid Climates*, Plano, TX, December 15-17, 2008.

This paper presents the analysis of the energy savings potential in K-5 schools in hot and humid climates. For the analysis, an existing K-5 school in Central Texas was selected as a case study school, and the building energy related data and information were collected.

- Cho, S., Haberl, J. S. 2008. "Validation of the eCALC Commercial Code-Compliant Simulation Versus Measured Data from an Office Building in a Hot and Humid Climate", *Proceedings of the Sixteenth Symposium on Improving Building Systems in Hot and Humid Climates*, Plano, TX, December 15-17, 2008.

This paper compares the results of a calibrated simulation of a case-study building versus simulation using the web-based eCALC code-compliant commercial simulation program. In this paper an extension of the previous work is presented using the eCALC commercial simulation model, which uses simplified geometry and ASHRAE Standard 90.1-compliant equipment selection and sizing values for energy calculation. This paper compares the results between the as-built geometry simulation and simplified geometry simulation with similar equipment configuration

- Kim, S., Haberl, J. S. 2008. "Detailed Analysis of the Thermal Mass Credits in a Code-Traceable DOE-2 Simulation of the 2001 IECC for a Single-Family Residence in Texas", *Proceedings of the Sixteenth Symposium on Improving Building Systems in Hot and Humid Climates*, Plano, TX, December 15-17, 2008.

This paper presents the results of a study that investigates the thermal mass credits in the 2001 International Energy Conservation Code (IECC) (ICC 1999, 2001) for a single-family residence in Texas using the DOE-2 building energy simulation program. In this analysis seven different wall types were simulated, and each wall type was matched to the recommended overall U-value of a lightweight wall that meets the prescriptive specifications of the 2001 IECC. This paper presents an analysis of the total annual cooling and heating energy use for wall types with varying thermal mass, and thermostat settings, as well as recommendations concerning the most energy-efficient wall type, and includes input specification methods using the DOE-2 program.

- Andolsun, S., Culp, C. 2008. "A Comparison of EnergyPlus to DOE-2.1E: Multiple Cases Ranging from a Sealed Box to a Residential Building", *Proceedings of the Sixteenth Symposium on Improving Building Systems in Hot and Humid Climates*, Plano, TX, December 15-17, 2008.

This study expanded upon the previous comparisons to include the simplest case scenario where the building was a sealed box without infiltration, internal load, system or plant. The simulations were then extended to include incremental changes on the building load by adding people, lights, equipment and infiltration. EPlus and DOE-2 were compared using multiple base case buildings in Austin from the simplest case to a fully inhabited residential building.

- Masuda, H., Baltazar, J. C., Ji, J., Claridge, D. E. 2008. “Development of Data Quality Control Limits for Data Screening Through the 'Energy Balance' Method”, *Proceedings of the Sixteenth Symposium on Improving Building Systems in Hot and Humid Climates*, Plano, TX, December 15-17, 2008.

This paper proposes a methodology to construct statistical control limits for data screening using “Energy Balance” methodology. Energy Balance (*EBL*) parameter represents quasi-steady state thermal energy storage in a building and indicates a predominant linear behavior when it is plotted versus the outside air temperature.

- Malhotra, M., Im, P., Haberl, J. S., Fisk, P., Canez, J., Schaider, N., Feigenbaum, L., Ramirez, E., Cho, S. 2008. “Design, Construction, Transportation, Operation and Post-Occupancy Analysis for the Texas A&M Solar Decathlon House”, *Proceedings of the Sixteenth Symposium on Improving Building Systems in Hot and Humid Climates*, Plano, TX, December 15-17, 2008.

This paper describes the design, construction, transportation, operation and post occupancy analysis of the 2007 Texas A&M Solar Decathlon House (TAMU SD house). The Texas A&M team designed and simulated varying designs using building energy simulation (DOE-2), solar thermal analysis (F-CHART), photovoltaic analysis (PV FCHART), lighting analysis (Ecotect, RADIANCE, DAYSIM), and other engineering analysis procedures.

- Ji, J., Baltazar, J. C., Claridge, D. E. 2008. “Study of the Outside Air Enthalpy Effects in the Screening of Metered Building Energy Data”, *Proceedings of the Sixteenth Symposium on Improving Building Systems in Hot and Humid Climates*, Plano, TX, December 15-17, 2008.

A design of experiment process is conducted to study the linear relations for the energy balance load (E_{BL}) as the function of outside air enthalpy (h_{OA}) and as the function of outside air dry-bulb temperature (T_{OA}). Study cases are also presented to illustrate the difference between application of h_{OA} and T_{OA} in energy use data analysis for buildings with different functions.

6 CALCULATED NOx REDUCTION POTENTIAL FROM IMPLEMENTATION OF THE IECC/IRC

6.1 Calculated 2008 Electricity and Natural Gas Savings Due to the Implementation of the IECC/IRC to New Residential Construction (Single-family and Multi-family), and Commercial Buildings Using Code-traceable, Fuel-Neutral Simulation.

A complete reporting of the savings from the implementation of the IECC/IRC requires tracking and analyzing savings to new construction and construction activity to existing buildings that undergoes a building permit. Adoption of the IECC/IRC is expected to impact the following types of buildings:

- single-family residential
- multi-family residential
- commercial buildings
- industrial buildings
- renewables

Adoption of the IECC/IRC is also expected to impact construction activity in existing buildings that undergoes a building permit. Such activity would impact the following types of buildings:

- single-family residential
- multi-family residential
- commercial buildings
- industrial buildings
- renewables

The following sections report calculations of the energy savings associated only with new construction activity in new residences (i.e., single-family and multi-family), and commercial construction. Calculation of energy savings adoption of the IECC / IRC in industrial building and renewables is currently under development at the Laboratory, and will be reported in future reports.

6.1.1 2008 Results for New Single-family Residential Construction

In this section of the report, calculations are provided regarding the potential electricity reductions and associated emissions reductions from the implementation of the IECC/IRC to new single-family residences in the 41 non-attainment and affected counties as well as other counties in ERCOT region[19]. To calculate the NOx emissions reductions from the implementation of the IECC/IRC, a number of procedures were followed. First, new construction activity by county had to be determined; then energy savings attributable to the IECC/IRC had to be modeled using the code-traceable, DOE-2 simulation that the Laboratory has developed for the TERP; these estimates were then applied to the NAHB Builder's survey data to determine the appropriate number of housing types; then estimates of the NOx reduction potential from the electricity reductions in each county were calculated using the US EPA's 2007 eGRID database[20].

In Table 4 and Table 5, the 1999 and IECC/IRC code-compliant building characteristics are shown for each county. The 1999 building characteristics reflect those published by the NAHB, ARI and GAMA for Texas. The IECC/IRC code-compliant characteristics are the minimum building code characteristics required by the IECC/IRC for each county for single-family residences (i.e., Type A.1)[21]. In Table 4 and Table 5, the rows are sorted first by the US EPA's non-attainment, affected designation, and other ERCOT Counties, then alphabetically. Next, in the third column, the NAHB survey classification is listed. The fourth column in Table 4 and Table 5 lists the window area for the average house as defined by the NAHB

[19] The three new counties, Henderson, Hood and Hunt were added in the 2003 Legislative session are included in this.
[20] This preliminary analysis does not include actual power transfers on the grid, and assumes transmission and distribution losses of 7%. Counties were assigned to utility service districts as indicated.
[21] As modified by the 2001 Supplement.

survey[22]. The fifth, sixth, seventh, eighth, and ninth columns show the NAHB's average glazing U-value, Solar Heat Gain Coefficient (SHGC), roof insulation and wall insulation, respectively. In columns nine through thirteen of Table 4 and Table 5, the corresponding values from the IECC / IRC code-compliant house are listed for each county (i.e., percent area, glazing U-value, SHGC, roof and wall insulation R-value). For each county, the identical window percent area was used for the 1999 and code-compliant calculation (i.e., window-to-wall area).

The IECC/IRC SHGC is 0.4 for all non-attainment and affected counties since they all fall below the 3,500 HDD_{65}, as required by the IECC/IRC. All the 1999 houses were assumed to have an air-conditioner efficiency[23] equal to a SEER 11, a furnace efficiency (AFUE) of 0.80, and a domestic water heater efficiency of 76%. All the IECC/IRC code-compliant houses were assumed to have an air-conditioner efficiency equal to a SEER 13[24]. The values shown in Table 4 and Table 5, represent the only changes that were made to the simulation to obtain the savings calculations. All other variables in the simulation remained the same for the 1999 and IECC/IRC code-compliant simulation. In cases where the 1999 values were more efficient than the IECC/IRC code-compliant simulation, the 1999 values were used in both simulations, since this indicates that the prevailing practice is already above code. For example, in Brazoria County, according to the NAHB, the roof insulation is R-27.08, which is already above the code-required insulation of R-19. Therefore, R-27.08 was used in both simulations.

In the code-traceable simulation results are shown for each county. In a similar fashion as Table 4 and Table 5, Table 6 and Table 7 is first divided into US EPA affected and then non-attainment classifications, followed by an alphabetical listing of counties. In the third column, the IECC/IRC climate zone is listed followed by the number of projected new housing units[25] in the fourth column. In the fifth column, the total simulated energy use is listed if all new construction had been built to pre-code specifications, and, in the sixth column, the total county-wide energy use for code-compliant construction is shown.

The values in the fifth and sixth columns come from the associated tables in the 2007 Volume III Appendix. , which remain the same as the 2006 listing, 24 simulations were run for each county, which were then distributed according to the NAHB's survey data to account for 1 story, 2 story, slab-on-grade, crawlspace, and three different system types. In the seventh and eighth columns, the total pre-code and code-compliant peak OSD energy use is reported for the Ozone Season Day across all counties[26]. In a similar fashion as the annual pre-code and code-compliant energy use, these values are from the associated tables for each county in the Volume III Appendix to this report for the 1999 peak OSD results.

In the ninth and tenth columns, the total annual electricity and peak OSD savings are shown for each county, respectively. A 7% transmission and distribution loss is used in the 2007 report, which represents a fixed 1.07 multiplier for the electricity use. In the eleventh and twelfth columns, the total annual pre-code and code-compliant natural gas use is shown for those residences that had natural gas-fired furnaces and domestic water heaters. Similarly, in columns thirteen and fourteen, the simulated total peak OSD natural gas use on the peak Ozone Season Day (OSD) is shown for each county. Finally, in columns fifteen and sixteen, the total annual and peak OSD natural gas savings are shown for each county.

Table 8 and Table 9 the 2006 PCA assignments for each county are shown. These assignments are the same with the assignments used in the 2006 annual report. These assignments were expanded from the 2005 report because all ERCOT counties are shown in the 2006 report. In Table 10, the annual electricity savings

[22] This value represents the NAHB's reported number of window units times an average window size of 3 x 5 feet, which was determined by surveying local building suppliers. Additional information about the procedures used to determine these values can be found in the MS Thesis by Im (2003).

[23] The choice of a SEER 11 efficiency for the air conditioner was based on ARI sales numbers for Texas which show an average SEER 11 for houses built in 1999.

[24] Based on the regulation effective ….

[25] The number of projected new housing units uses the published values for the new housing units in 2006. A vacancy rate of 0% was assumed for 2007 calculations, based on information suggested by the Real Estate Center at Texas A&M University.

[26] In the 2005 report, the peak Ozone Season Day (OSD) was used to report peak savings. This is different than the peak day for 2004, which was August 19, 1999. This change was made at the request of the TCEQ. In the 2002 and 2003 reports, these dates represent the TMY2 non-coincident dates that were chosen by the DOE-2 simulation program as the peak date for the houses simulated in a specific county. Hence, the 2002 and 2003 dates did not correspond to the same calendar date.

are assigned to PCA provider(s) according to Table 8 and Table 9. The total electricity savings for each PCA, as shown in then entered into the bottom row of Table 11 and Table 13, which is the 2007 US EPA eGRID database for Texas. eGRID then proportions each MWh of electricity savings according to the 1999 measured data from the power plants assigned to that PCA. For each county in which there is a power plant the lbs-NOx/MWh are calculated and displayed as NOx reductions (lbs) in the column adjacent to the PCA column. Adding across the rows then totals the NOx reductions in each county from multiple PCAs that have power plants in that county. Counties that do not show NOx reductions represent counties that do not have power plants in eGRID's database. In Table 12 the PCA assignments for peak reductions are shown for each county; and in the peak OSD NOx reductions are shown calculated with eGRID.

Table 4: 1999 and IECC/IRC Code-complaint Building Characteristics used in the DOE-2 Simulator for Single-family Residential (1)

	County	Climate Zone	Division (East or West)	1999 Average Area %	1999 Average Glazing U-value (Btu/ hr-ft2-F)	1999 Average SHGC	1999 Average Roof Insulation (hr-ft2-F/Btu)	1999 Average Wall Insulation (hr-ft2-F/Btu)	2000 IECC Area %	2000 IECC Glazing U-value (Btu/ hr-ft2-F)	2000 IECC SHGC	2000 IECC Roof Insulation (hr-ft2-F/Btu)	2000 IECC Wall Insulation (hr-ft2-F/Btu)
	BRAZORIA	3	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	19.00	11.00
	CHAMBERS	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	COLLIN	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	DALLAS	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	DENTON	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	EL PASO	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	FORT BEND	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
Non-attainment	GALVESTON	3	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	19.00	11.00
	HARDIN	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	HARRIS	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	JEFFERSON	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	LIBERTY	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	MONTGOMERY	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	ORANGE	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	TARRANT	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	WALLER	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	BASTROP	4	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.52	0.40	30.00	13.00
	BEXAR	4	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.52	0.40	30.00	13.00
	CALDWELL	4	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.52	0.40	30.00	13.00
	COMAL	4	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.52	0.40	30.00	13.00
	ELLIS	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	GREGG	6	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	GUADALUPE	4	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.52	0.40	30.00	13.00
	HARRISON	6	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	HAYS	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	HENDERSON	5	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.65	0.40	30.00	13.00
	HOOD	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	HUNT	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
Affected	JOHNSON	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	KAUFMAN	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	NUECES	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	PARKER	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	ROCKWALL	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	RUSK	5	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.65	0.40	30.00	13.00
	SAN PATRICIO	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	SMITH	5	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.65	0.40	30.00	13.00
	TRAVIS	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	UPSHUR	6	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	VICTORIA	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	WILLIAMSON	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	WILSON	4	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.52	0.40	30.00	13.00
	ANDERSON	5	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.65	0.40	30.00	13.00
	ANDREWS	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	ANGELINA	5	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.65	0.40	30.00	13.00
	ARANSAS	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	ARCHER	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	ATASCOSA	3	West Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	AUSTIN	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	BANDERA	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	BAYLOR	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	BEE	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	BELL	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	BLANCO	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	BORDEN	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	BOSQUE	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	BRAZOS	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	BREWSTER	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	BRISCOE	8	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.41	0.40	38.00	19.00
	BROOKS	2	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.90	0.40	19.00	11.00
	BROWN	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	BURLESON	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	BURNET	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	CALHOUN	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	CALLAHAN	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	CAMERON	2	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.90	0.40	19.00	11.00
	CHEROKEE	5	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.65	0.40	30.00	13.00
	CHILDRESS	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	CLAY	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
ERCOT	COKE	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	COLEMAN	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	COLORADO	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	COMANCHE	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	CONCHO	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	COOKE	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	CORYELL	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	COTTLE	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	CRANE	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	CROCKETT	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	CROSBY	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	CULBERSON	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	DAWSON	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	DE WITT	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	DELTA	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	DICKENS	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	DIMMIT	3	West Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	DUVAL	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	EASTLAND	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	ECTOR	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	EDWARDS	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	ERATH	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	FALLS	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	FANNIN	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	FAYETTE	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	FISHER	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	FOARD	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	FRANKLIN	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	FREESTONE	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00

Table 5: 1999 and IECC/IRC Code-compliant Characteristics used in the DOE-2 Simulator for Single-family Residential (2)

	County	Climate Zone	Division (East or West)	1999 Average Area %	1999 Average Glazing U-value (Btu/ hr-ft2-F)	1999 Average SHGC	1999 Average Roof Insulation (hr-ft2-F/Btu)	1999 Average Wall Insulation (hr-ft2-F/Btu)	2000 IECC Area %	2000 IECC Glazing U-value (Btu/ hr-ft2-F)	2000 IECC SHGC	2000 IECC Roof Insulation (hr-ft2-F/Btu)	2000 IECC Wall Insulation (hr-ft2-F/Btu)
	FRIO	3	West Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	GILLESPIE	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	GLASSCOCK	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	GOLIAD	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	GONZALES	4	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.52	0.40	30.00	13.00
	GRAYSON	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	GRIMES	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	HALL	8	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.41	0.40	38.00	19.00
	HAMILTON	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	HARDEMAN	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	HASKELL	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	HIDALGO	2	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.90	0.40	19.00	11.00
	HILL	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	HOPKINS	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	HOUSTON	5	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.65	0.40	30.00	13.00
	HOWARD	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	HUDSPETH	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	IRION	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	JACK	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	JACKSON	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	JEFF DAVIS	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	JIM HOGG	2	West Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	JIM WELLS	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	JONES	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	KARNES	3	West Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	KENDALL	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	KENEDY	2	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.90	0.40	19.00	11.00
	KENT	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	KERR	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	KIMBLE	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	KING	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	KINNEY	4	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.52	0.40	30.00	13.00
	KLEBERG	2	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.90	0.40	19.00	11.00
	KNOX	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	LA SALLE	3	West Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	LAMAR	6	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	LAMPASAS	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	LAVACA	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	LEE	4	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.52	0.40	30.00	13.00
	LEON	5	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.65	0.40	30.00	13.00
	LIMESTONE	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	LIVE OAK	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	LLANO	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	LOVING	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	MADISON	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	MARTIN	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	MASON	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	MATAGORDA	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	MAVERICK	3	West Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	MCCULLOCH	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	MCLENNAN	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	MCMULLEN	3	West Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
ERCOT	MEDINA	4	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.52	0.40	30.00	13.00
	MENARD	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	MIDLAND	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	MILAM	4	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.52	0.40	30.00	13.00
	MILLS	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	MITCHELL	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	MONTAGUE	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	MOTLEY	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	NACOGDOCHES	5	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.65	0.40	30.00	13.00
	NAVARRO	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	NOLAN	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	PALO PINTO	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	PECOS	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	PRESIDIO	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	RAINS	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	REAGAN	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	REAL	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	RED RIVER	6	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	REEVES	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	REFUGIO	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	ROBERTSON	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	RUNNELS	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	SAN SABA	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	SCHLEICHER	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	SCURRY	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	SHACKELFORD	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	SOMERVELL	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	STARR	2	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.90	0.40	19.00	11.00
	STEPHENS	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	STERLING	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	STONEWALL	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	SUTTON	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	TAYLOR	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	TERRELL	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	THROCKMORTON	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	TITUS	6	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	TOM GREEN	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	UPTON	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	UVALDE	4	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.52	0.40	30.00	13.00
	VAL VERDE	4	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.52	0.40	30.00	13.00
	VAN ZANDT	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	WARD	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	WASHINGTON	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	WEBB	3	West Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	WHARTON	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	WICHITA	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	WILBARGER	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	WILLACY	2	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.90	0.40	19.00	11.00
	WINKLER	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	WISE	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	YOUNG	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	ZAPATA	2	West Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	ZAVALA	3	West Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00

Table 6: 2008 Annual and Peak-day Electricity Savings from Implementation of the IECC/IRC for Single-family Residences Using 1999 Base Year (1)

2008 Summary TRY 1999															
	County	Climate Zone	No. of Projected Units (2006)	Precode Total Annual Elec. Use (MWh/yr)	Code-compliant Total Annual Elec. Use (MWh/yr)	Precode OSD Elec. Use (MWh/day)	Code-compliant OSD Elec. Use (MWh/day)	Total Annual Elec. Savings (MWh/yr) w/ 7% of T&D Loss	Total OSD Elec. Savings (MWh/day) w/ 7% of T&D Loss	Precode Total NG Use (Therm/yr)	Code-compliant Total NG Use (Therm/yr)	Precode OSD NG Use (Therm/day)	Code-compliant OSD NG Use (Therm/day)	Total Annual NG Savings (Therm/yr)	Total OSD NG Savings (Therm/day)
Affected County	BASTROP	4	19	904	771	4.22	3.43	142	0.85	12,401	11,882	20.29	19.29	519	1.00
	BEXAR	4	3,557	84,148	72,840	379.44	310.83	12,099	73.42	1,570,183	1,512,573	2,331.58	2,219.25	57,610	112.32
	CALDWELL	4	49	491	417	2.32	1.89	78	0.47	7,516	7,301	12.30	11.69	214	0.61
	COMAL	4	1,221	28,064	24,293	126.55	103.67	4,035	24.48	523,677	504,463	777.61	740.15	19,214	37.46
	ELLIS	5	643	19,444	16,680	93.37	75.37	2,958	19.25	449,626	420,674	489.34	465.02	28,951	24.32
	GREGG	6	203	4,654	4,095	20.20	16.41	599	4.05	99,237	82,128	176.91	145.45	17,109	31.46
	GUADALUPE	4	958	18,629	16,126	84.00	68.81	2,678	16.25	347,613	334,859	516.17	491.31	12,754	24.87
	HARRISON	6	78	544	480	2.36	1.92	69	0.47	11,785	9,753	20.81	17.11	2,032	3.70
	HAYS	5	1,348	25,008	21,163	118.27	95.30	4,114	24.57	381,275	357,226	625.84	595.02	24,049	30.82
	HENDERSON	5	49	1,774	1,570	8.23	6.79	219	1.54	39,644	36,156	42.44	40.33	3,488	2.11
	HOOD	5	102	1,694	1,453	8.14	6.57	258	1.68	39,179	36,656	42.64	40.52	2,523	2.12
	HUNT	6	44	1,342	1,150	6.43	5.19	205	1.33	31,078	29,047	33.71	32.03	2,032	1.68
	JOHNSON	5	753	20,009	17,164	96.08	77.56	3,044	19.81	462,685	432,893	503.55	478.52	29,792	25.03
	KAUFMAN	6	139	4,972	4,267	23.85	19.22	755	4.95	114,695	102,969	124.67	118.47	11,726	6.20
	NUECES	3	912	22,201	19,035	96.26	79.69	3,387	17.73	261,221	249,847	505.65	480.91	11,374	24.74
	PARKER	6	273	6,187	5,309	29.68	23.92	939	6.16	142,715	128,124	155.13	147.42	14,590	7.71
	ROCKWALL	6	589	12,293	10,549	58.97	47.53	1,866	12.24	283,561	254,571	308.22	292.90	28,990	15.32
	RUSK	5	7	200	178	0.87	0.73	24	0.16	4,644	4,397	5.67	5.41	246	0.26
	SAN PATRICI	3	181	4,433	3,801	19.22	15.91	676	3.54	52,166	49,895	100.98	96.04	2,271	4.94
	SMITH	5	258	5,758	5,100	26.71	22.08	704	4.95	128,669	120,524	137.75	130.90	8,145	6.85
	TRAVIS	5	3,892	108,121	91,499	511.34	412.05	17,786	106.24	1,648,446	1,544,471	2,705.84	2,572.59	103,975	133.25
	UPSHUR	6	4	82	72	0.35	0.29	10	0.07	1,774	1,465	3.12	2.57	309	0.56
	VICTORIA	3	59	1,525	1,344	6.82	5.66	194	1.24	25,052	24,220	40.39	38.48	832	1.91
	WILLIAMSON	5	2,402	63,985	54,148	302.60	243.85	10,525	62.87	975,534	914,003	1,601.29	1,522.43	61,532	78.86
	WILSON	4	24	817	707	3.68	3.02	117	0.71	15,236	14,677	22.62	21.53	559	1.09
Nonattainment County	BRAZORIA	3	1,977	42,679	37,121	198.89	164.57	5,947	36.73	639,235	624,691	1,029.22	979.21	14,544	50.02
	CHAMBERS	4	316	7,219	6,241	33.25	27.36	1,046	6.30	103,565	98,561	177.51	169.05	5,004	8.46
	COLLIN	6	4,042	109,211	93,554	523.89	422.64	16,753	108.34	2,519,173	2,354,128	2,738.26	2,602.15	165,045	136.10
	DALLAS	5	3,687	103,706	88,963	497.97	402.00	15,775	102.69	2,398,128	2,243,713	2,609.93	2,480.21	154,415	129.72
	DENTON	6	3,060	62,728	53,829	300.91	242.53	9,522	62.46	1,446,946	1,299,017	1,572.78	1,494.61	147,929	78.17
	EL PASO	6	2,897	44,101	37,551	163.16	133.50	7,009	31.73	1,017,361	835,293	1,933.98	1,612.05	182,068	321.93
	FORT BEND	4	5,689	111,335	96,773	519.04	429.17	15,581	96.16	1,666,108	1,581,338	2,682.91	2,552.53	84,770	130.38
	GALVESTON	3	1,517	40,847	35,528	190.35	157.50	5,692	35.15	611,802	597,883	985.05	937.18	13,920	47.87
	HARDIN	4	97	1,899	1,656	7.62	6.24	260	1.47	33,206	27,886	75.64	62.59	5,320	13.05
	HARRIS	4	14,823	378,990	329,423	1,767	1,461	53,037	327.33	5,671,530	5,382,969	9,132.78	8,688.97	288,561	443.82
	JEFFERSON	4	532	9,135	7,965	37	30	1,253	7.10	159,669	134,090	363.72	300.99	25,580	62.73
	LIBERTY	4	240	3,394	2,970	14	11	454	2.67	59,392	49,872	132.73	109.51	9,519	23.22
	MONTGOMER	4	3,583	80,175	69,689	373.77	309.06	11,220	69.25	1,199,806	1,138,761	1,932.03	1,838.14	61,045	93.89
	ORANGE	4	317	3,529	3,077	14	12	483	2.74	61,777	51,816	140.55	116.31	9,961	24.24
	TARRANT	5	5,880	138,608	118,903	666	537	21,084	137.25	3,205,215	2,998,833	3,488.30	3,314.92	206,383	173.38
	WALLER	4	7	948	824	4.42	3.65	133	0.82	14,188	13,466	22.85	21.74	722	1.11
ERCOT	ANDERSON	5	23	3,051	2,714	13.36	11.08	360	2.44	70,981	67,219	86.62	82.66	3,763	3.96
	ANDREWS	6	57	2,267	1,989	8.85	7.28	298	1.68	77,549	72,528	71.86	68.75	5,021	3.11
	ANGELINA	5	71	1,697	1,509	7.43	6.16	200	1.35	39,471	37,379	48.17	45.97	2,092	2.20
	ARANSAS	3	127	2,773	2,378	12.02	9.95	423	2.21	32,628	31,208	63.16	60.07	1,421	3.09
	ARCHER	7	14	150	130	0.68	0.54	22	0.14	5,378	4,844	3.99	3.81	535	0.18
	ATASCOSA	3	41	1,056	923	4.87	4.00	142	0.94	18,931	18,801	29.75	28.31	130	1.43
	AUSTIN	4	36	853	742	3.98	3.29	119	0.74	12,769	12,119	20.56	19.56	650	1.00
	BANDERA	5	0	30	26	0.14	0.11	4	0.03	532	507	0.84	0.80	25	0.04
	BAYLOR	7	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	BEE	3	6	59	52	0.26	0.22	8	0.05	973	941	1.57	1.49	32	0.07
	BELL	5	1,599	37,254	31,938	182.29	145.44	5,688	39.43	940,632	912,516	998.23	952.41	28,115	45.82
	BLANCO	5	14	295	249	1.39	1.12	48	0.29	4,494	4,211	7.38	7.01	283	0.36
	BORDEN	7	19	283	252	0.97	0.81	33	0.17	11,894	10,689	8.55	8.20	1,205	0.35
	BOSQUE	5	7	115	98	0.56	0.45	18	0.12	2,901	2,814	3.08	2.94	87	0.14
	BRAZOS	4	792	13,636	11,853	63.57	52.57	1,908	11.78	204,066	193,684	328.61	312.64	10,383	15.97
	BREWSTER	5	29	459	398	1.91	1.54	65	0.39	15,228	14,776	13.34	12.74	452	0.61
	BRISCOE	8	7	102	92	0.31	0.27	11	0.04	6,943	5,889	3.58	3.44	1,054	0.14
	BROOKS	2	6	104	89	0.45	0.37	16	0.09	1,166	1,148	2.25	2.14	18	0.11
	BROWN	5	156	4,021	3,447	19.67	15.70	614	4.26	101,522	98,487	107.74	102.79	3,034	4.95
	BURLESON	4	11	190	165	0.88	0.73	27	0.16	2,838	2,693	4.57	4.35	144	0.22
	BURNET	5	315	7,779	6,583	36.79	29.65	1,280	7.64	118,602	111,121	194.68	185.09	7,481	9.59
	CALHOUN	3	86	1,214	1,070	5.43	4.51	154	0.99	19,944	19,282	32.15	30.63	662	1.52
	CALLAHAN	6	5	79	69	0.34	0.28	11	0.07	2,635	2,448	2.25	2.15	187	0.10
	CAMERON	2	1,086	29,855	25,598	130.60	107.43	4,555	24.79	335,700	330,539	648.20	616.22	5,161	31.97
	CHEROKEE	5	32	242	216	1.06	0.88	29	0.19	5,639	5,340	6.88	6.57	299	0.31
	CHILDRESS	7	0	45	40	0.15	0.13	5	0.03	1,878	1,688	1.35	1.29	190	0.06
	CLAY	7	4	100	86	0.45	0.36	15	0.09	3,586	3,229	2.66	2.54	356	0.12
	COKE	6	0	76	67	0.32	0.26	10	0.06	2,534	2,344	2.22	2.12	190	0.10
	COLEMAN	5	1	32	27	0.14	0.11	5	0.03	1,058	1,028	0.90	0.86	30	0.04
	COLORADO	4	9	253	220	1.18	0.97	35	0.22	3,783	3,591	6.09	5.80	192	0.30
	COMANCHE	5	4	16	14	0.08	0.06	3	0.02	414	402	0.44	0.42	12	0.02
	CONCHO	5	1	15	13	0.06	0.05	2	0.01	508	493	0.44	0.42	15	0.02
	COOKE	6	48	372	319	1.78	1.44	57	0.37	8,612	8,049	9.34	8.88	563	0.46
	CORYELL	5	196	3,233	2,772	15.82	12.62	494	3.42	81,632	79,192	86.63	82.65	2,440	3.98
	COTTLE	7	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	CRANE	5	16	221	193	0.86	0.70	30	0.17	7,560	7,447	7.00	6.70	114	0.30
	CROCKETT	5	19	290	252	1.21	0.98	41	0.25	9,644	9,358	8.45	8.07	286	0.38
	CROSBY	7	2	75	66	0.25	0.21	9	0.04	3,130	2,813	2.25	2.16	317	0.09
	CULBERSON	6	4	28	25	0.11	0.09	4	0.02	699	656	0.89	0.85	43	0.04
	DAWSON	7	3	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	DE WITT	3	5	74	65	0.33	0.27	9	0.06	1,216	1,176	1.96	1.87	40	0.09
	DELTA	6	3	162	139	0.78	0.63	25	0.16	3,736	3,491	4.06	3.86	245	0.20
	DICKENS	7	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	DIMMIT	3	5	245	206	1.09	0.89	42	0.22	2,816	2,743	5.78	5.49	73	0.28
	DUVAL	3	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	EASTLAND	6	1	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	ECTOR	6	254	3,165	2,776	12.35	10.16	416	2.35	108,267	101,256	100.32	95.98	7,010	4.34
	EDWARDS	5	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	ERATH	6	42	1,041	905	4.49	3.65	146	0.90	34,785	32,315	29.73	28.39	2,470	1.33
	FALLS	5	0	164	141	0.80	0.64	25	0.17	4,144	4,020	4.40	4.20	124	0.20
	FANNIN	6	19	533	457	2.56	2.06	81	0.53	12,356	11,549	13.40	12.73	808	0.67
	FAYETTE	4	14	348	302	1.62	1.34	49	0.30	5,202	4,937	8.38	7.97	265	0.41
	FISHER	6	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	FOARD	7	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	FRANKLIN	6	1	65	55	0.31	0.25	10	0.06	1,494	1,396	1.62	1.54	98	0.08
	FREESTONE	5	6	361	310	1.77	1.41	55	0.38	9,116	8,844	9.67	9.23	272	0.44
	FRIO	3	6	164	143	0.75	0.62	22	0.14	2,933	2,913	4.61	4.39	20	0.22

Table 7: 2008 Annual and Peak-day Electricity Savings from Implementation of the IECC/IRC for Single-family Residences Using 1999 Base Year (2)

2008 Summary TRY 1999															
	County	Climate Zone	No. of Projected Units (2006)	Precode Total Annual Elec. Use (MWh/yr)	Code-compliant Total Annual Elec. Use (MWh/yr)	Precode OSD Elec. Use (MWh/day)	Code-compliant OSD Elec. Use (MWh/day)	Total Annual Elec. Savings (MWh/yr) w/ 7% of T&D Loss	Total OSD Elec. Savings (MWh/day) w/ 7% of T&D Loss	Precode Total NG Use (Therm/yr)	Code-compliant Total NG Use (Therm/yr)	Precode OSD NG Use (Therm/day)	Code-compliant OSD NG Use (Therm/day)	Total Annual NG Savings (Therm/yr)	Total OSD NG Savings (Therm/day)
ERCOT	GILLESPIE	5	42	1,032	873	4.88	3.93	170	1.01	15,730	14,738	25.82	24.55	992	1.27
	GLASSCOCK	6	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	GOLIAD	3	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	GONZALES	4	2	91	79	0.41	0.34	13	0.08	1,693	1,631	2.51	2.39	62	0.12
	GRAYSON	6	185	4,300	3,686	20.61	16.64	657	4.25	99,601	93,090	108.02	102.65	6,511	5.37
	GRIMES	4	11	269	233	1.25	1.04	38	0.23	4,020	3,815	6.47	6.16	205	0.31
	HALL	8	1	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	HAMILTON	5	2	66	56	0.32	0.26	10	0.07	1,658	1,608	1.76	1.68	50	0.08
	HARDEMAN	7	0	17	14	0.08	0.06	2	0.02	598	538	0.44	0.42	59	0.02
	HASKELL	6	2	32	27	0.14	0.11	4	0.03	1,054	979	0.90	0.86	75	0.04
	HIDALGO	2	3,144	94,835	81,312	414.85	341.24	14,469	78.76	1,066,354	1,049,959	2,059.01	1,957.44	16,395	101.57
	HILL	5	14	345	295	1.69	1.35	53	0.36	8,702	8,442	9.23	8.81	260	0.42
	HOPKINS	6	12	292	250	1.40	1.13	45	0.29	6,725	6,284	7.31	6.95	441	0.36
	HOUSTON	5	4	86	76	0.37	0.31	10	0.07	1,990	1,885	2.43	2.32	105	0.11
	HOWARD	6	10	236	207	0.92	0.76	31	0.17	8,057	7,535	7.47	7.14	522	0.32
	HUDSPETH	6	10	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	IRION	5	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	JACK	6	1	16	14	0.07	0.06	2	0.01	527	490	0.45	0.43	37	0.02
	JACKSON	3	11	222	196	0.99	0.82	28	0.18	3,648	3,527	5.88	5.60	121	0.28
	JEFF DAVIS	6	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	JIM HOGG	2	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	JIM WELLS	3	31	440	381	1.66	1.37	63	0.31	7,040	5,902	16.84	13.88	1,137	2.96
	JONES	6	1	16	14	0.07	0.06	2	0.01	527	490	0.45	0.43	37	0.02
	KARNES	3	30	675	584	3.16	2.58	97	0.63	10,974	10,850	18.82	17.93	124	0.89
	KENDALL	5	193	7,934	6,900	36.61	29.83	1,106	7.26	141,672	134,985	223.31	212.55	6,686	10.76
	KENEDY	2	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	KENT	7	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	KERR	5	69	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	KIMBLE	5	4	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	KING	7	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	KINNEY	4	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	KLEBERG	2	26	543	468	2.41	1.99	80	0.44	6,135	6,037	12.48	11.87	98	0.61
	KNOX	7	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	LA SALLE	3	10	263	221	1.17	0.95	45	0.23	3,017	2,939	6.19	5.89	78	0.30
	LAMAR	6	26	727	648	3.43	2.84	85	0.63	16,032	14,881	17.50	16.63	1,151	0.87
	LAMPASAS	5	19	328	281	1.61	1.28	50	0.35	8,288	8,040	8.79	8.39	248	0.40
	LAVACA	4	7	221	196	1.01	0.84	27	0.18	3,480	3,339	5.88	5.60	141	0.28
	LEE	4	11	229	195	1.08	0.88	37	0.22	3,507	3,407	5.74	5.46	100	0.28
	LEON	5	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	LIMESTONE	5	15	312	267	1.53	1.22	48	0.33	7,873	7,638	8.36	7.97	235	0.38
	LIVE OAK	3	6	33	28	0.14	0.12	5	0.03	391	374	0.76	0.72	17	0.04
	LLANO	5	307	4,242	3,590	20.06	16.16	698	4.17	64,669	60,590	106.15	100.92	4,079	5.23
	LOVING	6	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	MADISON	4	8	237	206	1.10	0.91	33	0.20	3,547	3,366	5.71	5.43	180	0.28
	MARTIN	6	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	MASON	5	4	164	139	0.77	0.62	27	0.16	2,497	2,339	4.10	3.90	157	0.20
	MATAGORDA	3	97	1,776	1,566	7.95	6.59	226	1.44	29,186	28,217	47.05	44.83	969	2.22
	MAVERICK	3	81	1,876	1,578	8.36	6.80	319	1.67	21,523	20,966	44.14	41.98	557	2.16
	MCCULLOCH	5	3	61	53	0.25	0.21	9	0.05	2,030	1,970	1.78	1.70	60	0.08
	MCLENNAN	5	551	13,392	11,481	65.53	52.28	2,045	14.17	338,130	328,024	358.84	342.36	10,107	16.47
	MCMULLEN	3	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	MEDINA	4	15	559	484	2.52	2.07	80	0.49	10,440	10,057	15.50	14.76	383	0.75
	MENARD	5	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	MIDLAND	6	483	7,566	6,638	29.54	24.29	994	5.61	258,833	242,073	239.84	229.47	16,759	10.37
	MILAM	4	5	82	70	0.40	0.32	13	0.08	1,191	1,190	2.08	1.98	1	0.10
	MILLS	5	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	MITCHELL	6	1	16	14	0.07	0.06	2	0.01	527	490	0.45	0.43	37	0.02
	MONTAGUE	6	1	16	14	0.08	0.06	2	0.02	374	350	0.41	0.39	24	0.02
	MOTLEY	7	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	NACOGDOCH	5	42	841	748	3.68	3.06	99	0.67	19,570	18,532	23.88	22.79	1,037	1.09
	NAVARRO	5	28	1,083	929	5.30	4.23	165	1.15	27,349	26,531	29.02	27.69	817	1.33
	NOLAN	6	3	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	PALO PINTO	6	9	205	178	0.88	0.72	29	0.18	6,852	6,365	5.86	5.59	486	0.26
	PECOS	5	9	199	173	0.83	0.67	28	0.17	6,599	6,403	5.78	5.52	196	0.26
	PRESIDIO	5	7	199	173	0.83	0.67	28	0.17	6,599	6,403	5.78	5.52	196	0.26
	RAINS	6	3	130	111	0.62	0.50	20	0.13	2,989	2,793	3.25	3.09	196	0.16
	REAGAN	5	5	44	39	0.17	0.14	6	0.03	1,512	1,489	1.40	1.34	23	0.06
	REAL	5	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	RED RIVER	6	1	31	28	0.15	0.12	4	0.03	682	633	0.74	0.71	49	0.04
	REEVES	6	1	15	13	0.06	0.05	2	0.01	504	471	0.47	0.45	33	0.02
	REFUGIO	3	3	74	65	0.33	0.27	9	0.06	1,216	1,176	1.96	1.87	40	0.09
	ROBERTSON	4	11	253	220	1.18	0.97	35	0.22	3,783	3,591	6.09	5.80	192	0.30
	RUNNELS	5	2	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	SAN SABA	5	5	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	SCHLEICHER	5	2	15	13	0.06	0.05	2	0.01	508	493	0.44	0.42	15	0.02
	SCURRY	7	8	60	53	0.20	0.17	7	0.04	2,504	2,250	1.80	1.73	254	0.07
	SHACKELFOI	6	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	SOMERVELL	5	43	887	761	4.26	3.44	135	0.88	20,522	19,201	22.33	21.22	1,321	1.11
	STARR	2	0	35	30	0.15	0.12	5	0.03	389	383	0.75	0.71	6	0.04
	STEPHENS	6	1	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	STERLING	6	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	STONEWALL	7	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	SUTTON	5	0	61	53	0.25	0.21	9	0.05	2,030	1,970	1.78	1.70	60	0.08
	TAYLOR	6	184	4,371	3,800	18.83	15.32	611	3.76	145,991	135,625	124.76	119.17	10,366	5.59
	TERRELL	5	0	76	66	0.32	0.26	11	0.07	2,538	2,463	2.22	2.12	75	0.10
	THROCKMOR	6	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	TITUS	6	9	526	469	2.48	2.06	61	0.46	11,597	10,765	12.66	12.03	833	0.63
	TOM GREEN	5	259	5,442	4,726	22.64	18.30	766	4.64	180,706	175,342	158.33	151.14	5,364	7.19
	UPTON	5	1	59	51	0.23	0.19	8	0.05	2,016	1,986	1.87	1.79	30	0.08
	UVALDE	4	26	333	288	1.50	1.23	48	0.29	6,207	5,980	9.22	8.77	228	0.44
	VAL VERDE	4	89	2,797	2,421	12.61	10.33	402	2.44	52,198	50,283	77.51	73.78	1,915	3.73
	VAN ZANDT	6	14	470	402	2.25	1.82	72	0.47	10,834	10,125	11.78	11.19	710	0.59
	WARD	6	2	221	194	0.86	0.71	29	0.16	7,553	7,064	7.00	6.70	489	0.30
	WASHINGTOI	4	88	1,185	1,030	5.52	4.57	166	1.02	17,735	16,832	28.56	27.17	902	1.39
	WEBB	3	668	22,042	18,535	98.23	79.88	3,752	19.63	252,846	246,307	518.56	493.19	6,539	25.37
	WHARTON	3	98	2,058	1,813	9.20	7.64	261	1.67	33,808	32,685	54.50	51.93	1,123	2.57
	WICHITA	7	140	3,491	3,011	15.71	12.61	513	3.31	124,895	112,482	92.65	88.43	12,413	4.22
	WILBARGER	7	2	33	29	0.15	0.12	5	0.03	1,195	1,076	0.89	0.85	119	0.04
	WILLACY	2	34	518	444	2.27	1.87	79	0.43	5,828	5,739	11.25	10.70	90	0.56
	WINKLER	6	4	88	77	0.34	0.28	12	0.07	3,021	2,826	2.80	2.68	196	0.12
	WISE	6	72	1,765	1,512	8.47	6.83	271	1.75	40,722	38,054	44.26	42.06	2,668	2.20
	YOUNG	6	10	110	96	0.48	0.39	15	0.10	3,689	3,427	3.15	3.01	262	0.14
	ZAPATA	2	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	ZAVALA	3	9	544	457	2.42	1.97	93	0.48	6,236	6,074	12.79	12.16	161	0.63
	TOTAL		78,977					279,732	1,716					2,026,636	2,686

Table 8: 2007 Allocation of PCA for each of 41 Non-attainment and Affected Counties, and ERCOT Counties (1)

County	Elec. Utilities 1	PCA	1998 Annual net Generation (MWh)	Percentage	Elec. Utilities 2	PCA	1998 Annual net Generation (MWh)	Percentage
ANDERSON	ONCOR	TXU Electric/PCA	97581030	100%	Trinity Valley EC			0%
ANDREWS	ONCOR	TXU Electric/PCA	97581030	100%	Cap Rock EC			0%
ANGELINA	ONCOR	TXU Electric/PCA	97581030	100%	Sam Houston EC			0%
ARANSAS	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	San Patricio EC			0%
ARCHER	ONCOR	TXU Electric/PCA	97581030	98%	T-NMP	Texas-New Mexico Power Co/PCA	2,067,714	2%
ATASCOSA	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	54%	CPSB	San Antonio Public Service Bd/PCA	14,641,059	46%
AUSTIN	RELIANT(CENTER POINT)	Reliant Energy HL&P/PCA	74,386,176	100%	Bellville			0%
BANDERA*	Bandera EC							
BASTROP	ONCOR	TXU Electric/PCA	97581030	100%	Smithville			0%
BAYLOR	ONCOR	TXU Electric/PCA	97581030	100%	Seymour			0%
BEE	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	San Patricio EC			0%
BELL	ONCOR	TXU Electric/PCA	97581030	100%	Bartlett EC			0%
BEXAR	CPSB	San Antonio Public Service Bd/PCA	14,641,059	100%	Bandera EC			0%
BLANCO*	Pedernales EC				Central Texas EC			
BORDEN*	Lyntegar EC				Big Country EC			
BOSQUE	T-NMP	Texas-New Mexico Power Co/PCA	2067714	100%	United Coop Services			0%
BRAZORIA	RELIANT(CENTER POINT)	Reliant Energy HL&P/PCA	74,386,176	97%	T-NMP	Texas-New Mexico Power Co/PCA	2,067,714	3%
BRAZOS*	BRYAN				College Station			
BREWSTER	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Rio Grande EC			0%
BRISCOE	XCEL(SPS)				WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%
BROOKS	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Medina EC			0%
BROWN	ONCOR	TXU Electric/PCA	97581030	85%	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	15%
BURLESON	ENTERGY	Entergy Electric System/PCA	32,288,113	100%	BRYAN			0%
BURNET	ONCOR	TXU Electric/PCA	97581030	100%	Pedernales EC			0%
CALDWELL	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Luling			0%
CALHOUN	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Victoria EC			0%
CALLAHAN	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Taylor EC			0%
CAMERON	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Magic Valley EC			0%
CHAMBERS	RELIANT(CENTER POINT)	Reliant Energy HL&P/PCA	74,386,176	70%	ENTERGY	Entergy Electric System/PCA	32,288,113	30%
CHEROKEE	ONCOR	TXU Electric/PCA	97581030	100%	Cherokee County EC			0%
CHILDRESS	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Greenbelt EC			0%
CLAY	ONCOR	TXU Electric/PCA	97581030	98%	T-NMP	Texas-New Mexico Power Co/PCA	2,067,714	2%
COKE	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Concho Valley EC			0%
COLEMAN	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Coleman			0%
COLLIN	ONCOR	TXU Electric/PCA	97581030	98%	T-NMP	Texas-New Mexico Power Co/PCA	2,067,714	2%
COLORADO	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Weimar			0%
COMAL	CPSB	San Antonio Public Service Bd/PCA	14,641,059	100%	New Braunfels			0%
COMANCHE	ONCOR	TXU Electric/PCA	97581030	98%	T-NMP	Texas-New Mexico Power Co/PCA	2,067,714	2%
CONCHO	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Concho Valley EC			0%
COOKE	ONCOR	TXU Electric/PCA	97581030	100%	Cooke County EC			0%
CORYELL	ONCOR	TXU Electric/PCA	97581030	98%	T-NMP	Texas-New Mexico Power Co/PCA	2,067,714	2%
COTTLE	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	South Plains EC			0%
CRANE	ONCOR	TXU Electric/PCA	97581030	100%				0%
CROCKETT	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Rio Grande EC			0%
CROSBY*	XCEL(SPS)				Crosbyton			
CULBERSON	EPEC	El Paso Electric Co/PCA	3066882	100%	Rio Grande EC			0%
DALLAS	ONCOR	TXU Electric/PCA	97581030	100%	Garland			0%
DAWSON	ONCOR	TXU Electric/PCA	97581030	100%	Lyntegar EC			0%
DELTA	ONCOR	TXU Electric/PCA	97581030	100%	Lamar County EC			0%
DENTON	ONCOR	TXU Electric/PCA	97581030	98%	T-NMP	Texas-New Mexico Power Co/PCA	2,067,714	2%
DEWITT	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Yoakum			0%
DICKENS	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	South Plains EC			0%
DIMMIT	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Medina EC			0%
DUVAL	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Medina EC			0%
EASTLAND	ONCOR	TXU Electric/PCA	97581030	85%	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	15%
ECTOR	ONCOR	TXU Electric/PCA	97581030	100%	Goldsmith			0%
EDWARDS	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Rio Grande EC			0%
ELLIS	ONCOR	TXU Electric/PCA	97581030	100%	Navarro County EC			0%
ERATH	ONCOR	TXU Electric/PCA	97581030	98%	T-NMP	Texas-New Mexico Power Co/PCA	2,067,714	2%
FALLS	ONCOR	TXU Electric/PCA	97581030	100%	Belfalls EC			0%
FANNIN	ONCOR	TXU Electric/PCA	97581030	98%	T-NMP	Texas-New Mexico Power Co/PCA	2,067,714	2%
FAYETTE*	La Grange				Schulenburg			
FISHER	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Big Country EC			0%
FOARD*	XCEL(SPS)				Floydada			
FORT BEND	RELIANT(CENTER POINT)	Reliant Energy HL&P/PCA	74,386,176	100%				0%
FRANKLIN	SWEPCO(AEP)	Southwestern Public Service Co/PCA			FEC Electric			
FREESTONE	ONCOR	TXU Electric/PCA	97581030	100%	Navasota Valley EC			0%
FRIO	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Medina EC			0%
GALVESTON	RELIANT(CENTER POINT)	Reliant Energy HL&P/PCA	74,386,176	97%	T-NMP	Texas-New Mexico Power Co/PCA	2,067,714	3%
GILLESPIE*	Fredericksburg				Pedernales EC			
GLASSCOCK	ONCOR	TXU Electric/PCA	97581030	100%	Cap Rock EC			0%
GOLIAD	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Karnes EC			0%
GONZALES	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Gonzales			0%
GRAYSON	ONCOR	TXU Electric/PCA	97581030	98%	T-NMP	Texas-New Mexico Power Co/PCA	2,067,714	2%
GRIMES	ENTERGY	Entergy Electric System/PCA	32,288,113	100%	Mid-South EC			0%
GUADALUPE	CPSB	San Antonio Public Service Bd/PCA	14,641,059	100%	Seguin			0%
HALL	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Lighthouse EC			0%
HAMILTON	T-NMP	Texas-New Mexico Power Co/PCA	2067714	100%	United Coop Services			0%
HARDEMAN	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	South Plains EC			0%
HARRIS	RELIANT(CENTER POINT)	Reliant Energy HL&P/PCA	74,386,176	70%	ENTERGY	Entergy Electric System/PCA	32,288,113	30%
HASKELL	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Big Country EC			0%
HAYS	San Marcos	Lower Colorado River Authority/PCA		100%	Pedernales EC			0%
HENDERSON	ONCOR	TXU Electric/PCA	97581030	100%	Trinity Valley EC			0%
HIDALGO	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Magic Valley EC			0%
HILL	ONCOR	TXU Electric/PCA	97581030	98%	T-NMP	Texas-New Mexico Power Co/PCA	2,067,714	2%
HOOD	ONCOR	TXU Electric/PCA	97581030	98%	T-NMP	Texas-New Mexico Power Co/PCA	2,067,714	2%
HOPKINS	ONCOR	TXU Electric/PCA	97581030	100%	SWEPCO(AEP)			0%
HOUSTON	ONCOR	TXU Electric/PCA	97581030	100%	Houston County EC			0%
HOWARD	ONCOR	TXU Electric/PCA	97581030	100%	Cap Rock EC			0%
HUDSPETH	EPEC	El Paso Electric Co/PCA	3066882	100%	Rio Grande EC			0%
HUNT	ONCOR	TXU Electric/PCA	97581030	98%	T-NMP	Texas-New Mexico Power Co/PCA	2,067,714	2%
IRION	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Cap Rock EC			0%
JACK	ONCOR	TXU Electric/PCA	97581030	98%	T-NMP	Texas-New Mexico Power Co/PCA	2,067,714	2%
JACKSON	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Jackson EC			0%
JEFF DAVIS	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Rio Grande EC			0%
JIM HOGG	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Medina EC			0%
JIM WELLS	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Nueces EC			0%
JOHNSON	ONCOR	TXU Electric/PCA	97581030	98%	T-NMP	Texas-New Mexico Power Co/PCA	2,067,714	2%
JONES	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Taylor EC			0%
KARNES	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Floresville			0%

Table 9: 2006 Allocation of PCA for each of 41 Non-attainment and Affected Counties, and ERCOT Counties (2)

County	Elec. Utilities 1	PCA	1998 Annual net Generation (MWh)	Percentage	Elec. Utilities 2	PCA	1998 Annual net Generation (MWh)	Percentage
KAUFMAN	ONCOR	TXU Electric/PCA	97581030	100%	Trinity Valley EC			0%
KENDALL*	Boerne				Central Texas EC			
KENEDY*	Nueces EC				Magic Valley EC			
KENT	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	South Plains EC			0%
KERR*	Kerrville				Bandera EC			
KIMBLE	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Central Texas EC			0%
KING	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	South Plains EC			0%
KINNEY	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Rio Grande EC			0%
KLEBERG	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Nueces EC			0%
KNOX	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Tri-County EC			0%
LA SALLE	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Medina EC			0%
LAMAR	ONCOR	TXU Electric/PCA	97581030	98%	T-NMP	Texas-New Mexico Power Co/PCA	2,067,714	2%
LAMPASAS	ONCOR	TXU Electric/PCA	97581030	100%	Lampasas			0%
LAVACA*	Schulenburg				Yoakum			
LEE*	Giddings				Lexington			
LEON	ONCOR	TXU Electric/PCA	97581030	75%	ENTERGY	Entergy Electric System/PCA	32,288,113	25%
LIMESTONE	ONCOR	TXU Electric/PCA	97581030	75%	ENTERGY	Entergy Electric System/PCA	32,288,113	25%
LIVE OAK	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	San Patricio EC			0%
LLANO*	Llano				Pedernales EC			
LOVING	ONCOR	TXU Electric/PCA	97581030	100%				0%
MADISON	ENTERGY	Entergy Electric System/PCA	32,288,113	100%	Houston County EC			0%
MARTIN	ONCOR	TXU Electric/PCA	97581030	100%	Cap Rock EC			0%
MASON*	Mason				Cap Rock EC			
MATAGORDA	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	19%	RELIANT(CENTER POINT)	Reliant Energy HL&P/PCA	74,386,176	81%
MAVERICK	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Rio Grande EC			0%
McCULLOCH	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Brady			0%
McLENNAN	ONCOR	TXU Electric/PCA	97581030	98%	T-NMP	Texas-New Mexico Power Co/PCA	2,067,714	2%
McMULLEN	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Karnes EC			0%
MEDINA	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	54%	CPSB	San Antonio Public Service Bd/PCA	14,641,059	46%
MENARD	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Cap Rock EC			0%
MIDLAND	ONCOR	TXU Electric/PCA	97581030	100%	Cap Rock EC			0%
MILAM	ONCOR	TXU Electric/PCA	97581030	75%	ENTERGY	Entergy Electric System/PCA	32,288,113	25%
MILLS*	Goldwaithe				Cap Rock EC			
MITCHELL	ONCOR	TXU Electric/PCA	97581030	100%	Cap Rock EC			0%
MONTAGUE	ONCOR	TXU Electric/PCA	97581030	98%	T-NMP	Texas-New Mexico Power Co/PCA	2,067,714	2%
MONTGOMERY	ENTERGY	Entergy Electric System/PCA	32,288,113	30%	RELIANT(CENTER POINT)	Reliant Energy HL&P/PCA	74,386,176	70%
MOTLEY	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Lighthouse EC			0%
NACOGDOCHES	ONCOR	TXU Electric/PCA	97581030	100%	Cherokee County EC			0%
NAVARRO	ONCOR	TXU Electric/PCA	97581030	100%	Navarro County EC			0%
NOLAN	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	15%	ONCOR	TXU Electric/PCA	97,581,030	85%
NUECES	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Robstown			0%
PALO PINTO	ONCOR	TXU Electric/PCA	97581030	98%	T-NMP	Texas-New Mexico Power Co/PCA	2,067,714	2%
PARKER	ONCOR	TXU Electric/PCA	97581030	100%	Weatherford			0%
PECOS	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	15%	ONCOR	TXU Electric/PCA	97,581,030	85%
PRESIDIO	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Rio Grande EC			0%
RAINS	T-NMP	Texas-New Mexico Power Co/PCA	2067714	100%	FEC Electric			0%
REAGAN	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Cap Rock EC			0%
REAL	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Bandera EC			0%
RED RIVER	ONCOR	TXU Electric/PCA	97581030	100%	SWEPCO(AEP)			0%
REEVES	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	15%	ONCOR	TXU Electric/PCA	97,581,030	85%
REFUGIO	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	San Patricio EC			0%
ROBERTSON	ENTERGY	Entergy Electric System/PCA	32,288,113	100%	Hearne			0%
ROCKWALL	ONCOR	TXU Electric/PCA	97581030	100%	FEC Electric			0%
RUNNELS	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Coleman County EC			0%
RUSK	SWEPCO(AEP)	Southwestern Public Service Co/PCA		0%	ONCOR	TXU Electric/PCA	97,581,030	100%
SAN PATRICIO	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	San Patricio EC			0%
SAN SABA*	San Saba				Central Texas EC			
SCHLEICHER	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Pedernales EC			0%
SCURRY	ONCOR	TXU Electric/PCA	97581030	100%	Cap Rock EC			0%
SHACKELFORD	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Fort Belknap EC			0%
SMITH	ONCOR	TXU Electric/PCA	97581030	100%	SWEPCO(AEP)			0%
SOMERVELL	T-NMP	Texas-New Mexico Power Co/PCA	2067714	100%	United Coop Services			0%
STARR	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Medina EC			0%
STEPHENS	ONCOR	TXU Electric/PCA	97581030	100%	Comanche EC			0%
STERLING	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Cap Rock EC			0%
STONEWALL	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Big Country EC			0%
SUTTON	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Pedernales EC			0%
TARRANT	ONCOR	TXU Electric/PCA	97581030	100%	Tri-County EC			0%
TAYLOR	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Taylor EC			0%
TERRELL	T-NMP	Texas-New Mexico Power Co/PCA	2067714	100%	Rio Grande EC			0%
THROCKMORTON	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Fort Belknap EC			0%
TITUS	SWEPCO(AEP)	Southwestern Public Service Co/PCA		0%	T-NMP	Texas-New Mexico Power Co/PCA	2,067,714	100%
TOM GREEN	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Concho Valley EC			0%
TRAVIS	ONCOR	TXU Electric/PCA	97581030	97%	Austin Energy	Austin Energy/PCA	3,359,240	3%
UPTON	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	15%	ONCOR	TXU Electric/PCA	97,581,030	85%
UVALDE	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Bandera EC			0%
VAL VERDE	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Rio Grande EC			0%
VAN ZANDT	ONCOR	TXU Electric/PCA	97581030	100%	SWEPCO(AEP)			0%
VICTORIA	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Victoria EC			0%
WALLER	RELIANT(CENTER POINT)	Reliant Energy HL&P/PCA	74,386,176	100%	Hempstead			0%
WARD	ONCOR	TXU Electric/PCA	97581030	98%	T-NMP	Texas-New Mexico Power Co/PCA	2,067,714	2%
WASHINGTON	ENTERGY	Entergy Electric System/PCA	32,288,113	100%	Bluebonnet EC			0%
WEBB	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Rio Grande EC			0%
WHARTON	RELIANT(CENTER POINT)	Reliant Energy HL&P/PCA	74,386,176	81%	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17162569	19%
WICHITA	ONCOR	TXU Electric/PCA	97581030	100%	Electra			0%
WILBARGER	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Vernon			0%
WILLACY	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Magic Valley EC			0%
WILLIAMSON	ONCOR	TXU Electric/PCA	97581030	97%	Austin Energy	Austin Energy/PCA	3,359,240	3%
WILSON	Floresville	San Antonio Public Service Bd/PCA		100%	Guadalupe Valley EC			
WINKLER	ONCOR	TXU Electric/PCA	97581030	98%	T-NMP	Texas-New Mexico Power Co/PCA	2,067,714	2%
WISE	ONCOR	TXU Electric/PCA	97581030	100%	Bridgeport			0%
YOUNG	ONCOR	TXU Electric/PCA	97581030	98%	T-NMP	Texas-New Mexico Power Co/PCA	2,067,714	2%
ZAPATA	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Medina EC			0%
ZAVALA	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	17,162,569	100%	Medina EC			0%

Table 10: 2008 Totalized Annual Electricity Savings from IECC/IRC by PCA for Single-family Residences Using 1999 Base Year

PCA	Total Electricity Savings by PCA (MWh)
American Electric Power - West (ERCOT)/PCA	15,579.47
Austin Energy/PCA	505.99
Brownsville Public Utils Board/PCA	0.00
Lower Colorado River Authority/PCA	3,149.14
Reliant Energy HL&P/PCA	41,223.95
San Antonio Public Service Bd /PCA	10,763.30
South Texas Electric Coop Inc/PCA	0.00
Texas Municipal Power Pool/PCA	0.00
Texas-New Mexico Power Co/PCA	799.77
TXU Electric/PCA	64,934.75
El Paso Electric Co/PCA	58.33
Entergy Electric System/PCA	10,742.28
Total	147,756.98

Table 11: 2008 Annual NOx Reductions from IECC/IRC by PCA for Single-family Residences by County Using 2007 eGRID

Area	County	American Electric Power - West (ERCOT) /PCA	NOx Reductions (lbs)	Austin Energy/PCA	NOx Reductions (lbs)	Brownsville Public Utils Board/PCA	NOx Reductions (lbs/year)	Lower Colorado River Auhotrity /PCA	NOx Reductions (lbs)	Reliant Energy HL&P/PCA	NOx Reductions (lbs)	San Antonio Public Service Bd/PCA	NOx Reductions (lbs)	South Texas Electric Coop INC/PCA	NOx Reductions (lbs)	Texas Municipal Power Pool/PCA	NOx Reductions (lbs)	Texas-New Mexico Power Co/PCA	NOx Reductions (lbs)	TXU Electric/PCA	NOx Reductions (lbs)	Total Nox Reductions (lbs)	Total Nox Reductions (Tons)
Houston-Galveston Area	Brazoria	0.00883113	137.584334	0.010890729	5.510624279	0.006522185	0	0.003944232	12.42093068	0.0654443	2697.872355	0.014877	160.1302794	0.006262	0	0.0048171	0	0.121275	96.99233691	0.00816387	530.1188568	3640.629717	1.820314859
	Chambers	0.02176222	339.043824	0.026955801	13.63942591	0.016072371	0	0.009076193	28.58218516	0.1649402	6799.487971	0.037472	403.3255319	0.015056	0	0.0095532	0	0.011519	9.21224643	0.01581859	1027.176323	8620.467507	4.310233754
	Fort Bend	0.07043123	1097.28108	0.087239726	44.14262407	0.052016606	0	0.029374182	92.50335482	0.5338124	22005.85591	0.121275	1305.322339	0.048726	0	0.030918	0	0.037279	29.81450492	0.05119528	3324.3524	27899.27222	13.94963611
	Galveston	0.03385674	527.469953	0.041710519	21.10519851	0.025004711	0	0.015351589	48.34427249	0.2495874	10288.97819	0.056747	610.7855195	0.024143	0	0.0192972	0	0.567751	454.0716326	0.03283689	2132.254991	14083.00976	7.04150488
	Harris	0.06826733	1063.56866	0.084559408	42.78640359	0.050418468	0	0.028471701	89.66131842	0.5174117	21329.75672	0.117549	1265.218133	0.047229	0	0.0299681	0	0.036133	28.89849589	0.04962237	3222.216315	27042.10604	13.52105302
	Liberty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Montgomery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Waller	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beaumont/ Port Arthur Area	Hardin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jefferson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Orange	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dallas/ Fort Worth Area	Collin	0.00203914	31.7686389	0.003716345	1.880441529	0.001505992	0	0.005950953	18.74037173	0.0024815	102.2963384	0.000717	7.717831971	0.019166	0	0.0766809	0	0.000864	0.69133119	0.0040002	259.7519379	422.8468916	0.211423446
	Dallas	0.00453947	70.7225411	0.004683963	2.37004871	0.003352602	0	0.00774211	24.38097321	0.0020856	85.97713658	0.000681	7.330456402	0.007503	0	0.026717	0	0.007525	6.018232163	0.04037045	2621.445289	2818.244677	1.409122338
	Denton	0.00047388	7.3828024	0.000872802	0.441630792	0.000349982	0	0.001396994	4.399326498	0.0005854	24.13428911	0.000169	1.818680294	0.004544	0	0.0181872	0	0.000187	0.149241883	0.00084941	55.1559254	93.48189639	0.046740948
	Tarrant	0.01216249	189.485148	0.012266309	6.206657298	0.008982543	0	0.020308652	63.9547498	0.0053165	219.1673279	0.001753	18.86274812	0.017326	0	0.0602168	0	0.020603	16.47806171	0.11064724	7184.850547	7699.00524	3.84950262
	Ellis	0.00327981	51.0977469	0.003307809	1.673725915	0.002422289	0	0.005476558	17.24643669	0.0014337	59.10202848	0.000473	5.086646297	0.004672	0	0.0162384	0	0.005556	4.443576887	0.02983782	1937.511607	2076.161768	1.038080884
	Johnson	0.00028606	4.45663867	0.000526868	0.266591025	0.000211267	0	0.000843297	2.655659398	0.0003534	14.56869631	0.000102	1.097848822	0.002743	0	0.0109787	0	0.000113	0.090090065	0.00051274	33.29494906	56.43047335	0.028215237
	Kaufman	0.00632545	98.5471792	0.006379446	3.227949914	0.004671629	0	0.010562096	33.26149958	0.002765	113.9842468	0.000911	9.810112475	0.009011	0	0.0313175	0	0.010715	8.569887998	0.05754527	3736.687333	4004.088209	2.002044104
	Parker	0.00021749	3.38837021	0.000400576	0.202688429	0.000160626	0	0.000641157	2.019090589	0.0002687	11.07654002	7.75E-05	0.834691462	0.002085	0	0.0083471	0	8.56E-05	0.06849523	0.00038984	25.31405885	42.90393479	0.021451967
	Rockwall	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Henderson	0.00081989	12.7735261	0.000826893	0.41840165	0.000605529	0	0.001369042	4.311301811	0.0003584	14.77445382	0.000118	1.271570922	0.001168	0	0.0040593	0	0.001389	1.11081503	0.00745892	484.343372	519.0034413	0.259501721
	Hood	0.01252711	195.165696	0.012634039	6.392725776	0.009251829	0	0.020917482	65.87203996	0.0054759	225.7377134	0.001805	19.42823171	0.017846	0	0.062022	0	0.021221	16.97205513	0.11396431	7400.244139	7929.812601	3.9649063
	Hunt	0.00618756	96.3988617	0.006240374	3.157580967	0.004569788	0	0.010331844	32.53640261	0.0027047	111.499403	0.000892	9.596253119	0.008815	0	0.0306347	0	0.010482	8.383065398	0.05629078	3655.227967	3916.799534	1.958399767
El Paso Area	El Paso	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Antonio Area	Bexar	0.03341375	520.568433	0.051775843	26.19817466	0.024677545	0	0.090663423	285.5116389	0.0011418	47.07120947	1.143572	12308.60549	0.046874	0	0.0046695	0	0.00052	0.415547492	0.00250387	162.5878564	13350.95835	6.675479174
	Comal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Guadalupe	0.00200047	31.1662124	0.076378745	38.64705162	0.001477434	0	0.133848731	421.5081345	0.0012371	50.99950216	0.003555	38.26133754	0.001062	0	0.0018557	0	0.000402	0.321283145	0.00183516	119.1659664	700.0694877	0.350034744
	Wilson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Austin Area	Bastrop	0.00450233	70.1439612	0.171901148	86.98064611	0.003325174	0	0.301245466	948.6635678	0.0027843	114.78158	0.008001	86.11254211	0.00239	0	0.0041765	0	0.000904	0.723093079	0.0041303	268.199832	1575.605222	0.787802611
	Caldwell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hays	0.0024586	38.3036644	0.093870431	47.49770932	0.001815785	0	0.164501762	518.0387638	0.0015205	62.67902537	0.004369	47.02366189	0.001305	0	0.0022807	0	0.000494	0.394861	0.00225544	146.4564616	860.3941474	0.430197074
	Travis	0.00051001	7.94563745	0.299602906	151.5967436	0.000376663	0	0.033939476	106.8800969	0.0003347	13.79801898	0.000906	9.752851967	0.000271	0	0.0004717	0	0.000103	0.082637955	0.00046734	30.34633078	320.4023176	0.160201159
	Williamson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North East Texas Area	Gregg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Harrison	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rusk	0.00068596	10.6869666	0.00069182	0.350055611	0.000506616	0	0.001145408	3.607049328	0.0002999	12.36104223	9.88E-05	1.063859419	0.000977	0	0.0033962	0	0.001162	0.929363051	0.00624051	405.2257326	434.2240689	0.217112034
	Smith	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Upshur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corpus Christi Area	Nueces	0.22756873	3545.39953	0.004556851	2.305731372	0.168069652	0	0.007612767	23.97365479	0.0016809	69.29284088	0.001627	17.50969267	0.046792	0	0.0072464	0	0.001609	1.287174117	0.00828339	537.8801544	4197.648781	2.09882439
	San Patricio	0.05031335	783.855199	0.001007478	0.50977598	0.037158653	0	0.001683113	5.300354381	0.0003716	15.32000923	0.00036	3.87123186	0.010345	0	0.0016021	0	0.000356	0.284582348	0.00183138	118.9203506	928.0615032	0.464030752
Victoria Area	Victoria	0.02183674	340.204704	0.002215582	1.121067371	0.016127403	0	0.003612695	11.37687622	0.0011996	49.4531238	0.000555	5.977816028	0.525456	0	0.0324127	0	0.000477	0.381375635	0.00225485	146.4180639	554.9330272	0.277466514
Other ERCOT counties	Andrews	2.4742E-05	0.38546846	2.49533E-05	0.012626164	1.82731E-05	0	4.13138E-05	0.13010275	1.082E-05	0.445850734	3.57E-06	0.038372371	3.52E-05	0	0.0001225	0	4.19E-05	0.033521219	0.00022509	14.61609685	15.66203855	0.007831019
	Angelina	0.00031082	4.8424087	0.000313473	0.158614918	0.000229554	0	0.000519	1.634402692	0.0001359	5.600954924	4.48E-05	0.482049049	0.000443	0	0.0015389	0	0.000527	0.421106931	0.00282766	183.613244	196.7527812	0.098376391
	Bosque	0.00059539	9.27588649	0.001096604	0.554872915	0.000439723	0	0.001755208	5.527393392	0.0007356	30.32275741	0.000212	2.28502282	0.005709	0	0.0228507	0	0.000234	0.187510202	0.00106721	69.2989024	117.4523456	0.058726173
	Brazos	0.00193973	30.2198849	0.003572622	1.807718936	0.001432574	0	0.005718288	18.00767964	0.0023964	98.78842745	0.000692	7.444369522	0.018599	0	0.0744451	0	0.000764	0.610888967	0.00347685	225.7687023	382.6476718	0.191323836
	Calhoun	0.08269981	1288.41894	0.001655986	0.837916278	0.061077496	0	0.002766524	8.712166492	0.0006108	25.18142401	0.000591	6.363124816	0.017004	0	0.0026334	0	0.000585	0.467766609	0.00301023	195.4687968	1525.45014	0.76272507
	Cameron	0.04837175	753.606038	0.000968599	0.490103603	0.297964476	0	0.001618161	5.095812433	0.0003573	14.7288064	0.000346	3.721840093	0.009946	0	0.0015403	0	0.000342	0.273600247	0.00176071	114.3311857	892.247387	0.446123693
	Cherokee	0.0035039	54.5888775	0.003533808	1.788079212	0.002587786	0	0.00585073	18.42475799	0.0015316	63.14003241	0.000505	5.434179169	0.004992	0	0.0173479	0	0.005936	4.747173589	0.03187642	2069.887427	2218.010527	1.109005263
	Coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Coleman	0.00129879	20.2344074	2.6007E-05	0.013159337	0.000959212	0	4.34478E-05	0.13682314	9.593E-06	0.395470118	9.28E-06	0.099931828	0.000267	0	4.136E-05	0	9.19E-06	0.007346198	4.7275E-05	3.069805273	23.9569433	0.011978472
	Crockett	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Ector	0.00353575	55.0850638	0.003565928	1.804331981	0.002611307	0	0.005903911	18.59223006	0.0015456	63.71394455	0.000509	5.483573211	0.005037	0	0.0175056	0	0.00599	4.790323084	0.03216616	2088.701695	2238.171162	1.119085581
	Fannin	0.00705631	109.933622	0.007116546	3.600917146	0.005211403	0	0.011782473	37.10463524	0.0030845	127.1543362	0.001017	10.94360295	0.010052	0	0.034936	0	0.011954	9.560079138	0.06419422	4168.435646	4466.732839	2.23336642
	Fayette	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Freestone	0.00367718	57.2884664	0.003708565	1.87650526	0.00271576	0	0.006140067	19.33591927	0.0016074	66.26250234	0.00053	5.70291614	0.005238	0	0.0182058	0	0.006229	4.981936008	0.03345281	2172.249763	2327.698009	1.163849004
	Frio	0.00858833	133.801677	0.000871383	0.440913051	0.006342868	0	0.001420864	4.474497552	0.0004718	19.44979246	0.000218	2.351060401	0.206661	0	0.0127478	0	0.000188	0.149994103	0.00088683	57.58586589	218.2538003	0.1091269
	Grimes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hardeman	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Haskell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hidalgo	0.18852746	2937.15729	0.003775086	1.910164325	0.139235931	0	0.006306735	19.86077853	0.0013925	57.40508815	0.001348	14.5057619	0.038764	0	0.0060032	0	0.001333	1.066348886	0.00686231	445.6024213	3477.507852	1.738753926
	Howard	0.00055511	8.64836544	0.000559851	0.283280462	0.000409976	0	0.000926915	2.918983636	0.0002427	10.00310134	8E-05	0.860922031	0.000791	0	0.0027484	0	0.00094	0.75208163	0.00505009	327.9265612	351.3932957	0.175696648
	Jack	0.00212145	33.0510383	0.002139557	1.082599189	0.001566784	0	0.003542346	11.15533804	0.0009273	38.22836673	0.000306	3.290143927	0.003022	0	0.0105033	0	0.003594	2.874193851	0.0192997	1253.221017	1342.902697	0.671451349
	Jones	0.04071872	634.375991	0.000815354	0.412562988	0.030072592	0	0.001362147	4.289590179	0.0003008	12.39852214	0.000291	3.132997716	0.008372	0	0.0012966	0	0.000288	0.230313213	0.00148214	96.24253988	751.082517	0.375541258
	Lamar	0.00095084	14.8135469	0.000958954	0.485223299	0.000702236	0	0.001587687	4.99984665	0.0004156	17.1340367	0.000137	1.474649628	0.001355	0	0.0047076	0	0.001611	1.288219904	0.00865017	561.696372	601.8918951	0.300945948
	Limestone	0.00071976	11.2134271	0.000891528	0.451106014	0.000531572	0	0.000300183	0.945318058	0.0054552	224.8840923	0.001239	13.33945975	0.000498	0	0.000316	0	0.000381	0.304682895	0.00052318	33.97250146	285.1105876	0.142555294
	Llano	0.00123817	19.2900903	0.047274044	23.92029892	0.000914447	0	0.082844655	260.8892568	0.0007657	31.56575432	0.0022	23.68156412	0.000657	0	0.0011486	0	0.000249	0.198855761	0.00113586	73.75686935	433.3026896	0.216651345
	McLennan	0.02453432	382.231587	0.024743738	12.52013939	0.018119687	0	0.040966843	129.0102456	0.0107245	442.106816	0.003535	38.05014914	0.034951	0	0.1214699	0	0.041562	33.2397327	0.22319886	14493.36189	15530.52056	7.765260282
	Milam	0.0022454	34.9822119	0.002264571	1.145855507	0.001658332	0	0.003749326	11.80714493	0.0009815	40.46205189	0.000324	3.482387181	0.003199	0	0.011117	0	0.003804	3.042133124	0.02042738	1326.446777	1421.368561	0.710684281
	Mitchell	0.01494317	232.806605	0.015070721	7.625667896	0.011036196	0	0.024951762	78.57654433	0.006532	269.2749375	0.002153	23.17528516	0.021288	0	0.073984	0	0.025314	20.24539461	0.1359442	8827.502716	9459.20715	4.729603575
	Nolan	0.00056465	8.79700377	0.000569473	0.288149167	0.000417022	0	0.000942846	2.969151828	0.0002468	10.17502334	8.14E-05	0.875718586	0.000804	0	0.0027956	0	0.000957	0.765007559	0.00513689	333.5625923	357.4326465	0.178716323
	Palo Pinto	0.003207	49.963325	0.005906709	2.988748931	0.002368511	0	0.009454195	29.77256707	0.003962	163.3294873	0.001144	12.30797056	0.03075	0	0.1230821	0	0.001263	1.009998685	0.00574838	373.2692923	632.6413898	0.316320695
	Pecos	4.0968E-05	0.6382546	4.13174E-05	0.02090627	3.02565E-05	0	6.84069E-05	0.215422759	1.791E-05	0.738234934	5.9E-06	0.063536567	5.84E-05	0	0.0002028	0	6.94E-05	0.05550408	0.0003727	24.20117871	25.93303792	0.012966519
	Presidio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Robertson	0.00073771	11.4930933	0.000835096	0.42255229	0.00054483	0	0.000735917	2.317504432	0.0031497	129.842168	0.000731	7.866629834	0.000761	0	0.0018663	0	0.191633	153.2623576	0.00339774	220.6312247	525.8355301	0.262917765
	Taylor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Titus	0.00569644	88.7474584	0.005745061	2.906956375	0.004207073	0	0.009511781	29.95391218	0.00249	102.6494344	0.000821	8.834576049	0.008115	0	0.0282032	0	0.00965	7.717681876	0.05182285	3365.103968	3605.913987	1.802956994
	Tom Green	0.00148245	23.0957506	2.96846E-05	0.015020196	0.001094854	0	4.95918E-05	0.156171271	1.095E-05	0.451393462	1.06E-05	0.114063166	0.000305	0	4.72E-05	0	1.05E-05	0.008385022	5.396E-05	3.503905774	27.34468948	0.013672345
	Upton	3.1166E-05	0.48555165	3.14322E-05	0.015904427	2.30176E-05	0	5.20405E-05	0.163882681	1.362E-05	0.561611598	4.49E-06	0.048335389	4.44E-05	0	0.0001543	0	5.28E-05	0.042224681	0.00028353	18.41102613	19.72853655	0.009864268
	Ward	0.01855953	289.147565	0.01871795	9.471137218	0.013707039	0	0.030990277	97.59266253	0.0081128	334.4415096	0.002674	28.7838795	0.02644	0	0.0918886	0	0.03144	25.14493327	0.16884373	10963.82516	11748.40684	5.874203422
	Webb	0.02001433	311.812552	0.000400768	0.202785603	0.014781473	0	0.000669531	2.108446851	0.0001478	6.094201047	0.000143	1.539951112	0.004115	0	0.0006373	0	0.000142	0.113205026	0.00072851	47.30574989	369.1768914	0.184588446
	Wharton	0.00014434	2.24873556	0.000178787	0.090464594	0.000106601	0	6.01986E-05	0.189573653	0.001094	45.09815337	0.000249	2.675089179	9.99E-05	0	6.336E-05	0	7.64E-05	0.061100969	0.00010492	6.812829956	57.17594727	0.028587974
	Wichita	0.00020763	3.23481476	0.000209406	0.105957574	0.000153346	0	0.000346701	1.091809939	9.076E-05	3.741537064	2.99E-05	0.3220173	0.000296	0	0.001028	0	0.000352	0.281306887	0.00188893	122.6568982	131.4343417	0.065717171
	Wilbarger	0.02861682	445.834775	0.000573025	0.28994623	0.021134796	0	0.000957307	3.014692388	0.0002114	8.713590054	0.000205	2.201847723	0.005884	0	0.0009112	0	0.000202	0.16186243	0.00104164	67.63854828	527.8552618	0.263927631
	Wise	0.00284449	44.3156001	0.002882008	1.458273686	0.002100781	0	0.00476997	15.02129566	0.0012561	51.78039039	0.000413	4.447839826	0.004182	0	0.0146143	0	0.004798	3.837262622	0.02576141	1672.810762	1793.671424	0.896835712
	Young	0.00623586	97.1513181	0.006289085	3.182227961	0.004605458	0	0.010412491	32.7903706	0.0027258	112.3697291	0.000899	9.671158179	0.008883	0	0.0308739	0	0.010564	8.44850073	0.05673017	3683.759422	3947.372727	1.973686363
	Total	**1.12183722**	**17477.626**	**1.172570094**	**593.3113613**	**1.090766584**	**0**	**1.189130767**	**3744.736981**	**1.62936**	**67168.65921**	**1.542363**	**16600.91133**	**1.359386**	**0**	**1.2316428**	**0**	**1.221806**	**977.1665216**	**1.52878695**	**99271.39611**	**205833.8075**	**102.9169038**

Energy Savings by PCA (MWh)		American Electric Power - West (ERCOT)		Austin Energy		Brownsville Public Utils Board		Lower Colorado River Auhotrity		Reliant Energy HL&P		San Antonio Public Service Bd		South Texas Electric Coop INC		Texas Municipal Power Pool		Texas-New Mexico Power Co		TXU Electric
		15,579.47		505.99		0.00		3,149.14		41,223.95		10,763.30		0.00		0.00		799.77		64,934.75

Table 12: 2008 Totalized OSD Electricity Savings from IECC/IRC by PCA for Single-family Residences

PCA	Total Electricity Savings by PCA (MWh)
American Electric Power - West (ERCOT)/PCA	77.93
Austin Energy/PCA	2.95
Brownsville Public Utils Board/PCA	0.00
Lower Colorado River Authority/PCA	18.38
Reliant Energy HL&P/PCA	241.66
San Antonio Public Service Bd /PCA	63.16
South Texas Electric Coop Inc/PCA	0.00
Texas Municipal Power Pool/PCA	0.00
Texas-New Mexico Power Co/PCA	4.92
TXU Electric/PCA	401.40
El Paso Electric Co/PCA	0.30
Entergy Electric System/PCA	63.14
Total	873.86

Table 13: 2008 OSD NOx Reductions from IECC/IRC by PCA for Single-family Residences by County Using 2007 eGRID

Area	County	American Electric Power - West (ERCOT) /PCA	NOx Reductions (lbs)	Austin Energy/PCA	NOx Reductions (lbs)	Brownsville Public Utils Board/PCA	NOx Reductions (lbs/year)	Lower Colorado River Auhotrity /PCA	NOx Reductions (lbs)	Reliant Energy HL&P/PCA	NOx Reductions (lbs)	San Antonio Public Service Bd/PCA	NOx Reductions (lbs)	South Texas Electric Coop INC/PCA	NOx Reductions (lbs)	Texas Municipal Power Pool/PCA	NOx Reductions (lbs)	Texas-New Mexico Power Co/PCA	NOx Reductions (lbs)	TXU Electric/PCA	NOx Reductions (lbs)	Total Nox Reductions (lbs)	Total Nox Reductions (Tons)
Houston-Galveston Area	Brazoria	0.00957217	0.74593731	0.011806715	0.034878498	0.007069474	0	0.004263638	0.078378924	0.0710018	17.15863139	0.01614	1.019434852	0.006781	0	0.0051797	0	0.126288	0.621918971	0.008772	3.520986795	23.18016674	0.011590083
	Chambers	0.0218814	1.70516717	0.027103415	0.080066845	0.016160386	0	0.009125896	0.16776235	0.1658435	40.07853555	0.037677	2.379728943	0.015138	0	0.0096055	0	0.011582	0.057035149	0.015905	6.384432305	50.85272831	0.025426364
	Fort Bend	0.05569551	4.34022408	0.068987309	0.203797055	0.041133619	0	0.023228475	0.427011617	0.4221274	102.0133556	0.095902	6.057210712	0.038531	0	0.0244493	0	0.029479	0.14517364	0.040484	16.25052797	129.4373006	0.06471865
	Galveston	0.02755599	2.14737499	0.033893644	0.100126021	0.020351324	0	0.012791501	0.235147582	0.2014466	48.6825706	0.045813	2.893540538	0.019824	0	0.0167751	0	0.594657	2.928449421	0.028709	11.52411505	68.5113242	0.034255662
	Harris	0.07736057	6.02853277	0.09582276	0.283072303	0.057134232	0	0.032264145	0.593115349	0.5863312	141.6956464	0.133207	8.413411973	0.05352	0	0.0339599	0	0.040946	0.201644899	0.056232	22.57183926	179.7872629	0.089893631
	Liberty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Montgomery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Waller	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beaumont/ Port Arthur Area	Hardin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jefferson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Orange	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dallas/ Fort Worth Area	Collin	0.00176365	0.13743713	0.003151138	0.009308851	0.001302533	0	0.005050143	0.092837332	0.0020858	0.504052765	0.000604	0.038153983	0.015958	0	0.0637888	0	0.000846	0.004166887	0.004013	1.610921199	2.396878147	0.001198439
	Dallas	0.00504555	0.39318841	0.005305276	0.015672442	0.003726366	0	0.008757286	0.160986163	0.0024131	0.583158244	0.000782	0.049408126	0.00931	0	0.033672	0	0.008209	0.04042698	0.044002	17.66269226	18.90553263	0.009452766
	Denton	0.00063576	0.04954315	0.001170951	0.003459133	0.000469535	0	0.001874207	0.034453754	0.0007854	0.189811024	0.000227	0.014317903	0.006096	0	0.0243999	0	0.00025	0.001232875	0.00114	0.457425897	0.750243741	0.000375122
	Tarrant	0.01557224	1.21350935	0.015705165	0.046395004	0.011500796	0	0.026002176	0.478000886	0.006807	1.645008976	0.002244	0.141720791	0.022184	0	0.0770985	0	0.02638	0.129909221	0.141667	56.86589125	60.52043548	0.030260218
	Ellis	0.00350282	0.27296704	0.003532723	0.010436102	0.002586991	0	0.005848935	0.107521618	0.0015312	0.37002866	0.000505	0.031878704	0.00499	0	0.0173426	0	0.005934	0.029221807	0.031867	12.79142535	13.61347928	0.00680674
	Johnson	0.00033718	0.02627536	0.000621017	0.001834561	0.00024902	0	0.000993991	0.01827265	0.0004166	0.100666836	0.00012	0.007593542	0.003233	0	0.0129406	0	0.000133	0.000653859	0.000604	0.242597173	0.397893979	0.000198947
	Kaufman	0.00649275	0.50596538	0.006548174	0.019344116	0.004795187	0	0.01084145	0.199299575	0.0028381	0.685876532	0.000936	0.059089626	0.009249	0	0.0321458	0	0.010999	0.054164863	0.059067	23.70988903	25.23362912	0.012616815
	Parker	0.00047595	0.03708982	0.000876616	0.002589634	0.000351511	0	0.0014031	0.025793343	0.000588	0.142099488	0.00017	0.010718907	0.004564	0	0.0182667	0	0.000187	0.000922975	0.000853	0.342445789	0.561659957	0.00028083
	Rockwall	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Henderson	0.00095027	0.07405245	0.000958382	0.00283118	0.000701818	0	0.001586741	0.029169234	0.0004154	0.100384022	0.000137	0.008648283	0.001354	0	0.0047048	0	0.00161	0.007927501	0.008645	3.470149376	3.693162048	0.001846581
	Hood	0.01232788	0.96068369	0.012433111	0.036728949	0.00910469	0	0.020584816	0.37841295	0.0053888	1.302283568	0.001776	0.112194316	0.017562	0	0.0610356	0	0.020884	0.1028436	0.112152	45.01830497	47.91145204	0.023955726
	Hunt	0.00635121	0.49493539	0.006405424	0.018922416	0.004690653	0	0.010605108	0.194954867	0.0027763	0.6709245	0.000915	0.057801479	0.009048	0	0.031445	0	0.010759	0.052984075	0.05778	23.1930161	24.68353882	0.012341769
El Paso Area	El Paso	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Antonio Area	Bexar	0.03112811	2.42574281	0.048234164	0.142489695	0.0229895	0	0.084461674	1.552668303	0.0010637	0.257067272	1.065347	67.28781522	0.043667	0	0.0043501	0	0.000484	0.00238371	0.002333	0.936313294	72.6044803	0.03630224
	Comal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Guadalupe	0.00200761	0.15644851	0.076651484	0.226437978	0.00148271	0	0.134326688	2.469342369	0.0012416	0.300039095	0.003567	0.225324388	0.001066	0	0.0018623	0	0.000403	0.001985369	0.001842	0.739274628	4.118852335	0.002059426
	Wilson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Austin Area	Bastrop	0.00446951	0.34829906	0.170648096	0.504115612	0.003300936	0	0.299049574	5.497461395	0.002764	0.667972721	0.007942	0.501636445	0.002372	0	0.0041461	0	0.000898	0.004419999	0.0041	1.645836469	9.169741704	0.004584871
	Caldwell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hays	0.00246935	0.19243103	0.094281013	0.27851779	0.001823727	0	0.165221279	3.037281057	0.0015271	0.369046864	0.004388	0.27714808	0.001311	0	0.0022907	0	0.000496	0.002441996	0.002265	0.909304781	5.066171596	0.002533086
	Travis	0.00050761	0.03955682	0.298194277	0.88090283	0.000374892	0	0.033779905	0.620979723	0.0003331	0.080507044	0.000902	0.056961959	0.00027	0	0.0004695	0	0.000103	0.000506452	0.000465	0.186708883	1.866123712	0.000933062
	Williamson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North East Texas Area	Gregg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Harrison	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rusk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Smith	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Upshur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corpus Christi Area	Nueces	0.22352453	17.4187557	0.00447587	0.013222274	0.165082827	0	0.007477478	0.137459304	0.001651	0.398992582	0.001598	0.100923225	0.04596	0	0.0071176	0	0.001581	0.007784938	0.008136	3.265905602	21.34304366	0.010671522
	San Patricio	0.05533089	4.31180958	0.001107949	0.00327302	0.040864326	0	0.001850962	0.034026446	0.0004087	0.098765955	0.000396	0.024982366	0.011377	0	0.0017619	0	0.000391	0.00192707	0.002014	0.808436795	5.283221233	0.002641611
Victoria Area	Victoria	0.02060475	1.60568127	0.002090584	0.006175843	0.015217528	0	0.003408874	0.062665716	0.0011319	0.273550344	0.000524	0.03309956	0.495811	0	0.0305841	0	0.00045	0.002215837	0.002128	0.854043215	2.837431782	0.001418716
Other ERCOT counties	Andrews	2.5653E-05	0.00199905	2.58716E-05	7.6428E-05	1.89456E-05	0	4.28342E-05	0.000787426	1.121E-05	0.002709877	3.7E-06	0.000233461	3.65E-05	0	0.000127	0	4.35E-05	0.000214004	0.000233	0.093677033	0.099697283	4.98486E-05
	Angelina	0.00032149	0.02505299	0.000324234	0.000957828	0.000237435	0	0.000536817	0.009868365	0.0001405	0.033961337	4.63E-05	0.002925837	0.000458	0	0.0015917	0	0.000545	0.002681986	0.002925	1.17400072	1.249449068	0.000624725
	Bosque	0.00093945	0.0732094	0.001730301	0.005111525	0.000693828	0	0.002769496	0.050911953	0.0011606	0.280481766	0.000335	0.021157416	0.009008	0	0.0360555	0	0.00037	0.001821806	0.001684	0.675933468	1.108627336	0.000554314
	Brazos	0.00191393	0.14914791	0.003525105	0.010413597	0.00141352	0	0.005642234	0.103721805	0.0023645	0.571419351	0.000682	0.04310354	0.018351	0	0.073455	0	0.000754	0.003711526	0.003431	1.377064429	2.258582157	0.001129291
	Calhoun	0.08852525	6.89857023	0.001772635	0.005236584	0.065379841	0	0.0029614	0.054439747	0.0006539	0.158018081	0.000633	0.039969902	0.018202	0	0.0028189	0	0.000626	0.003083167	0.003222	1.293437919	8.452755634	0.004226378
	Cameron	0.05467229	4.2604865	0.001094762	0.003234061	0.285623104	0	0.001828931	0.033621432	0.0004038	0.097590352	0.000391	0.024685003	0.011242	0	0.0017409	0	0.000387	0.001904133	0.00199	0.798814045	5.220335524	0.002610168
	Cherokee	0.003513	0.27375969	0.003542982	0.010466406	0.002594504	0	0.005865919	0.10783384	0.0015356	0.371103151	0.000506	0.031971274	0.005005	0	0.0173929	0	0.005951	0.029306662	0.031959	12.82856915	13.65301017	0.006826505
	Coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Coleman	0.0013551	0.1055998	2.71346E-05	8.0159E-05	0.001000801	0	4.53316E-05	0.000833336	1.001E-05	0.00241886	9.69E-06	0.000611839	0.000279	0	4.315E-05	0	9.58E-06	4.71956E-05	4.93E-05	0.019799288	0.129390475	6.46952E-05
	Crockett	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Ector	0.00362926	0.28282022	0.003660242	0.010812809	0.002680373	0	0.006060061	0.111402781	0.0015864	0.383385429	0.000523	0.033029416	0.00517	0	0.0179686	0	0.006148	0.030276614	0.033017	13.25315206	14.10487933	0.00705244
	Fannin	0.00762852	0.59447284	0.007693632	0.022727942	0.005633999	0	0.012737922	0.234162634	0.0033346	0.805855482	0.001099	0.069426051	0.010867	0	0.0377689	0	0.012923	0.06363981	0.0694	27.85741043	29.64769519	0.014823848
	Fayette	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Freestone	0.00377443	0.29413303	0.003806652	0.011245322	0.002787588	0	0.006302464	0.115858892	0.0016499	0.398720846	0.000544	0.034350593	0.005377	0	0.0186873	0	0.006394	0.031487679	0.034338	13.78327814	14.6690745	0.007334537
	Frio	0.01476384	1.15051219	0.001497957	0.004425151	0.010903753	0	0.002442547	0.044901608	0.0008111	0.196005902	0.000375	0.023716692	0.355262	0	0.0219143	0	0.000322	0.001587705	0.001525	0.611944072	2.033093322	0.001016547
	Grimes	0.00055442	0.04320501	0.001021149	0.0030166	0.000409467	0	0.001634436	0.030046026	0.0006849	0.165528171	0.000198	0.012486189	0.005316	0	0.0212784	0	0.000218	0.001075151	0.000994	0.398906611	0.654263763	0.000327132
	Hardeman	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Haskell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hidalgo	0.239737	18.6821565	0.004800509	0.0141813	0.177056459	0	0.008019827	0.147429373	0.0017708	0.427931936	0.001714	0.108243294	0.049294	0	0.0076338	0	0.001695	0.008349588	0.008726	3.502785189	22.89107719	0.011445539
	Howard	0.00058508	0.04559402	0.000590075	0.001743155	0.000432108	0	0.000976955	0.017959466	0.0002558	0.061806335	8.43E-05	0.005324738	0.000833	0	0.0028967	0	0.000991	0.004880954	0.005323	2.136567245	2.273875908	0.001136938
	Jack	0.00217756	0.16969213	0.002196145	0.006487686	0.001608224	0	0.003636037	0.066841669	0.0009519	0.230031257	0.000314	0.01981765	0.003102	0	0.0107811	0	0.003689	0.018165969	0.01981	7.951891235	8.462927597	0.004231464
	Jones	0.04250012	3.31193757	0.000851025	0.002514034	0.031388236	0	0.00142174	0.026136002	0.0003139	0.075862969	0.000304	0.019189168	0.008739	0	0.0013533	0	0.000301	0.001480199	0.001547	0.620967171	4.058087112	0.002029044
	Lamar	0.00107998	0.08416041	0.001089199	0.003217629	0.000797614	0	0.001803327	0.033150755	0.0004721	0.114086168	0.000156	0.00982875	0.001539	0	0.005347	0	0.00183	0.009009583	0.009825	3.943815332	4.197268628	0.002098634
	Limestone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Llano	0.00124346	0.09689999	0.047475864	0.140249582	0.000918351	0	0.083198331	1.529444125	0.000769	0.18583613	0.00221	0.139559855	0.00066	0	0.0011535	0	0.00025	0.001229684	0.001141	0.457886784	2.55110615	0.001275553
	McLennan	0.02303137	1.79478194	0.023227961	0.068618272	0.017009692	0	0.038457253	0.706963945	0.0100675	2.432970458	0.003319	0.209605238	0.03281	0	0.1140288	0	0.039015	0.192135911	0.209526	84.10472861	89.50980437	0.044754902
	Milam	0.00165249	0.12877494	0.001666598	0.004923335	0.001220439	0	0.002759294	0.050724399	0.0007223	0.174564723	0.000238	0.015039098	0.002354	0	0.0081815	0	0.002799	0.01378568	0.015033	6.034482925	6.422295096	0.003211148
	Mitchell	0.01696145	1.32176729	0.017106233	0.050533932	0.012526789	0	0.028321847	0.52064365	0.0074142	1.791761277	0.002444	0.154363793	0.024163	0	0.0839765	0	0.028733	0.141498506	0.154305	61.9389337	65.91950216	0.032959751
	Nolan	0.00060327	0.04701168	0.000608422	0.001797355	0.000445544	0	0.001007331	0.018517883	0.0002637	0.06372809	8.69E-05	0.005490302	0.000859	0	0.0029868	0	0.001022	0.005032718	0.005488	2.202999918	2.344577944	0.001172289
	Palo Pinto	0.00307488	0.23961832	0.00566337	0.016730296	0.002270935	0	0.00906471	0.166637568	0.0037988	0.918031953	0.001096	0.069249364	0.029483	0	0.1180115	0	0.001211	0.005962871	0.005512	2.212366707	3.628597081	0.001814299
	Pecos	4.2262E-05	0.00329336	4.26225E-05	0.000125912	3.12122E-05	0	7.05678E-05	0.001297255	1.847E-05	0.004464418	6.09E-06	0.000384619	6.02E-05	0	0.0002092	0	7.16E-05	0.000352563	0.000384	0.154329331	0.164247462	8.21237E-05
	Presidio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Robertson	0.00035926	0.02799612	0.000406685	0.001201398	0.000265328	0	0.000358385	0.006588239	0.0015339	0.370681664	0.000356	0.022480719	0.000371	0	0.0009089	0	0.093323	0.459581188	0.001655	0.66419251	1.552721833	0.000776361
	Taylor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Titus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tom Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Upton	3.2238E-05	0.00251223	3.25131E-05	9.60478E-05	2.38092E-05	0	5.38302E-05	0.000989566	1.409E-05	0.003405528	4.65E-06	0.000293393	4.59E-05	0	0.0001596	0	5.46E-05	0.000268941	0.000293	0.117724835	0.125290542	6.26453E-05
	Ward	0.01980763	1.54356303	0.0199767	0.059013647	0.014628815	0	0.033074321	0.608008908	0.0086584	2.092423133	0.002854	0.18026641	0.028218	0	0.098068	0	0.033554	0.165242296	0.180198	72.33243592	76.98095334	0.038490477
	Webb	0.01418005	1.10501857	0.000283942	0.0008388	0.010472596	0	0.000474359	0.008720203	0.0001047	0.025311464	0.000101	0.006402411	0.002916	0	0.0004515	0	0.0001	0.000493864	0.000516	0.207183934	1.353969246	0.000676985
	Wharton	0.00015439	0.01203126	0.000191235	0.000564933	0.000114024	0	6.43902E-05	0.001183692	0.0011702	0.282784731	0.000266	0.016790808	0.000107	0	6.777E-05	0	8.17E-05	0.000402427	0.000112	0.045047054	0.358804904	0.000179402
	Wichita	0.00021984	0.01713186	0.000221719	0.000654987	0.000162364	0	0.000367089	0.006748233	9.61E-05	0.023223604	3.17E-05	0.00200076	0.000313	0	0.0010884	0	0.000372	0.001834008	0.002	0.802810793	0.854404243	0.000427202
	Wilbarger	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Wise	0.00291847	0.22742977	0.002955932	0.008732189	0.002155421	0	0.004892446	0.089938378	0.0012878	0.311204654	0.000424	0.026762701	0.004281	0	0.0149528	0	0.004924	0.024250496	0.026441	10.61335731	11.3016755	0.005650838
	Young	0.00549666	0.42834217	0.005543579	0.016376418	0.004059529	0	0.009178198	0.168723824	0.0024027	0.580652074	0.000792	0.05002433	0.00783	0	0.0272141	0	0.009311	0.045855105	0.050005	20.07241186	21.36238578	0.010681193
	Total	**1.14303735**	**89.0742903**	**1.154658244**	**3.411003472**	**1.089429227**	**0**	**1.180868675**	**21.70803949**	**1.5393506**	**372.0069371**	**1.443965**	**91.20152853**	**1.481727**	**0**	**1.2697054**	**0**	**1.151969**	**5.672992083**	**1.517783**	**609.2453892**	**1192.32018**	**0.59616009**

Energy Savings by PCA (MWh)		American Electric Power - West (ERCOT) /PCA		Austin Energy/PCA		Brownsville Public Utils Board/PCA		Lower Colorado River Auhotrity /PCA		Reliant Energy HL&P/PCA		San Antonio Public Service Bd/PCA		South Texas Electric Coop INC/PCA		Texas Municipal Power Pool/PCA		Texas-New Mexico Power Co/PCA		TXU Electric/PCA
		77.93		2.95		0.00		18.38		241.66		63.16		0.00		0.00		4.92		401.40

6.1.2 2008 Results for New Multi-family Residential Construction

In this section of the report, calculations are provided regarding the potential electricity reductions and associated emissions reductions from the implementation of the IECC/IRC to new multi-family residences in all the counties in ERCOT region as well as the 41 non-attainment and affected counties. To calculate the NOx emissions reductions from the implementation of the IECC /IRC in multi-family residences, new construction activity by county had to be determined. Then, energy savings attributable to the IECC/IRC had to be modeled using the code-traceable, DOE-2 simulation that the Laboratory has developed for the TERP. Next, these estimates were applied to the NAHB's survey data to determine the appropriate number of housing types. In addition, estimates of the NOx reduction potential from the electricity reductions in each county were calculated using the US EPA's 2007 eGRID database[27].

In Table 14 and Table 15, the 1999 and IECC/IRC code-compliant building characteristics for multi-family are shown for each county. The IECC/IRC code-compliant characteristics are the minimum building code characteristics required by the IECC/IRC for each county for multi-family residences (i.e., Type A.2). In Table 14 and Table 15, the rows are sorted first by the US EPA's non-attainment and affected designation, then alphabetically. Next, in the third column, the location of the TMY2 weather file is listed, followed by the NAHB survey classification. The fifth column in Table 14 and Table 15 lists the window area for the average house as defined by the NAHB survey[28]. The sixth, seventh, eighth and ninth columns show the NAHB's average glazing U-value, Solar Heat Gain Coefficient (SHGC), roof insulation and wall insulation, respectively. In columns ten through fourteen of Table 14 and Table 15, the corresponding values from the IECC/IRC code-compliant house are listed for each county (i.e., percent area, glazing U-value, SHGC, roof and wall insulation R-value). For each county the identical window percent area was used for the 1999 and code-compliant calculation (i.e., window-to-wall area).

The IECC/IRC SHGC is 0.4 for all non-attainment and affected counties since they all fall below the 3,500 HDD_{65}, as required by the IECC/IRC. All houses were assumed to have air conditioner efficiency[29] equal to a SEER 11, and furnace efficiency (AFUE) or 0.80. The values shown in Table 14 and Table 15, represent the only changes that were made to the simulation to obtain the savings calculations. All other variables in the simulation remained the same for the 1999 and IECC/IRC code-compliant simulation. In cases where the 1999 values were more efficient than the IECC/IRC code-compliant simulation, the 1999 values were used in both simulations, since this indicates that the prevailing practice is already above code.

In Table 16 and Table 17, the code-traceable simulation results for multi-family are shown for each county. In a similar fashion as Table 14 and Table 15, this table is first divided into US EPA affected and then non-attainment classifications, followed by an alphabetical listing of counties. In the third column, the IECC/IRC climate zone is listed followed by the number of projected new housing units[30] in the fourth column. In the fifth column, the total simulated energy use is listed if all new construction had been built to pre-code specifications, and, in the sixth column, the total county-wide energy use for code-compliant construction is shown. In a similar fashion as the 2007 report, the values in the fifth and sixth columns come from the associated tables in the 2007 Volume III Appendix to the 2007 Volume II Technical report. As previously explained, in the 2007 report, 18 simulations were run for each county, which were then

[27] This analysis assumes transmission and distribution losses of 7%. Counties were assigned to utility service districts as indicated in a fashion similar to the 2004 report.
[28] In a similar fashion as single-family, this value represents the NAHB's reported number of window units times an average window size of 3 x 5 feet, which was determined by surveying local building suppliers. Additional information about the procedures used to determine these values can be found in Im (2003).
[29] In a similar fashion as single-family, the choice of a SEER 11 efficiency for the air conditioner was based on ARI sales numbers for Texas which show an average SEER 11 for houses built in 1999.
[30] The number of projected new housing units uses the published values for the new housing units in 2006. A vacancy rate of 0% was assumed for 2006 calculations, based on information suggested by the Real Estate Center at Texas A&M University.

distributed according to the NAHB's survey data to account for 1, 2 or 3 story, and 3 fuel options (i.e., central air conditioning with electric resistance heating, heat pump heating, or a natural gas-fired furnace).

In the seventh and eighth columns, the total pre-code and code-compliant peak-day energy use is reported for peak OSD, Episode Day for the 2008 annual report across all counties. In a similar fashion as the annual pre-code and code-compliant energy use, these values are from the associated tables for each county in the Volume III Appendix to this report.

In the ninth and tenth columns, the total annual electricity and Ozone Season Day savings are shown for each county, respectively. In similar fashion as the 2007 report, a 7% transmission and distribution loss is used in the 2008 report, which represents a fixed 1.07 multiplier for the electricity use. In the eleventh and twelfth columns, the total annual pre-code and code-compliant natural gas use is shown for those residences that had natural gas-fired furnaces and domestic water heaters. Similarly, in columns thirteen and fourteen, the simulated total peak OSD natural gas use on the OSD, is shown for each county. Finally, in columns fifteen and sixteen, the total annual and peak-day natural gas savings are shown for each county.

In Table 18, the annual electricity savings from Table 16 and Table 17 are assigned to PCA provider(s) in a similar fashion as the single-family residential assignments. The total electricity savings for each PCA, as shown in Table 18, are then entered into the bottom row of Table 19 and Table 21, the 2007 US EPA eGRID database for Texas. eGRID then proportions each MWh of electricity savings according to the 1999 measured data from the power plants assigned to that PCA. For each county in which there is a power plant, the lbs-NOx/MWh are calculated and displayed as NOx reductions (lbs) in the column adjacent to the PCA column. In a similar fashion as the single-family residences, adding across the rows then totals the NOx reductions in each county from multiple PCAs that have power plants in that county. Counties that do not show NOx reductions represent counties that do not have power plants in eGRID's database. In Table 19, the PCA assignments for peak OSD reductions are shown for each county, and, in Table 21, the peak OSD NOx reductions are shown calculated with the 2007 eGRID.

Table 14: 1999 and IECC/IRC Code-compliant Building Characteristics used in the DOE-2 Simulations for Multi-family Residential (1)

		Climate Zone	1999 Average					2000 IECC				
			Area %	Glazing U-value (Btu/ hr-ft2-F)	SHGC	Roof Insulation (hr-ft2-F/Btu)	Wall Insulation (hr-ft2-F/Btu)	Area %	Glazing U-value (Btu/ hr-ft2-F)	SHGC	Roof Insulation (hr-ft2-F/Btu)	Wall Insulation (hr-ft2-F/Btu)
	BRAZORIA	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	CHAMBERS	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	COLLIN	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	DALLAS	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	DENTON	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	EL PASO	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	FORT BEND	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
Non-attainment	GALVESTON	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	HARDIN	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	HARRIS	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	JEFFERSON	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	LIBERTY	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	MONTGOMERY	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	ORANGE	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	TARRANT	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	WALLER	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	BASTROP	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	BEXAR	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	CALDWELL	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	COMAL	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	ELLIS	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	GREGG	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	GUADALUPE	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	HARRISON	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	HAYS	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	HENDERSON	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	HOOD	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	HUNT	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
Affected	JOHNSON	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	KAUFMAN	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	NUECES	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	PARKER	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	ROCKWALL	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	RUSK	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	SAN PATRICIO	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	SMITH	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	TRAVIS	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	UPSHUR	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	VICTORIA	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	WILLIAMSON	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	WILSON	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	ANDERSON	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	ANDREWS	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	ANGELINA	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	ARANSAS	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	ARCHER	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	ATASCOSA	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	AUSTIN	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	BANDERA	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	BAYLOR	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	BEE	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	BELL	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	BLANCO	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	BORDEN	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	BOSQUE	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	BRAZOS	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	BREWSTER	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	BRISCOE	8	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	BROOKS	2	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	BROWN	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	BURLESON	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	BURNET	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	CALHOUN	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	CALLAHAN	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	CAMERON	2	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	CHEROKEE	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	CHILDRESS	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	CLAY	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
ERCOT	COKE	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	COLEMAN	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	COLORADO	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	COMANCHE	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	CONCHO	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	COOKE	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	CORYELL	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	COTTLE	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	CRANE	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	CROCKETT	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	CROSBY	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	CULBERSON	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	DAWSON	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	DE WITT	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	DELTA	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	DICKENS	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	DIMMIT	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	DUVAL	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	EASTLAND	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	ECTOR	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	EDWARDS	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	ERATH	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	FALLS	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	FANNIN	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	FAYETTE	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	FISHER	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	FOARD	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	FRANKLIN	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	FREESTONE	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00

Table 15: 1999 and IECC/IRC Code-compliant Building Characteristics used in the DOE-2 Simulation for Multi-family Residential (2)

			1999 Average					2000 IECC				
		Climate Zone	Area %	Glazing U-value (Btu/ hr-ft2-F)	SHGC	Roof Insulation (hr-ft2-F/Btu)	Wall Insulation (hr-ft2-F/Btu)	Area %	Glazing U-value (Btu/ hr-ft2-F)	SHGC	Roof Insulation (hr-ft2-F/Btu)	Wall Insulation (hr-ft2-F/Btu)
	FRIO	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	GILLESPIE	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	GLASSCOCK	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	GOLIAD	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	GONZALES	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	GRAYSON	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	GRIMES	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	HALL	8	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	HAMILTON	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	HARDEMAN	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	HASKELL	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	HIDALGO	2	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	HILL	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	HOPKINS	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	HOUSTON	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	HOWARD	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	HUDSPETH	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	IRION	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	JACK	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	JACKSON	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	JEFF DAVIS	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	JIM HOGG	2	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	JIM WELLS	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	JONES	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	KARNES	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	KENDALL	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	KENEDY	2	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	KENT	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	KERR	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	KIMBLE	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	KING	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	KINNEY	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	KLEBERG	2	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	KNOX	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	LA SALLE	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	LAMAR	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	LAMPASAS	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	LAVACA	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	LEE	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	LEON	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	LIMESTONE	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	LIVE OAK	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	LLANO	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	LOVING	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	MADISON	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	MARTIN	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	MASON	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	MATAGORDA	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	MAVERICK	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	MCCULLOCH	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	MCLENNAN	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	MCMULLEN	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
ERCOT	MEDINA	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	MENARD	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	MIDLAND	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	MILAM	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	MILLS	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	MITCHELL	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	MONTAGUE	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	MOTLEY	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	NACOGDOCHES	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	NAVARRO	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	NOLAN	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	PALO PINTO	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	PECOS	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	PRESIDIO	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	RAINS	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	REAGAN	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	REAL	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	RED RIVER	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	REEVES	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	REFUGIO	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	ROBERTSON	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	RUNNELS	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	SAN SABA	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	SCHLEICHER	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	SCURRY	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	SHACKELFORD	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	SOMERVELL	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	STARR	2	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	STEPHENS	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	STERLING	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	STONEWALL	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	SUTTON	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	TAYLOR	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	TERRELL	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	THROCKMORTON	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	TITUS	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	TOM GREEN	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	UPTON	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	UVALDE	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	VAL VERDE	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	VAN ZANDT	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	WARD	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	WASHINGTON	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	WEBB	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	WHARTON	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	WICHITA	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	WILBARGER	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	WILLACY	2	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	WINKLER	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	WISE	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	YOUNG	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	ZAPATA	2	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	ZAVALA	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00

Table 16: 2008 Annual and OSD Electricity and Natural Gas Savings from Implementation of the IECC/IRC for Multi-family Residences (1)

2008Summary															
	County	Climate Zone	No. of Projected Units (2006)	Precode Total Annual Elec. Use (MWh/yr)	Code-compliant Total Annual Elec. Use (MWh/yr)	Precode OSD Elec. Use (MWh/day)	Code-compliant OSD Elec. Use (MWh/day)	Total Annual Elec. Savings (MWh/yr) w/ 7% of T&D Loss	Total OSD Elec. Savings (MWh/day) w/ 7% of T&D Loss	Precode Total NG Use (Therm/yr)	Code-compliant Total NG Use (Therm/yr)	Precode OSD NG Use (Therm/day)	Code-compliant OSD NG Use (Therm/day)	Total Annual NG Savings (Therm/yr)	Total OSD NG Savings (Therm/day)
Affected County	BASTROP	4	3	21	20	0.07	0.07	1.16	0.01	116	92	0.27	0.20	24.25	0.07
	BEXAR	4	4,562	31,938	30,484	108.17	98.87	1,556.46	9.95	179,799	142,940	420.94	314.19	36,859.42	106.75
	CALDWELL	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0.00	0.00
	COMAL	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0.00	0.00
	ELLIS	5	226	1,726	1,657	5.77	5.23	73.63	0.58	10,462	8,748	20.50	15.22	1,714.15	5.29
	GREGG	6	53	396	376	1.33	1.20	21.46	0.14	2,376	1,915	4.81	3.57	461.13	1.24
	GUADALUPE	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0.00	0.00
	HARRISON	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0.00	0.00
	HAYS	5	733	5,205	4,935	18.03	16.38	289.19	1.76	28,312	22,280	66.83	49.68	6,031.51	17.15
	HENDERSON	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0.00	0.00
	HOOD	5	36	275	264	0.92	0.83	11.73	0.09	1,667	1,393	3.27	2.42	273.05	0.84
	HUNT	6	18	138	131	0.46	0.41	7.39	0.05	833	678	1.63	1.21	154.91	0.42
	JOHNSON	5	10	76	73	0.26	0.23	3.26	0.03	463	387	0.91	0.67	75.85	0.23
	KAUFMAN	6	76	581	552	1.94	1.75	31.11	0.20	3,522	2,864	6.89	5.12	657.35	1.78
	NUECES	3	363	2,641	2,484	8.88	8.11	168.70	0.83	13,552	10,544	33.21	24.72	3,008.42	8.49
	PARKER	6	16	122	116	0.41	0.37	6.56	0.04	741	603	1.45	1.08	137.69	0.37
	ROCKWALL	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0.00	0.00
	RUSK	5	8	57	55	0.18	0.17	2.20	0.02	356	294	0.76	0.57	61.83	0.19
	SAN PATRICI	3	6	44	41	0.15	0.13	2.79	0.01	224	174	0.55	0.41	49.73	0.14
	SMITH	5	89	665	638	2.23	2.03	29.03	0.22	3,986	3,302	8.07	5.99	683.72	2.08
	TRAVIS	5	2,956	20,996	19,904	72.71	66.06	1,168.76	7.12	114,046	89,851	269.51	200.34	24,195.13	69.17
	UPSHUR	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0.00	0.00
	VICTORIA	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0.00	0.00
	WILLIAMSON	5	390	2,771	2,626	9.60	8.72	154.52	0.94	15,047	11,853	35.56	26.43	3,193.24	9.13
	WILSON	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0.00	0.00
Nonattainment County	BRAZORIA	3	150	1,061	1,006	3.59	3.28	58.50	0.34	5,766	4,545	13.78	10.27	1,220.44	3.51
	CHAMBERS	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0.00	0.00
	COLLIN	6	2,502	19,124	18,355	63.98	57.98	822.21	6.42	115,817	96,731	226.99	168.44	19,085.65	58.55
	DALLAS	5	10,606	81,019	77,786	270.75	245.48	3,459.10	27.03	490,978	410,534	962.21	714.03	80,443.54	248.18
	DENTON	6	1,635	12,493	11,865	41.78	37.69	671.75	4.38	75,684	61,542	148.33	110.07	14,141.59	38.26
	EL PASO	6	1,084	7,825	7,466	23.74	21.78	384.82	2.10	48,361	39,240	103.38	78.02	9,120.64	25.37
	FORT BEND	4	198	1,401	1,329	4.75	4.33	77.45	0.44	7,611	6,000	18.18	13.55	1,610.98	4.63
	GALVESTON	3	167	10,731	10,178	36.33	33.16	591.87	3.39	58,310	45,967	139.31	103.81	12,342.71	35.50
	HARDIN	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0.00	0.00
	HARRIS	4	13,054	92,367	87,596	312.82	285.50	5,104.87	29.22	501,766	395,555	1,198.80	893.34	106,210.75	305.46
	JEFFERSON	4	982	6,990	6,623	23.65	21.56	392.70	2.24	38,268	30,328	91.17	68.19	7,939.37	22.98
	LIBERTY	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0.00	0.00
	MONTGOME	4	854	6,047	5,733	20.49	18.70	335.89	1.92	32,824	25,875	78.43	58.44	6,948.51	19.98
	ORANGE	4	320	2,278	2,159	7.71	7.03	128.04	0.73	12,470	9,883	29.71	22.22	2,587.17	7.49
	TARRANT	5	3,305	25,245	24,237	84.39	76.51	1,078.79	8.43	152,997	127,929	299.84	222.50	25,067.50	77.34
	WALLER	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0.00	0.00
ERCOT	ANDERSON	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	ANDREWS	6	4	34	33	0.10	0.10	0.86	0.00	187	157	0.39	0.30	**29**	**0.09**
	ANGELINA	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	ARANSAS	3	14	102	96	0.34	0.31	6.51	0.03	523	407	1.28	0.95	**116**	**0.33**
	ARCHER	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	ATASCOSA	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	AUSTIN	4	10	71	67	0.24	0.22	3.91	0.02	384	303	0.92	0.68	**81**	**0.23**
	BANDERA	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	BAYLOR	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	BEE	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	BELL	5	559	4,641	4,547	14.69	14.16	101.26	0.57	24,311	20,311	52.97	39.89	**4,000**	**13.08**
	BLANCO	5	36	256	242	0.89	0.80	14.23	0.09	1,389	1,094	3.28	2.44	**295**	**0.84**
	BORDEN	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	BOSQUE	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	BRAZOS	4	1,344	9,510	9,019	32.21	29.39	525.58	3.01	51,660	40,725	123.43	91.98	**10,935**	**31.45**
	BREWSTER	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	BRISCOE	8	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	BROOKS	2	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	BROWN	5	82	681	667	2.15	2.08	14.85	0.08	3,566	2,979	7.77	5.85	**587**	**1.92**
	BURLESON	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	BURNET	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	CALHOUN	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	CALLAHAN	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	CAMERON	2	220	1,788	1,721	5.72	5.50	71.65	0.23	8,085	6,263	20.04	14.89	**1,823**	**5.15**
	CHEROKEE	5	74	531	512	1.71	1.56	20.39	0.15	3,292	2,720	7.03	5.30	**572**	**1.73**
	CHILDRESS	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	CLAY	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	COKE	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	COLEMAN	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	COLORADO	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	COMANCHE	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	CONCHO	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	COOKE	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	CORYELL	5	30	249	244	0.79	0.76	5.43	0.03	1,305	1,090	2.84	2.14	**215**	**0.70**
	COTTLE	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	CRANE	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	CROCKETT	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	CROSBY	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	CULBERSON	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	DAWSON	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	DE WITT	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	DELTA	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	DICKENS	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	DIMMIT	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	DUVAL	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	EASTLAND	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	ECTOR	6	462	3,923	3,830	11.69	11.26	98.86	0.45	21,542	18,151	45.27	34.46	**3,392**	**10.81**
	EDWARDS	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	ERATH	6	222	1,928	1,884	5.72	5.52	46.95	0.21	10,409	8,810	21.32	16.13	**1,600**	**5.19**
	FALLS	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	FANNIN	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	FAYETTE	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	FISHER	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	FOARD	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	FRANKLIN	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	FREESTONE	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	FRIO	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**

Table 17: 2008 Annual and OSD Electricity and Natural Gas Savings from Implementation of the IECC/IRC for Multi-family Residences (2)

2008Summary															
	County	Climate Zone	No. of Projected Units (2006)	Precode Total Annual Elec. Use (MWh/yr)	Code-compliant Total Annual Elec. Use (MWh/yr)	Precode OSD Elec. Use (MWh/day)	Code-compliant OSD Elec. Use (MWh/day)	Total Annual Elec. Savings (MWh/yr) w/ 7% of T&D Loss	Total OSD Elec. Savings (MWh/day) w/ 7% of T&D Loss	Precode Total NG Use (Therm/yr)	Code-compliant Total NG Use (Therm/yr)	Precode OSD NG Use (Therm/day)	Code-compliant OSD NG Use (Therm/day)	Total Annual NG Savings (Therm/yr)	Total OSD NG Savings (Therm/day)
	GILLESPIE	5	49	348	330	1.21	1.09	19.37	0.12	1,890	1,489	4.47	3.32	**401**	**1.15**
	GLASSCOCK	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	GOLIAD	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	GONZALES	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	GRAYSON	6	18	138	131	0.46	0.41	7.39	0.05	833	678	1.63	1.21	**155**	**0.42**
	GRIMES	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	HALL	8	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	HAMILTON	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	HARDEMAN	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	HASKELL	6	3	26	25	0.08	0.07	0.63	0.00	141	119	0.29	0.22	**22**	**0.07**
	HIDALGO	2	557	4,527	4,357	14.48	13.93	181.39	0.59	20,470	15,856	50.74	37.71	**4,615**	**13.03**
	HILL	5	8	66	65	0.21	0.20	1.45	0.01	348	291	0.76	0.57	**57**	**0.19**
	HOPKINS	6	2	15	15	0.05	0.05	0.66	0.01	93	77	0.18	0.13	**15**	**0.05**
	HOUSTON	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	HOWARD	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	HUDSPETH	6	10	81	79	0.26	0.25	2.44	0.01	417	336	0.95	0.72	**80**	**0.23**
	IRION	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	JACK	6	8	69	68	0.21	0.20	1.69	0.01	375	317	0.77	0.58	**58**	**0.19**
	JACKSON	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	JEFF DAVIS	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	JIM HOGG	2	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	JIM WELLS	3	2	15	14	0.05	0.04	0.93	0.00	75	58	0.18	0.14	**17**	**0.05**
	JONES	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	KARNES	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	KENDALL	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	KENEDY	2	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	KENT	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	KERR	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	KIMBLE	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	KING	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	KINNEY	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	KLEBERG	2	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	KNOX	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	LA SALLE	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	LAMAR	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	LAMPASAS	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	LAVACA	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	LEE	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	LEON	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	LIMESTONE	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	LIVE OAK	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	LLANO	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	LOVING	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	MADISON	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	MARTIN	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	MASON	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	MATAGORDA	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	MAVERICK	3	14	102	96	0.34	0.31	6.51	0.03	523	407	1.28	0.95	**116**	**0.33**
	MCCULLOCH	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	MCLENNAN	5	307	2,549	2,497	8.07	7.78	55.61	0.31	13,351	11,154	29.09	21.91	**2,197**	**7.18**
	MCMULLEN	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
ERCOT	MEDINA	4	2	14	13	0.05	0.04	0.68	0.00	79	63	0.18	0.14	**16**	**0.05**
	MENARD	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	MIDLAND	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	MILAM	4	8	57	54	0.19	0.17	3.13	0.02	308	242	0.73	0.55	**65**	**0.19**
	MILLS	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	MITCHELL	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	MONTAGUE	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	MOTLEY	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	NACOGDOCH	5	15	108	104	0.35	0.32	4.13	0.03	667	551	1.42	1.07	**116**	**0.35**
	NAVARRO	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	NOLAN	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	PALO PINTO	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	PECOS	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	PRESIDIO	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	RAINS	6	4	31	29	0.10	0.09	1.31	0.01	185	155	0.36	0.27	**31**	**0.09**
	REAGAN	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	REAL	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	RED RIVER	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	REEVES	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	REFUGIO	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	ROBERTSON	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	RUNNELS	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	SAN SABA	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	SCHLEICHER	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	SCURRY	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	SHACKELFO	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	SOMERVELL	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	STARR	2	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	STEPHENS	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	STERLING	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	STONEWALL	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	SUTTON	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	TAYLOR	6	6	52	51	0.15	0.15	1.27	0.01	281	238	0.58	0.44	**43**	**0.14**
	TERRELL	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	THROCKMOR	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	TITUS	6	75	573	550	1.92	1.74	24.65	0.19	3,472	2,900	6.80	5.05	**572**	**1.76**
	TOM GREEN	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	UPTON	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	UVALDE	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	VAL VERDE	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	VAN ZANDT	6	4	31	29	0.10	0.09	1.31	0.01	185	155	0.36	0.27	**31**	**0.09**
	WARD	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	WASHINGTO	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	WEBB	3	419	3,049	2,867	10.26	9.36	194.72	0.96	15,643	12,170	38.34	28.53	**3,473**	**9.80**
	WHARTON	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	WICHITA	7	4	36	35	0.10	0.10	0.85	0.00	196	168	0.38	0.29	**28**	**0.09**
	WILBARGER	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	WILLACY	2	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	WINKLER	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	WISE	6	8	61	59	0.20	0.19	2.63	0.02	370	309	0.73	0.54	**61**	**0.19**
	YOUNG	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	ZAPATA	2	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	ZAVALA	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	TOTAL		**48,982**					**18,057**	**115.90**					**400,112**	**1,178**

Table 18: 2008 Total Annual Electricity Savings from IECC/IRC by PCA for Multi-family Residences

PCA	Total Electricity Savings by PCA (MWh)
American Electric Power - West(ERCOT)/PCA	695.57
Austin Energy/PCA	50.54
Brownsville Public Utils Board/PCA	0.00
Lower Colorado River Authority/PCA	310.28
Reliant Energy HL&P/PCA	4,690.79
San Antonio Public Service Bd /PCA	1,582.44
South Texas Electric Coop Inc/PCA	0.00
Texas Municipal Power Pool/PCA	0.00
Texas-New Mexico Power Co/PCA	95.45
TXU Electric/PCA	7,993.10
El Paso Electric Co/PCA	7.81
Entergy Electric System/PCA	1,704.16
Total	17,130.15

Table 19: 2008 Annual NOx Reductions from IECC/IRC by PCA for Multi-family Residences by County using 2007 eGRID

Area	County	American Electric Power - West (ERCOT) /PCA	NOx Reductions (lbs)	Austin Energy/PCA	NOx Reductions (lbs)	Brownsville Public Utils Board/PCA	NOx Reductions (lbs/year)	Lower Colorado River Auhotrity /PCA	NOx Reductions (lbs)	Reliant Energy HL&P/PCA	NOx Reductions (lbs)	San Antonio Public Service Bd/PCA	NOx Reductions (lbs)	South Texas Electric Coop INC/PCA	NOx Reductions (lbs)	Texas Municipal Power Pool/PCA	NOx Reductions (lbs)	Texas-New Mexico Power Co/PCA	NOx Reductions (lbs)	TXU Electric/PCA	NOx Reductions (lbs)	Total Nox Reductions (lbs)	Total Nox Reductions (Tons)
Houston-Galveston Area	Brazoria	0.00883113	6.14263653	0.010890729	0.550465003	0.006522185	0	0.003944232	1.22381043	0.0654443	306.98575	0.014877	23.5426958	0.006262	0	0.0048171	0	0.121275	11.57558081	0.00816387	65.25465096	415.2755895	0.207637795
	Chambers	0.02176222	15.1370648	0.026955801	1.362463895	0.016072371	0	0.009076193	2.816147775	0.1649402	773.7007684	0.037472	59.2977814	0.015056	0	0.0095532	0	0.011519	1.099438434	0.01581859	126.4396306	979.8532953	0.489926648
	Fort Bend	0.07043123	48.9895809	0.087239726	4.409476757	0.052016606	0	0.029374182	9.114177778	0.5338124	2504.004375	0.121275	191.9112791	0.048726	0	0.030918	0	0.037279	3.558221424	0.05119528	409.2090911	3171.196202	1.585598101
	Galveston	0.03385674	23.5496012	0.041710519	2.108231765	0.025004711	0	0.015351589	4.763268261	0.2495874	1170.763206	0.056747	89.79899202	0.024143	0	0.0192972	0	0.567751	54.19132116	0.03283689	262.4686019	1607.643222	0.803821611
	Harris	0.06826733	47.4844445	0.084559408	4.274001741	0.050418468	0	0.028471701	8.834157393	0.5174117	2427.072338	0.117549	186.015073	0.047229	0	0.0299681	0	0.036133	3.44890004	0.04962237	396.6367132	3073.765628	1.536882814
	Liberty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Montgomery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Waller	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beaumont/ Port Arthur Area	Hardin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jefferson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Orange	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dallas/ Fort Worth Area	Collin	0.00203914	1.41835335	0.003716345	0.187840288	0.001505992	0	0.005950953	1.846452811	0.0024815	11.64010525	0.000717	1.134692146	0.019166	0	0.0766809	0	0.000864	0.082507137	0.0040002	31.97400324	48.28395422	0.024141977
	Dallas	0.00453947	3.15750239	0.004683963	0.236747926	0.003352602	0	0.00774211	2.402210435	0.0020856	9.783174398	0.000681	1.077739362	0.007503	0	0.026717	0	0.007525	0.718247802	0.04037045	322.6851774	340.0607997	0.1700304
	Denton	0.00047388	0.32961508	0.000872802	0.0441152	0.000349982	0	0.001396994	0.433457185	0.0005854	2.74619473	0.000169	0.267386262	0.004544	0	0.0181872	0	0.000187	0.017811319	0.00084941	6.789384333	10.62796411	0.005313982
	Tarrant	0.01216249	8.45981777	0.012266309	0.619992845	0.008982543	0	0.020308652	6.301338589	0.0053165	24.93863225	0.001753	2.773241529	0.017326	0	0.0602168	0	0.020603	1.966579434	0.11064724	884.4147093	929.4743117	0.464737156
	Ellis	0.00327981	2.28132722	0.003307809	0.167191137	0.002422289	0	0.005476558	1.699258262	0.0014337	6.725107103	0.000473	0.747849606	0.004672	0	0.0162384	0	0.005556	0.530320075	0.02983782	238.4967862	250.6478396	0.12532392
	Johnson	0.00028606	0.19897259	0.000526868	0.026630201	0.000211267	0	0.000843297	0.261657017	0.0003534	1.657744168	0.000102	0.161408079	0.002743	0	0.0109787	0	0.000113	0.010751827	0.00051274	4.098421046	6.415584929	0.003207792
	Kaufman	0.00632545	4.39977056	0.006379446	0.322445039	0.004671629	0	0.010562096	3.277191632	0.002765	12.97005006	0.000911	1.442303695	0.009011	0	0.0313175	0	0.010715	1.022775966	0.05754527	459.9652032	483.3997401	0.24169987
	Parker	0.00021749	0.15127832	0.000400576	0.020246869	0.000160626	0	0.000641157	0.198937115	0.0002687	1.260378364	7.75E-05	0.122718122	0.002085	0	0.0083471	0	8.56E-05	0.008174585	0.00038984	3.11601833	4.877751703	0.002438876
	Rockwall	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Henderson	0.00081989	0.57029115	0.000826893	0.041794805	0.000605529	0	0.001369042	0.424784282	0.0003584	1.681156923	0.000118	0.186949074	0.001168	0	0.0040593	0	0.001389	0.132570567	0.00745892	59.61994614	62.65749294	0.031328746
	Hood	0.01252711	8.71343342	0.012634039	0.638579521	0.009251829	0	0.020917482	6.490245504	0.0054759	25.68626389	0.001805	2.856380135	0.017846	0	0.062022	0	0.021221	2.025535233	0.11396431	910.9284495	957.3388872	0.478669444
	Hunt	0.00618756	4.30385605	0.006240374	0.315415773	0.004569788	0	0.010331844	3.205749221	0.0027047	12.68730441	0.000892	1.410861636	0.008815	0	0.0306347	0	0.010482	1.000479564	0.05629078	449.9380132	472.8616798	0.23643084
El Paso Area	El Paso	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Antonio Area	Bexar	0.03341375	23.2414736	0.051775843	2.616977234	0.024677545	0	0.090663423	28.13091308	0.0011418	5.356143152	1.143572	1809.637476	0.046874	0	0.0046695	0	0.00052	0.049593645	0.00250387	20.01365106	1889.046228	0.944523114
	Comal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Guadalupe	0.00200047	1.39145722	0.076378745	3.860515306	0.001477434	0	0.133848731	41.53038644	0.0012371	5.803136086	0.003555	5.62526359	0.001062	0	0.0018557	0	0.000402	0.038343638	0.00183516	14.66866052	72.91776279	0.036458881
	Wilson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Austin Area	Bastrop	0.00450233	3.13167092	0.171901148	8.688634747	0.003325174	0	0.301245466	93.4699982	0.0027843	13.06077708	0.008001	12.66044992	0.00239	0	0.0041765	0	0.000904	0.08629777	0.0041303	33.0138915	164.1117201	0.08205586
	Caldwell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hays	0.0024586	1.7101183	0.093870431	4.744621546	0.001815785	0	0.164501762	51.04136383	0.0015205	7.132126757	0.004369	6.913519237	0.001305	0	0.0022807	0	0.000494	0.04712481	0.00225544	18.02796705	89.61684154	0.044808421
	Travis	0.00051001	0.35474361	0.299602906	15.14323925	0.000376663	0	0.033939476	10.53069055	0.0003347	1.570050264	0.000906	1.433885133	0.000271	0	0.0004717	0	0.000103	0.009862453	0.00046734	3.735462713	32.77793396	0.016388967
	Williamson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North East Texas Area	Gregg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Harrison	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rusk	0.00068596	0.47713391	0.00069182	0.03496761	0.000506616	0	0.001145408	0.355395638	0.0002999	1.40653942	9.88E-05	0.156410885	0.000977	0	0.0033962	0	0.001162	0.110915124	0.00624051	49.88100952	52.42237211	0.026211186
	Smith	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Upshur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corpus Christi Area	Nueces	0.22756873	158.289102	0.004556851	0.230323165	0.168069652	0	0.007612767	2.362078134	0.0016809	7.88470021	0.001627	2.574312425	0.046792	0	0.0072464	0	0.001609	0.153618198	0.00828339	66.21002306	237.704157	0.118852078
	San Patricio	0.05031335	34.9962632	0.001007478	0.050922332	0.037158653	0	0.001683113	0.522233731	0.0003716	1.743234632	0.00036	0.569156779	0.010345	0	0.0016021	0	0.000356	0.033963569	0.00183138	14.63842659	52.55420088	0.0262771
Victoria Area	Victoria	0.02183674	15.1888938	0.002215582	0.111985198	0.016127403	0	0.003612695	1.12094175	0.0011996	5.627176641	0.000555	0.878871284	0.525456	0	0.0324127	0	0.000477	0.045515395	0.00225485	18.02324051	40.9966246	0.020498312
Other ERCOT counties	Andrews	2.4742E-05	0.01720975	2.49533E-05	0.001261248	1.82731E-05	0	4.13138E-05	0.012818774	1.082E-05	0.050732505	3.57E-06	0.005641588	3.52E-05	0	0.0001225	0	4.19E-05	0.0040006	0.00022509	1.799159351	1.890823821	0.000945412
	Angelina	0.00031082	0.21619581	0.000313473	0.015844296	0.000229554	0	0.000519	0.161034556	0.0001359	0.637321979	4.48E-05	0.070871881	0.000443	0	0.0015389	0	0.000527	0.050257139	0.00282766	22.60175807	23.75328373	0.011876642
	Bosque	0.00059539	0.41413435	0.001096604	0.055427136	0.000439723	0	0.001755208	0.544603448	0.0007356	3.450368735	0.000212	0.335948937	0.005709	0	0.0228507	0	0.000234	0.022378464	0.00106721	8.530305289	13.35316636	0.006676583
	Brazos	0.00193973	1.34920716	0.003572622	0.180575913	0.001432574	0	0.005718288	1.774262067	0.0023964	11.24094675	0.000692	1.094487112	0.018599	0	0.0744451	0	0.000764	0.072906735	0.00347685	27.79085799	43.50324374	0.021751622
	Calhoun	0.08269981	57.5231862	0.001655986	0.083700786	0.061077496	0	0.002766524	0.858393021	0.0006108	2.865346213	0.000591	0.935520205	0.017004	0	0.0026334	0	0.000585	0.055825752	0.00301023	24.06110997	86.38308216	0.043191541
	Cameron	0.04837175	33.645749	0.000968599	0.048957227	0.297964476	0	0.001618161	0.502080606	0.0003573	1.675962789	0.000346	0.547192882	0.009946	0	0.0015403	0	0.000342	0.032652907	0.00176071	14.07352619	50.52612165	0.025263061
	Cherokee	0.0035039	2.43719341	0.003533808	0.17861407	0.002587786	0	0.00585073	1.815355996	0.0015316	7.184583869	0.000505	0.798944632	0.004992	0	0.0173479	0	0.005936	0.566552918	0.03187642	254.7915054	267.7727503	0.133886375
	Coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Coleman	0.00129879	0.90339217	2.6007E-05	0.001314507	0.000959212	0	4.34478E-05	0.013480921	9.593E-06	0.044999791	9.28E-06	0.014692191	0.000267	0	4.136E-05	0	9.19E-06	0.000876734	4.7275E-05	0.377875771	1.356632084	0.000678316
	Crockett	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Ector	0.00353575	2.45934631	0.003565928	0.180237584	0.002611307	0	0.005903911	1.831856698	0.0015456	7.249888237	0.000509	0.806206649	0.005037	0	0.0175056	0	0.00599	0.571702608	0.03216616	257.1074361	270.2066742	0.135103337
	Fannin	0.00705631	4.90813354	0.007116546	0.359701327	0.005211403	0	0.011782473	3.655848403	0.0030845	14.46864941	0.001017	1.608951887	0.010052	0	0.034936	0	0.011954	1.140950638	0.06419422	513.1109933	539.2532285	0.269626614
	Fayette	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Freestone	0.00367718	2.55772017	0.003708565	0.187447088	0.00271576	0	0.006140067	1.905130965	0.0016074	7.539883766	0.00053	0.838454915	0.005238	0	0.0182058	0	0.006229	0.594570713	0.03345281	267.3917335	281.0149412	0.140507471
	Frio	0.00858833	5.97375474	0.000871383	0.044043504	0.006342868	0	0.001420864	0.440863645	0.0004718	2.213154789	0.000218	0.345657923	0.206661	0	0.0127478	0	0.000188	0.017901093	0.00088683	7.088496346	16.12387204	0.008061936
	Grimes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hardeman	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Haskell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hidalgo	0.18852746	131.133314	0.003775086	0.190809345	0.139235931	0	0.006306735	1.95684434	0.0013925	6.532015499	0.001348	2.132668106	0.038764	0	0.0060032	0	0.001333	0.127263742	0.00686231	54.8511529	196.9240676	0.098462034
	Howard	0.00055511	0.38611784	0.000559851	0.028297335	0.000409976	0	0.000926915	0.287601848	0.0002427	1.138233824	8E-05	0.126574596	0.000791	0	0.0027484	0	0.00094	0.089757418	0.00505009	40.36591609	42.42249895	0.021211249
	Jack	0.00212145	1.47560779	0.002139557	0.108142551	0.001566784	0	0.003542346	1.099114019	0.0009273	4.349932942	0.000306	0.483723989	0.003022	0	0.0105033	0	0.003594	0.343021565	0.0192997	154.2644617	162.1240045	0.081062002
	Jones	0.04071872	28.3225642	0.000815354	0.041211571	0.030072592	0	0.001362147	0.422645077	0.0003008	1.410804188	0.000291	0.460620018	0.008372	0	0.0012966	0	0.000288	0.027486802	0.00148214	11.84691559	42.53224742	0.021266124
	Lamar	0.00095084	0.6613706	0.000958954	0.048469725	0.000702236	0	0.001587687	0.492625282	0.0004156	1.949649358	0.000137	0.216806139	0.001355	0	0.0047076	0	0.001611	0.153743008	0.00865017	69.14166556	72.66432968	0.036332165
	Limestone	0.00071976	0.50063844	0.000891528	0.045061695	0.000531572	0	0.000300183	0.093140372	0.0054552	25.58913197	0.001239	1.961195873	0.000498	0	0.000316	0	0.000381	0.036362475	0.00052318	4.181823937	32.40735477	0.016203677
	Llano	0.00123817	0.86123187	0.047274044	2.389436612	0.000914447	0	0.082844655	25.70491709	0.0007657	3.591806982	0.0022	3.481714153	0.000657	0	0.0011486	0	0.000249	0.023732503	0.00113586	9.079055958	45.13189517	0.022565948
	McLennan	0.02453432	17.0652402	0.024743738	1.250656589	0.018119687	0	0.040966843	12.71113157	0.0107245	50.30649141	0.003535	5.59421422	0.034951	0	0.1214699	0	0.041562	3.967006306	0.22319886	1784.051368	1874.946108	0.937473054
	Milam	0.0022454	1.56182762	0.002264571	0.114461325	0.001658332	0	0.003749326	1.163335299	0.0009815	4.604099716	0.000324	0.511988004	0.003199	0	0.011117	0	0.003804	0.36306433	0.02042738	163.278141	171.5969172	0.085798459
	Mitchell	0.01494317	10.3939621	0.015070721	0.761740065	0.011036196	0	0.024951762	7.741995905	0.006532	30.64028159	0.002153	3.407279939	0.021288	0	0.073984	0	0.025314	2.416192958	0.1359442	1086.615956	1141.977409	0.570988704
	Nolan	0.00056465	0.39275399	0.000569473	0.028783677	0.000417022	0	0.000942846	0.292544823	0.0002468	1.157796501	8.14E-05	0.128750017	0.000804	0	0.0027956	0	0.000957	0.091300067	0.00513689	41.05967983	43.15160891	0.021575804
	Palo Pinto	0.003207	2.23067944	0.005906709	0.298550873	0.002368511	0	0.009454195	2.933433817	0.003962	18.58495086	0.001144	1.809544128	0.03075	0	0.1230821	0	0.001263	0.120538609	0.00574838	45.94735137	71.9250491	0.035962525
	Pecos	4.0968E-05	0.02849573	4.13174E-05	0.00208836	3.02565E-05	0	6.84069E-05	0.02122519	1.791E-05	0.084002345	5.9E-06	0.009341282	5.84E-05	0	0.0002028	0	6.94E-05	0.006624152	0.0003727	2.979029041	3.1308061	0.001565403
	Presidio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Robertson	0.00073771	0.51312452	0.000835096	0.042209419	0.00054483	0	0.000735917	0.228339258	0.0031497	14.77449266	0.000731	1.156568725	0.000761	0	0.0018663	0	0.191633	18.29114405	0.00339774	27.15846338	62.16434201	0.031082171
	Taylor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Titus	0.00569644	3.96224892	0.005745061	0.290380485	0.004207073	0	0.009511781	2.951301402	0.00249	11.68028337	0.000821	1.298878246	0.008115	0	0.0282032	0	0.00965	0.92106916	0.05182285	414.22538	435.3295415	0.217664771
	Tom Green	0.00148245	1.03114066	2.96846E-05	0.001500391	0.001094854	0	4.95918E-05	0.015387255	1.095E-05	0.051363201	1.06E-05	0.01676981	0.000305	0	4.72E-05	0	1.05E-05	0.001000713	5.396E-05	0.431311102	1.548473134	0.000774237
	Upton	3.1166E-05	0.0216781	3.14322E-05	0.001588718	2.30176E-05	0	5.20405E-05	0.016147046	1.362E-05	0.063904713	4.49E-06	0.007106372	4.44E-05	0	0.0001543	0	5.28E-05	0.005039318	0.00028353	2.26629381	2.381758079	0.001190879
	Ward	0.01855953	12.9093796	0.01871795	0.946086924	0.013707039	0	0.030990277	9.615617485	0.0081128	38.05546154	0.002674	4.231867461	0.02644	0	0.0918886	0	0.03144	3.000929933	0.16884373	1349.585239	1418.344581	0.709172291
	Webb	0.02001433	13.9212882	0.000400768	0.020256576	0.014781473	0	0.000669531	0.207741216	0.0001478	0.693447514	0.000143	0.226406903	0.004115	0	0.0006373	0	0.000142	0.013510489	0.00072851	5.82307186	20.90572278	0.010452861
	Wharton	0.00014434	0.10039781	0.000178787	0.009036652	0.000106601	0	6.01986E-05	0.018678328	0.001094	5.131632861	0.000249	0.393297326	9.99E-05	0	6.336E-05	0	7.64E-05	0.007292114	0.00010492	0.838621066	6.498956153	0.003249478
	Wichita	0.00020763	0.14442263	0.000209406	0.01058427	0.000153346	0	0.000346701	0.107573935	9.076E-05	0.425742367	2.99E-05	0.047343671	0.000296	0	0.001028	0	0.000352	0.033572658	0.00188893	15.09837459	15.86761412	0.007933807
	Wilbarger	0.02861682	19.9048895	0.000573025	0.028963189	0.021134796	0	0.000957307	0.297031847	0.0002114	0.991502794	0.000205	0.323720356	0.005884	0	0.0009112	0	0.000202	0.019317522	0.00104164	8.325925032	29.89135027	0.014945675
	Wise	0.00284449	1.97852921	0.002882008	0.145669272	0.002100781	0	0.00476997	1.480019394	0.0012561	5.891991868	0.000413	0.653930914	0.004182	0	0.0146143	0	0.004798	0.457959309	0.02576141	205.9136003	216.5217003	0.10826085
	Young	0.00623586	4.33745047	0.006289085	0.3178778	0.004605458	0	0.010412491	3.230772199	0.0027258	12.78633716	0.000899	1.421874338	0.008883	0	0.0308739	0	0.010564	1.008288965	0.05673017	453.4500749	476.5526758	0.238276338
	Total	**1.12183722**	**780.311978**	**1.172570094**	**59.26681326**	**1.090766584**	**0**	**1.189130767**	**368.9617381**	**1.62936**	**7642.993629**	**1.542363**	**2440.701452**	**1.359386**	**0**	**1.2316428**	**0**	**1.221806**	**116.6202444**	**1.52878695**	**12219.75076**	**23628.60662**	**11.81430331**

Energy Savings by PCA (MWh)																						
		695.57		50.54		0.00		310.28		4,690.79		1,582.44		0.00		0.00		95.45		7,993.10		

Table 20: 2008 Total OSD Electricity Savings from IECC/IRC by PCA for Multi-family Residences

PCA	Total Electricity Savings by PCA (MWh)
American Electric Power - West(ERCOT)/PCA	3.05
Austin Energy/PCA	0.31
Brownsville Public Utils Board/PCA	0.00
Lower Colorado River Authority/PCA	1.88
Reliant Energy HL&P/PCA	26.86
San Antonio Public Service Bd /PCA	10.10
South Texas Electric Coop Inc/PCA	0.00
Texas Municipal Power Pool/PCA	0.00
Texas-New Mexico Power Co/PCA	0.65
TXU Electric/PCA	58.05
El Paso Electric Co/PCA	0.04
Entergy Electric System/PCA	9.76
Total	110.69

Table 21: 2008 OSD NOx Reductions from IECC/IRC by PCA for Multi-family Residences by County using 2007 eGRID

Area	County	American Electric Power - West (ERCOT) /PCA	NOx Reductions (lbs)	Austin Energy/PCA	NOx Reductions (lbs)	Brownsville Public Utils Board/PCA	NOx Reductions (lbs/year)	Lower Colorado River Auhotrity /PCA	NOx Reductions (lbs)	Reliant Energy HL&P/PCA	NOx Reductions (lbs)	San Antonio Public Service Bd/PCA	NOx Reductions (lbs)	South Texas Electric Coop INC/PCA	NOx Reductions (lbs)	Texas Municipal Power Pool/PCA	NOx Reductions (lbs)	Texas-New Mexico Power Co/PCA	NOx Reductions (lbs)	TXU Electric/PCA	NOx Reductions (lbs)	Total Nox Reductions (lbs)	Total Nox Reductions (Tons)
Houston-Galveston Area	Brazoria	0.00957217	0.02922075	0.011806715	0.003606396	0.007069474	0	0.004263638	0.008032854	0.0710018	1.907016286	0.01614	0.162951088	0.006781	0	0.0051797	0	0.126288	0.081689118	0.008772	0.50919527	2.701711758	0.001350856
	Chambers	0.0218814	0.06679684	0.027103415	0.008278818	0.016160386	0	0.009125896	0.01719353	0.1658435	4.45434244	0.037677	0.380386662	0.015138	0	0.0096055	0	0.011582	0.007491572	0.015905	0.923298757	5.857788623	0.002928894
	Fort Bend	0.05569551	0.17002044	0.068987309	0.021072377	0.041133619	0	0.023228475	0.043763318	0.4221274	11.33779997	0.095902	0.968212018	0.038531	0	0.0244493	0	0.029479	0.019068572	0.040484	2.35010594	14.91004263	0.007455021
	Galveston	0.02755599	0.08411953	0.033893644	0.010352913	0.020351324	0	0.012791501	0.024099669	0.2014466	5.410597901	0.045813	0.462516636	0.019824	0	0.0167751	0	0.594657	0.384652119	0.028709	1.666585312	8.042924085	0.004021462
	Harris	0.07736057	0.23615688	0.09582276	0.029269344	0.057134232	0	0.032264145	0.060786861	0.5863312	15.74810363	0.133207	1.344837908	0.05352	0	0.0339599	0	0.040946	0.026486077	0.056232	3.264276313	20.70991701	0.010354959
	Liberty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Montgomery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Waller	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beaumont/ Port Arthur Area	Hardin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jefferson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Orange	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dallas/ Fort Worth Area	Collin	0.00176365	0.00538385	0.003151138	0.000962524	0.001302533	0	0.005050143	0.009514659	0.0020858	0.0560206	0.000604	0.006098706	0.015958	0	0.0637888	0	0.000846	0.000547321	0.004013	0.232966922	0.311494583	0.000155747
	Dallas	0.00504555	0.01540245	0.005305276	0.001620512	0.003726366	0	0.008757286	0.016499056	0.0024131	0.064812411	0.000782	0.007897619	0.00931	0	0.033672	0	0.008209	0.005310088	0.044002	2.554329193	2.665871325	0.001332936
	Denton	0.00063576	0.00194076	0.001170951	0.00035767	0.000469535	0	0.001874207	0.003531076	0.0007854	0.021095663	0.000227	0.002288639	0.006096	0	0.0243999	0	0.00025	0.000161938	0.00114	0.066151655	0.095527405	4.77637E-05
	Tarrant	0.01557224	0.04753704	0.015705165	0.004797189	0.011500796	0	0.026002176	0.048989077	0.006807	0.182826872	0.002244	0.022653294	0.022184	0	0.0770985	0	0.02638	0.017063589	0.141667	8.223786269	8.547653326	0.004273827
	Ellis	0.00350282	0.01069299	0.003532723	0.001079081	0.002586991	0	0.005848935	0.011019613	0.0015312	0.041125114	0.000505	0.005095637	0.00499	0	0.0173426	0	0.005934	0.003838287	0.031867	1.849860185	1.922710908	0.000961355
	Johnson	0.00033718	0.00102929	0.000621017	0.000189691	0.00024902	0	0.000993991	0.001872717	0.0004166	0.011188147	0.00012	0.001213786	0.003233	0	0.0129406	0	0.000133	8.58844E-05	0.000604	0.035083725	0.050663241	2.53316E-05
	Kaufman	0.00649275	0.01982028	0.006548174	0.002000159	0.004795187	0	0.01084145	0.020425699	0.0028381	0.076228557	0.000936	0.009445154	0.009249	0	0.0321458	0	0.010999	0.00711456	0.059067	3.42885789	3.563892298	0.001781946
	Parker	0.00047595	0.00145293	0.000876616	0.000267765	0.000351511	0	0.0014031	0.002643493	0.000588	0.015792987	0.00017	0.001713359	0.004564	0	0.0182667	0	0.000187	0.000121233	0.000853	0.049523553	0.071515316	3.57577E-05
	Rockwall	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Henderson	0.00095027	0.00290087	0.000958382	0.000292741	0.000701818	0	0.001586741	0.002989479	0.0004154	0.011156715	0.000137	0.001382381	0.001354	0	0.0047048	0	0.00161	0.001041278	0.008645	0.501843305	0.52160677	0.000260803
	Hood	0.01232788	0.03763305	0.012433111	0.00379773	0.00910469	0	0.020584816	0.038782566	0.0053888	0.144736251	0.001776	0.017933648	0.017562	0	0.0610356	0	0.020884	0.013508517	0.112152	6.510421452	6.766813212	0.003383407
	Hunt	0.00635121	0.0193882	0.006405424	0.001956556	0.004690653	0	0.010605108	0.019980421	0.0027763	0.074566783	0.000915	0.00923925	0.009048	0	0.031445	0	0.010759	0.006959464	0.05778	3.354109171	3.486199844	0.0017431
El Paso Area	El Paso	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Antonio Area	Bexar	0.03112811	0.09502409	0.048234164	0.014733267	0.0229895	0	0.084461674	0.159128966	0.0010637	0.028570546	1.065347	10.7555894	0.043667	0	0.0043501	0	0.000484	0.000313101	0.002333	0.135407012	11.18876638	0.005594383
	Comal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Guadalupe	0.00200761	0.00612859	0.076651484	0.023413421	0.00148271	0	0.134326688	0.253076525	0.0012416	0.03334645	0.003567	0.036016872	0.001066	0	0.0018623	0	0.000403	0.000260778	0.001842	0.106911831	0.459154464	0.000229577
	Wilson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Austin Area	Bastrop	0.00446951	0.01364399	0.170648096	0.052124963	0.003300936	0	0.299049574	0.563420626	0.002764	0.074238721	0.007942	0.080183843	0.002372	0	0.0041461	0	0.000898	0.000580567	0.0041	0.238016271	1.022208978	0.000511104
	Caldwell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hays	0.00246935	0.00753814	0.094281013	0.028798413	0.001823727	0	0.165221279	0.311283095	0.0015271	0.041015997	0.004388	0.044300605	0.001311	0	0.0022907	0	0.000496	0.000320756	0.002265	0.131501116	0.564758121	0.000282379
	Travis	0.00050761	0.00154957	0.298194277	0.091084319	0.000374892	0	0.033779905	0.063642609	0.0003331	0.008947581	0.000902	0.009105058	0.00027	0	0.0004695	0	0.000103	6.65225E-05	0.000465	0.027001317	0.201396973	0.000100698
	Williamson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North East Texas Area	Gregg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Harrison	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rusk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Smith	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Upshur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corpus Christi Area	Nueces	0.22352453	0.68234828	0.00447587	0.001367168	0.165082827	0	0.007477478	0.014087849	0.001651	0.044344175	0.001598	0.016132026	0.04596	0	0.0071176	0	0.001581	0.001022552	0.008136	0.472306141	1.231608191	0.000615804
	San Patricio	0.05533089	0.16890735	0.001107949	0.000338426	0.040864326	0	0.001850962	0.003487283	0.0004087	0.010976883	0.000396	0.003993295	0.011377	0	0.0017619	0	0.000391	0.000253121	0.002014	0.11691387	0.304870226	0.000152435
Victoria Area	Victoria	0.02060475	0.06289966	0.002090584	0.000638575	0.015217528	0	0.003408874	0.006422447	0.0011319	0.030402481	0.000524	0.005290784	0.495811	0	0.0305841	0	0.00045	0.00029105	0.002128	0.123509343	0.229454342	0.000114727
Other ERCOT counties	Andrews	2.5653E-05	7.8309E-05	2.58716E-05	7.90257E-06	1.89456E-05	0	4.28342E-05	8.07013E-05	1.121E-05	0.000301177	3.7E-06	3.73175E-05	3.65E-05	0	0.000127	0	4.35E-05	2.81094E-05	0.000233	0.013547311	0.014080828	7.04041E-06
	Angelina	0.00032149	0.00098141	0.000324234	9.90383E-05	0.000237435	0	0.000536817	0.001011383	0.0001405	0.003774475	4.63E-05	0.000467679	0.000458	0	0.0015917	0	0.000545	0.000352279	0.002925	0.169780703	0.176466964	8.82335E-05
	Bosque	0.00093945	0.00286785	0.001730301	0.000528526	0.000693828	0	0.002769496	0.005217835	0.0011606	0.031172841	0.000335	0.003381897	0.009008	0	0.0360555	0	0.00037	0.000239294	0.001684	0.097751609	0.141159849	7.05799E-05
	Brazos	0.00191393	0.0058426	0.003525105	0.001076754	0.00141352	0	0.005642234	0.01063018	0.0023645	0.063507746	0.000682	0.006889865	0.018351	0	0.073455	0	0.000754	0.000487509	0.003431	0.199147209	0.287581864	0.000143791
	Calhoun	0.08852525	0.27023902	0.001772635	0.000541457	0.065379841	0	0.0029614	0.005579389	0.0006539	0.017562185	0.000633	0.00638897	0.018202	0	0.0028189	0	0.000626	0.000404974	0.003222	0.187053377	0.487769376	0.000243885
	Cameron	0.05467229	0.16689686	0.001094762	0.000334398	0.285623104	0	0.001828931	0.003445774	0.0004038	0.010846226	0.000391	0.003945763	0.011242	0	0.0017409	0	0.000387	0.000250108	0.00199	0.115522255	0.301241383	0.000150621
	Cherokee	0.003513	0.01072404	0.003542982	0.001082214	0.002594504	0	0.005865919	0.011051612	0.0015356	0.041244534	0.000506	0.005110433	0.005005	0	0.0173929	0	0.005951	0.003849433	0.031959	1.855231819	1.928294086	0.000964147
	Coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Coleman	0.0013551	0.00413668	2.71346E-05	8.28834E-06	0.001000801	0	4.53316E-05	8.54064E-05	1.001E-05	0.000268833	9.69E-06	9.77991E-05	0.000279	0	4.315E-05	0	9.58E-06	6.19914E-06	4.93E-05	0.002863318	0.007466525	3.73326E-06
	Crockett	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Ector	0.00362926	0.01107897	0.003660242	0.001118032	0.002680373	0	0.006060061	0.011417383	0.0015864	0.04260959	0.000523	0.005279572	0.00517	0	0.0179686	0	0.006148	0.003976836	0.033017	1.916633812	1.992114197	0.000996057
	Fannin	0.00762852	0.0232874	0.007693632	0.002350043	0.005633999	0	0.012737922	0.023998724	0.0033346	0.08956306	0.001099	0.011097375	0.010867	0	0.0377689	0	0.012923	0.008359095	0.0694	4.028660843	4.187316538	0.002093658
	Fayette	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Freestone	0.00377443	0.01152213	0.003806652	0.001162753	0.002787588	0	0.006302464	0.011874079	0.0016499	0.044313974	0.000544	0.005490754	0.005377	0	0.0186873	0	0.006394	0.00413591	0.034338	1.993299164	2.071798765	0.001035899
	Frio	0.01476384	0.04506924	0.001497957	0.000457555	0.010903753	0	0.002442547	0.00460185	0.0008111	0.021784164	0.000375	0.003790984	0.355262	0	0.0219143	0	0.000322	0.000208545	0.001525	0.088497641	0.164409976	8.2205E-05
	Grimes	0.00055442	0.00169248	0.001021149	0.000311913	0.000409467	0	0.001634436	0.00307934	0.0006849	0.018396859	0.000198	0.001995849	0.005316	0	0.0212784	0	0.000218	0.000141221	0.000994	0.057688759	0.083306419	4.16532E-05
	Hardeman	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Haskell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hidalgo	0.239737	0.73183972	0.004800509	0.00146633	0.177056459	0	0.000819827	0.015109656	0.0017708	0.047560505	0.001714	0.017302099	0.049294	0	0.0076338	0	0.001695	0.001096719	0.008726	0.506563005	1.320938036	0.000660469
	Howard	0.00058508	0.00178606	0.000590075	0.00018024	0.000432108	0	0.000976955	0.001840619	0.0002558	0.006869178	8.43E-05	0.00085113	0.000833	0	0.0028967	0	0.000991	0.000641114	0.005323	0.308984384	0.321152728	0.000160576
	Jack	0.00217756	0.00664738	0.002196145	0.000670819	0.001608224	0	0.003636037	0.00685043	0.0009519	0.025565754	0.000314	0.003167743	0.003102	0	0.0107811	0	0.003689	0.002386102	0.01981	1.149980287	1.195268518	0.000597634
	Jones	0.04250012	0.12973917	0.000851025	0.000259948	0.031388236	0	0.00142174	0.002678611	0.0003139	0.008431437	0.000304	0.003067284	0.008739	0	0.0013533	0	0.000301	0.000194424	0.001547	0.089802537	0.234173411	0.000117087
	Lamar	0.00107998	0.00329683	0.001089199	0.000332699	0.000797614	0	0.001803327	0.003397535	0.0004721	0.012679577	0.000156	0.001571072	0.001539	0	0.005347	0	0.00183	0.00118341	0.009825	0.570343552	0.592804676	0.000296402
	Limestone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Llano	0.00124346	0.00379588	0.047475864	0.014501642	0.000918351	0	0.083198331	0.15674878	0.000769	0.020653892	0.00221	0.02230788	0.00066	0	0.0011535	0	0.00025	0.000161519	0.001141	0.066218307	0.284387903	0.000142194
	McLennan	0.02303137	0.07030734	0.023227961	0.007095049	0.017009692	0	0.038457253	0.07245491	0.0100675	0.270401187	0.003319	0.033504251	0.03281	0	0.1140288	0	0.039015	0.025237071	0.209526	12.1629908	12.64199061	0.006320995
	Milam	0.00165249	0.00504453	0.001666598	0.000509067	0.001220439	0	0.002759294	0.005198613	0.0007223	0.019401184	0.000238	0.002403918	0.002354	0	0.0081815	0	0.002799	0.00181075	0.015033	0.872690056	0.907058114	0.000453529
	Mitchell	0.01696145	0.05177785	0.017106233	0.005225149	0.012526789	0	0.028321847	0.053359424	0.0074142	0.199136974	0.002444	0.024674208	0.024163	0	0.0839765	0	0.028733	0.018585843	0.154305	8.957435491	9.310194935	0.004655097
	Nolan	0.00060327	0.0018416	0.000608422	0.000185844	0.000445544	0	0.001007331	0.00189785	0.0002637	0.007082762	8.69E-05	0.000877595	0.000859	0	0.0029868	0	0.001022	0.000661048	0.005488	0.318591691	0.331138388	0.000165569
	Palo Pinto	0.00307488	0.00938661	0.00566337	0.001729893	0.002270935	0	0.00906471	0.017078254	0.0037988	0.102030392	0.001096	0.011069132	0.029483	0	0.1180115	0	0.001211	0.000783224	0.005512	0.31994629	0.4620238	0.000231012
	Pecos	4.2262E-05	0.00012901	4.26225E-05	1.30192E-05	3.12122E-05	0	7.05678E-05	0.000132952	1.847E-05	0.000496177	6.09E-06	6.14792E-05	6.02E-05	0	0.0002092	0	7.16E-05	4.63092E-05	0.000384	0.022318676	0.023197625	1.15988E-05
	Presidio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Robertson	0.00035926	0.0010967	0.000406685	0.000124223	0.000265328	0	0.000358385	0.000675212	0.0015339	0.04119769	0.000356	0.00359342	0.000371	0	0.0009089	0	0.093323	0.060366034	0.001655	0.096053665	0.20310694	0.000101553
	Taylor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Titus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tom Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Upton	3.2238E-05	9.8412E-05	3.25131E-05	9.93123E-06	2.38092E-05	0	5.38302E-05	0.000101418	1.409E-05	0.000378492	4.65E-06	4.68973E-05	4.59E-05	0	0.0001596	0	5.46E-05	3.53254E-05	0.000293	0.017025037	0.017695512	8.84776E-06
	Ward	0.01980763	0.06046629	0.0199767	0.006101942	0.014628815	0	0.033074321	0.062313263	0.0086584	0.232552638	0.002854	0.0288146	0.028218	0	0.098068	0	0.033554	0.021704592	0.180198	10.46051473	10.87246806	0.005436234
	Webb	0.01418005	0.04328711	0.000283942	8.6731E-05	0.010472596	0	0.000474359	0.000893711	0.0001047	0.002813125	0.000101	0.00102339	0.002916	0	0.0004515	0	0.0001	6.48691E-05	0.000516	0.029962361	0.078131294	3.90656E-05
	Wharton	0.00015439	0.0004713	0.000191235	5.84134E-05	0.000114024	0	6.43902E-05	0.000121314	0.0011702	0.031428794	0.000266	0.002683919	0.000107	0	6.777E-05	0	8.17E-05	5.28588E-05	0.000112	0.006514579	0.04133118	2.06656E-05
	Wichita	0.00021984	0.00067111	0.000221719	6.77249E-05	0.000162364	0	0.000367089	0.000691609	9.61E-05	0.00258108	3.17E-05	0.00031981	0.000313	0	0.0010884	0	0.000372	0.000240897	0.002	0.116100253	0.120672484	6.03362E-05
	Wilbarger	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Wise	0.00291847	0.00890915	0.002955932	0.000902898	0.002155421	0	0.004892446	0.009217552	0.0012878	0.034587394	0.000424	0.004277871	0.004281	0	0.0149528	0	0.004924	0.003185305	0.026441	1.534874074	1.595954245	0.000797977
	Young	0.00549666	0.01677953	0.005543579	0.001693302	0.004059529	0	0.009178198	0.017292069	0.0024027	0.064533874	0.000792	0.007996116	0.00783	0	0.0272141	0	0.009311	0.006023073	0.050005	2.902816107	3.017134071	0.001508567
	Total	**1.14303735**	**3.48932437**	**1.154658244**	**0.352693758**	**1.089429227**	**0**	**1.180868675**	**2.224800926**	**1.5393506**	**41.34498094**	**1.443965**	**14.57806574**	**1.481727**	**0**	**1.2697054**	**0**	**1.151969**	**0.745148068**	**1.517783**	**88.10736552**	**150.8423793**	**0.07542119**
Energy Savings by PCA (MWh)		3.05		0.31		0.00		1.88		26.86		10.10		0.00		0.00		0.65		58.05			

6.1.3 2008 Results for New Residential Construction (Single-family and Multi-family), using 1999 Base Year and 2007 eGRID

In Table 22 and Table 23, the combined NOx emissions reductions are listed from single-family electricity savings, multi-family electricity savings, and natural gas savings (single-family and multi-family), which also show the 2008 annual and OSD electricity savings are shown for the combined single-family and multi-family savings.

Using the 2007 eGRID the total NOx reductions from electricity and natural gas savings from new construction in 2008 are calculated to be 132.81 tons NOx/year, which represents 102.92 tons NOx/year (77.5%) from single-family residential electricity savings, 11.81 tons NOx/year (8.9%) from multi-family residential electricity savings, and 18.08 tons NOx/year (13.6%) from natural gas savings from single-family and multi-family residential. On a peak Ozone Season Day (OSD), the NOx reductions in 2008 are calculated to be 0.71 tons of NOx/day, which represents 0.60 tons NOx/day (83.3%) from single-family residential electricity savings, 0.08 tons NOx/day (11.1%) from multi-family residential electricity savings, and 0.04 tons NOx/day (5.6%) from natural gas savings from single-family and multi-family residential.

Figure 63 through Figure 68 show the electricity and NOx reductions tabulated in Table 22 and Table 23. Figure 63 shows the annual electricity savings by county as a stacked bar chart, and Figure 64 shows the OSD electricity savings by county in a similar fashion. Figure 95 shows the spatial distribution of the electricity savings by county across the state.

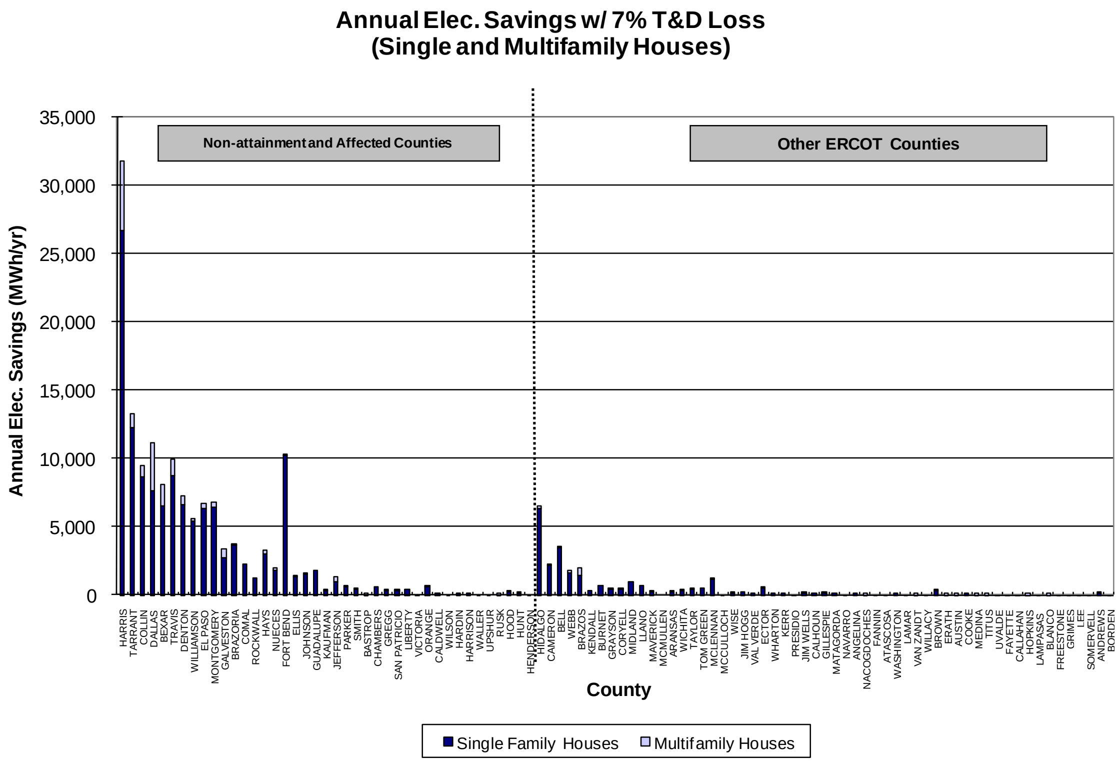
Figure 66 shows the annual NOx reductions in a similar format at the electricity savings using a stacked bar chart with the ordering of the counties determined by Figure 63. Figure 67 shows the OSD NOx reductions, also as a stacked bar chart, and Figure 68 shows the spatial distribution of the NOx savings by county across the state.

Table 22: 2008 Annual and OSD NOx Reductions from Electricity and Natural Gas Savings Due to the IECC/IRC for Single-family and Multi-family Residences by county (Using 1999 Base year and 2007 eGRID)(1)

	Electricity Savings and Resultant NOx Reductions (Single Family Houses)				Electricity Savings and Resultant NOx Reductions (Multifamily Houses)				Total Electricity Savings and Resultant NOx Reductions (Single and Multi-Family Houses)				Total Natural Gas Savings and Resultant NOx Reductions (Single and Multi-Family Houses)				Total Nox Reductions	
County	Total Annual Electricity Savings per County w/ 7% T&D Loss (MWh/County)	Annual Nox Reductions (Tons)	OSD Electricity Savings per County w/ 7% T&D Loss (MWh/County)	OSD Nox Reductions (Tons)	Total Annual Electricity Savings per County w/ 7% T&D Loss (MWh/County)	Annual Nox Reductions (Tons)	OSD Electricity Savings per County w/ 7% T&D Loss (MWh/County)	OSD Nox Reductions (Tons)	Total Annual Electricity Savings per County w/ 7% T&D Loss (MWh/County)	Annual Nox Reductions (Tons)	OSD Electricity Savings per County w/ 7% T&D Loss (MWh/County)	OSD Nox Reductions (Tons)	Total Annual N.G. Savings (Therm/County)	Annual Nox Reductions (Tons)	Total OSD N.G. Savings (Therm/County)	OSD Nox Reductions (Tons)	Annual Nox Reductions (Tons)	OSD Nox Reductions (Tons)
HARRIS	26,690.34	13.52	156.98	0.09	5,104.87	1.54	29.22	0.01	31,795.21	15.06	186.2040	0.1002	668,389.62	3.07	1,676.8875	0.0077	18.13	0.1080
TARRANT	12,247.05	3.85	78.55	0.03	1,078.79	0.46	8.43	0.00	13,325.84	4.31	86.9796	0.0345	339,960.43	1.56	670.7466	0.0031	5.88	0.0376
COLLIN	8,668.33	0.21	54.72	0.00	822.21	0.02	6.42	0.00	9,490.54	0.24	61.1391	0.0014	235,552.96	1.08	466.4654	0.0021	1.32	0.0035
DALLAS	7,679.40	1.41	49.25	0.01	3,459.10	0.17	27.03	0.00	11,138.50	1.58	76.2888	0.0108	277,894.26	1.28	620.2724	0.0029	2.86	0.0136
BEXAR	6,535.73	6.68	38.35	0.04	1,556.46	0.94	9.95	0.01	8,092.19	7.62	48.2996	0.0419	178,274.06	0.82	465.7232	0.0021	8.44	0.0440
TRAVIS	8,778.08	0.16	51.23	0.00	1,168.76	0.02	7.12	0.00	9,946.85	0.18	58.3499	0.0010	190,246.03	0.88	461.9510	0.0021	1.05	0.0032
DENTON	6,583.35	0.05	42.10	0.00	671.75	0.01	4.38	0.00	7,255.10	0.05	46.4810	0.0004	198,445.97	0.91	347.0742	0.0016	0.96	0.0020
WILLIAMSON	5,417.51	0.00	31.62	0.00	154.52	0.00	0.94	0.00	5,572.03	0.00	32.5600	0.0000	105,673.78	0.49	251.5358	0.0012	0.49	0.0012
EL PASO	6,365.18	0.00	28.82	0.00	384.82	0.00	2.10	0.00	6,750.00	0.00	30.9134	0.0000	174,465.43	0.80	317.7308	0.0015	0.80	0.0015
MONTGOMERY	6,451.56	0.00	37.94	0.00	335.89	0.00	1.92	0.00	6,787.45	0.00	39.8651	0.0000	142,837.79	0.66	351.4828	0.0016	0.66	0.0016
GALVESTON	2,771.57	7.04	15.97	0.03	591.87	0.80	3.39	0.00	3,363.43	7.85	19.3587	0.0383	64,644.45	0.30	175.8506	0.0008	8.14	0.0391
BRAZORIA	3,611.99	1.82	20.81	0.01	58.50	0.21	0.34	0.00	3,670.49	2.03	21.1460	0.0129	69,381.64	0.32	186.4220	0.0009	2.35	0.0138
COMAL	2,243.50	0.00	13.17	0.00	0.00	0.00	0.00	0.00	2,243.50	0.00	13.1654	0.0000	48,542.95	0.22	123.2233	0.0006	0.22	0.0006
ROCKWALL	1,267.19	0.00	8.10	0.00	0.00	0.00	0.00	0.00	1,267.19	0.00	8.1043	0.0000	35,475.58	0.16	59.4419	0.0003	0.16	0.0003
HAYS	3,040.30	0.43	17.75	0.00	289.19	0.04	1.76	0.00	3,329.49	0.48	19.5080	0.0028	63,543.49	0.29	153.1924	0.0007	0.77	0.0035
NUECES	1,790.67	2.10	8.76	0.01	168.70	0.12	0.83	0.00	1,959.36	2.22	9.5903	0.0113	35,422.51	0.16	92.8724	0.0004	2.38	0.0117
FORT BEND	10,243.63	13.95	60.25	0.06	77.45	1.59	0.44	0.01	10,321.08	15.54	60.6915	0.0722	217,372.67	1.00	530.9795	0.0024	16.54	0.0746
ELLIS	1,339.26	1.04	8.59	0.01	73.63	0.13	0.58	0.00	1,412.90	1.16	9.1652	0.0078	36,148.87	0.17	70.1800	0.0003	1.33	0.0081
JOHNSON	1,568.37	0.03	10.06	0.00	3.26	0.00	0.03	0.00	1,571.63	0.03	10.0847	0.0002	40,401.42	0.19	76.2268	0.0004	0.22	0.0006
GUADALUPE	1,760.26	0.35	10.33	0.00	0.00	0.04	0.00	0.00	1,760.26	0.39	10.3296	0.0023	38,086.93	0.18	96.6814	0.0004	0.56	0.0027
KAUFMAN	299.05	2.00	1.91	0.01	31.11	0.24	0.20	0.00	330.16	2.24	2.1151	0.0144	9,029.34	0.04	15.8063	0.0001	2.29	0.0145
JEFFERSON	982.80	0.00	5.57	0.00	392.70	0.00	2.24	0.00	1,375.50	0.00	7.8131	0.0000	28,010.72	0.13	72.1994	0.0003	0.13	0.0003
PARKER	587.34	0.02	3.76	0.00	6.56	0.00	0.04	0.00	593.89	0.02	3.7991	0.0003	16,580.54	0.08	27.9256	0.0001	0.10	0.0004
SMITH	422.73	0.00	2.92	0.00	29.03	0.00	0.22	0.00	451.76	0.00	3.1416	0.0000	12,859.70	0.06	25.9528	0.0001	0.06	0.0001
BASTROP	51.34	0.79	0.32	0.00	1.16	0.08	0.01	0.00	52.50	0.87	0.3256	0.0051	374.50	0.00	0.4218	0.0000	0.87	0.0051
CHAMBERS	580.81	4.31	3.30	0.03	0.00	0.49	0.00	0.00	580.81	4.80	3.2963	0.0284	11,922.08	0.05	29.2363	0.0001	4.86	0.0285
GREGG	357.38	0.00	2.42	0.00	21.46	0.00	0.14	0.00	378.84	0.00	2.5575	0.0000	10,676.27	0.05	20.0218	0.0001	0.05	0.0001
SAN PATRICIO	355.41	0.46	1.74	0.00	2.79	0.03	0.01	0.00	358.20	0.49	1.7523	0.0028	6,482.79	0.03	16.8865	0.0001	0.52	0.0029
LIBERTY	434.18	0.00	2.55	0.00	0.00	0.00	0.00	0.00	434.18	0.00	2.5493	0.0000	9,102.27	0.04	22.2048	0.0001	0.04	0.0001
VICTORIA	87.04	0.28	0.53	0.00	0.00	0.02	0.00	0.00	87.04	0.30	0.5320	0.0015	2,101.62	0.01	5.4587	0.0000	0.31	0.0016
ORANGE	584.61	0.00	3.32	0.00	128.04	0.00	0.73	0.00	712.65	0.00	4.0477	0.0000	14,638.94	0.07	36.8168	0.0002	0.07	0.0002
CALDWELL	108.93	0.00	0.62	0.00	0.00	0.00	0.00	0.00	108.93	0.00	0.6203	0.0000	1,875.39	0.01	4.9451	0.0000	0.01	0.0000
WILSON	44.10	0.00	0.26	0.00	0.00	0.00	0.00	0.00	44.10	0.00	0.2588	0.0000	954.16	0.00	2.4221	0.0000	0.00	0.0000
HARDIN	178.91	0.00	1.01	0.00	0.00	0.00	0.00	0.00	178.91	0.00	1.0145	0.0000	3,659.63	0.02	8.9744	0.0000	0.02	0.0000
HARRISON	134.09	0.00	0.91	0.00	0.00	0.00	0.00	0.00	134.09	0.00	0.9134	0.0000	3,962.54	0.02	7.2166	0.0000	0.02	0.0000
WALLER	12.60	0.00	0.07	0.00	0.00	0.00	0.00	0.00	12.60	0.00	0.0741	0.0000	265.48	0.00	0.6476	0.0000	0.00	0.0000
UPSHUR	6.85	0.00	0.05	0.00	0.00	0.00	0.00	0.00	6.85	0.00	0.0467	0.0000	206.09	0.00	0.3701	0.0000	0.00	0.0000
RUSK	9.85	0.22	0.07	0.00	2.20	0.03	0.02	0.00	12.05	0.24	0.0828	0.0000	374.54	0.00	0.8348	0.0000	0.25	0.0000
HOOD	212.45	3.96	1.36	0.02	11.73	0.48	0.09	0.00	224.18	4.44	1.4544	0.0273	5,735.48	0.03	11.1362	0.0001	4.47	0.0274
HUNT	93.68	1.96	0.59	0.01	7.39	0.24	0.05	0.00	101.07	2.19	0.6407	0.0141	2,528.14	0.01	4.8617	0.0000	2.21	0.0141
HENDERSON	81.85	0.26	0.57	0.00	0.00	0.03	0.00	0.00	81.85	0.29	0.5653	0.0021	2,503.50	0.01	4.5335	0.0000	0.30	0.0021
HIDALGO	6,347.81	1.74	30.38	0.01	181.39	0.10	0.59	0.00	6,529.20	1.84	30.9751	0.0121	110,694.11	0.51	303.9167	0.0014	2.35	0.0135
CAMERON	2,192.66	0.45	10.50	0.00	71.65	0.03	0.23	0.00	2,264.30	0.47	10.7287	0.0028	38,464.61	0.18	105.6247	0.0005	0.65	0.0032
BELL	3,457.97		20.83		101.26		0.57		3,559.23	0.00	21.3943	0.0000	88,669.51	0.41	174.4517	0.0008	0.41	0.0008
WEBB	1,636.16	0.18	7.56	0.00	194.72	0.01	0.96	0.00	1,830.88	0.20	8.5215	0.0007	28,961.35	0.13	77.2192	0.0004	0.33	0.0011
BRAZOS	1,426.08	0.19	8.39	0.00	525.58	0.02	3.01	0.00	1,951.66	0.21	11.3964	0.0013	40,972.62	0.19	104.7254	0.0005	0.40	0.0018
KENDALL	362.37		2.16		0.00		0.00		362.37	0.00	2.1556	0.0000	8,946.54	0.04	19.4776	0.0001	0.04	0.0001
BURNET	710.46		4.15		0.00		0.00		710.46	0.00	4.1467	0.0000	13,439.37	0.06	31.7898	0.0001	0.06	0.0001
GRAYSON	393.90		2.49		7.39		0.05		401.29	0.00	2.5396	0.0000	10,133.28	0.05	19.0914	0.0001	0.05	0.0001
CORYELL	423.87		2.55		5.43		0.03		429.30	0.00	2.5834	0.0000	10,593.14	0.05	20.4823	0.0001	0.05	0.0001
MIDLAND	998.78		4.76		0.00		0.00		998.78	0.00	4.7563	0.0000	32,559.40	0.15	48.7444	0.0002	0.15	0.0002
LLANO	692.41	0.22	4.04	0.00	0.00	0.02	0.00	0.00	692.41	0.24	4.0414	0.0014	13,098.05	0.06	30.9824	0.0001	0.30	0.0016
MAVERICK	198.40		0.92		6.51		0.03		204.90	0.00	0.9491	0.0000	3,206.74	0.01	8.5021	0.0000	0.01	0.0000
MCMULLEN	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
ARANSAS	249.36		1.22		6.51		0.03		255.86	0.00	1.2518	0.0000	4,629.83	0.02	12.0776	0.0001	0.02	0.0001
WICHITA	313.37	0.07	1.79	0.00	0.85	0.01	0.00	0.00	314.21	0.07	1.7923	0.0005	12,264.99	0.06	14.2224	0.0001	0.13	0.0006
TAYLOR	402.67	0.00	2.10	0.00	1.27	0.00	0.01	0.00	403.94	0.00	2.1072	0.0000	12,821.26	0.06	18.7097	0.0001	0.06	0.0001
TOM GREEN	525.30	0.01	2.75	0.00	0.00	0.00	0.00	0.00	525.30	0.01	2.7545	0.0000	15,150.45	0.07	26.1383	0.0001	0.08	0.0001
MCLENNAN	1,191.58	7.77	7.18	0.04	55.61	0.94	0.31	0.01	1,247.20	8.70	7.4882	0.0511	31,373.16	0.14	62.7907	0.0003	8.85	0.0514
MCCULLOCH	6.08		0.03		0.00		0.00		6.08	0.00	0.0319	0.0000	175.49	0.00	0.3028	0.0000	0.00	0.0000
WISE	154.41	0.90	0.97	0.01	2.63	0.11	0.02	0.00	157.04	1.01	0.9953	0.0064	3,916.95	0.02	7.4534	0.0000	1.02	0.0065
JIM HOGG	237.75		2.80		0.00		0.00		237.75	0.00	2.7959	0.0000	29,410.17	0.14	46.8020	0.0002	0.14	0.0002
VAL VERDE	163.53		0.96		0.00		0.00		163.53	0.00	0.9596	0.0000	3,538.35	0.02	8.9819	0.0000	0.02	0.0000
ECTOR	525.24	1.12	2.50	0.01	98.86	0.14	0.45	0.00	624.10	1.25	2.9549	0.0080	20,513.98	0.09	36.4445	0.0002	1.35	0.0082
WHARTON	144.57	0.03	0.88	0.00	0.00	0.00	0.00	0.00	144.57	0.03	0.8837	0.0002	3,490.82	0.02	9.0670	0.0000	0.05	0.0002
KERR	155.62		0.91		0.00		0.00		155.62	0.00	0.9083	0.0000	2,943.86	0.01	6.9635	0.0000	0.01	0.0000
PRESIDIO	14.20	0.00	0.07	0.00	0.00	0.00	0.00	0.00	14.20	0.00	0.0744	0.0000	409.47	0.00	0.7064	0.0000	0.00	0.0000
JIM WELLS	135.48		0.66		0.93		0.00		136.41	0.00	0.6673	0.0000	2,468.96	0.01	6.4307	0.0000	0.01	0.0000
CALHOUN	126.87	0.76	0.78	0.00	0.00	0.04	0.00	0.00	126.87	0.81	0.7755	0.0045	3,063.37	0.01	7.9567	0.0000	0.82	0.0045
GILLESPIE	94.73		0.55		19.37		0.12		114.10	0.00	0.6708	0.0000	2,192.99	0.01	5.3852	0.0000	0.01	0.0000
MATAGORDA	143.10		0.87		0.00		0.00		143.10	0.00	0.8747	0.0000	3,455.20	0.02	8.9744	0.0000	0.02	0.0000
NAVARRO	60.55		0.36		0.00		0.00		60.55	0.00	0.3647	0.0000	1,482.64	0.01	2.8258	0.0000	0.01	0.0000
ANGELINA	99.87	0.10	0.67	0.00	0.00	0.01	0.00	0.00	99.87	0.11	0.6716	0.0007	3,171.81	0.01	6.5689	0.0000	0.12	0.0007
NACOGDOCHES	59.08		0.40		4.13		0.03		63.21	0.00	0.4284	0.0000	1,992.21	0.01	4.2368	0.0000	0.01	0.0000
FANNIN	40.45	2.23	0.26	0.01	0.00	0.27	0.00	0.00	40.45	2.50	0.2559	0.0169	1,024.81	0.00	1.9175	0.0000	2.51	0.0169
ATASCOSA	75.16		0.44		0.00		0.00		75.16	0.00	0.4407	0.0000	1,601.11	0.01	4.1377	0.0000	0.01	0.0000
WASHINGTON	158.45		0.93		0.00		0.00		158.45	0.00	0.9319	0.0000	3,337.50	0.02	8.1418	0.0000	0.02	0.0000
LAMAR	44.31	0.30	0.30	0.00	0.00	0.04	0.00	0.00	44.31	0.34	0.3022	0.0024	1,332.83	0.01	2.4055	0.0000	0.34	0.0024
VAN ZANDT	30.02		0.19		1.31		0.01		31.34	0.00	0.1998	0.0000	780.28	0.00	1.5065	0.0000	0.00	0.0000
WILLACY	68.65		0.33		0.00		0.00		68.65	0.00	0.3286	0.0000	1,147.17	0.01	3.1457	0.0000	0.01	0.0000
BROWN	337.36		2.03		14.85		0.08		352.22	0.00	2.1151	0.0000	8,847.22	0.04	17.6623	0.0001	0.04	0.0001
ERATH	91.91		0.48		46.95		0.21		138.86	0.00	0.6896	0.0000	4,516.31	0.02	9.4334	0.0000	0.02	0.0000
AUSTIN	64.82		0.38		3.91		0.02		68.73	0.00	0.4036	0.0000	1,446.70	0.01	3.5647	0.0000	0.01	0.0000
COOKE	102.20		0.65		0.00		0.00		102.20	0.00	0.6464	0.0000	2,588.98	0.01	4.8442	0.0000	0.01	0.0000
MEDINA	27.56		0.16		0.68		0.00		28.24	0.00	0.1661	0.0000	612.51	0.00	1.5606	0.0000	0.00	0.0000
TITUS	15.34	1.80	0.10	0.00	24.65	0.22	0.19	0.00	39.99	2.02	0.2969	0.0000	1,033.48	0.00	2.5877	0.0000	2.03	0.0000
UVALDE	47.77		0.28		0.00		0.00		47.77	0.00	0.2803	0.0000	1,033.67	0.00	2.6239	0.0000	0.00	0.0000
FAYETTE	25.21	0.00	0.15	0.00	0.00	0.00	0.00	0.00	25.21	0.00	0.1483	0.0000	530.97	0.00	1.2953	0.0000	0.00	0.0000
CALLAHAN	10.94		0.06		0.00		0.00		10.94	0.00	0.0571	0.0000	347.23	0.00	0.5046	0.0000	0.00	0.0000
HOPKINS	25.73		0.16		0.66		0.01		26.39	0.00	0.1676	0.0000	657.91	0.00	1.2578	0.0000	0.00	0.0000
LAMPASAS	41.09		0.25		0.00		0.00		41.09	0.00	0.2475	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
BLANCO	31.58		0.18		14.23		0.09		45.81	0.00	0.2710	0.0000	891.97	0.00	2.2553	0.0000	0.00	0.0000
FREESTONE	12.98	1.16	0.08	0.01	0.00	0.14	0.00	0.00	12.98	1.30	0.0782	0.0084	317.71	0.00	0.6055	0.0000	1.31	0.0084
GRIMES	19.81	0.00	0.12	0.00	0.00	0.00	0.00	0.00	19.81	0.00	0.1165	0.0004	417.19	0.00	1.0177	0.0000	0.00	0.0004
LEE	29.47		0.18		0.00		0.00		29.47	0.00	0.1836	0.0000	220.26	0.00	0.2220	0.0000	0.00	0.0000
SOMERVELL	89.56		0.57		0.00		0.00		89.56	0.00	0.5744	0.0000	2,302.79	0.01	4.3396	0.0000	0.01	0.0000
ANDREWS	117.87	0.01	0.56	0.00	0.86	0.00	0.00	0.00	118.72	0.01	0.5652	0.0001	3,871.78	0.02	5.8460	0.0000	0.03	0.0001
BORDEN	33.78		0.15		0.00		0.00		33.78	0.00	0.1514	0.0000	1,724.24	0.01	1.7579	0.0000	0.01	0.0000

Table 23: 2008 Annual and OSD NOx Reductions from Electricity and Natural Gas Savings Due to the IECC/IRC for Single-family and Multi-family Residences by County (Using 1999 Base year and 2007 eGRID)(2)

	Electricity Savings and Resultant NOx Reductions (Single Family Houses)				Electricity Savings and Resultant NOx Reductions (Multifamily Houses)				Total Electricity Savings and Resultant NOx Reductions (Single and Multi-Family Houses)				Total Natural Gas Savings and Resultant NOx Reductions (Single and Multi-Family Houses)				Total Nox Reductions	
County	Total Annual Electricity Savings per County w/ 7% T&D Loss (MWh/County)	Annual Nox Reductions (Tons)	OSD Electricity Savings per County w/ 7% T&D Loss (MWh/County)	OSD Nox Reductions (Tons)	Total Annual Electricity Savings per County w/ 7% T&D Loss (MWh/County)	Annual Nox Reductions (Tons)	OSD Electricity Savings per County w/ 7% T&D Loss (MWh/County)	OSD Nox Reductions (Tons)	Total Annual Electricity Savings per County w/ 7% T&D Loss (MWh/County)	Annual Nox Reductions (Tons)	OSD Electricity Savings per County w/ 7% T&D Loss (MWh/County)	OSD Nox Reductions (Tons)	Total Annual N.G. Savings (Therm/County)	Annual Nox Reductions (Tons)	Total OSD N.G. Savings (Therm/County)	OSD Nox Reductions (Tons)	Annual Nox Reductions (Tons)	OSD Nox Reductions (Tons)
CHEROKEE	45.01	1.11	0.30	0.01	20.39	0.13	0.15	0.00	65.40	1.24	0.4561	0.0078	2,001.46	0.01	4.6922	0.0000	1.25	0.0078
DIMMIT	12.25		0.06		0.00		0.00		12.25	0.00	0.0566	0.0000	190.78	0.00	0.5046	0.0000	0.00	0.0000
FALLS	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
COLORADO	16.21		0.10		0.00		0.00		16.21	0.00	0.0953	0.0000	341.34	0.00	0.8327	0.0000	0.00	0.0000
FRIO	11.00	0.11	0.06	0.00	0.00	0.01	0.00	0.00	11.00	0.12	0.0645	0.0011	234.31	0.00	0.6055	0.0000	0.12	0.0011
MILAM	11.42	0.71	0.06	0.00	3.13	0.09	0.02	0.00	14.55	0.80	0.0794	0.0037	258.85	0.00	0.6918	0.0000	0.80	0.0037
JACKSON	16.23		0.10		0.00		0.00		16.23	0.00	0.0992	0.0000	391.83	0.00	1.0177	0.0000	0.00	0.0000
ANDERSON	32.35		0.22		0.00		0.00		32.35	0.00	0.2176	0.0000	1,027.49	0.00	2.1280	0.0000	0.00	0.0000
HILL	30.28		0.18		1.45		0.01		31.73	0.00	0.1905	0.0000	798.57	0.00	1.6001	0.0000	0.00	0.0000
CULBERSON	8.74		0.04		0.00		0.00		8.74	0.00	0.0396	0.0000	228.27	0.00	0.4037	0.0000	0.00	0.0000
MASON	9.02		0.05		0.00		0.00		9.02	0.00	0.0527	0.0000	170.66	0.00	0.4037	0.0000	0.00	0.0000
PECOS	18.25	0.01	0.10	0.00	0.00	0.00	0.00	0.00	18.25	0.01	0.0957	0.0001	526.46	0.00	0.9083	0.0000	0.02	0.0001
RAINS	6.43		0.04		1.31		0.01		7.75	0.00	0.0509	0.0000	191.18	0.00	0.3964	0.0000	0.00	0.0000
LAVACA	10.18		0.06		0.00		0.00		10.18	0.00	0.0630	0.0000	276.51	0.00	0.6476	0.0000	0.00	0.0000
PALO PINTO	19.70	0.32	0.10	0.00	0.00	0.04	0.00	0.00	19.70	0.35	0.1028	0.0020	625.01	0.00	0.9083	0.0000	0.36	0.0020
KIMBLE	8.11		0.04		0.00		0.00		8.11	0.00	0.0425	0.0000	233.98	0.00	0.4037	0.0000	0.00	0.0000
MADISON	14.40		0.08		0.00		0.00		14.40	0.00	0.0847	0.0000	303.41	0.00	0.7402	0.0000	0.00	0.0000
ARCHER	31.34		0.18		0.00		0.00		31.34	0.00	0.1788	0.0000	1,223.70	0.01	1.4129	0.0000	0.01	0.0000
REFUGIO	4.43		0.03		0.00		0.00		4.43	0.00	0.0271	0.0000	106.86	0.00	0.2776	0.0000	0.00	0.0000
LIMESTONE	32.44	0.14	0.20	0.00	0.00	0.02	0.00	0.00	32.44	0.16	0.1954	0.0000	794.27	0.00	1.5138	0.0000	0.16	0.0000
CLAY	8.95		0.05		0.00		0.00		8.95	0.00	0.0511	0.0000	349.63	0.00	0.4037	0.0000	0.00	0.0000
BEE	8.85		0.05		0.00		0.00		8.85	0.00	0.0541	0.0000	213.72	0.00	0.5551	0.0000	0.00	0.0000
MARTIN	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
GONZALES	3.67		0.02		0.00		0.00		3.67	0.00	0.0216	0.0000	79.51	0.00	0.2018	0.0000	0.00	0.0000
BURLESON	19.81		0.12		0.00		0.00		19.81	0.00	0.1165	0.0000	417.19	0.00	1.0177	0.0000	0.00	0.0000
KARNES	56.35		0.32		0.00		0.00		56.35	0.00	0.3183	0.0000	1,162.37	0.01	3.0276	0.0000	0.01	0.0000
KLEBERG	51.60		0.25		0.00		0.00		51.60	0.00	0.2483	0.0000	886.07	0.00	2.4055	0.0000	0.00	0.0000
BREWSTER	58.82		0.31		0.00		0.00		58.82	0.00	0.3084	0.0000	1,696.38	0.01	2.9267	0.0000	0.01	0.0000
WINKLER	8.27		0.04		0.00		0.00		8.27	0.00	0.0394	0.0000	269.64	0.00	0.4037	0.0000	0.00	0.0000
FRANKLIN	2.14		0.01		0.00		0.00		2.14	0.00	0.0135	0.0000	53.55	0.00	0.1009	0.0000	0.00	0.0000
YOUNG	21.88	1.97	0.11	0.01	0.00	0.24	0.00	0.00	21.88	2.21	0.1142	0.0122	694.46	0.00	1.0092	0.0000	2.22	0.0122
HOUSTON	5.63		0.04		0.00		0.00		5.63	0.00	0.0378	0.0000	178.69	0.00	0.3701	0.0000	0.00	0.0000
SCURRY	14.22		0.06		0.00		0.00		14.22	0.00	0.0637	0.0000	725.99	0.00	0.7402	0.0000	0.00	0.0000
BOSQUE	15.14	0.06	0.09	0.00	0.00	0.01	0.00	0.00	15.14	0.07	0.0912	0.0006	370.66	0.00	0.7064	0.0000	0.07	0.0006
COMANCHE	8.65		0.05		0.00		0.00		8.65	0.00	0.0521	0.0000	211.81	0.00	0.4037	0.0000	0.00	0.0000
BRISCOE	11.88		0.05		0.00		0.00		11.88	0.00	0.0497	0.0000	967.61	0.00	0.7064	0.0000	0.00	0.0000
CONCHO	2.03		0.01		0.00		0.00		2.03	0.00	0.0106	0.0000	58.50	0.00	0.1009	0.0000	0.00	0.0000
ZAVALA	22.04		0.10		0.00		0.00		22.04	0.00	0.1019	0.0000	343.41	0.00	0.9083	0.0000	0.00	0.0000
NOLAN	6.57	0.18	0.03	0.00	0.00	0.02	0.00	0.00	6.57	0.20	0.0343	0.0013	208.34	0.00	0.3028	0.0000	0.20	0.0013
BROOKS	12.11		0.06		0.00		0.00		12.11	0.00	0.0580	0.0000	202.44	0.00	0.5551	0.0000	0.00	0.0000
ROBERTSON	19.81	0.26	0.12	0.00	0.00	0.03	0.00	0.00	19.81	0.29	0.1165	0.0009	417.19	0.00	1.0177	0.0000	0.30	0.0009
LIVE OAK	11.78		0.06		0.00		0.00		11.78	0.00	0.0576	0.0000	213.25	0.00	0.5551	0.0000	0.00	0.0000
HAMILTON	4.33		0.03		0.00		0.00		4.33	0.00	0.0261	0.0000	105.90	0.00	0.2018	0.0000	0.00	0.0000
JONES	2.19	0.38	0.01	0.00	0.00	0.02	0.00	0.00	2.19	0.40	0.0114	0.0021	69.45	0.00	0.1009	0.0000	0.40	0.0021
REAGAN	10.00		0.05		0.00		0.00		10.00	0.00	0.0488	0.0000	280.28	0.00	0.5046	0.0000	0.00	0.0000
WARD	4.14	5.87	0.02	0.04	0.00	0.71	0.00	0.01	4.14	6.58	0.0197	0.0439	134.82	0.00	0.2018	0.0000	6.58	0.0439
RED RIVER	1.70	0.00	0.01	0.00	0.00	0.00	0.00	0.00	1.70	0.00	0.0116	0.0000	51.26	0.00	0.0925	0.0000	0.00	0.0000
HASKELL	4.38	0.00	0.02	0.00	0.63	0.00	0.00	0.00	5.01	0.00	0.0257	0.0000	160.51	0.00	0.2720	0.0000	0.00	0.0000
HOWARD	20.68	0.18	0.10	0.00	0.00	0.02	0.00	0.00	20.68	0.20	0.0985	0.0013	674.11	0.00	1.0092	0.0000	0.20	0.0013
SAN SABA	11.28		0.07		0.00		0.00		11.28	0.00	0.0658	0.0000	213.32	0.00	0.5046	0.0000	0.00	0.0000
JACK	2.19	0.67	0.01	0.00	1.69	0.08	0.01	0.00	3.88	0.75	0.0190	0.0048	127.09	0.00	0.2881	0.0000	0.75	0.0048
STEPHENS	2.19		0.01		0.00		0.00		2.19	0.00	0.0114	0.0000	69.45	0.00	0.1009	0.0000	0.00	0.0000
RUNNELS	4.06		0.02		0.00		0.00		4.06	0.00	0.0213	0.0000	116.99	0.00	0.2018	0.0000	0.00	0.0000
REEVES	2.07		0.01		0.00		0.00		2.07	0.00	0.0098	0.0000	67.41	0.00	0.1009	0.0000	0.00	0.0000
DE WITT	7.38		0.05		0.00		0.00		7.38	0.00	0.0451	0.0000	178.10	0.00	0.4626	0.0000	0.00	0.0000
CHILDRESS	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
CROSBY	3.56		0.02		0.00		0.00		3.56	0.00	0.0159	0.0000	181.50	0.00	0.1850	0.0000	0.00	0.0000
DAWSON	5.33		0.02		0.00		0.00		5.33	0.00	0.0239	0.0000	272.25	0.00	0.2776	0.0000	0.00	0.0000
MITCHELL	2.19	4.73	0.01	0.03	0.00	0.57	0.00	0.00	2.19	5.30	0.0114	0.0376	69.45	0.00	0.1009	0.0000	5.30	0.0376
WILBARGER	4.48	0.26	0.03	0.00	0.00	0.01	0.00	0.00	4.48	0.28	0.0255	0.0000	174.81	0.00	0.2018	0.0000	0.28	0.0000
COLEMAN	2.11	0.01	0.01	0.00	0.00	0.00	0.00	0.00	2.11	0.01	0.0112	0.0001	59.77	0.00	0.1009	0.0000	0.01	0.0001
UPTON	2.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	2.00	0.01	0.0098	0.0001	56.06	0.00	0.1009	0.0000	0.01	0.0001
COKE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
CROCKETT	38.54	0.00	0.20	0.00	0.00	0.00	0.00	0.00	38.54	0.00	0.2021	0.0000	1,111.42	0.01	1.9175	0.0000	0.01	0.0000
HARDEMAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
BANDERA	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
BAYLOR	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
COTTLE	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
CRANE	32.01		0.16		0.00		0.00		32.01	0.00	0.1563	0.0000	896.90	0.00	1.6147	0.0000	0.00	0.0000
DELTA	6.43		0.04		0.00		0.00		6.43	0.00	0.0406	0.0000	160.66	0.00	0.3028	0.0000	0.00	0.0000
DICKENS	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
DUVAL	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
EASTLAND	2.19		0.01		0.00		0.00		2.19	0.00	0.0114	0.0000	69.45	0.00	0.1009	0.0000	0.00	0.0000
EDWARDS	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
FISHER	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
FOARD	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
GLASSCOCK	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
GOLIAD	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
HALL	1.70		0.01		0.00		0.00		1.70	0.00	0.0071	0.0000	138.23	0.00	0.1009	0.0000	0.00	0.0000
HUDSPETH	21.86		0.10		2.44		0.01		24.29	0.00	0.1080	0.0000	651.02	0.00	1.2432	0.0000	0.00	0.0000
IRION	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
JEFF DAVIS	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
KENEDY	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
KENT	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
KING	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
KINNEY	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
KNOX	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
LA SALLE	24.49		0.11		0.00		0.00		24.49	0.00	0.1132	0.0000	381.57	0.00	1.0092	0.0000	0.00	0.0000
LEON	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
LOVING	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
MENARD	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
MILLS	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
MONTAGUE	2.13		0.01		0.00		0.00		2.13	0.00	0.0135	0.0000	53.94	0.00	0.1009	0.0000	0.00	0.0000
MOTLEY	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
REAL	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
SCHLEICHER	4.06		0.02		0.00		0.00		4.06	0.00	0.0213	0.0000	116.99	0.00	0.2018	0.0000	0.00	0.0000
SHACKELFORD	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
STARR	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
STERLING	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
STONEWALL	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
SUTTON	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
TERRELL	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
THROCKMORTON	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
ZAPATA	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
TOTAL	**156,803.12**	**102.92**	**918.52**	**0.60**	**18,057.18**	**11.81**	**115.90**	**0.08**	**174,860.30**	**114.73**	**1,034.42**	**0.67**	**3,929,681.91**	**18.08**	**8,884.60**	**0.04**	**132.81**	**0.71**



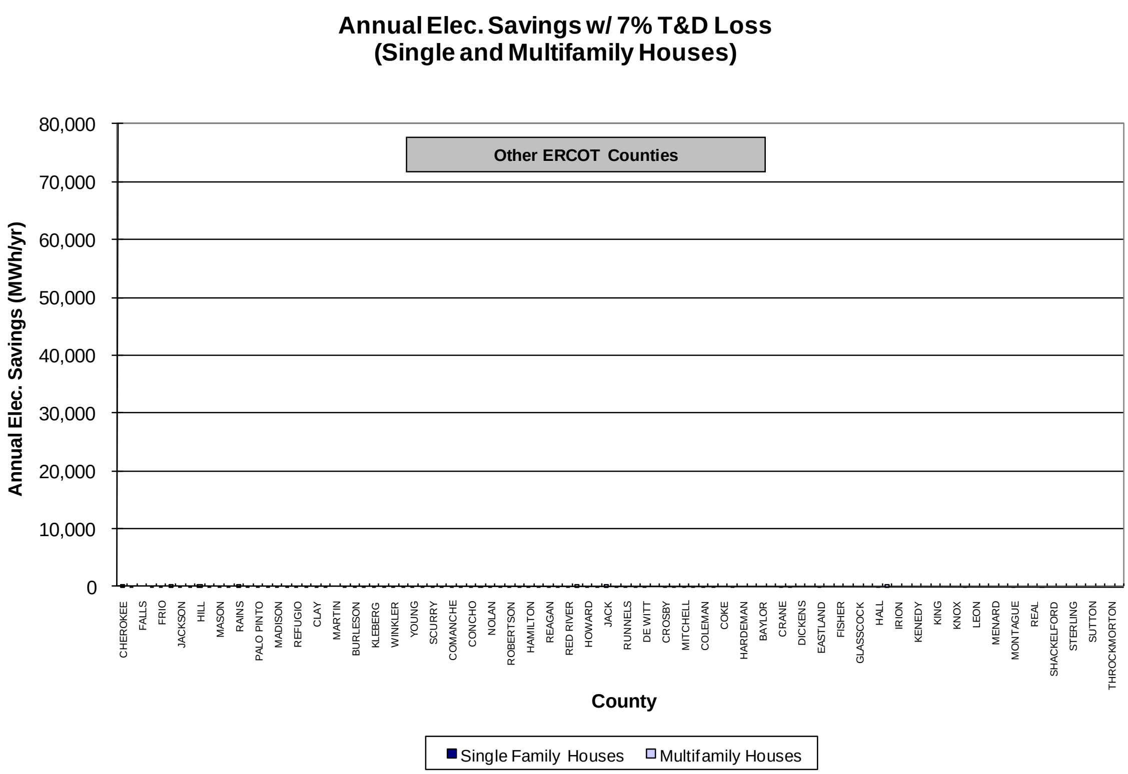
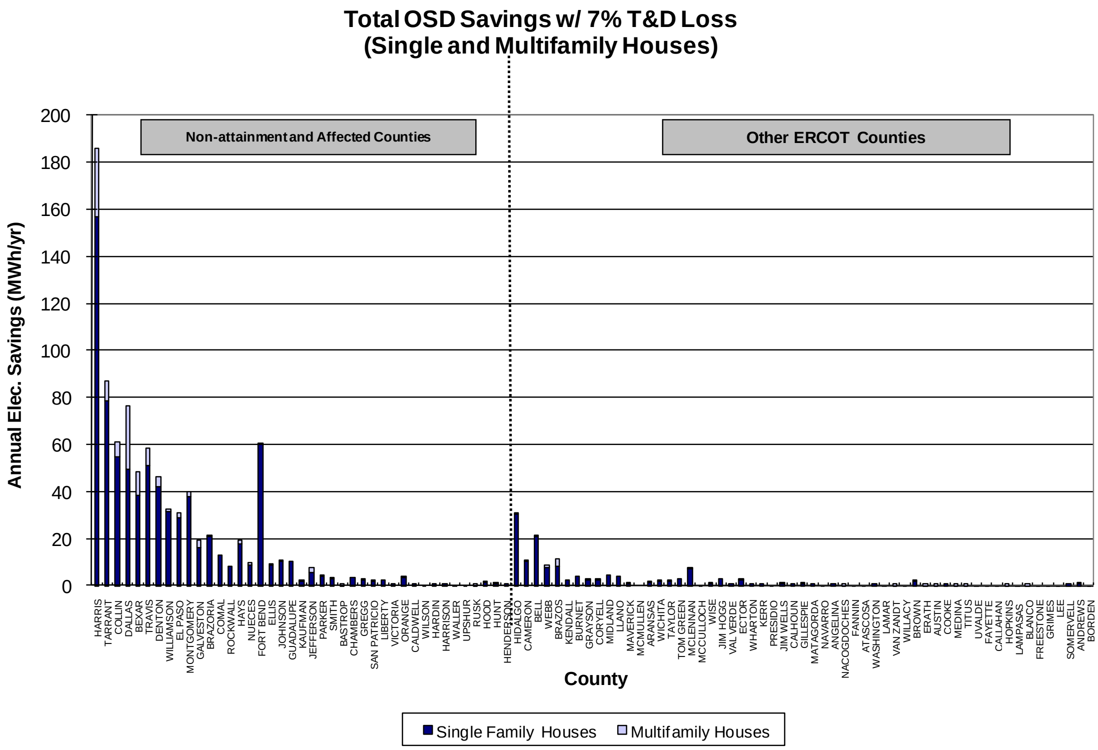


Figure 63: 2008 Annual Electricity Reductions from IECC/IRC by PCA for Single-family and Multi-family Residences by County



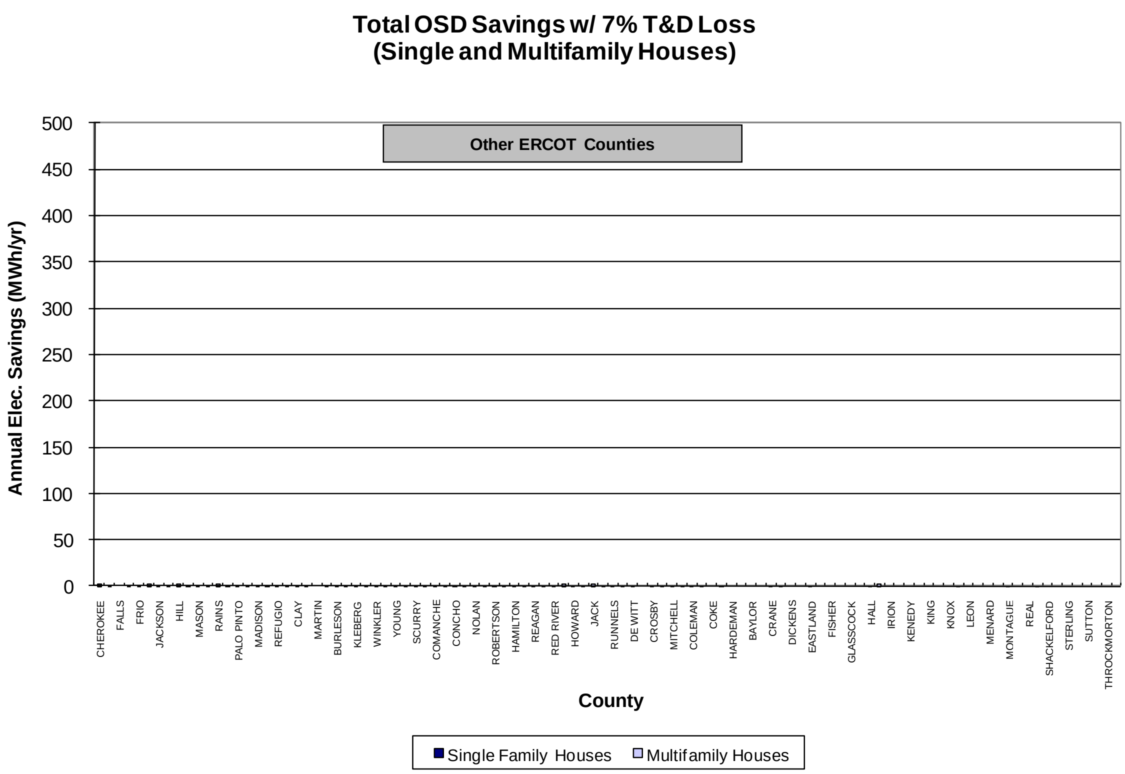
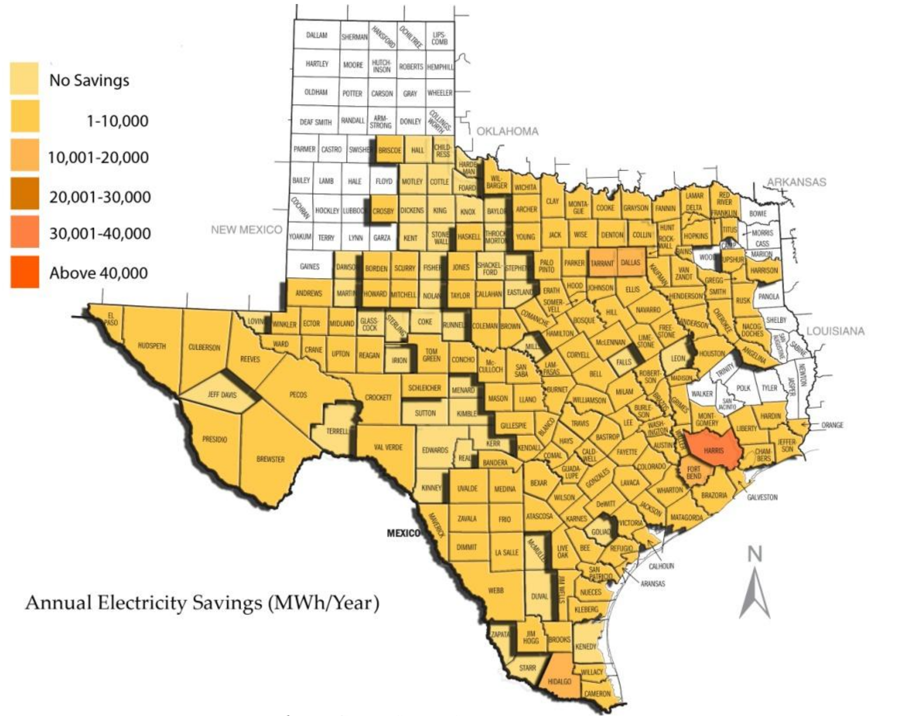


Figure 64: 2008 Annual Electricity Reductions from IECC/IRC by PCA for Single-family and Multi-family Residences by County



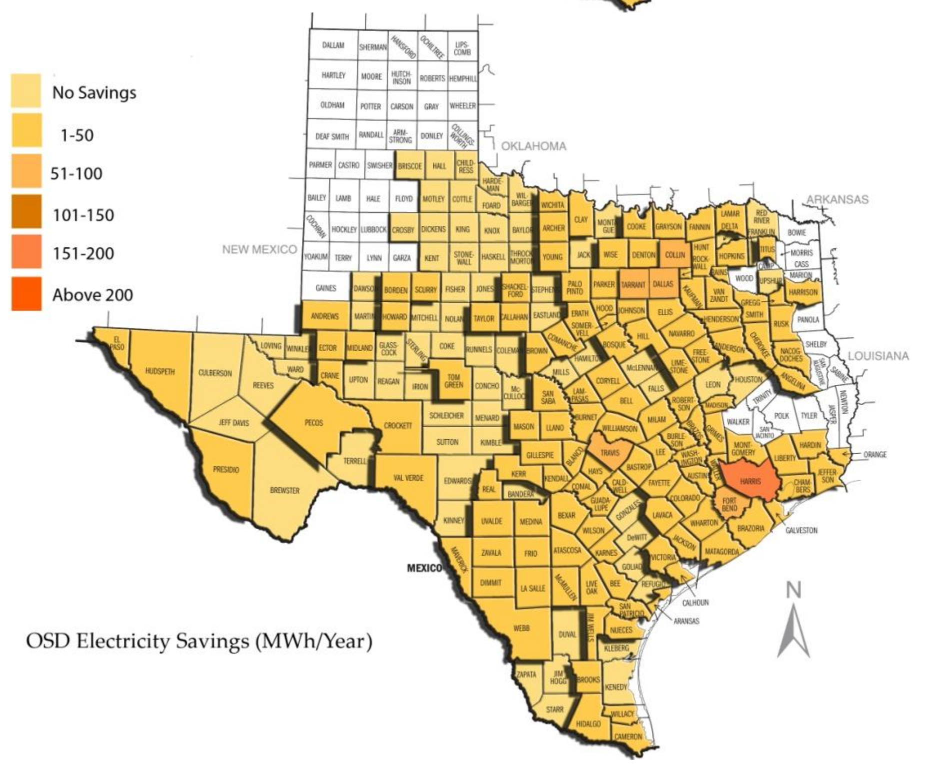
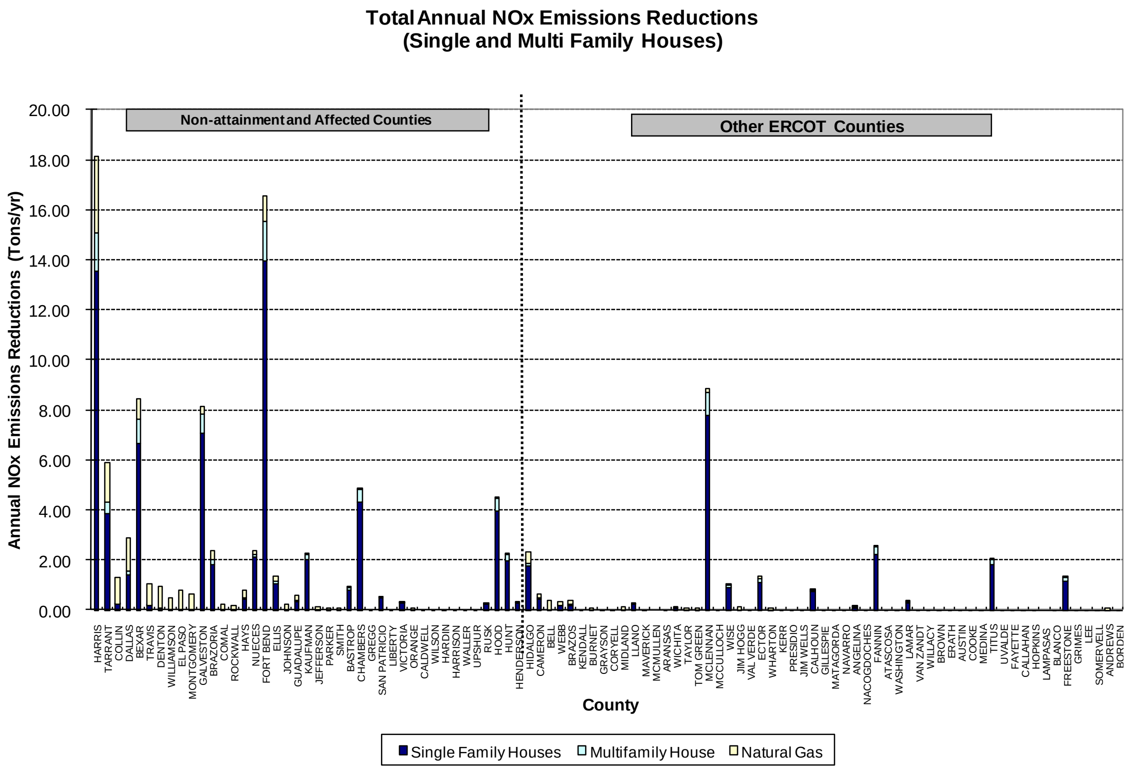


Figure 65: 2008 Annual and OSD Electricity Reductions from IECC/IRC by PCA for Single-family and Multi-family Residences by County



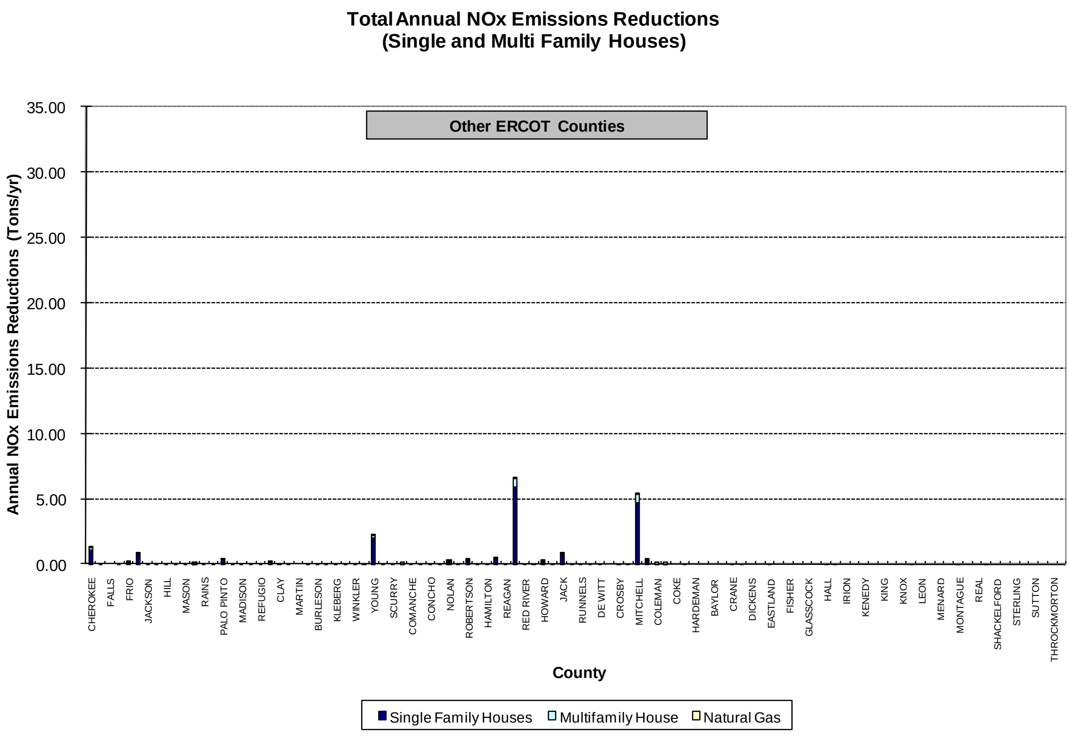
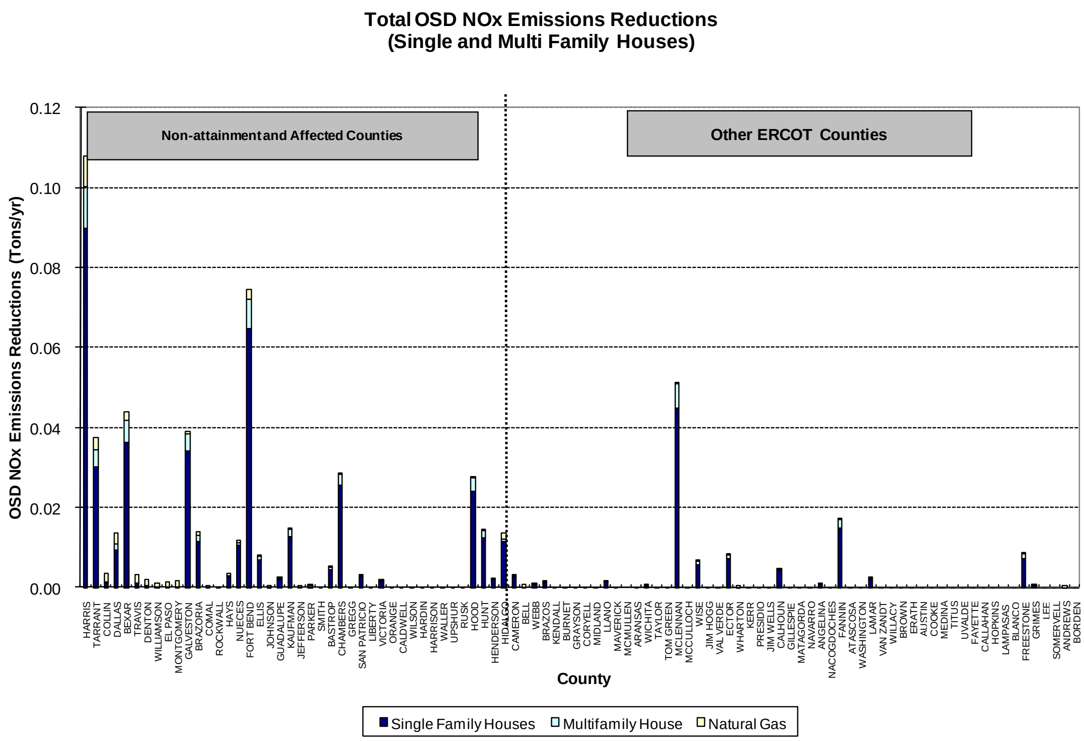


Figure 66: 2008 Annual NOx Reductions from Electricity and Natural Gas Savings due to the IECC/IRC for Single-family and Multi-family Residences by County (using 1999 Base Year and 2007 eGRID)



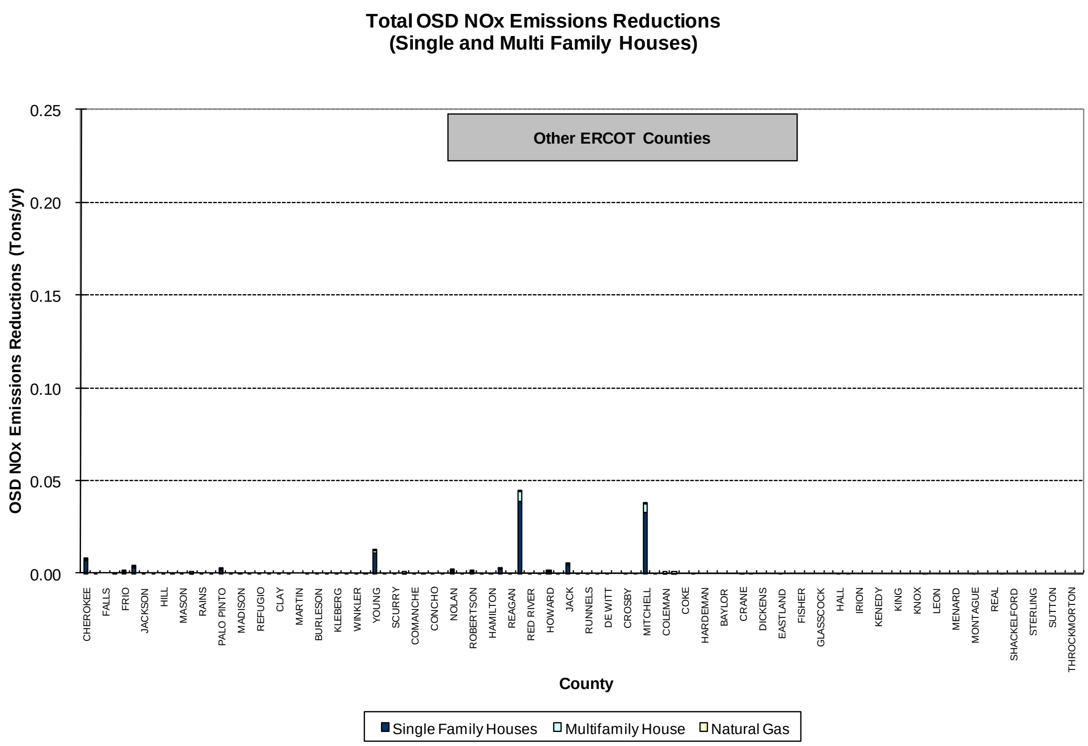
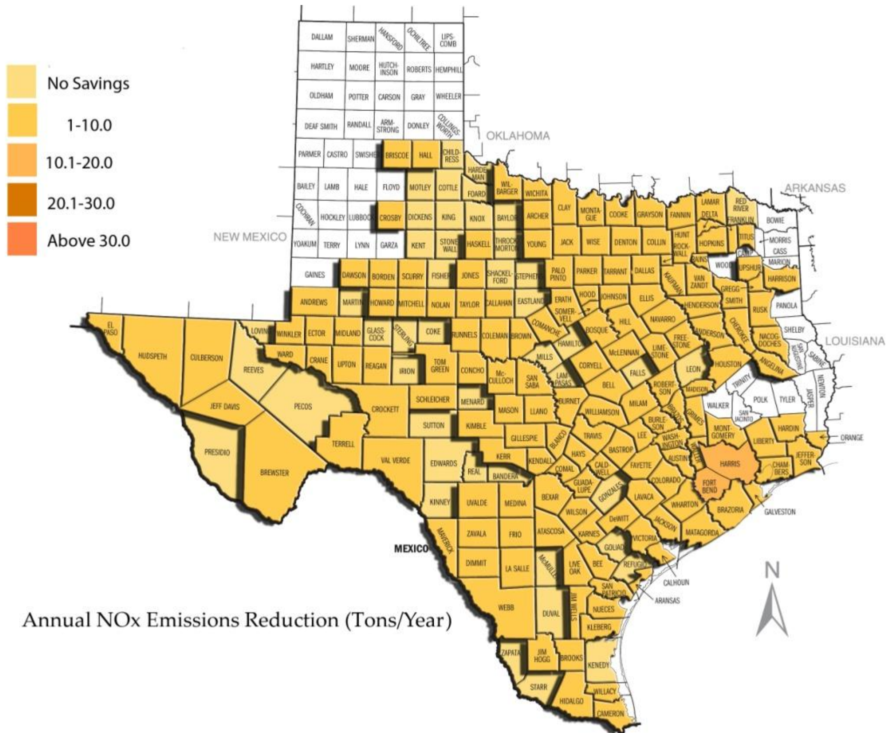


Figure 67: 2008 OSD NOx Reductions from Electricity and Natural Gas Savings due to the IECC/IRC for Single-family and Multi-family Residences by County (using 1999 Base Year and 2007 eGRID)



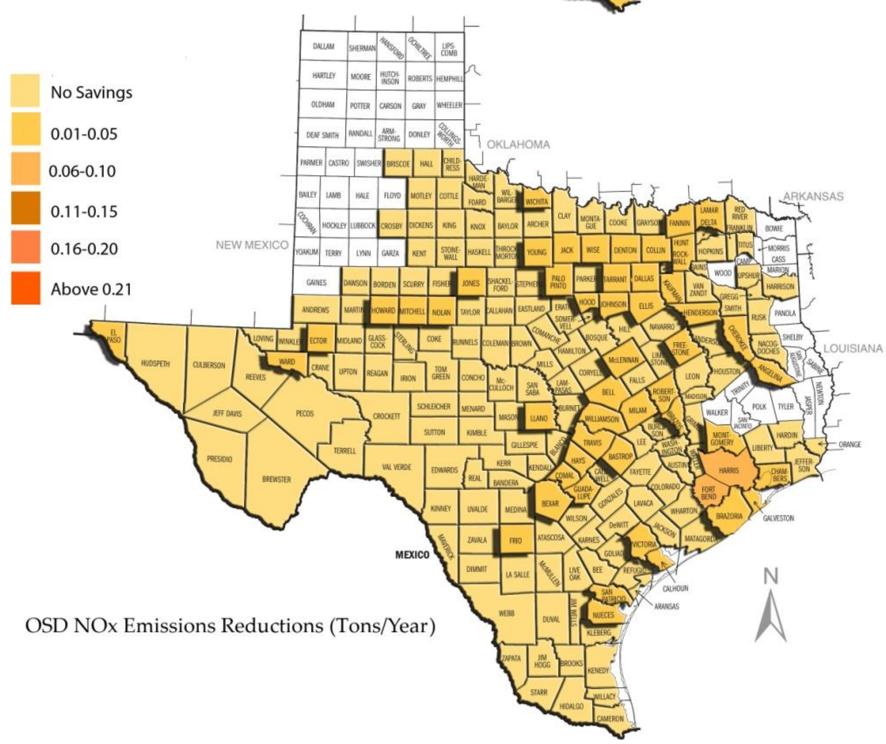


Figure 68: 2008 Annual and OSD NOx Reductions from Electricity and Natural Gas Savings Due to the IECC/IRC for Single-family and Multi-family Residences by County (Using 1999 Base Year and 2007 eGRID)

6.1.4 2008 Results for Commercial Construction

This section reports on the calculated energy and emissions savings from new commercial construction in 2008 that was built to meet the new ASHRAE Standard 90.1-1999 energy code. Construction prior to September 2001 was assumed to comply with ASHRAE Standard 90.1-1989, which was determined from a survey of engineers and architects reported in the Laboratory's 2006 Annual report to the TCEQ. To determine the energy and emissions savings from new commercial construction in all counties in ERCOT region as well as the 41 non-attainment and affected counties, data from two sources were merged into one analysis as shown in Figure 69. In this figure, the analysis is described that covers results shown in Figure 70 to Figure 75 and in Table 24 to Table 49.

Beginning in the upper left of Figure 69, the Dodge database of the square footage of new commercial construction in Texas (Dodge 2005) was merged with the energy savings calculations published by the Pacific Northwest National Laboratory (PNNL) in a report prepared for the U.S.D.O.E. (USDOE 2004). This allowed for the new construction to be tracked by county, and energy savings to be calculated by building type. In the next block in Figure 69 and Table 24, the merged categories from the Dodge and PNNL database can be seen. This resulted in 12 Dodge categories being merged into 7 PNNL energy use categories. In the 4^{th} and 5^{th} PNNL category, the Dodge "stores and restaurant" category had to be split into two categories to match the two PNNL categories for "retail" and "food." To accomplish this, information published in the 1999 and 2003 CBEC database (Table 25) by the U.S.D.O.E's Energy Information Agency (EIA) was used to determine the percentages used to split the Dodge conditioned area for each county as shown (i.e., 21.06% for food and 78.94% for retail). Table 26 shows the Dodge data for 1999 to 2003 prior to merging into the PNNL categories, which are shown by category in Figure 70 and Figure 71. Table 28 shows the Dodge data for 1999 to 2003 after merging into the required PNNL categories for the energy savings calculations, which were then used with the Dodge data from Table 28 for 2003 in the 2007 calculations. The square footage of all PNNL building types are shown for each county, followed by individual graphs of each building type in the lower seven graphs.

In the next step the PNNL energy savings, which represent buildings built to ASHRAE Standard 90.1-1989 versus Standard 90.1-1999, which are expressed per square foot, were then multiplied by the published square feet of new construction. For the 2008 results, the values for 2005 were assumed[31] for 2007. Table 31 shows the annual and OSD energy use calculated for new construction, by building type, for Standard 90.1-1989, and 90.1-1999. Table 40 shows the county-wide annual electricity and natural gas savings by building type[32] [33].

In order to calculate the Ozone Season Day electricity and natural gas savings, simulations were performed on a typical office building that simulated a 6-story, 90,000-sq. ft. office building in Central Texas. Figure 74 provides an image of the office building (3-story shown). Table 48 (building LOADS) and Table 49 (building SYSTEM and PLANT information) provide the input characteristics used to simulate the office building. The results of these simulations show about a 13% annual energy use reduction (Haberl et al. 2005). The simulations were also used to simulate the electricity and natural gas used during the Ozone Season Day (July 15 to Sept. 15) as shown in Figure 76, Figure 77, and Table 50. In the bottom row of Table 50, a ratio was calculated to allow for the conversion of annual savings to OSD savings. This ratio was then used in the remaining building types to accomplish this conversion.

In the next calculation step, electric utility providers were assigned to each county according to the published 1998 sales data from the Texas Public Utilities Commission as shown in Table 51. In the case where more than one utility was shown selling electricity in a county, a percentage of electricity use was allocated according to the PUCT's 1998 sales data. In the lower half of Table 51, the total electricity savings by utility provider is shown for 2005 for all estimated new commercial construction. Table 52 shows the calculated annual NOx emissions reductions from electricity using the 1999 eGRID table for Texas.

---

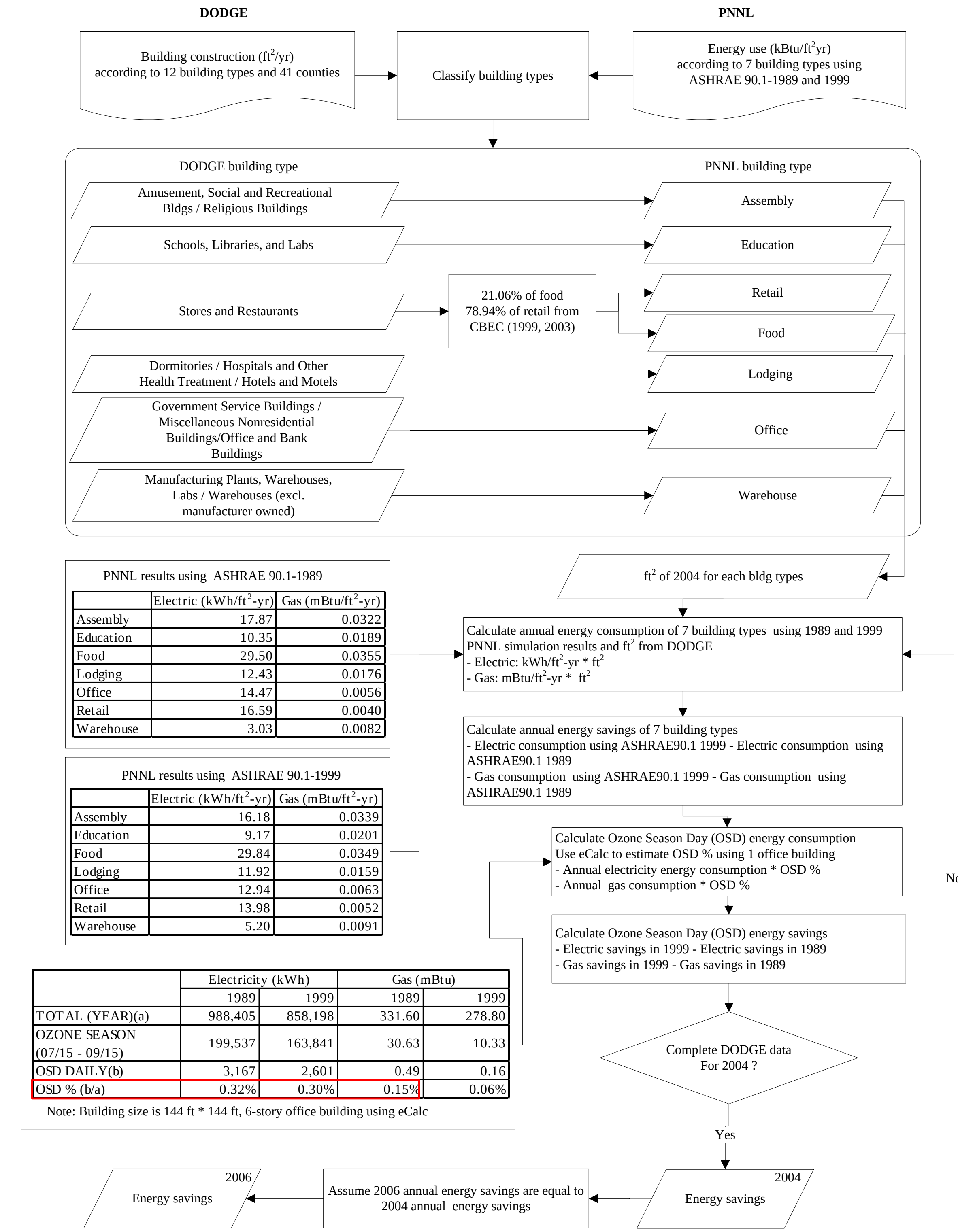
[31] This assumption is based on conversations with Texas State demographer's office.
[32] In this table (-) values are savings, (+) values are increased energy use.
[33] In a similar fashion as the preceeding table, in this table (-) values are savings, (+) values are increased energy use.

In a similar fashion as the annual calculations, electric utility providers were assigned to each county to calculate the OSD electricity savings by utility, as shown in Table 53. Table 54 shows the calculated NOx emissions reductions from electricity savings using the 1999 eGRID table for Texas.
Table 55 shows the data transformation required to present the data in the bar charts that follow.

Table 56 shows the transformation of the annual and OSD county-wide electricity and natural gas savings, along with the associated 1999 NOx emissions reductions with 7% T&D losses. Figure 78 shows the data transformed which uses the 1999 eGRID and 7% T&D losses. In Figure 80 and Figure 81 the NOx emissions reductions from the electricity use savings are shown using the 2007 eGRID for Texas.

6.1.5 2008 Results for New Residential (Single-family and Multi-family), and Commercial Construction using 2007 eGRID

Using the 2007 eGRID, the total NOx reductions from electricity and natural gas savings from new commercial construction in 2008 are calculated to be 38.51 tons NOx/year which represents 41.35 tons NOx/year from electricity savings and an increase of 2.84 tons NOx/year from natural gas. On a peak Ozone Season Day (OSD), the NOx reductions in 2008 are calculated to be 0.31 tons of NOx/day which represents 0.26 tons NOx/day from electricity savings and 0.05 tons NOx/day from natural gas savings.



PNNL results using ASHRAE 90.1-1989

	Electric (kWh/ft²-yr)	Gas (mBtu/ft²-yr)
Assembly	17.87	0.0322
Education	10.35	0.0189
Food	29.50	0.0355
Lodging	12.43	0.0176
Office	14.47	0.0056
Retail	16.59	0.0040
Warehouse	3.03	0.0082

PNNL results using ASHRAE 90.1-1999

	Electric (kWh/ft²-yr)	Gas (mBtu/ft²-yr)
Assembly	16.18	0.0339
Education	9.17	0.0201
Food	29.84	0.0349
Lodging	11.92	0.0159
Office	12.94	0.0063
Retail	13.98	0.0052
Warehouse	5.20	0.0091

	Electricity (kWh)		Gas (mBtu)	
	1989	1999	1989	1999
TOTAL (YEAR)(a)	988,405	858,198	331.60	278.80
OZONE SEASON (07/15 - 09/15)	199,537	163,841	30.63	10.33
OSD DAILY(b)	3,167	2,601	0.49	0.16
OSD % (b/a)	0.32%	0.30%	0.15%	0.06%

Note: Building size is 144 ft * 144 ft, 6-story office building using eCalc

Figure 69: Analysis Method for Calculating the 2008 Energy and Emissions Savings from Commercial Buildings (Updated)

Table 24: Commercial Building Descriptions from USDOE (2004) Report and Dodge (2005)

No	PNNL Bldg Types	Dodge Bldg Types
1	Assembly	Amusement, Social and Recreational Bldgs
2		Religious Buildings
3	Education	Schools, Libraries, and Labs (nonmfg)
4	Retail	Stores and Restaurants
5	Food	Stores and Restaurants
6	Lodging	Dormitories
7		Hospitals and Other Health Treatment
8		Hotels and Motels
9	Office	Government Service Buildings
10		Miscellaneous Nonresidential Buildings
11		Office and Bank Buildings
12	Warehouse	Manufacturing Plants, Warehouses, Labs
13		Warehouses (excl. manufacturer owned)

Table 25: Floor Area from CBEC (1999, 2003) Database for Retail and Food Type Commercial Buildings

		CBEC (1999)		CBEC (2003)	
		All (million square feet)	South (million square feet)	All (million square feet)	South (million square feet)
Food	Food Sales	994	392	1,255	487
	Food Service	1851	676	1,654	764
Retail	Retail (Other Than Mall)	4766	1566	4,317	1,844
	Enclosed and Strip Malls	5631	2513	6,875	3,251

	South		All	
	Food %	Retail %	Food %	Retail %
CBEC (1999)[34]	20.75	79.25	21.48	78.52
CBEC (2003)[35]	19.71	80.29	20.63	79.37
Average	20.23	79.77	21.06	78.94

[34] http://www.eia.doe.gov/emeu/cbecs/pdf/alltables.pdf, pg. 4
[35] http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/pdf2003/seta.pdf, pg. 1

Table 26: 2008 New Commercial Building Construction (sq. ft. x 1000) [36]

Table shows Dodge (2005) data before merging into PNNL building types (sq. ft. x 1000) (Part 1)

County	Assembly	Education	Retail	Food	Lodging	Office	Warehouse
HARRIS	1424	2949	2360	630	1642	2392	4792
TARRANT	737	1564	1667	445	1003	902	1875
COLLIN	459	974	1131	302	487	683	490
DALLAS	909	1769	1283	342	865	2020	2910
BEXAR	532	1781	1141	305	1202	886	904
TRAVIS	315	525	646	172	652	527	398
DENTON	327	1041	621	166	383	315	758
WILLIAMSON	116	399	305	81	123	134	119
EL PASO	295	746	343	92	300	461	1116
MONTGOMERY	176	477	408	109	195	321	204
GALVESTON	84	197	173	46	106	174	62
BRAZORIA	94	366	237	63	57	70	115
COMAL	25	145	71	19	47	52	28
ROCKWALL	26	158	95	25	15	26	36
HAYS	75	219	121	32	59	137	65
NUECES	102	150	70	19	162	121	124
FORT BEND	211	546	454	121	182	347	484
ELLIS	46	117	63	17	21	26	300
JOHNSON	9	134	51	14	4	8	64
GUADALUPE	21	140	69	18	38	66	142
KAUFMAN	20	118	28	8	5	15	79
JEFFERSON	88	117	165	44	245	102	48
PARKER	10	130	71	19	37	8	6
SMITH	80	113	87	23	120	121	147
BASTROP	5	53	16	4	45	6	6
CHAMBERS	7	33	5	1	0	13	0
GREGG	48	33	45	12	80	25	42
SAN PATRICIO	13	56	23	6	19	75	241
LIBERTY	5	171	13	3	6	15	2
VICTORIA	17	16	29	8	20	17	10
ORANGE	11	107	17	5	19	18	15
CALDWELL	2	60	12	3	6	2	11
WILSON	2	24	5	1	10	0	0
HARDIN	6	38	13	3	0	1	0
HARRISON	39	61	32	9	33	13	10
WALLER	3	12	0	0	0	0	14
UPSHUR	11	29	4	1	2	5	2
RUSK	1	6	11	3	1	2	2
HOOD	34	62	12	3	6	10	0
HUNT	17	80	14	4	13	18	11
HENDERSON	4	21	9	2	2	3	17
HIDALGO	0	0	0	0	0	0	0
CAMERON	80	390	169	45	215	170	298
BELL	78	257	88	23	326	162	118
WEBB	28	275	53	14	95	78	118
BRAZOS	150	293	106	28	209	188	54
KENDALL	0	0	0	0	0	0	0
BURNET	7	51	10	3	9	12	2
GRAYSON	25	113	43	12	35	17	90
CORYELL	13	35	19	5	16	4	7
MIDLAND	88	59	89	24	51	59	18
LLANO	1	24	0	0	56	4	0
MAVERICK	13	41	12	3	28	24	1
MCMULLEN	2	1	0	0	0	1	0
ARANSAS	4	1	26	7	7	14	0
WICHITA	59	50	51	13	165	57	28
TAYLOR	34	49	80	21	60	32	52
TOM GREEN	61	89	52	14	112	40	33
MCLENNAN	71	266	99	26	122	92	121
MCCULLOCH	0	9	0	0	0	0	0
WISE	18	73	1	0	47	19	0
JIM HOGG	0	8	0	0	1	10	0
VAL VERDE	9	29	7	2	9	27	3
ECTOR	28	92	38	10	125	22	219
WHARTON	9	16	30	8	6	6	11
KERR	43	50	23	6	53	26	0
PRESIDIO	3	5	0	0	0	1	0
JIM WELLS	0	47	22	6	23	7	4
CALHOUN	0	11	18	5	1	21	0
GILLESPIE	8	6	13	3	7	2	5
MATAGORDA	4	26	5	1	9	6	7
NAVARRO	3	30	18	5	14	2	34
ANGELINA	33	53	45	12	29	21	7
NACOGDOCHES	22	117	19	5	27	14	13
FANNIN	6	20	3	1	4	2	5
ATASCOSA	11	21	11	3	9	2	2
WASHINGTON	30	36	33	9	12	13	25
LAMAR	4	29	5	1	2	5	2
VAN ZANDT	1	41	0	0	0	1	0
WILLACY	2	42	27	7	1	26	7
BROWN	5	15	8	2	12	10	6
ERATH	4	31	2	1	8	2	2
AUSTIN	1	38	1	0	5	1	194
COOKE	21	76	50	13	66	16	19
MEDINA	3	20	1	0	0	11	1
TITUS	4	26	7	2	0	2	0
UVALDE	14	32	33	9	5	7	8
FAYETTE	2	14	3	1	15	4	1
CALLAHAN	3	18	0	0	0	3	1
HOPKINS	5	17	10	3	5	2	12
LAMPASAS	2	9	12	3	7	4	0
BLANCO	0	18	0	0	0	0	0
FREESTONE	0	8	0	0	1	1	0
GRIMES	3	8	0	0	0	4	0
LEE	1	13	1	0	0	5	0
SOMERVELL	0	7	0	0	1	5	1
ANDREWS	1	6	0	0	3	0	0
BORDEN	0	0	0	0	0	0	0
CHEROKEE	37	56	10	3	26	21	34
DIMMIT	0	3	0	0	0	6	0

[36] Source: Dodge/McGraw-Hill 2007

Table 27: 2008 New Commercial Building Construction (sq. ft. x 1000)[37]

Table shows Dodge (2005) data before merging into PNNL building types (sq. ft. x 1000) (Part 2)

County	Assembly	Education	Retail	Food	Lodging	Office	Warehouse
FALLS	0	0	0	0	0	0	0
COLORADO	0	17	0	0	4	8	0
FRIO	0	16	4	1	2	1	0
MILAM	3	39	10	3	0	19	0
JACKSON	1	16	1	0	0	0	0
ANDERSON	1	1	2	1	2	2	1
HILL	4	49	7	2	3	1	0
CULBERSON	1	8	0	0	0	1	0
MASON	0	1	0	0	0	2	0
PECOS	3	6	0	0	9	11	0
RAINS	1	8	0	0	0	1	0
LAVACA	7	2	0	0	1	2	0
PALO PINTO	4	26	15	4	3	2	2
KIMBLE	2	0	0	0	0	2	0
MADISON	1	10	0	0	0	0	0
ARCHER	1	17	0	0	4	0	2
REFUGIO	1	1	0	0	0	2	0
LIMESTONE	3	5	9	2	4	9	0
CLAY	0	3	0	0	0	5	0
BEE	19	49	5	1	21	19	0
MARTIN	0	0	0	0	0	0	0
GONZALES	0	4	1	0	2	1	0
BURLESON	1	12	1	0	2	8	0
KARNES	0	7	0	0	1	5	0
KLEBERG	6	38	33	9	8	6	1
BREWSTER	4	11	0	0	6	10	6
WINKLER	1	0	0	0	0	0	0
FRANKLIN	0	0	0	0	0	0	26
YOUNG	10	21	23	6	6	4	2
HOUSTON	2	5	17	5	7	2	0
SCURRY	1	0	4	1	2	1	12
BOSQUE	1	16	0	0	0	1	0
COMANCHE	7	36	1	0	72	0	2
BRISCOE	0	0	0	0	0	0	0
CONCHO	0	0	0	0	0	2	0
ZAVALA	0	5	0	0	1	1	0
NOLAN	6	17	10	3	8	0	0
BROOKS	0	0	0	0	0	9	0
ROBERTSON	1	3	0	0	1	0	1
LIVE OAK	10	0	0	0	0	0	0
HAMILTON	0	6	0	0	4	0	0
JONES	8	8	0	0	0	0	4
REAGAN	1	0	0	0	0	8	0
WARD	0	0	0	0	0	7	0
RED RIVER	2	14	0	0	0	0	0
HASKELL	0	0	9	2	0	14	0
HOWARD	4	10	1	0	5	3	0
SAN SABA	4	3	1	0	0	0	0
JACK	1	1	0	0	0	17	0
STEPHENS	0	6	0	0	1	0	0
RUNNELS	0	6	1	0	0	2	0
REEVES	5	2	0	0	4	47	0
DE WITT	0	0	0	0	0	0	0
CHILDRESS	0	0	0	0	0	0	0
CROSBY	1	0	0	0	1	0	0
DAWSON	0	7	0	0	0	16	0
MITCHELL	4	0	0	0	5	14	0
WILBARGER	3	7	9	2	11	17	1
COLEMAN	1	1	0	0	1	1	0
UPTON	0	0	0	0	0	0	0
COKE	0	0	0	0	0	0	0
CROCKETT	3	2	0	0	0	0	0
HARDEMAN	0	0	0	0	0	0	0
BANDERA	0	0	0	0	0	0	0
BAYLOR	0	1	0	0	2	0	0
COTTLE	0	2	0	0	0	0	0
CRANE	1	1	0	0	0	0	0
DELTA	0	3	0	0	0	0	0
DICKENS	0	0	0	0	0	0	0
DUVAL	0	20	1	0	0	4	0
EASTLAND	7	4	20	5	1	4	0
EDWARDS	0	0	0	0	0	0	0
FISHER	0	3	0	0	2	0	0
FOARD	0	0	0	0	0	0	0
GLASSCOCK	0	0	0	0	0	0	0
GOLIAD	0	4	0	0	0	1	0
HALL	0	1	0	0	0	0	0
HUDSPETH	1	9	0	0	0	13	0
IRION	0	0	0	0	0	0	0
JEFF DAVIS	6	0	0	0	0	2	0
KENEDY	0	0	0	0	0	1	0
KENT	0	0	0	0	2	0	0
KING	0	0	0	0	0	0	0
KINNEY	0	3	0	0	0	23	0
KNOX	1	1	0	0	0	0	0
LA SALLE	0	1	0	0	2	0	0
LEON	7	7	0	0	0	0	0
LOVING	0	0	0	0	0	0	0
MENARD	0	1	0	0	0	0	0
MILLS	2	8	0	0	0	1	0
MONTAGUE	1	13	10	3	6	5	1
MOTLEY	0	1	0	0	0	0	0
REAL	0	1	0	0	4	1	0
SCHLEICHER	0	0	0	0	0	0	0
SHACKELFORD	2	4	0	0	2	0	0
STARR	0	0	0	0	0	0	0
STERLING	0	0	0	0	0	0	0
STONEWALL	0	0	0	0	0	0	0
SUTTON	0	2	0	0	1	1	0
TERRELL	0	0	0	0	0	6	0
THROCKMORTON	1	0	0	0	0	1	0
ZAPATA	2	40	1	0	1	12	0
TOTAL	7632	19555	13469	3593	10475	11788	17272

[37] Source: Dodge/McGraw-Hill 2007

Table 28: 2008 New Commercial Building Construction (sq. ft. x 1000)[38]

Table shows Dodge (2005) data merged into PNNL building types (sq. ft. x 1000) (Part 1)

(square feet in thousands)								
Non-attainment Counties	**Assembly**	**Education**	**Retail**	**Food**	**Lodging**	**Office**	**Warehouse**	**Stores and Restaurants**
BRAZORIA	94	366	237	63	57	70	115	514
CHAMBERS	7	33	5	1	0	13	0	0
COLLIN	459	974	1,131	302	487	683	490	1,580
DALLAS	909	1,769	1,283	342	865	2,020	2,910	2,004
DENTON	327	1,041	621	166	383	315	758	907
EL PASO	295	746	343	92	300	461	1,116	537
FORT BEND	211	546	454	121	182	347	484	370
GALVESTON	84	197	173	46	106	174	62	426
HARDIN	6	38	13	3	0	1	0	0
HARRIS	1,424	2,949	2,360	630	1,642	2,392	4,792	4,778
JEFFERSON	88	117	165	44	245	102	48	195
LIBERTY	5	171	13	3	6	15	2	9
MONTGOMERY	176	477	408	109	195	321	204	452
ORANGE	11	107	17	5	19	18	15	104
TARRANT	737	1,564	1,667	445	1,003	902	1,875	2,836
WALLER	3	12	0	0	0	0	14	22
TOTAL (NON-ATTAINMENT)	4,836	11,106	8,892	2,372	5,490	7,833	12,884	14,734

Affected Counties	**Assembly**	**Education**	**Retail**	**Food**	**Lodging**	**Office**	**Warehouse**	**Stores and Restaurants**
BASTROP	5	53	16	4	45	6	6	29
BEXAR	532	1,781	1,141	305	1,202	886	904	1,735
CALDWELL	2	60	12	3	6	2	11	4
COMAL	25	145	71	19	47	52	28	152
ELLIS	46	117	63	17	21	26	300	87
GREGG	48	33	45	12	80	25	42	13
GUADALUPE	21	140	69	18	38	66	142	387
HARRISON	39	61	32	9	33	13	10	4
HAYS	75	219	121	32	59	137	65	405
HENDERSON	4	21	9	2	2	3	17	2
HOOD	34	62	12	3	6	10	0	0
HUNT	17	80	14	4	13	18	11	15
JOHNSON	9	134	51	14	4	8	64	193
KAUFMAN	20	118	28	8	5	15	79	194
NUECES	102	150	70	19	162	121	124	103
PARKER	10	130	71	19	37	8	6	532
ROCKWALL	26	158	95	25	15	26	36	152
RUSK	1	6	11	3	1	2	2	140
SAN PATRICIO	13	56	23	6	19	75	241	161
SMITH	80	113	87	23	120	121	147	64
TRAVIS	315	525	646	172	652	527	398	1,436
UPSHUR	11	29	4	1	2	5	2	0
VICTORIA	17	16	29	8	20	17	10	15
WILLIAMSON	116	399	305	81	123	134	119	946
WILSON	2	24	5	1	10	0	0	74
TOTAL (AFFECTED)	1,570	4,630	3,030	808	2,723	2,302	2,763	6,843

[38] Source: Dodge/McGraw-Hill 2007

Table 29: 2008 New Commercial Building Construction (sq. ft. x 1000)[39]

Table shows Dodge (2005) data merged into PNNL building types (sq. ft. x 1000) (Part 2)

ERCOT Counties	Assembly	Education	Retail	Food	Lodging	Office	Warehouse	Stores and Restaurants
ANDERSON	1	1	2	1	2	2	1	28
ANDREWS	1	6	0	0	3	0	0	0
ANGELINA	33	53	45	12	29	21	7	134
ARANSAS	4	1	26	7	7	14	0	160
ARCHER	1	17	0	0	4	0	2	0
ATASCOSA	11	21	11	3	9	2	2	3
AUSTIN	1	38	1	0	5	1	194	0
BANDERA	0	0	0	0	0	0	0	0
BASTROP	0	0	0	0	0	0	0	29
BAYLOR	0	1	0	0	2	0	0	0
BEE	19	49	5	1	21	19	0	0
BELL	78	257	88	23	326	162	118	510
BEXAR	532	1,781	1,141	305	1,202	886	904	1,735
BLANCO	0	18	0	0	0	0	0	0
BORDEN	0	0	0	0	0	0	0	0
BOSQUE	1	16	0	0	0	1	0	0
BRAZORIA	94	366	237	63	57	70	115	514
BRAZOS	150	293	106	28	209	188	54	158
BREWSTER	4	11	0	0	6	10	6	0
BRISCOE	0	0	0	0	0	0	0	0
BROOKS	0	0	0	0	0	9	0	0
BROWN	5	15	8	2	12	10	6	105
BURLESON	1	12	1	0	2	8	0	0
BURNET	7	51	10	3	9	12	2	28
CALDWELL	0	0	0	0	0	0	0	4
CALHOUN	0	11	18	5	1	21	0	155
CALLAHAN	3	18	0	0	0	3	1	0
CAMERON	80	390	169	45	215	170	298	512
CHAMBERS	7	33	5	1	0	13	0	0
CHEROKEE	37	56	10	3	26	21	34	6
CHILDRESS	0	0	0	0	0	0	0	0
CLAY	0	3	0	0	0	5	0	0
COKE	0	0	0	0	0	0	0	0
COLEMAN	1	1	0	0	1	1	0	0
COLLIN	459	974	1,131	302	487	683	490	1,580
COLORADO	0	17	0	0	4	8	0	0
COMAL	25	145	71	19	47	52	28	152
COMANCHE	7	36	1	0	72	0	2	0
CONCHO	0	0	0	0	0	2	0	0
COOKE	21	76	50	13	66	16	19	0
CORYELL	13	35	19	5	16	4	7	155
COTTLE	0	2	0	0	0	0	0	0
CRANE	1	1	0	0	0	0	0	0
CROCKETT	3	2	0	0	0	0	0	0
CROSBY	1	0	0	0	1	0	0	0
CULBERSON	1	8	0	0	0	1	0	0
DALLAS	0	0	0	0	0	0	0	2,004
DAWSON	0	7	0	0	0	16	0	0
DE WITT	0	0	0	0	0	0	0	0
DELTA	0	3	0	0	0	0	0	0
DENTON	0	0	0	0	0	0	0	907
DICKENS	0	0	0	0	0	0	0	0
DIMMIT	0	3	0	0	0	6	0	0
DUVAL	0	20	1	0	0	4	0	0
EASTLAND	7	4	20	5	1	4	0	0
ECTOR	28	92	38	10	125	22	219	26
EDWARDS	0	0	0	0	0	0	0	0
ELLIS	46	117	63	17	21	26	300	87
ERATH	4	31	2	1	8	2	2	15
FALLS	0	0	0	0	0	0	0	0
FANNIN	6	20	3	1	4	2	5	0
FAYETTE	2	14	3	1	15	4	1	0
FISHER	0	3	0	0	2	0	0	0
FOARD	0	0	0	0	0	0	0	0
FORT BEND	0	0	0	0	0	0	0	370
FRANKLIN	0	0	0	0	0	0	26	0
FREESTONE	0	8	0	0	1	1	0	0
FRIO	0	16	4	1	2	1	0	0
GALVESTON	0	0	0	0	0	0	0	426
GILLESPIE	8	6	13	3	7	2	5	155
GLASSCOCK	0	0	0	0	0	0	0	0
GOLIAD	0	4	0	0	0	1	0	0
GONZALES	0	4	1	0	2	1	0	7
GRAYSON	25	113	43	12	35	17	90	103
GRIMES	3	8	0	0	0	4	0	0
GUADALUPE	21	140	69	18	38	66	142	387
HALL	0	1	0	0	0	0	0	0
HAMILTON	0	6	0	0	4	0	0	0
HARDEMAN	0	0	0	0	0	0	0	0
HARRIS	1,424	2,949	2,360	630	1,642	2,392	4,792	4,778
HASKELL	0	0	9	2	0	14	0	0
HAYS	75	219	121	32	59	137	65	405
HENDERSON	0	0	0	0	0	0	0	2
HIDALGO	0	0	0	0	0	0	0	943
HILL	4	49	7	2	3	1	0	0
HOOD	34	62	12	3	6	10	0	0
HOPKINS	5	17	10	3	5	2	12	3
HOUSTON	2	5	17	5	7	2	0	0
HOWARD	4	10	1	0	5	3	0	6
HUDSPETH	1	9	0	0	0	13	0	0
HUNT	17	80	14	4	13	18	11	15
IRION	0	0	0	0	0	0	0	0
JACK	1	1	0	0	0	17	0	0
JACKSON	1	16	1	0	0	0	0	0
JEFF DAVIS	6	0	0	0	0	2	0	0
JIM HOGG	0	8	0	0	1	10	0	0
JIM WELLS	0	47	22	6	23	7	4	3
JOHNSON	9	134	51	14	4	8	64	193
JONES	8	8	0	0	0	0	4	0
KARNES	0	7	0	0	1	5	0	0
KAUFMAN	20	118	28	8	5	15	79	194
KENDALL	0	0	0	0	0	0	0	9
KENEDY	0	0	0	0	0	1	0	0

[39] Source: Dodge/McGraw-Hill 2007

Table 30: 2008 New Commercial Building Construction (sq. ft. x 1000)[40]

Table shows Dodge (2005) data merged into PNNL building types (sq. ft. x 1000) (Part 3)

ERCOT Counties	Assembly	Education	Retail	Food	Lodging	Office	Warehouse	Stores and Restaurants
KENT	0	0	0	0	2	0	0	0
KERR	43	50	23	6	53	26	0	0
KIMBLE	2	0	0	0	0	2	0	0
KING	0	0	0	0	0	0	0	0
KINNEY	0	3	0	0	0	23	0	0
KLEBERG	6	38	33	9	8	6	1	160
KNOX	1	1	0	0	0	0	0	0
LA SALLE	0	1	0	0	2	0	0	0
LAMAR	4	29	5	1	2	5	2	10
LAMPASAS	2	9	12	3	7	4	0	2
LAVACA	7	2	0	0	1	2	0	0
LEE	1	13	1	0	0	5	0	12
LEON	7	7	0	0	0	0	0	0
LIMESTONE	3	5	9	2	4	9	0	0
LIVE OAK	10	0	0	0	0	0	0	0
LLANO	1	24	0	0	56	4	0	0
LOVING	0	0	0	0	0	0	0	0
MADISON	1	10	0	0	0	0	0	0
MARTIN	0	0	0	0	0	0	0	0
MASON	0	1	0	0	0	2	0	0
MATAGORDA	4	26	5	1	9	6	7	0
MAVERICK	13	41	12	3	28	24	1	30
MCCULLOCH	0	9	0	0	0	0	0	0
MCLENNAN	71	266	99	26	122	92	121	148
MCMULLEN	2	1	0	0	0	1	0	0
MEDINA	3	20	1	0	0	11	1	0
MENARD	0	1	0	0	0	0	0	0
MIDLAND	88	59	89	24	51	59	18	188
MILAM	3	39	10	3	0	19	0	100
MILLS	2	8	0	0	0	1	0	0
MITCHELL	4	0	0	0	5	14	0	0
MONTAGUE	1	13	10	3	6	5	1	100
MONTGOMERY	0	0	0	0	0	0	0	452
MOTLEY	0	1	0	0	0	0	0	0
NACOGDOCHES	22	117	19	5	27	14	13	0
NAVARRO	3	30	18	5	14	2	34	215
NOLAN	6	17	10	3	8	0	0	100
NUECES	0	0	0	0	0	0	0	103
PALO PINTO	4	26	15	4	3	2	2	203
PARKER	10	130	71	19	37	8	6	532
PECOS	3	6	0	0	9	11	0	0
PRESIDIO	3	5	0	0	0	1	0	0
RAINS	1	8	0	0	0	1	0	0
REAGAN	1	0	0	0	0	8	0	0
REAL	0	1	0	0	4	1	0	0
RED RIVER	2	14	0	0	0	0	0	0
REEVES	5	2	0	0	4	47	0	5
REFUGIO	1	1	0	0	0	2	0	0
ROBERTSON	1	3	0	0	1	0	1	0
ROCKWALL	26	158	95	25	15	26	36	152
RUNNELS	0	6	1	0	0	2	0	0
RUSK	1	6	11	3	1	2	2	140
SAN PATRICIO	13	56	23	6	19	75	241	161
SAN SABA	4	3	1	0	0	0	0	0
SCHLEICHER	0	0	0	0	0	0	0	0
SCURRY	1	0	4	1	2	1	12	0
SHACKELFORD	2	4	0	0	2	0	0	0
SMITH	80	113	87	23	120	121	147	64
SOMERVELL	0	7	0	0	1	5	1	0
STARR	0	0	0	0	0	0	0	0
STEPHENS	0	6	0	0	1	0	0	0
STERLING	0	0	0	0	0	0	0	0
STONEWALL	0	0	0	0	0	0	0	0
SUTTON	0	2	0	0	1	1	0	0
TARRANT	737	1,564	1,667	445	1,003	902	1,875	2,836
TAYLOR	34	49	80	21	60	32	52	384
TERRELL	0	0	0	0	0	6	0	0
THROCKMORTON	1	0	0	0	0	1	0	0
TITUS	4	26	7	2	0	2	0	0
TOM GREEN	61	89	52	14	112	40	33	158
TRAVIS	315	525	646	172	652	527	398	1,436
UPTON	0	0	0	0	0	0	0	0
UVALDE	14	32	33	9	5	7	8	236
VAL VERDE	9	29	7	2	9	27	3	5
VAN ZANDT	1	41	0	0	0	1	0	0
VICTORIA	0	0	0	0	0	0	0	15
WALLER	3	12	0	0	0	0	14	22
WARD	0	0	0	0	0	7	0	0
WASHINGTON	30	36	33	9	12	13	25	253
WEBB	28	275	53	14	95	78	118	33
WHARTON	9	16	30	8	6	6	11	29
WICHITA	59	50	51	13	165	57	28	103
WILBARGER	3	7	9	2	11	17	1	0
WILLACY	2	42	27	7	1	26	7	4
WILLIAMSON	116	399	305	81	123	134	119	946
WILSON	0	0	0	0	0	0	0	74
WINKLER	1	0	0	0	0	0	0	0
WISE	18	73	1	0	47	19	0	0
YOUNG	10	21	23	6	6	4	2	0
ZAPATA	2	40	1	0	1	12	0	0
ZAVALA	0	5	0	0	1	1	0	0
TOTAL (ERCOT COUNTIES)	5,290	13,900	9,756	2,603	7,815	7,821	11,452	26,415

[40] Source: Dodge/McGraw-Hill 2007

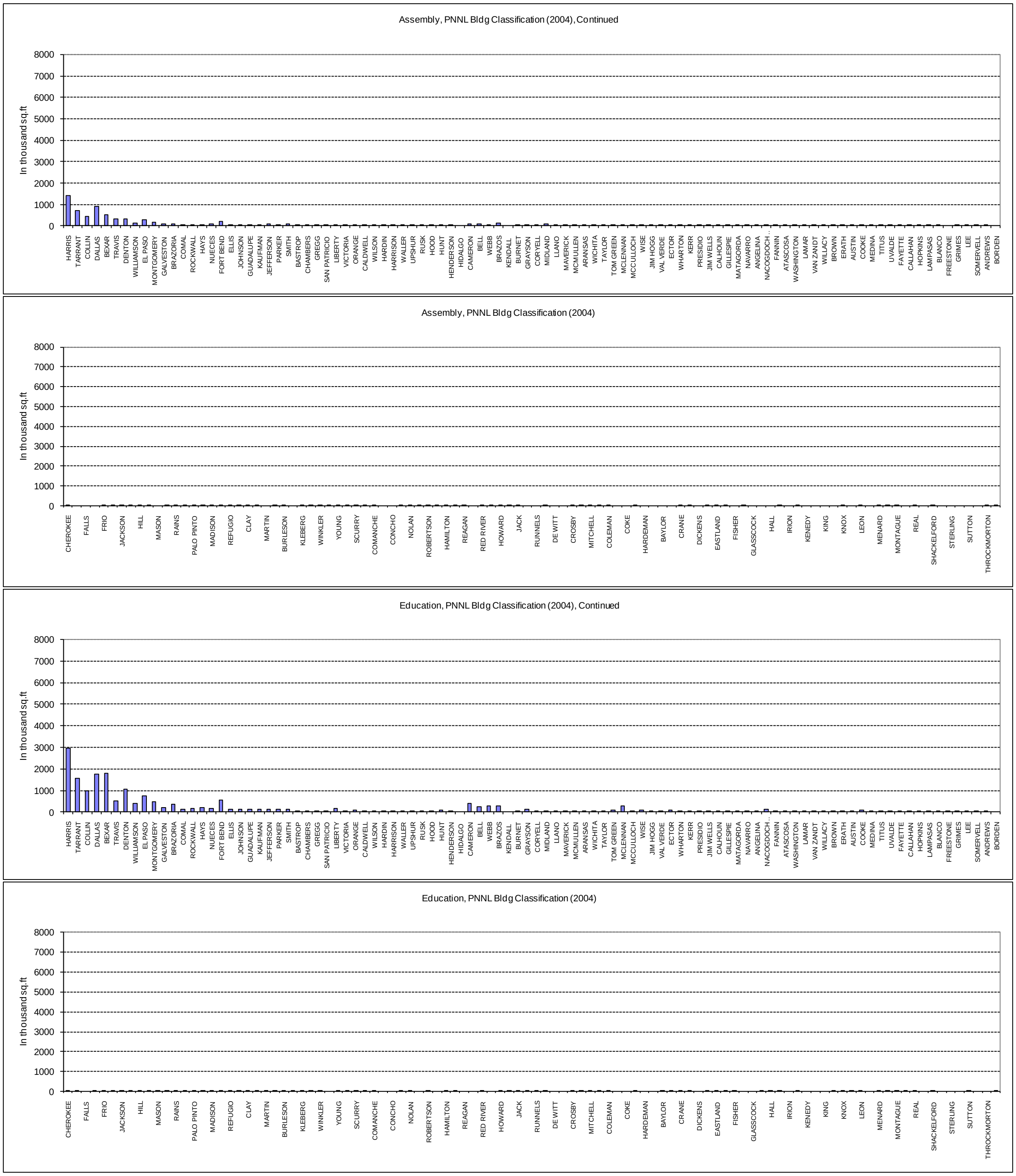


Figure 70: 2008 New Commercial Building Construction (sq. ft. x 1000), Part 1 (Dodge 2007)

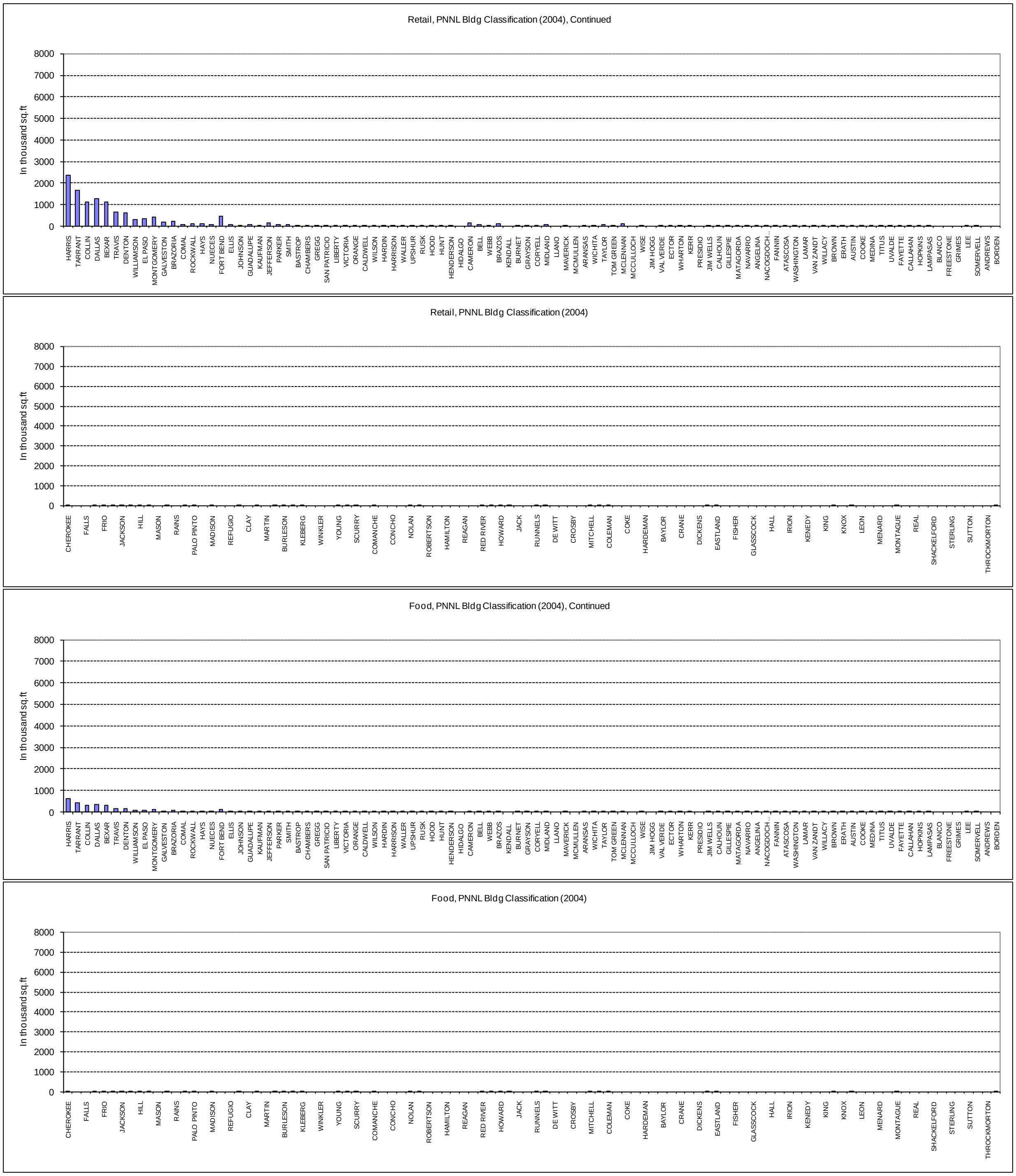


Figure 71: 2008 New Commercial Building Construction (sq. ft. x 1000), Part 2 (Dodge 2007)

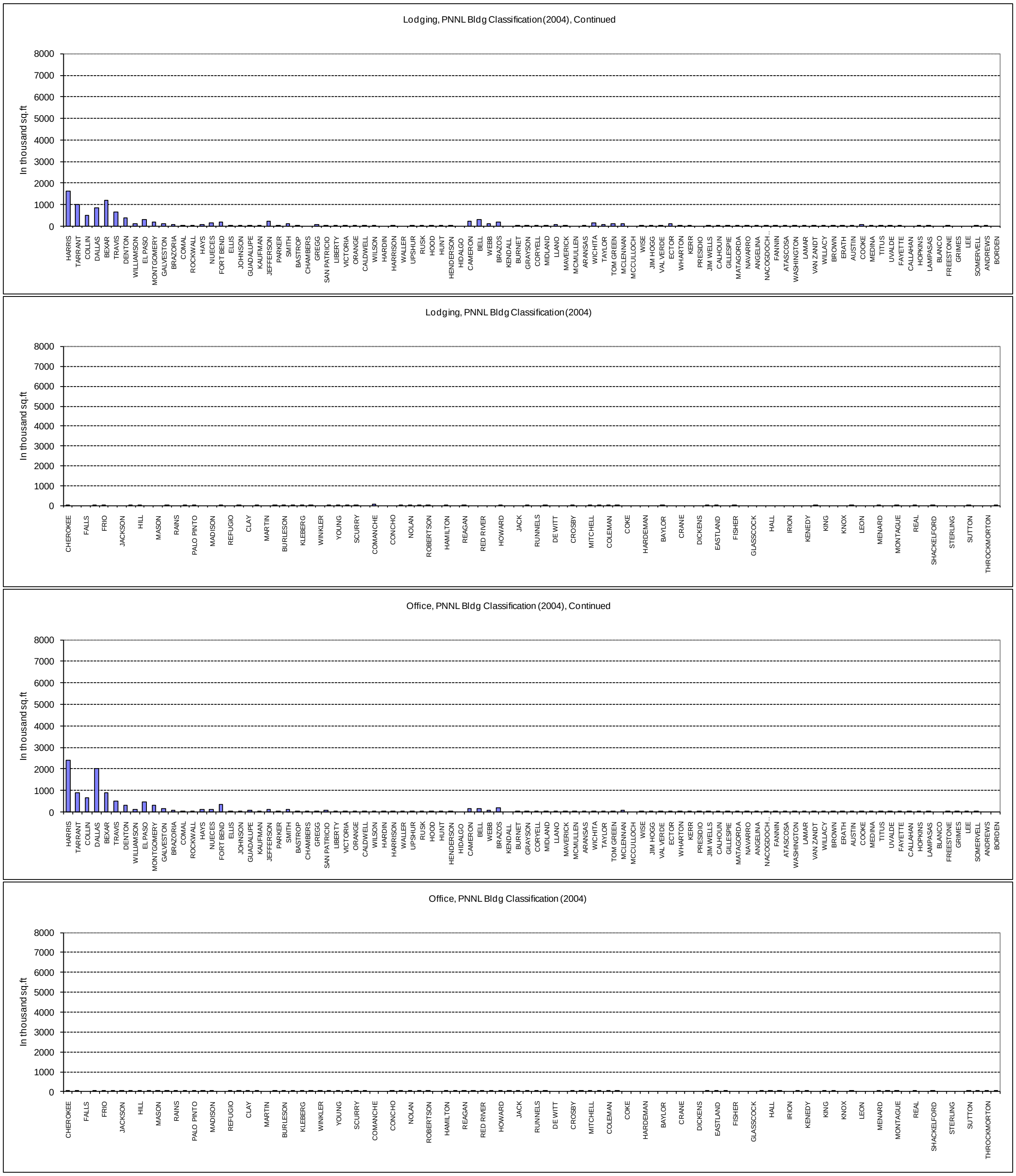


Figure 72: 2008 New Commercial Building Construction (sq. ft. x 1000), Part 3 (Dodge 2007)

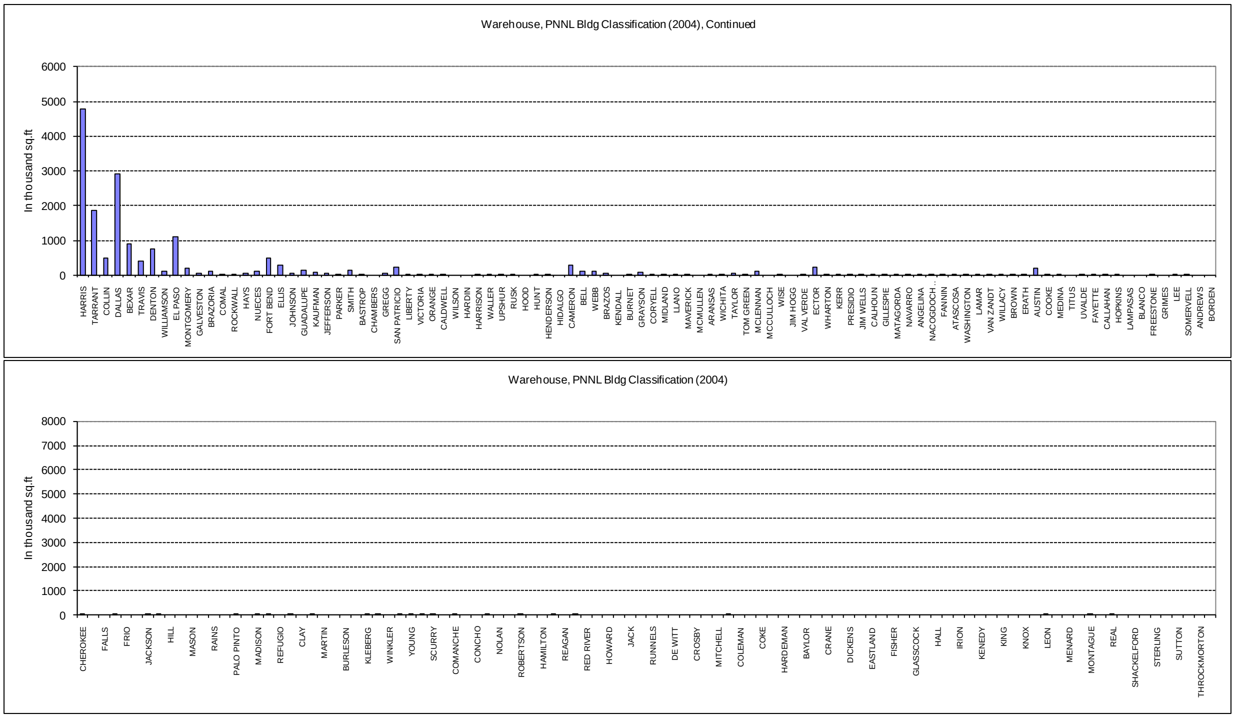


Figure 73: 2008 New Commercial Building Construction (sq. ft. x 1000), Part 4 (Dodge 2007)

Table 31: Calculated ASHRAE Standard 90.1-1989 and 1999 Energy Use for Assembly, Education, and Retail Building Types (USEDOE 2004) (Part 1)

Non-attainment Counties	**Assembly**									**Education**									**Retail**								
	In	**Electricity (kWh/yr), PNNL**				**Gas (mBtu/yr), PNNL**				**In**	**Electricity (kWh/yr), PNNL**				**Gas (mBtu/yr), PNNL**				**In**	**Electricity (kWh/yr), PNNL**				**Gas (mBtu/yr), PNNL**			
	thousand	**1989 (Annual)**	**1989 (OSD)**	**1999 (Annual)**	**1999 (OSD)**	**1989 (Annual)**	**1989 (OSD)**	**1999 (Annual)**	**1999 (OSD)**	**thousand**	**1989 (Annual)**	**1989 (OSD)**	**1999 (Annual)**	**1999 (OSD)**	**1989 (Annual)**	**1989 (OSD)**	**1999 (Annual)**	**1999 (OSD)**	**thousand**	**1989 (Annual)**	**1989 (OSD)**	**1999 (Annual)**	**1999 (OSD)**	**1989 (Annual)**	**1989 (OSD)**	**1999 (Annual)**	**1999 (OSD)**
Brazoria	94	1676521	5640.9	1517449	4828	3019	5	3178	2	366	3785990	12738	3354823	10675	6898	11	7333	5	237	3936500	13245	3316470	10553	937	1	1227	1
Chambers	7	121565	409.0	110031	350	219	0	230	0	33	346585	1166	307114	977	631	1	671	0	5	85951	289	72413	230	20	0	27	0
Collin	459	8211993	27630.3	7432821	23650	14786	23	15567	10	974	10083496	33927	8935137	28431	18371	28	19530	12	1131	18764361	63135	15808827	50302	4467	7	5847	4
Dallas	909	16249127	54672.3	14707374	46797	29257	45	30803	19	1769	18307345	61597	16222414	51618	33354	51	35459	22	1283	21286842	71622	17933997	57064	5068	8	6633	4
Denton	327	5848082	19676.6	5293203	16842	10530	16	11086	7	1041	10777562	36263	9550160	30388	19636	30	20875	13	621	10304989	34672	8681872	27625	2453	4	3211	2
El Paso	295	5266305	17719.2	4766627	15167	9482	15	9983	6	746	7724164	25989	6844497	21778	14073	22	14961	9	343	5693033	19155	4796336	15261	1355	2	1774	1
Fort Bend	211	3763926	12664.2	3406796	10840	6777	10	7135	4	546	5646948	19000	5003845	15922	10288	16	10937	7	454	7539432	25367	6351912	20211	1795	3	2349	1
Galveston	84	1500463	5048.5	1358096	4321	2702	4	2844	2	197	2038584	6859	1806420	5748	3714	6	3948	2	173	2868610	9652	2416781	7690	683	1	894	1
Hardin	6	111361	374.7	100795	321	201	0	211	0	38	394860	1329	349892	1113	719	1	765	0	13	217605	732	183331	583	52	0	68	0
Harris	1424	25443486	85607.9	23029352	73277	45812	71	48232	30	2949	30530802	102725	27053802	86082	55625	86	59134	37	2360	39158503	131754	32990731	104973	9322	14	12202	8
Jefferson	88	1576170	5303.2	1426619	4539	2838	4	2988	2	117	1215416	4089	1076998	3427	2214	3	2354	1	165	2739476	9217	2307987	7344	652	1	854	1
Liberty	5	83894	282.3	75934	242	151	0	159	0	171	1765150	5939	1564126	4977	3216	5	3419	2	13	216065	727	182033	579	51	0	67	0
Montgomery	176	3142465	10573.2	2844301	9050	5658	9	5957	4	477	4933359	16599	4371523	13910	8988	14	9555	6	408	6769525	22777	5703271	18147	1612	2	2109	1
Orange	11	198199	666.9	179393	571	357	1	376	0	107	1102776	3710	977187	3109	2009	3	2136	1	17	290106	976	244412	778	69	0	90	0
Tarrant	737	13173191	44322.9	11923290	37939	23719	37	24972	15	1564	16186680	54462	14343260	45639	29491	45	31352	19	1667	27652878	93042	23297332	74129	6583	10	8617	5
Waller	3	55885	188.0	50582	161	101	0	106	0	12	121569	409	107724	343	221	0	235	0	0	8266	28	6964	22	2	0	3	0
Total (Non-attainment)	4836	86422633	290780	78222663	248896	155608	240	163829	101	11106	114961287	386802	101868922	324135	209450	322	222666	138	8892	147532142	496391	124294667	395491	35123	54	45971	28

Affected Counties	**Assembly**									**Education**									**Retail**								
	In	**Electricity (kWh/yr), PNNL**				**Gas (mBtu/yr), PNNL**				**In**	**Electricity (kWh/yr), PNNL**				**Gas (mBtu/yr), PNNL**				**In**	**Electricity (kWh/yr), PNNL**				**Gas (mBtu/yr), PNNL**			
	thousand	**1989 (Annual)**	**1989 (OSD)**	**1999 (Annual)**	**1999 (OSD)**	**1989 (Annual)**	**1989 (OSD)**	**1999 (Annual)**	**1999 (OSD)**	**thousand**	**1989 (Annual)**	**1989 (OSD)**	**1999 (Annual)**	**1999 (OSD)**	**1989 (Annual)**	**1989 (OSD)**	**1999 (Annual)**	**1999 (OSD)**	**thousand**	**1989 (Annual)**	**1989 (OSD)**	**1999 (Annual)**	**1999 (OSD)**	**1989 (Annual)**	**1989 (OSD)**	**1999 (Annual)**	**1999 (OSD)**
Bastrop	5	97542	328.2	88287	281	176	0	185	0	53	547404	1842	485063	1543	997	2	1060	1	16	268439	903	226157	720	64	0	84	0
Bexar	532	9511289	32002.0	8608837	27392	17126	26	18030	11	1781	18434651	62026	16335221	51977	33586	52	35706	22	1141	18937531	63718	15954721	50766	4508	7	5901	4
Caldwell	2	37358	125.7	33813	108	67	0	71	0	60	616464	2074	546258	1738	1123	2	1194	1	12	200847	676	169212	538	48	0	63	0
Comal	25	444257	1494.8	402105	1279	800	1	842	1	145	1495954	5033	1325587	4218	2726	4	2897	2	71	1179079	3967	993364	3161	281	0	367	0
Ellis	46	818987	2755.6	741280	2359	1475	2	1553	1	117	1208903	4068	1071227	3409	2203	3	2341	1	63	1041359	3504	877337	2792	248	0	324	0
Gregg	48	859056	2890.4	777547	2474	1547	2	1628	1	33	346554	1166	307087	977	631	1	671	0	45	743451	2501	626352	1993	177	0	232	0
Guadalupe	21	372804	1254.3	337431	1074	671	1	707	0	140	1453668	4891	1288117	4099	2648	4	2816	2	69	1147425	3861	966697	3076	273	0	358	0
Harrison	39	704949	2371.9	638062	2030	1269	2	1336	1	61	632144	2127	560152	1782	1152	2	1224	1	32	532576	1792	448691	1428	127	0	166	0
Hays	75	1333807	4487.8	1207252	3841	2402	4	2528	2	219	2263435	7616	2005664	6382	4124	6	4384	3	121	2003494	6741	1687928	5371	477	1	624	0
Henderson	4	75569	254.3	68399	218	136	0	143	0	21	218288	734	193429	615	398	1	423	0	9	147716	497	124449	396	35	0	46	0
Hood	34	609755	2051.6	551901	1756	1098	2	1156	1	62	640323	2154	567400	1805	1167	2	1240	1	12	206282	694	173791	553	49	0	64	0
Hunt	17	295412	994.0	267383	851	532	1	560	0	80	828602	2788	734237	2336	1510	2	1605	1	14	231671	779	195181	621	55	0	72	0
Johnson	9	168450	566.8	152467	485	303	0	319	0	134	1384855	4660	1227141	3905	2523	4	2682	2	51	848104	2854	714521	2274	202	0	264	0
Kaufman	20	351861	1183.9	318475	1013	634	1	667	0	118	1225788	4124	1086189	3456	2233	3	2374	1	28	472862	1591	398383	1268	113	0	147	0
Nueces	102	1814053	6103.6	1641932	5224	3266	5	3439	2	150	1557085	5239	1379756	4390	2837	4	3016	2	70	1161107	3907	978224	3113	276	0	362	0
Parker	10	170394	573.3	154227	491	307	0	323	0	130	1346966	4532	1193567	3798	2454	4	2609	2	71	1170704	3939	986309	3138	279	0	365	0
Rockwall	26	472358	1589.3	427540	1360	851	1	895	1	158	1632628	5493	1446696	4603	2975	5	3162	2	95	1582511	5325	1333253	4242	377	1	493	0
Rusk	1	10290	34.6	9314	30	19	0	20	0	6	63102	212	55916	178	115	0	122	0	11	177507	597	149548	476	42	0	55	0
San Patricio	13	237634	799.6	215087	684	428	1	450	0	56	583636	1964	517168	1646	1063	2	1130	1	23	378735	1274	319082	1015	90	0	118	0
Smith	80	1423915	4790.9	1288811	4101	2564	4	2699	2	113	1174684	3952	1040906	3312	2140	3	2275	1	87	1441125	4849	1214136	3863	343	1	449	0
Travis	315	5624194	18923.3	5090558	16198	10127	16	10662	7	525	5430906	18273	4812407	15313	9895	15	10519	6	646	10715898	36055	9028059	28726	2551	4	3339	2
Upshur	11	194637	654.9	176170	561	350	1	369	0	29	298730	1005	264709	842	544	1	579	0	4	62400	210	52572	167	15	0	19	0
Victoria	17	303662	1021.7	274850	875	547	1	576	0	16	167296	563	148243	472	305	0	324	0	29	485664	1634	409168	1302	116	0	151	0
Williamson	116	2080761	7001.0	1883333	5993	3747	6	3944	2	399	4130519	13898	3660115	11646	7525	12	8000	5	305	5062247	17033	4264903	13570	1205	2	1577	1
Wilson	2	40072	134.8	36270	115	72	0	76	0	24	248006	834	219762	699	452	1	480	0	5	77288	260	65114	207	18	0	24	0
Total (Affected)	1570	28053066	94388	25391329	80792	50511	78	53179	33	4630	47930590	161269	42472015	135141	87326	134	92836	57	3030	50276024	169160	42357154	134776	11969	18	15666	10

Table 32: Calculated ASHRAE Standard 90.1-1989 and 1999 Energy Use for Assembly, Education, and Retail Building Types (USDOE 2004) (Part 2)

ERCOT Counties	Assembly									Education									Retail								
	In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL				In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL				In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL			
	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)
ANDERSON	1	22657	76.2	20507	65	41	0	43	0	1	10260	35	9092	29	19	0	20	0	2	33980	114	28628	91	8	0	11	0
ANDREWS	1	11949	40.2	10815	34	22	0	23	0	6	58202	196	51573	164	106	0	113	0	0	0	0	0	0	0	0	0	0
ANGELINA	33	596317	2006.4	539737	1717	1074	2	1130	1	53	548779	1846	486282	1547	1000	2	1063	1	45	753098	2534	634480	2019	179	0	235	0
ARANSAS	4	71112	239.3	64365	205	128	0	135	0	1	14463	49	12816	41	26	0	28	0	26	438058	1474	369060	1174	104	0	136	0
ARCHER	1	22097	74.3	20000	64	40	0	42	0	17	177212	596	157031	500	323	0	343	0	0	0	0	0	0	0	0	0	0
ATASCOSA	11	203235	683.8	183952	585	366	1	385	0	21	217377	731	192621	613	396	1	421	0	11	187293	630	157793	502	45	0	58	0
AUSTIN	1	9965	33.5	9019	29	18	0	19	0	38	390934	1315	346412	1102	712	1	757	0	1	12949	44	10909	35	3	0	4	0
BANDERA	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bastrop	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BAYLOR	0	0	0.0	0	0	0	0	0	0	1	13545	46	12002	38	25	0	26	0	0	0	0	0	0	0	0	0	0
BEE	19	340565	1145.9	308251	981	613	1	646	0	49	505963	1702	448341	1427	922	1	980	1	5	91052	306	76711	244	22	0	28	0
BELL	78	1389922	4676.6	1258043	4003	2503	4	2635	2	257	2664897	8966	2361405	7514	4855	7	5162	3	88	1458600	4908	1228859	3910	347	1	454	0
Bexar	532	9511289	32002.0	8608837	27392	17126	26	18030	11	1781	18434651	62026	16335221	51977	33586	52	35706	22	1141	18937531	63718	15954721	50766	4508	7	5901	4
BLANCO	0	2511	8.4	2273	7	5	0	5	0	18	182545	614	161756	515	333	1	354	0	0	0	0	0	0	0	0	0	0
BORDEN	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BOSQUE	1	16718	56.2	15132	48	30	0	32	0	16	166996	562	147978	471	304	0	323	0	0	0	0	0	0	0	0	0	0
Brazoria	94	1676521	5640.9	1517449	4828	3019	5	3178	2	366	3785990	12738	3354823	10675	6898	11	7333	5	237	3936500	13245	3316470	10553	937	1	1227	1
BRAZOS	150	2675710	9002.8	2421833	7706	4818	7	5072	3	293	3032776	10204	2687388	8551	5525	9	5874	4	106	1753685	5901	1477465	4701	417	1	546	0
BREWSTER	4	78573	264.4	71118	226	141	0	149	0	11	110667	372	98063	312	202	0	214	0	0	0	0	0	0	0	0	0	0
BRISCOE	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BROOKS	0	3191	10.7	2889	9	6	0	6	0	0	0	0	0	0	0	0	0	0	0	7877	27	6636	21	2	0	2	0
BROWN	5	97218	327.1	87994	280	175	0	184	0	15	153228	516	135777	432	279	0	297	0	8	128186	431	107996	344	31	0	40	0
BURLESON	1	20479	68.9	18536	59	37	0	39	0	12	122631	413	108665	346	223	0	238	0	1	8495	29	7157	23	2	0	3	0
BURNET	7	120960	407.0	109483	348	218	0	229	0	51	528463	1778	468279	1490	963	1	1024	1	10	168145	566	141661	451	40	0	52	0
Caldw ell	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CALHOUN	0	797	2.7	721	2	1	0	2	0	11	114579	386	101530	323	209	0	222	0	18	302450	1018	254812	811	72	0	94	0
CALLAHAN	3	50151	168.7	45393	144	90	0	95	0	18	181279	610	160634	511	330	1	351	0	0	4016	14	3383	11	1	0	1	0
CAMERON	80	1429686	4810.4	1294034	4117	2574	4	2710	2	390	4036917	13583	3577172	11382	7355	11	7819	5	169	2797914	9414	2357221	7500	666	1	872	1
Chambers	7	121565	409.0	110031	350	219	0	230	0	33	346585	1166	307114	977	631	1	671	0	5	85951	289	72413	230	20	0	27	0
CHEROKEE	37	654229	2201.2	592154	1884	1178	2	1240	1	56	579037	1948	513094	1633	1055	2	1122	1	10	160208	539	134974	429	38	0	50	0
CHILDRESS	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CLAY	0	6687	22.5	6053	19	12	0	13	0	3	34255	115	30354	97	62	0	66	0	0	0	0	0	0	0	0	0	0
COKE	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COLEMAN	1	15629	52.6	14146	45	28	0	30	0	1	15299	51	13557	43	28	0	30	0	0	2433	8	2050	7	1	0	1	0
Collin	459	8211993	27630.3	7432821	23650	14786	23	15567	10	974	10083496	33927	8935137	28431	18371	28	19530	12	1131	18764361	63135	15808827	50302	4467	7	5847	4
COLORADO	0	0	0.0	0	0	0	0	0	0	17	175440	590	155460	495	320	0	340	0	0	3736	13	3147	10	1	0	1	0
Comal	25	444257	1494.8	402105	1279	800	1	842	1	145	1495954	5033	1325587	4218	2726	4	2897	2	71	1179079	3967	993364	3161	281	0	367	0
COMANCHE	7	124622	419.3	112798	359	224	0	236	0	36	376215	1266	333370	1061	685	1	729	0	1	17608	59	14834	47	4	0	5	0
CONCHO	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COOKE	21	384248	1292.9	347789	1107	692	1	728	0	76	788052	2652	698305	2222	1436	2	1526	1	50	831672	2798	700677	2229	198	0	259	0
CORYELL	13	233140	784.4	211019	671	420	1	442	0	35	360748	1214	319664	1017	657	1	699	0	19	316953	1066	267031	850	75	0	99	0
COTTLE	0	0	0.0	0	0	0	0	0	0	2	15771	53	13975	44	29	0	31	0	0	0	0	0	0	0	0	0	0
CRANE	1	26794	90.2	24252	77	48	0	51	0	1	15042	51	13329	42	27	0	29	0	0	0	0	0	0	0	0	0	0
CROCKETT	3	53522	180.1	48444	154	96	0	101	0	2	16699	56	14797	47	30	0	32	0	0	0	0	0	0	0	0	0	0
CROSBY	1	12762	42.9	11552	37	23	0	24	0	0	2227	7	1973	6	4	0	4	0	0	0	0	0	0	0	0	0	0
CULBERSON	1	12158	40.9	11005	35	22	0	23	0	8	86206	290	76388	243	157	0	167	0	0	6178	21	5205	17	1	0	2	0
Dallas	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DAWSON	0	7110	23.9	6435	20	13	0	13	0	7	69580	234	61656	196	127	0	135	0	0	0	0	0	0	0	0	0	0
DE WITT	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DELTA	0	4103	13.8	3714	12	7	0	8	0	3	27275	92	24169	77	50	0	53	0	0	0	0	0	0	0	0	0	0
Denton	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DICKENS	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DIMMIT	0	0	0.0	0	0	0	0	0	0	3	27056	91	23975	76	49	0	52	0	0	0	0	0	0	0	0	0	0
DUVAL	0	3799	12.8	3439	11	7	0	7	0	20	211498	712	187412	596	385	1	410	0	1	13038	44	10985	35	3	0	4	0
EASTLAND	7	127633	429.4	115523	368	230	0	242	0	4	38973	131	34535	110	71	0	75	0	20	328893	1107	277090	882	78	0	102	0
ECTOR	28	496586	1670.8	449469	1430	894	1	941	1	92	956241	3217	847339	2696	1742	3	1852	1	38	632430	2128	532817	1695	151	0	197	0
EDWARDS	0	2736	9.2	2476	8	5	0	5	0	0	4824	16	4275	14	9	0	9	0	0	0	0	0	0	0	0	0	0
Ellis	46	818987	2755.6	741280	2359	1475	2	1553	1	117	1208903	4068	1071227	3409	2203	3	2341	1	63	1041359	3504	877337	2792	248	0	324	0
ERATH	4	75155	252.9	68024	216	135	0	142	0	31	320569	1079	284061	904	584	1	621	0	2	39999	135	33699	107	10	0	12	0
FALLS	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FANNIN	6	101053	340.0	91465	291	182	0	192	0	20	211108	710	187066	595	385	1	409	0	3	51090	172	43043	137	12	0	16	0
FAYETTE	2	37593	126.5	34026	108	68	0	71	0	14	145633	490	129048	411	265	0	282	0	3	47377	159	39915	127	11	0	15	0
FISHER	0	0	0.0	0	0	0	0	0	0	3	35161	118	31157	99	64	0	68	0	0	0	0	0	0	0	0	0	0
FOARD	0	3169	10.7	2869	9	6	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fort Bend	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FRANKLIN	0	6927	23.3	6270	20	12	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FREESTONE	0	0	0.0	0	0	0	0	0	0	8	85916	289	76132	242	157	0	166	0	0	0	0	0	0	0	0	0	0
FRIO	0	8931	30.0	8083	26	16	0	17	0	16	160971	542	142639	454	293	0	312	0	4	62766	211	52879	168	15	0	20	0
Galveston	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GILLESPIE	8	134757	453.4	121971	388	243	0	255	0	6	57087	192	50585	161	104	0	111	0	13	208982	703	176066	560	50	0	65	0
GLASSCOCK	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GOLIAD	0	0	0.0	0	0	0	0	0	0	4	45234	152	40083	128	82	0	88	0	0	0	0	0	0	0	0	0	0
GONZALES	0	8812	29.6	7975	25	16	0	17	0	4	40649	137	36019	115	74	0	79	0	1	14678	49	12366	39	3	0	5	0
GRAYSON	25	454792	1530.2	411640	1310	819	1	862	1	113	1167263	3927	1034329	3291	2127	3	2261	1	43	720274	2423	606825	1931	171	0	224	0
GRIMES	3	53156	178.9	48113	153	96	0	101	0	8	78902	265	69916	222	144	0	153	0	0	0	0	0	0	0	0	0	0
Guadalupe	21	372804	1254.3	337431	1074	671	1	707	0	140	1453668	4891	1288117	4099	2648	4	2816	2	69	1147425	3861	966697	3076	273	0	358	0
HALL	0	0	0.0	0	0	0	0	0	0	1	5566	19	4933	16	10	0	11	0	0	0	0	0	0	0	0	0	0
HAMILTON	0	6079	20.5	5502	18	11	0	12	0	6	60442	203	53558	170	110	0	117	0	0	0	0	0	0	0	0	0	0
HARDEMAN	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Harris	1424	25443486	85607.9	23029352	73277	45812	71	48232	30	2949	30530802	102725	27053802	86082	55625	86	59134	37	2360	39158503	131754	32990731	104973	9322	14	12202	8
HASKELL	0	3040	10.2	2751	9	5	0	6	0	0	0	0	0	0	0	0	0	0	9	142865	481	120362	383	34	0	45	0
Hays	75	1333807	4487.8	1207252	3841	2402	4	2528	2	219	2263435	7616	2005664	6382	4124	6	4384	3	121	2003494	6741	1687928	5371	477	1	624	0
Henderson	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HIDALGO	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HILL	4	74779	251.6	67684	215	135	0	142	0	49	509749	1715	451696	1437	929	1	987	1	7	115486	389	97296	310	27	0	36	0
Hood	34	609755	2051.6	551901	1756	1098	2	1156	1	62	640323	2154	567400	1805	1167	2	1240	1	12	206282	694	173791	553	49	0	64	0
HOPKINS	5	89866	302.4	81339	259	162	0	170	0	17	171905	578	152328	485	313	0	333	0	10	169246	569	142588	454	40	0	53	0
HOUSTON	2	32935	110.8	29811	95	59	0	62	0	5	56468	190	50037	159	103	0	109	0	17	287444	967	242169	771	68	0	90	0
HOWARD	4	74809	251.7	67711	215	135	0	142	0	10	104544	352	92638	295	190	0	202	0	1	18200	61	15333	49	4	0	6	0
HUDSPETH	1	11622	39.1	10520	33	21	0	22	0	9	89856	302	79623	253	164	0	174	0	0	0	0	0	0	0	0	0	0
Hunt	17	295412	994.0	267383	851	532	1	560	0	80	828602	2788	734237	2336	1510	2	1605	1	14	231671	779	195181	621	55	0	72	0
IRION	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JACK	1	22797	76.7	20634	66	41	0	43	0	1	9834	33	8714	28	18	0	19	0	0	0	0	0	0	0	0	0	0

Table 33: Calculated ASHRAE Standard 90.1-1989 and 1999 Energy Use for Assembly, Education, and Retail Building Types (USDOE 2004) (Part 3)

ERCOT Counties	Assembly									Education									Retail								
	In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL				In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL				In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL			
	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)
JIM WELLS	0	3828	12.9	3465	11	7	0	7	0	47	489688	1648	433919	1381	892	1	948	1	22	357686	1203	301348	959	85	0	111	0
Johnson	9	168450	566.8	152467	485	303	0	319	0	134	1384855	4660	1227141	3905	2523	4	2682	2	51	848104	2854	714521	2274	202	0	264	0
JONES	8	144631	486.6	130908	417	260	0	274	0	8	87407	294	77452	246	159	0	169	0	0	0	0	0	0	0	0	0	0
KARNES	0	0	0.0	0	0	0	0	0	0	7	69397	233	61494	196	126	0	134	0	0	1843	6	1553	5	0	0	1	0
Kaufman	20	351861	1183.9	318475	1013	634	1	667	0	118	1225788	4124	1086189	3456	2233	3	2374	1	28	472862	1591	398383	1268	113	0	147	0
KENDALL	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KENEDY	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KENT	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KERR	43	759912	2556.8	687810	2189	1368	2	1441	1	50	513000	1726	454577	1446	935	1	994	1	23	374653	1261	315642	1004	89	0	117	0
KIMBLE	2	28876	97.2	26136	83	52	0	55	0	0	2783	9	2466	8	5	0	5	0	0	0	0	0	0	0	0	0	0
KING	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KINNEY	0	0	0.0	0	0	0	0	0	0	3	31830	107	28205	90	58	0	62	0	0	7334	25	6179	20	2	0	2	0
KLEBERG	6	104819	352.7	94874	302	189	0	199	0	38	393893	1325	349035	1111	718	1	763	0	33	540651	1819	455495	1449	129	0	168	0
KNOX	1	15198	51.1	13756	44	27	0	29	0	1	12988	44	11509	37	24	0	25	0	0	0	0	0	0	0	0	0	0
LA SALLE	0	0	0.0	0	0	0	0	0	0	1	12865	43	11400	36	23	0	25	0	0	6642	22	5595	18	2	0	2	0
LAMAR	4	71970	242.2	65142	207	130	0	136	0	29	295471	994	261821	833	538	1	572	0	5	83467	281	70320	224	20	0	26	0
LAMPASAS	2	31745	106.8	28733	91	57	0	60	0	9	96596	325	85595	272	176	0	187	0	12	194288	654	163686	521	46	0	61	0
LAVACA	7	125704	422.9	113777	362	226	0	238	0	2	21179	71	18767	60	39	0	41	0	0	2343	8	1974	6	1	0	1	0
LEE	1	12379	41.7	11205	36	22	0	23	0	13	136482	459	120939	385	249	0	264	0	1	14982	50	12623	40	4	0	5	0
LEON	7	122663	412.7	111024	353	221	0	233	0	7	69157	233	61281	195	126	0	134	0	0	0	0	0	0	0	0	0	0
LIMESTONE	3	50862	171.1	46036	146	92	0	96	0	5	54694	184	48465	154	100	0	106	0	9	151293	509	127463	406	36	0	47	0
LIVE OAK	10	186022	625.9	168372	536	335	1	353	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LLANO	1	10536	35.4	9536	30	19	0	20	0	24	250505	843	221976	706	456	1	485	0	0	0	0	0	0	0	0	0	0
LOVING	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MADISON	1	9848	33.1	8914	28	18	0	19	0	10	102171	344	90535	288	186	0	198	0	0	1030	3	868	3	0	0	0	0
MARTIN	0	0	0.0	0	0	0	0	0	0	0	4639	16	4110	13	8	0	9	0	0	0	0	0	0	0	0	0	0
MASON	0	0	0.0	0	0	0	0	0	0	1	11504	39	10194	32	21	0	22	0	0	0	0	0	0	0	0	0	0
MATAGORDA	4	66293	223.1	60003	191	119	0	126	0	26	268096	902	237564	756	488	1	519	0	5	76595	258	64531	205	18	0	24	0
MAVERICK	13	224837	756.5	203504	648	405	1	426	0	41	420833	1416	372906	1187	767	1	815	1	12	194059	653	163493	520	46	0	60	0
MCCULLOCH	0	7181	24.2	6500	21	13	0	14	0	9	98327	331	87129	277	179	0	190	0	0	0	0	0	0	0	0	0	0
MCLENNAN	71	1264507	4254.6	1144528	3642	2277	4	2397	1	266	2749028	9249	2435955	7751	5009	8	5325	3	99	1647523	5543	1388026	4417	392	1	513	0
MCMULLEN	2	39019	131.3	35317	112	70	0	74	0	1	6494	22	5754	18	12	0	13	0	0	0	0	0	0	0	0	0	0
MEDINA	3	58967	198.4	53372	170	106	0	112	0	20	207980	700	184294	586	379	1	403	0	1	14047	47	11834	38	3	0	4	0
MENARD	0	6063	20.4	5488	17	11	0	11	0	1	12255	41	10859	35	22	0	24	0	0	0	0	0	0	0	0	0	0
MIDLAND	88	1570456	5284.0	1421448	4523	2828	4	2977	2	59	607742	2045	538529	1714	1107	2	1177	1	89	1475546	4965	1243136	3956	351	1	460	0
MILAM	3	48633	163.6	44019	140	88	0	92	0	39	401493	1351	355769	1132	731	1	778	0	10	163494	550	137743	438	39	0	51	0
MILLS	2	29303	98.6	26522	84	53	0	56	0	8	82901	279	73460	234	151	0	161	0	0	0	0	0	0	0	0	0	0
MITCHELL	4	64548	217.2	58424	186	116	0	122	0	0	1577	5	1397	4	3	0	3	0	0	3475	12	2928	9	1	0	1	0
MONTAGUE	1	22501	75.7	20366	65	41	0	43	0	13	130667	440	115786	368	238	0	253	0	10	162490	547	136897	436	39	0	51	0
Montgomery	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MOTLEY	0	0	0.0	0	0	0	0	0	0	1	6587	22	5837	19	12	0	13	0	0	0	0	0	0	0	0	0	0
NACOGDOCHES	22	387336	1303.2	350584	1116	697	1	734	0	117	1212500	4080	1074415	3419	2209	3	2348	1	19	314772	1059	265193	844	75	0	98	0
NAVARRO	3	56233	189.2	50897	162	101	0	107	0	30	308983	1040	273794	871	563	1	598	0	18	294959	992	248501	791	70	0	92	0
NOLAN	6	99496	334.8	90056	287	179	0	189	0	17	178115	599	157830	502	325	0	345	0	10	170522	574	143663	457	41	0	53	0
Nueces	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PALO PINTO	4	76832	258.5	69542	221	138	0	146	0	26	267664	901	237181	755	488	1	518	0	15	240710	810	202796	645	57	0	75	0
Parker	10	170394	573.3	154227	491	307	0	323	0	130	1346966	4532	1193567	3798	2454	4	2609	2	71	1170704	3939	986309	3138	279	0	365	0
PECOS	3	57633	193.9	52165	166	104	0	109	0	6	63842	215	56572	180	116	0	124	0	0	5642	19	4753	15	1	0	2	0
PRESIDIO	3	45915	154.5	41559	132	83	0	87	0	5	49955	168	44266	141	91	0	97	0	0	0	0	0	0	0	0	0	0
RAINS	1	10886	36.6	9853	31	20	0	21	0	8	83394	281	73897	235	152	0	162	0	0	0	0	0	0	0	0	0	0
REAGAN	1	25330	85.2	22927	73	46	0	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REAL	0	8055	27.1	7291	23	15	0	15	0	1	5937	20	5261	17	11	0	12	0	0	0	0	0	0	0	0	0	0
RED RIVER	2	29224	98.3	26451	84	53	0	55	0	14	141850	477	125695	400	258	0	275	0	0	1120	4	943	3	0	0	0	0
REEVES	5	87301	293.7	79017	251	157	0	165	0	2	19946	67	17675	56	36	0	39	0	0	8149	27	6866	22	2	0	3	0
REFUGIO	1	19462	65.5	17615	56	35	0	37	0	1	7904	27	7004	22	14	0	15	0	0	0	0	0	0	0	0	0	0
ROBERTSON	1	23405	78.7	21184	67	42	0	44	0	3	31888	107	28257	90	58	0	62	0	0	0	0	0	0	0	0	0	0
Rockwall	26	472358	1589.3	427540	1360	851	1	895	1	158	1632628	5493	1446696	4603	2975	5	3162	2	95	1582511	5325	1333253	4242	377	1	493	0
RUNNELS	0	0	0.0	0	0	0	0	0	0	6	62344	210	55244	176	114	0	121	0	1	12743	43	10736	34	3	0	4	0
Rusk	1	10290	34.6	9314	30	19	0	20	0	6	63102	212	55916	178	115	0	122	0	11	177507	597	149548	476	42	0	55	0
San Patricio	13	237634	799.6	215087	684	428	1	450	0	56	583636	1964	517168	1646	1063	2	1130	1	23	378735	1274	319082	1015	90	0	118	0
SAN SABA	4	76288	256.7	69050	220	137	0	145	0	3	27832	94	24662	78	51	0	54	0	1	12061	41	10161	32	3	0	4	0
SCHLEICHER	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SCURRY	1	9645	32.5	8730	28	17	0	18	0	0	2598	9	2302	7	5	0	5	0	4	67189	226	56606	180	16	0	21	0
SHACKELFORD	2	32067	107.9	29025	92	58	0	61	0	4	40449	136	35843	114	74	0	78	0	0	0	0	0	0	0	0	0	0
Smith	80	1423915	4790.9	1288811	4101	2564	4	2699	2	113	1174684	3952	1040906	3312	2140	3	2275	1	87	1441125	4849	1214136	3863	343	1	449	0
SOMERVELL	0	4515	15.2	4087	13	8	0	9	0	7	69676	234	61741	196	127	0	135	0	0	2596	9	2187	7	1	0	1	0
STARR	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STEPHENS	0	0	0.0	0	0	0	0	0	0	6	61962	208	54905	175	113	0	120	0	0	0	0	0	0	0	0	0	0
STERLING	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STONEWALL	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUTTON	0	0	0.0	0	0	0	0	0	0	2	17163	58	15208	48	31	0	33	0	0	0	0	0	0	0	0	0	0
Tarrant	737	13173191	44322.9	11923290	37939	23719	37	24972	15	1564	16186680	54462	14343260	45639	29491	45	31352	19	1667	27652878	93042	23297332	74129	6583	10	8617	5
TAYLOR	34	603333	2030.0	546088	1738	1086	2	1144	1	49	509017	1713	451048	1435	927	1	986	1	80	1321963	4448	1113743	3544	315	0	412	0
TERRELL	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
THROCKMORTON	1	18237	61.4	16507	53	33	0	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TITUS	4	77529	260.9	70173	223	140	0	147	0	26	266414	896	236073	751	485	1	516	0	7	112830	380	95058	302	27	0	35	0
TOM GREEN	61	1088975	3664.0	985651	3136	1961	3	2064	1	89	917348	3087	812876	2586	1671	3	1777	1	52	858726	2889	723470	2302	204	0	268	0
Travis	315	5624194	18923.3	5090558	16198	10127	16	10662	7	525	5430906	18273	4812407	15313	9895	15	10519	6	646	10715898	36055	9028059	28726	2551	4	3339	2
UPTON	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UVALDE	14	247696	833.4	224194	713	446	1	470	0	32	336383	1132	298074	948	613	1	652	0	33	548476	1845	462086	1470	131	0	171	0
VAL VERDE	9	157653	530.4	142695	454	284	0	299	0	29	301608	1015	267259	850	550	1	584	0	7	118083	397	99484	317	28	0	37	0
VAN ZANDT	1	25812	86.8	23363	74	46	0	49	0	41	421271	1417	373294	1188	768	1	816	1	0	2498	8	2105	7	1	0	1	0
Victoria	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waller	3	55885	188.0	50582	161	101	0	106	0	12	121569	409	107724	343	221	0	235	0	0	8266	28	6964	22	2	0	3	0
WARD	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WASHINGTON	30	538405	1811.5	487320	1551	969	1	1021	1	36	371846	1251	329498	1048	677	1	720	0	33	552098	1858	465139	1480	131	0	172	0
WEBB	28	496008	1668.9	448946	1428	893	1	940	1	275	2844976	9572	2520976	8021	5183	8	5510	3	53	886532	2983	746896	2377	211	0	276	0
WHARTON	9	163879	551.4	148330	472	295	0	311	0	16	164564	554	145822	464	300	0	319	0	30	490695	1651	413407	1315	117	0	153	0
WICHITA	59	1055744	3552.2	955573	3041	1901	3	2001	1	50	518780	1746	459699	1463	945	1	1005	1	51	838701	2822	706599	2248	200	0	261	0
WILBARGER	3	54900	184.7	49691	158	99	0	104	0	7	71157	239	63054	201	130	0	138	0	9	143084	481	120547	384	34	0	45	0
WILLACY	2	33642	113.2	30450	97	61	0	64	0	42	434189	1461	384742	1224	791	1	841	1	27	440514	1482	371130	1181	105	0	137	0
Williamson	116	2080761	7001.0	1883333	5993	3747	6	3944	2	399	4130519	13898	3660115	11646	7525	12	8000	5	305	5062247	17033	4264903	13570	1205	2	1577	1
Wilson	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WINKLER	1	15603	52.5	14123	45	28	0	30	0	0	2350	8	2083	7	4	0	5	0	0	0	0	0	0	0	0	0	0
WISE	18	326272	1097.8	295315	940	587	1	619	0	73	751659	2529	666056	2119	1369	2	1456	1	1	16045	54	13518	43	4	0	5	0
YOUNG	10	176112	592.6	159403	507	317	0	334	0	21	214119	720	189734	604	390	1	415	0	23	374023	1258	315112	1003	89	0	117	0
ZAPATA	2	39514	133.0	35765	114	71	0	75	0	40	417287	1404	369764	1177	760	1	808	0	1	13038	44	10985	35	3	0	4	0
ZAVALA	0	2206	7.4	1997	6	4	0	4	0	5	47261	159	41879	133	86	0	92	0	0	0	0	0	0	0	0	0	0
Total	5290	94536282	318080	85566471	272263	170217	262	179209	111	13900	143890166	484137	127503235	405701	262156	404	278697	172	9756	161871126	544637	136375149	433930	38537	59	50439	31

Table 34: Calculated ASHRAE Standard 90.1-1989 and 1999 Energy Use for Food and Lodging Building Types (USDOE 2004) (Part 1)

	Food									Lodging								
Non-attainment Counties	In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL				In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL			
	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)
Brazoria	63	1867347	6283	1889034	6011	2248	3	2210	1	57	712562	2398	683260	2174	1010	2	914	1
Chambers	1	40772	137	41246	131	49	0	48	0	0	0	0	0	0	0	0	0	0
Collin	302	8901199	29949	9004579	28652	10717	17	10533	7	487	6048611	20351	5799883	18455	8571	13	7758	5
Dallas	342	10097781	33975	10215059	32503	12158	19	11949	7	865	10748030	36163	10306055	32793	15230	23	13785	9
Denton	166	4888349	16447	4945123	15735	5886	9	5784	4	383	4755051	15999	4559516	14508	6738	10	6099	4
El Paso	92	2700589	9086	2731954	8693	3252	5	3196	2	300	3725876	12536	3572662	11368	5279	8	4779	3
Fort Bend	121	3576460	12033	3617997	11512	4306	7	4232	3	182	2265983	7624	2172803	6914	3211	5	2906	2
Galveston	46	1360775	4579	1376579	4380	1638	3	1610	1	106	1320945	4444	1266626	4030	1872	3	1694	1
Hardin	3	103225	347	104424	332	124	0	122	0	0	0	0	0	0	0	0	0	0
Harris	630	18575512	62500	18791251	59792	22365	34	21981	14	1642	20405764	68658	19566648	62259	28914	45	26172	16
Jefferson	44	1299518	4372	1314611	4183	1565	2	1538	1	245	3047832	10255	2922501	9299	4319	7	3909	2
Liberty	3	102494	345	103684	330	123	0	121	0	6	69309	233	66459	211	98	0	89	0
Montgomery	109	3211241	10805	3248537	10336	3866	6	3800	2	195	2428968	8173	2329085	7411	3442	5	3115	2
Orange	5	137617	463	139215	443	166	0	163	0	19	238514	803	228706	728	338	1	306	0
Tarrant	445	13117620	44136	13269970	42224	15794	24	15522	10	1003	12461094	41927	11948675	38019	17657	27	15983	10
Waller	0	3921	13	3967	13	5	0	5	0	0	0	0	0	0	0	0	0	0
Total (Non-attainment)	2372	69984419	235472	70797230	225269	84261	130	82814	51	5490	68228538	229564	65422879	208168	96678	149	87510	54
	Food									Lodging								
Affected Counties	In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL				In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL			
	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)
Bastrop	4	127339	428	128817	410	153	0	151	0	45	559083	1881	536093	1706	792	1	717	0
Bexar	305	8983345	30226	9087679	28916	10816	17	10630	7	1202	14935661	50253	14321484	45569	21163	33	19156	12
Caldwell	3	95275	321	96382	307	115	0	113	0	6	69142	233	66299	211	98	0	89	0
Comal	19	559316	1882	565812	1800	673	1	662	0	47	581977	1958	558045	1776	825	1	746	0
Ellis	17	493987	1662	499724	1590	595	1	585	0	21	266351	896	255398	813	377	1	342	0
Gregg	12	352669	1187	356765	1135	425	1	417	0	80	998050	3358	957008	3045	1414	2	1280	1
Guadalupe	18	544301	1831	550622	1752	655	1	644	0	38	468384	1576	449123	1429	664	1	601	0
Harrison	9	252637	850	255571	813	304	0	299	0	33	409496	1378	392657	1249	580	1	525	0
Hays	32	950392	3198	961430	3059	1144	2	1125	1	59	733196	2467	703046	2237	1039	2	940	1
Henderson	2	70072	236	70885	226	84	0	83	0	2	27774	93	26632	85	39	0	36	0
Hood	3	97853	329	98990	315	118	0	116	0	6	77791	262	74592	237	110	0	100	0
Hunt	4	109897	370	111174	354	132	0	130	0	13	161474	543	154834	493	229	0	207	0
Johnson	14	402313	1354	406985	1295	484	1	476	0	4	53496	180	51296	163	76	0	69	0
Kaufman	8	224310	755	226916	722	270	0	265	0	5	66900	225	64149	204	95	0	86	0
Nueces	19	550791	1853	557188	1773	663	1	652	0	162	2010800	6766	1928113	6135	2849	4	2579	2
Parker	19	555344	1869	561794	1788	669	1	657	0	37	462291	1555	443281	1410	655	1	593	0
Rockwall	25	750692	2526	759410	2416	904	1	888	1	15	190484	641	182651	581	270	0	244	0
Rusk	3	84203	283	85181	271	101	0	100	0	1	11089	37	10633	34	16	0	14	0
San Patricio	6	179660	604	181746	578	216	0	213	0	19	239932	807	230066	732	340	1	308	0
Smith	23	683622	2300	691562	2200	823	1	809	0	120	1495844	5033	1434333	4564	2120	3	1919	1
Travis	172	5083271	17103	5142309	16362	6120	9	6015	4	652	8107053	27277	7773679	24735	11487	18	10398	6
Upshur	1	29601	100	29945	95	36	0	35	0	2	25338	85	24296	77	36	0	32	0
Victoria	8	230383	775	233059	742	277	0	273	0	20	245665	827	235562	750	348	1	315	0
Williamson	81	2401364	8080	2429254	7730	2891	4	2842	2	123	1525664	5133	1462927	4655	2162	3	1957	1
Wilson	1	36663	123	37089	118	44	0	43	0	10	118930	400	114040	363	169	0	153	0
Total (Affected)	808	23849300	80244	24126290	76767	28715	44	28221	17	2723	33841865	113865	32450237	103253	47953	74	43406	27

Table 35: Calculated ASHRAE Standard 90.1-1989 and 1999 Energy Use for Food and Lodging Building Types (USDOE 2004) (Part 2)

ERCOT Counties	Food									Lodging								
	In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL				In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL			
	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)
ANDERSON	1	16119	54	16306	52	19	0	19	0	2	19734	66	18922	60	28	0	25	0
ANDREWS	0	0	0	0	0	0	0	0	0	3	37237	125	35705	114	53	0	48	0
ANGELINA	12	357245	1202	361394	1150	430	1	423	0	29	360732	1214	345898	1101	511	1	463	0
ARANSAS	7	207800	699	210214	669	250	0	246	0	7	82169	276	78791	251	116	0	105	0
ARCHER	0	0	0	0	0	0	0	0	0	4	50754	171	48667	155	72	0	65	0
ATASCOSA	3	88846	299	89877	286	107	0	105	0	9	109701	369	105190	335	155	0	141	0
AUSTIN	0	6142	21	6214	20	7	0	7	0	5	56664	191	54334	173	80	0	73	0
BANDERA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bastrop	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BAYLOR	0	0	0	0	0	0	0	0	0	2	27034	91	25923	82	38	0	35	0
BEE	1	43192	145	43694	139	52	0	51	0	21	264203	889	253339	806	374	1	339	0
BELL	23	691912	2328	699948	2227	833	1	819	1	326	4048580	13622	3882097	12352	5737	9	5193	3
Bexar	305	8983345	30226	9087679	28916	10816	17	10630	7	1202	14935661	50253	14321484	45569	21163	33	19156	12
BLANCO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BORDEN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BOSQUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brazoria	63	1867347	6283	1889034	6011	2248	3	2210	1	57	712562	2398	683260	2174	1010	2	914	1
BRAZOS	28	831891	2799	841552	2678	1002	2	984	1	209	2595034	8731	2488322	7918	3677	6	3328	2
BREWSTER	0	0	0	0	0	0	0	0	0	6	70947	239	68029	216	101	0	91	0
BRISCOE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BROOKS	0	3737	13	3780	12	4	0	4	0	0	2026	7	1943	6	3	0	3	0
BROWN	2	60807	205	61513	196	73	0	72	0	12	153260	516	146957	468	217	0	197	0
BURLESON	0	4030	14	4077	13	5	0	5	0	2	30507	103	29252	93	43	0	39	0
BURNET	3	79763	268	80689	257	96	0	94	0	9	113521	382	108853	346	161	0	146	0
Caldw ell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CALHOUN	5	143473	483	145139	462	173	0	170	0	1	13003	44	12469	40	18	0	17	0
CALLAHAN	0	1905	6	1927	6	2	0	2	0	0	0	0	0	0	0	0	0	0
CAMERON	45	1327239	4466	1342654	4272	1598	2	1571	1	215	2670151	8984	2560350	8147	3784	6	3425	2
Chambers	1	40772	137	41246	131	49	0	48	0	0	0	0	0	0	0	0	0	0
CHEROKEE	3	75998	256	76880	245	92	0	90	0	26	327581	1102	314110	999	464	1	420	0
CHILDRESS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CLAY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COKE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COLEMAN	0	1154	4	1167	4	1	0	1	0	1	8690	29	8333	27	12	0	11	0
Collin	302	8901199	29949	9004579	28652	10717	17	10533	7	487	6048611	20351	5799883	18455	8571	13	7758	5
COLORADO	0	1772	6	1793	6	2	0	2	0	4	46663	157	44744	142	66	0	60	0
Comal	19	559316	1882	565812	1800	673	1	662	0	47	581977	1958	558045	1776	825	1	746	0
COMANCHE	0	8353	28	8450	27	10	0	10	0	72	892150	3002	855463	2722	1264	2	1144	1
CONCHO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COOKE	13	394518	1327	399100	1270	475	1	467	0	66	822420	2767	788601	2509	1165	2	1055	1
CORYELL	5	150352	506	152099	484	181	0	178	0	16	204096	687	195704	623	289	0	262	0
COTTLE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CRANE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CROCKETT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CROSBY	0	0	0	0	0	0	0	0	0	1	8518	29	8168	26	12	0	11	0
CULBERSON	0	2931	10	2965	9	4	0	3	0	0	0	0	0	0	0	0	0	0
Dallas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DAWSON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DE WITT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DELTA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Denton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DICKENS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DIMMIT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DUVAL	0	6185	21	6257	20	7	0	7	0	0	1173	4	1125	4	2	0	2	0
EASTLAND	5	156016	525	157828	502	188	0	185	0	1	7677	26	7362	23	11	0	10	0
ECTOR	10	300004	1009	303488	966	361	1	355	0	125	1557904	5242	1493840	4753	2208	3	1998	1
EDWARDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ellis	17	493987	1662	499724	1590	595	1	585	0	21	266351	896	255398	813	377	1	342	0
ERATH	1	18974	64	19194	61	23	0	22	0	8	96184	324	92229	293	136	0	123	0
FALLS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FANNIN	1	24235	82	24517	78	29	0	29	0	4	48807	164	46800	149	69	0	63	0
FAYETTE	1	22474	76	22735	72	27	0	27	0	15	187133	630	179438	571	265	0	240	0
FISHER	0	0	0	0	0	0	0	0	0	2	24882	84	23859	76	35	0	32	0
FOARD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fort Bend	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FRANKLIN	0	0	0	0	0	0	0	0	0	0	1958	7	1877	6	3	0	3	0
FREESTONE	0	0	0	0	0	0	0	0	0	1	6291	21	6032	19	9	0	8	0
FRIO	1	29774	100	30120	96	36	0	35	0	2	28674	96	27495	87	41	0	37	0
Galveston	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GILLESPIE	3	99134	334	100286	319	119	0	117	0	7	85532	288	82015	261	121	0	110	0
GLASSCOCK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GOLIAD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GONZALES	0	6963	23	7044	22	8	0	8	0	2	19727	66	18915	60	28	0	25	0
GRAYSON	12	341675	1150	345643	1100	411	1	404	0	35	430137	1447	412449	1312	609	1	552	0
GRIMES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Guadalupe	18	544301	1831	550622	1752	655	1	644	0	38	468384	1576	449123	1429	664	1	601	0
HALL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HAMILTON	0	0	0	0	0	0	0	0	0	4	44384	149	42559	135	63	0	57	0
HARDEMAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Harris	630	18575512	62500	18791251	59792	22365	34	21981	14	1642	20405764	68658	19566648	62259	28914	45	26172	16
HASKELL	2	67770	228	68557	218	82	0	80	0	0	0	0	0	0	0	0	0	0
Hays	32	950392	3198	961430	3059	1144	2	1125	1	59	733196	2467	703046	2237	1039	2	940	1
Henderson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HIDALGO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HILL	2	54783	184	55419	176	66	0	65	0	3	36489	123	34989	111	52	0	47	0
Hood	3	97853	329	98990	315	118	0	116	0	6	77791	262	74592	237	110	0	100	0
HOPKINS	3	80285	270	81217	258	97	0	95	0	5	67957	229	65162	207	96	0	87	0
HOUSTON	5	136354	459	137938	439	164	0	161	0	7	86474	291	82918	264	123	0	111	0
HOWARD	0	8633	29	8734	28	10	0	10	0	5	65986	222	63273	201	94	0	85	0
HUDSPETH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hunt	4	109897	370	111174	354	132	0	130	0	13	161474	543	154834	493	229	0	207	0
IRION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JACKSON	0	4540	15	4593	15	5	0	5	0	0	0	0	0	0	0	0	0	0
JEFF DAVIS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JIM HOGG	0	0	0	0	0	0	0	0	0	1	11310	38	10845	35	16	0	15	0

Table 36: Calculated ASHRAE Standard 90.1-1989 and 1999 Energy Use for Food and Lodging Building Types (USDOE 2004) (Part 3)

ERCOT Counties	Food									Lodging								
	In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL				In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL			
	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)
JIM WELLS	6	169675	571	171645	546	204	0	201	0	23	281727	948	270142	860	399	1	361	0
Johnson	14	402313	1354	406985	1295	484	1	476	0	4	53496	180	51296	163	76	0	69	0
JONES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KARNES	0	874	3	884	3	1	0	1	0	1	17449	59	16731	53	25	0	22	0
Kaufman	8	224310	755	226916	722	270	0	265	0	5	66900	225	64149	204	95	0	86	0
KENDALL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KENEDY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KENT	0	0	0	0	0	0	0	0	0	2	29856	100	28629	91	42	0	38	0
KERR	6	177723	598	179787	572	214	0	210	0	53	660434	2222	633276	2015	936	1	847	1
KIMBLE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KINNEY	0	3479	12	3519	11	4	0	4	0	0	0	0	0	0	0	0	0	0
KLEBERG	9	256467	863	259446	826	309	0	303	0	8	101491	341	97318	310	144	0	130	0
KNOX	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LA SALLE	0	3151	11	3187	10	4	0	4	0	2	18700	63	17931	57	26	0	24	0
LAMAR	1	39594	133	40054	127	48	0	47	0	2	25902	87	24837	79	37	0	33	0
LAMPASAS	3	92164	310	93234	297	111	0	109	0	7	82702	278	79301	252	117	0	106	0
LAVACA	0	1111	4	1124	4	1	0	1	0	1	9654	32	9257	29	14	0	12	0
LEE	0	7107	24	7190	23	9	0	8	0	0	0	0	0	0	0	0	0	0
LEON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LIMESTONE	2	71769	241	72602	231	86	0	85	0	4	43522	146	41732	133	62	0	56	0
LIVE OAK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LLANO	0	0	0	0	0	0	0	0	0	56	698508	2350	669785	2131	990	2	896	1
LOVING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MADISON	0	488	2	494	2	1	0	1	0	0	0	0	0	0	0	0	0	0
MARTIN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MASON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MATAGORDA	1	36334	122	36756	117	44	0	43	0	9	105652	355	101307	322	150	0	136	0
MAVERICK	3	92055	310	93124	296	111	0	109	0	28	350147	1178	335748	1068	496	1	449	0
MCCULLOCH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MCLENNAN	26	781531	2630	790608	2516	941	1	925	1	122	1512941	5090	1450727	4616	2144	3	1940	1
MCMULLEN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEDINA	0	6663	22	6741	21	8	0	8	0	0	865	3	829	3	1	0	1	0
MENARD	0	0	0	0	0	0	0	0	0	0	2879	10	2761	9	4	0	4	0
MIDLAND	24	699951	2355	708080	2253	843	1	828	1	51	629814	2119	603915	1922	892	1	808	0
MILAM	3	77556	261	78457	250	93	0	92	0	0	0	0	0	0	0	0	0	0
MILLS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MITCHELL	0	1649	6	1668	5	2	0	2	0	5	63978	215	61347	195	91	0	82	0
MONTAGUE	3	77080	259	77975	248	93	0	91	0	6	75501	254	72397	230	107	0	97	0
Montgomery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MOTLEY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NACOGDOCHES	5	149317	502	151052	481	180	0	177	0	27	334937	1127	321163	1022	475	1	430	0
NAVARRO	5	139919	471	141544	450	168	0	166	0	14	170536	574	163523	520	242	0	219	0
NOLAN	3	80890	272	81829	260	97	0	96	0	8	98350	331	94306	300	139	0	126	0
Nueces	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PALO PINTO	4	114185	384	115511	368	137	0	135	0	3	32481	109	31145	99	46	0	42	0
Parker	19	555344	1869	561794	1788	669	1	657	0	37	462291	1555	443281	1410	655	1	593	0
PECOS	0	2676	9	2707	9	3	0	3	0	9	117532	395	112699	359	167	0	151	0
PRESIDIO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RAINS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REAGAN	0	0	0	0	0	0	0	0	0	0	4443	15	4260	14	6	0	6	0
REAL	0	0	0	0	0	0	0	0	0	4	45267	152	43406	138	64	0	58	0
RED RIVER	0	531	2	537	2	1	0	1	0	0	0	0	0	0	0	0	0	0
REEVES	0	3866	13	3911	12	5	0	5	0	4	50132	169	48071	153	71	0	64	0
REFUGIO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ROBERTSON	0	0	0	0	0	0	0	0	0	1	17112	58	16408	52	24	0	22	0
Rockwall	25	750692	2526	759410	2416	904	1	888	1	15	190484	641	182651	581	270	0	244	0
RUNNELS	0	6045	20	6115	19	7	0	7	0	0	0	0	0	0	0	0	0	0
Rusk	3	84203	283	85181	271	101	0	100	0	1	11089	37	10633	34	16	0	14	0
San Patricio	6	179660	604	181746	578	216	0	213	0	19	239932	807	230066	732	340	1	308	0
SAN SABA	0	5721	19	5788	18	7	0	7	0	0	0	0	0	0	0	0	0	0
SCHLEICHER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SCURRY	1	31872	107	32242	103	38	0	38	0	2	28790	97	27606	88	41	0	37	0
SHACKELFORD	0	0	0	0	0	0	0	0	0	2	27679	93	26541	84	39	0	36	0
Smith	23	683622	2300	691562	2200	823	1	809	0	120	1495844	5033	1434333	4564	2120	3	1919	1
SOMERVELL	0	1232	4	1246	4	1	0	1	0	1	7419	25	7114	23	11	0	10	0
STARR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STEPHENS	0	0	0	0	0	0	0	0	0	1	14250	48	13664	43	20	0	18	0
STERLING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STONEWALL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUTTON	0	0	0	0	0	0	0	0	0	1	14097	47	13517	43	20	0	18	0
Tarrant	445	13117620	44136	13269970	42224	15794	24	15522	10	1003	12461094	41927	11948675	38019	17657	27	15983	10
TAYLOR	21	627096	2110	634379	2019	755	1	742	0	60	739461	2488	709053	2256	1048	2	948	1
TERRELL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
THROCKMORTON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TITUS	2	53523	180	54144	172	64	0	63	0	0	1298	4	1245	4	2	0	2	0
TOM GREEN	14	407352	1371	412083	1311	490	1	482	0	112	1394077	4691	1336751	4253	1975	3	1788	1
Travis	172	5083271	17103	5142309	16362	6120	9	6015	4	652	8107053	27277	7773679	24735	11487	18	10398	6
UPTON	0	0	0	0	0	0	0	0	0	0	1697	6	1627	5	2	0	2	0
UVALDE	9	260179	875	263201	837	313	0	308	0	5	60581	204	58090	185	86	0	78	0
VAL VERDE	2	56015	188	56665	180	67	0	66	0	9	106443	358	102066	325	151	0	137	0
VAN ZANDT	0	1185	4	1199	4	1	0	1	0	0	2574	9	2468	8	4	0	3	0
Victoria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waller	0	3921	13	3967	13	5	0	5	0	0	0	0	0	0	0	0	0	0
WARD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WASHINGTON	9	261897	881	264939	843	315	0	310	0	12	143166	482	137278	437	203	0	184	0
WEBB	14	420542	1415	425426	1354	506	1	498	0	95	1183021	3980	1134374	3609	1676	3	1517	1
WHARTON	8	232770	783	235473	749	280	0	275	0	6	79399	267	76134	242	113	0	102	0
WICHITA	13	397852	1339	402473	1281	479	1	471	0	165	2054694	6913	1970202	6269	2911	4	2635	2
WILBARGER	2	67874	228	68663	218	82	0	80	0	11	137552	463	131896	420	195	0	176	0
WILLACY	7	208966	703	211392	673	252	0	247	0	1	15831	53	15180	48	22	0	20	0
Williamson	81	2401364	8080	2429254	7730	2891	4	2842	2	123	1525664	5133	1462927	4655	2162	3	1957	1
Wilson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WINKLER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WISE	0	7611	26	7700	24	9	0	9	0	47	586882	1975	562748	1791	832	1	753	0
YOUNG	6	177424	597	179485	571	214	0	210	0	6	77078	259	73908	235	109	0	99	0
ZAPATA	0	6185	21	6257	20	7	0	7	0	1	17192	58	16485	52	24	0	22	0
ZAVALA	0	0	0	0	0	0	0	0	0	1	14859	50	14248	45	21	0	19	0
Total	2603	76786364	258358	77678174	247163	92451	142	90863	56	7815	97120225	326774	93126496	296318	137617	212	124566	77

Table 37: Calculated ASHRAE Standard 90.1-1989 and 1999 Energy Use for Office and Warehouse Building Types (USDOE 2004) (Part 1)

	Office									Warehouse								
Non-attainment Counties	**In**	**Electricity (kWh/yr), PNNL**				**Gas (mBtu/yr), PNNL**				**In**	**Electricity (kWh/yr), PNNL**				**Gas (mBtu/yr), PNNL**			
	thousand	**1989 (Annual)**	**1989 (OSD)**	**1999 (Annual)**	**1999 (OSD)**	**1989 (Annual)**	**1989 (OSD)**	**1999 (Annual)**	**1999 (OSD)**	**thousand**	**1989 (Annual)**	**1989 (OSD)**	**1999 (Annual)**	**1999 (OSD)**	**1989 (Annual)**	**1989 (OSD)**	**1999 (Annual)**	**1999 (OSD)**
Brazoria	70	1006377	3386	899582	2862	390	1	439	0	115	349290	1175	599788	1908	945	1	1051	1
Chambers	13	187704	632	167785	534	73	0	82	0	0	0	0	0	0	0	0	0	0
Collin	683	9882059	33249	8833392	28107	3830	6	4315	3	490	1482606	4988	2545874	8101	4009	6	4460	3
Dallas	2020	29244380	98397	26141015	83178	11334	17	12769	8	2910	8813374	29654	15133992	48155	23834	37	26511	16
Denton	315	4553131	15320	4069960	12950	1765	3	1988	1	758	2294228	7719	3939561	12535	6204	10	6901	4
El Paso	461	6675507	22461	5967113	18987	2587	4	2915	2	1116	3378773	11368	5801901	18461	9137	14	10163	6
Fort Bend	347	5018629	16886	4486060	14274	1945	3	2191	1	484	1464384	4927	2514585	8001	3960	6	4405	3
Galveston	174	2512353	8453	2245746	7146	974	1	1097	1	62	187161	630	321387	1023	506	1	563	0
Hardin	1	19015	64	16997	54	7	0	8	0	0	0	0	0	0	0	0	0	0
Harris	2392	34622642	116492	30948544	98475	13419	21	15117	9	4792	14512762	48830	24920764	79295	39246	60	43655	27
Jefferson	102	1482297	4987	1324998	4216	574	1	647	0	48	144376	486	247917	789	390	1	434	0
Liberty	15	223620	752	199890	636	87	0	98	0	2	7119	24	12224	39	19	0	21	0
Montgomery	321	4641833	15618	4149249	13202	1799	3	2027	1	204	619201	2083	1063268	3383	1674	3	1863	1
Orange	18	258081	868	230694	734	100	0	113	0	15	44942	151	77172	246	122	0	135	0
Tarrant	902	13052258	43916	11667174	37124	5059	8	5699	4	1875	5679685	19110	9752939	31033	15359	24	17085	11
Waller	0	5860	20	5238	17	2	0	3	0	14	41200	139	70747	225	111	0	124	0
Total (Non-attainment)	7833	113385746	381501	101353437	322495	43944	68	49506	31	12884	39019101	131285	67002119	213193	105517	162	117370	72

	Office									Warehouse								
Affected Counties	**In**	**Electricity (kWh/yr), PNNL**				**Gas (mBtu/yr), PNNL**				**In**	**Electricity (kWh/yr), PNNL**				**Gas (mBtu/yr), PNNL**			
	thousand	**1989 (Annual)**	**1989 (OSD)**	**1999 (Annual)**	**1999 (OSD)**	**1989 (Annual)**	**1989 (OSD)**	**1999 (Annual)**	**1999 (OSD)**	**thousand**	**1989 (Annual)**	**1989 (OSD)**	**1999 (Annual)**	**1999 (OSD)**	**1989 (Annual)**	**1989 (OSD)**	**1999 (Annual)**	**1999 (OSD)**
Bastrop	6	86529	291	77347	246	34	0	38	0	6	18800	63	32283	103	51	0	57	0
Bexar	886	12820683	43137	11460173	36465	4969	8	5598	3	904	2737440	9210	4700628	14957	7403	11	8234	5
Caldwell	2	22441	76	20059	64	9	0	10	0	11	33795	114	58032	185	91	0	102	0
Comal	52	746267	2511	667074	2123	289	0	326	0	28	83568	281	143500	457	226	0	251	0
Ellis	26	369490	1243	330281	1051	143	0	161	0	300	907390	3053	1558136	4958	2454	4	2729	2
Gregg	25	367624	1237	328613	1046	142	0	161	0	42	128635	433	220886	703	348	1	387	0
Guadalupe	66	949774	3196	848985	2701	368	1	415	0	142	430184	1447	738696	2350	1163	2	1294	1
Harrison	13	183113	616	163682	521	71	0	80	0	10	30150	101	51773	165	82	0	91	0
Hays	137	1978598	6657	1768632	5628	767	1	864	1	65	195820	659	336254	1070	530	1	589	0
Henderson	3	39054	131	34910	111	15	0	17	0	17	52343	176	89881	286	142	0	157	0
Hood	10	151613	510	135524	431	59	0	66	0	0	0	0	0	0	0	0	0	0
Hunt	18	253675	854	226756	722	98	0	111	0	11	31929	107	54827	174	86	0	96	0
Johnson	8	116939	393	104529	333	45	0	51	0	64	193180	650	331721	1055	522	1	581	0
Kaufman	15	211365	711	188936	601	82	0	92	0	79	238489	802	409524	1303	645	1	717	0
Nueces	121	1758539	5917	1571925	5002	682	1	768	0	124	374541	1260	643147	2046	1013	2	1127	1
Parker	8	119804	403	107091	341	46	0	52	0	6	19203	65	32975	105	52	0	58	0
Rockwall	26	376948	1268	336947	1072	146	0	165	0	36	110448	372	189658	603	299	0	332	0
Rusk	2	34329	116	30686	98	13	0	15	0	2	7269	24	12482	40	20	0	22	0
San Patricio	75	1086356	3655	971074	3090	421	1	474	0	241	729781	2455	1253152	3987	1974	3	2195	1
Smith	121	1755115	5905	1568865	4992	680	1	766	0	147	444233	1495	762820	2427	1201	2	1336	1
Travis	527	7627861	25665	6818405	21695	2956	5	3330	2	398	1205668	4057	2070327	6588	3260	5	3627	2
Upshur	5	72923	245	65184	207	28	0	32	0	2	5713	19	9809	31	15	0	17	0
Victoria	17	248022	835	221702	705	96	0	108	0	10	29570	99	50777	162	80	0	89	0
Williamson	134	1944494	6543	1738147	5531	754	1	849	1	119	359954	1211	618099	1967	973	1	1083	1
Wilson	0	4033	14	3605	11	2	0	2	0	0	0	0	0	0	0	0	0	0
Total (Affected)	2302	33325590	112128	29789133	94786	12916	20	14550	9	2763	8368102	28156	14369388	45722	22629	35	25171	16

Table 38: Calculated ASHRAE Standard 90.1-1989 and 1999 Energy Use for Office and Warehouse Building Types (USDOE 2004) (Part 2)

ERCOT Counties	Office									Warehouse								
	In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL				In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL			
	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)
ANDERSON	2	22984	77	20545	65	9	0	10	0	1	3419	12	5871	19	9	0	10	0
ANDREWS	3	43370	146	38768	123	17	0	19	0	0	0	0	0	0	0	0	0	0
ANGELINA	29	420152	1414	375566	1195	163	0	183	0	7	20386	69	35007	111	55	0	61	0
ARANSAS	7	95704	322	85548	272	37	0	42	0	0	589	2	1012	3	2	0	2	0
ARCHER	4	59114	199	52841	168	23	0	26	0	2	6304	21	10826	34	17	0	19	0
ATASCOSA	9	127771	430	114212	363	50	0	56	0	2	6317	21	10847	35	17	0	19	0
AUSTIN	5	65998	222	58995	188	26	0	29	0	194	588084	1979	1009835	3213	1590	2	1769	1
BANDERA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bastrop	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BAYLOR	2	31487	106	28146	90	12	0	14	0	0	0	0	0	0	0	0	0	0
BEE	21	307723	1035	275068	875	119	0	134	0	0	664	2	1140	4	2	0	2	0
BELL	326	4715461	15866	4215064	13412	1828	3	2059	1	118	356792	1200	612669	1949	965	1	1073	1
Bexar	1202	17395858	58531	15549838	49478	6742	10	7595	5	904	2737440	9210	4700628	14957	7403	11	8234	5
BLANCO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BORDEN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BOSQUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brazoria	57	829935	2792	741863	2361	322	0	362	0	115	349290	1175	599788	1908	945	1	1051	1
BRAZOS	209	3022487	10170	2701746	8597	1171	2	1320	1	54	164393	553	282289	898	445	1	494	0
BREWSTER	6	82633	278	73864	235	32	0	36	0	6	16803	57	28854	92	45	0	51	0
BRISCOE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BROOKS	0	2360	8	2109	7	1	0	1	0	0	0	0	0	0	0	0	0	0
BROWN	12	178504	601	159562	508	69	0	78	0	6	18864	63	32392	103	51	0	57	0
BURLESON	2	35532	120	31761	101	14	0	16	0	0	0	0	0	0	0	0	0	0
BURNET	9	132220	445	118189	376	51	0	58	0	2	7333	25	12592	40	20	0	22	0
Caldwell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CALHOUN	1	15145	51	13538	43	6	0	7	0	0	574	2	985	3	2	0	2	0
CALLAHAN	0	0	0	0	0	0	0	0	0	1	3790	13	6508	21	10	0	11	0
CAMERON	215	3109977	10464	2779951	8845	1205	2	1358	1	298	903667	3041	1551743	4937	2444	4	2718	2
Chambers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CHEROKEE	26	381540	1284	341052	1085	148	0	167	0	34	101948	343	175061	557	276	0	307	0
CHILDRESS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CLAY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COKE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COLEMAN	1	10122	34	9048	29	4	0	4	0	0	0	0	0	0	0	0	0	0
Collin	487	7044936	23704	6297339	20037	2730	4	3076	2	490	1482606	4988	2545874	8101	4009	6	4460	3
COLORADO	4	54350	183	48582	155	21	0	24	0	0	358	1	615	2	1	0	1	0
Comal	47	677840	2281	605908	1928	263	0	296	0	28	83568	281	143500	457	226	0	251	0
COMANCHE	72	1039104	3496	928836	2955	403	1	454	0	2	4758	16	8171	26	13	0	14	0
CONCHO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COOKE	66	957889	3223	856239	2724	371	1	418	0	19	58911	198	101160	322	159	0	177	0
CORYELL	16	237715	800	212489	676	92	0	104	0	7	21164	71	36343	116	57	0	64	0
COTTLE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CRANE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CROCKETT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CROSBY	1	9921	33	8869	28	4	0	4	0	0	0	0	0	0	0	0	0	0
CULBERSON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dallas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DAWSON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DE WITT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DELTA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Denton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DICKENS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DIMMIT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DUVAL	0	1366	5	1221	4	1	0	1	0	0	0	0	0	0	0	0	0	0
EASTLAND	1	8942	30	7993	25	3	0	4	0	0	0	0	0	0	0	0	0	0
ECTOR	125	1814521	6105	1621967	5161	703	1	792	0	219	661970	2227	1136710	3617	1790	3	1991	1
EDWARDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ellis	21	310224	1044	277304	882	120	0	135	0	300	907390	3053	1558136	4958	2454	4	2729	2
ERATH	8	112028	377	100140	319	43	0	49	0	2	4921	17	8450	27	13	0	15	0
FALLS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FANNIN	4	56847	191	50814	162	22	0	25	0	5	13683	46	23495	75	37	0	41	0
FAYETTE	15	217958	733	194828	620	84	0	95	0	1	1866	6	3204	10	5	0	6	0
FISHER	2	28981	98	25906	82	11	0	13	0	0	0	0	0	0	0	0	0	0
FOARD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fort Bend	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FRANKLIN	0	2280	8	2038	6	1	0	1	0	26	80036	269	137434	437	216	0	241	0
FREESTONE	1	7327	25	6550	21	3	0	3	0	0	53	0	91	0	0	0	0	0
FRIO	2	33397	112	29853	95	13	0	15	0	0	0	0	0	0	0	0	0	0
Galveston	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GILLESPIE	7	99621	335	89049	283	39	0	43	0	5	15750	53	27046	86	43	0	47	0
GLASSCOCK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GOLIAD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GONZALES	2	22976	77	20538	65	9	0	10	0	0	0	0	0	0	0	0	0	0
GRAYSON	35	500989	1686	447825	1425	194	0	219	0	90	273066	919	468898	1492	738	1	821	1
GRIMES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Guadalupe	38	545536	1836	487644	1552	211	0	238	0	142	430184	1447	738696	2350	1163	2	1294	1
HALL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HAMILTON	4	51695	174	46209	147	20	0	23	0	0	0	0	0	0	0	0	0	0
HARDEMAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Harris	1642	23766993	79967	21244879	67599	9211	14	10377	6	4792	14512762	48830	24920764	79295	39246	60	43655	27
HASKELL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hays	59	853968	2873	763347	2429	331	1	373	0	65	195820	659	336254	1070	530	1	589	0
Henderson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HIDALGO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HILL	3	42500	143	37990	121	16	0	19	0	0	0	0	0	0	0	0	0	0
Hood	6	90605	305	80990	258	35	0	40	0	0	0	0	0	0	0	0	0	0
HOPKINS	5	79150	266	70751	225	31	0	35	0	12	36340	122	62402	199	98	0	109	0
HOUSTON	7	100718	339	90030	286	39	0	44	0	0	608	2	1044	3	2	0	2	0
HOWARD	5	76855	259	68700	219	30	0	34	0	0	0	0	0	0	0	0	0	0
HUDSPETH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hunt	13	188072	633	168114	535	73	0	82	0	11	31929	107	54827	174	86	0	96	0
IRION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 39: Calculated ASHRAE Standard 90.1-1989 and 1999 Energy Use for Office and Warehouse Building Types (USDOE 2004) (Part 3)

ERCOT Counties	Office									Warehouse								
	In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL				In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL			
	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)
JIM WELLS	23	328133	1104	293312	933	127	0	143	0	4	11339	38	19470	62	31	0	34	0
Johnson	4	62308	210	55696	177	24	0	27	0	64	193180	650	331721	1055	522	1	581	0
JONES	0	0	0	0	0	0	0	0	0	4	11506	39	19757	63	31	0	35	0
KARNES	1	20323	68	18166	58	8	0	9	0	0	0	0	0	0	0	0	0	0
Kaufman	5	77920	262	69651	222	30	0	34	0	79	238489	802	409524	1303	645	1	717	0
KENDALL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KENEDY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KENT	2	34774	117	31084	99	13	0	15	0	0	0	0	0	0	0	0	0	0
KERR	53	769221	2588	687592	2188	298	0	336	0	0	1162	4	1995	6	3	0	3	0
KIMBLE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KINNEY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KLEBERG	8	118209	398	105665	336	46	0	52	0	1	2838	10	4874	16	8	0	9	0
KNOX	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LA SALLE	2	21780	73	19469	62	8	0	10	0	0	0	0	0	0	0	0	0	0
LAMAR	2	30169	102	26967	86	12	0	13	0	2	4642	16	7971	25	13	0	14	0
LAMPASAS	7	96325	324	86103	274	37	0	42	0	0	0	0	0	0	0	0	0	0
LAVACA	1	11244	38	10051	32	4	0	5	0	0	0	0	0	0	0	0	0	0
LEE	0	0	0	0	0	0	0	0	0	0	1435	5	2463	8	4	0	4	0
LEON	0	0	0	0	0	0	0	0	0	0	166	1	285	1	0	0	0	0
LIMESTONE	4	50691	171	45311	144	20	0	22	0	0	1485	5	2550	8	4	0	4	0
LIVE OAK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LLANO	56	813566	2737	727232	2314	315	0	355	0	0	98	0	169	1	0	0	0	0
LOVING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MADISON	0	0	0	0	0	0	0	0	0	0	221	1	380	1	1	0	1	0
MARTIN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MASON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MATAGORDA	9	123055	414	109996	350	48	0	54	0	7	20739	70	35612	113	56	0	62	0
MAVERICK	28	407823	1372	364545	1160	158	0	178	0	1	1627	5	2793	9	4	0	5	0
MCCULLOCH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MCLENNAN	122	1762152	5929	1575155	5012	683	1	769	0	121	366536	1233	629402	2003	991	2	1103	1
MCMULLEN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEDINA	0	1007	3	900	3	0	0	0	0	1	2069	7	3553	11	6	0	6	0
MENARD	0	3353	11	2997	10	1	0	1	0	0	0	0	0	0	0	0	0	0
MIDLAND	51	733557	2468	655713	2086	284	0	320	0	18	54249	183	93154	296	147	0	163	0
MILAM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MILLS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MITCHELL	5	74516	251	66609	212	29	0	33	0	0	0	0	0	0	0	0	0	0
MONTAGUE	6	87938	296	78606	250	34	0	38	0	1	2279	8	3914	12	6	0	7	0
Montgomery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MOTLEY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NACOGDOCHES	27	390107	1313	348710	1110	151	0	170	0	13	40661	137	69821	222	110	0	122	0
NAVARRO	14	198626	668	177549	565	77	0	87	0	34	102711	346	176372	561	278	0	309	0
NOLAN	8	114550	385	102394	326	44	0	50	0	0	0	0	0	0	0	0	0	0
Nueces	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PALO PINTO	3	37831	127	33817	108	15	0	17	0	2	4579	15	7863	25	12	0	14	0
Parker	37	538439	1812	481301	1531	209	0	235	0	6	19203	65	32975	105	52	0	58	0
PECOS	9	136892	461	122365	389	53	0	60	0	0	0	0	0	0	0	0	0	0
PRESIDIO	0	0	0	0	0	0	0	0	0	0	884	3	1517	5	2	0	3	0
RAINS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REAGAN	0	5175	17	4626	15	2	0	2	0	0	0	0	0	0	0	0	0	0
REAL	4	52724	177	47129	150	20	0	23	0	0	1217	4	2090	7	3	0	4	0
RED RIVER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REEVES	4	58390	196	52194	166	23	0	25	0	0	0	0	0	0	0	0	0	0
REFUGIO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ROBERTSON	1	19931	67	17816	57	8	0	9	0	1	3671	12	6303	20	10	0	11	0
Rockwall	15	221860	746	198317	631	86	0	97	0	36	110448	372	189658	603	299	0	332	0
RUNNELS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rusk	1	12916	43	11545	37	5	0	6	0	2	7269	24	12482	40	20	0	22	0
San Patricio	19	279453	940	249798	795	108	0	122	0	241	729781	2455	1253152	3987	1974	3	2195	1
SAN SABA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SCHLEICHER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SCURRY	2	33532	113	29974	95	13	0	15	0	12	35410	119	60805	193	96	0	107	0
SHACKELFORD	2	32238	108	28817	92	12	0	14	0	0	0	0	0	0	0	0	0	0
Smith	120	1742239	5862	1557356	4955	675	1	761	0	147	444233	1495	762820	2427	1201	2	1336	1
SOMERVELL	1	8642	29	7725	25	3	0	4	0	1	2752	9	4725	15	7	0	8	0
STARR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STEPHENS	1	16597	56	14836	47	6	0	7	0	0	0	0	0	0	0	0	0	0
STERLING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STONEWALL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUTTON	1	16419	55	14676	47	6	0	7	0	0	0	0	0	0	0	0	0	0
Tarrant	1003	14513680	48833	12973512	41280	5625	9	6337	4	1875	5679685	19110	9752939	31033	15359	24	17085	11
TAYLOR	60	861264	2898	769868	2450	334	1	376	0	52	156657	527	269006	856	424	1	471	0
TERRELL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
THROCKMORTON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TITUS	0	1512	5	1352	4	1	0	1	0	0	0	0	0	0	0	0	0	0
TOM GREEN	112	1623709	5463	1451404	4618	629	1	709	0	33	99397	334	170680	543	269	0	299	0
Travis	652	9442444	31770	8440427	26856	3660	6	4123	3	398	1205668	4057	2070327	6588	3260	5	3627	2
UPTON	0	1976	7	1766	6	1	0	1	0	0	0	0	0	0	0	0	0	0
UVALDE	5	70560	237	63073	201	27	0	31	0	8	23882	80	41009	130	65	0	72	0
VAL VERDE	9	123976	417	110820	353	48	0	54	0	3	9904	33	17006	54	27	0	30	0
VAN ZANDT	0	2998	10	2680	9	1	0	1	0	0	863	3	1481	5	2	0	3	0
Victoria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waller	0	0	0	0	0	0	0	0	0	14	41200	139	70747	225	111	0	124	0
WARD	0	0	0	0	0	0	0	0	0	0	207	1	355	1	1	0	1	0
WASHINGTON	12	166748	561	149053	474	65	0	73	0	25	75930	255	130384	415	205	0	228	0
WEBB	95	1377888	4636	1231669	3919	534	1	602	0	118	357701	1204	614231	1954	967	1	1076	1
WHARTON	6	92478	311	82664	263	36	0	40	0	11	34233	115	58784	187	93	0	103	0
WICHITA	165	2393143	8052	2139186	6807	927	1	1045	1	28	84529	284	145150	462	229	0	254	0
WILBARGER	11	160210	539	143209	456	62	0	70	0	1	4339	15	7451	24	12	0	13	0
WILLACY	1	18439	62	16482	52	7	0	8	0	7	21743	73	37337	119	59	0	65	0
Williamson	123	1776971	5979	1588402	5054	689	1	776	0	119	359954	1211	618099	1967	973	1	1083	1
Wilson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WINKLER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WISE	47	683553	2300	611015	1944	265	0	298	0	0	169	1	290	1	0	0	1	0
YOUNG	6	89774	302	80248	255	35	0	39	0	2	4742	16	8144	26	13	0	14	0

Table 40: Calculated ASHRAE Standard 90.1-1989 and 1999 Annual Electricity and Natural Gas Savings (USDOE 2004). A decrease in energy use is negative (i.e., savings); a positive value represents an energy use increase (+) (Part 1)

Counties	Assembly		Education		Retail		Food		Lodging		Office		Warehouse		Total		Total*1.07 (T&D loss) for eGrid	
	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	MWh/yr	Therm/yr
Non-attainment Counties																		
(square feet in thousands)																		
Brazoria	-159072	159	-431167	435	-620030	289	21688	-39	-29302	-96	-106795	49	250498	106	-1074180	905	1149	-9686
Chambers	-11534	12	-39471	40	-13538	6	474	-1	0	0	-19919	9	0	0	-83988	66	90	-707
Collin	-779172	781	-1148359	1159	-2955535	1380	103380	-184	-248728	-813	-1048668	485	1063269	450	-5013813	3258	5365	-34864
Dallas	-1541753	1546	-2084932	2105	-3352845	1565	117277	-209	-441975	-1444	-3103366	1434	6320617	2677	-4086976	7674	4373	-82112
Denton	-554879	556	-1227403	1239	-1623117	758	56774	-101	-195535	-639	-483171	223	1645333	697	-2381997	2733	2549	-29245
El Paso	-499679	501	-879666	888	-896698	419	31365	-56	-153214	-501	-708394	327	2423128	1026	-683157	2605	731	-27871
Fort Bend	-357130	358	-643103	649	-1187520	554	41538	-74	-93181	-304	-532569	246	1050201	445	-1721763	1874	1842	-20053
Galveston	-142367	143	-232164	234	-451829	211	15804	-28	-54319	-178	-266607	123	134225	57	-997257	562	1067	-6018
Hardin	-10566	11	-44969	45	-34275	16	1199	-2	0	0	-2018	1	0	0	-90628	71	97	-757
Harris	-2414134	2420	-3477000	3510	-6167773	2879	215739	-384	-839116	-2742	-3674098	1698	10408002	4409	-5948379	11790	6365	-126152
Jefferson	-149550	150	-138418	140	-431489	201	15093	-27	-125331	-410	-157299	73	103541	44	-883454	171	945	-1832
Liberty	-7960	8	-201024	203	-34032	16	1190	-2	-2850	-9	-23730	11	5105	2	-263301	228	282	-2445
Montgomery	-298164	299	-561836	567	-1066253	498	37296	-66	-99883	-326	-492584	228	444067	188	-2037356	1387	2180	-14839
Orange	-18806	19	-125590	127	-45694	21	1598	-3	-9808	-32	-27387	13	32231	14	-193455	158	207	-1695
Tarrant	-1249901	1253	-1843420	1861	-4355546	2033	152350	-271	-512419	-1674	-1385084	640	4073254	1725	-5120766	5567	5479	-59567
Waller	-5302	5	-13845	14	-1302	1	46	0	0	0	-622	0	29547	13	8522	33	-9	-349
Total (Non-attainment)	-8199970	8220	-13092365	13216	-23237474	10848	812811	-1447	-2805660	-9168	-12032309	5562	27983018	11853	-30571949	39083	32712	-418192
Affected Counties																		
(square feet in thousands)																		
Bastrop	-9255	9	-62341	63	-42281	20	1479	-3	-22990	-75	-9182	4	13483	6	-131088	24	140	-258
Bexar	-902452	905	-2099430	2119	-2982810	1392	104334	-186	-614177	-2007	-1360510	629	1963188	832	-5891857	3684	6304	-39419
Caldwell	-3545	4	-70206	71	-31635	15	1107	-2	-2843	-9	-2381	1	24237	10	-85267	89	91	-955
Comal	-42152	42	-170367	172	-185714	87	6496	-12	-23932	-78	-79193	37	59932	25	-434929	273	465	-2923
Ellis	-77707	78	-137676	139	-164022	77	5737	-10	-10953	-36	-39210	18	650746	276	226915	541	-243	-5791
Gregg	-81509	82	-39467	40	-117099	55	4096	-7	-41041	-134	-39012	18	92252	39	-221781	92	237	-984
Guadalupe	-35372	35	-165551	167	-180728	84	6322	-11	-19261	-63	-100788	47	308512	131	-186868	390	200	-4173
Harrison	-66887	67	-71992	73	-83885	39	2934	-5	-16839	-55	-19432	9	21623	9	-234478	137	251	-1463
Hays	-126555	127	-257771	260	-315566	147	11038	-20	-30150	-99	-209966	97	140435	59	-788535	573	844	-6128
Henderson	-7170	7	-24860	25	-23266	11	814	-1	-1142	-4	-4144	2	37538	16	-22231	56	24	-597
Hood	-57855	58	-72923	74	-32491	15	1136	-2	-3199	-10	-16089	7	0	0	-181420	142	194	-1517
Hunt	-28029	28	-94365	95	-36490	17	1276	-2	-6640	-22	-26920	12	22898	10	-168270	139	180	-1483
Johnson	-15983	16	-157714	159	-133583	62	4673	-8	-2200	-7	-12409	6	138541	59	-178676	286	191	-3065
Kaufman	-33385	33	-139599	141	-74480	35	2605	-5	-2751	-9	-22430	10	171035	72	-99004	278	106	-2978
Nueces	-172121	173	-177329	179	-182884	85	6397	-11	-82687	-270	-186613	86	268606	114	-526631	355	563	-3802
Parker	-16167	16	-153399	155	-184395	86	6450	-11	-19010	-62	-12713	6	13772	6	-365464	195	391	-2089
Rockwall	-44818	45	-185932	188	-249258	116	8719	-16	-7833	-26	-40001	18	79209	34	-439914	360	471	-3851
Rusk	-976	1	-7186	7	-27959	13	978	-2	-456	-1	-3643	2	5213	2	-34030	22	36	-235
San Patricio	-22547	23	-66467	67	-59654	28	2087	-4	-9866	-32	-115282	53	523371	222	251640	357	-269	-3815
Smith	-135104	135	-133779	135	-226989	106	7940	-14	-61511	-201	-186250	86	318587	135	-417106	382	446	-4091
Travis	-533636	535	-618499	624	-1687838	788	59038	-105	-333374	-1089	-809456	374	864659	366	-3059106	1493	3273	-15977
Upshur	-18468	19	-34021	34	-9829	5	344	-1	-1042	-3	-7738	4	4097	2	-66657	59	71	-629
Victoria	-28812	29	-19052	19	-76496	36	2676	-5	-10102	-33	-26320	12	21207	9	-136900	67	146	-719
Williamson	-197427	198	-470404	475	-797344	372	27890	-50	-62738	-205	-206346	95	258145	109	-1448224	995	1550	-10647
Wilson	-3802	4	-28244	29	-12173	6	426	-1	-4891	-16	-428	0	0	0	-49113	21	53	-230
Total (Affected)	-2661737	2668	-5458575	5510	-7918870	3697	276990	-493	-1391628	-4548	-3536457	1635	6001285	2542	-14688991	11011	15717	-117819

Table 41: Calculated ASHRAE Standard 90.1-1989 and 1999 Annual Electricity and Natural Gas Savings (USDOE 2004). A decrease in energy use is negative (i.e., savings); a positive value represents an energy use increase (+) (Part 2)

Counties	Assembly		Education		Retail		Food		Lodging		Office		Warehouse		Total		Total*1.07 (T&D loss) for eGrid	
	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	MWh/yr	Therm/yr
ERCOT Counties																		
(square feet in thousands)																		
ANDERSON	-2150	2	-1168	1	-5352	2	187	0	-811	-3	-2439	1	2452	1	-9281	5	10	-54
ANDREWS	-1134	1	-6628	7	0	0	0	0	-1531	-5	-4602	2	0	0	-13896	5	15	-53
ANGELINA	-56580	57	-62498	63	-118619	55	4149	-7	-14834	-48	-44586	21	14620	6	-278347	146	298	-1564
ARANSAS	-6747	7	-1647	2	-68998	32	2413	-4	-3379	-11	-10156	5	422	0	-88091	30	94	-323
ARCHER	-2097	2	-20182	20	0	0	0	0	-2087	-7	-6273	3	4521	2	-26117	20	28	-219
ATASCOSA	-19283	19	-24756	25	-29500	14	1032	-2	-4511	-15	-13559	6	4530	2	-86047	50	92	-532
AUSTIN	-945	1	-44521	45	-2040	1	71	0	-2330	-8	-7004	3	421751	179	364982	221	-391	-2364
BANDERA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bastrop	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BAYLOR	0	0	-1543	2	0	0	0	0	-1112	-4	-3341	2	0	0	-5996	-1	6	6
BEE	-32314	32	-57622	58	-14341	7	502	-1	-10864	-36	-32655	15	476	0	-146818	76	157	-815
BELL	-131879	132	-303492	306	-229741	107	8036	-14	-166484	-544	-500397	231	255877	108	-1068079	327	1143	-3500
Bexar	-902452	905	-2099430	2119	-2982810	1392	104334	-186	-614177	-2007	-1846020	853	1963188	832	-6377367	3908	6824	-41821
BLANCO	-238	0	-20789	21	0	0	0	0	0	0	0	0	0	0	-21027	21	22	-227
BORDEN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BOSQUE	-1586	2	-19018	19	0	0	0	0	0	0	0	0	0	0	-20605	21	22	-222
Brazoria	-159072	159	-431167	435	-620030	289	21688	-39	-29302	-96	-88071	41	250498	106	-1055457	897	1129	-9594
BRAZOS	-253877	255	-345388	349	-276219	129	9662	-17	-106712	-349	-320741	148	117896	50	-1175379	564	1258	-6039
BREWSTER	-7455	7	-12603	13	0	0	0	0	-2917	-10	-8769	4	12051	5	-19694	20	21	-212
BRISCOE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BROOKS	-303	0	0	0	-1241	1	43	0	-83	0	-250	0	0	0	-1834	1	2	-7
BROWN	-9224	9	-17450	18	-20190	9	706	-1	-6302	-21	-18943	9	13528	6	-57875	29	62	-309
BURLESON	-1943	2	-13966	14	-1338	1	47	0	-1254	-4	-3771	2	0	0	-22225	14	24	-152
BURNET	-11477	12	-60184	61	-26484	12	926	-2	-4668	-15	-14031	6	5259	2	-110659	76	118	-818
Caldw ell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CALHOUN	-76	0	-13049	13	-47638	22	1666	-3	-535	-2	-1607	1	411	0	-60827	32	65	-339
CALLAHAN	-4758	5	-20645	21	-633	0	22	0	0	0	0	0	2718	1	-23296	27	25	-289
CAMERON	-135652	136	-459744	464	-440694	206	15415	-27	-109801	-359	-330026	153	648076	275	-812425	847	869	-9059
Chambers	-11534	12	-39471	40	-13538	6	474	-1	0	0	0	0	0	0	-64070	57	69	-609
CHEROKEE	-62075	62	-65944	67	-25234	12	883	-2	-13471	-44	-40488	19	73113	31	-133216	145	143	-1548
CHILDRESS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CLAY	-634	1	-3901	4	0	0	0	0	0	0	0	0	0	0	-4536	5	5	-49
COKE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COLEMAN	-1483	1	-1742	2	-383	0	13	0	-357	-1	-1074	0	0	0	-5026	3	5	-29
Collin	-779172	781	-1148359	1159	-2955535	1380	103380	-184	-248728	-813	-747597	346	1063269	450	-4712742	3119	5043	-33375
COLORADO	0	0	-19980	20	-588	0	21	0	-1919	-6	-5767	3	257	0	-27978	17	30	-181
Comal	-42152	42	-170367	172	-185714	87	6496	-12	-23932	-78	-71931	33	59932	25	-427668	270	458	-2887
COMANCHE	-11824	12	-42845	43	-2773	1	97	0	-36687	-120	-110268	51	3412	1	-200888	-11	215	120
CONCHO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COOKE	-36458	37	-89747	91	-130995	61	4582	-8	-33819	-111	-101650	47	42249	18	-345838	135	370	-1439
CORYELL	-22121	22	-41084	41	-49923	23	1746	-3	-8393	-27	-25226	12	15178	6	-129822	75	139	-797
COTTLE	0	0	-1796	2	0	0	0	0	0	0	0	0	0	0	-1796	2	2	-19
CRANE	-2542	3	-1713	2	0	0	0	0	0	0	0	0	0	0	-4255	4	5	-46
CROCKETT	-5078	5	-1902	2	0	0	0	0	0	0	0	0	0	0	-6980	7	7	-75
CROSBY	-1211	1	-254	0	0	0	0	0	-350	-1	-1053	0	0	0	-2868	1	3	-9
CULBERSON	-1154	1	-9818	10	-973	0	34	0	0	0	0	0	0	0	-11910	11	13	-123
Dallas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DAWSON	-675	1	-7924	8	0	0	0	0	0	0	0	0	0	0	-8599	9	9	-93
DE WITT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DELTA	-389	0	-3106	3	0	0	0	0	0	0	0	0	0	0	-3496	4	4	-38
Denton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DICKENS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DIMMIT	0	0	-3081	3	0	0	0	0	0	0	0	0	0	0	-3081	3	3	-33
DUVAL	-361	0	-24087	24	-2054	1	72	0	-48	0	-145	0	0	0	-26622	25	28	-272
EASTLAND	-12110	12	-4438	4	-51803	24	1812	-3	-316	-1	-949	0	0	0	-67804	37	73	-396
ECTOR	-47117	47	-108901	110	-99613	47	3484	-6	-64063	-209	-192554	89	474740	201	-34024	278	36	-2977
EDWARDS	-260	0	-549	1	0	0	0	0	0	0	0	0	0	0	-809	1	1	-9
Ellis	-77707	78	-137676	139	-164022	77	5737	-10	-10953	-36	-32920	15	650746	276	233205	538	-250	-5760
ERATH	-7131	7	-36508	37	-6300	3	220	0	-3955	-13	-11888	5	3529	1	-62033	41	66	-435
FALLS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FANNIN	-9588	10	-24042	24	-8047	4	281	-1	-2007	-7	-6032	3	9813	4	-39623	38	42	-401
FAYETTE	-3567	4	-16585	17	-7462	3	261	0	-7695	-25	-23129	11	1338	1	-56840	9	61	-101
FISHER	0	0	-4004	4	0	0	0	0	-1023	-3	-3075	1	0	0	-8103	2	9	-23
FOARD	-301	0	0	0	0	0	0	0	0	0	0	0	0	0	-301	0	0	-3
Fort Bend	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FRANKLIN	-657	1	0	0	0	0	0	0	-81	0	-242	0	57399	24	56419	25	-60	-266

Table 42: Calculated ASHRAE Standard 90.1-1989 and 1999 Annual Electricity and Natural Gas Savings (USDOE 2004). A decrease in energy use is negative (i.e., savings); a positive value represents an energy use increase (+) (Part 3)

Counties	Assembly		Education		Retail		Food		Lodging		Office		Warehouse		Total		Total*1.07 (T&D loss) for eGrid	
	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	MWh/yr	Therm/yr
ERCOT Counties																		
(square feet in thousands)																		
FREESTONE	0	0	-9785	10	0	0	0	0	-259	-1	-778	0	38	0	-10783	9	12	-101
FRIO	-847	1	-18332	19	-9886	5	346	-1	-1179	-4	-3544	2	0	0	-33443	21	36	-226
Galveston	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GILLESPIE	-12786	13	-6501	7	-32916	15	1151	-2	-3517	-11	-10572	5	11295	5	-53846	31	58	-330
GLASSCOCK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GOLIAD	0	0	-5151	5	0	0	0	0	0	0	0	0	0	0	-5151	5	6	-56
GONZALES	-836	1	-4629	5	-2312	1	81	0	-811	-3	-2438	1	0	0	-10946	5	12	-53
GRAYSON	-43152	43	-132934	134	-113449	53	3968	-7	-17688	-58	-53164	25	195832	83	-160586	273	172	-2922
GRIMES	-5044	5	-8986	9	0	0	0	0	0	0	0	0	0	0	-14029	14	15	-151
Guadalupe	-35372	35	-165551	167	-180728	84	6322	-11	-19261	-63	-57891	27	308512	131	-143971	370	154	-3961
HALL	0	0	-634	1	0	0	0	0	0	0	0	0	0	0	-634	1	1	-7
HAMILTON	-577	1	-6883	7	0	0	0	0	-1825	-6	-5486	3	0	0	-14771	4	16	-44
HARDEMAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Harris	-2414134	2420	-3477000	3510	-6167773	2879	215739	-384	-839116	-2742	-2522114	1166	10408002	4409	-4796395	11257	5132	-120455
HASKELL	-288	0	0	0	-22502	11	787	-1	0	0	0	0	0	0	-22004	9	24	-101
Hays	-126555	127	-257771	260	-315566	147	11038	-20	-30150	-99	-90622	42	140435	59	-669191	518	716	-5538
Henderson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HIDALGO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HILL	-7095	7	-58053	59	-18190	8	636	-1	-1500	-5	-4510	2	0	0	-88712	70	95	-752
Hood	-57855	58	-72923	74	-32491	15	1136	-2	-3199	-10	-9615	4	0	0	-174946	139	187	-1485
HOPKINS	-8527	9	-19577	20	-26658	12	932	-2	-2794	-9	-8399	4	26062	11	-38961	45	42	-480
HOUSTON	-3125	3	-6431	6	-45275	21	1584	-3	-3556	-12	-10688	5	436	0	-67055	21	72	-229
HOWARD	-7098	7	-11906	12	-2867	1	100	0	-2713	-9	-8156	4	0	0	-32640	15	35	-163
HUDSPETH	-1103	1	-10233	10	0	0	0	0	0	0	0	0	0	0	-11336	11	12	-122
Hunt	-28029	28	-94365	95	-36490	17	1276	-2	-6640	-22	-19958	9	22898	10	-161308	135	173	-1448
IRION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JACK	-2163	2	-1120	1	0	0	0	0	0	0	0	0	0	0	-3283	3	4	-35
JACKSON	-2296	2	-18895	19	-1508	1	53	0	0	0	0	0	655	0	-21991	22	24	-238
JEFF DAVIS	-10753	11	-169	0	0	0	0	0	0	0	0	0	0	0	-10922	11	12	-117
JIM HOGG	-726	1	-9743	10	0	0	0	0	-465	-2	-1398	1	0	0	-12333	10	13	-104
JIM WELLS	-363	0	-55768	56	-56338	26	1971	-4	-11585	-38	-34821	16	8132	3	-148773	61	159	-654
Johnson	-15983	16	-157714	159	-133583	62	4673	-8	-2200	-7	-6612	3	138541	59	-172878	284	185	-3037
JONES	-13723	14	-9954	10	0	0	0	0	0	0	0	0	8251	3	-15426	27	17	-292
KARNES	0	0	-7903	8	-290	0	10	0	-718	-2	-2157	1	0	0	-11058	7	12	-72
Kaufman	-33385	33	-139599	141	-74480	35	2605	-5	-2751	-9	-8269	4	171035	72	-84843	272	91	-2908
KENDALL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KENEDY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KENT	0	0	0	0	0	0	0	0	-1228	-4	-3690	2	0	0	-4918	-2	5	25
KERR	-72102	72	-58423	59	-59011	28	2064	-4	-27158	-89	-81628	38	833	0	-295425	104	316	-1118
KIMBLE	-2740	3	-317	0	0	0	0	0	0	0	0	0	0	0	-3057	3	3	-33
KING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KINNEY	0	0	-3625	4	-1155	1	40	0	0	0	0	0	0	0	-4740	4	5	-44
KLEBERG	-9945	10	-44859	45	-85157	40	2979	-5	-4173	-14	-12544	6	2036	1	-151664	83	162	-885
KNOX	-1442	1	-1479	1	0	0	0	0	0	0	0	0	0	0	-2921	3	3	-31
LA SALLE	0	0	-1465	1	-1046	0	37	0	-769	-3	-2311	1	0	0	-5555	0	6	-5
LAMAR	-6829	7	-33650	34	-13147	6	460	-1	-1065	-3	-3201	1	3329	1	-54103	46	58	-487
LAMPASAS	-3012	3	-11001	11	-30602	14	1070	-2	-3401	-11	-10222	5	0	0	-57167	20	61	-215
LAVACA	-11927	12	-2412	2	-369	0	13	0	-397	-1	-1193	1	0	0	-16285	14	17	-148
LEE	-1175	1	-15543	16	-2360	1	83	0	0	0	0	0	1029	0	-17966	18	19	-195
LEON	-11639	12	-7876	8	0	0	0	0	0	0	0	0	119	0	-19395	20	21	-210
LIMESTONE	-4826	5	-6229	6	-23830	11	834	-1	-1790	-6	-5379	2	1065	0	-40155	18	43	-191
LIVE OAK	-17650	18	0	0	0	0	0	0	0	0	0	0	0	0	-17650	18	19	-189
LLANO	-1000	1	-28529	29	0	0	0	0	-28724	-94	-86334	40	71	0	-144516	-24	155	258
LOVING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MADISON	-934	1	-11636	12	-162	0	6	0	0	0	0	0	159	0	-12568	13	13	-137
MARTIN	0	0	-528	1	0	0	0	0	0	0	0	0	0	0	-528	1	1	-6
MASON	0	0	-1310	1	0	0	0	0	0	0	0	0	0	0	-1310	1	1	-14
MATAGORDA	-6290	6	-30532	31	-12064	6	422	-1	-4345	-14	-13058	6	14873	6	-50994	40	55	-430
MAVERICK	-21333	21	-47927	48	-30566	14	1069	-2	-14399	-47	-43277	20	1167	0	-155266	56	166	-595
MCCULLOCH	-681	1	-11198	11	0	0	0	0	0	0	0	0	0	0	-11879	12	13	-128
MCLENNAN	-119979	120	-313073	316	-259498	121	9077	-16	-62214	-203	-186997	86	262866	111	-669819	536	717	-5733
MCMULLEN	-3702	4	-740	1	0	0	0	0	0	0	0	0	0	0	-4442	4	5	-48
MEDINA	-5595	6	-23686	24	-2212	1	77	0	-36	0	-107	0	1484	1	-30074	31	32	-331
MENARD	-575	1	-1396	1	0	0	0	0	-118	0	-356	0	0	0	-2445	2	3	-19
MIDLAND	-149008	149	-69213	70	-232410	108	8129	-14	-25899	-85	-77844	36	38905	16	-507339	281	543	-3008
MILAM	-4614	5	-45724	46	-25752	12	901	-2	0	0	0	0	0	0	-75189	61	80	-655
MILLS	-2780	3	-9441	10	0	0	0	0	0	0	0	0	0	0	-12222	12	13	-132
MITCHELL	-6124	6	-180	0	-547	0	19	0	-2631	-9	-7908	4	0	0	-17371	2	19	-17
MONTAGUE	-2135	2	-14881	15	-25593	12	895	-2	-3105	-10	-9332	4	1634	1	-52516	22	56	-239
Montgomery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MOTLEY	0	0	-750	1	0	0	0	0	0	0	0	0	0	0	-750	1	1	-8

Table 43: Calculated ASHRAE Standard 90.1-1989 and 1999 Annual Electricity and Natural Gas Savings (USDOE 2004). A decrease in energy use is negative (i.e., savings); a positive value represents an energy use increase (+) (Part 4)

Counties	Assembly		Education		Retail		Food		Lodging		Office		Warehouse		Total		Total*1.07 (T&D loss) for eGrid	
	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	MWh/yr	Therm/yr
ERCOT Counties																		
(square feet in thousands)																		
NACOGDOCHES	-36751	37	-138086	139	-49579	23	1734	-3	-13773	-45	-41398	19	29160	12	-248692	183	266	-1956
NAVARRO	-5335	5	-35189	36	-46458	22	1625	-3	-7013	-23	-21078	10	73661	31	-39787	78	43	-831
NOLAN	-9440	9	-20285	20	-26859	13	939	-2	-4044	-13	-12156	6	0	0	-71844	33	77	-355
Nueces	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PALO PINTO	-7290	7	-30483	31	-37914	18	1326	-2	-1336	-4	-4015	2	3284	1	-76427	52	82	-560
Parker	-16167	16	-153399	155	-184395	86	6450	-11	-19010	-62	-57138	26	13772	6	-409888	216	439	-2309
PECOS	-5468	5	-7271	7	-889	0	31	0	-4833	-16	-14527	7	0	0	-32956	4	35	-44
PRESIDIO	-4357	4	-5689	6	0	0	0	0	0	0	0	0	634	0	-9412	10	10	-111
RAINS	-1033	1	-9497	10	0	0	0	0	0	0	0	0	0	0	-10530	11	11	-114
REAGAN	-2403	2	0	0	0	0	0	0	-183	-1	-549	0	0	0	-3135	2	3	-22
REAL	-764	1	-676	1	0	0	0	0	-1861	-6	-5595	3	873	0	-8024	-2	9	18
RED RIVER	-2773	3	-16155	16	-176	0	6	0	0	0	0	0	0	0	-19098	19	20	-205
REEVES	-8283	8	-2272	2	-1284	1	45	0	-2062	-7	-6196	3	0	0	-20051	7	21	-78
REFUGIO	-1847	2	-900	1	0	0	0	0	0	0	0	0	0	0	-2747	3	3	-30
ROBERTSON	-2221	2	-3632	4	0	0	0	0	-704	-2	-2115	1	2632	1	-6038	6	6	-61
Rockwall	-44818	45	-185932	188	-249258	116	8719	-16	-7833	-26	-23543	11	79209	34	-423457	352	453	-3769
RUNNELS	0	0	-7100	7	-2007	1	70	0	0	0	0	0	0	0	-9037	8	10	-85
Rusk	-976	1	-7186	7	-27959	13	978	-2	-456	-1	-1371	1	5213	2	-31757	21	34	-224
San Patricio	-22547	23	-66467	67	-59654	28	2087	-4	-9866	-32	-29655	14	523371	222	337268	317	-361	-3392
SAN SABA	-7238	7	-3170	3	-1900	1	66	0	0	0	0	0	0	0	-12241	11	13	-120
SCHLEICHER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SCURRY	-915	1	-296	0	-10583	5	370	-1	-1184	-4	-3558	2	25395	11	9229	14	-10	-150
SHACKELFORD	-3043	3	-4607	5	0	0	0	0	-1138	-4	-3421	2	0	0	-12208	6	13	-60
Smith	-135104	135	-133779	135	-226989	106	7940	-14	-61511	-201	-184884	85	318587	135	-415740	382	445	-4084
SOMERVELL	-428	0	-7935	8	-409	0	14	0	-305	-1	-917	0	1974	1	-8007	9	9	-95
STARR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STEPHENS	0	0	-7057	7	0	0	0	0	-586	-2	-1761	1	0	0	-9404	6	10	-64
STERLING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STONEWALL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUTTON	0	0	-1955	2	0	0	0	0	-580	-2	-1742	1	0	0	-4277	1	5	-9
Tarrant	-1249901	1253	-1843420	1861	-4355546	2033	152350	-271	-512419	-1674	-1540168	712	4073254	1725	-5275849	5639	5645	-60334
TAYLOR	-57246	57	-57969	59	-208220	97	7283	-13	-30408	-99	-91396	42	112349	48	-325606	191	348	-2040
TERRELL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
THROCKMORTON	-1730	2	0	0	0	0	0	0	0	0	0	0	0	0	-1730	2	2	-19
TITUS	-7356	7	-30341	31	-17772	8	622	-1	-53	0	-160	0	0	0	-55060	45	59	-482
TOM GREEN	-103324	104	-104472	105	-135256	63	4731	-8	-57327	-187	-172305	80	71284	30	-496670	186	531	-1993
Travis	-533636	535	-618499	624	-1687838	788	59038	-105	-333374	-1089	-1002017	463	864659	366	-3251666	1582	3479	-16929
UPTON	0	0	0	0	0	0	0	0	-70	0	-210	0	0	0	-279	0	0	1
UVALDE	-23502	24	-38309	39	-86389	40	3022	-5	-2491	-8	-7488	3	17127	7	-138030	100	148	-1067
VAL VERDE	-14958	15	-34349	35	-18599	9	651	-1	-4377	-14	-13156	6	7102	3	-77686	52	83	-556
VAN ZANDT	-2449	2	-47976	48	-393	0	14	0	-106	0	-318	0	619	0	-50611	51	54	-547
Victoria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waller	-5302	5	-13845	14	-1302	1	46	0	0	0	0	0	29547	13	9143	32	-10	-346
WARD	0	0	0	0	0	0	0	0	0	0	0	0	148	0	148	0	0	-1
WASHINGTON	-51085	51	-42348	43	-86960	41	3042	-5	-5887	-19	-17695	8	54454	23	-146479	141	157	-1510
WEBB	-47062	47	-324000	327	-139636	65	4884	-9	-48648	-159	-146219	68	256530	109	-444151	448	475	-4794
WHARTON	-15549	16	-18741	19	-77288	36	2703	-5	-3265	-11	-9814	5	24551	10	-97403	70	104	-749
WICHITA	-100171	100	-59081	60	-132102	62	4621	-8	-84492	-276	-253956	117	60621	26	-564561	80	604	-861
WILBARGER	-5209	5	-8104	8	-22537	11	788	-1	-5656	-18	-17001	8	3112	1	-54607	13	58	-141
WILLACY	-3192	3	-49448	50	-69384	32	2427	-4	-651	-2	-1957	1	15593	7	-106611	87	114	-926
Williamson	-197427	198	-470404	475	-797344	372	27890	-50	-62738	-205	-188569	87	258145	109	-1430447	987	1531	-10559
Wilson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WINKLER	-1480	1	-268	0	0	0	0	0	0	0	0	0	0	0	-1748	2	2	-19
WISE	-30957	31	-85603	86	-2527	1	88	0	-24133	-79	-72537	34	121	0	-215549	73	231	-783
YOUNG	-16710	17	-24385	25	-58912	28	2061	-4	-3170	-10	-9527	4	3401	1	-107241	61	115	-649
ZAPATA	-3749	4	-47523	48	-2054	1	72	0	-707	-2	-2125	1	0	0	-56086	51	60	-548
ZAVALA	-209	0	-5382	5	0	0	0	0	-611	-2	-1837	1	464	0	-7575	5	8	-50
Total	-8969811	8992	-16386931	16541	-25495977	11902	891810	-1588	-3993729	-13051	-12003878	5548	24873791	10536	-41084725	38882	43961	-416037

Table 44: Calculated ASHRAE Standard 90.1-1989 and 1999 OSD Electricity and Natural Gas Savings (USDOE 2004). A decrease in energy use is negative (i.e., savings); a positive value represents an energy use increase (+) (Part 1)

Counties	Assembly		Education		Retail		Food		Lodging		Office		Warehouse		Total		Total*1.07 (T&D loss) for eGrid	
	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	MWh/yr	Therm/yr
Non-attainment Counties																		
(square feet in thousands)																		
Brazoria	-813	-3	-2064	-6	-2692	-1	-272	-2	-223	-1	-524	0	733	-1	-5855	-14	6	146
Chambers	-59	0	-189	-1	-59	0	-6	0	0	0	-98	0	0	0	-410	-1	0	9
Collin	-3980	-13	-5497	-16	-12833	-3	-1298	-10	-1897	-8	-5143	-3	3112	-3	-27535	-58	29	617
Dallas	-7875	-26	-9980	-29	-14558	-4	-1472	-11	-3370	-15	-15219	-10	18501	-20	-33974	-115	36	1234
Denton	-2834	-9	-5875	-17	-7048	-2	-713	-5	-1491	-7	-2369	-1	4816	-5	-15514	-47	17	507
El Paso	-2552	-8	-4211	-12	-3894	-1	-394	-3	-1168	-5	-3474	-2	7093	-8	-8600	-40	9	428
Fort Bend	-1824	-6	-3078	-9	-5156	-1	-521	-4	-711	-3	-2612	-2	3074	-3	-10828	-29	12	306
Galveston	-727	-2	-1111	-3	-1962	0	-198	-2	-414	-2	-1307	-1	393	0	-5328	-11	6	116
Hardin	-54	0	-215	-1	-149	0	-15	0	0	0	-10	0	0	0	-443	-1	0	10
Harris	-12331	-41	-16643	-49	-26781	-7	-2708	-21	-6399	-28	-18018	-11	30465	-33	-52415	-191	56	2040
Jefferson	-764	-3	-663	-2	-1874	0	-189	-1	-956	-4	-771	0	303	0	-4914	-11	5	123
Liberty	-41	0	-962	-3	-148	0	-15	0	-22	0	-116	0	15	0	-1289	-3	1	35
Montgomery	-1523	-5	-2689	-8	-4630	-1	-468	-4	-762	-3	-2416	-2	1300	-1	-11188	-24	12	258
Orange	-96	0	-601	-2	-198	0	-20	0	-75	0	-134	0	94	0	-1030	-3	1	30
Tarrant	-6384	-21	-8824	-26	-18912	-5	-1912	-15	-3908	-17	-6792	-4	11923	-13	-34810	-101	37	1085
Waller	-27	0	-66	0	-6	0	-1	0	0	0	-3	0	86	0	-16	0	0	4
Total (Non-attainment)	-41885	-138	-62667	-185	-100900	-26	-10203	-79	-21396	-95	-59006	-37	81908	-90	-214148	-649	229	6949
Affected Counties																		
(square feet in thousands)																		
Bastrop	-47	0	-298	-1	-184	0	-19	0	-175	-1	-45	0	39	0	-729	-2	1	22
Bexar	-4610	-15	-10049	-30	-12952	-3	-1310	-10	-4684	-21	-6672	-4	5746	-6	-34529	-90	37	958
Caldwell	-18	0	-336	-1	-137	0	-14	0	-22	0	-12	0	71	0	-468	-1	1	15
Comal	-215	-1	-815	-2	-806	0	-82	-1	-183	-1	-388	0	175	0	-2314	-5	2	56
Ellis	-397	-1	-659	-2	-712	0	-72	-1	-84	0	-192	0	1905	-2	-211	-7	0	70
Gregg	-416	-1	-189	-1	-508	0	-51	0	-313	-1	-191	0	270	0	-1399	-4	1	46
Guadalupe	-181	-1	-792	-2	-785	0	-79	-1	-147	-1	-494	0	903	-1	-1575	-6	2	61
Harrison	-342	-1	-345	-1	-364	0	-37	0	-128	-1	-95	0	63	0	-1248	-3	1	34
Hays	-646	-2	-1234	-4	-1370	0	-139	-1	-230	-1	-1030	-1	411	0	-4238	-9	5	100
Henderson	-37	0	-119	0	-101	0	-10	0	-9	0	-20	0	110	0	-186	-1	0	8
Hood	-296	-1	-349	-1	-141	0	-14	0	-24	0	-79	0	0	0	-903	-2	1	25
Hunt	-143	0	-452	-1	-158	0	-16	0	-51	0	-132	0	67	0	-885	-2	1	25
Johnson	-82	0	-755	-2	-580	0	-59	0	-17	0	-61	0	406	0	-1147	-4	1	39
Kaufman	-171	-1	-668	-2	-323	0	-33	0	-21	0	-110	0	501	-1	-825	-4	1	38
Nueces	-879	-3	-849	-3	-794	0	-80	-1	-631	-3	-915	-1	786	-1	-3362	-10	4	112
Parker	-83	0	-734	-2	-801	0	-81	-1	-145	-1	-62	0	40	0	-1865	-4	2	43
Rockwall	-229	-1	-890	-3	-1082	0	-109	-1	-60	0	-196	0	232	0	-2335	-5	2	55
Rusk	-5	0	-34	0	-121	0	-12	0	-3	0	-18	0	15	0	-179	0	0	3
San Patricio	-115	0	-318	-1	-259	0	-26	0	-75	0	-565	0	1532	-2	173	-4	0	42
Smith	-690	-2	-640	-2	-986	0	-100	-1	-469	-2	-913	-1	933	-1	-2866	-9	3	95
Travis	-2726	-9	-2960	-9	-7329	-2	-741	-6	-2542	-11	-3970	-2	2531	-3	-17737	-42	19	448
Upshur	-94	0	-163	0	-43	0	-4	0	-8	0	-38	0	12	0	-338	-1	0	10
Victoria	-147	0	-91	0	-332	0	-34	0	-77	0	-129	0	62	0	-748	-2	1	17
Williamson	-1008	-3	-2252	-7	-3462	-1	-350	-3	-478	-2	-1012	-1	756	-1	-7807	-17	8	183
Wilson	-19	0	-135	0	-53	0	-5	0	-37	0	-2	0	0	0	-252	-1	0	7
Total (Affected)	-13596	-45	-26128	-77	-34385	-9	-3477	-27	-10612	-47	-17343	-11	17566	-19	-87974	-235	94	2512

Table 45: Calculated ASHRAE Standard 90.1-1989 and 1999 OSD Electricity and Natural Gas Savings (USDOE 2004). A decrease in energy use is negative (i.e., savings); a positive value represents an energy use increase (+) (Part 2)

Counties	Assembly		Education		Retail		Food		Lodging		Office		Warehouse		Total		Total*1.07 (T&D loss) for eGrid	
	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	MWh/yr	Therm/yr
ERCOT Counties																		
(square feet in thousands)																		
ANDERSON	-11	0	-6	0	-23	0	-2	0	-6	0	-12	0	7	0	-53	0	0	1
ANDREWS	-6	0	-32	0	0	0	0	0	-12	0	-23	0	0	0	-72	0	0	2
ANGELINA	-289	-1	-299	-1	-515	0	-52	0	-113	-1	-219	0	43	0	-1444	-3	2	33
ARANSAS	-34	0	-8	0	-300	0	-30	0	-26	0	-50	0	1	0	-447	-1	0	6
ARCHER	-11	0	-97	0	0	0	0	0	-16	0	-31	0	13	0	-141	0	0	5
ATASCOSA	-98	0	-118	0	-128	0	-13	0	-34	0	-66	0	13	0	-446	-1	0	11
AUSTIN	-5	0	-213	-1	-9	0	-1	0	-18	0	-34	0	1234	-1	955	-2	-1	23
BANDERA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bastrop	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BAYLOR	0	0	-7	0	0	0	0	0	-8	0	-16	0	0	0	-32	0	0	1
BEE	-165	-1	-276	-1	-62	0	-6	0	-83	0	-160	0	1	0	-751	-2	1	20
BELL	-674	-2	-1453	-4	-998	0	-101	-1	-1270	-6	-2454	-2	749	-1	-6199	-16	7	166
Bexar	-4610	-15	-10049	-30	-12952	-3	-1310	-10	-4684	-21	-9053	-6	5746	-6	-36910	-91	39	974
BLANCO	-1	0	-100	0	0	0	0	0	0	0	0	0	0	0	-101	0	0	3
BORDEN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BOSQUE	-8	0	-91	0	0	0	0	0	0	0	0	0	0	0	-99	0	0	3
Brazoria	-813	-3	-2064	-6	-2692	-1	-272	-2	-223	-1	-432	0	733	-1	-5763	-14	6	146
BRAZOS	-1297	-4	-1653	-5	-1199	0	-121	-1	-814	-4	-1573	-1	345	0	-6312	-15	7	165
BREWSTER	-38	0	-60	0	0	0	0	0	-22	0	-43	0	35	0	-128	0	0	5
BRISCOE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BROOKS	-2	0	0	0	-5	0	-1	0	-1	0	-1	0	0	0	-9	0	0	0
BROWN	-47	0	-84	0	-88	0	-9	0	-48	0	-93	0	40	0	-329	-1	0	9
BURLESON	-10	0	-67	0	-6	0	-1	0	-10	0	-18	0	0	0	-111	0	0	3
BURNET	-59	0	-288	-1	-115	0	-12	0	-36	0	-69	0	15	0	-562	-1	1	15
Caldw ell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CALHOUN	0	0	-62	0	-207	0	-21	0	-4	0	-8	0	1	0	-301	0	0	5
CALLAHAN	-24	0	-99	0	-3	0	0	0	0	0	0	0	8	0	-118	0	0	4
CAMERON	-693	-2	-2201	-6	-1914	0	-193	-1	-837	-4	-1618	-1	1897	-2	-5559	-18	6	188
Chambers	-59	0	-189	-1	-59	0	-6	0	0	0	0	0	0	0	-313	-1	0	9
CHEROKEE	-317	-1	-316	-1	-110	0	-11	0	-103	0	-199	0	214	0	-841	-3	1	31
CHILDRESS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CLAY	-3	0	-19	0	0	0	0	0	0	0	0	0	0	0	-22	0	0	1
COKE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COLEMAN	-8	0	-8	0	-2	0	0	0	-3	0	-5	0	0	0	-26	0	0	1
Collin	-3980	-13	-5497	-16	-12833	-3	-1298	-10	-1897	-8	-3666	-2	3112	-3	-26058	-57	28	607
COLORADO	0	0	-96	0	-3	0	0	0	-15	0	-28	0	1	0	-141	0	0	4
Comal	-215	-1	-815	-2	-806	0	-82	-1	-183	-1	-353	0	175	0	-2279	-5	2	55
COMANCHE	-60	0	-205	-1	-12	0	-1	0	-280	-1	-541	0	10	0	-1089	-2	1	26
CONCHO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COOKE	-186	-1	-430	-1	-569	0	-58	0	-258	-1	-498	0	124	0	-1875	-4	2	43
CORYELL	-113	0	-197	-1	-217	0	-22	0	-64	0	-124	0	44	0	-692	-2	1	17
COTTLE	0	0	-9	0	0	0	0	0	0	0	0	0	0	0	-9	0	0	0
CRANE	-13	0	-8	0	0	0	0	0	0	0	0	0	0	0	-21	0	0	1
CROCKETT	-26	0	-9	0	0	0	0	0	0	0	0	0	0	0	-35	0	0	1
CROSBY	-6	0	-1	0	0	0	0	0	-3	0	-5	0	0	0	-15	0	0	0
CULBERSON	-6	0	-47	0	-4	0	0	0	0	0	0	0	0	0	-58	0	0	2
Dallas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DAWSON	-3	0	-38	0	0	0	0	0	0	0	0	0	0	0	-41	0	0	1
DE WITT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DELTA	-2	0	-15	0	0	0	0	0	0	0	0	0	0	0	-17	0	0	1
Denton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DICKENS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DIMMIT	0	0	-15	0	0	0	0	0	0	0	0	0	0	0	-15	0	0	0
DUVAL	-2	0	-115	0	-9	0	-1	0	0	0	-1	0	0	0	-128	0	0	4
EASTLAND	-62	0	-21	0	-225	0	-23	0	-2	0	-5	0	0	0	-338	-1	0	5
ECTOR	-241	-1	-521	-2	-433	0	-44	0	-489	-2	-944	-1	1390	-2	-1281	-7	1	76
EDWARDS	-1	0	-3	0	0	0	0	0	0	0	0	0	0	0	-4	0	0	0
Ellis	-397	-1	-659	-2	-712	0	-72	-1	-84	0	-161	0	1905	-2	-180	-7	0	70
ERATH	-36	0	-175	-1	-27	0	-3	0	-30	0	-58	0	10	0	-319	-1	0	9
FALLS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FANNIN	-49	0	-115	0	-35	0	-4	0	-15	0	-30	0	29	0	-219	-1	0	7
FAYETTE	-18	0	-79	0	-32	0	-3	0	-59	0	-113	0	4	0	-301	-1	0	7
FISHER	0	0	-19	0	0	0	0	0	-8	0	-15	0	0	0	-42	0	0	1
FOARD	-2	0	0	0	0	0	0	0	0	0	0	0	0	0	-2	0	0	0
Fort Bend	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FRANKLIN	-3	0	0	0	0	0	0	0	-1	0	-1	0	168	0	163	0	0	2

Table 46: Calculated ASHRAE Standard 90.1-1989 and 1999 OSD Electricity and Natural Gas Savings (USDOE 2004). A decrease in energy use is negative (i.e., savings); a positive value represents an energy use increase (+) (Part 3)

Counties	Assembly		Education		Retail		Food		Lodging		Office		Warehouse		Total		Total*1.07 (T&D loss) for eGrid	
	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	MWh/yr	Therm/yr
ERCOT Counties																		
(square feet in thousands)																		
FREESTONE	0	0	-47	0	0	0	0	0	-2	0	-4	0	0	0	-53	0	0	2
FRIO	-4	0	-88	0	-43	0	-4	0	-9	0	-17	0	0	0	-166	0	0	4
Galveston	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GILLESPIE	-65	0	-31	0	-143	0	-14	0	-27	0	-52	0	33	0	-299	-1	0	7
GLASSCOCK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GOLIAD	0	0	-25	0	0	0	0	0	0	0	0	0	0	0	-25	0	0	1
GONZALES	-4	0	-22	0	-10	0	-1	0	-6	0	-12	0	0	0	-56	0	0	1
GRAYSON	-220	-1	-636	-2	-493	0	-50	0	-135	-1	-261	0	573	-1	-1222	-5	1	48
GRIMES	-26	0	-43	0	0	0	0	0	0	0	0	0	0	0	-69	0	0	2
Guadalupe	-181	-1	-792	-2	-785	0	-79	-1	-147	-1	-284	0	903	-1	-1365	-6	1	60
HALL	0	0	-3	0	0	0	0	0	0	0	0	0	0	0	-3	0	0	0
HAMILTON	-3	0	-33	0	0	0	0	0	-14	0	-27	0	0	0	-77	0	0	2
HARDEMAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Harris	-12331	-41	-16643	-49	-26781	-7	-2708	-21	-6399	-28	-12368	-8	30465	-33	-46766	-187	50	2002
HASKELL	-1	0	0	0	-98	0	-10	0	0	0	0	0	0	0	-109	0	0	1
Hays	-646	-2	-1234	-4	-1370	0	-139	-1	-230	-1	-444	0	411	0	-3652	-9	4	96
Henderson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HIDALGO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HILL	-36	0	-278	-1	-79	0	-8	0	-11	0	-22	0	0	0	-435	-1	0	12
Hood	-296	-1	-349	-1	-141	0	-14	0	-24	0	-47	0	0	0	-871	-2	1	25
HOPKINS	-44	0	-94	0	-116	0	-12	0	-21	0	-41	0	76	0	-251	-1	0	8
HOUSTON	-16	0	-31	0	-197	0	-20	0	-27	0	-52	0	1	0	-341	-1	0	5
HOWARD	-36	0	-57	0	-12	0	-1	0	-21	0	-40	0	0	0	-168	0	0	4
HUDSPETH	-6	0	-49	0	0	0	0	0	0	0	0	0	0	0	-55	0	0	2
Hunt	-143	0	-452	-1	-158	0	-16	0	-51	0	-98	0	67	0	-851	-2	1	25
IRION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JACK	-11	0	-5	0	0	0	0	0	0	0	0	0	0	0	-16	0	0	1
JACKSON	-12	0	-90	0	-7	0	-1	0	0	0	0	0	2	0	-107	0	0	3
JEFF DAVIS	-55	0	-1	0	0	0	0	0	0	0	0	0	0	0	-56	0	0	2
JIM HOGG	-4	0	-47	0	0	0	0	0	-4	0	-7	0	0	0	-61	0	0	2
JIM WELLS	-2	0	-267	-1	-245	0	-25	0	-88	0	-171	0	24	0	-773	-2	1	17
Johnson	-82	0	-755	-2	-580	0	-59	0	-17	0	-32	0	406	0	-1119	-4	1	39
JONES	-70	0	-48	0	0	0	0	0	0	0	0	0	24	0	-94	0	0	4
KARNES	0	0	-38	0	-1	0	0	0	-5	0	-11	0	0	0	-55	0	0	2
Kaufman	-171	-1	-668	-2	-323	0	-33	0	-21	0	-41	0	501	-1	-756	-4	1	38
KENDALL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KENEDY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KENT	0	0	0	0	0	0	0	0	-9	0	-18	0	0	0	-27	0	0	1
KERR	-368	-1	-280	-1	-256	0	-26	0	-207	-1	-400	0	2	0	-1535	-3	2	37
KIMBLE	-14	0	-2	0	0	0	0	0	0	0	0	0	0	0	-16	0	0	1
KING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KINNEY	0	0	-17	0	-5	0	-1	0	0	0	0	0	0	0	-23	0	0	1
KLEBERG	-51	0	-215	-1	-370	0	-37	0	-32	0	-62	0	6	0	-760	-1	1	15
KNOX	-7	0	-7	0	0	0	0	0	0	0	0	0	0	0	-14	0	0	0
LA SALLE	0	0	-7	0	-5	0	0	0	-6	0	-11	0	0	0	-29	0	0	1
LAMAR	-35	0	-161	0	-57	0	-6	0	-8	0	-16	0	10	0	-273	-1	0	8
LAMPASAS	-15	0	-53	0	-133	0	-13	0	-26	0	-50	0	0	0	-290	0	0	5
LAVACA	-61	0	-12	0	-2	0	0	0	-3	0	-6	0	0	0	-83	0	0	3
LEE	-6	0	-74	0	-10	0	-1	0	0	0	0	0	3	0	-89	0	0	3
LEON	-59	0	-38	0	0	0	0	0	0	0	0	0	0	0	-97	0	0	3
LIMESTONE	-25	0	-30	0	-103	0	-10	0	-14	0	-26	0	3	0	-205	0	0	4
LIVE OAK	-90	0	0	0	0	0	0	0	0	0	0	0	0	0	-90	0	0	3
LLANO	-5	0	-137	0	0	0	0	0	-219	-1	-423	0	0	0	-784	-2	1	18
LOVING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MADISON	-5	0	-56	0	-1	0	0	0	0	0	0	0	0	0	-61	0	0	2
MARTIN	0	0	-3	0	0	0	0	0	0	0	0	0	0	0	-3	0	0	0
MASON	0	0	-6	0	0	0	0	0	0	0	0	0	0	0	-6	0	0	0
MATAGORDA	-32	0	-146	0	-52	0	-5	0	-33	0	-64	0	44	0	-290	-1	0	9
MAVERICK	-109	0	-229	-1	-133	0	-13	0	-110	0	-212	0	3	0	-803	-2	1	19
MCCULLOCH	-3	0	-54	0	0	0	0	0	0	0	0	0	0	0	-57	0	0	2
MCLENNAN	-613	-2	-1499	-4	-1127	0	-114	-1	-474	-2	-917	-1	769	-1	-3974	-11	4	119
MCMULLEN	-19	0	-4	0	0	0	0	0	0	0	0	0	0	0	-22	0	0	1
MEDINA	-29	0	-113	0	-10	0	-1	0	0	0	-1	0	4	0	-149	0	0	5
MENARD	-3	0	-7	0	0	0	0	0	-1	0	-2	0	0	0	-12	0	0	0
MIDLAND	-761	-3	-331	-1	-1009	0	-102	-1	-198	-1	-382	0	114	0	-2669	-6	3	62
MILAM	-24	0	-219	-1	-112	0	-11	0	0	0	0	0	0	0	-366	-1	0	9
MILLS	-14	0	-45	0	0	0	0	0	0	0	0	0	0	0	-59	0	0	2
MITCHELL	-31	0	-1	0	-2	0	0	0	-20	0	-39	0	0	0	-94	0	0	2
MONTAGUE	-11	0	-71	0	-111	0	-11	0	-24	0	-46	0	5	0	-269	-1	0	5
Montgomery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MOTLEY	0	0	-4	0	0	0	0	0	0	0	0	0	0	0	-4	0	0	0

Table 47: Calculated ASHRAE Standard 90.1-1989 and 1999 OSD Electricity and Natural Gas Savings (USDOE 2004). A decrease in energy use is negative (i.e., savings); a positive value represents an energy use increase (+) (Part 4)

Counties	Assembly		Education		Retail		Food		Lodging		Office		Warehouse		Total		Total*1.07 (T&D loss) for eGrid	
	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	MWh/yr	Therm/yr
ERCOT Counties																		
(square feet in thousands)																		
NACOGDOCHES	-188	-1	-661	-2	-215	0	-22	0	-105	0	-203	0	85	0	-1308	-3	1	37
NAVARRO	-27	0	-168	0	-202	0	-20	0	-53	0	-103	0	216	0	-359	-1	0	14
NOLAN	-48	0	-97	0	-117	0	-12	0	-31	0	-60	0	0	0	-364	-1	0	8
Nueces	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PALO PINTO	-37	0	-146	0	-165	0	-17	0	-10	0	-20	0	10	0	-385	-1	0	8
Parker	-83	0	-734	-2	-801	0	-81	-1	-145	-1	-280	0	40	0	-2083	-4	2	44
PECOS	-28	0	-35	0	-4	0	0	0	-37	0	-71	0	0	0	-175	0	0	4
PRESIDIO	-22	0	-27	0	0	0	0	0	0	0	0	0	2	0	-48	0	0	2
RAINS	-5	0	-45	0	0	0	0	0	0	0	0	0	0	0	-51	0	0	2
REAGAN	-12	0	0	0	0	0	0	0	-1	0	-3	0	0	0	-16	0	0	1
REAL	-4	0	-3	0	0	0	0	0	-14	0	-27	0	3	0	-46	0	0	1
RED RIVER	-14	0	-77	0	-1	0	0	0	0	0	0	0	0	0	-92	0	0	3
REEVES	-42	0	-11	0	-6	0	-1	0	-16	0	-30	0	0	0	-105	0	0	3
REFUGIO	-9	0	-4	0	0	0	0	0	0	0	0	0	0	0	-14	0	0	0
ROBERTSON	-11	0	-17	0	0	0	0	0	-5	0	-10	0	8	0	-37	0	0	1
Rockw all	-229	-1	-890	-3	-1082	0	-109	-1	-60	0	-115	0	232	0	-2254	-5	2	54
RUNNELS	0	0	-34	0	-9	0	-1	0	0	0	0	0	0	0	-44	0	0	1
Rusk	-5	0	-34	0	-121	0	-12	0	-3	0	-7	0	15	0	-168	0	0	3
San Patricio	-115	0	-318	-1	-259	0	-26	0	-75	0	-145	0	1532	-2	593	-4	-1	40
SAN SABA	-37	0	-15	0	-8	0	-1	0	0	0	0	0	0	0	-61	0	0	2
SCHLEICHER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SCURRY	-5	0	-1	0	-46	0	-5	0	-9	0	-17	0	74	0	-9	0	0	2
SHACKELFORD	-16	0	-22	0	0	0	0	0	-9	0	-17	0	0	0	-63	0	0	2
Smith	-690	-2	-640	-2	-986	0	-100	-1	-469	-2	-907	-1	933	-1	-2859	-9	3	95
SOMERVELL	-2	0	-38	0	-2	0	0	0	-2	0	-4	0	6	0	-43	0	0	2
STARR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STEPHENS	0	0	-34	0	0	0	0	0	-4	0	-9	0	0	0	-47	0	0	1
STERLING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STONEWALL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUTTON	0	0	-9	0	0	0	0	0	-4	0	-9	0	0	0	-22	0	0	1
Tarrant	-6384	-21	-8824	-26	-18912	-5	-1912	-15	-3908	-17	-7553	-5	11923	-13	-35571	-102	38	1090
TAYLOR	-292	-1	-277	-1	-904	0	-91	-1	-232	-1	-448	0	329	0	-1917	-4	2	47
TERRELL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
THROCKMORTON	-9	0	0	0	0	0	0	0	0	0	0	0	0	0	-9	0	0	0
TITUS	-38	0	-145	0	-77	0	-8	0	0	0	-1	0	0	0	-269	-1	0	7
TOM GREEN	-528	-2	-500	-1	-587	0	-59	0	-437	-2	-845	-1	209	0	-2748	-7	3	70
Travis	-2726	-9	-2960	-9	-7329	-2	-741	-6	-2542	-11	-4914	-3	2531	-3	-18681	-42	20	454
UPTON	0	0	0	0	0	0	0	0	-1	0	-1	0	0	0	-2	0	0	0
UVALDE	-120	0	-183	-1	-375	0	-38	0	-19	0	-37	0	50	0	-722	-1	1	16
VAL VERDE	-76	0	-164	0	-81	0	-8	0	-33	0	-65	0	21	0	-407	-1	0	11
VAN ZANDT	-13	0	-230	-1	-2	0	0	0	-1	0	-2	0	2	0	-245	-1	0	8
Victoria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waller	-27	0	-66	0	-6	0	-1	0	0	0	0	0	86	0	-13	0	0	4
WARD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WASHINGTON	-261	-1	-203	-1	-378	0	-38	0	-45	0	-87	0	159	0	-852	-2	1	24
WEBB	-240	-1	-1551	-5	-606	0	-61	0	-371	-2	-717	0	751	-1	-2796	-9	3	95
WHARTON	-79	0	-90	0	-336	0	-34	0	-25	0	-48	0	72	0	-540	-1	1	12
WICHITA	-512	-2	-283	-1	-574	0	-58	0	-644	-3	-1245	-1	177	0	-3138	-7	3	74
WILBARGER	-27	0	-39	0	-98	0	-10	0	-43	0	-83	0	9	0	-291	-1	0	6
WILLACY	-16	0	-237	-1	-301	0	-30	0	-5	0	-10	0	46	0	-554	-1	1	12
Williamson	-1008	-3	-2252	-7	-3462	-1	-350	-3	-478	-2	-925	-1	756	-1	-7720	-17	8	183
Wilson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WINKLER	-8	0	-1	0	0	0	0	0	0	0	0	0	0	0	-9	0	0	0
WISE	-158	-1	-410	-1	-11	0	-1	0	-184	-1	-356	0	0	0	-1119	-3	1	30
YOUNG	-85	0	-117	0	-256	0	-26	0	-24	0	-47	0	10	0	-545	-1	1	11
ZAPATA	-19	0	-227	-1	-9	0	-1	0	-5	0	-10	0	0	0	-272	-1	0	8
ZAVALA	-1	0	-26	0	0	0	0	0	-5	0	-9	0	1	0	-39	0	0	1
Total	-45817	-151	-78437	-231	-110706	-28	-11195	-86	-30456	-135	-58867	-37	72807	-80	-262670	-749	281	8016

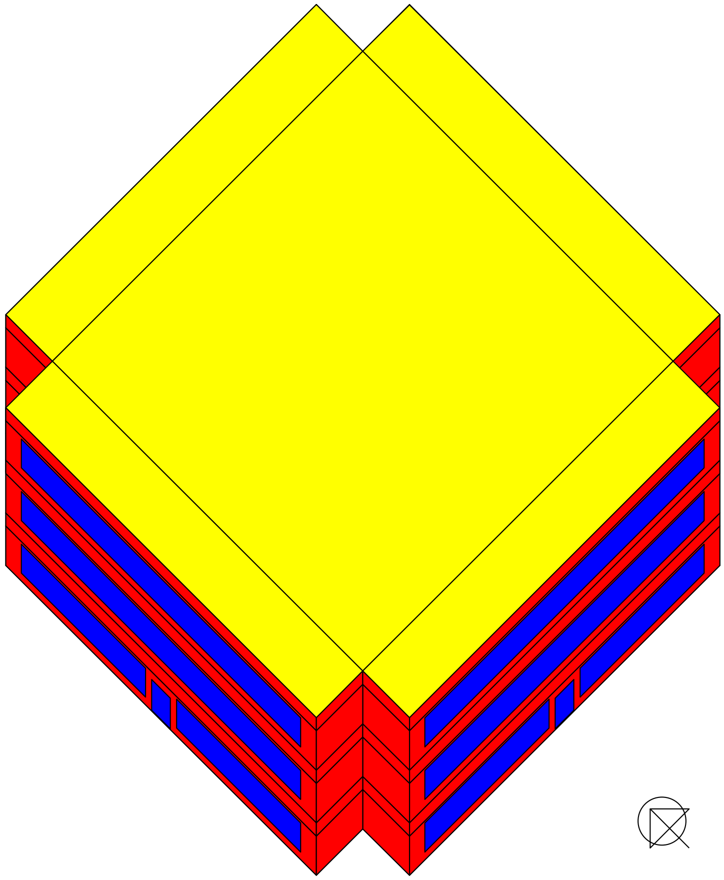


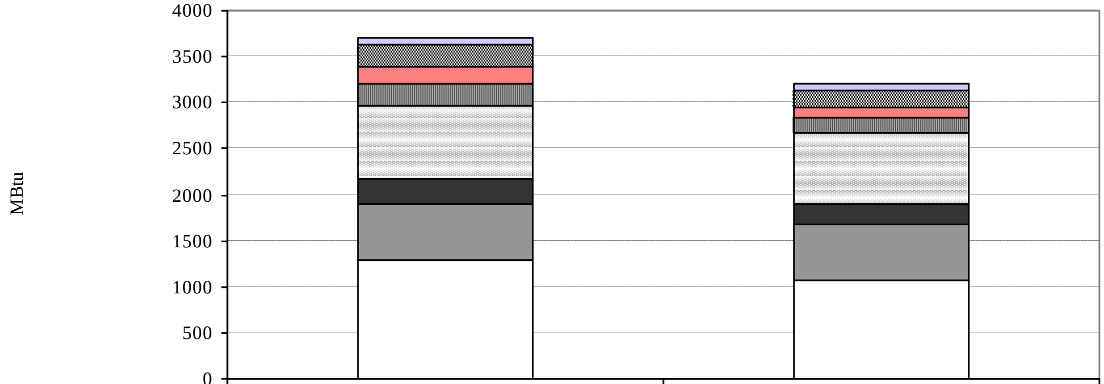
Figure 74: Typical Office Building Used for Annual to OSD calculation (3-story shown)

Table 48: Office/Retail Simulation Input Parameters (LOADS)

NAME	DESCRIPTION	DEFAULT	STATUS	COMMENT
LOADS				
b01	Quick or thermal mode (Q or T)	Quick (Q)	Fixed	Q simulates the building as massless, T will include thermal mass
b02	Location	Bastrop (BAS)	User Defined	41 counties linked to 9 TRY packed weather files according to climate zone
b03	Azimuth of building (degree)	0	User Defined	Orientation of the building
b04	Length of building (ft)	122	User Defined	
b05	Width of building (ft)	122	User Defined	
b06	Floor to ceiling height (ft)	9	User Defined	
b07	Door height (ft)	7	Fixed	
b08	Door width (ft)	6	Fixed	
b09	Run year	2000	User Defined	
b10	Floor to floor height (ft)	13	User Defined	This defines the plenum height in conjunction with b06
b11	Number of floor	6	User Defined	
b12	Perimeter depth (ft)	15	Fixed	Used for thermal zoning
b13	Void			
b14	Underground floor mode	No (N)	User Defined	This allows the user to activate/deactivate underground floors
b15	Front wall: Attached to another building?	No (N)	User Defined	These 4 parameters are used to attach buildings to the different orientations of the model for the retail scenario
b16	Right wall: Attached to another building?	No (N)	User Defined	
b17	Back wall: Attached to another building?	No (N)	User Defined	
b18	Left wall: Attached to another building?	No (N)	User Defined	
b19	Building type	Office (O)	User Defined	Allows the user to switch between Office and Retail
b20	Code compliance	Code (C)	User Defined	Allows user to run user defined model or either of ASHRAE 90.1 1989 or 1999
c01	Roof absorptance	0.45	User Defined	c01 and c03 are used to determine "roof color"
c02	Roof roughness	1	Fixed	This is used to calculate the outside film coefficient for heat transfer calculations, DOE-2 allows values from 1 to 6 increasing in smoothness
c03	Roof outside emissivity	0.89	User Defined	c01 and c03 are used to determine "roof color"
c04	Roof insulation R-value (hr-sq.ft-F/Btu)	R-15	User Defined	
c05	Wall absorptance	0.57	User Defined	c05 and c07 are used to define "wall color"
c06	Wall roughness	2	Fixed	This is used to calculate the outside film coefficient for heat transfer calculations, DOE-2 allows values from 1 to 6 increasing in smoothness
c07	Wall outside emissivity	0.9	User Defined	c05 and c07 are used to define "wall color"
c08	Wall insulation R-value (hr-sq.ft-F/Btu)	R-13	User Defined	
c09	Ground reflectance	0.24	Fixed	This defines the fraction of sunlight reflected from the ground
c10	Void			
c11	U-Factor of glazing (Btu/hr-sq.ft-F)	1.22	User Defined	
c12	Solar Heat Gain Coefficient(SHGC)	0.17	User Defined	
c13	Number of pane of glazing	1	Fixed	
c14	Frame absorptance of glazing	0.7	Fixed	
c15	Frame type - A,B,C,D,E	Aluminum w/o thermal break (A)	User Defined	Allows user to select from 5 different frame types
c16	Void			
c17	Floor weight (lb/sq-ft)	70	User Defined	This corresponds to medium construction, user has a choice of light, medium or heavy construction
c18	Slab-on-grade floor insulation R-value (Exterior insulation, horizontal) (hr-sq.ft-F/Btu)	R-0 (A)	User Defined	User can choose from 9 insulation R-values and insulation depths
c19	Slab-on-grade floor R-value (hr-sq.ft-F/Btu)	0.88	Fixed	
c20	Below-grade wall insulation R-value (hr-sq.ft-F/Btu) (Exterior insulation, vertical, basement wall = 8 ft)	R-0 (A)	User Defined	User can choose from 9 insulation R-values
c21	Below-grade wall R-value (concrete wall) (hr-sq.ft-F/Btu)	0.88	Fixed	
c22	Void			
c23	Floor R-value	1.67	Fixed	
c24	Void			
c25	Ceiling R-value (hr-sq.ft-F/Btu)	1.89	Fixed	
c26	Interior wall R-value (hr-sq.ft-F/Btu)	2.01	Fixed	
c27	Percent window-front (%)	50	User Defined	
c28	Percent window-right (%)	50	User Defined	
c29	Percent window-back (%)	50	User Defined	
c30	Percent window-left (%)	50	User Defined	
sp01	void			
sp02	void			
sp03	Area per person (ft^2/person) for office	275	User Defined	
sp04	Lighting load (W/ft2) for office	1.3	User Defined	
sp05	Equipment load (W/ft2) for office	0.75	User Defined	
sp06	Area per person (ft^2/person) for retail	300	User Defined	
sp07	Lighting load (W/ft2) for retail	1.9	User Defined	
sp08	Equipment load (W/ft2) for retail	0.25	User Defined	
s01	Front Shade (S)	0	User Defined	
s02	Back Shade (N)	0	User Defined	
s03	Left Shade (W)	0	User Defined	
s04	Right Shade (E)	0	User Defined	

Table 49: Office/Retail Simulation Input Parameters (SYSTEMS and PLANT)

NAME	DESCRIPTION	DEFAULT	STATUS	COMMENT
SYSTEM				
sy01	Mode of system	Variable air volume (2)	User Defined	User can choose from Packaged single zone, variable air volume or packaged variable volume system
sy02	Cooling Capacity of cooling system (Btu/hr)	0	Fixed	DOE-2 is autosizing the system
sy03	Heating Capacity of heating system (Btu/hr)	0	Fixed	DOE-2 is autosizing the system
sy04	Seasonal Energy Efficiency Ratio (SEER) for PVAVS and PSZ	10	User Defined	
sy05	ANNUAL FUEL UTILIZATION EFFICIENCY (AFUE) for PSZ	0.8	User Defined	
sy06	**Spare parameter for systems other than VAVS**HEATING SEASONAL PERFORMANCE FACTOR (HSPF)	6.8	User Defined	Unused, since heatpump systems are not included in the office/retail scenario
sy07	**Spare parameter for Pilot light	0	Fixed	Unused
sy08	**Spare parameter for Pilot light	0	Fixed	Unused
sy09	**Spare parameter for Pilot light	0	Fixed	Unused
sy10	Void			
sy11	Exterior lighting (kW)	0	Fixed	
sy12	Void			
sy13	Fan control type	Variable frequency drives (1)	User Defined	User can choose from 4 different type of fan control
sy14	Economizer type	None (1)	User Defined	
sy15	Economizer drybulb limit (F) (use when economizer type(sy14) = dry bulb(2))	65	Fixed	This corresponds to the temperature above which the outside air dampers return to the minimum position
sy16	User input for numbers of fans	Autosized (A)	Fixed	Autosized by DOE-2
sy17	Number of Fans	6	Fixed	equal to the number of floors
sy18	Supply fan total pressure (in W.G)	5.5	Fixed	
sy19	Supply fan efficiency	0.54	Fixed	
sy20	Return fan total pressure (in W.G)	2	Fixed	
sy21	Return fan efficiency	0.51	Fixed	
sy22	Supply motor efficiency	0.5	Fixed	
sy23	Return motor efficiency	0.5	Fixed	
sy24	User input for DHW gallon/hr-person	Autosized (A)	Fixed	The size of DHW depends on the gallons per hour per person requirements of ASHRAE 90.1
sy25	Maximum DHW gallon/h-person (maximum hourly, to be used with occupancy schedule)	0.4	Fixed	
PLANT				
p01	Chiller type	Electric Centrifugal (1)	Fixed	
p02	Number of chillers	1	Fixed	
p03	Chillers size (MBtu/h)	-999	Fixed	Chiller is being autosized by DOE-2
p04	Condenser type	water-cooled (W)	Fixed	
p05	COP	5	User Defined	
p06	Switch for a chiller sizing	Autosized (A)	Fixed	Chiller is being autosized by DOE-2
p07	Cooling tower type	Open tower (O)		
p08	Void			
p09	Gpm/hp	38.2	Fixed	Value from ASHRAE 90.1 1999 for axial fan cooling towers
p10	Cooling tower capacity control	Two-speed fan (1)	Fixed	
p11	Boiler type	Gas fired-hotwater boiler (1)	User Defined	User can choose from gas fired or electric boilers
p12	Number of boilers	1	Fixed	
p13	Boiler size (MBtu/h)	-999	Fixed	Boiler is being autosized by DOE-2
p14	Boiler fuel type	Gas (G)	Fixed	Depends on the value of p10
p15	Boilers efficiency (Et,Ec,AFUE) (%)	80	User Defined	
p16	Switch for a boiler sizing	Autosized (A)	Fixed	Boiler is being autosized by DOE-2
p17	Void			
p18	DHW heater type	Gas water heater (1)	User Defined	User can choose from gas fired or electric water heaters
p19	Number of DHW heater	1	Fixed	
p20	DHW size (MBtu/h)	-999	Fixed	Water heater is being autosized by DOE-2
p21	DHW fuel type	Gas (G)	Fixed	Depends on the value of p18
p22	DHW heater Efficiency (Et,Ec,Energy factor) (%)	54	User Defined	
p23	Switch for a DHW heater sizing	Autosized (A)	Fixed	Water heater is being autosized by DOE-2
p24	DHW Storage Capacity (gal)	75	Fixed	



	ASHRAE 90.1-1989	ASHRAE 90.1-1999
DOMHOT WATER	71.5	71.5
VENT FANS	239.2	177.9
PUMPS & MISC	184.1	111.2
HEAT REJECT	233.9	174.3
SPACE COOL	798.1	774.3
SPACE HEAT	272.1	214.3
MISC EQUIPMT	616.2	616.2
AREA LIGHTS	1289.9	1068.1

Figure 75: Comparison of Annual Energy Use ASHRAE Standard 90.1-1989 vs 90.1-1999

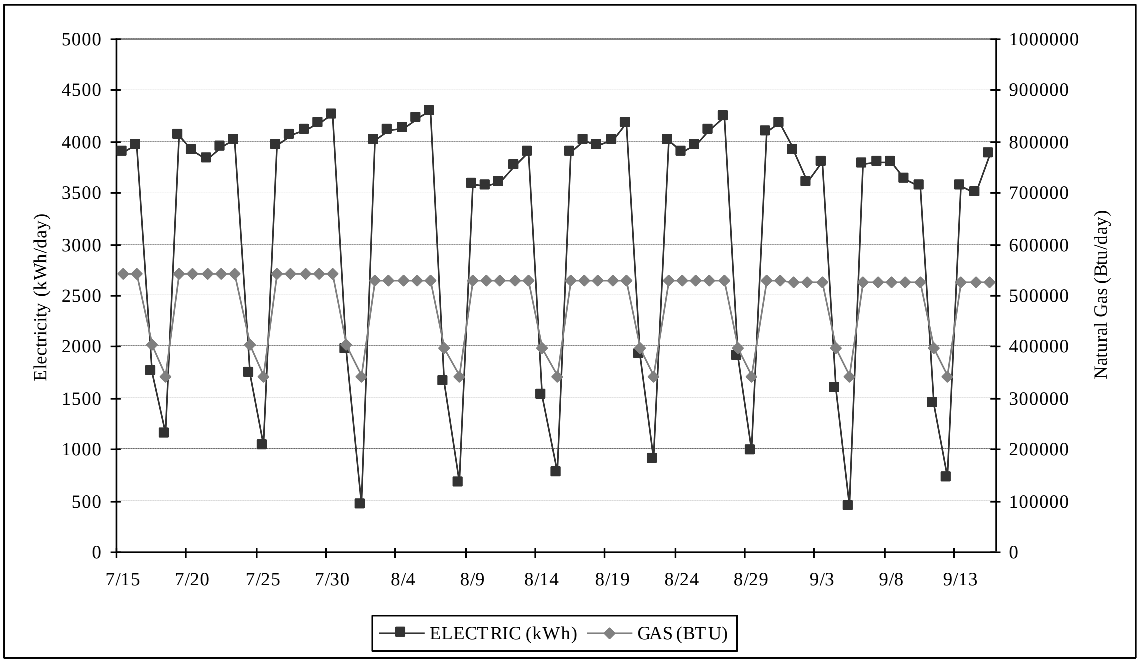


Figure 76: Simulated Electricity and Natural Gas for Building Built to 90.1-1989 Standard for OSD (07/15 – 09/15)

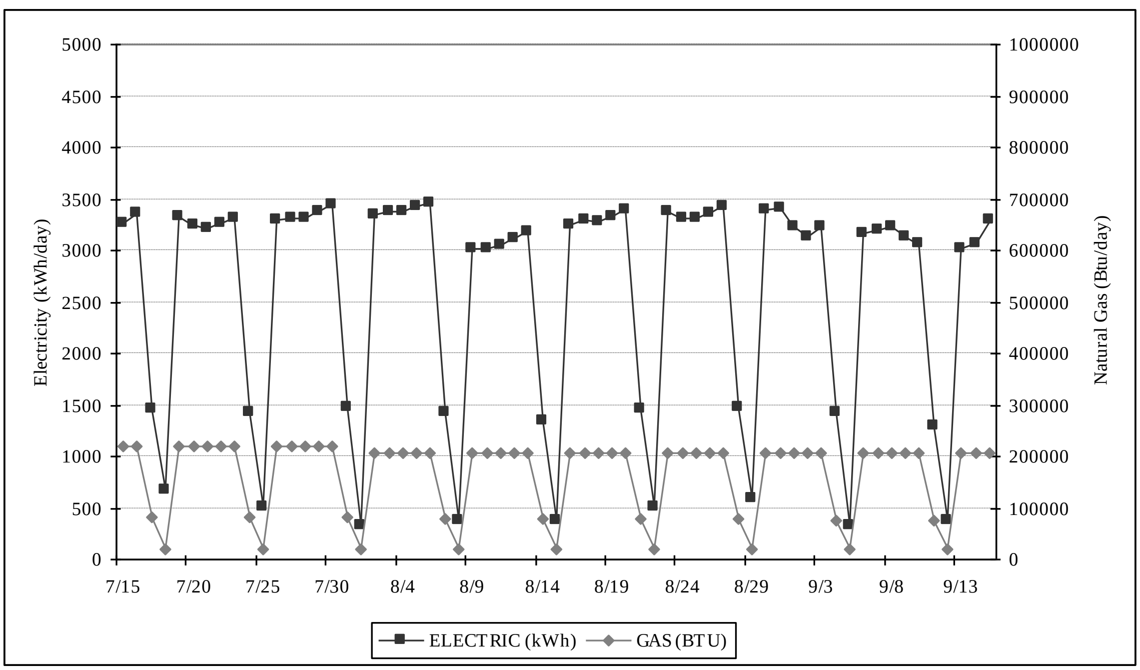


Figure 77: Simulated Electricity and Natural Gas for Building Built to 90.1-1989 Standard for OSD (07/15 – 09/15)

Table 50: Simulated Electricity and Natural Gas for Building Built to 90.1-1989 Standard for Annual and OSD (07/15 – 09/15)

	Electricity (kW)		Gas (Btu)	
	1989	1999	1989	1999
TOTAL (YEAR) (a)	988,405	858,198	331,600,000	278,800,000
OSD (07/15 - 09/15)	199,537	163,841	30,633,205	10,332,355
OSD PER DAY (b)	3167	2601	486241	164006
OSD % (b/a)	0.32%	0.30%	0.15%	0.06%

Table 51: Totalized Annual Electricity Savings from 90.1-1999 by PCA for Commercial Buildings

PCA	Total Electricity Savings by PCA (MWh)
American Electric Power - West (ERCOT)/PCA	4,773.76
Austin Energy/PCA	183.04
Brownsville Public Utils Board/PCA	0.00
Lower Colorado River Authority/PCA	916.80
Reliant Energy HL&P/PCA	10,382.09
San Antonio Public Service Bd /PCA	7,168.26
South Texas Electric Coop Inc/PCA	0.00
Texas Municipal Power Pool/PCA	0.00
Texas-New Mexico Power Co/PCA	451.99
TXU Electric/PCA	31,083.51
El Paso Electric Co/PCA	43.49
Entergy Electric System/PCA	3,060.77
Total	58,063.71

Table 52: 2008 Annual NOx Reductions from IECC / IRC by PCA for Commercial Buildings by County using 2007 eGRID

Area	County	American Electric Power - West (ERCOT) /PCA	NOx Reductions (lbs)	Austin Energy/PCA	NOx Reductions (lbs)	Brownsville Public Utils Board/PCA	NOx Reductions (lbs/year)	Lower Colorado River Auhotrity /PCA	NOx Reductions (lbs)	Reliant Energy HL&P/PCA	NOx Reductions (lbs)	San Antonio Public Service Bd/PCA	NOx Reductions (lbs)	South Texas Electric Coop INC/PCA	NOx Reductions (lbs)	Texas Municipal Power Pool/PCA	NOx Reductions (lbs)	Texas-New Mexico Power Co/PCA	NOx Reductions (lbs)	TXU Electric/PCA	NOx Reductions (lbs)	Total Nox Reductions (lbs)	Total Nox Reductions (Tons)
Houston-Galveston Area	Brazoria	0.00883113	42.157686	0.010890729	1.99341709	0.006522185	0	0.003944232	3.616055598	0.0654443	679.4488362	0.014877434	106.6453347	0.006262315	0	0.0048171	0	0.121274957	54.81451495	0.00816387	253.7617704	1142.437615	0.571218807
	Chambers	0.02176222	103.887577	0.026955801	4.933935492	0.016072371	0	0.009076193	8.32101662	0.1649402	1712.425045	0.037472294	268.6111989	0.015055623	0	0.0095532	0	0.011518588	5.20623418	0.01581859	491.697435	2595.082442	1.297541221
	Fort Bend	0.07043123	336.221647	0.087239726	15.96818378	0.052016606	0	0.029374182	26.93012968	0.5338124	5542.090663	0.121275295	869.3330092	0.048726002	0	0.030918	0	0.037278747	16.84945098	0.05119528	1591.329076	8398.72216	4.19936108
	Galveston	0.03385674	161.623871	0.041710519	7.634609305	0.025004711	0	0.015351589	14.07427363	0.2495874	2591.239814	0.056747051	406.7776961	0.024143087	0	0.0192972	0	0.567751219	256.6152862	0.03283689	1020.685823	4458.651372	2.229325686
	Harris	0.06826733	325.891706	0.084559408	15.47758363	0.050418468	0	0.028471701	26.10273905	0.5174117	5371.817667	0.117549281	842.6239665	0.047228963	0	0.0299681	0	0.03613341	16.33177512	0.04962237	1542.437712	8140.68315	4.070341575
	Liberty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Montgomery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Waller	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beaumont/ Port Arthur Area	Hardin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jefferson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Orange	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dallas/ Fort Worth Area	Collin	0.00203914	9.73433719	0.003716345	0.680232237	0.001505992	0	0.005950953	5.455809054	0.0024815	25.76294165	0.000717051	5.140007103	0.019166247	0	0.0766809	0	0.00086441	0.390700803	0.0040002	124.3402508	171.5042789	0.085752139
	Dallas	0.00453947	21.6703355	0.004683963	0.857343082	0.003352602	0	0.00774211	7.09793468	0.0020856	21.65301308	0.00068106	4.882018436	0.007502816	0	0.026717	0	0.007524933	3.401160209	0.04037045	1254.855565	1314.41737	0.657208685
	Denton	0.00047388	2.26218971	0.000872802	0.159755832	0.000349982	0	0.001396994	1.280758231	0.0005854	6.078128426	0.000168971	1.211224819	0.00454374	0	0.0181872	0	0.000186605	0.084342967	0.00084941	26.40250408	37.47890406	0.018739452
	Tarrant	0.01216249	58.0607918	0.012266309	2.245200562	0.008982543	0	0.020308652	18.61888911	0.0053165	55.19645345	0.001752506	12.56242163	0.017326428	0	0.0602168	0	0.020603444	9.31245693	0.11064724	3439.304924	3595.301138	1.797650569
	Ellis	0.00327981	15.6570352	0.003307809	0.605454786	0.002422289	0	0.005476558	5.020885754	0.0014337	14.88461987	0.000472592	3.387660964	0.004672353	0	0.0162384	0	0.005556053	2.511255213	0.02983782	927.4644153	969.5313271	0.484765664
	Johnson	0.00028606	1.36557388	0.000526868	0.096436824	0.000211267	0	0.000843297	0.77313144	0.0003534	3.669070455	0.000101999	0.731157502	0.002742835	0	0.0109787	0	0.000112645	0.050913746	0.00051274	15.93790734	22.62419119	0.011312096
	Kaufman	0.00632545	30.1961779	0.006379446	1.167680865	0.004671629	0	0.010562096	9.683286608	0.002765	28.70649669	0.000911441	6.533447215	0.009011105	0	0.0313175	0	0.010715411	4.843209977	0.05754527	1788.709043	1869.839342	0.934919671
	Parker	0.00021749	1.03824209	0.000400576	0.073320654	0.000160626	0	0.000641157	0.587809723	0.0002687	2.789584248	7.75498E-05	0.555897052	0.00208537	0	0.0083471	0	8.56434E-05	0.038709582	0.00038984	12.11754743	17.20111078	0.008600555
	Rockwall	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Henderson	0.00081989	3.91397977	0.000826893	0.151352906	0.000605529	0	0.001369042	1.255131958	0.0003584	3.720889699	0.00011814	0.846854867	0.001168005	0	0.0040593	0	0.001388914	0.627769048	0.00745892	231.8495748	242.3655531	0.121182777
	Hood	0.01252711	59.8013879	0.012634039	2.312509104	0.009251829	0	0.020917482	19.17706208	0.0054759	56.85117992	0.001805044	12.93902865	0.017845854	0	0.062022	0	0.021221112	9.591633724	0.11396431	3542.411348	3703.084149	1.851542075
	Hunt	0.00618756	29.5379046	0.006240374	1.142225553	0.004569788	0	0.010331844	9.472192043	0.0027047	28.08069827	0.000891572	6.391018796	0.008814664	0	0.0306347	0	0.010481817	4.737628541	0.05629078	1749.715386	1829.077054	0.914538527
El Paso Area	El Paso	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Antonio Area	Bexar	0.03341375	159.509153	0.051775843	9.476946068	0.024677545	0	0.090663423	83.1198552	0.0011418	11.85470411	1.143571754	8197.421227	0.046873844	0	0.0046695	0	0.000519582	0.234843648	0.00250387	77.82892789	8539.445657	4.269722828
	Comal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Guadalupe	0.00200047	9.54974564	0.076378745	13.98021155	0.001477434	0	0.133848731	122.711968	0.0012371	12.8440296	0.003554796	25.48170878	0.001061766	0	0.0018557	0	0.000401718	0.181570837	0.00183516	57.04337096	241.7926054	0.120896303
	Wilson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Austin Area	Bastrop	0.00450233	21.4930509	0.171901148	31.4644399	0.003325174	0	0.301245466	276.1806093	0.0027843	28.90730202	0.008000571	57.35018328	0.002389654	0	0.0041765	0	0.000904124	0.408650803	0.0041303	128.3841601	544.1883963	0.272094198
	Caldwell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hays	0.0024586	11.7367567	0.093870431	17.18185467	0.001815785	0	0.164501762	150.814542	0.0015205	15.78547286	0.004368889	31.31733847	0.001304924	0	0.0022807	0	0.000493717	0.223152827	0.00225544	70.10701564	297.1661331	0.148583067
	Travis	0.00051001	2.43464992	0.299602906	54.83871232	0.000376663	0	0.033939476	31.11557278	0.0003347	3.474978317	0.000906121	6.495312228	0.000271138	0	0.0004717	0	0.000103327	0.04670224	0.00046734	14.52643784	112.9323656	0.056466183
	Williamson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North East Texas Area	Gregg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Harrison	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rusk	0.00068596	3.27462997	0.00069182	0.126629362	0.000506616	0	0.001145408	1.050105765	0.0002999	3.113081217	9.88414E-05	0.708520863	0.000977211	0	0.0033962	0	0.001162035	0.52522278	0.00624051	193.9768752	202.7750651	0.101387533
	Smith	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Upshur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corpus Christi Area	Nueces	0.22756873	1086.35799	0.004556851	0.834076883	0.168069652	0	0.007612767	6.979353707	0.0016809	17.45113701	0.001626796	11.6612988	0.046792036	0	0.0072464	0	0.001609426	0.727437106	0.00828339	257.4770138	1381.488303	0.690744152
	San Patricio	0.05031335	240.18375	0.001007478	0.184406721	0.037158653	0	0.001683113	1.543070855	0.0003716	3.858285742	0.00035967	2.578205814	0.010345288	0	0.0016021	0	0.000355829	0.160829648	0.00183138	56.92579751	305.4343463	0.152717173
Victoria Area	Victoria	0.02183674	104.243286	0.002215582	0.405535697	0.016127403	0	0.003612695	3.312104222	0.0011996	12.45458012	0.000555389	3.981172038	0.52545648	0	0.0324127	0	0.000476855	0.215531671	0.00225485	70.08863511	194.7008448	0.097350422
Other ERCOT counties	Andrews	2.4742E-05	0.11811271	2.49533E-05	0.004567398	1.82731E-05	0	4.13138E-05	0.03787629	1.082E-05	0.112285803	3.56511E-06	0.025555656	3.5247E-05	0	0.0001225	0	4.19135E-05	0.018944273	0.00022509	6.996556651	7.31389878	0.003656949
	Angelina	0.00031082	1.483779	0.000313473	0.057377472	0.000229554	0	0.000519	0.475817083	0.0001359	1.41057908	4.47864E-05	0.321040358	0.000442787	0	0.0015389	0	0.000526534	0.237985525	0.00282766	87.89353795	91.88011646	0.045940058
	Bosque	0.00059539	2.84225608	0.001096604	0.200720117	0.000439723	0	0.001755208	1.609167809	0.0007356	7.636670502	0.000212298	1.521804772	0.005708837	0	0.0228507	0	0.000234455	0.105970029	0.00106721	33.17258372	47.08917303	0.023544587
	Brazos	0.00193973	9.25977821	0.003572622	0.653925515	0.001432574	0	0.005718288	5.242503352	0.0023964	24.8794877	0.000691644	4.957883556	0.018598805	0	0.0744451	0	0.000763829	0.345239464	0.00347685	108.0728687	153.4116865	0.076705843
	Calhoun	0.08269981	394.788852	0.001655986	0.303108422	0.061077496	0	0.002766524	2.536337994	0.0006108	6.341845346	0.000591187	4.237784247	0.0170045	0	0.0026334	0	0.000584875	0.264354903	0.00301023	93.56865409	502.0409366	0.251020468
	Cameron	0.04837175	230.915001	0.000968599	0.177290421	0.297964476	0	0.001618161	1.48352338	0.0003573	3.709393569	0.00034579	2.478712232	0.009946061	0	0.0015403	0	0.000342098	0.154623193	0.00176071	54.72901732	293.6475616	0.146823781
	Cherokee	0.0035039	16.7267645	0.003533808	0.646821028	0.002587786	0	0.00585073	5.363925695	0.0015316	15.90157572	0.00050488	3.61911475	0.00499158	0	0.0173479	0	0.005935657	2.682830685	0.03187642	990.8311904	1035.772223	0.517886111
	Coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Coleman	0.00129879	6.20009392	2.6007E-05	0.004760268	0.000959212	0	4.34478E-05	0.039832771	9.593E-06	0.099597637	9.2845E-06	0.066553704	0.000267053	0	4.136E-05	0	9.18536E-06	0.00415165	4.7275E-05	1.469480308	7.884470256	0.003942235
	Crockett	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Ector	0.00353575	16.8788026	0.003565928	0.652700316	0.002611307	0	0.005903911	5.412681167	0.0015456	16.0461133	0.00050947	3.65201074	0.005036951	0	0.0175056	0	0.00598961	2.707216309	0.03216616	999.8373633	1045.186888	0.522593444
	Fannin	0.00705631	33.6851369	0.007116546	1.302598293	0.005211403	0	0.011782473	10.80212324	0.0030845	32.02333335	0.001016752	7.288341741	0.010052276	0	0.034936	0	0.011953503	5.402809309	0.06419422	1995.381971	2085.886314	1.042943157
	Fayette	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Freestone	0.00367718	17.5539547	0.003708565	0.678808328	0.00271576	0	0.006140067	5.629188414	0.0016074	16.68795783	0.000529848	3.79809117	0.005238429	0	0.0182058	0	0.006229194	2.815504961	0.03345281	1039.830858	1086.994363	0.543497182
	Frio	0.00858833	40.998629	0.000871383	0.159496196	0.006342868	0	0.001420864	1.302642478	0.0004718	4.898355856	0.000218433	1.565785211	0.206660746	0	0.0127478	0	0.000187546	0.084768078	0.00088683	27.56568851	76.57536536	0.038287683
	Grimes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hardeman	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Haskell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hidalgo	0.18852746	899.984402	0.003775086	0.690984182	0.139235931	0	0.006306735	5.781988581	0.0013925	14.45725194	0.001347706	9.660707756	0.03876448	0	0.0060032	0	0.001333316	0.60263933	0.00686231	213.3047294	1144.482703	0.572241351
	Howard	0.00055511	2.64997521	0.000559851	0.102474073	0.000409976	0	0.000926915	0.849791967	0.0002427	2.519242822	7.99868E-05	0.573366377	0.000790802	0	0.0027484	0	0.00094037	0.425033472	0.00505009	156.9746551	164.094539	0.08204727
	Jack	0.00212145	10.1272816	0.002139557	0.391620189	0.001566784	0	0.003542346	3.2476087	0.0009273	9.627667979	0.000305682	2.191206444	0.00302217	0	0.0105033	0	0.003593766	1.624329785	0.0192997	599.902418	627.1121327	0.313556066
	Jones	0.04071872	194.381315	0.000815354	0.149240824	0.030072592	0	0.001362147	1.248811138	0.0003008	3.12252039	0.000291082	2.086548472	0.008372468	0	0.0012966	0	0.000287974	0.13015984	0.00148214	46.07019161	247.1887874	0.123594394
	Lamar	0.00095084	4.53906952	0.000958954	0.175525016	0.000702236	0	0.001587687	1.455585248	0.0004156	4.315141624	0.000137007	0.98210347	0.001354543	0	0.0047076	0	0.001610734	0.728028125	0.00865017	268.877562	281.073015	0.140536508
	Limestone	0.00071976	3.43594451	0.000891528	0.163183406	0.000531572	0	0.000300183	0.275206645	0.0054552	56.63619872	0.001239347	8.883960954	0.000497945	0	0.000316	0	0.000380962	0.172189326	0.00052318	16.26224384	85.8289274	0.042914464
	Llano	0.00123817	5.91074249	0.047274044	8.652945702	0.000914447	0	0.082844655	75.95164013	0.0007657	7.94971452	0.002200214	15.77171001	0.000657172	0	0.0011486	0	0.000248641	0.11238189	0.00113586	35.30656098	149.6556957	0.074827848
	McLennan	0.02453432	117.120887	0.024743738	4.529044002	0.018119687	0	0.040966843	37.55823397	0.0107245	111.342911	0.003535175	25.34105919	0.034951066	0	0.1214699	0	0.041561501	18.78519358	0.22319886	6937.804845	7252.482173	3.626241087
	Milam	0.0022454	10.7190191	0.002264571	0.414502574	0.001658332	0	0.003749326	3.43736662	0.0009815	10.19021304	0.000323543	2.319238733	0.003198756	0	0.011117	0	0.00380375	1.719239446	0.02042738	634.9547427	663.7543222	0.331877161
	Mitchell	0.01494317	71.3350674	0.015070721	2.758514451	0.011036196	0	0.024951762	22.87567335	0.006532	67.81586333	0.002153177	15.43453275	0.02128772	0	0.073984	0	0.025313952	11.44153776	0.1359442	4225.623534	4417.284723	2.208642362
	Nolan	0.00056465	2.69551999	0.000569473	0.104235282	0.000417022	0	0.000942846	0.864397231	0.0002468	2.562540721	8.13615E-05	0.58322075	0.000804394	0	0.0027956	0	0.000956532	0.432338467	0.00513689	159.6725581	166.9148105	0.083457405
	Palo Pinto	0.003207	15.3094332	0.005906709	1.081152134	0.002368511	0	0.009454195	8.667567717	0.003962	41.13390681	0.001143513	8.196998374	0.030749889	0	0.1230821	0	0.001262858	0.570793423	0.00574838	178.6796965	253.6395481	0.126819774
	Pecos	4.0968E-05	0.19556977	4.13174E-05	0.007562649	3.02565E-05	0	6.84069E-05	0.062715162	1.791E-05	0.185921645	5.90308E-06	0.042314786	5.83617E-05	0	0.0002028	0	6.93999E-05	0.031367728	0.0003727	11.58482456	12.11027631	0.006055138
	Presidio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Robertson	0.00073771	3.521638	0.000835096	0.152854362	0.00054483	0	0.000735917	0.674685745	0.0031497	32.70025349	0.000730875	5.239105149	0.00076086	0	0.0018663	0	0.191632518	86.61510858	0.00339774	105.6136175	234.5172628	0.117258631
	Taylor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Titus	0.00569644	27.193412	0.005745061	1.051564437	0.004207073	0	0.009511781	8.72036199	0.00249	25.85186753	0.000820806	5.883748676	0.008115023	0	0.0282032	0	0.00964985	4.361591875	0.05182285	1610.83638	1683.898927	0.841949463
	Tom Green	0.00148245	7.07684786	2.96846E-05	0.005433416	0.001094854	0	4.95918E-05	0.045465514	1.095E-05	0.113681717	1.05974E-05	0.075965049	0.000304817	0	4.72E-05	0	1.04843E-05	0.004738734	5.396E-05	1.677279201	8.999411492	0.004499706
	Upton	3.1166E-05	0.14877954	3.14322E-05	0.005753279	2.30176E-05	0	5.20405E-05	0.047710506	1.362E-05	0.141439734	4.49076E-06	0.032190937	4.43986E-05	0	0.0001543	0	5.27959E-05	0.023862972	0.00028353	8.813145439	9.212882406	0.004606441
	Ward	0.01855953	88.5986933	0.01871795	3.426095817	0.013707039	0	0.030990277	28.41175936	0.0081128	84.22781532	0.002674262	19.16980645	0.026439509	0	0.0918886	0	0.03144012	14.21047646	0.16884373	5248.256398	5486.301045	2.743150522
	Webb	0.02001433	95.5435495	0.000400768	0.073355806	0.014781473	0	0.000669531	0.613823652	0.0001478	1.53480123	0.000143074	1.025593675	0.004115289	0	0.0006373	0	0.000141547	0.063976998	0.00072851	22.64471578	121.4998167	0.060749908
	Wharton	0.00014434	0.68904275	0.000178787	0.032724726	0.000106601	0	6.01986E-05	0.055189815	0.001094	11.35779747	0.000248538	1.78158548	9.98576E-05	0	6.336E-05	0	7.6398E-05	0.034530769	0.00010492	3.261222967	17.21209398	0.008606047
	Wichita	0.00020763	0.99119064	0.000209406	0.038329167	0.000153346	0	0.000346701	0.317854237	9.076E-05	0.942291802	2.99181E-05	0.214460643	0.00029579	0	0.001028	0	0.000351734	0.158978544	0.00188893	58.71443966	61.3775447	0.030688772
	Wilbarger	0.02861682	136.609757	0.000573025	0.104885352	0.021134796	0	0.000957307	0.877655271	0.0002114	2.194484335	0.00020457	1.466410901	0.005884109	0	0.0009112	0	0.000202386	0.091475377	0.00104164	32.37779139	173.7224595	0.08686123
	Wise	0.00284449	13.5788945	0.002882008	0.527516945	0.002100781	0	0.00476997	4.373089396	0.0012561	13.04069332	0.000413241	2.962221564	0.004181914	0	0.0146143	0	0.004797945	2.168601109	0.02576141	800.7551798	837.4061966	0.418703098
	Young	0.00623586	29.7684674	0.006289085	1.151141373	0.004605458	0	0.010412491	9.546128724	0.0027258	28.29988657	0.000898531	6.440904896	0.008883468	0	0.0308739	0	0.010563634	4.774608843	0.05673017	1763.373064	1843.354202	0.921677101
	Total	**1.12183722**	**5355.37911**	**1.172570094**	**214.6248678**	**1.090766584**	**0**	**1.189130767**	**1090.190217**	**1.62936**	**16916.16997**	**1.542362643**	**11056.05855**	**1.359385821**	**0**	**1.2316428**	**0**	**1.221806085**	**552.2385645**	**1.52878695**	**47520.07008**	**82704.73136**	**41.35236568**

Energy Savings by PCA (MWh)		American Electric Power - West (ERCOT) /PCA		Austin Energy/PCA		Brownsville Public Utils Board/PCA		Lower Colorado River Auhotrity /PCA		Reliant Energy HL&P/PCA		San Antonio Public Service Bd/PCA		South Texas Electric Coop INC/PCA		Texas Municipal Power Pool/PCA		Texas-New Mexico Power Co/PCA		TXU Electric/PCA
		4,773.76		183.04		0.00		916.80		10,382.09		7,168.26		0.00		0.00		451.99		31,083.51

Table 53: 2008 Totalized OSD Electricity Savings from IECC/IRC by PCA for Commercial Buildings (w/7% T&D)

PCA	Total Electricity Savings by PCA (MWh)
American Electric Power - West (ERCOT)/PCA	29.06
Austin Energy/PCA	1.03
Brownsville Public Utils Board/PCA	0.00
Lower Colorado River Authority/PCA	4.92
Reliant Energy HL&P/PCA	74.08
San Antonio Public Service Bd /PCA	42.14
South Texas Electric Coop Inc/PCA	0.00
Texas Municipal Power Pool/PCA	0.00
Texas-New Mexico Power Co/PCA	2.47
TXU Electric/PCA	197.47
El Paso Electric Co/PCA	0.22
Entergy Electric System/PCA	23.16
Total	374.56

Table 54: 2008 OSD NOx Reductions from Electricity Savings from the IECC/IRC by PCA for Commercial Buildings by County using 2007 eGRID (w/7% T&D)

Area	County	American Electric Power - West (ERCOT) /PCA	NOx Reductions (lbs)	Austin Energy/PCA	NOx Reductions (lbs)	Brownsville Public Utils Board/PCA	NOx Reductions (lbs/year)	Lower Colorado River Auhotrity /PCA	NOx Reductions (lbs)	Reliant Energy HL&P/PCA	NOx Reductions (lbs)	San Antonio Public Service Bd/PCA	NOx Reductions (lbs)	South Texas Electric Coop INC/PCA	NOx Reductions (lbs)	Texas Municipal Power Pool/PCA	NOx Reductions (lbs)	Texas-New Mexico Power Co/PCA	NOx Reductions (lbs)	TXU Electric/PCA	NOx Reductions (lbs)	Total Nox Reductions (lbs)	Total Nox Reductions (Tons)
Houston-Galveston Area	Brazoria	0.00957217	0.27816581	0.011806715	0.012157533	0.007069474	0	0.004263638	0.020992488	0.0710018	5.259801803	0.016140391	0.680229075	0.006781035	0	0.0051797	0	0.126288	0.311448413	0.008772	1.732173298	8.294968416	0.004147484
	Chambers	0.0218814	0.63587006	0.027103415	0.027908751	0.016160386	0	0.009125896	0.044932349	0.1658435	12.28566246	0.037677498	1.587900212	0.01513807	0	0.0096055	0	0.011582	0.028562413	0.015905	3.140864708	17.75170095	0.00887585
	Fort Bend	0.05569551	1.61850321	0.068987309	0.071037161	0.041133619	0	0.023228475	0.114367944	0.4221274	31.27114391	0.095901908	4.041740216	0.038531479	0	0.0244493	0	0.029479	0.072700949	0.040484	7.994557283	45.18405067	0.022592025
	Galveston	0.02755599	0.80077278	0.033893644	0.034900741	0.020351324	0	0.012791501	0.062980361	0.2014466	14.92314082	0.045812515	1.930746628	0.019823685	0	0.0167751	0	0.594657	1.466526936	0.028709	5.66936644	24.88843471	0.012444217
	Harris	0.07736057	2.2480866	0.09582276	0.098669986	0.057134232	0	0.032264145	0.158856061	0.5863312	43.43534163	0.1332069	5.613941324	0.053519883	0	0.0339599	0	0.040946	0.100980974	0.056232	11.10436918	62.76024576	0.031380123
	Liberty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Montgomery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Waller	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beaumont/ Port Arthur Area	Hardin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jefferson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Orange	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dallas/ Fort Worth Area	Collin	0.00176365	0.05125137	0.003151138	0.003244769	0.001302533	0	0.005050143	0.024864932	0.0020858	0.154512186	0.00060408	0.025458663	0.015958397	0	0.0637888	0	0.000846	0.002086719	0.004013	0.792503593	1.053922234	0.000526961
	Dallas	0.00504555	0.14662301	0.005305276	0.005462914	0.003726366	0	0.008757286	0.043117461	0.0024131	0.178761156	0.000782263	0.032968113	0.009310387	0	0.033672	0	0.008209	0.020245272	0.044002	8.689281071	9.116458995	0.004558229
	Denton	0.00063576	0.01847503	0.001170951	0.001205744	0.000469535	0	0.001874207	0.009227864	0.0007854	0.058184615	0.000226691	0.009553778	0.006095882	0	0.0243999	0	0.00025	0.000617407	0.00114	0.225033768	0.322298201	0.000161149
	Tarrant	0.01557224	0.45252704	0.015705165	0.01617182	0.011500796	0	0.026002176	0.12802457	0.006807	0.504260566	0.002243821	0.094564751	0.022183886	0	0.0770985	0	0.02638	0.06505674	0.141667	27.9755603	29.23616579	0.014618083
	Ellis	0.00350282	0.10179153	0.003532723	0.003637693	0.002586991	0	0.005848935	0.028797873	0.0015312	0.113428476	0.000504725	0.021271415	0.004990048	0	0.0173426	0	0.005934	0.014633877	0.031867	6.292828323	6.576389183	0.003288195
	Johnson	0.00033718	0.00979828	0.000621017	0.00063947	0.00024902	0	0.000993991	0.004894025	0.0004166	0.030858382	0.000120226	0.005066874	0.003232969	0	0.0129406	0	0.000133	0.000327443	0.000604	0.119347322	0.170931801	8.54659E-05
	Kaufman	0.00649275	0.18867841	0.006548174	0.006742743	0.004795187	0	0.01084145	0.053379069	0.0028381	0.21024839	0.000935547	0.0394282	0.009249437	0	0.0321458	0	0.010999	0.027125014	0.059067	11.66424047	12.1898423	0.006094921
	Parker	0.00047595	0.01383108	0.000876616	0.000902664	0.000351511	0	0.0014031	0.006908317	0.000588	0.043559135	0.000169709	0.007152308	0.0045636	0	0.0182667	0	0.000187	0.000462213	0.000853	0.168468525	0.241284244	0.000120642
	Rockwall	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Henderson	0.00095027	0.02761473	0.000958382	0.000986859	0.000701818	0	0.001586741	0.007812493	0.0004154	0.030771688	0.000136926	0.005770662	0.001353736	0	0.0047048	0	0.00161	0.003969983	0.008645	1.707163485	1.784089904	0.000892045
	Hood	0.01232788	0.35824639	0.012433111	0.012802542	0.00910469	0	0.020584816	0.101351602	0.0053888	0.399201621	0.001776337	0.074862887	0.017562038	0	0.0610356	0	0.020884	0.051502651	0.112152	22.14706	23.14502769	0.011572514
	Hunt	0.00635121	0.18456524	0.006405424	0.006595752	0.004690653	0	0.010605108	0.052215412	0.0027763	0.205664998	0.000915153	0.03856867	0.0090478	0	0.031445	0	0.010759	0.026533692	0.05778	11.40996133	11.9241051	0.005962053
El Paso Area	El Paso	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Antonio Area	Bexar	0.03112811	0.9045783	0.048234164	0.049667368	0.0229895	0	0.084461674	0.415856326	0.0010637	0.078801326	1.065346769	44.89853197	0.043667482	0	0.0043501	0	0.000484	0.001193729	0.002333	0.460625665	46.80925468	0.023404627
	Comal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Guadalupe	0.00200761	0.05834086	0.076651484	0.078929065	0.00148271	0	0.134326688	0.661372196	0.0012416	0.091973896	0.00356749	0.150350167	0.001065557	0	0.0018623	0	0.000403	0.000994245	0.001842	0.363691159	1.40565159	0.000702826
	Wilson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Austin Area	Bastrop	0.00446951	0.12988342	0.170648096	0.175718642	0.003300936	0	0.299049574	1.472403407	0.002764	0.204760161	0.007942252	0.334722414	0.002372235	0	0.0041461	0	0.000898	0.002213474	0.0041	0.809680397	3.129381915	0.001564691
	Caldwell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hays	0.00246935	0.07175902	0.094281013	0.097082428	0.001823727	0	0.165221279	0.813485108	0.0015271	0.113127517	0.004387998	0.184930093	0.001310631	0	0.0022907	0	0.000496	0.001222918	0.002265	0.447338645	1.728945731	0.000864473
	Travis	0.00050761	0.01475105	0.298194277	0.307054662	0.000374892	0	0.033779905	0.166319069	0.0003331	0.024678605	0.000901861	0.038008491	0.000269863	0	0.0004695	0	0.000103	0.000253624	0.000465	0.0918527	0.642918196	0.000321459
	Williamson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North East Texas Area	Gregg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Harrison	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rusk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Smith	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Upshur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corpus Christi Area	Nueces	0.22352453	6.49558905	0.00447587	0.004608863	0.165082827	0	0.007477478	0.036816183	0.001651	0.122307068	0.001597886	0.067342128	0.045960479	0	0.0071176	0	0.001581	0.003898589	0.008136	1.606684378	8.337246261	0.004168623
	San Patricio	0.05533089	1.60790722	0.001107949	0.00114087	0.040864326	0	0.001850962	0.009113416	0.0004087	0.030275687	0.000395538	0.016669757	0.01137698	0	0.0017619	0	0.000391	0.00096505	0.002014	0.397715956	2.063787957	0.001031894
Victoria Area	Victoria	0.02060475	0.59877099	0.002090584	0.002152702	0.015217528	0	0.003408874	0.016783968	0.0011319	0.083854042	0.000524055	0.022086044	0.495811308	0	0.0305841	0	0.00045	0.001109661	0.002128	0.420152343	1.144909752	0.000572455
Other ERCOT counties	Andrews	2.5653E-05	0.00074546	2.58716E-05	2.66404E-05	1.89456E-05	0	4.28342E-05	0.000210899	1.121E-05	0.000830685	3.69632E-06	0.00015578	3.65442E-05	0	0.000127	0	4.35E-05	0.00010717	0.000233	0.046085051	0.048161687	2.40808E-05
	Angelina	0.00032149	0.00934246	0.000324234	0.000333868	0.000237435	0	0.000536817	0.002643077	0.0001405	0.010410498	4.63239E-05	0.001952297	0.000457988	0	0.0015917	0	0.000545	0.001343101	0.002925	0.577557604	0.603582902	0.000301791
	Bosque	0.00093945	0.02730035	0.001730301	0.001781715	0.000693828	0	0.002769496	0.013635918	0.0011606	0.085978798	0.000334979	0.014117518	0.009007821	0	0.0360555	0	0.00037	0.000912335	0.001684	0.332530047	0.476256684	0.000238128
	Brazos	0.00191393	0.05561841	0.003525105	0.003629848	0.00141352	0	0.005642234	0.027780157	0.0023645	0.175162719	0.000682445	0.028761309	0.018351436	0	0.073455	0	0.000754	0.001858681	0.003431	0.677456172	0.970267297	0.000485134
	Calhoun	0.08852525	2.57253032	0.001772635	0.001825307	0.065379841	0	0.0029614	0.014580779	0.0006539	0.048438816	0.000632831	0.026670355	0.01820231	0	0.0028189	0	0.000626	0.001544008	0.003222	0.636315543	3.301905128	0.001650953
	Cameron	0.05467229	1.58876844	0.001094762	0.001127291	0.285623104	0	0.001828931	0.00900494	0.0004038	0.029915318	0.00039083	0.016471339	0.011241561	0	0.0017409	0	0.000387	0.000953563	0.00199	0.392981979	2.039222874	0.001019611
	Cherokee	0.003513	0.10208711	0.003542982	0.003648256	0.002594504	0	0.005865919	0.028881497	0.0015356	0.11375785	0.000506191	0.021333183	0.005004538	0	0.0173929	0	0.005951	0.01467637	0.031959	6.31110147	6.595485735	0.003297743
	Coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Coleman	0.0013551	0.03937898	2.71346E-05	2.79409E-05	0.001000801	0	4.53316E-05	0.000223195	1.001E-05	0.000741477	9.68705E-06	0.000408256	0.000278632	0	4.315E-05	0	9.58E-06	2.36349E-05	4.93E-05	0.009740394	0.050543881	2.52719E-05
	Crockett	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Ector	0.00362926	0.10546585	0.003660242	0.003769001	0.002680373	0	0.006060061	0.029837378	0.0015864	0.117522856	0.000522944	0.02203924	0.005170172	0	0.0179686	0	0.006148	0.015162109	0.033017	6.519977905	6.813774343	0.003406887
	Fannin	0.00762852	0.22168353	0.007693632	0.007922236	0.005633999	0	0.012737922	0.062716559	0.0033346	0.247026702	0.001099201	0.046325293	0.010867422	0	0.0377689	0	0.012923	0.031869936	0.0694	13.70464171	14.32218597	0.007161093
	Fayette	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Freestone	0.00377443	0.10968449	0.003806652	0.003919761	0.002787588	0	0.006302464	0.031030873	0.0016499	0.12222377	0.000543862	0.02292081	0.005376978	0	0.0186873	0	0.006394	0.015768594	0.034338	6.780777021	7.086325316	0.003543163
	Frio	0.01476384	0.42903492	0.001497957	0.001542467	0.010903753	0	0.002442547	0.012026147	0.0008111	0.060083591	0.000375499	0.015825222	0.355261637	0	0.0219143	0	0.000322	0.000795101	0.001525	0.30105003	0.820357475	0.000410179
	Grimes	0.00055442	0.01611148	0.001021149	0.001051491	0.000409467	0	0.001634436	0.008047327	0.0006849	0.050740957	0.00019769	0.008331547	0.005316025	0	0.0212784	0	0.000218	0.000538421	0.000994	0.196244809	0.281066035	0.000140533
	Hardeman	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Haskell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hidalgo	0.239737	6.96672099	0.004800509	0.004943149	0.177056459	0	0.008019827	0.0394865	0.0017708	0.131178129	0.001713782	0.072226524	0.049294041	0	0.0076338	0	0.001695	0.004181358	0.008726	1.723218895	8.941955549	0.004470978
	Howard	0.00058508	0.01700236	0.000590075	0.000607608	0.000432108	0	0.000976955	0.004810144	0.0002558	0.018946096	8.43049E-05	0.00355299	0.000833494	0	0.0028967	0	0.000991	0.002444314	0.005323	1.051098725	1.098462239	0.000549231
	Jack	0.00217756	0.06327951	0.002196145	0.002261401	0.001608224	0	0.003636037	0.017902427	0.0009519	0.070513714	0.000313767	0.013223544	0.003102103	0	0.0107811	0	0.003689	0.009097266	0.01981	3.911986743	4.088264606	0.002044132
	Jones	0.04250012	1.2350472	0.000851025	0.000876312	0.031388236	0	0.00142174	0.007000092	0.0003139	0.023255012	0.000303816	0.012804182	0.008738755	0	0.0013533	0	0.000301	0.000741263	0.001547	0.305489005	1.585213062	0.000792607
	Lamar	0.00107998	0.03138407	0.001089199	0.001121563	0.000797614	0	0.001803327	0.008878877	0.0004721	0.03497194	0.000155616	0.006558341	0.001538517	0	0.005347	0	0.00183	0.004511875	0.009825	1.94018666	2.027613326	0.001013807
	Limestone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Llano	0.00124346	0.03613476	0.047475864	0.048886536	0.000918351	0	0.083198331	0.409636117	0.000769	0.056966153	0.002209607	0.093122842	0.000659977	0	0.0011535	0	0.00025	0.000615809	0.001141	0.225260504	0.870622718	0.000435311
	McLennan	0.02303137	0.6692881	0.023227961	0.023918144	0.017009692	0	0.038457253	0.189348509	0.0100675	0.745802046	0.003318614	0.139861392	0.032809997	0	0.1140288	0	0.039015	0.096219005	0.209526	41.37589079	43.24032799	0.021620164
	Milam	0.00165249	0.04802117	0.001666598	0.001716118	0.001220439	0	0.002759294	0.013585685	0.0007223	0.053511019	0.000238109	0.010035003	0.002354105	0	0.0081815	0	0.002799	0.006903678	0.015033	2.96870474	3.102477414	0.001551239
	Mitchell	0.01696145	0.49289727	0.017106233	0.017614519	0.012526789	0	0.028321847	0.139445724	0.0074142	0.549245973	0.002443993	0.103000932	0.024162925	0	0.0839765	0	0.028733	0.070860493	0.154305	30.47127789	31.8443428	0.015922171
	Nolan	0.00060327	0.01753102	0.000608422	0.000626501	0.000445544	0	0.001007331	0.004959706	0.0002637	0.01953519	8.69262E-05	0.003663464	0.00085941	0	0.0029868	0	0.001022	0.002520316	0.005488	1.083780729	1.132616924	0.000566308
	Palo Pinto	0.00307488	0.08935553	0.00566337	0.005831648	0.002270935	0	0.00906471	0.044631095	0.0037988	0.281413244	0.001096403	0.046207397	0.029483083	0	0.1180115	0	0.001211	0.002986123	0.005512	1.088388783	1.558813821	0.000779407
	Pecos	4.2262E-05	0.00122812	4.26225E-05	4.3889E-05	3.12122E-05	0	7.05678E-05	0.000347448	1.847E-05	0.001368522	6.08954E-06	0.000256641	6.02052E-05	0	0.0002092	0	7.16E-05	0.000176559	0.000384	0.075923359	0.079344538	3.96723E-05
	Presidio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Robertson	0.00035926	0.01043997	0.000406685	0.000418769	0.000265328	0	0.000358385	0.00176455	0.0015339	0.113628648	0.00035593	0.015000506	0.000370532	0	0.0009089	0	0.093323	0.230151898	0.001655	0.326754003	0.698158342	0.000349079
	Taylor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Titus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tom Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Upton	3.2238E-05	0.00093683	3.25131E-05	3.34792E-05	2.38092E-05	0	5.38302E-05	0.000265039	1.409E-05	0.00104393	4.6452E-06	0.00019577	4.59255E-05	0	0.0001596	0	5.46E-05	0.000134682	0.000293	0.05791553	0.060525259	3.02626E-05
	Ward	0.01980763	0.57560662	0.0199767	0.020570277	0.014628815	0	0.033074321	0.162845052	0.0086584	0.64141077	0.002854101	0.120284737	0.028217522	0	0.098068	0	0.033554	0.082751055	0.180198	35.58443168	37.18790019	0.01859395
	Webb	0.01418005	0.41206999	0.000283942	0.000292379	0.010472596	0	0.000474359	0.002335561	0.0001047	0.007758969	0.000101367	0.004272079	0.002915661	0	0.0004515	0	0.0001	0.00024732	0.000516	0.101925539	0.528901838	0.000264451
	Wharton	0.00015439	0.00448655	0.000191235	0.000196918	0.000114024	0	6.43902E-05	0.000317032	0.0011702	0.086684748	0.000265844	0.011203851	0.000106811	0	6.777E-05	0	8.17E-05	0.00020153	0.000112	0.022161203	0.125251831	6.26259E-05
	Wichita	0.00021984	0.0063886	0.000221719	0.000228308	0.000162364	0	0.000367089	0.001807402	9.61E-05	0.007118957	3.16774E-05	0.001335029	0.000313184	0	0.0010884	0	0.000372	0.000918446	0.002	0.394948206	0.41274495	0.000206372
	Wilbarger	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Wise	0.00291847	0.08481033	0.002955932	0.003043763	0.002155421	0	0.004892446	0.024088495	0.0012878	0.095396583	0.000423725	0.017857705	0.004280539	0	0.0149528	0	0.004924	0.012144313	0.026441	5.221313004	5.458654189	0.002729327
	Young	0.00549666	0.15973212	0.005543579	0.005708298	0.004059529	0	0.009178198	0.045189864	0.0024027	0.177992915	0.000792019	0.033379282	0.007830425	0	0.0272141	0	0.009311	0.022963602	0.050005	9.874758944	10.31972502	0.005159863
	Total	**1.14303735**	**33.2164934**	**1.154658244**	**1.188967139**	**1.089429227**	**0**	**1.180868675**	**5.814136562**	**1.5393506**	**114.0348967**	**1.443965054**	**60.85521919**	**1.48172714**	**0**	**1.2697054**	**0**	**1.151969**	**2.840955914**	**1.517783**	**299.722395**	**517.673064**	**0.258836532**

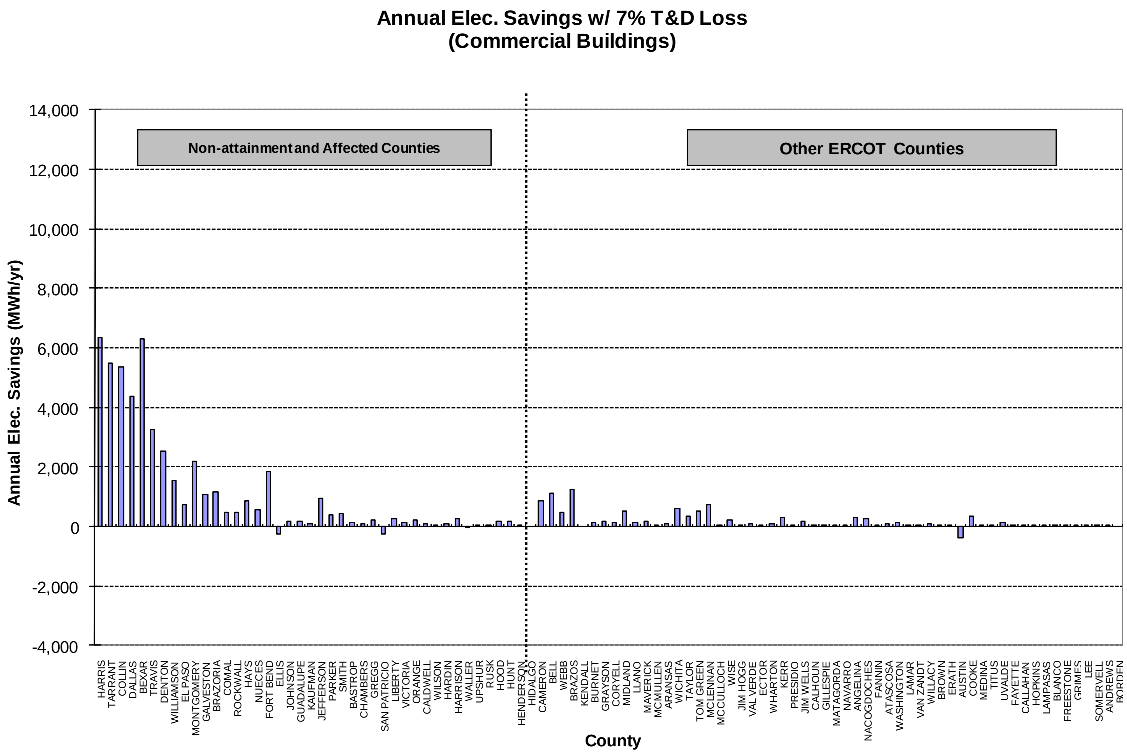
Energy Savings by PCA (MWh)		American Electric Power - West (ERCOT)		Austin Energy		Brownsville Public Utils Board		Lower Colorado River Auhotrity		Reliant Energy HL&P		San Antonio Public Service Bd		South Texas Electric Coop INC		Texas Municipal Power Pool		Texas-New Mexico Power Co		TXU Electric	
		29.06		1.03		0.00		4.92		74.08		42.14		0.00		0.00		2.47		197.47	

Table 55: 2008 Annual and OSD NOx Reductions from IECC/IRC by PCA for Commercial Buildings by County using 2007 eGRID (w/7% T&D) (1)

	Electricity Savings and Resultant NOx Reductions (Office)				Total Natural Gas Savings and Resultant NOx Reductions (Office)				Total Nox Reductions	
County	Total Annual Electricity Savings per County w/ 7% T&D Loss (MWh/County)	Annual Nox Reductions (Tons)	OSD Electricity Savings per County w/ 7% T&D Loss (MWh/County)	OSD Nox Reductions (Tons)	Total Annual N.G. Savings (Therm/County)	Annual Nox Reductions (Tons)	Total OSD N.G. Savings (Therm/County)	OSD Nox Reductions (Tons)	Annual Nox Reductions (Tons)	OSD Nox Reductions (Tons)
HARRIS	6,364.77	4.07	56.08	0.03	(126,152.41)	(0.58)	2,040.2133	0.0094	3.49	0.0408
TARRANT	5,479.22	1.80	37.25	0.01	(59,566.62)	(0.27)	1,084.5248	0.0050	1.52	0.0196
COLLIN	5,364.78	0.09	29.46	0.00	(34,863.73)	(0.16)	617.2667	0.0028	(0.07)	0.0034
DALLAS	4,373.06	0.66	36.35	0.00	(82,112.16)	(0.38)	1,234.0985	0.0057	0.28	0.0102
BEXAR	6,304.29	4.27	36.95	0.02	(39,419.45)	(0.18)	957.9633	0.0044	4.09	0.0278
TRAVIS	3,273.24	0.06	18.98	0.00	(15,976.54)	(0.07)	447.8557	0.0021	(0.02)	0.0024
DENTON	2,548.74	0.02	16.60	0.00	(29,244.88)	(0.13)	506.8846	0.0023	(0.12)	0.0025
WILLIAMSON	1,549.60	0.00	8.35	0.00	(10,646.90)	(0.05)	183.4041	0.0008	(0.05)	0.0008
EL PASO	730.98	0.00	9.20	0.00	(27,871.28)	(0.13)	428.3613	0.0020	(0.13)	0.0020
MONTGOMERY	2,179.97	0.00	11.97	0.00	(14,838.59)	(0.07)	257.5907	0.0012	(0.07)	0.0012
GALVESTON	1,067.06	2.23	5.70	0.01	(6,018.20)	(0.03)	115.5423	0.0005	2.20	0.0130
BRAZORIA	1,149.37	0.57	6.26	0.00	(9,686.20)	(0.04)	146.3996	0.0007	0.53	0.0048
COMAL	465.37	0.00	2.48	0.00	(2,922.68)	(0.01)	55.6054	0.0003	(0.01)	0.0003
ROCKWALL	470.71	0.00	2.50	0.00	(3,850.90)	(0.02)	55.0408	0.0003	(0.02)	0.0003
HAYS	843.73	0.15	4.53	0.00	(6,128.38)	(0.03)	99.6230	0.0005	0.12	0.0013
NUECES	563.49	0.69	3.60	0.00	(3,802.42)	(0.02)	111.9558	0.0005	0.67	0.0047
FORT BEND	1,842.29	4.20	11.59	0.02	(20,053.04)	(0.09)	306.0918	0.0014	4.11	0.0240
ELLIS	(242.80)	0.48	0.23	0.00	(5,790.88)	(0.03)	70.3569	0.0003	0.46	0.0036
JOHNSON	191.18	0.01	1.23	0.00	(3,065.49)	(0.01)	39.1093	0.0002	(0.00)	0.0003
GUADALUPE	199.95	0.12	1.69	0.00	(4,173.12)	(0.02)	60.9884	0.0003	0.10	0.0010
KAUFMAN	105.93	0.93	0.88	0.01	(2,978.21)	(0.01)	38.3237	0.0002	0.92	0.0063
JEFFERSON	945.30	0.00	5.26	0.00	(1,832.05)	(0.01)	122.7066	0.0006	(0.01)	0.0006
PARKER	391.05	0.01	2.00	0.00	(2,089.06)	(0.01)	42.7254	0.0002	(0.00)	0.0003
SMITH	446.30	0.00	3.07	0.00	(4,091.05)	(0.02)	94.8573	0.0004	(0.02)	0.0004
BASTROP	140.26	0.27	0.78	0.00	(258.29)	(0.00)	22.2030	0.0001	0.27	0.0017
CHAMBERS	89.87	1.30	0.44	0.01	(707.16)	(0.00)	9.3559	0.0000	1.29	0.0089
GREGG	237.31	0.00	1.50	0.00	(983.54)	(0.00)	45.6052	0.0002	(0.00)	0.0002
SAN PATRICIO	(269.26)	0.15	(0.18)	0.00	(3,815.23)	(0.02)	42.3554	0.0002	0.14	0.0012
LIBERTY	281.73	0.00	1.38	0.00	(2,444.75)	(0.01)	35.4456	0.0002	(0.01)	0.0002
VICTORIA	146.48	0.10	0.80	0.00	(719.04)	(0.00)	17.0053	0.0001	0.09	0.0007
ORANGE	207.00	0.00	1.10	0.00	(1,694.57)	(0.01)	30.1311	0.0001	(0.01)	0.0001
CALDWELL	91.24	0.00	0.50	0.00	(955.45)	(0.00)	14.7111	0.0001	(0.00)	0.0001
WILSON	52.55	0.00	0.27	0.00	(229.66)	(0.00)	7.3226	0.0000	(0.00)	0.0000
HARDIN	96.97	0.00	0.47	0.00	(757.38)	(0.00)	10.4174	0.0000	(0.00)	0.0000
HARRISON	250.89	0.00	1.34	0.00	(1,463.49)	(0.01)	34.4608	0.0002	(0.01)	0.0002
WALLER	(9.12)	0.00	0.02	0.00	(349.04)	(0.00)	4.1497	0.0000	(0.00)	0.0000
UPSHUR	71.32	0.00	0.36	0.00	(628.50)	(0.00)	9.7221	0.0000	(0.00)	0.0000
RUSK	36.41	0.10	0.19	0.00	(234.82)	(0.00)	3.0692	0.0000	0.10	0.0000
HOOD	194.12	1.85	0.97	0.01	(1,516.58)	(0.01)	24.7175	0.0001	1.84	0.0117
HUNT	180.05	0.91	0.95	0.01	(1,482.58)	(0.01)	25.1534	0.0001	0.91	0.0061
HENDERSON	23.79	0.12	0.20	0.00	(596.83)	(0.00)	8.0105	0.0000	0.12	0.0009
HIDALGO	0.00	0.57	0.00	0.00	0.00	0.00	0.0000	0.0000	0.57	0.0045
CAMERON	869.30	0.15	5.95	0.00	(9,058.64)	(0.04)	188.0215	0.0009	0.11	0.0019
BELL	1,142.84		6.63		(3,500.49)	(0.02)	166.2135	0.0008	(0.02)	0.0008
WEBB	475.24	0.06	2.99	0.00	(4,793.57)	(0.02)	95.4114	0.0004	0.04	0.0007
BRAZOS	1,257.66	0.08	6.75	0.00	(6,038.87)	(0.03)	164.5281	0.0008	0.05	0.0012
KENDALL	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
BURNET	118.40		0.60		(817.79)	(0.00)	14.7725	0.0001	(0.00)	0.0001
GRAYSON	171.83		1.31		(2,921.80)	(0.01)	48.2176	0.0002	(0.01)	0.0002
CORYELL	138.91		0.74		(797.22)	(0.00)	16.9898	0.0001	(0.00)	0.0001
MIDLAND	542.85		2.86		(3,007.75)	(0.01)	61.7977	0.0003	(0.01)	0.0003
LLANO	154.63	0.07	0.84	0.00	258.16	0.00	17.7269	0.0001	0.08	0.0005
MAVERICK	166.13		0.86		(594.67)	(0.00)	19.2372	0.0001	(0.00)	0.0001
MCMULLEN	4.75		0.02		(47.70)	(0.00)	0.7804	0.0000	(0.00)	0.0000
ARANSAS	94.26		0.48		(322.84)	(0.00)	6.3511	0.0000	(0.00)	0.0000
WICHITA	604.08	0.03	3.36	0.00	(860.96)	(0.00)	74.3694	0.0003	0.03	0.0005
TAYLOR	348.40	0.00	2.05	0.00	(2,039.52)	(0.01)	46.9692	0.0002	(0.01)	0.0002
TOM GREEN	531.44	0.00	2.94	0.00	(1,993.03)	(0.01)	69.8041	0.0003	(0.00)	0.0003
MCLENNAN	716.71	3.63	4.25	0.02	(5,732.60)	(0.03)	119.1497	0.0005	3.60	0.0222
MCCULLOCH	12.71		0.06		(128.25)	(0.00)	1.8157	0.0000	(0.00)	0.0000
WISE	230.64	0.42	1.20	0.00	(783.05)	(0.00)	29.7724	0.0001	0.42	0.0029
JIM HOGG	13.20		0.07		(103.68)	(0.00)	1.8182	0.0000	(0.00)	0.0000
VAL VERDE	83.12		0.44		(556.17)	(0.00)	11.0468	0.0001	(0.00)	0.0001
ECTOR	36.41	0.52	1.37	0.00	(2,976.83)	(0.01)	75.5946	0.0003	0.51	0.0038
WHARTON	104.22	0.01	0.58	0.00	(749.43)	(0.00)	11.7001	0.0001	0.01	0.0001
KERR	316.10		1.64		(1,117.78)	(0.01)	37.2239	0.0002	(0.01)	0.0002
PRESIDIO	10.07	0.00	0.05	0.00	(111.05)	(0.00)	1.6685	0.0000	(0.00)	0.0000
JIM WELLS	159.19		0.83		(654.11)	(0.00)	16.8164	0.0001	(0.00)	0.0001
CALHOUN	65.08	0.25	0.32	0.00	(339.08)	(0.00)	4.5336	0.0000	0.25	0.0017
GILLESPIE	57.61		0.32		(330.36)	(0.00)	6.8808	0.0000	(0.00)	0.0000
MATAGORDA	54.56		0.31		(429.55)	(0.00)	8.8432	0.0000	(0.00)	0.0000
NAVARRO	42.57		0.38		(831.30)	(0.00)	14.2773	0.0001	(0.00)	0.0001
ANGELINA	297.83	0.05	1.55	0.00	(1,563.52)	(0.01)	32.6956	0.0002	0.04	0.0005
NACOGDOCHES	266.10		1.40		(1,955.59)	(0.01)	37.2371	0.0002	(0.01)	0.0002
FANNIN	42.40	1.04	0.23	0.01	(401.49)	(0.00)	7.0140	0.0000	1.04	0.0072
ATASCOSA	92.07		0.48		(531.79)	(0.00)	10.8745	0.0001	(0.00)	0.0001
WASHINGTON	156.73		0.91		(1,510.26)	(0.01)	24.3865	0.0001	(0.01)	0.0001
LAMAR	57.89	0.14	0.29	0.00	(487.28)	(0.00)	7.5558	0.0000	0.14	0.0010
VAN ZANDT	54.15		0.26		(546.83)	(0.00)	7.7830	0.0000	(0.00)	0.0000
WILLACY	114.07		0.59		(926.25)	(0.00)	12.2181	0.0001	(0.00)	0.0001
BROWN	61.93		0.35		(309.46)	(0.00)	8.6414	0.0000	(0.00)	0.0000
ERATH	66.38		0.34		(434.57)	(0.00)	9.0519	0.0000	(0.00)	0.0000
AUSTIN	(390.53)		(1.02)		(2,364.49)	(0.01)	22.5802	0.0001	(0.01)	0.0001
COOKE	370.05		2.01		(1,439.19)	(0.01)	43.4710	0.0002	(0.01)	0.0002
MEDINA	32.18		0.16		(331.43)	(0.00)	4.7642	0.0000	(0.00)	0.0000
TITUS	58.91	0.84	0.29	0.00	(482.46)	(0.00)	6.7923	0.0000	0.84	0.0000
UVALDE	147.69		0.77		(1,067.38)	(0.00)	15.9190	0.0001	(0.00)	0.0001
FAYETTE	60.82	0.00	0.32	0.00	(101.09)	(0.00)	7.1002	0.0000	(0.00)	0.0000
CALLAHAN	24.93		0.13		(289.08)	(0.00)	4.1038	0.0000	(0.00)	0.0000
HOPKINS	41.69		0.27		(480.26)	(0.00)	7.9627	0.0000	(0.00)	0.0000
LAMPASAS	61.17		0.31		(215.24)	(0.00)	5.2426	0.0000	(0.00)	0.0000
BLANCO	22.50		0.11		(227.09)	(0.00)	3.1854	0.0000	(0.00)	0.0000
FREESTONE	11.54	0.54	0.06	0.00	(100.65)	(0.00)	1.5995	0.0000	0.54	0.0036
GRIMES	15.01	0.00	0.07	0.00	(151.15)	(0.00)	2.2690	0.0000	(0.00)	0.0002
LEE	19.22		0.09		(195.36)	(0.00)	2.7102	0.0000	(0.00)	0.0000
SOMERVELL	8.57		0.05		(94.88)	(0.00)	1.5048	0.0000	(0.00)	0.0000
ANDREWS	14.87	0.00	0.08	0.00	(52.97)	(0.00)	1.9120	0.0000	0.00	0.0000
BORDEN	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000

Table 56: 2008 Annual and OSD NOx Reductions from IECC / IRC by PCA for Commercial Buildings by County using 2007 eGRID (w/7% T&D) (2)

	Electricity Savings and Resultant NOx Reductions (Office)				Total Natural Gas Savings and Resultant NOx Reductions (Office)				Total Nox Reductions	
County	Total Annual Electricity Savings per County w/ 7% T&D Loss (MWh/County)	Annual Nox Reductions (Tons)	OSD Electricity Savings per County w/ 7% T&D Loss (MWh/County)	OSD Nox Reductions (Tons)	Total Annual N.G. Savings (Therm/County)	Annual Nox Reductions (Tons)	Total OSD N.G. Savings (Therm/County)	OSD Nox Reductions (Tons)	Annual Nox Reductions (Tons)	OSD Nox Reductions (Tons)
CHEROKEE	142.54	0.52	0.90	0.00	(1,547.94)	(0.01)	31.1095	0.0001	0.51	0.0034
DIMMIT	3.30		0.02		(33.28)	(0.00)	0.4658	0.0000	(0.00)	0.0000
FALLS	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
COLORADO	29.94		0.15		(180.94)	(0.00)	3.9411	0.0000	(0.00)	0.0000
FRIO	35.78	0.04	0.18	0.00	(226.18)	(0.00)	3.9418	0.0000	0.04	0.0004
MILAM	80.45	0.33	0.39	0.00	(654.82)	(0.00)	8.9810	0.0000	0.33	0.0016
JACKSON	23.53		0.11		(238.20)	(0.00)	3.3656	0.0000	(0.00)	0.0000
ANDERSON	9.93		0.06		(53.65)	(0.00)	1.2800	0.0000	(0.00)	0.0000
HILL	94.92		0.47		(751.70)	(0.00)	11.6207	0.0001	(0.00)	0.0001
CULBERSON	12.74		0.06		(122.62)	(0.00)	1.7390	0.0000	(0.00)	0.0000
MASON	1.40		0.01		(14.15)	(0.00)	0.1980	0.0000	(0.00)	0.0000
PECOS	35.26	0.01	0.19	0.00	(43.89)	(0.00)	4.3556	0.0000	0.01	0.0001
RAINS	11.27		0.05		(113.66)	(0.00)	1.6221	0.0000	(0.00)	0.0000
LAVACA	17.43		0.09		(147.61)	(0.00)	2.7190	0.0000	(0.00)	0.0000
PALO PINTO	81.78	0.13	0.41	0.00	(559.59)	(0.00)	8.4726	0.0000	0.12	0.0008
KIMBLE	3.27		0.02		(32.81)	(0.00)	0.5427	0.0000	(0.00)	0.0000
MADISON	13.45		0.07		(137.12)	(0.00)	1.9408	0.0000	(0.00)	0.0000
ARCHER	27.95		0.15		(219.01)	(0.00)	4.5461	0.0000	(0.00)	0.0000
REFUGIO	2.94		0.01		(29.53)	(0.00)	0.4695	0.0000	(0.00)	0.0000
LIMESTONE	42.97	0.04	0.22	0.00	(191.05)	(0.00)	3.8181	0.0000	0.04	0.0000
CLAY	4.85		0.02		(48.94)	(0.00)	0.7043	0.0000	(0.00)	0.0000
BEE	157.10		0.80		(814.84)	(0.00)	20.2548	0.0001	(0.00)	0.0001
MARTIN	0.57		0.00		(5.71)	(0.00)	0.0798	0.0000	(0.00)	0.0000
GONZALES	11.71		0.06		(52.67)	(0.00)	1.3354	0.0000	(0.00)	0.0000
BURLESON	23.78		0.12		(152.26)	(0.00)	3.1040	0.0000	(0.00)	0.0000
KARNES	11.83		0.06		(72.20)	(0.00)	1.5391	0.0000	(0.00)	0.0000
KLEBERG	162.28		0.81		(885.16)	(0.00)	14.6575	0.0001	(0.00)	0.0001
BREWSTER	21.07		0.14		(212.07)	(0.00)	5.0098	0.0000	(0.00)	0.0000
WINKLER	1.87		0.01		(18.77)	(0.00)	0.3078	0.0000	(0.00)	0.0000
FRANKLIN	(60.37)		(0.17)		(265.58)	(0.00)	2.1303	0.0000	(0.00)	0.0000
YOUNG	114.75	0.92	0.58	0.01	(649.34)	(0.00)	11.1089	0.0001	0.92	0.0052
HOUSTON	71.75		0.37		(229.47)	(0.00)	5.3631	0.0000	(0.00)	0.0000
SCURRY	(9.87)		0.01		(150.12)	(0.00)	2.1370	0.0000	(0.00)	0.0000
BOSQUE	22.05	0.02	0.11	0.00	(222.43)	(0.00)	3.1612	0.0000	0.02	0.0003
COMANCHE	214.95		1.17		120.32	0.00	25.7620	0.0001	0.00	0.0001
BRISCOE	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
CONCHO	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
ZAVALA	8.11		0.04		(50.20)	(0.00)	1.1488	0.0000	(0.00)	0.0000
NOLAN	76.87	0.08	0.39	0.00	(355.33)	(0.00)	7.9234	0.0000	0.08	0.0006
BROOKS	1.96		0.01		(6.94)	(0.00)	0.1526	0.0000	(0.00)	0.0000
ROBERTSON	6.46	0.12	0.04	0.00	(60.83)	(0.00)	1.3647	0.0000	0.12	0.0004
LIVE OAK	18.89		0.10		(189.33)	(0.00)	3.1874	0.0000	(0.00)	0.0000
HAMILTON	15.81		0.08		(43.85)	(0.00)	1.9854	0.0000	(0.00)	0.0000
JONES	16.51	0.12	0.10	0.00	(292.11)	(0.00)	4.2667	0.0000	0.12	0.0008
REAGAN	3.35		0.02		(22.11)	(0.00)	0.5182	0.0000	(0.00)	0.0000
WARD	(0.16)	2.74	(0.00)	0.02	(0.67)	(0.00)	0.0051	0.0000	2.74	0.0186
RED RIVER	20.43	0.00	0.10	0.00	(204.99)	(0.00)	2.9510	0.0000	(0.00)	0.0000
HASKELL	23.54	0.00	0.12	0.00	(100.50)	(0.00)	1.1324	0.0000	(0.00)	0.0000
HOWARD	34.92	0.08	0.18	0.00	(162.60)	(0.00)	4.4691	0.0000	0.08	0.0006
SAN SABA	13.10		0.07		(120.10)	(0.00)	1.8775	0.0000	(0.00)	0.0000
JACK	3.51	0.31	0.02	0.00	(35.30)	(0.00)	0.5599	0.0000	0.31	0.0020
STEPHENS	10.06		0.05		(64.44)	(0.00)	1.3366	0.0000	(0.00)	0.0000
RUNNELS	9.67		0.05		(85.37)	(0.00)	1.1696	0.0000	(0.00)	0.0000
REEVES	21.45		0.11		(77.51)	(0.00)	2.8505	0.0000	(0.00)	0.0000
DE WITT	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
CHILDRESS	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
CROSBY	3.07		0.02		(8.69)	(0.00)	0.4184	0.0000	(0.00)	0.0000
DAWSON	9.20		0.04		(92.82)	(0.00)	1.3196	0.0000	(0.00)	0.0000
MITCHELL	18.59	2.21	0.10	0.02	(17.13)	(0.00)	2.3714	0.0000	2.21	0.0159
WILBARGER	58.43	0.09	0.31	0.00	(141.37)	(0.00)	5.9603	0.0000	0.09	0.0000
COLEMAN	5.38	0.00	0.03	0.00	(29.20)	(0.00)	0.7142	0.0000	0.00	0.0000
UPTON	0.30	0.00	0.00	0.00	1.40	0.00	0.0321	0.0000	0.00	0.0000
COKE	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.0000	0.00	0.0000
CROCKETT	7.47	0.00	0.04	0.00	(75.01)	(0.00)	1.2045	0.0000	(0.00)	0.0000
HARDEMAN	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.0000	0.00	0.0000
BANDERA	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
BAYLOR	6.42		0.03		5.68	0.00	0.7453	0.0000	0.00	0.0000
COTTLE	1.92		0.01		(19.40)	(0.00)	0.2715	0.0000	(0.00)	0.0000
CRANE	4.55		0.02		(45.77)	(0.00)	0.7180	0.0000	(0.00)	0.0000
DELTA	3.74		0.02		(37.73)	(0.00)	0.5398	0.0000	(0.00)	0.0000
DICKENS	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
DUVAL	28.49		0.14		(271.94)	(0.00)	3.8267	0.0000	(0.00)	0.0000
EASTLAND	72.55		0.36		(395.74)	(0.00)	5.4903	0.0000	(0.00)	0.0000
EDWARDS	0.87		0.00		(8.72)	(0.00)	0.1299	0.0000	(0.00)	0.0000
FISHER	8.67		0.04		(22.68)	(0.00)	1.0766	0.0000	(0.00)	0.0000
FOARD	0.32		0.00		(3.23)	(0.00)	0.0543	0.0000	(0.00)	0.0000
GLASSCOCK	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
GOLIAD	5.51		0.03		(55.64)	(0.00)	0.7787	0.0000	(0.00)	0.0000
HALL	0.68		0.00		(6.85)	(0.00)	0.0958	0.0000	(0.00)	0.0000
HUDSPETH	12.13		0.06		(122.36)	(0.00)	1.7459	0.0000	(0.00)	0.0000
IRION	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
JEFF DAVIS	11.69		0.06		(117.17)	(0.00)	1.9674	0.0000	(0.00)	0.0000
KENEDY	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
KENT	5.26		0.03		24.68	0.00	0.5656	0.0000	0.00	0.0000
KING	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
KINNEY	5.07		0.02		(44.15)	(0.00)	0.6034	0.0000	(0.00)	0.0000
KNOX	3.13		0.02		(31.44)	(0.00)	0.4840	0.0000	(0.00)	0.0000
LA SALLE	5.94		0.03		(4.90)	(0.00)	0.6259	0.0000	(0.00)	0.0000
LEON	20.75		0.10		(210.45)	(0.00)	3.2963	0.0000	(0.00)	0.0000
LOVING	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
MENARD	2.62		0.01		(18.86)	(0.00)	0.3694	0.0000	(0.00)	0.0000
MILLS	13.08		0.06		(131.80)	(0.00)	1.9292	0.0000	(0.00)	0.0000
MONTAGUE	56.19		0.29		(239.42)	(0.00)	5.3501	0.0000	(0.00)	0.0000
MOTLEY	0.80		0.00		(8.10)	(0.00)	0.1134	0.0000	(0.00)	0.0000
REAL	8.59		0.05		17.96	0.00	1.1277	0.0000	0.00	0.0000
SCHLEICHER	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
SHACKELFORD	13.06		0.07		(59.51)	(0.00)	1.7701	0.0000	(0.00)	0.0000
STARR	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
STERLING	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
STONEWALL	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
SUTTON	4.58		0.02		(9.46)	(0.00)	0.5625	0.0000	(0.00)	0.0000
TERRELL	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
THROCKMORTON	1.85		0.01		(18.56)	(0.00)	0.3125	0.0000	(0.00)	0.0000
ZAPATA	60.01		0.29		(548.18)	(0.00)	8.2846	0.0000	(0.00)	0.0000
TOTAL	**60,824.84**	**41.35**	**394.99**	**0.26**	**(617,226.62)**	**(2.84)**	**11,365.77**	**0.05**	**38.51**	**0.31**



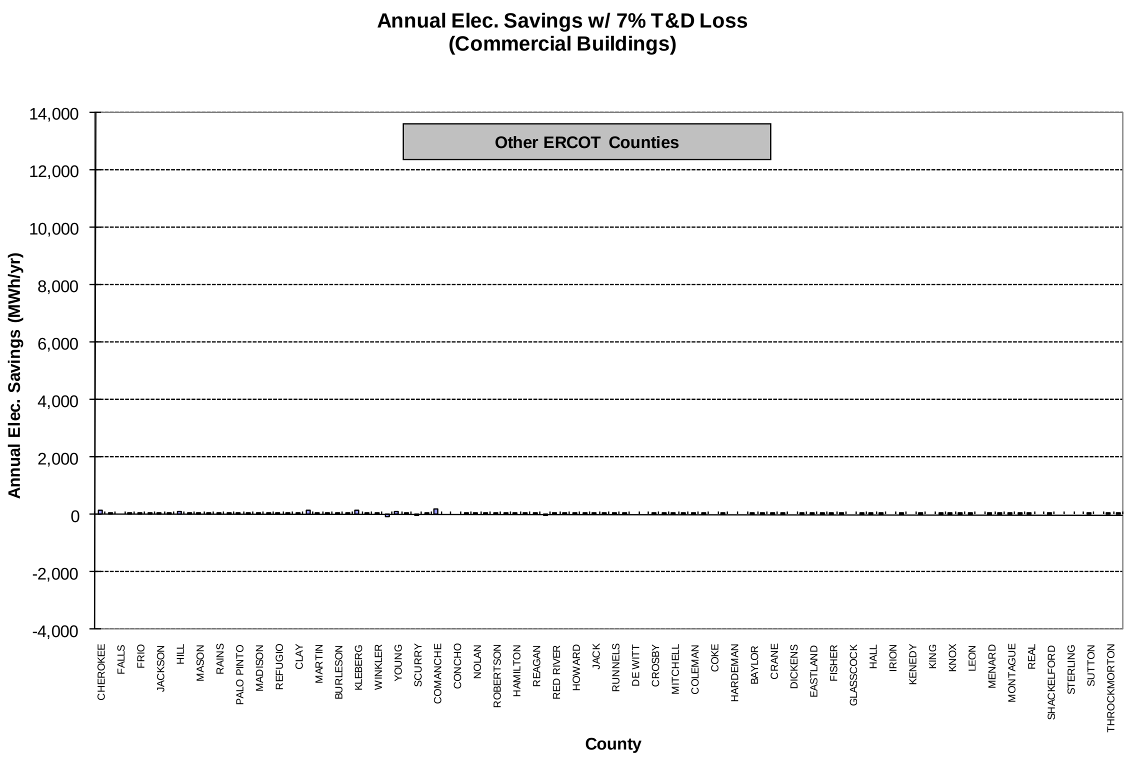
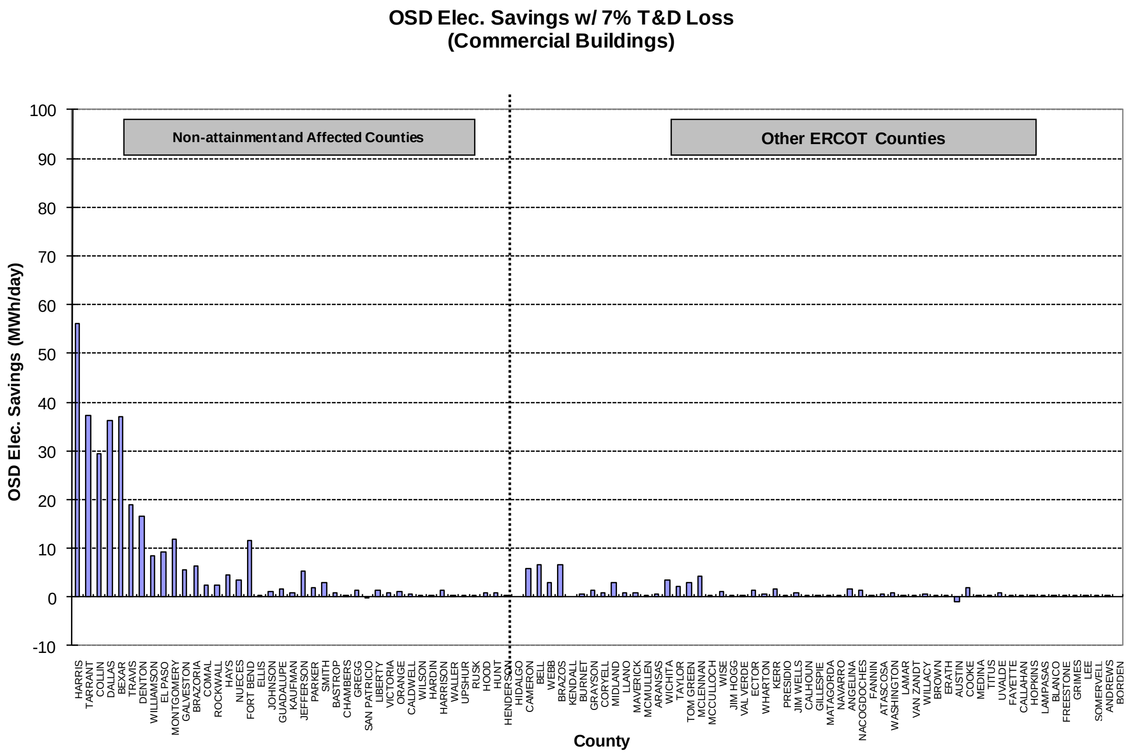


Figure 78: 2008 Annual Electricity Reductions from IECC/IRC by PCA for Commercial Buildings with 7% T&D losses



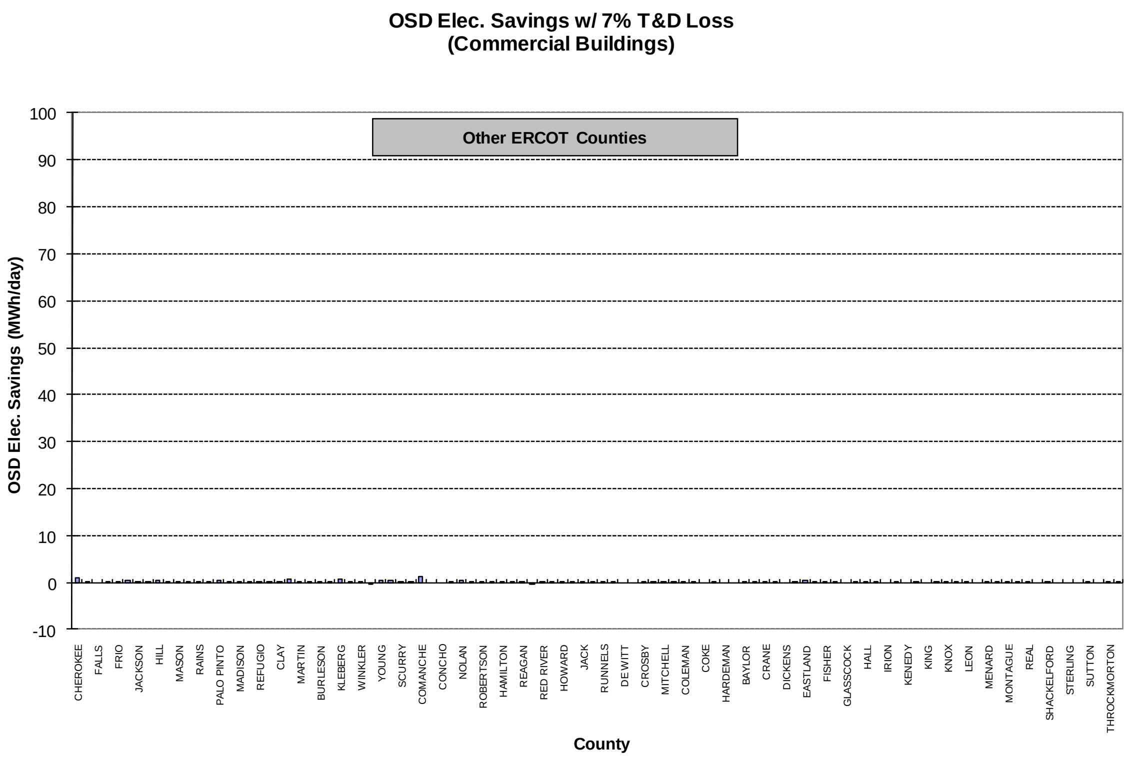
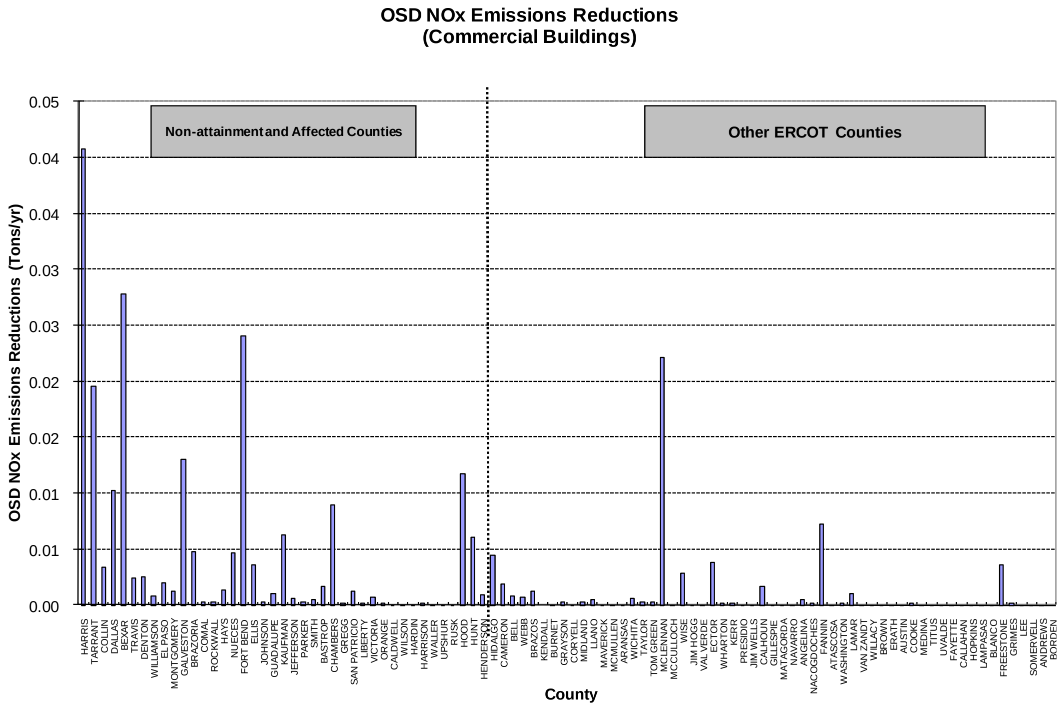


Figure 79: 2008 OSD Electricity Reductions from IECC/IRC by PCA for Commercial Buildings with 7% T&D losses



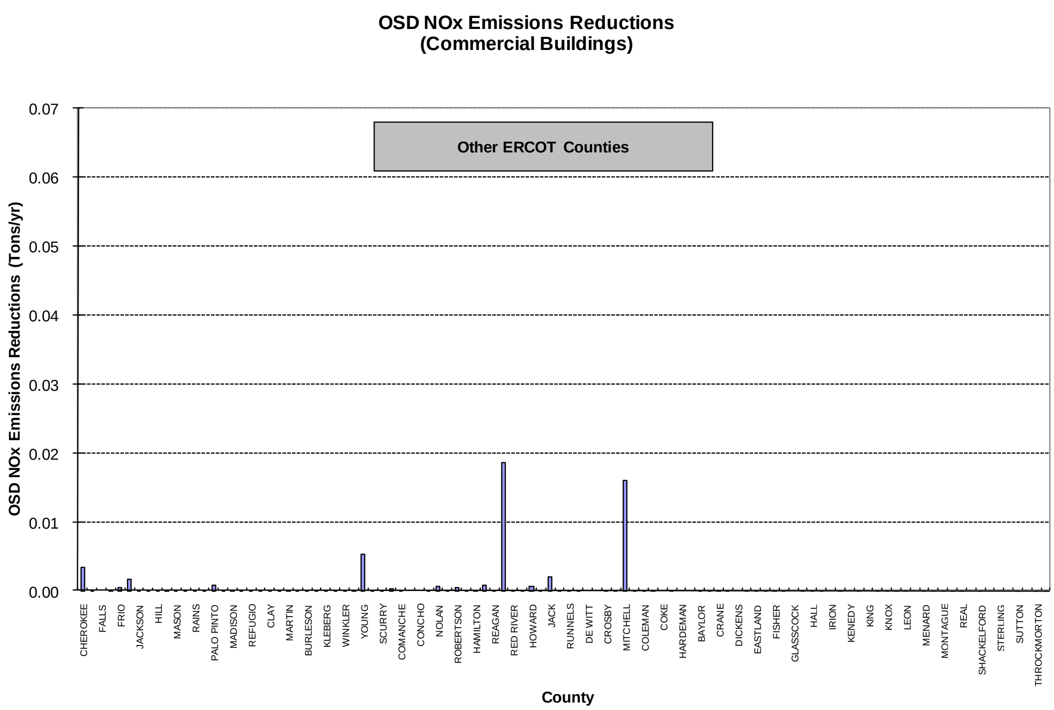
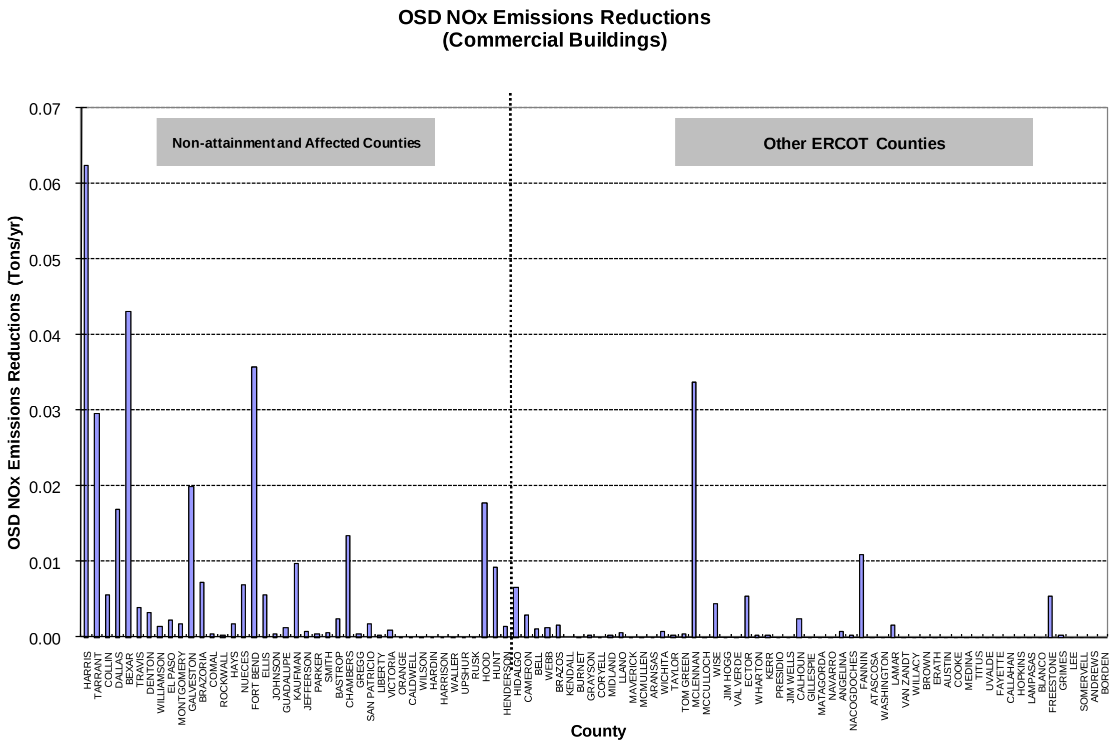


Figure 80: 2006 OSD NOx Reductions from Electricity Savings from the IECC/IRC by PCA for Commercial Buildings by County using 2007 eGRID with 7% T&D losses



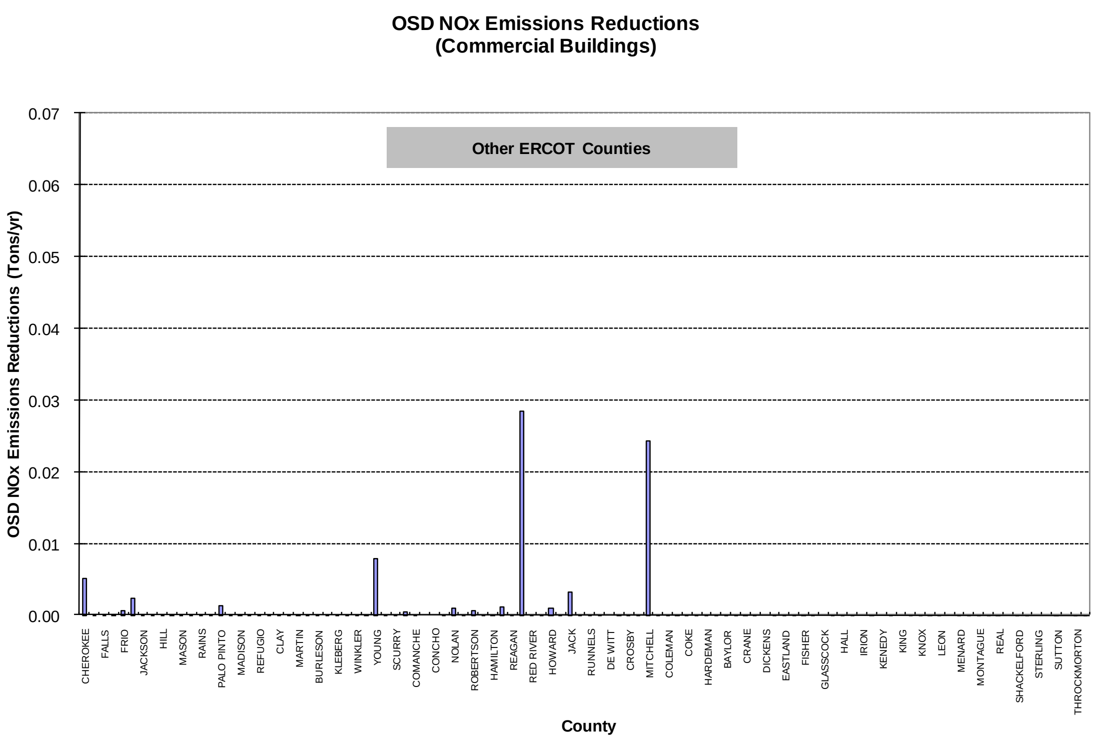


Figure 81: 2008 OSD NOx Reductions from Electricity Savings from the IECC/IRC by PCA for Commercial Buildings by County using 2007 eGRID with 7% T&D losses

6.1.6 2008 Results for New Residential (Single-family and Multi-family), and Commercial Construction using 2007 eGRID.

As shown in Table 58, and Figure 82 through Figure 87 the total annual electricity savings in 2008 were calculated to be 235,608 MWh/yr [41] which includes 156,726 MWh/yr (i.e., 66.5%) for single-family residential, 18,057 MWh/yr (i.e., 7.7%) for multi-family residential, and 60,824 MWh/yr (i.e., 25.8%) for new commercial buildings. Natural gas savings were calculated to be 330,120 MMBtu (3,301,202 therms) for new residential and commercial construction.

Using the 2007 eGRID, the total NOx reductions from electricity and natural gas savings from new residential (single-family and multi-family) and commercial construction in 2008 were calculated to be 171.21 tons NOx/year which represents 156.03 tons NOx/year from electricity savings and 15.19 tons NOx/year from natural gas savings. On a peak Ozone Season Day (OSD), the NOx reductions in 2008 are calculated to be 1.02 tons of NOx/day which represents 0.93 tons NOx/day from electricity savings and 0.09 tons NOx/day from natural gas savings.

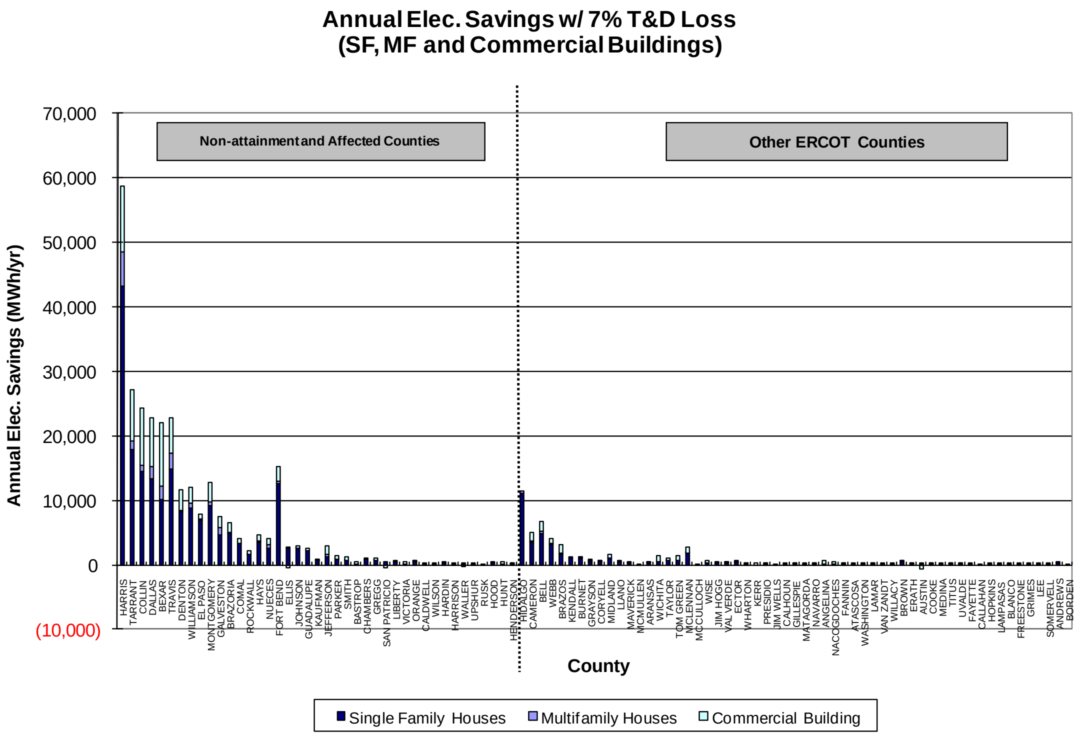
Table 57: 2008 Annual and OSD NOx Reductions from Electricity and Natural Gas Savings Due to the IECC / IRC for Single-family and Multi-family Residences and for Commercial Buildings by County (using 2008 eGRID) (Part 1)

	Electricity Savings and Resultant NOx Reductions (Single Family Houses)				Electricity Savings and Resultant NOx Reductions (Multifamily Houses)				Electricity Savings and Resultant NOx Reductions (Commercial Buildings)				Total Electricity Savings and Resultant NOx Reductions (SF, MF and Commecial Buildings)				Total Natural Gas Savings and Resultant NOx Reductions (SF, MF and Commecial Buildings)				Total Nox Reductions	
County	Total Annual Electricity Savings per County w/ 7% T&D Loss (MWh/County)	Annual Nox Reductions (Tons)	OSD Electricity Savings per County w/ 7% T&D Loss (MWh/County)	OSD Nox Reductions (Tons)	Total Annual Electricity Savings per County w/ 7% T&D Loss (MWh/County)	Annual Nox Reductions (Tons)	OSD Electricity Savings per County w/ 7% T&D Loss (MWh/County)	OSD Nox Reductions (Tons)	Total Annual Electricity Savings per County w/ 7% T&D Loss (MWh/County)	Annual Nox Reductions (Tons)	OSD Electricity Savings per County w/ 7% T&D Loss (MWh/County)	OSD Nox Reductions (Tons)	Total Annual Electricity Savings per County w/ 7% T&D Loss (MWh/County)	Annual Nox Reductions (Tons)	OSD Electricity Savings per County w/ 7% T&D Loss (MWh/County)	OSD Nox Reductions (Tons)	Total Annual N.G. Savings (Therm/County)	Annual Nox Reductions (Tons)	Total OSD N.G. Savings (Therm/County)	OSD Nox Reductions (Tons)	Annual Nox Reductions (Tons)	OSD Nox Reductions (Tons)
HARRIS	26,690.34	13.52	156.98	0.09	5,104.87	1.54	29.22	0.01	10,298.79	6.04	90.75	0.05	42,094.00	21.10	276.95	0.15	464,263.22	2.14	4,978.14	0.02	23.24	0.17
TARRANT	12,247.05	3.85	78.55	0.03	1,078.79	0.46	8.43	0.00	8,004.51	2.72	54.41	0.02	21,330.35	7.04	141.39	0.06	252,940.49	1.16	2,255.11	0.01	8.20	0.07
COLLIN	8,668.33	0.21	54.72	0.00	822.21	0.02	6.42	0.00	8,949.71	0.13	49.15	0.00	18,440.25	0.36	110.29	0.00	177,392.12	0.82	1,496.21	0.01	1.18	0.01
DALLAS	7,679.40	1.41	49.25	0.01	3,459.10	0.17	27.03	0.00	7,622.91	0.99	63.37	0.01	18,761.41	2.57	139.66	0.02	134,760.31	0.62	2,771.49	0.01	3.19	0.03
BEXAR	6,535.73	6.68	38.35	0.04	1,556.46	0.94	9.95	0.01	9,863.19	6.62	57.80	0.04	17,955.38	14.24	106.10	0.08	116,601.50	0.54	1,964.48	0.01	14.77	0.09
TRAVIS	8,778.08	0.16	51.23	0.00	1,168.76	0.02	7.12	0.00	5,552.40	0.08	32.19	0.00	15,499.25	0.26	90.54	0.00	163,145.03	0.75	1,221.65	0.01	1.01	0.01
DENTON	6,583.35	0.05	42.10	0.00	671.75	0.01	4.38	0.00	3,225.90	0.03	21.01	0.00	10,481.00	0.08	67.49	0.00	161,431.13	0.74	988.63	0.00	0.82	0.01
WILLIAMSON	5,417.51	0.00	31.62	0.00	154.52	0.00	0.94	0.00	2,520.52	0.00	13.59	0.00	8,092.55	0.00	46.15	0.00	88,355.94	0.41	549.85	0.00	0.41	0.00
EL PASO	6,365.18	0.00	28.82	0.00	384.82	0.00	2.10	0.00	804.91	0.00	10.13	0.00	7,554.91	0.00	41.05	0.00	143,775.27	0.66	789.42	0.00	0.66	0.00
MONTGOMERY	6,451.56	0.00	37.94	0.00	335.89	0.00	1.92	0.00	3,087.13	0.00	16.95	0.00	9,874.57	0.00	56.82	0.00	121,824.39	0.56	716.27	0.00	0.56	0.00
GALVESTON	2,771.57	7.04	15.97	0.03	591.87	0.80	3.39	0.00	1,819.71	3.35	9.72	0.02	5,183.14	11.19	29.08	0.06	54,381.38	0.25	372.89	0.00	11.44	0.06
BRAZORIA	3,611.99	1.82	20.81	0.01	58.50	0.21	0.34	0.00	1,571.45	0.86	8.57	0.01	5,241.94	2.88	29.71	0.02	56,138.43	0.26	386.58	0.00	3.14	0.02
COMAL	2,243.50	0.00	13.17	0.00	0.00	0.00	0.00	0.00	707.40	0.00	3.76	0.00	2,950.90	0.00	16.93	0.00	44,100.29	0.20	207.75	0.00	0.20	0.00
ROCKWALL	1,267.19	0.00	8.10	0.00	0.00	0.00	0.00	0.00	606.57	0.00	3.22	0.00	1,873.75	0.00	11.32	0.00	30,513.22	0.14	130.37	0.00	0.14	0.00
HAYS	3,040.30	0.43	17.75	0.00	289.19	0.04	1.76	0.00	955.77	0.20	5.14	0.00	4,285.26	0.67	24.64	0.00	56,601.32	0.26	266.04	0.00	0.93	0.01
NUECES	1,790.67	2.10	8.76	0.01	168.70	0.12	0.83	0.00	826.09	1.01	5.27	0.01	2,785.45	3.23	14.86	0.02	29,848.13	0.14	257.00	0.00	3.37	0.02
FORT BEND	10,243.63	13.95	60.25	0.06	77.45	1.59	0.44	0.01	2,281.73	6.24	14.35	0.03	12,602.80	21.77	75.04	0.11	192,536.37	0.89	910.08	0.00	22.66	0.11
ELLIS	1,339.26	1.04	8.59	0.01	73.63	0.13	0.58	0.00	(455.01)	0.73	0.42	0.01	957.88	1.90	9.59	0.01	25,296.59	0.12	202.03	0.00	2.01	0.01
JOHNSON	1,568.37	0.03	10.06	0.00	3.26	0.00	0.03	0.00	314.83	0.02	2.02	0.00	1,886.46	0.05	12.11	0.00	35,353.34	0.16	140.63	0.00	0.21	0.00
GUADALUPE	1,760.26	0.35	10.33	0.00	0.00	0.04	0.00	0.00	257.14	0.16	2.17	0.00	2,017.39	0.55	12.50	0.00	32,720.24	0.15	175.11	0.00	0.70	0.00
KAUFMAN	299.05	2.00	1.91	0.01	31.11	0.24	0.20	0.00	233.97	1.42	1.95	0.01	564.13	3.66	4.07	0.02	2,451.57	0.01	100.45	0.00	3.67	0.02
JEFFERSON	982.80	0.00	5.57	0.00	392.70	0.00	2.24	0.00	1,204.72	0.00	6.70	0.00	2,580.22	0.00	14.51	0.00	25,675.89	0.12	228.58	0.00	0.12	0.00
PARKER	587.34	0.02	3.76	0.00	6.56	0.00	0.04	0.00	547.18	0.01	2.79	0.00	1,141.07	0.04	6.59	0.00	13,657.38	0.06	87.71	0.00	0.10	0.00
SMITH	422.73	0.00	2.92	0.00	29.03	0.00	0.22	0.00	640.05	0.00	4.40	0.00	1,091.81	0.00	7.54	0.00	6,992.70	0.03	161.99	0.00	0.03	0.00
BASTROP	51.34	0.79	0.32	0.00	1.16	0.08	0.01	0.00	398.65	0.36	2.22	0.00	451.15	1.23	2.54	0.01	(359.59)	(0.00)	63.52	0.00	1.23	0.01
CHAMBERS	580.81	4.31	3.30	0.03	0.00	0.49	0.00	0.00	129.97	1.93	0.63	0.01	710.78	6.73	3.93	0.04	10,899.39	0.05	42.77	0.00	6.78	0.04
GREGG	357.38	0.00	2.42	0.00	21.46	0.00	0.14	0.00	397.46	0.00	2.51	0.00	776.30	0.00	5.07	0.00	9,028.95	0.04	96.40	0.00	0.04	0.00
SAN PATRICIO	355.41	0.46	1.74	0.00	2.79	0.03	0.01	0.00	(397.19)	0.22	(0.27)	0.00	(38.99)	0.71	1.48	0.00	854.80	0.00	79.37	0.00	0.72	0.00
LIBERTY	434.18	0.00	2.55	0.00	0.00	0.00	0.00	0.00	294.64	0.00	1.44	0.00	728.83	0.00	3.99	0.00	6,545.46	0.03	59.27	0.00	0.03	0.00
VICTORIA	87.04	0.28	0.53	0.00	0.00	0.02	0.00	0.00	255.72	0.14	1.40	0.00	342.76	0.44	1.93	0.00	846.34	0.00	35.15	0.00	0.45	0.00
ORANGE	584.61	0.00	3.32	0.00	128.04	0.00	0.73	0.00	171.08	0.00	0.91	0.00	883.73	0.00	4.96	0.00	13,238.38	0.06	61.72	0.00	0.06	0.00
CALDWELL	108.93	0.00	0.62	0.00	0.00	0.00	0.00	0.00	55.86	0.00	0.31	0.00	164.78	0.00	0.93	0.00	1,290.42	0.01	13.95	0.00	0.01	0.00
WILSON	44.10	0.00	0.26	0.00	0.00	0.00	0.00	0.00	118.24	0.00	0.61	0.00	162.34	0.00	0.87	0.00	437.44	0.00	18.90	0.00	0.00	0.00
HARDIN	178.91	0.00	1.01	0.00	0.00	0.00	0.00	0.00	140.96	0.00	0.69	0.00	319.87	0.00	1.70	0.00	2,558.69	0.01	24.12	0.00	0.01	0.00
HARRISON	134.09	0.00	0.91	0.00	0.00	0.00	0.00	0.00	128.66	0.00	0.68	0.00	262.75	0.00	1.60	0.00	3,212.03	0.01	24.89	0.00	0.01	0.00
WALLER	12.60	0.00	0.07	0.00	0.00	0.00	0.00	0.00	(78.15)	0.00	0.15	0.00	(65.55)	0.00	0.22	0.00	(2,726.28)	(0.01)	36.22	0.00	(0.01)	0.00
UPSHUR	6.85	0.00	0.05	0.00	0.00	0.00	0.00	0.00	106.98	0.00	0.54	0.00	113.83	0.00	0.59	0.00	(736.66)	(0.00)	14.95	0.00	(0.00)	0.00
RUSK	9.85	0.22	0.07	0.00	2.20	0.03	0.02	0.00	72.82	0.15	0.38	0.00	84.87	0.40	0.47	0.00	(95.09)	(0.00)	6.97	0.00	0.40	0.00
HOOD	212.45	3.96	1.36	0.02	11.73	0.48	0.09	0.00	199.83	2.80	0.99	0.02	424.01	7.25	2.45	0.04	4,174.29	0.02	36.58	0.00	7.27	0.05
HUNT	93.68	1.96	0.59	0.01	7.39	0.24	0.05	0.00	339.64	1.38	1.79	0.01	440.71	3.58	2.43	0.02	(268.55)	(0.00)	52.31	0.00	3.58	0.02
HENDERSON	81.85	0.26	0.57	0.00	0.00	0.03	0.00	0.00	55.34	0.18	0.46	0.00	137.19	0.47	1.03	0.00	1,114.96	0.01	23.17	0.00	0.48	0.00
HIDALGO	6,347.81	1.74	30.38	0.01	181.39	0.10	0.59	0.00	0.00	0.84	0.00	0.01	6,529.20	2.68	30.98	0.02	110,694.11	0.51	303.92	0.00	3.18	0.02
CAMERON	2,192.66	0.45	10.50	0.00	71.65	0.03	0.23	0.00	1,383.19	0.22	9.46	0.00	3,647.49	0.69	20.19	0.00	24,050.86	0.11	404.80	0.00	0.80	0.01
BELL	3,457.97		20.83		101.26		0.57		1,622.42	0.00	9.42	0.00	5,181.66	0.00	30.81	0.00	83,700.07	0.39	410.41	0.00	0.39	0.00
WEBB	1,636.16	0.18	7.56	0.00	194.72	0.01	0.96	0.00	894.28	0.09	5.63	0.00	2,725.16	0.28	14.15	0.00	19,941.11	0.09	256.76	0.00	0.38	0.00
BRAZOS	1,426.08	0.19	8.39	0.00	525.58	0.02	3.01	0.00	1,370.40	0.11	7.36	0.00	3,322.06	0.33	18.76	0.00	34,392.39	0.16	284.00	0.00	0.49	0.00
KENDALL	362.37		2.16		0.00		0.00		0.00	0.00	0.00	0.00	362.37	0.00	2.16	0.00	8,946.54	0.04	19.48	0.00	0.04	0.00
BURNET	710.46		4.15		0.00		0.00		178.55	0.00	0.91	0.00	889.00	0.00	5.05	0.00	12,206.19	0.06	54.07	0.00	0.06	0.00
GRAYSON	393.90		2.49		7.39		0.05		247.06	0.00	1.88	0.00	648.35	0.00	4.42	0.00	5,932.21	0.03	88.42	0.00	0.03	0.00
CORYELL	423.87		2.55		5.43		0.03		139.62	0.00	0.74	0.00	568.92	0.00	3.33	0.00	9,791.85	0.05	37.56	0.00	0.05	0.00
MIDLAND	998.78		4.76		0.00		0.00		577.69	0.00	3.04	0.00	1,576.48	0.00	7.80	0.00	29,358.61	0.14	114.51	0.00	0.14	0.00
LLANO	692.41	0.22	4.04	0.00	0.00	0.02	0.00	0.00	130.46	0.10	0.71	0.00	822.87	0.34	4.75	0.00	13,315.85	0.06	45.94	0.00	0.40	0.00
MAVERICK	198.40		0.92		6.51		0.03		219.46	0.00	1.14	0.00	424.36	0.00	2.08	0.00	2,421.19	0.01	33.91	0.00	0.01	0.00
MCMULLEN	0.00		0.00		0.00		0.00		4.75	0.00	0.02	0.00	4.75	0.00	0.02	0.00	(47.70)	(0.00)	0.78	0.00	(0.00)	0.00
ARANSAS	249.36		1.22		6.51		0.03		123.94	0.00	0.63	0.00	379.81	0.00	1.88	0.00	4,205.30	0.02	20.43	0.00	0.02	0.00
WICHITA	313.37	0.07	1.79	0.00	0.85	0.01	0.00	0.00	901.81	0.05	5.01	0.00	1,216.02	0.12	6.81	0.00	10,979.70	0.05	125.25	0.00	0.17	0.00
TAYLOR	402.67	0.00	2.10	0.00	1.27	0.00	0.01	0.00	524.49	0.00	3.09	0.00	928.43	0.00	5.19	0.00	9,750.89	0.04	89.42	0.00	0.04	0.00
TOM GREEN	525.30	0.01	2.75	0.00	0.00	0.00	0.00	0.00	730.47	0.01	4.04	0.00	1,255.77	0.02	6.80	0.00	12,410.99	0.06	122.09	0.00	0.08	0.00
MCLENNAN	1,191.58	7.77	7.18	0.04	55.61	0.94	0.31	0.01	1,061.40	5.49	6.30	0.03	2,308.60	14.19	13.79	0.08	22,883.50	0.11	239.24	0.00	14.30	0.09
MCCULLOCH	6.08		0.03		0.00		0.00		16.95	0.00	0.08	0.00	23.03	0.00	0.11	0.00	4.48	0.00	2.72	0.00	0.00	0.00
WISE	154.41	0.90	0.97	0.01	2.63	0.11	0.02	0.00	349.16	0.63	1.81	0.00	506.20	1.64	2.81	0.01	2,731.50	0.01	52.53	0.00	1.65	0.01
JIM HOGG	237.75		2.80		0.00		0.00		13.20	0.00	0.07	0.00	250.94	0.00	2.86	0.00	29,306.49	0.13	48.62	0.00	0.13	0.00
VAL VERDE	163.53		0.96		0.00		0.00		172.79	0.00	0.90	0.00	336.32	0.00	1.86	0.00	2,382.27	0.01	31.94	0.00	0.01	0.00
ECTOR	525.24	1.12	2.50	0.01	98.86	0.14	0.45	0.00	30.82	0.79	1.16	0.01	654.91	2.05	4.12	0.01	17,994.22	0.08	100.43	0.00	2.13	0.01
WHARTON	144.57	0.03	0.88	0.00	0.00	0.00	0.00	0.00	147.82	0.01	0.82	0.00	292.40	0.04	1.70	0.00	2,427.86	0.01	25.66	0.00	0.06	0.00
KERR	155.62		0.91		0.00		0.00		316.10	0.00	1.64	0.00	471.73	0.00	2.55	0.00	1,826.08	0.01	44.19	0.00	0.01	0.00
PRESIDIO	14.20	0.00	0.07	0.00	0.00	0.00	0.00	0.00	18.70	0.00	0.09	0.00	32.90	0.00	0.17	0.00	203.24	0.00	3.81	0.00	0.00	0.00
JIM WELLS	135.48		0.66		0.93		0.00		164.32	0.00	0.85	0.00	300.73	0.00	1.52	0.00	1,793.75	0.01	23.79	0.00	0.01	0.00
CALHOUN	126.87	0.76	0.78	0.00	0.00	0.04	0.00	0.00	62.06	0.37	0.31	0.00	188.93	1.17	1.08	0.01	2,740.06	0.01	12.28	0.00	1.19	0.01
GILLESPIE	94.73		0.55		19.37		0.12		86.42	0.00	0.48	0.00	200.52	0.00	1.15	0.00	1,697.45	0.01	15.71	0.00	0.01	0.00
MATAGORDA	143.10		0.87		0.00		0.00		67.50	0.00	0.38	0.00	210.60	0.00	1.26	0.00	2,923.80	0.01	19.91	0.00	0.01	0.00
NAVARRO	60.55		0.36		0.00		0.00		100.35	0.00	0.91	0.00	160.90	0.00	1.27	0.00	(476.86)	(0.00)	36.48	0.00	(0.00)	0.00
ANGELINA	99.87	0.10	0.67	0.00	0.00	0.01	0.00	0.00	499.18	0.07	2.59	0.00	599.05	0.18	3.26	0.00	551.26	0.00	61.37	0.00	0.18	0.00
NACOGDOCHES	59.08		0.40		4.13		0.03		373.81	0.00	1.97	0.00	437.02	0.00	2.40	0.00	(754.92)	(0.00)	56.55	0.00	(0.00)	0.00
FANNIN	40.45	2.23	0.26	0.01	0.00	0.27	0.00	0.00	73.64	1.58	0.41	0.01	114.09	4.08	0.66	0.03	327.49	0.00	14.10	0.00	4.08	0.03
ATASCOSA	75.16		0.44		0.00		0.00		159.44	0.00	0.83	0.00	234.60	0.00	1.27	0.00	680.21	0.00	22.97	0.00	0.00	0.00
WASHINGTON	158.45		0.93		0.00		0.00		133.58	0.00	0.78	0.00	292.03	0.00	1.71	0.00	2,050.34	0.01	28.93	0.00	0.01	0.00
LAMAR	44.31	0.30	0.30	0.00	0.00	0.04	0.00	0.00	104.65	0.21	0.53	0.00	148.96	0.55	0.83	0.00	451.98	0.00	16.06	0.00	0.55	0.00
VAN ZANDT	30.02		0.19		1.31		0.01		112.17	0.00	0.54	0.00	143.51	0.00	0.74	0.00	(352.44)	(0.00)	17.63	0.00	(0.00)	0.00
WILLACY	68.65		0.33		0.00		0.00		100.65	0.00	0.52	0.00	169.30	0.00	0.85	0.00	329.89	0.00	13.93	0.00	0.00	0.00
BROWN	337.36		2.03		14.85		0.08		97.26	0.00	0.55	0.00	449.47	0.00	2.67	0.00	8,361.21	0.04	31.23	0.00	0.04	0.00
ERATH	91.91		0.48		46.95		0.21		104.30	0.00	0.54	0.00	243.17	0.00	1.23	0.00	3,833.42	0.02	23.66	0.00	0.02	0.00
AUSTIN	64.82		0.38		3.91		0.02		(585.80)	0.00	(1.53)	0.00	(517.06)	0.00	(1.13)	0.00	(2,100.04)	(0.01)	37.43	0.00	(0.01)	0.00
COOKE	102.20		0.65		0.00		0.00		177.31	0.00	0.96	0.00	279.51	0.00	1.61	0.00	1,899.37	0.01	25.67	0.00	0.01	0.00
MEDINA	27.56		0.16		0.68		0.00		79.38	0.00	0.39	0.00	107.62	0.00	0.56	0.00	(205.01)	(0.00)	13.31	0.00	(0.00)	0.00
TITUS	15.34	1.80	0.10	0.00	24.65	0.22	0.19	0.00	222.57	1.27	1.09	0.00	262.55	3.30	1.38	0.00	(789.16)	(0.00)	28.25	0.00	3.29	0.00
UVALDE	47.77		0.28		0.00		0.00		124.97	0.00	0.65	0.00	172.74	0.00	0.93	0.00	130.51	0.00	16.09	0.00	0.00	0.00
FAYETTE	25.21	0.00	0.15	0.00	0.00	0.00	0.00	0.00	95.57	0.00	0.51	0.00	120.78	0.00	0.66	0.00	372.11	0.00	12.45	0.00	0.00	0.00
CALLAHAN	10.94		0.06		0.00		0.00		24.93	0.00	0.13	0.00	35.87	0.00	0.18	0.00	58.15	0.00	4.61	0.00	0.00	0.00
HOPKINS	25.73		0.16		0.66		0.01		62.53	0.00	0.40	0.00	88.92	0.00	0.57	0.00	(62.48)	(0.00)	13.20	0.00	(0.00)	0.00
LAMPASAS	41.09		0.25		0.00		0.00		64.39	0.00	0.33	0.00	105.48	0.00	0.57	0.00	779.51	0.00	7.44	0.00	0.00	0.00
BLANCO	31.58		0.18		14.23		0.09		28.93	0.00	0.14	0.00	74.74	0.00	0.41	0.00	599.99	0.00	6.35	0.00	0.00	0.00
FREESTONE	12.98	1.16	0.08	0.01	0.00	0.14	0.00	0.00	39.35	0.82	0.19	0.01	52.32	2.13	0.27	0.01	(65.22)	(0.00)	6.15	0.00	2.13	0.01
GRIMES	19.81	0.00	0.12	0.00	0.00	0.00	0.00	0.00	23.20	0.00	0.11	0.00	43.01	0.00	0.23	0.00	183.59	0.00	4.52	0.00	0.00	0.00
LEE	29.47		0.18		0.00		0.00		24.47	0.00	0.12	0.00	53.93	0.00	0.30	0.00	(28.37)	(0.00)	3.67	0.00	(0.00)	0.00
SOMERVELL	89.56		0.57		0.00		0.00		10.96	0.00	0.06	0.00	100.52	0.00	0.63	0.00	2,181.43	0.01	6.26	0.00	0.01	0.00
ANDREWS	117.87	0.01	0.56	0.00	0.86	0.00	0.00	0.00	40.17	0.01	0.21	0.00	158.90	0.01	0.77	0.00	3,728.65	0.02	11.01	0.00	0.03	0.00
BORDEN	33.78		0.15		0.00		0.00		0.00	0.00	0.00	0.00	33.78	0.00	0.15	0.00	1,724.24	0.01	1.76	0.00	0.01	0.00

[41] In 2005, it is estimated that there were 128,804 single family residences and 29,972 multi-family residences, which totaled about 350 million sq. ft., and 122 million sq. ft. of commercial building construction.

Table 58: 2008 Annual and OSD NOx Reductions from Electricity and Natural Gas Savings Due to the IECC / IRC for Single-family and Multi-family Residences and for Commercial Buildings by County (using 2007 eGRID) (Part 2)

	Electricity Savings and Resultant NOx Reductions (Single Family Houses)				Electricity Savings and Resultant NOx Reductions (Multifamily Houses)				Electricity Savings and Resultant NOx Reductions (Commercial Buildings)				Total Electricity Savings and Resultant NOx Reductions (SF, MF and Commecial Buildings)				Total Natural Gas Savings and Resultant NOx Reductions (SF, MF and Commecial Buildings)				Total Nox Reductions	
CHEROKEE	45.01	1.11	0.30	0.01	20.39	0.13	0.15	0.00	75.72	0.78	0.48	0.01	141.12	2.03	0.93	0.01	1,179.12	0.01	21.22	0.00	2.03	0.01
DIMMIT	12.25		0.06		0.00		0.00		9.23	0.00	0.04	0.00	21.48	0.00	0.10	0.00	97.60	0.00	1.81	0.00	0.00	0.00
FALLS	0.00		0.00		0.00		0.00		23.44	0.00	0.11	0.00	23.44	0.00	0.11	0.00	(229.58)	(0.00)	3.37	0.00	(0.00)	0.00
COLORADO	16.21		0.10		0.00		0.00		53.22	0.00	0.27	0.00	69.42	0.00	0.36	0.00	19.66	0.00	7.84	0.00	0.00	0.00
FRIO	11.00	0.11	0.06	0.00	0.00	0.01	0.00	0.00	65.60	0.06	0.33	0.00	76.60	0.17	0.39	0.00	(180.36)	(0.00)	7.83	0.00	0.17	0.00
MILAM	11.42	0.71	0.06	0.00	3.13	0.09	0.02	0.00	80.45	0.50	0.39	0.00	95.00	1.30	0.47	0.01	(395.98)	(0.00)	9.67	0.00	1.30	0.01
JACKSON	16.23		0.10		0.00		0.00		32.09	0.00	0.16	0.00	48.31	0.00	0.26	0.00	67.00	0.00	5.61	0.00	0.00	0.00
ANDERSON	32.35		0.22		0.00		0.00		92.40	0.00	0.53	0.00	124.75	0.00	0.75	0.00	528.30	0.00	14.04	0.00	0.00	0.00
HILL	30.28		0.18		1.45		0.01		142.38	0.00	0.70	0.00	174.11	0.00	0.89	0.00	(328.98)	(0.00)	19.03	0.00	(0.00)	0.00
CULBERSON	8.74		0.04		0.00		0.00		6.37	0.00	0.03	0.00	15.11	0.00	0.07	0.00	166.96	0.00	1.27	0.00	0.00	0.00
MASON	9.02		0.05		0.00		0.00		3.50	0.00	0.02	0.00	12.53	0.00	0.07	0.00	135.28	0.00	0.90	0.00	0.00	0.00
PECOS	18.25	0.01	0.10	0.00	0.00	0.00	0.00	0.00	50.94	0.01	0.27	0.00	69.19	0.02	0.37	0.00	463.07	0.00	7.20	0.00	0.03	0.00
RAINS	6.43		0.04		1.31		0.01		30.05	0.00	0.14	0.00	37.79	0.00	0.20	0.00	(111.91)	(0.00)	4.72	0.00	(0.00)	0.00
LAVACA	10.18		0.06		0.00		0.00		37.34	0.00	0.19	0.00	47.52	0.00	0.25	0.00	(39.79)	(0.00)	6.47	0.00	(0.00)	0.00
PALO PINTO	19.70	0.32	0.10	0.00	0.00	0.04	0.00	0.00	118.12	0.19	0.59	0.00	137.82	0.54	0.70	0.00	(183.29)	(0.00)	13.15	0.00	0.54	0.00
KIMBLE	8.11		0.04		0.00		0.00		3.27	0.00	0.02	0.00	11.38	0.00	0.06	0.00	201.17	0.00	0.95	0.00	0.00	0.00
MADISON	14.40		0.08		0.00		0.00		25.21	0.00	0.12	0.00	39.62	0.00	0.21	0.00	46.31	0.00	4.38	0.00	0.00	0.00
ARCHER	31.34		0.18		0.00		0.00		17.96	0.00	0.10	0.00	49.30	0.00	0.28	0.00	1,082.91	0.00	4.34	0.00	0.00	0.00
REFUGIO	4.43		0.03		0.00		0.00		4.90	0.00	0.02	0.00	9.32	0.00	0.05	0.00	57.65	0.00	1.06	0.00	0.00	0.00
LIMESTONE	32.44	0.14	0.20	0.00	0.00	0.02	0.00	0.00	54.42	0.06	0.28	0.00	86.86	0.22	0.47	0.00	552.27	0.00	6.35	0.00	0.23	0.00
CLAY	8.95		0.05		0.00		0.00		7.28	0.00	0.04	0.00	16.23	0.00	0.09	0.00	276.22	0.00	1.46	0.00	0.00	0.00
BEE	8.85		0.05		0.00		0.00		104.73	0.00	0.54	0.00	113.58	0.00	0.59	0.00	(329.50)	(0.00)	14.06	0.00	(0.00)	0.00
MARTIN	0.00		0.00		0.00		0.00		0.57	0.00	0.00	0.00	0.57	0.00	0.00	0.00	(5.71)	(0.00)	0.08	0.00	(0.00)	0.00
GONZALES	3.67		0.02		0.00		0.00		35.14	0.00	0.18	0.00	38.81	0.00	0.20	0.00	(78.50)	(0.00)	4.21	0.00	(0.00)	0.00
BURLESON	19.81		0.12		0.00		0.00		25.94	0.00	0.13	0.00	45.75	0.00	0.25	0.00	251.08	0.00	4.40	0.00	0.00	0.00
KARNES	56.35		0.32		0.00		0.00		17.35	0.00	0.09	0.00	73.71	0.00	0.41	0.00	1,056.49	0.00	5.28	0.00	0.00	0.00
KLEBERG	51.60		0.25		0.00		0.00		205.97	0.00	1.03	0.00	257.57	0.00	1.28	0.00	(237.39)	(0.00)	21.01	0.00	(0.00)	0.00
BREWSTER	58.82		0.31		0.00		0.00		21.80	0.00	0.14	0.00	80.62	0.00	0.45	0.00	1,477.00	0.01	8.11	0.00	0.01	0.00
WINKLER	8.27		0.04		0.00		0.00		2.81	0.00	0.01	0.00	11.08	0.00	0.05	0.00	241.49	0.00	0.87	0.00	0.00	0.00
FRANKLIN	2.14		0.01		0.00		0.00		(241.47)	0.00	(0.70)	0.00	(239.33)	0.00	(0.68)	0.00	(1,008.76)	(0.00)	8.62	0.00	(0.00)	0.00
YOUNG	21.88	1.97	0.11	0.01	0.00	0.24	0.00	0.00	80.32	1.40	0.41	0.01	102.21	3.61	0.52	0.02	239.92	0.00	8.79	0.00	3.61	0.02
HOUSTON	5.63		0.04		0.00		0.00		107.62	0.00	0.55	0.00	113.25	0.00	0.59	0.00	(165.51)	(0.00)	8.41	0.00	(0.00)	0.00
SCURRY	14.22		0.06		0.00		0.00		(4.94)	0.00	0.00	0.00	9.29	0.00	0.07	0.00	650.93	0.00	1.81	0.00	0.00	0.00
BOSQUE	15.14	0.06	0.09	0.00	0.00	0.01	0.00	0.00	22.05	0.04	0.11	0.00	37.18	0.10	0.20	0.00	148.23	0.00	3.87	0.00	0.10	0.00
COMANCHE	8.65		0.05		0.00		0.00		53.74	0.00	0.29	0.00	62.39	0.00	0.34	0.00	241.89	0.00	6.84	0.00	0.00	0.00
BRISCOE	11.88		0.05		0.00		0.00		0.00	0.00	0.00	0.00	11.88	0.00	0.05	0.00	967.61	0.00	0.71	0.00	0.00	0.00
CONCHO	2.03		0.01		0.00		0.00		0.00	0.00	0.00	0.00	2.03	0.00	0.01	0.00	58.50	0.00	0.10	0.00	0.00	0.00
ZAVALA	22.04		0.10		0.00		0.00		27.92	0.00	0.14	0.00	49.96	0.00	0.25	0.00	170.50	0.00	4.87	0.00	0.00	0.00
NOLAN	6.57	0.18	0.03	0.00	0.00	0.02	0.00	0.00	76.87	0.13	0.39	0.00	83.44	0.33	0.42	0.00	(146.99)	(0.00)	8.23	0.00	0.33	0.00
BROOKS	12.11		0.06		0.00		0.00		1.96	0.00	0.01	0.00	14.08	0.00	0.07	0.00	195.50	0.00	0.71	0.00	0.00	0.00
ROBERTSON	19.81	0.26	0.12	0.00	0.00	0.03	0.00	0.00	9.40	0.19	0.06	0.00	29.20	0.48	0.17	0.00	328.70	0.00	3.00	0.00	0.48	0.00
LIVE OAK	11.78		0.06		0.00		0.00		6.30	0.00	0.03	0.00	18.08	0.00	0.09	0.00	150.14	0.00	1.62	0.00	0.00	0.00
HAMILTON	4.33		0.03		0.00		0.00		31.61	0.00	0.16	0.00	35.94	0.00	0.19	0.00	18.21	0.00	4.17	0.00	0.00	0.00
JONES	2.19	0.38	0.01	0.00	0.00	0.02	0.00	0.00	16.51	0.18	0.10	0.00	18.69	0.58	0.11	0.00	(222.67)	(0.00)	4.37	0.00	0.58	0.00
REAGAN	10.00		0.05		0.00		0.00		2.01	0.00	0.01	0.00	12.02	0.00	0.06	0.00	267.02	0.00	0.82	0.00	0.00	0.00
WARD	4.14	5.87	0.02	0.04	0.00	0.71	0.00	0.01	(1.19)	4.15	(0.00)	0.03	2.95	10.74	0.02	0.07	129.79	0.00	0.24	0.00	10.74	0.07
RED RIVER	1.70	0.00	0.01	0.00	0.00	0.00	0.00	0.00	40.87	0.00	0.20	0.00	42.57	0.00	0.21	0.00	(358.71)	(0.00)	5.99	0.00	(0.00)	0.00
HASKELL	4.38	0.00	0.02	0.00	0.63	0.00	0.00	0.00	23.54	0.00	0.12	0.00	28.56	0.00	0.14	0.00	60.01	0.00	1.40	0.00	0.00	0.00
HOWARD	20.68	0.18	0.10	0.00	0.00	0.02	0.00	0.00	55.88	0.12	0.29	0.00	76.56	0.32	0.39	0.00	413.94	0.00	8.16	0.00	0.32	0.00
SAN SABA	11.28		0.07		0.00		0.00		13.10	0.00	0.07	0.00	24.38	0.00	0.13	0.00	93.22	0.00	2.38	0.00	0.00	0.00
JACK	2.19	0.67	0.01	0.00	1.69	0.08	0.01	0.00	3.51	0.47	0.02	0.00	7.39	1.23	0.04	0.01	91.79	0.00	0.85	0.00	1.23	0.01
STEPHENS	2.19		0.01		0.00		0.00		10.06	0.00	0.05	0.00	12.25	0.00	0.06	0.00	5.01	0.00	1.44	0.00	0.00	0.00
RUNNELS	4.06		0.02		0.00		0.00		9.67	0.00	0.05	0.00	13.73	0.00	0.07	0.00	31.62	0.00	1.37	0.00	0.00	0.00
REEVES	2.07		0.01		0.00		0.00		21.45	0.00	0.11	0.00	23.52	0.00	0.12	0.00	(10.10)	(0.00)	2.95	0.00	(0.00)	0.00
DE WITT	7.38		0.05		0.00		0.00		0.00	0.00	0.00	0.00	7.38	0.00	0.05	0.00	178.10	0.00	0.46	0.00	0.00	0.00
CHILDRESS	0.00		0.00		0.00		0.00		7.10	0.00	0.06	0.00	7.10	0.00	0.06	0.00	(148.59)	(0.00)	2.94	0.00	(0.00)	0.00
CROSBY	3.56		0.02		0.00		0.00		7.67	0.00	0.04	0.00	11.23	0.00	0.06	0.00	159.78	0.00	1.23	0.00	0.00	0.00
DAWSON	5.33		0.02		0.00		0.00		9.20	0.00	0.04	0.00	14.53	0.00	0.07	0.00	179.43	0.00	1.60	0.00	0.00	0.00
MITCHELL	2.19	4.73	0.01	0.03	0.00	0.57	0.00	0.00	18.59	3.34	0.10	0.02	20.78	8.64	0.11	0.06	52.32	0.00	2.47	0.00	8.64	0.06
WILBARGER	4.48	0.26	0.03	0.00	0.00	0.01	0.00	0.00	58.43	0.13	0.31	0.00	62.91	0.41	0.34	0.00	33.44	0.00	6.16	0.00	0.41	0.00
COLEMAN	2.11	0.01	0.01	0.00	0.00	0.00	0.00	0.00	10.76	0.01	0.06	0.00	12.86	0.02	0.07	0.00	1.36	0.00	1.53	0.00	0.02	0.00
UPTON	2.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	1.20	0.01	0.01	0.00	3.20	0.02	0.02	0.00	61.67	0.00	0.23	0.00	0.02	0.00
COKE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.95	0.00	0.05	0.00	8.95	0.00	0.05	0.00	(108.79)	(0.00)	1.66	0.00	(0.00)	0.00
CROCKETT	38.54	0.00	0.20	0.00	0.00	0.00	0.00	0.00	7.47	0.00	0.04	0.00	46.00	0.00	0.24	0.00	1,036.41	0.00	3.12	0.00	0.00	0.00
HARDEMAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.86	0.00	0.00	0.00	0.86	0.00	0.00	0.00	(8.66)	(0.00)	0.15	0.00	(0.00)	0.00
BANDERA	0.00		0.00		0.00		0.00		62.03	0.00	0.30	0.00	62.03	0.00	0.30	0.00	(501.42)	(0.00)	8.56	0.00	(0.00)	0.00
BAYLOR	0.00		0.00		0.00		0.00		6.42	0.00	0.03	0.00	6.42	0.00	0.03	0.00	5.68	0.00	0.75	0.00	0.00	0.00
COTTLE	0.00		0.00		0.00		0.00		1.92	0.00	0.01	0.00	1.92	0.00	0.01	0.00	(19.40)	(0.00)	0.27	0.00	(0.00)	0.00
CRANE	32.01		0.16		0.00		0.00		4.27	0.00	0.02	0.00	36.28	0.00	0.18	0.00	853.99	0.00	2.29	0.00	0.00	0.00
DELTA	6.43		0.04		0.00		0.00		12.47	0.00	0.06	0.00	18.90	0.00	0.10	0.00	34.91	0.00	2.10	0.00	0.00	0.00
DICKENS	0.00		0.00		0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DUVAL	0.00		0.00		0.00		0.00		28.49	0.00	0.14	0.00	28.49	0.00	0.14	0.00	(271.94)	(0.00)	3.83	0.00	(0.00)	0.00
EASTLAND	2.19		0.01		0.00		0.00		72.55	0.00	0.36	0.00	74.74	0.00	0.37	0.00	(326.30)	(0.00)	5.59	0.00	(0.00)	0.00
EDWARDS	0.00		0.00		0.00		0.00		0.87	0.00	0.00	0.00	0.87	0.00	0.00	0.00	(8.72)	(0.00)	0.13	0.00	(0.00)	0.00
FISHER	0.00		0.00		0.00		0.00		8.67	0.00	0.04	0.00	8.67	0.00	0.04	0.00	(22.68)	(0.00)	1.08	0.00	(0.00)	0.00
FOARD	0.00		0.00		0.00		0.00		0.32	0.00	0.00	0.00	0.32	0.00	0.00	0.00	(3.23)	(0.00)	0.05	0.00	(0.00)	0.00
GLASSCOCK	0.00		0.00		0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GOLIAD	0.00		0.00		0.00		0.00		5.51	0.00	0.03	0.00	5.51	0.00	0.03	0.00	(55.64)	(0.00)	0.78	0.00	(0.00)	0.00
HALL	1.70		0.01		0.00		0.00		0.68	0.00	0.00	0.00	2.37	0.00	0.01	0.00	131.38	0.00	0.20	0.00	0.00	0.00
HUDSPETH	21.86		0.10		2.44		0.01		12.13	0.00	0.06	0.00	36.42	0.00	0.17	0.00	528.67	0.00	2.99	0.00	0.00	0.00
IRION	0.00		0.00		0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JEFF DAVIS	0.00		0.00		0.00		0.00		11.69	0.00	0.06	0.00	11.69	0.00	0.06	0.00	(117.17)	(0.00)	1.97	0.00	(0.00)	0.00
KENEDY	0.00		0.00		0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
KENT	0.00		0.00		0.00		0.00		5.26	0.00	0.03	0.00	5.26	0.00	0.03	0.00	24.68	0.00	0.57	0.00	0.00	0.00
KING	0.00		0.00		0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
KINNEY	0.00		0.00		0.00		0.00		5.07	0.00	0.02	0.00	5.07	0.00	0.02	0.00	(44.15)	(0.00)	0.60	0.00	(0.00)	0.00
KNOX	0.00		0.00		0.00		0.00		3.13	0.00	0.02	0.00	3.13	0.00	0.02	0.00	(31.44)	(0.00)	0.48	0.00	(0.00)	0.00
LA SALLE	24.49		0.11		0.00		0.00		8.92	0.00	0.05	0.00	33.41	0.00	0.16	0.00	374.22	0.00	1.95	0.00	0.00	0.00
LEON	0.00		0.00		0.00		0.00		20.75	0.00	0.10	0.00	20.75	0.00	0.10	0.00	(210.45)	(0.00)	3.30	0.00	(0.00)	0.00
LOVING	0.00		0.00		0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MENARD	0.00		0.00		0.00		0.00		2.62	0.00	0.01	0.00	2.62	0.00	0.01	0.00	(18.86)	(0.00)	0.37	0.00	(0.00)	0.00
MILLS	0.00		0.00		0.00		0.00		13.08	0.00	0.06	0.00	13.08	0.00	0.06	0.00	(131.80)	(0.00)	1.93	0.00	(0.00)	0.00
MONTAGUE	2.13		0.01		0.00		0.00		56.19	0.00	0.29	0.00	58.32	0.00	0.30	0.00	(185.48)	(0.00)	5.45	0.00	(0.00)	0.00
MOTLEY	0.00		0.00		0.00		0.00		0.80	0.00	0.00	0.00	0.80	0.00	0.00	0.00	(8.10)	(0.00)	0.11	0.00	(0.00)	0.00
REAL	0.00		0.00		0.00		0.00		8.59	0.00	0.05	0.00	8.59	0.00	0.05	0.00	17.96	0.00	1.13	0.00	0.00	0.00
SCHLEICHER	4.06		0.02		0.00		0.00		0.00	0.00	0.00	0.00	4.06	0.00	0.02	0.00	116.99	0.00	0.20	0.00	0.00	0.00
SHACKELFORD	0.00		0.00		0.00		0.00		13.06	0.00	0.07	0.00	13.06	0.00	0.07	0.00	(59.51)	(0.00)	1.77	0.00	(0.00)	0.00
STARR	0.00		0.00		0.00		0.00		256.71	0.00	1.25	0.00	256.71	0.00	1.25	0.00	(2,333.60)	(0.01)	35.45	0.00	(0.01)	0.00
STERLING	0.00		0.00		0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STONEWALL	0.00		0.00		0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUTTON	0.00		0.00		0.00		0.00		18.30	0.00	0.10	0.00	18.30	0.00	0.10	0.00	(37.84)	(0.00)	2.25	0.00	(0.00)	0.00
TERRELL	0.00		0.00		0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
THROCKMORTON	0.00		0.00		0.00		0.00		1.85	0.00	0.01	0.00	1.85	0.00	0.01	0.00	(18.56)	(0.00)	0.31	0.00	(0.00)	0.00
ZAPATA	0.00		0.00		0.00		0.00		60.01	0.00	0.29	0.00	60.01	0.00	0.29	0.00	(548.18)	(0.00)	8.28	0.00	(0.00)	0.00
TOTAL	**156,803.12**	**102.92**	**918.52**	**0.60**	**18,057.18**	**11.81**	**115.90**	**0.08**	**90,227.41**	**62.23**	**590.76**	**0.39**	**265,087.71**	**176.96**	**1,625.18**	**1.06**	**2,991,843.77**	**13.76**	**26,011.08**	**0.12**	**190.72**	**1.18**



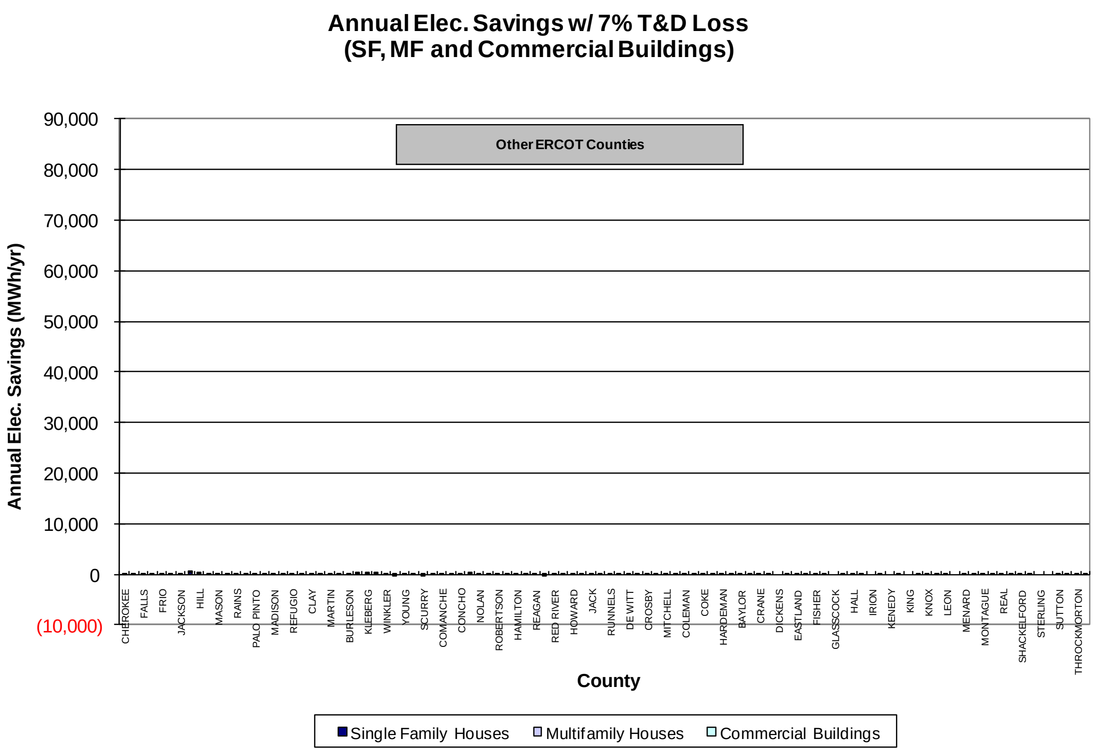
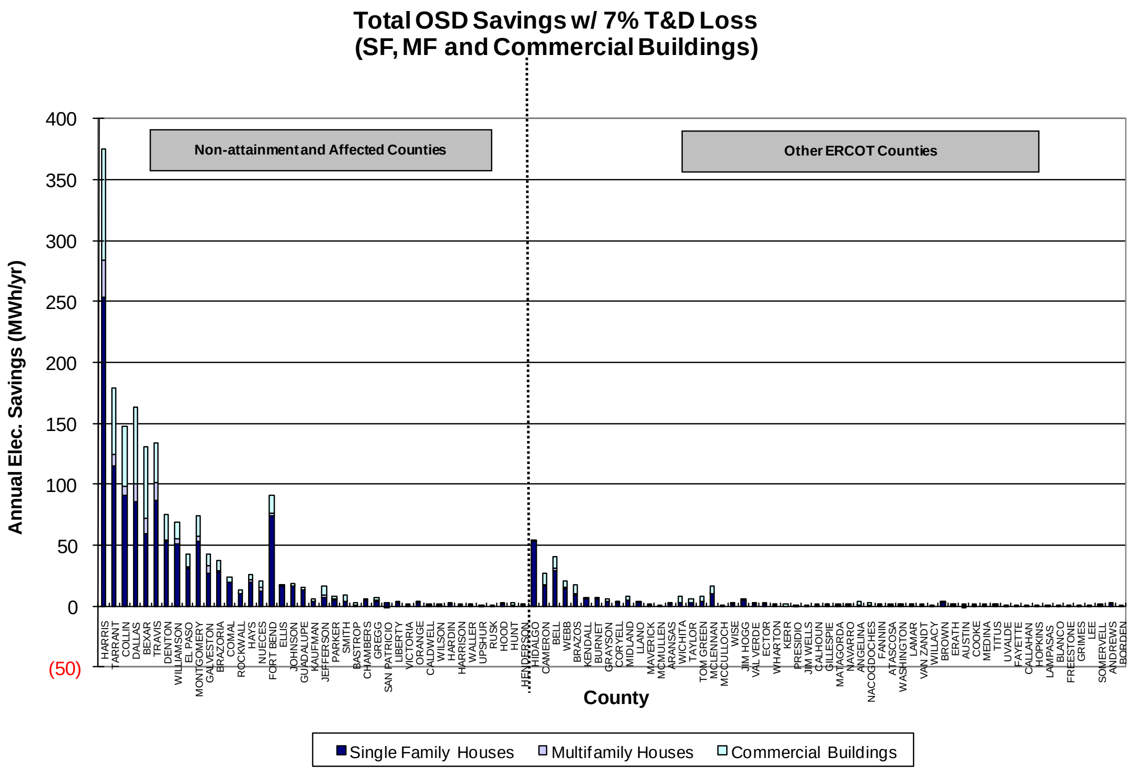


Figure 82: 2008 Annual Electricity Reductions from IECC/IRC by PCA for Single-family and Multi-family Residences and for Commercial Buildings by County



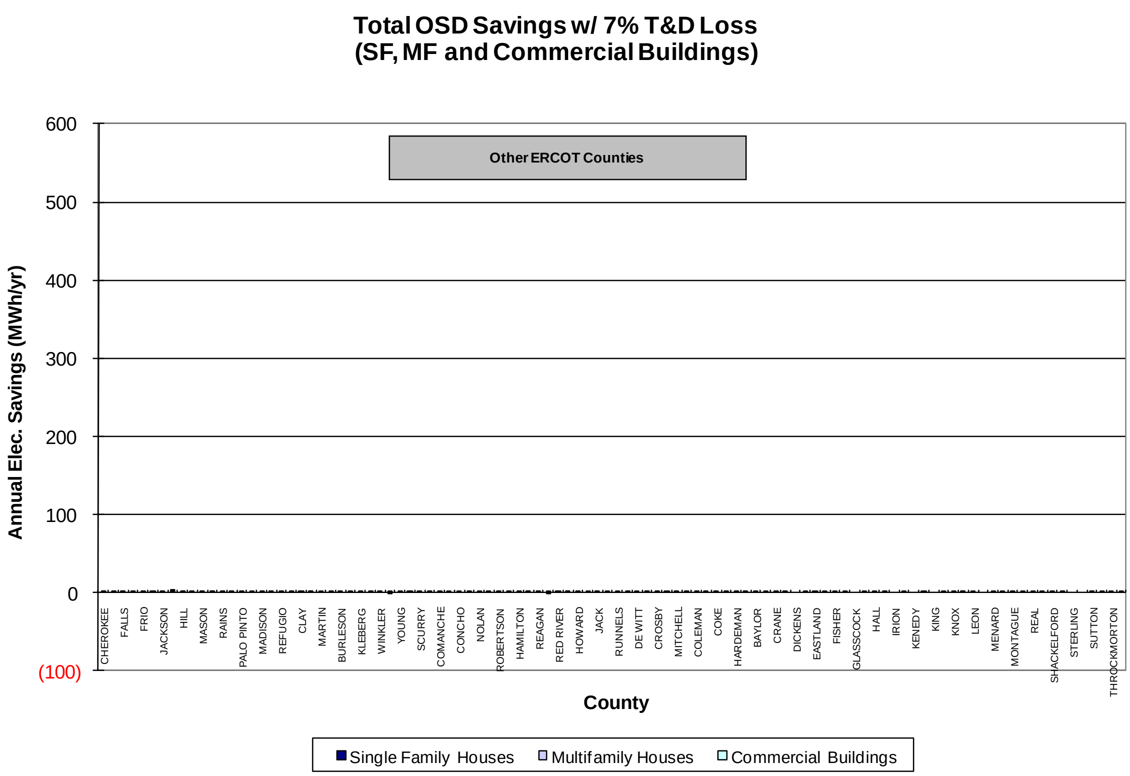
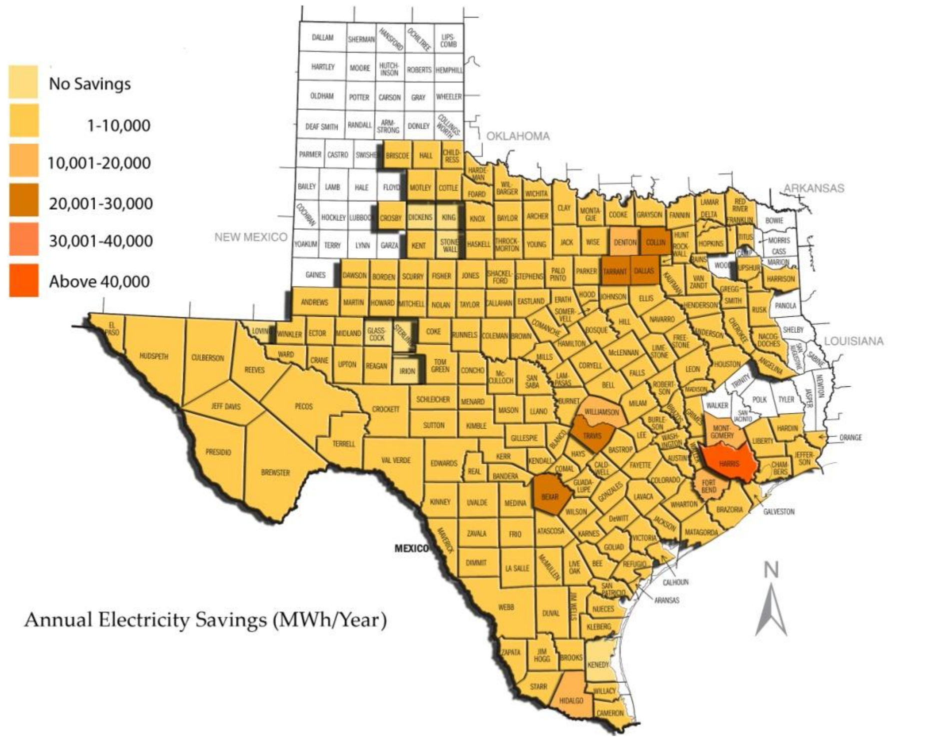


Figure 83: 2008 OSD Electricity Reductions from IECC/IRC by PCA for Single-family and Multi-family Residences and for Commercial Buildings by County



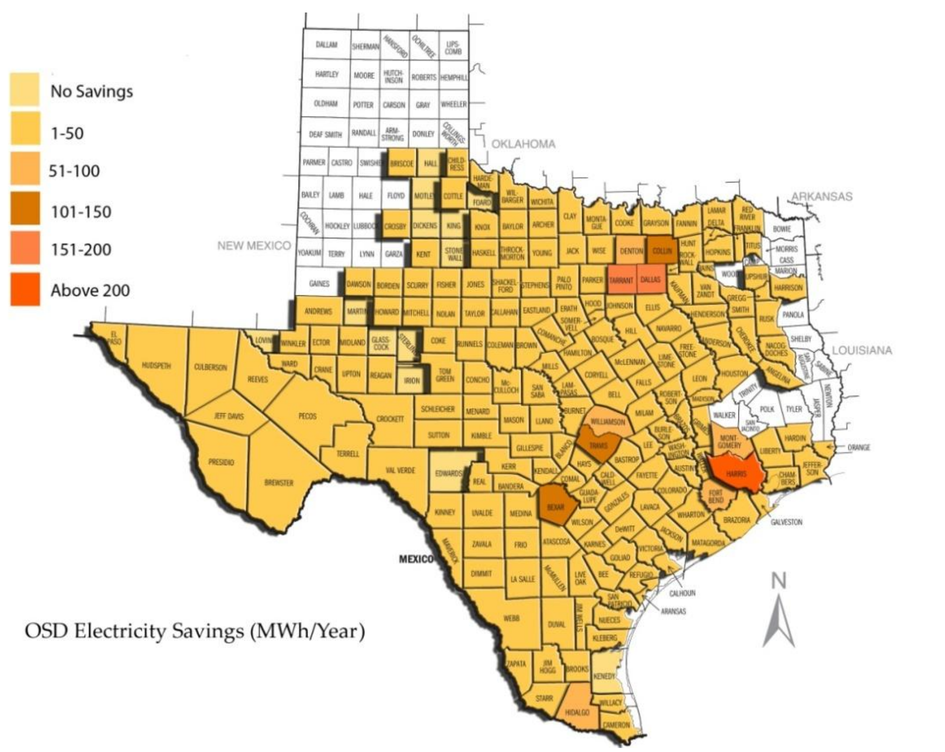
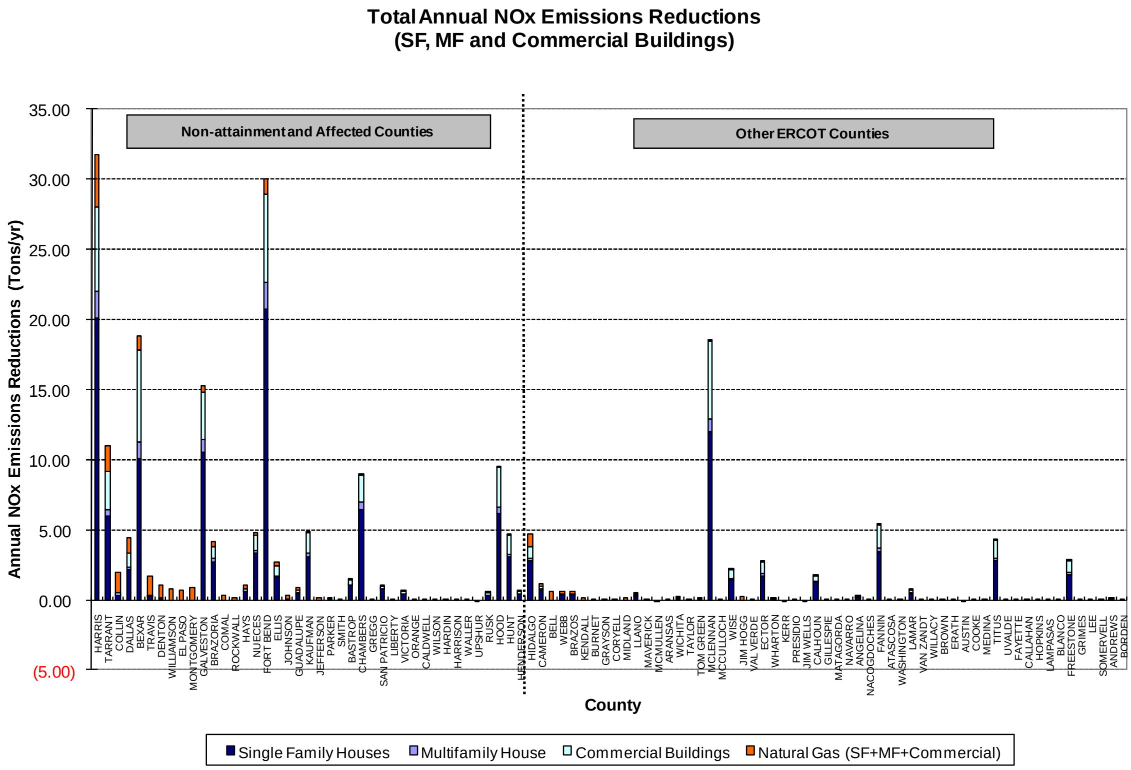


Figure 84: 2008 Annual and OSD Electricity Reductions from IECC/IRC by PCA for Single-family and Multi-family Residences and for Commercial Buildings by County



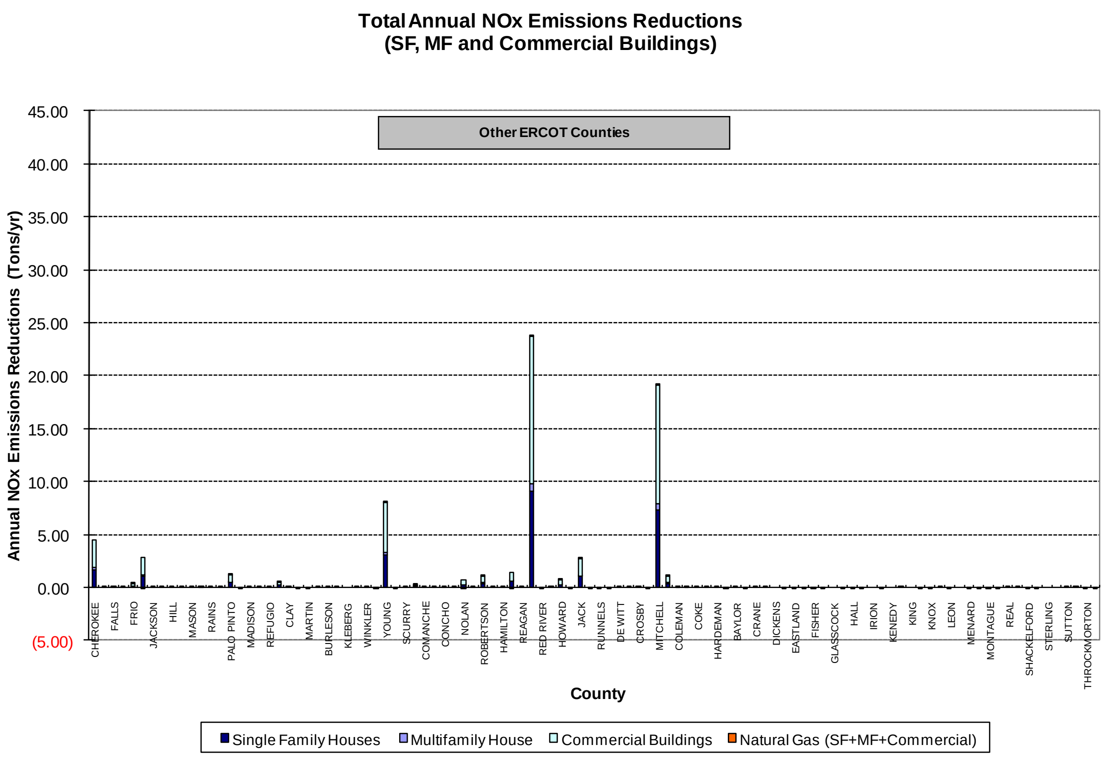
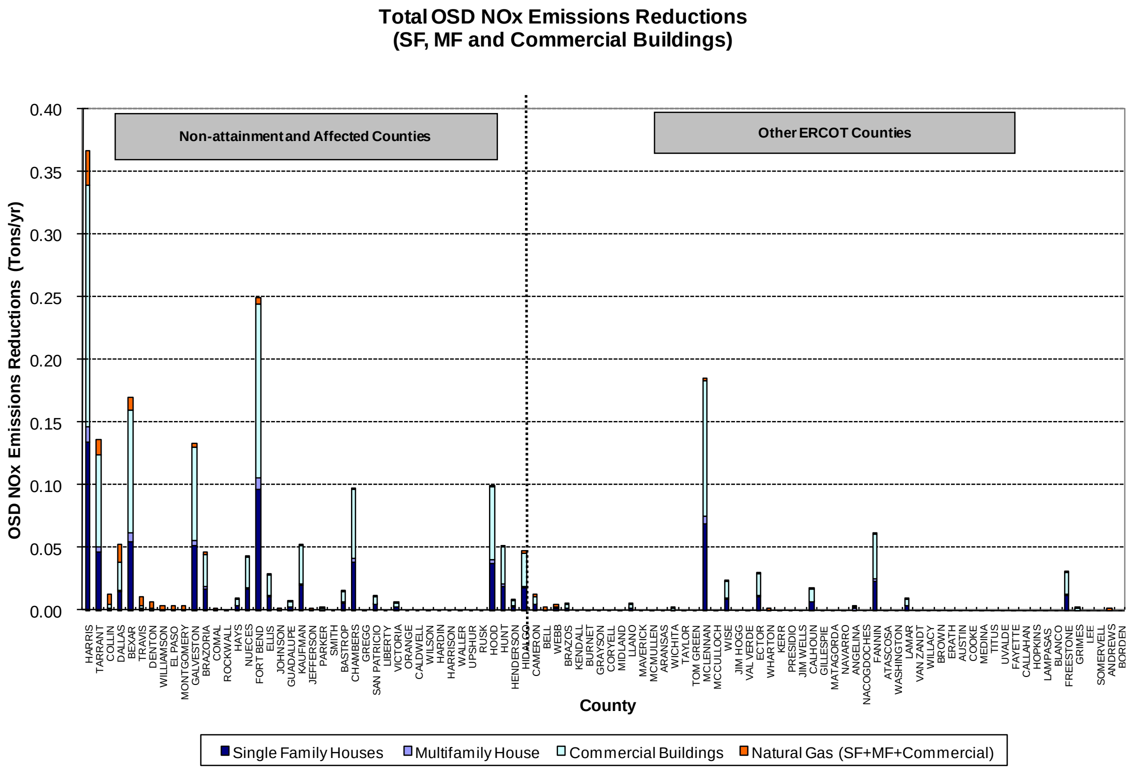


Figure 85: 2008 Annual NOx Reductions from Electricity and Natural Gas Savings Due to the IECC/IRC for Single-family and Multi-family Residences and for Commercial Buildings by County (using 1999 eGRID)



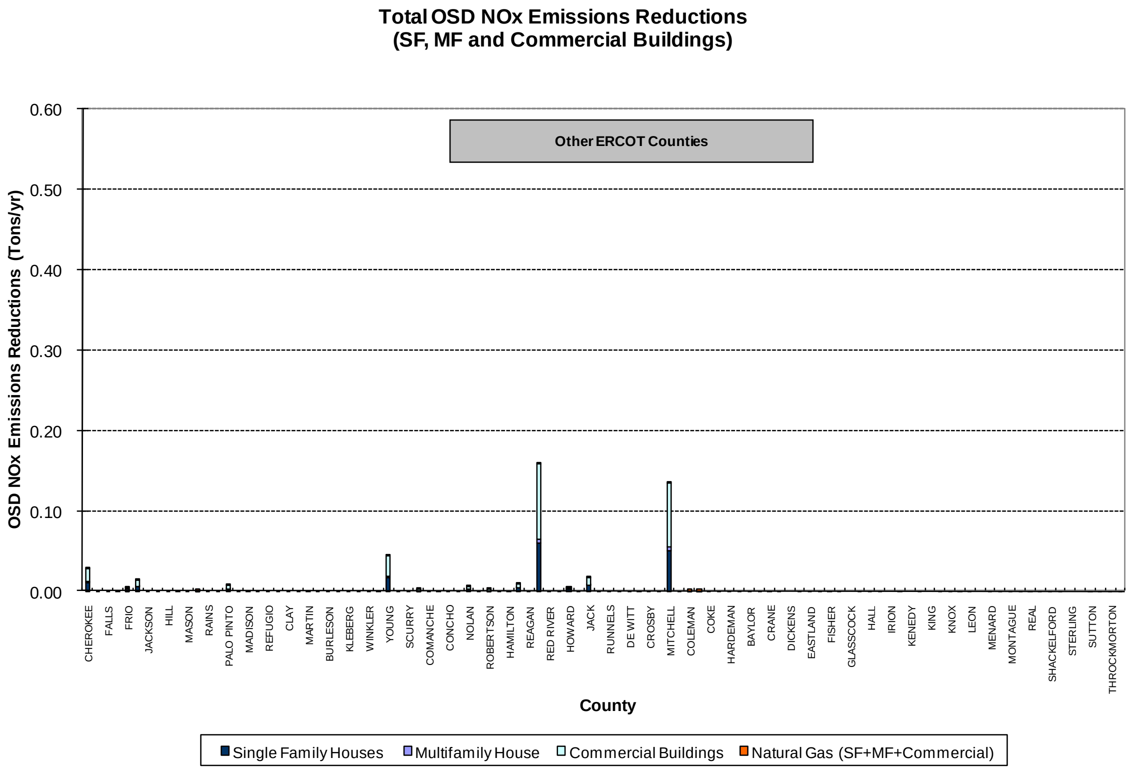
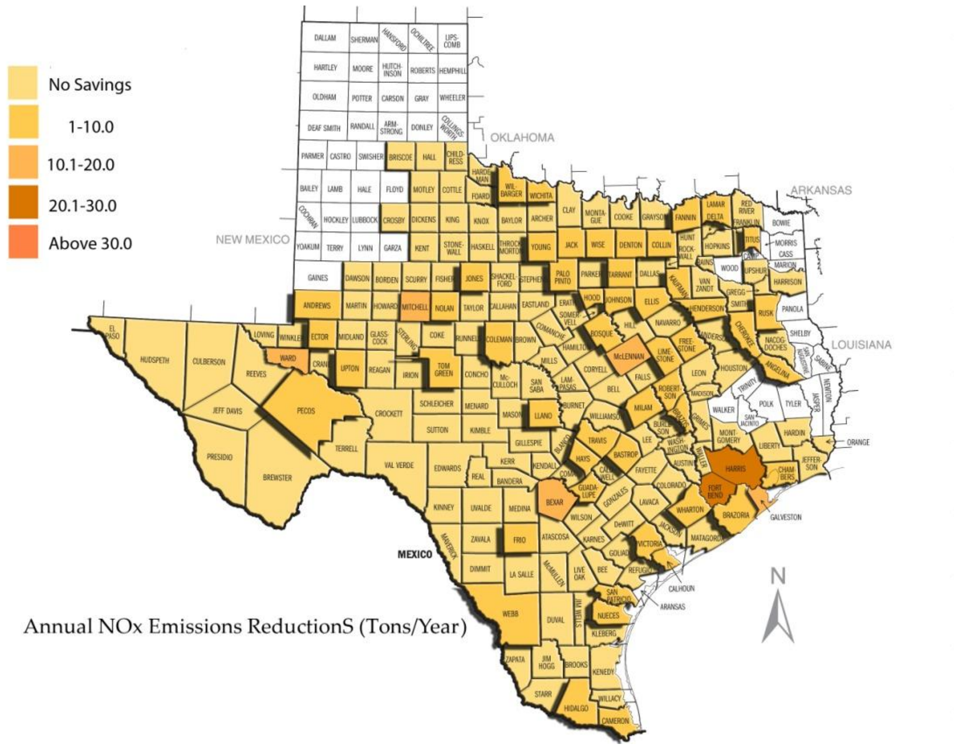


Figure 86: 2008 OSD NOx Reductions from Electricity and Natural Gas Savings Due to the IECC/IRC for Single-family and Multi-family Residences and for Commercial Buildings by County (using 2007 eGRID)



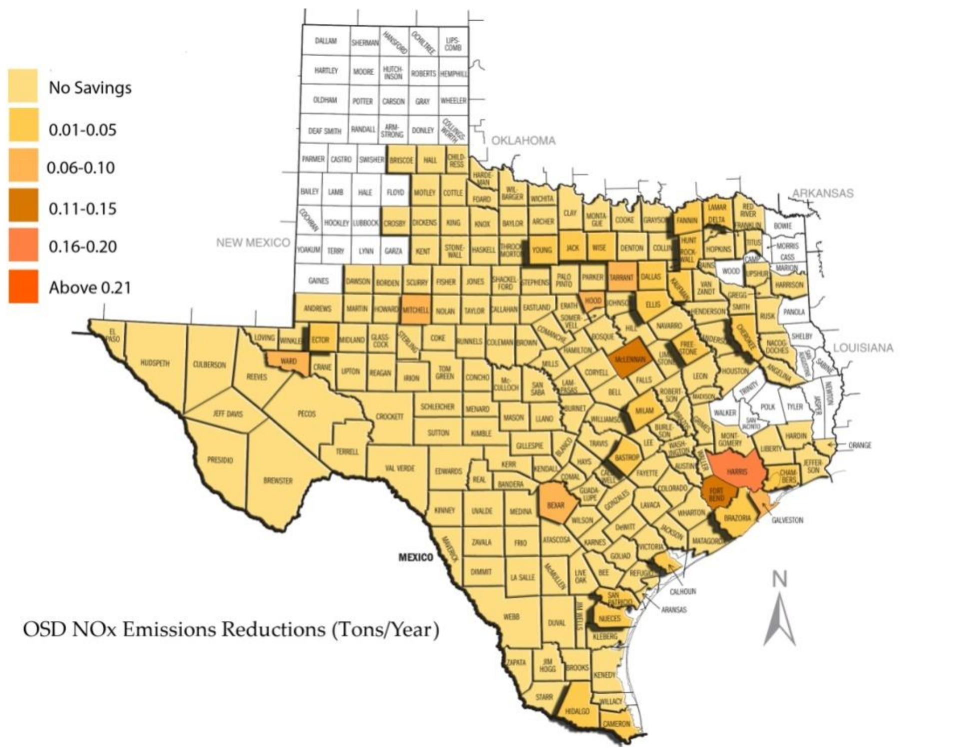
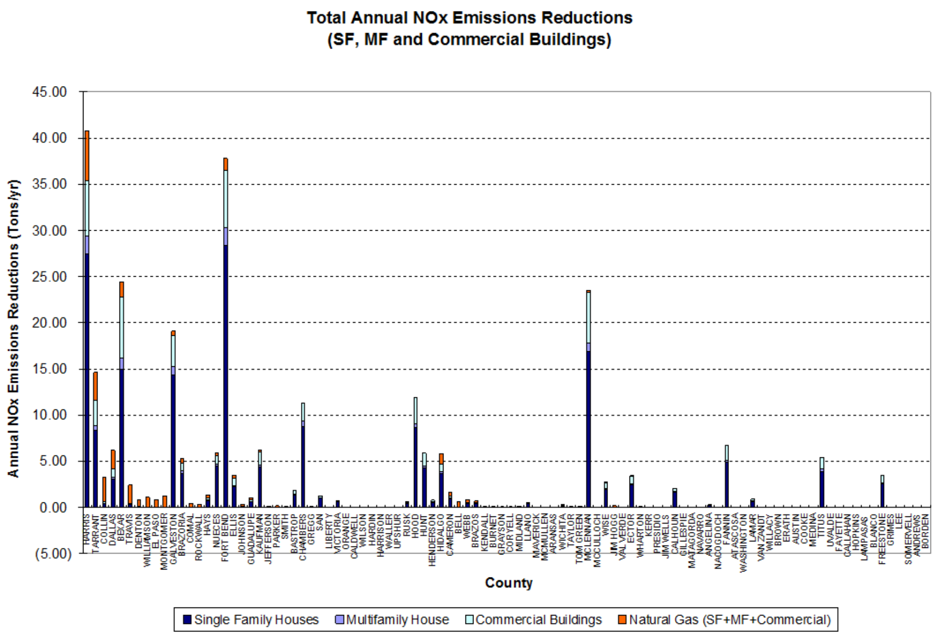


Figure 87: 2008 Annual and OSD NOx Reductions from Electricity and Natural Gas Savings Due to the IECC/IRC for Single-family and Multi-family Residences and for Commercial Buildings by County (using 2007 eGRID)

7 COMPARISON OF 2008 EMISSIONS REDUCTIONS VS 2007 EMISSIONS REDUCTIONS

In this section a side-by-side comparison is presented of the 2008 emissions reductions calculations versus the 2007 emissions reductions for both the annual and Ozone Season Day (OSD). In Figure 88 and Figure 89 the annual and OSD NOx reductions are presented for the 2007 analysis, respectively. These can be compared to the values presented in Figure 90 and Figure 91 for the 2008 analysis.



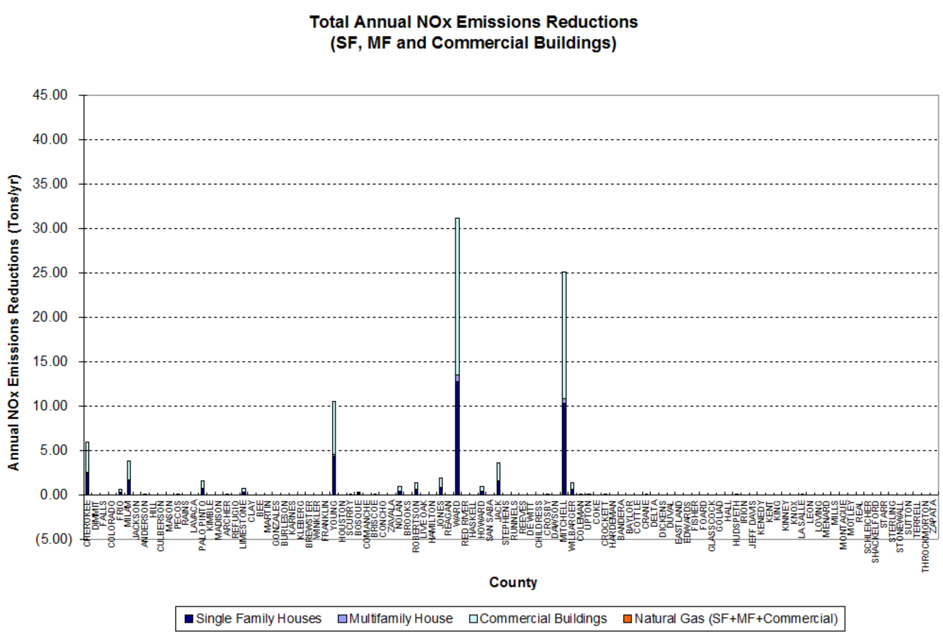
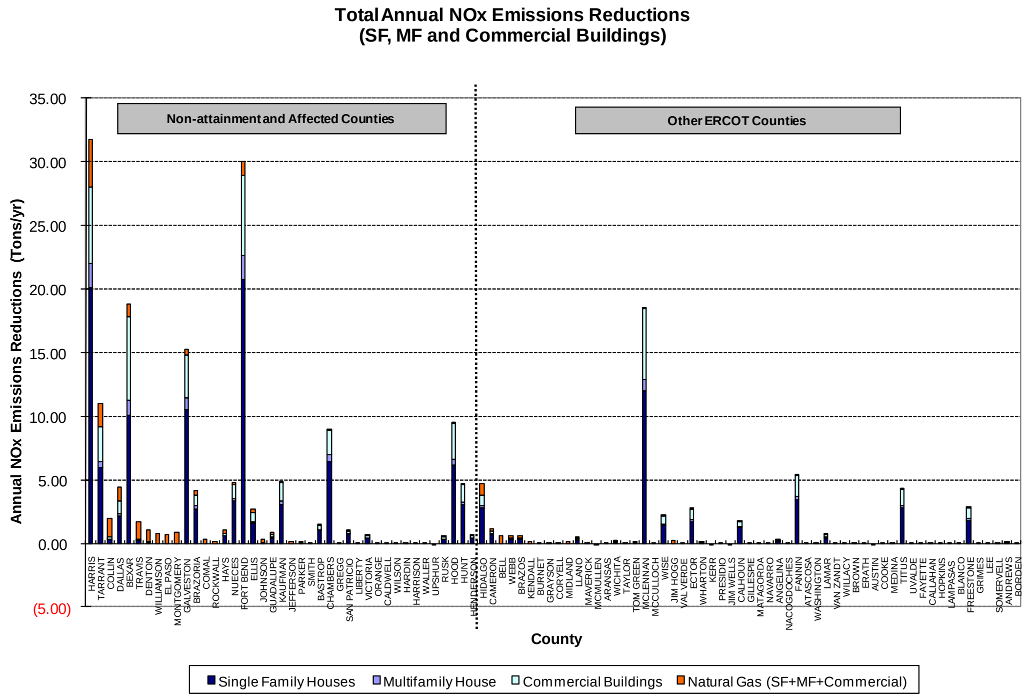


Figure 88: 2007 Annual NOx Reductions from Electricity and Natural Gas Savings Due to the IECC/IRC for Single-family, Multi-family Residences, and Commercial Buildings by County (using 2007 eGRID)



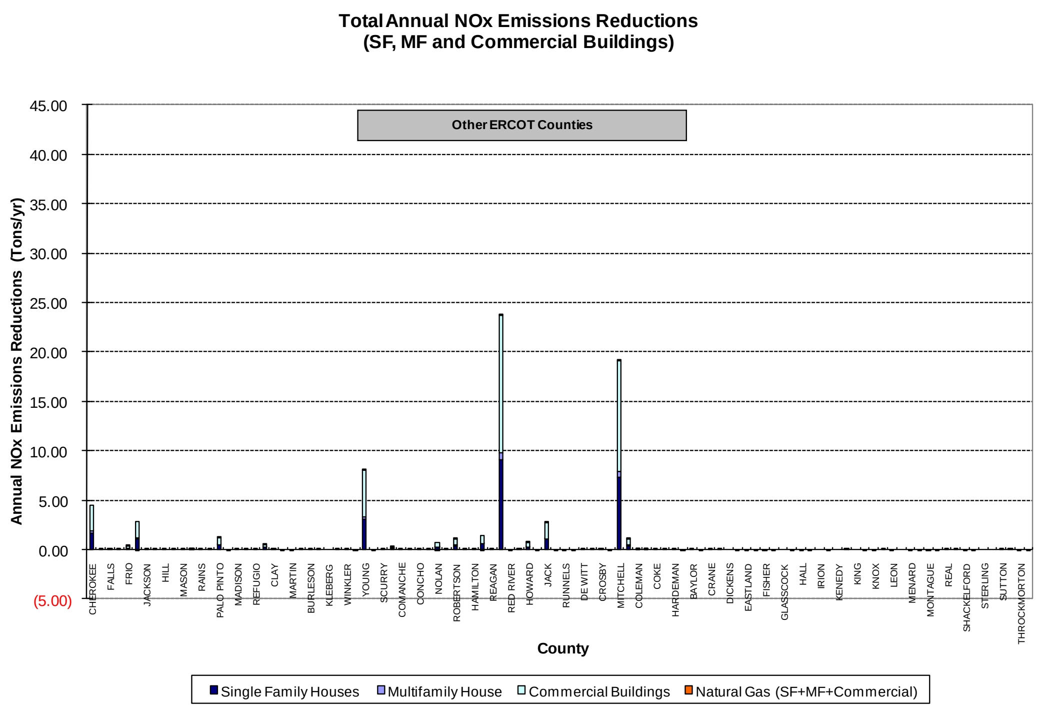
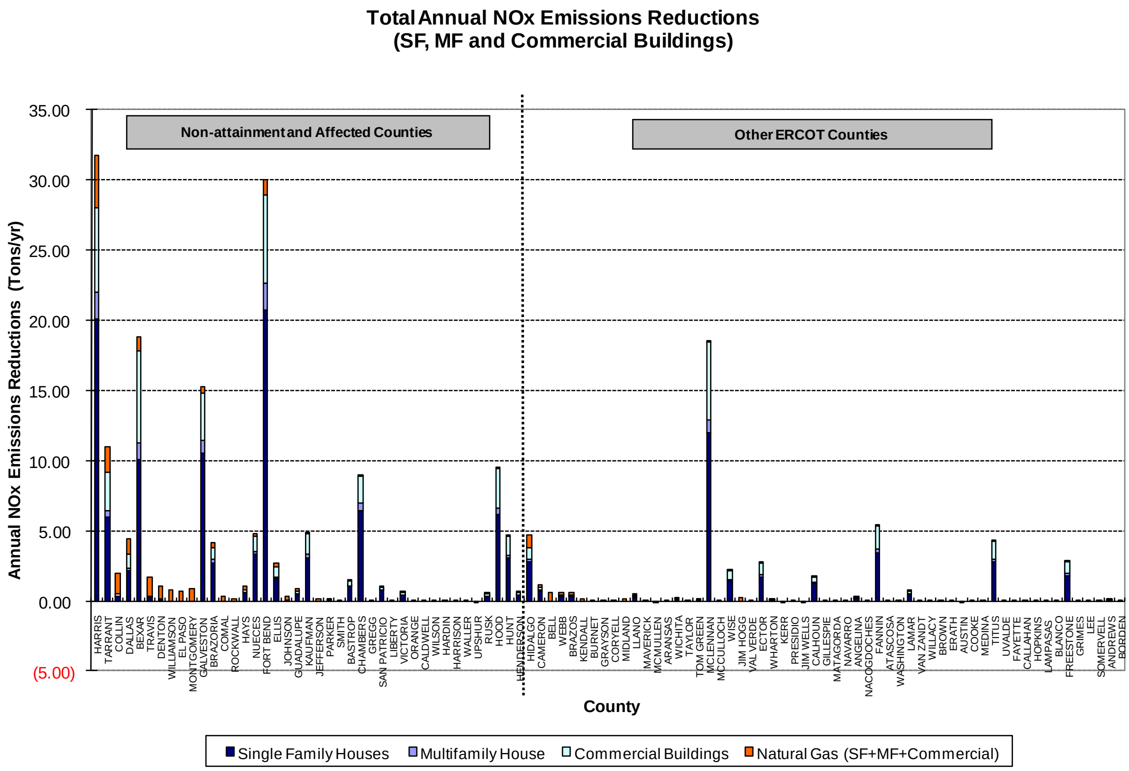


Figure 89: 2007 OSD NOx Reductions from Electricity and Natural Gas Savings Due to the IECC/IRC for Single-family, Multi-family Residences, and Commercial Buildings by County (Using 2007 eGRID)



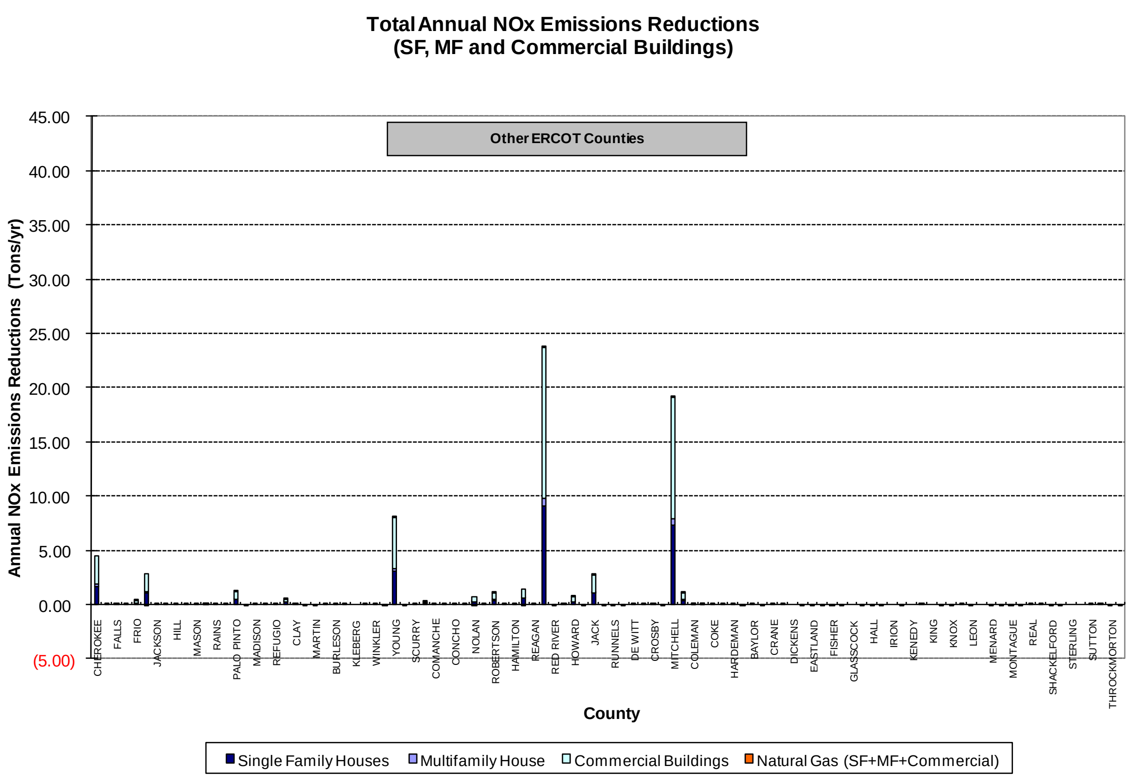
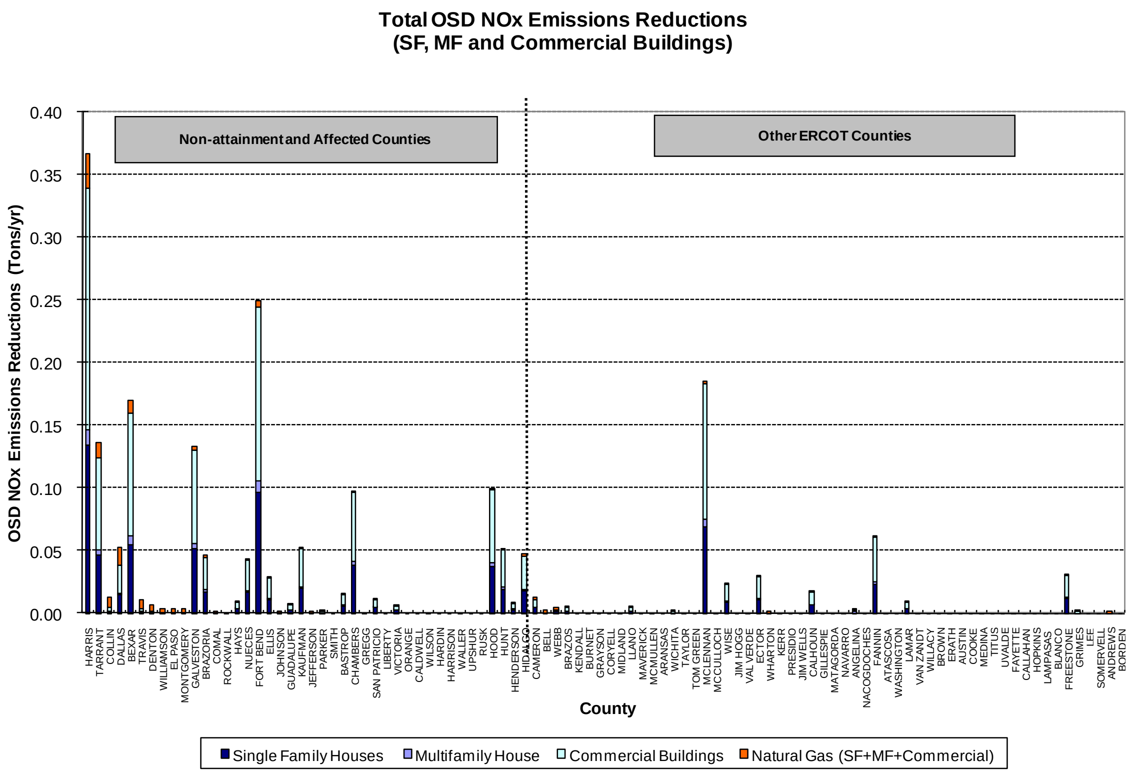


Figure 90: 2008 Annual NOx Reductions from Electricity and Natural Gas Savings Due to the IECC/IRC for Single-family and Multi-family Residences and for Commercial Buildings by County (using 1999 eGRID)



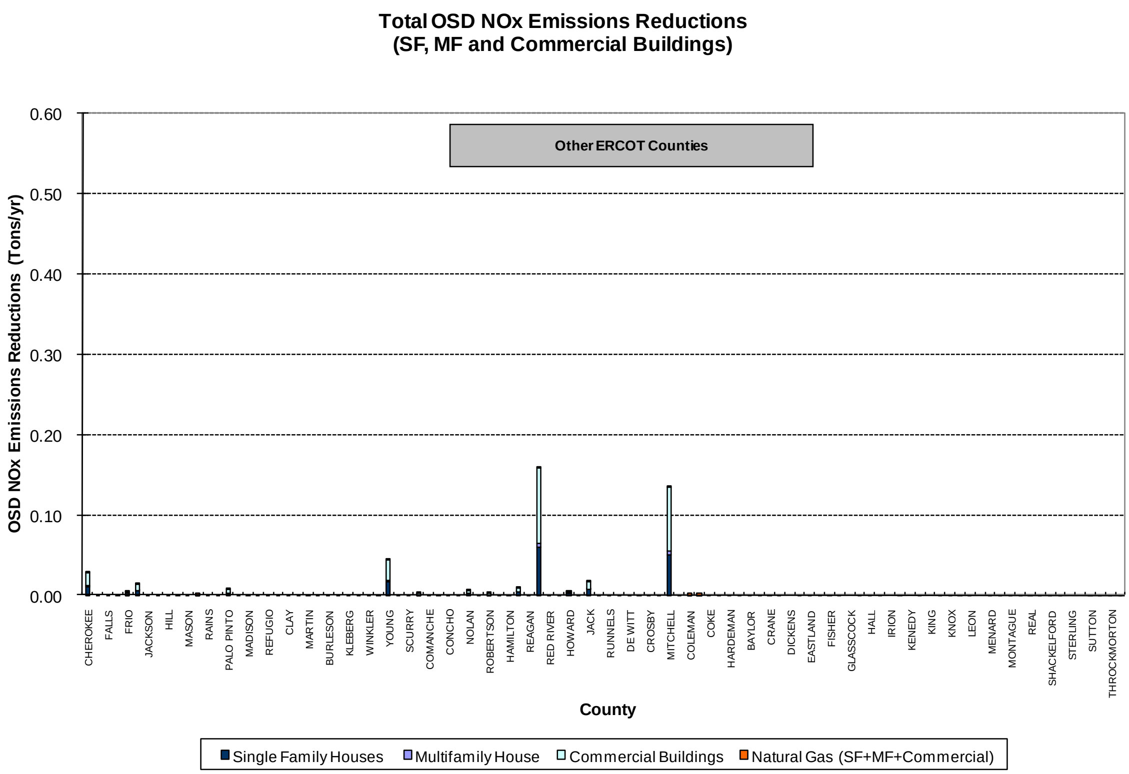


Figure 91: 2008 OSD NOx Reductions from Electricity and Natural Gas Savings Due to the IECC/IRC for Single-family and Multi-family Residences and for Commercial Buildings by County (using 2007 eGRID)

8 CALCULATION OF INTEGRATED NOx EMISSIONS REDUCTIONS FROM MULTIPLE STATE AGENCIES PARTICIPATING IN THE TEXAS EMISSIONS REDUCTION PLAN (TERP)

8.1 Background

In January 2005, the Laboratory was asked by the Texas Commission on Environmental Quality (TCEQ) to develop a method by which the NOx emissions savings from the energy-efficiency programs from multiple Texas State Agencies working under Senate Bill 5 and Senate Bill 7 could be reported in a uniform format to allow the TCEQ to consider the combined savings for Texas' State Implementation Plan (SIP) planning purposes. This required that the analysis should include the cumulative savings estimates from all projects projected through 2020 for both the annual and Ozone Season Day (OSD) NOx reductions. The NOx emissions reduction from all these programs were calculated using estimated emissions factors for 2007 from the US Environmental Protection Agency (US EPA) eGRID database, which had been specially prepared for this purpose. The different programs included in the 2006 cumulative analysis are:

- ESL Single-family new construction
- ESL Multi-family new construction
- ESL Commercial new construction
- Federal Buildings
- Furnace Pilot Light Program
- PUC Senate Bill 7 and Senate Bill 5 Program
- SECO TERP Program
- Electricity generated by wind farms in Texas (ERCOT)[42]
- SEER13 upgrades to Single-family and Multi-family residences

The Laboratory's single-family and multi-family programs include the energy savings attained by constructing new residences in Texas according to the IECC 2000/2001 building code (IECC 2000). The baseline for comparison for the code programs is the published data on residential construction characteristics by the National Association of Home Builders (NAHB) for 1999 (NAHB 1999). Annual electricity (MWh) and natural gas (MBtu) savings are from the Laboratory's Annual Reports to the TCEQ (Haberl et al., 2002 - 2007).

The Texas Public Utility Commission's (PUC) Senate Bill and Senate Bill 7 programs include their incentive and rebates programs managed by the different Utilities for Texas (PUC 2007). These include the Residential Energy Efficiency Programs (REEP) as well as the Commercial & Industrial Standard Offer Programs (C&I SOP). The energy efficiency measures include high efficiency HVAC equipment, variable speed drives, increased insulation levels, infiltration reduction, duct sealing, Energy Star Homes, etc. Annual electricity savings according to the utilities (or Power Control Authorities – PCAs) were reported for the different programs completed in the years 2001 through 2007. The PUC also reported the savings from the TERP grant program which was conducted in 2002 and 2003.

The Texas State Energy Conservation Office (SECO) funds energy-efficiency programs directed towards school districts, government agencies, city and county governments, private industries and residential energy consumers. For the 2007 reporting year SECO submitted annual energy savings values for 149 projects which included projects funded by SECO and by Energy Service projects.

The *Electric Reliability Council of Texas (ERCOT) electricity production from currently installed green power generation (wind)* in Texas is reported. Projections through 2013 include planned projects by ERCOT, annual growth factors beyond 2013 comply with the Legislative requirements. Actual measured electricity production for 2001 through 2007, were included.

Finally, NOx emissions reductions from several other programs are also reported, including: energy efficiency *measures applied to Federal buildings in Texas, reductions from the elimination of pilot lights in*

[42] ERCOT is the Electric Reliability Council of Texas.

residential furnaces, and reductions from the installation of SEER 13 air conditioners in existing residences.

8.2 Description of the Analysis Method

Annual and Ozone Season Day (OSD) NOx emissions reduction were calculated for 2008 and cumulatively from 2006 to 2020 using several factors to discount the potential savings. These factors include an annual degradation factor, a transmission and distribution factor, a discount factor and growth factors as shown in Table 59, and are described as follows:

Annual degradation factor: This factor was used to account for an assumed decrease in the performance of the measures installed as the equipment wears down and degrades. With the exception of electricity generated from wind, an annual degradation factor of 5% was used for all the programs[43]. This value was taken from a study by Kats et al. (1996).

Transmission and distribution loss: This factor adjusts the reported savings to account for the loss in energy resulting from the transmission and distribution of the power from the electricity producers to the electricity consumers. For this calculation, the energy savings reported at the consumer level are increased by 7% to give credit for the actual power produced that is lost in the transmission and distribution system on its way to the customer. In the case of electricity generated by wind, the T&D losses were assumed to cancel out since wind energy is displacing power produced by conventional power plants; therefore, there is no net increase or decrease in T&D losses.

Initial discount factor: This factor was used to discount the reported savings for any inaccuracies in the assumptions and methods employed in the calculation procedures. For the Laboratory's single- and multi-family program, the discount factor was assumed to be 20%. For PUC's TERP and Senate Bill 2007 programs and electricity from wind, the discount factor was taken as 25%. For the savings in the SECO program, the discount factor was 60%.

Growth factor: The growth factors shown in Table 59 were used to account for several different factors. Growth factors for single-family (3.25%) and multi-family residential (1.54%) construction are projections based on the average growth rate for these housing types from recent U.S. Census data for Texas. Growth factors for wind energy are from the Texas Public Utilities Commission[44]. No growth was assumed for Federal buildings, pilot lights, PUC programs and SECO entries.

Figure 92 shows the overall information flow that was used to calculate the NOx emissions savings from the annual and Ozone Season Day (OSD) electricity savings (MWh) from all programs. For the Laboratory's single-family and multi-family code-implementation programs, the annual and ozone season savings were calculated from DOE-2 hourly simulation models[45]. The base case is taken as the average characteristics of single- and multi-family residences for Texas published by the National Association of Home Builders for 1999 (NAHB 1999). The OSD consumption is the average daily consumption for the period between July 15 and September 15, 1999.The annual electricity savings from PUC programs were calculated using deemed savings tables and spreadsheets created for the utilities incentive programs by Frontier Associates in Austin, Texas (PUC 2007).

[43] A degradation of 5% per year would accumulate as a 5%, 10%, 15%...etc, degradation in performance. Although the assumption of this high level of degradation may not actually occur, it was chosen as a conservative estimate. For wind energy, a degradation factor of 0% was used. The choice of a 0% degradation factor for wind is based on two years of analysis of measured wind data from all Texas wind farms that shows no degradation, on average, for a two year period after the wind farms became operational.

[44] The growth factors for wind energy through 2012 are based on permitted wind farms registered with the Texas Public Utilities Commission, http://www.puc.state.tx.us/electric/maps/gen_tables.xls. Growth factors for 2013 through 2020 assume a linear projection based on the permits for 2011 and 2012.

[45] These values are based on a performance analysis as defined by Chapter 4 of IECC 2000/2001. This analysis is discussed in the Laboratory's annual reports to the TCEQ.

The SECO electricity savings were submitted as annual savings by project[46]. A description of the measures completed for the project was also submitted for information purposes. The electricity production from wind farms in Texas was from the actual on-site metered data measured at 15-minute intervals.

Integration of the savings from the different programs into a uniform format allowed for creditable NOx emissions to be evaluated using different criteria as shown in Table 59. These include evaluation across programs, evaluation across individual counties by program, evaluation by SIP area, evaluation for all ERCOT counties except Houston/Galveston, and evaluation within a 200 km radius of Dallas/Ft.Worth.

8.3 Calculation Procedure

ESL Single-family and Multi-family. The calculation of the annual and OSD electricity savings reported for the years 2002 through 2007 included the savings from code-compliant new housing in all 41 non-attainment and affected counties as reported in the Laboratory's annual report submitted by the Laboratory to the Texas Commission of Environmental Quality (TCEQ). The savings for 2001 were also incorporated since some of the programs were reporting savings from September to December 2001. In 2005 to 2007 the annual and OSD electricity savings were calculated for new residential construction in all the counties in ERCOT region, which includes the 41 non-attainment and affected counties. These savings were then tabulated by county and program. Using the calculated values through 2007, savings were then projected to 2020 by incorporating the different adjustment factors mentioned above.

In these calculations, it was assumed that the same amount of electricity savings from the code-complaint construction would be achieved for each year after 2007 through 2020[47]. The projected energy savings through 2020, according to county, were then divided into the different Power Control Authorities (PCA) in eGRID. To determine which PCA was to be used, or in counties with multiple PCA, the allocation to each PCA by county was obtained from PUC's listing published in the Laboratory's 2005 annual report[48].

For the 2008 annual and OSD NOx emissions calculations, the US EPA's 2007 eGRID were used[49]. An example of the eGRID spreadsheet[50] is given in Table 60. The total electricity savings for each PCA were used to calculate the NOx emissions reduction for each of the different counties using the emissions factors contained in eGRID. Similar calculations were performed for each year for which the analysis was required. The cumulative NOx emissions reduction for the electricity savings from residential new construction for 2006 through 2020 is provided in
Table 61. NOx emissions reduction is provided in Table 62.

ESL-Commercial Buildings. The annual and OSD electricity savings for 2002 through 2007 for commercial buildings were obtained from the annual reports for 2005 and 2007 submitted by the Laboratory to TCEQ[51]. These savings were also tabulated by county and program. Using the calculated values through 2007, savings were then projected to 2020 by incorporating the different adjustment factors mentioned above[52]. In the projected 2008 cumulative electricity savings was assumed that the same amount of electricity savings

---

[46] The reporting requirements to the SECO did not require energy savings by project type, although for selected sites, energy savings by project type was available. Annual savings were reported by SECO in 2004. Values for 2005 to 2007 use the adjusted values from 2004 as shown, www.seco.cpa.state.tx.us.

[47] This would include the appropriate discount and degradation factors for each year.

[48] Haberl et al., 2005, pp. 197.

[49] This required two separate versions of the 2007 eGRID, which were specially prepared for Texas by Mr. Art Diem at the US EPA. One of the versions contains estimates of annual SOx, NOx and CO2 data for 2007, using a 25% capacity factor. The second version contains estimates of SOx, NOx and CO2 data for 2007 for an average day in the ozone season period, which runs from Mid July to Mid September.

[50] To use this spreadsheet electricity savings for each PCA is entered in the bottom row of the spreadsheet (MWh). The spreadsheet then allocates the MWh of electricity savings according to the counties (blue columns) where the PCA owned and operated a power plant. Totals for all PCAs are then listed on the far right columns (white columns). Similar spreadsheets for the 2007 eGRID exist for SOx and CO2.

[51] These savings include new construction in office, assembly, education, retail, food, lodging and warehouse construction as defined by Dodge building type (Dodge 2005), using energy savings from the Pacific Northwest National Laboratory (USDOE 2004), and data from CBECS (1995 - 2003).

[52] This also includes the appropriate discount and degradation factors for each year.

from 2007 would be achieved for each year after 2007 through 2020. Similarly to the single family calculations, the projected energy saving numbers through 2020, by county, were allocated into the appropriate Power Control Authorities (PCA).

Federal Buildings. Energy savings achieved from Energy Savings Performance Contracts (ESPCs) were also reported in 2008. This includes savings (estimated) from energy conservation measures implemented in Federal Buildings in Texas. The 2008 savings include projects implemented in 14 Federal buildings reported by the regional office of the Department of Energy. Annual kWh savings reported for each of the projects were divided by 365 to obtain the average Ozone Season Day savings[53]. In the calculation for 2008, it was assumed that the electricity savings from 2006 would also be achieved for each year from 2008 through 2020 after the appropriate degradation factors were applied. Similarly to the single family calculations, the projected energy saving numbers through 2020, by county, were proportioned into the PUC's Power Control Authorities (PCA) and the cumulative NOx emission reduction values calculated.

Furnace Pilot Light Program. For the furnace pilot light program savings, the N.G. energy savings achieved by retrofitting existing furnaces in single-family and multi-family residences for the entire residential stock for Texas have been projected until 2020. Pilot light removal saves an estimated 500 Btu/hr of natural gas for each hour of operation for the entire life of the furnace when the furnace is replaced with a code-compliant replacement. The energy savings for the Ozone Season Day are calculated by dividing the annual number by 365. It is also being assumed that of the total furnaces that were retrofitted, 75% are operational during the Ozone Season Period. Cumulative NOx emissions reduction for the N.G. savings from the removal of furnace pilot lights were also calculated by county for 2006 through 2020 by SIP area[54].

PUC-Senate Bill 7. For the PUC Senate Bill 7 program savings, the annual electricity savings for 2001 through 2007 were obtained from the Public Utilities Commission[55]. Using these values savings were projected through 2020 by incorporating the different adjustment factors mentioned above. Similar savings were assumed for each year after 2008 until 2020. The 2007 annual and OSD eGRID was also used to calculate the NOx emissions savings for the PUC-Senate Bill 7 program. The total electricity savings for each PCA were used to calculate the NOx emissions reduction for each county using the emissions factors contained in the US EPA's eGRID spreadsheet. The cumulative NOx emissions reduction for each county by SIP area for the different programs was then calculated.

PUC-TERP Grants Program. To calculate the annual electricity savings from the PUC's TERP program, electricity savings were also obtained from the Public Utilities Commission[56]. The annual and average day electricity savings were then proportioned according to the PCA and program. Using the actual reported numbers through 2007, savings through 2020 were projected incorporating the different adjustment factors mentioned above[57]. The 2007 annual and OSD eGRID were used to calculate the NOx emissions savings for PUC-TERP Grants Program. The total electricity savings for each PCA were used to calculate the NOx emissions reduction for each of the different counties.

SECO Savings. The annual electricity savings from energy conservation projects reported by political subdivisions for 35 counties through 2007 were obtained from the State Energy Conservation Office[58].

---

[53] This method yields suitable OSD values for lighting retrofits and/or retrofits that are not weather dependent. In the case of retrofits to cooling systems, weather normalization would increase the OSD savings substantially. Retrofits to heating systems would be reduced by weather normalization.

[54] These use the NOx/MBtu values provided in the US EPA AP 42 guideline.

[55] In a similar fashion to the previous programs, to obtain the Ozone Season Day (OSD) savings, the annual electricity savings were divided by 365.

[56] In a similar fashion as the PUC's Senate Bill 7 program, the annual electricity savings numbers were then divided by 365 to get average electricity savings per day for OSD calculations. The preferred approach would be to weather-normalize the savings and then calculate savings for the OSD period. However, only annual values were obtained for the 2005 report to the TCEQ. Dividing the annual values by 365 is probably a reasonable approach for lighting projects. However, this undercounts potential savings from electric loads associated with the cooling season.

[57] Since the savings for the PUC's Senate Bill 5 were only reported for two years these savings actually reduced due to the imposed degradation factor.

[58] In a similar fashion as the PUC's Senate Bill 5 and 7 programs, these annual electricity savings numbers were divided by 365 to get average electricity savings per day for the OSD calculations.

These submittals included information gathered from SECO's website[59] and paper submittals[60]. The annual and average day electricity values where then summarized according to county and program. Using the actual reported numbers for 2004, savings through 2020 were projected using the different adjustment factors mentioned above. In a similar fashion as the previous programs it was assumed that the same amount of electricity savings will be achieved for each year after 2005 until 2020. The 2007 annual and OSD eGRID were then used to calculate the NOx emissions savings for the SECO program.

Electricity Generated by Wind Farms. The measured electricity production from all the wind farms in Texas for 2001 through 2007 was obtained from the Energy Reliability Council of Texas (ERCOT). To obtain the annual production, the 15-minute data were summed for the 12 months, while for the OSD period the data were converted to average daily electricity production during the months of July, August and September. Using the reported numbers for 2007, savings through 2020 were projected incorporating the different adjustment factors mentioned above. The 2007 annual and OSD eGRID were then used to calculate the NOx emissions reduction for the electricity generated by Texas' wind farms[61]. The total electricity savings for each PCA were used to calculate the NOx emissions reduction for each of the different counties.

SEER 13 Single-Family and Multi-family. In January of 2006, Federal Regulations mandated that the minimum efficiency for residential air conditioners be increased to SEER 13 from the previous SEER 10. Although the electricity savings from new construction reflected this change in values, the annual and OSD electricity savings from the replacement of the air conditioning units by air conditioners with an efficiency of SEER 13 in existing residences needed to be calculated.

In the 2008 report to the TCEQ, the annual and OSD electricity savings for all the counties in ERCOT region as well as the 41 non-attainment and affected counties was calculated for the retrofit. Using the numbers for 2007, the savings through 2020 were projected by incorporating the appropriate adjustment factors[62]. In this analysis it was assumed that an equal number of existing houses had their air conditioners replaced as reported for 2007 by the air conditioner manufacturers. This replacement rate continued until all the existing air conditioner stock was replaced with SEER 13 air conditioners. The total electricity savings for each PCA were used to calculate the NOx emissions reduction for each of the different county using the emissions factors contained in the 2007 eGRID. Cumulative NOx emissions reduction for each county by SIP area was also calculated.

8.4 Results

The total cumulative annual and OSD electricity savings for all the different programs in the integrated format was calculated using the adjustment factors shown in Table 60 and
Table 61 for 2001 through 2020. NOx emissions reduction from the electricity and natural gas savings for the annual and OSD for all the programs in the integrated format is shown in Table 62. In
Table 61 and Table 62 annual values are shown for 2005, and cumulative annual values are shown 2006 through 2020. The OSD NOx emissions reduction is also shown in Figure 93 as stacked bar charts and in Figure 94 for the individual components.

In 2008, the cumulative annual electricity savings[63] from code-compliant residential and commercial construction is calculated to be 1,551,569 MWh/year (6.8% of the total electricity savings), savings from retrofits to Federal buildings is 206,960 MWh/year (0.9%), savings from furnace pilot light retrofits is 2,548,904 MBtu/year, savings from the PUC's Senate Bill 5 and Senate Bill 7 programs is 2,015,453

[59] This web site was developed for SECO by the Laboratory, at the request of the TCEQ.
[60] In these submittals, there were several municipalities whose electricity or natural consumption increased in 2004 as compared to 2001, which caused the reported savings from these municipalities to be negative. Since no additional information was reported from these projects that might have indicated what the cause of this was, it was assumed that the energy conservation projects were working as designed, but that other factors had changed the energy consumption. Therefore, in the final values of electricity savings from the political subdivisions that reported to SECO for the calculation of annual and OSD NOx reductions, the negative savings were omitted.
[61] This credited the electricity generated by the wind farm to the utility that either owned the wind farm or was associated with the wind farm owner.
[62] Additional details about this calculation are contained in the Laboratory's 2006 Annual Report to the TCEQ, available at the Senate Bill 5 web site "eslsb5.tamu.edu".
[63] This includes the savings from 2001 through 2008.

MWh/year (8.8%), savings from SECO's Senate Bill 5 program is 445,357 MWh/year (1.9%), electricity savings from green power purchases (wind) is 15,171,518 MWh/year (66.2%), and savings from residential air conditioner retrofits[64] is 989,385 MWh/year (4.3%). The total savings from all programs is 22,929,144 MWh/year.

In 2008, the cumulative OSD electricity savings from code-compliant residential and commercial construction is calculated to be 6,904 MWh/day (14.2%), savings from retrofits to Federal buildings is 567 MWh/day (1.2%), savings from furnace pilot light retrofits is 6,983 MBtu/day, savings from the PUC's Senate Bill 5 and Senate Bill 7 programs is 5,522 MWh/day (11.4%), savings from SECO's Senate Bill 5 program is 1,220 MWh/day (2.5%), electricity savings from green power purchases (wind) are 25,575 MWh/day (52.6%), and savings from residential air conditioner retrofits are 7,017 MWh/day (14.5%). The total savings from all programs is 48,602 MWh/day, which would be a 2,025 MW average hourly load reduction during the OSD period.

By 2013, the cumulative annual electricity savings from code-compliant residential and commercial construction is calculated to be 2,045,171 MWh/year (5.8% of the total electricity savings), savings from retrofits to Federal buildings will be 402,732 MWh/year (1.1%), savings from furnace pilot light retrofits will remain at 2,548,904 MBtu/year, savings from the PUC's Senate Bill 5 and Senate Bill 7 programs will be 3,527,334 MWh/year (10.0%), savings from SECO's Senate Bill 5 program will be 489,440 MWh/year (1.4%), electricity savings from green power purchases (wind) will be 23,985,240 MWh/year (68.0%), and savings from residential air conditioner retrofits[65] will be 2,286,233 MWh/year (6.5%). The total savings from all programs will be 35,285,055 MWh/year.

By 2013, the cumulative OSD electricity savings from code-compliant residential and commercial construction is calculated to be 12,110 MWh/day (15%), savings from retrofits to Federal buildings will be 1,103 MWh/day (1.4%), savings from furnace pilot light retrofits will remain at 6,983 MBtu/day, savings from the PUC's Senate Bill 5 and Senate Bill 7 programs will be 9,664 MWh/day (11.9%), savings from SECO's Senate Bill 5 program will be 1,341 MWh/day (1.7%), electricity savings from green power purchases (wind) will be 40,432 MWh/day (50.0%), and savings from residential air conditioner retrofits will be 16,216 MWh/day (20%). The total savings from all programs will be 80,866 MWh/day, which would be a 3,369 MW average hourly load reduction during the OSD period.

In 2008, the cumulative annual NOx emissions reduction[66] from code-compliant residential and commercial construction is calculated to be 1,091 tons-NOx/year (8.6% of the total NOx savings), savings from retrofits to Federal buildings is 158 tons-NOx/year (1.2%), savings from furnace pilot light retrofits is 117 tons-NOx/year (0.9%), savings from the PUC's Senate Bill 5 and Senate Bill 7 programs is 1,426 tons-NOx/year (11.2%), savings from SECO's Senate Bill 5 program is 340 tons-NOx/year (2.7%), electricity savings from green power purchases (wind) is 8,914 tons-NOx/year (70.0%), and savings from residential air conditioner retrofits is 682 tons-NOx/year (5.3%). The total NOx emissions reduction from all programs is 12,727 tons-NOx/year.

In 2008, the cumulative OSD NOx emissions reduction from code-compliant residential and commercial construction is calculated to be 6 tons-NOx/day (19.2%), savings from retrofits to Federal buildings is 0.42 tons-NOx/day (1.3%), savings from furnace pilot light retrofits is 0.32 tons-NOx/day (1.0%), savings from the PUC's Senate Bill 5 and Senate Bill 7 programs is 3.82 tons-NOx/day (12.1%), savings from SECO's Senate Bill 5 program is 0.92 tons-NOx/day (2.9%), electricity savings from green power purchases (wind) are 15.13 tons-NOx/day (48.2%), and savings from residential air conditioner retrofits are 4.77 tons-NOx/day (15.2%). The total NOx emissions reduction from all programs is 31.38 tons-NOx/day.

[64] This assumes air conditioners in existing homes are replaced with the more efficient SEER 13 units, versus an average of SEER 11, which is slightly more efficient than the previous minimum standard of SEER 10.
[65] This assumes air conditioners in existing homes are replaced with the more efficient SEER 13 units, versus an average of SEER 11, which is slightly more efficient than the previous minimum standard of SEER 10.
[66] These NOx emissions reduction were calculated with the US EPA's 2007 eGRID for annual (25% capacity factor) and Ozone Season Day OSD.

By 2013, the cumulative NOx emissions reduction from code-compliant residential and commercial construction is calculated to be 1,435 tons-NOx/year (7% of the total NOx savings), savings from retrofits to Federal buildings will be 308 tons-NOx/year (1.5%), savings from furnace pilot light retrofits will be 117 tons-NOx/year (0.6%), savings from the PUC's Senate Bill 5 and Senate Bill 7 programs will be 2,495 tons-NOx/year (12.2%), savings from SECO's Senate Bill 5 program will be 373 tons-NOx/year (1.8%), electricity savings from green power purchases (wind) will be 14,092 tons-NOx/year (69.1%), and savings from residential air conditioner retrofits will be 1,574 tons-NOx/year (7.7%). The total NOx emissions reduction from all programs will be 20,395 tons-NOx/year.

By 2013, the cumulative OSD NOx emissions reduction from code-compliant residential and commercial construction is calculated to be 8.32 tons-NOx/day (15.9%), savings from retrofits to Federal buildings will be 0.81 tons-NOx/day (1.6%), savings from furnace pilot light retrofits will be 0.32 tons-NOx/day (0.6%), savings from the PUC's Senate Bill 5 and Senate Bill 7 programs will be 6.69 tons-NOx/day (12.8%), savings from SECO's Senate Bill 5 program will be 1.01 tons-NOx/day (1.9%), electricity savings from green power purchases (wind) will be 23.92 tons-NOx/day (45.9%), and savings from residential air conditioner retrofits will be 11.03 tons-NOx/day (21.2%). The total NOx emissions reduction from all programs will be 52.10 tons-NOx/day.

Table 59: Final Adjustment Factors used for the Calculation of the Annual and OSD NOx Savings for the Different Programs

	ESL-Single Family[16]	ESL-Multifamily[16]	ESL-Commercial[16]	Federal Buildings[15]	Furnace Pilot Light Program[15]	PUC (SB7)[15]	PUC (SB5 Grant Program)[15]	SECO[15]	Wind-ERCOT[8]	SEER13 Single Family	SEER13 Multifamily
Annual Degradation Factor [11]	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	0.00%	5.00%	5.00%
T&D Loss [9]	7.00%	7.00%	7.00%	7.00%	0.00%	7.00%	7.00%	7.00%	0.00%	7.00%	7.00%
Initial Discount Factor [12]	20.00%	20.00%	20.00%	20.00%	20.00%	25.00%	25.00%	60.00%	25.00%	20.00%	20.00%
Growth Factor	3.25%	1.54%	3.25%	0.00%	0.00%	0.00%	0.00%	0.00%	Actual Rates	N.A.	N.A.
Weather Normalized	Yes	Yes	Yes	No	No	No	No	No	See note 7	Yes	Yes

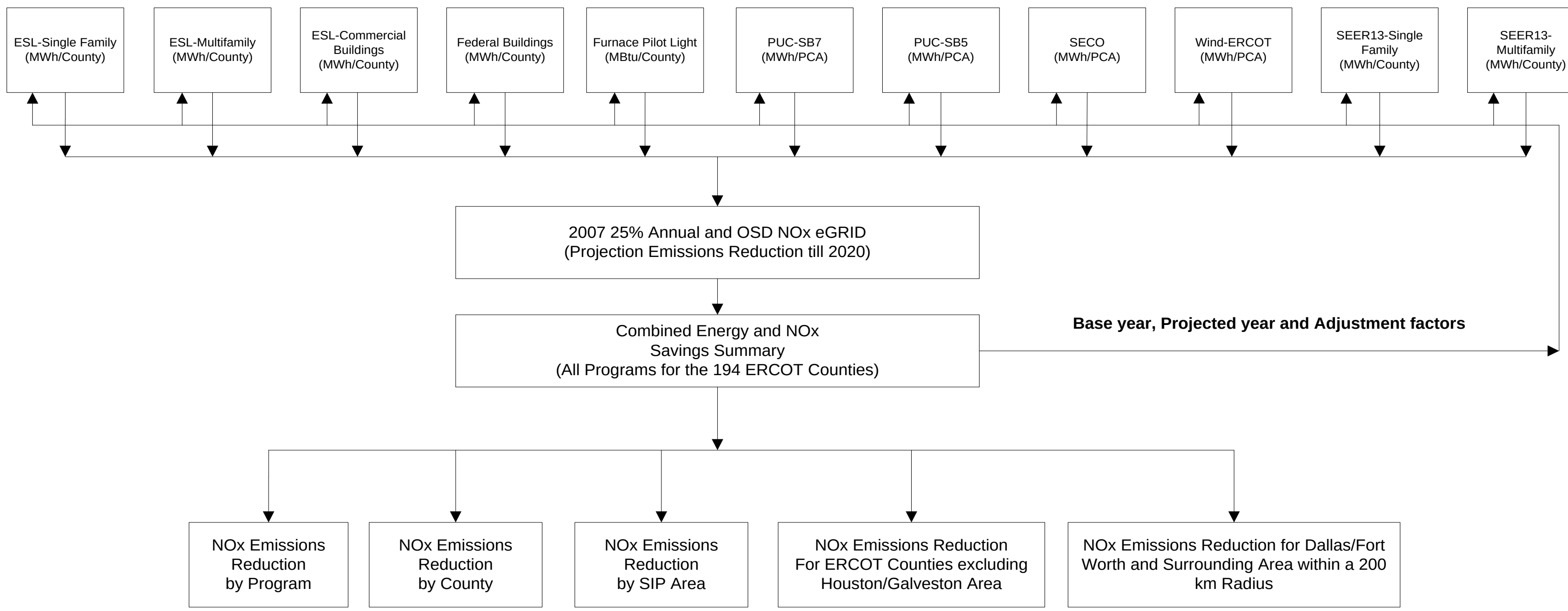


Figure 92: Process Flow Diagram of the NOx Emissions Reduction Calculations

Table 60: Example of NOx Emissions Reduction Calculations using eGRID

Area	County	American Electric Power - West (ERCOT) /PCA	NOx Reductions (lbs)	Austin Energy/PCA	NOx Reductions (lbs)	Brownsville Public Utils Board/PCA	NOx Reductions (lbs)	Lower Colorado River Auhotrity /PCA	NOx Reductions (lbs)	Reliant Energy HL&P/PCA	NOx Reductions (lbs)	San Antonio Public Service Bd/PCA	NOx Reductions (lbs)	South Texas Electric Coop INC/PCA	NOx Reductions (lbs)	Texas Municipal Power Pool/PCA	NOx Reductions (lbs)	Texas-New Mexico Power Co/PCA	NOx Reductions (lbs)	TXU Electric/PCA	NOx Reductions (lbs)	Total Nox Reductions (lbs)	Total Nox Reductions (Tons)
Houston-Galveston Area	Brazoria	0.008831132	226.0465792	0.010890729	8.193488679	0.006522185	0	0.003944232	14.32402746	0.065444292	3035.079423	0.014877434	272.3666894	0.006262315	0	0.004817148	0	0.121274957	139.7235344	0.00816387	940.7285451	4636.462287	2.318231144
	Chambers	0.021762222	557.0379581	0.026955801	20.27982242	0.016072371	0	0.009076193	32.96145962	0.164940225	7649.355979	0.037472294	686.0191605	0.015055623	0	0.009553214	0	0.011518588	13.2708178	0.015818592	1822.787617	10781.71281	5.390856407
	Fort Bend	0.070431234	1802.797078	0.087239726	65.63359654	0.052016606	0	0.029374182	106.6764342	0.533812376	24756.36787	0.121275295	2220.231709	0.048726002	0	0.030918012	0	0.037278747	42.94966114	0.051195276	5899.267979	34893.92432	17.44696216
	Galveston	0.033856739	866.6159501	0.041710519	31.3803294	0.025004711	0	0.015351589	55.75143316	0.249587379	11574.99759	0.056747051	1038.889275	0.024143087	0	0.019297151	0	0.567751219	654.118618	0.032836887	3783.817742	18005.57093	9.002785467
	Harris	0.068267332	1747.408655	0.084559408	63.61709594	0.050418468	0	0.028471701	103.3989497	0.517411736	23995.76304	0.117549281	2152.01819	0.047228963	0	0.029968099	0	0.03613341	41.63009278	0.049622373	5718.021208	33821.85723	16.91092861
	Liberty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Montgomery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Waller	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beaumont/ Port Arthur Area	Hardin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jefferson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Orange	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dallas/ Fort Worth Area	Collin	0.002039135	52.19483875	0.003716345	2.795940278	0.001505992	0	0.005950953	21.61171382	0.002481478	115.0823578	0.000717051	13.12731328	0.019166247	0	0.07668094	0	0.00086441	0.995905867	0.004000199	460.945804	666.7538738	0.333376937
	Dallas	0.004539471	116.1948312	0.004683963	3.523914222	0.003352602	0	0.00774211	28.1165509	0.002085611	96.72341896	0.00068106	12.46842352	0.007502816	0	0.026717045	0	0.007524933	8.669640256	0.040370454	4651.916039	4917.612818	2.458806409
	Denton	0.00047388	12.12970385	0.000872802	0.656640103	0.000349982	0	0.001396994	5.073377767	0.000585443	27.15083393	0.000168971	3.093405773	0.00454374	0	0.018187155	0	0.000186605	0.214992277	0.000849405	97.87758499	146.1965387	0.073098269
	Tarrant	0.012162492	311.3179263	0.012266309	9.228387517	0.008982543	0	0.020308652	73.75369976	0.005316504	246.5610524	0.001752506	32.08377752	0.017326428	0	0.060216761	0	0.020603444	23.73767965	0.110647237	12749.95959	13446.64211	6.723321056
	Ellis	0.003279814	83.95193355	0.003307809	2.488584531	0.002422289	0	0.005476558	19.88888265	0.001433682	66.48919108	0.000472592	8.651911537	0.004672353	0	0.016238427	0	0.005556053	6.401250735	0.029837824	3438.233618	3626.105373	1.813052686
	Johnson	0.000286058	7.322112154	0.000526868	0.396381687	0.000211267	0	0.000843297	3.062551359	0.000353404	16.38963767	0.000101999	1.867338584	0.002742835	0	0.010978701	0	0.000112645	0.129780379	0.000512745	59.08393672	88.25173856	0.044125869
	Kaufman	0.006325453	161.9098051	0.006379446	4.799487271	0.004671629	0	0.010562096	38.3577242	0.002765	128.2311379	0.000911441	16.68608752	0.009011105	0	0.031317452	0	0.010715411	12.34546025	0.057545265	6630.9817	6993.311403	3.496655701
	Parker	0.000217489	5.566981877	0.000400576	0.301367914	0.000160626	0	0.000641157	2.328449436	0.000268692	12.46099677	7.75498E-05	1.419732426	0.00208537	0	0.008347076	0	8.56434E-05	0.098671668	0.000389838	44.92135575	67.09755584	0.033548778
	Rockwall	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Henderson	0.000819895	20.98648722	0.000826893	0.622101782	0.000605529	0	0.001369042	4.971866208	0.000358395	16.62111282	0.00011814	2.162823693	0.001168005	0	0.004059317	0	0.001388914	1.600198603	0.007458924	859.4971295	906.4617199	0.45323086
	Hood	0.01252711	320.6508812	0.012634039	9.505044007	0.009251829	0	0.020917482	75.96475123	0.005475887	253.9526704	0.001805044	33.04561243	0.017845854	0	0.062021991	0	0.021221112	24.4493081	0.113964315	13132.18878	13849.75705	6.924878523
	Hunt	0.006187558	158.3801895	0.006240374	4.694858985	0.004569788	0	0.010331844	37.5215301	0.002704724	125.4357135	0.000891572	16.32233268	0.008814664	0	0.030634735	0	0.010481817	12.0763306	0.056290785	6486.427041	6840.857996	3.420428998
El Paso Area	El Paso	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Antonio Area	Bexar	0.033413751	855.276978	0.051775843	38.95283667	0.024677545	0	0.090663423	329.2568536	0.001141841	52.95463998	1.143571754	20935.7914	0.046873844	0	0.004669544	0	0.000519582	0.598622181	0.002503865	288.5221599	22501.3535	11.25067675
	Comal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Guadalupe	0.002000467	51.20507169	0.076378745	57.46248772	0.001477434	0	0.133848731	486.0903138	0.001237133	57.37392999	0.003554796	65.07897116	0.001061766	0	0.001855699	0	0.000401718	0.462828487	0.001835165	211.4673431	929.140946	0.464570473
	Wilson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Austin Area	Bastrop	0.004502334	115.2442433	0.171901148	129.3274415	0.003325174	0	0.301245466	1094.014881	0.002784342	129.1281298	0.008000571	146.4694129	0.002389654	0	0.004176513	0	0.000904124	1.041660856	0.004130298	475.937112	2091.162881	1.04558144
	Caldwell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hays	0.002458599	62.93167289	0.093870431	70.62211537	0.001815785	0	0.164501762	597.4110691	0.001520452	70.51327681	0.004368889	79.98286869	0.001304924	0	0.002280677	0	0.000493717	0.568821994	0.00225544	259.8960069	1141.925832	0.570962916
	Travis	0.000510007	13.05442349	0.299602906	225.4020851	0.000376663	0	0.033939476	123.2559365	0.000334709	15.52263338	0.000906121	16.58869273	0.000271138	0	0.000471744	0	0.000103327	0.119045148	0.000467336	53.85143207	447.7942484	0.223897124
	Williamson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North East Texas Area	Gregg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Harrison	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rusk	0.000685965	17.55833805	0.00069182	0.520481264	0.000506616	0	0.001145408	4.159710327	0.000299851	13.90604891	9.88414E-05	1.809525774	0.000977211	0	0.003396227	0	0.001162035	1.338805667	0.006240507	719.0980079	758.3909179	0.379195459
	Smith	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Upshur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corpus Christi Area	Nueces	0.22756873	5824.975938	0.004556851	3.428283791	0.168069652	0	0.007612767	27.64682441	0.001680888	77.95375313	0.001626796	29.78235622	0.046792036	0	0.007246366	0	0.001609426	1.854254911	0.008283395	954.5014455	6920.142856	3.460071428
	San Patricio	0.050313351	1287.848557	0.001007478	0.757961986	0.037158653	0	0.001683113	6.112458369	0.000371629	17.2348572	0.00035967	6.584604794	0.010345288	0	0.001602105	0	0.000355829	0.409958691	0.001831382	211.0314828	1529.979881	0.76498994
Victoria Area	Victoria	0.021836736	558.9452467	0.002215582	1.666862472	0.016127403	0	0.003612695	13.12000619	0.001199621	55.63426979	0.000555389	10.16770824	0.52545648	0	0.032412721	0	0.000476855	0.549395481	0.002254849	259.8278678	899.9113567	0.449955678
Other ERCOT counties	Andrews	2.47421E-05	0.633312124	2.49533E-05	0.018773251	1.82731E-05	0	4.13138E-05	0.150036693	1.08153E-05	0.501577618	3.56511E-06	0.065267829	3.5247E-05	0	0.000122499	0	4.19135E-05	0.048289414	0.000225089	25.93716362	27.35442055	0.01367721
	Angelina	0.00031082	7.955919749	0.000313473	0.235837079	0.000229554	0	0.000519	1.884820844	0.000135867	6.301018286	4.47864E-05	0.81992053	0.000442787	0	0.001538876	0	0.000526534	0.606630902	0.002827658	325.8330045	343.6371519	0.171818576
	Bosque	0.000595392	15.23997933	0.001096604	0.825014503	0.000439723	0	0.001755208	6.374283599	0.000735562	34.11279889	0.000212298	3.88661097	0.005708837	0	0.02285067	0	0.000234455	0.270120186	0.001067208	122.9751683	183.6839758	0.091841988
	Brazos	0.001939725	49.65028649	0.003572622	2.687812467	0.001432574	0	0.005718288	20.7667609	0.002396384	111.1359931	0.000691644	12.66217912	0.018598805	0	0.074445136	0	0.000763829	0.880023807	0.003476855	400.6404605	598.4235164	0.299211758
	Calhoun	0.082699809	2116.830355	0.001655986	1.245858399	0.061077496	0	0.002766524	10.04701783	0.000610844	28.32885022	0.000591187	10.8230826	0.0170045	0	0.002633372	0	0.000584875	0.673847089	0.003010234	346.8714129	2514.820424	1.257410212
	Cameron	0.048371747	1238.150172	0.000968599	0.728712051	0.297964476	0	0.001618161	5.876577133	0.000357288	16.56975992	0.00034579	6.330503314	0.009946061	0	0.001540279	0	0.000342098	0.394138287	0.001760709	202.8877272	1470.93759	0.735468795
	Cherokee	0.003503899	89.68774747	0.003533808	2.658611083	0.002587786	0	0.00585073	21.24774271	0.001531635	71.03190513	0.00050488	9.243032581	0.00499158	0	0.017347879	0	0.005935657	6.838600793	0.031876422	3673.14266	3873.8503	1.93692515
	Coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Coleman	0.001298787	33.24447222	2.6007E-05	0.019566001	0.000959212	0	4.34478E-05	0.157786761	9.59321E-06	0.444899929	9.2845E-06	0.16997473	0.000267053	0	4.13567E-05	0	9.18536E-06	0.010582658	4.72752E-05	5.447558433	39.49484073	0.01974742
	Crockett	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Ector	0.003535748	90.50296541	0.003565928	2.682776563	0.002611307	0	0.005903911	21.44087434	0.001545556	71.67755054	0.00050947	9.327047245	0.005036951	0	0.017505563	0	0.00598961	6.900760344	0.032166163	3706.529738	3909.061712	1.954530856
	Fannin	0.007056315	180.6173605	0.007116546	5.354034748	0.005211403	0	0.011782473	42.78969328	0.003084477	143.0473568	0.001016752	18.61404924	0.010052276	0	0.034935966	0	0.011953503	13.77189259	0.064194222	7397.14566	7801.340048	3.900670024
	Fayette	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Freestone	0.003677178	94.12308402	0.003708565	2.790087625	0.00271576	0	0.006140067	22.29850932	0.001607379	74.54465257	0.000529848	9.700129134	0.005238429	0	0.018205785	0	0.006229194	7.176790757	0.033452809	3854.790927	4065.42418	2.03271209
	Frio	0.008588335	219.8317964	0.000871383	0.655572927	0.006342868	0	0.001420864	5.160066298	0.000471808	21.88082203	0.000218433	3.998934744	0.206660746	0	0.012747844	0	0.000187546	0.216075897	0.000886827	102.189664	353.9329323	0.176966466
	Grimes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hardeman	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Haskell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hidalgo	0.188527456	4825.653746	0.003775086	2.840133709	0.139235931	0	0.006306735	22.9037859	0.001392518	64.58015017	0.001347706	24.6729498	0.03876448	0	0.006003193	0	0.001333316	1.536142338	0.006862311	790.7489276	5732.935836	2.866467918
	Howard	0.000555113	14.20898268	0.000559851	0.421196428	0.000409976	0	0.000926915	3.366221326	0.000242653	11.25338899	7.99868E-05	1.464348181	0.000790802	0	0.002748377	0	0.00094037	1.083420679	0.005050094	581.9258697	613.723428	0.306861714
	Jack	0.002121449	54.30177924	0.002139557	1.609665938	0.001566784	0	0.003542346	12.86452461	0.000927334	43.00653033	0.000305682	5.596228347	0.00302217	0	0.010503338	0	0.003593766	4.140456206	0.019299698	2223.917843	2345.437027	1.172718514
	Jones	0.040718722	1042.259088	0.000815354	0.613420549	0.030072592	0	0.001362147	4.946827986	0.00030076	13.94821343	0.000291082	5.32893728	0.008372468	0	0.001296587	0	0.000287974	0.331780603	0.001482142	170.7883116	1238.216579	0.61910829
	Lamar	0.000950838	24.33817497	0.000958954	0.721455757	0.000702236	0	0.001587687	5.765907769	0.000415633	19.27561996	0.000137007	2.508241656	0.001354543	0	0.004707619	0	0.001610734	1.855761432	0.008650166	996.7647898	1051.229951	0.525614976
	Limestone	0.000719757	18.42329542	0.000891528	0.670728366	0.000531572	0	0.000300183	1.090156782	0.00545518	252.9923553	0.001239347	22.68917849	0.000497945	0	0.00031596	0	0.000380962	0.438914787	0.000523179	60.28629516	356.5909243	0.178295462
	Llano	0.001238174	31.69299001	0.047274044	35.56597012	0.000914447	0	0.082844655	300.8619059	0.000765714	35.51115798	0.002200214	40.28013466	0.000657172	0	0.001148571	0	0.000248641	0.286464175	0.001135861	130.8861051	575.0847279	0.287542364
	McLennan	0.024534317	627.9940467	0.024743738	18.61560781	0.018119687	0	0.040966843	148.7767984	0.010724513	497.3657473	0.003535175	64.71975936	0.034951066	0	0.121469933	0	0.041561501	47.88391622	0.22319886	25719.36288	27124.71876	13.56235938
	Milam	0.002245405	57.4746346	0.002264571	1.703718789	0.001658332	0	0.003749326	13.61619935	0.000981518	45.51940379	0.000323543	5.923216216	0.003198756	0	0.011117048	0	0.00380375	4.382383245	0.02042738	2353.86146	2482.481016	1.241240508
	Mitchell	0.014943169	382.493668	0.015070721	11.3382478	0.011036196	0	0.024951762	90.61580067	0.006532002	302.9316123	0.002153177	39.41900132	0.02128772	0	0.07398395	0	0.025313952	29.16475857	0.135944204	15664.94698	16520.91007	8.260455036
	Nolan	0.000564654	14.45319062	0.000569473	0.428435476	0.000417022	0	0.000942846	3.424076134	0.000246823	11.44679952	8.13615E-05	1.489515743	0.000804394	0	0.002795613	0	0.000956532	1.102041289	0.005136889	591.9273539	624.2714127	0.312135706
	Palo Pinto	0.003206998	82.08811543	0.005906709	4.443830552	0.002368511	0	0.009454195	34.33422818	0.003962005	183.7440401	0.001143513	20.93471146	0.030749889	0	0.123082087	0	0.001262858	1.454966345	0.005748375	662.3893373	989.3892293	0.494694615
	Pecos	4.09677E-05	1.048631523	4.13174E-05	0.031084551	3.02565E-05	0	6.84069E-05	0.248429171	1.79079E-05	0.830506919	5.90308E-06	0.108069782	5.83617E-05	0	0.000202832	0	6.93999E-05	0.079957102	0.0003727	42.94648142	45.29316047	0.02264658
	Presidio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Robertson	0.000737708	18.88277792	0.000835096	0.628273174	0.00054483	0	0.000735917	2.67258533	0.003149678	146.0711407	0.000730875	13.38040458	0.00076086	0	0.001866305	0	0.191632518	220.7840225	0.003397737	391.5236901	793.9428943	0.396971447
	Taylor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Titus	0.005696437	145.8091831	0.005745061	4.322217039	0.004207073	0	0.009511781	34.54335843	0.002490043	115.4795873	0.000820806	15.02679093	0.008115023	0	0.028203184	0	0.00964985	11.11780398	0.051822854	5971.584145	6297.883086	3.148941543
	Tom Green	0.001482448	37.94556586	2.96846E-05	0.022332825	0.001094854	0	4.95918E-05	0.180099353	1.09498E-05	0.507813132	1.05974E-05	0.19401082	0.000304817	0	4.72049E-05	0	1.04843E-05	0.012079149	5.39604E-05	6.217896494	45.07979763	0.022539899
	Upton	3.11661E-05	0.797745539	3.14322E-05	0.023647546	2.30176E-05	0	5.20405E-05	0.188992281	1.36234E-05	0.631807433	4.49076E-06	0.082213995	4.43986E-05	0	0.000154304	0	5.27959E-05	0.060827297	0.000283531	32.67149923	34.45673333	0.017228367
	Ward	0.018559529	475.0600294	0.01871795	14.08218954	0.013707039	0	0.030990277	112.54551	0.008112796	376.2433542	0.002674262	48.95869786	0.026439509	0	0.091888626	0	0.03144012	36.22285079	0.16884373	19455.98267	20519.0953	10.25954765
	Webb	0.020014327	512.2978652	0.000400768	0.301512399	0.014781473	0	0.000669531	2.431496589	0.000147832	6.855915242	0.000143074	2.619313398	0.004115289	0	0.000637307	0	0.000141547	0.163078928	0.000728512	83.94696529	608.6161471	0.304308074
	Wharton	0.00014434	3.694599265	0.000178787	0.134507561	0.000106601	0	6.01986E-05	0.218619544	0.001093979	50.7349716	0.000248538	4.550077512	9.98576E-05	0	6.33625E-05	0	7.6398E-05	0.088019771	0.000104918	12.08978615	71.5105814	0.035755291
	Wichita	0.000207633	5.314695266	0.000209406	0.157543345	0.000153346	0	0.000346701	1.259093698	9.07612E-05	4.209191786	2.99181E-05	0.547721432	0.00029579	0	0.001027996	0	0.000351734	0.405240184	0.001888925	217.6622165	229.5557022	0.114777851
	Wilbarger	0.028616818	732.4920115	0.000573025	0.431107444	0.021134796	0	0.000957307	3.476594279	0.000211372	9.802701684	0.00020457	3.745137877	0.005884109	0	0.000911232	0	0.000202386	0.233172965	0.001041639	120.0287677	870.2094935	0.435104747
	Wise	0.002844488	72.80908734	0.002882008	2.16823872	0.002100781	0	0.00476997	17.32281236	0.001256075	58.25242144	0.000413241	7.565361234	0.004181914	0	0.014614274	0	0.004797945	5.527817073	0.025761411	2968.505674	3132.151412	1.566075706
	Young	0.006235856	159.6164509	0.006289085	4.731505443	0.004605458	0	0.010412491	37.81441029	0.002725836	126.4148216	0.000898531	16.44973921	0.008883468	0	0.030873859	0	0.010563634	12.17059429	0.056730171	6537.057865	6894.255386	3.447127693
	Total	**1.121837219**	**28715.17018**	**1.172570094**	**882.1668247**	**1.090766584**	**0**	**1.189130767**	**4318.494059**	**1.629360006**	**75564.06999**	**1.542362643**	**28236.60382**	**1.359385821**	**0**	**1.231642808**	**0**	**1.221806085**	**1407.669558**	**1.528786947**	**176163.2035**	**315287.3779**	**157.643689**
Energy Savings by PCA (MWh)		25,597		752		0		3,632		46,377		18,307		0		0		1,152		115,231			

Table 61: Annual and OSD Electricity Savings for the Different Programs

Program	Annual															
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
ESL-Single Family (MWh)	225,389	1,001,051	1,197,537	1,256,764	1,313,777	1,368,371	1,420,340	1,469,480	1,515,583	1,558,446	1,597,862	1,633,626	1,665,533	1,693,376	1,716,950	1,736,050
ESL-Multifamily (MWh)	9,228	37,821	51,312	63,156	74,493	85,311	95,599	105,346	114,541	123,171	131,227	138,696	145,568	151,830	157,472	162,483
ESL-Commercial (MWh)	63,456	129,063	192,036	231,649	270,392	308,184	344,944	380,592	415,047	448,228	480,055	510,445	539,320	566,597	592,196	616,037
Federal Buildings (MWh)	52,276	109,073	159,415	206,960	251,708	293,659	332,813	369,171	402,732	433,496	461,464	486,635	509,009	528,586	545,366	559,350
Furnace Pilot Light Prog. (MMBtu)	2,209,050	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904
PUC (SB7) (MWh)	302,192	1,362,701	1,630,383	2,003,432	2,353,192	2,679,663	2,982,846	3,262,739	3,519,343	3,752,658	3,962,684	4,149,421	4,312,869	4,453,028	4,569,898	4,663,479
PUC (SB5 grant program) (MWh)	0	13,633	12,827	12,021	11,215	10,409	9,603	8,797	7,991	7,186	6,380	5,574	4,768	3,962	3,156	2,350
SECO (MWh)	115,360	293,764	353,701	445,357	457,921	468,611	477,428	484,371	489,440	492,636	493,959	493,408	490,983	486,685	480,513	472,468
Wind-ERCOT (MWh)	2,867,049	6,699,696	9,193,504	15,171,518	20,115,442	22,082,748	22,595,958	23,280,238	23,985,240	24,711,593	25,459,941	26,230,952	27,025,312	27,843,728	28,686,928	29,555,662
SEER13-Single Family (MWh)	0	374,246	624,639	913,010	1,185,311	1,441,594	1,681,860	1,906,108	2,114,339	2,306,551	2,482,746	2,642,923	2,787,083	2,915,224	2,803,568	2,590,509
SEER13-Multifamily (MWh)	0	31,634	52,532	76,375	98,620	119,281	138,371	155,904	171,894	186,354	199,298	210,738	220,690	229,165	219,722	202,900
Total Annual (MWh)	3,634,949	10,052,682	13,467,885	20,380,240	26,132,070	28,857,830	30,079,762	31,422,747	32,736,151	34,020,320	35,275,615	36,502,419	37,701,133	38,872,181	39,775,770	40,561,288
Total Annual (MMBtu)	2,209,050	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904

Program	Ozone Season Day - OSD															
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
ESL-Single Family (MWh)	776	5,537	6,519	6,904	7,275	7,809	8,138	8,450	8,744	9,019	9,274	9,507	9,717	9,904	10,065	10,199
ESL-Multifamily (MWh)	36	192	271	351	428	508	577	643	706	765	820	871	919	962	1,002	1,037
ESL-Commercial (MWh)	0	800	1,189	1,447	1,700	1,966	2,205	2,436	2,660	2,876	3,082	3,280	3,467	3,645	3,811	3,967
Federal Buildings (MWh)	0	299	437	567	690	805	912	1,011	1,103	1,188	1,264	1,333	1,395	1,448	1,494	1,532
Furnace Pilot Light Prog. (MMBtu)	5,819	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983
PUC (SB7) (MWh)	828	3,733	4,467	5,489	6,447	7,342	8,172	8,939	9,642	10,281	10,857	11,368	11,816	12,200	12,520	12,777
PUC (SB5 grant program) (MWh)	0	37	35	33	31	29	26	24	22	20	17	15	13	11	9	6
SECO (MWh)	316	805	969	1,220	1,255	1,284	1,308	1,327	1,341	1,350	1,353	1,352	1,345	1,333	1,316	1,294
Wind-ERCOT (MWh)	5,836	14,936	20,763	25,575	33,908	37,225	38,090	39,243	40,432	41,656	42,918	44,217	45,556	46,936	48,357	49,822
SEER13-Single Family (MWh)	0	2,666	4,449	6,503	8,442	10,268	11,979	13,576	15,059	16,428	17,683	18,824	19,851	20,764	19,969	18,451
SEER13-Multifamily (MWh)	0	213	354	514	664	803	931	1,049	1,157	1,254	1,341	1,418	1,485	1,542	1,479	1,365
Total OSD (MWh)	7,791	29,219	39,453	48,602	60,840	68,037	72,339	76,700	80,866	84,837	88,610	92,186	95,565	98,745	100,022	100,451
Total OSD (MMBtu)	5,819	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983

Table 62: Annual and OSD NOx Emissions Reduction Values for the Different Programs

Program	**Annual (in tons NOx)**															
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
ESL-Single Family	158	708	843	883	922	960	996	1,029	1,061	1,090	1,117	1,141	1,163	1,182	1,198	1,210
ESL-Multifamily	6	26	35	44	51	59	66	73	79	85	91	96	100	105	109	112
ESL-Commercial	44	90	136	164	192	218	245	270	295	319	341	363	384	403	421	438
Federal Buildings	40	84	122	158	193	225	255	283	308	332	353	373	390	405	418	428
Furnace Pilot Light Program	102	117	117	117	117	117	117	117	117	117	117	117	0	0	0	0
PUC (SB7)	237	1,074	1,157	1,421	1,668	1,899	2,113	2,311	2,492	2,657	2,805	2,937	3,052	3,151	3,234	3,553
PUC (SB5 grant program)	0	6	5	5	5	4	4	4	3	3	3	2	2	2	1	1
SECO	67	224	270	340	349	357	364	369	373	376	377	376	374	371	366	360
Wind-ERCOT	2,465	4,152	5,688	8,914	11,818	12,974	13,276	13,678	14,092	14,519	14,958	15,411	15,878	16,359	16,854	17,365
SEER13-Single Family	0	258	430	629	816	993	1,158	1,313	1,456	1,589	1,710	1,820	1,920	2,008	1,931	1,784
SEER13-Multifamily	0	22	36	53	68	82	95	107	118	128	137	145	152	158	151	140
Total Annual (Tons NOx)	3,119	6,760	8,839	12,727	16,200	17,889	18,689	19,554	20,395	21,214	22,009	22,782	23,415	24,143	24,683	25,392

Program	**Ozone Season Day - OSD (in tons Nox/day)**															
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
ESL-Single Family	0.76	3.85	4.50	4.76	5.01	5.37	5.60	5.80	6.00	6.19	6.36	6.51	6.65	6.77	6.88	6.97
ESL-Multifamily	0.03	0.13	0.18	0.24	0.29	0.35	0.39	0.44	0.48	0.52	0.56	0.59	0.63	0.66	0.68	0.71
ESL-Commercial	0.26	0.55	0.82	1.00	1.17	1.36	1.52	1.68	1.84	1.98	2.13	2.26	2.39	2.52	2.63	2.74
Federal Buildings	0.11	0.22	0.32	0.42	0.51	0.59	0.67	0.74	0.81	0.87	0.93	0.98	1.02	1.06	1.10	1.12
Furnace Pilot Light Program	0.28	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.00	0.00	0.00	0.00
PUC (SB7)	0.64	2.61	3.10	3.81	4.47	5.09	5.66	6.19	6.68	7.12	7.51	7.87	8.18	8.44	8.66	8.84
PUC (SB5 grant program)	0.00	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00
SECO	0.18	0.61	0.73	0.92	0.95	0.97	0.99	1.00	1.01	1.02	1.02	1.02	1.02	1.01	0.99	0.98
Wind-ERCOT	5.85	9.27	12.98	15.13	20.06	22.03	22.54	23.22	23.92	24.65	25.39	26.16	26.96	27.77	28.61	29.48
SEER13-Single Family	0.00	1.81	3.03	4.42	5.74	6.98	8.15	9.23	10.24	11.17	12.03	12.80	13.50	14.12	13.58	12.55
SEER13-Multifamily	0.00	0.15	0.24	0.35	0.45	0.55	0.63	0.71	0.79	0.85	0.91	0.97	1.01	1.05	1.01	0.93
Total OSD (Tons NOx)	8.09	19.53	26.24	31.38	38.99	43.61	46.48	49.36	52.10	54.70	57.17	59.49	61.36	63.40	64.15	64.31

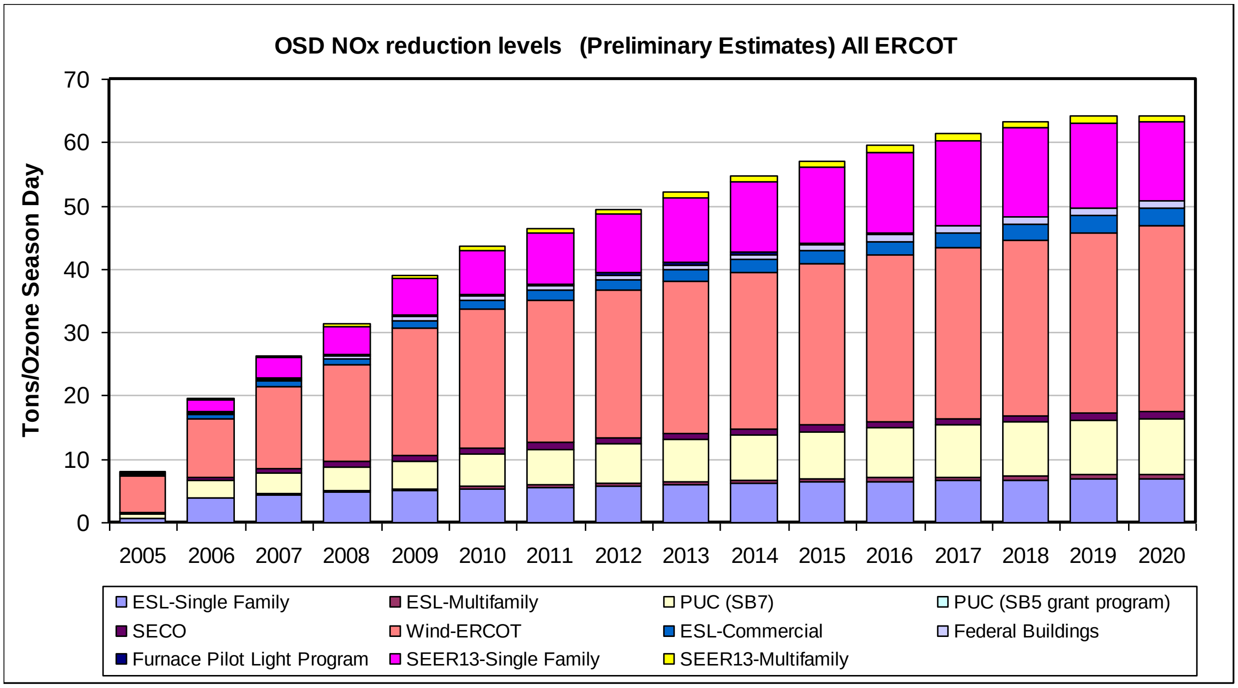


Figure 93: Cumulative OSD NOx Emissions Reduction Projections through 2020

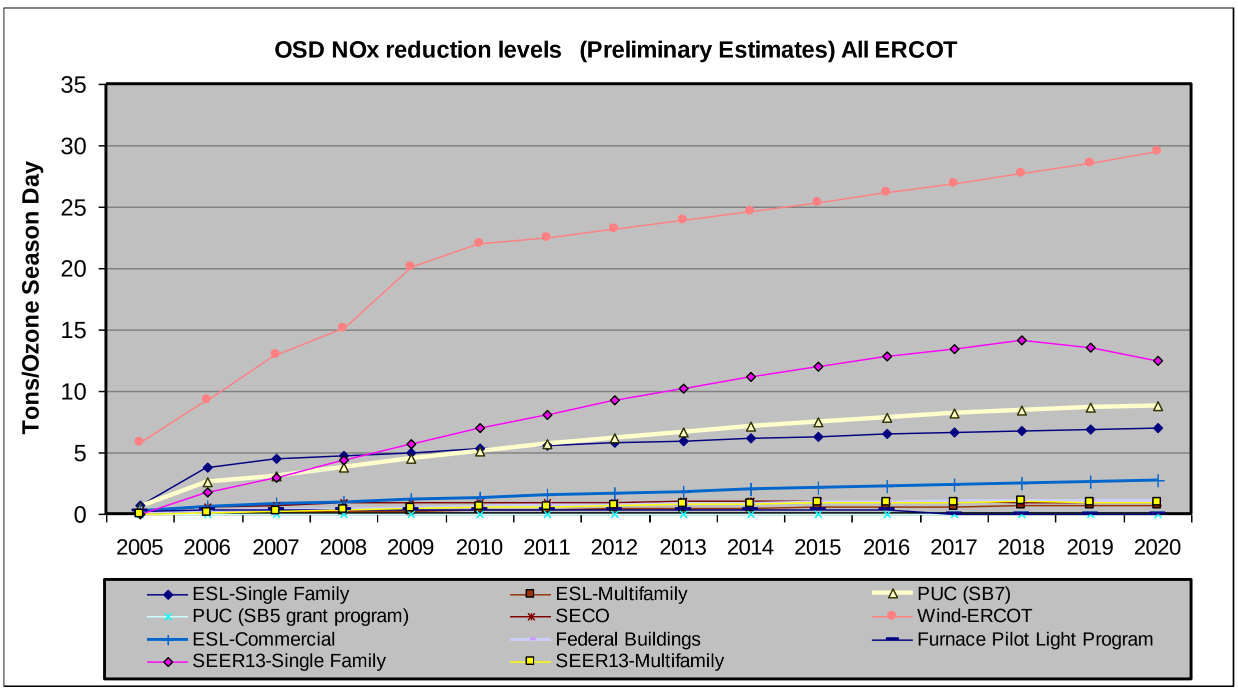


Figure 94: Cumulative OSD NOx Emissions Reduction Projections through 2020

8.5 Weather Data

In order to calculate the NOx emissions from energy efficiency and renewable energy (EE/RE) projects in non-attainment and affected counties in Texas several weather data sets needed to be assembled from the many different weather sources (Figure 95 and Figure 96), including hourly weather data sets needed for the DOE-2 simulations and daily average weather data for analysis that used monthly utility billing data. In 2007 these sources were updated.

In the archive the counties were grouped according to the nearest TMY2 weather station. Next, for each group, weather files were determined for F-CHART, PV F-CHART, ASHRAE 90.1-1989, and ASHRAE 90.1-1999 analysis. Finally, as shown in Table 64, weather files were assigned for NOAA data (temperature, humidity, wind speed) and NREL (solar radiation). In some instances, where solar radiation data were not available from the NREL database, TCEQ solar data were used. For NREL solar sources, solar data included global horizontal, direct normal beam, and diffuse solar radiation. For TCEQ solar sources, only global horizontal solar radiation data were available which required synthesis of direct normal beam and diffuse radiation using an iterative kt procedure (Erbs 1982). Synthetic beam and diffuse solar data were also used to fill missing NREL data.

In 2005, at the request of the TCEQ, the 9 weather stations assembled for calculating emissions from the non-attainment and affected counties were expanded to include all counties in ERCOT. To accomplish this, 8 additional weather stations were added to the original 9 stations for a total of 17 weather stations (Table 65). Assignment of weather stations was then performed as shown in Table 66, with additional details provided in Table 67. Figure 97 shows an updated map of Texas showing the available weather files, 2000/2001 IECC weather zones, and ERCOT county outline. Figure 98 shows the clustering of the counties around their chosen TMY2 and NOAA weather stations. Figure 99 shows the 2000/2001 and 2006 IECC weather zones and available weather files. During the period from July 2007 to August 2008, the Laboratory maintained and added additional years of weather data to the archive.

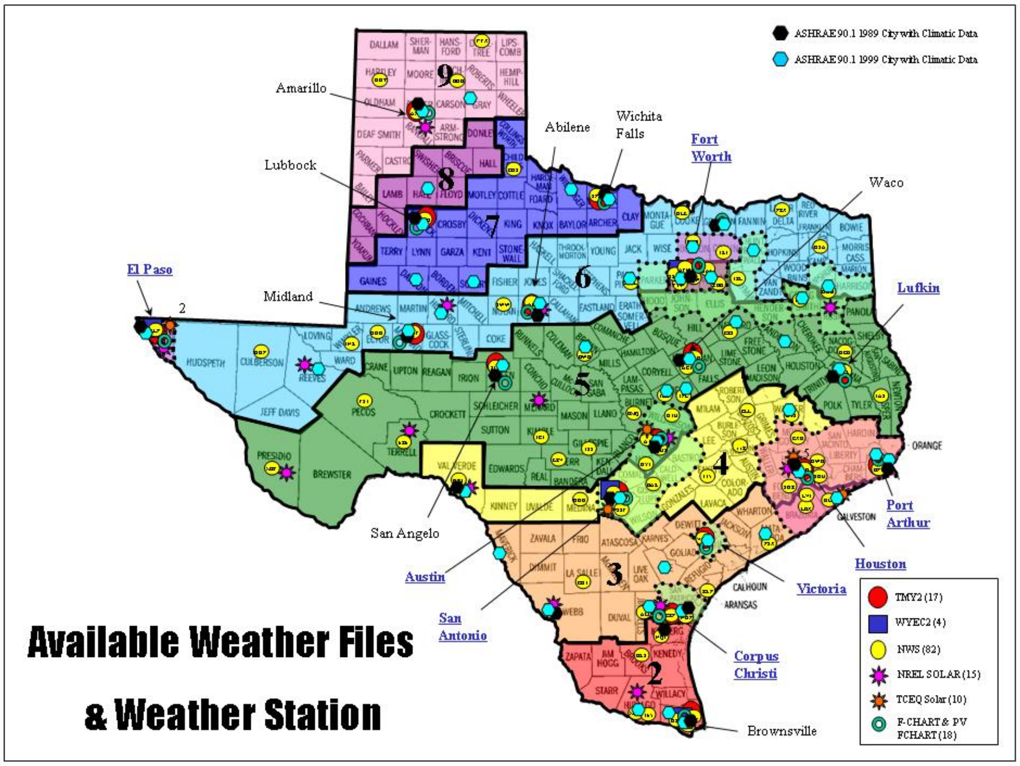


Figure 95: Available Weather Stations in Texas for 41 Non-attainment and Affected Counties

List of Available Weather Files and Weather Stations of Texas

Texas Weather Stations (NOAA)

1 Abilene Regional Airport (ABI)
2 Alice International Airport (ALI)
3 Amarillo International Airport (AMA)
4 Angleton / Lake Jackson Brazori (LBX)
5 Arlington Municipal Airport (GKY)
6 Austin - Bergstrom International (AUS)
7 Austin Camp Mabry (ATT)
8 Borger Hutchinson County Airport (BGD)
9 BRENHAM: BRENHAM MUNICIPAL AIRPORT (11R)
10 Brownsville S Padre Isl International (BRO)
11 BROWNWOOD: BROWNWOOD REGIONAL AIRPORT (BWD)
12 Burnet Municipal Airport (BMQ)
13 Childress Municipal Airport (CDS)
14 College Station (CLL)
15 Conroe Montgomery County Airport (CXO)
16 Corpus Christi International Airport (CRP)
17 CORPUS CHRISTI: CORPUS CHRISTI NAS/TRUAX FIELD ARPT (NGP)
18 Corsicana Campbell Field (CRS)
19 Cotulla La Salle Co Airport (COT)
20 Dalhart Municipal Airport (DHT)
21 Dallas - Fort Worth International Airport (DFW)
22 Dallas Love Field (DAL)
23 Dallas Redbird Airport (RBD)
24 Del Rio International Airport (DRT)
25 Denton Municipal Airport (DTO)
26 Dryden Terrell County Airport (6R6)
27 El Paso International Airport (ELP)
28 FALFURRIAS: BROOKS COUNTY AIRPORT (BKS)
29 Fort Stockton Pecos County Airport (FST)
30 Fort Worth Alliance Airport (AFW)
31 Fort Worth Meacham (FTW)
32 FREDERICKSBURG: GILLESPIE COUNTY AIRPORT (T82)
33 GAINESVILLE: GAINESVILLE MUNICIPAL AIRPORT (GLE)
34 Galveston Scholes Field (GLS)
35 GEORGETOWN: GEORGETOWN MUNICIPAL AIRPORT (GTU)
36 Harlingen Rio Grande Valley I (HRL)
37 Hondo Municipal Airport (HDO)
38 Houston Bush Intercontinental (IAH)
39 Houston Clover Field (LVJ)
40 Houston Hooks Memorial Airport (DWH)
41 Houston Sugarland Mem (SGR)
42 Houston William P Hobby Airport (HOU)
43 Huntsville Municipal Airport (UTS)
44 JASPER: JASPER COUNTY-BELL FIELD AIRPORT (JAS)
45 Junction Kimble County Airport (JCT)
46 KERRVILLE: KERRVILLE MUNI/LOUIS SCHREINER FLD AIRPORT (ERV)
47 KILLEEN: KILLEEN MUNICIPAL AIRPORT (ILE)
48 KINGSVILLE: KINGSVILLE NAS AIRPORT (NQI)
49 LA GRANGE: FAYETTE REGIONAL AIR CENTER AIRPORT (3T5)
50 Longview E Tx Rgnl Airport (GGG)
51 Lubbock International Airport (LBB)
52 Lufkin Angelina Cty Airport (LFK)
53 MARFA: MARFA MUNICIPAL AIRPORT (MRF)
54 McAllen Miller International Airport (MFE)
55 McKinney Municipal Airport (TKI)
56 Midland International Airport (MAF)
57 Mineral Wells Airport (MWL)
58 MOUNT PLEASANT: MOUNT PLEASANT REGIONAL AIRPORT (OSA)
59 NACOGDOCHES: A L MANGHAM JR REGIONAL AIRPORT (OCH)
60 New Braunfels Municipal Airport (BAZ)
61 Odessa Schlemeyer Field (ODO)
62 Palacios Municipal Airport (PSX)
63 PARIS: COX FIELD AIRPORT (PRX)
64 PERRYTON: PERRYTON OCHILTREE COUNTY AIRPORT (PYX)
65 Pine Springs Guadalupe Mounta (GDP)
66 Port Arthur Se Tx Rgnl Airport (BPT)
67 Port Isabel Cameron County Airport (PIL)
68 Rockport Aransas Co Airport (RKP)
69 San Angelo Mathis Field (SJT)
70 San Antonio International Airport (SAT)
71 San Antonio Stinson Municipal Airport (SSF)
72 SAN MARCOS: SAN MARCOS MUNICIPAL AIRPORT (HYI)
73 SWEETWATER: AVENGER FIELD AIRPORT (SWW)
74 TEMPLE: DRAUGHON-MILLER CNTRL TEXAS REGIONAL ARPT (TPL)
75 Terrell Municipal Airport (TRL)
76 Tyler Pounds Field (TYR)
77 Victoria Regional Airport (VCT)
78 WACO: MC GREGOR EXECUTIVE AIRPORT (PWG)
79 Waco Regional Airport (ACT)
80 WESLACO: MID VALLEY AIRPORT (T65)
81 Wichita Falls Municipal Airport (SPS)
82 Wink Winkler Co Airport (INK)

Texas TMY2 Weather Files

1 Abilene
2 Amarillo
3 Austin
4 Brownsville
5 Corpus Christi
6 El Paso
7 Fort Worth
8 Houston
9 Lubbock
10 Lufkin
11 Midland
12 Port Arthur
13 San Angelo
14 San Antonio
15 Victoria
16 Waco
17 Wichita Falls

Texas WYEC2 Weather Files

1 El Paso
2 Brownsville
3 Fort Worth
4 San Antonio

NREL Solar Stations

1 Abilene
2 Austin
3 Big Spring
4 Canyon
5 Clear Lake
6 Corpus Christi
7 Del Rio
8 Edinburg
9 El Paso
10 Laredo
11 Menard
12 Overton
13 Pecos
14 Presidio
15 Sanderson

TCEQ Solar Stations

1 Bexar
2 Travis
3 El Paso (2)
4 Galveston
5 Harris (5)

FCHART and PV FCHART (New Weather File)

1 ABILENE
2 AMARILLO
3 AUSTIN
4 BROWNSVILLE
5 CORPUS CHRISTI
6 EL PASO
7 FORT WORTH
8 HOUSTON
9 LUBBOCK
10 LUFKIN
11 MIDLAND-ODESSA
12 PORT ARTHUR
13 SAN ANGELO
14 SAN ANTONIO
15 SHERMAN
16 VICTORIA
17 WACO
18 WICHITA FALLS

Figure 96: List of Available Weather Files in Texas (Listed by Symbol)

Table 63: Assignment of Weather Stations for 41 Non-attainment and Affected Counties (NOAA, TMY2, F-CHART, PV F-CHART, NAHB, Climate Zone, HDD, CDD, 90.1-1989, 90.1-1999)

Area	No.	County	NOAA Weather Station		Solar Station		TMY2		FCHART		PV-FCHART		DOE Include File	Weather File	DOE TRY weather file name	East or West Texas	Climate Zone	HDD		CDD		AHSRAE 90.1-1989		AHSRAE 90.1-1999		County
			WBAN No.	Weather Station	Source	File	WBAN No.	File										1989	1999	1989	1999	Nearest City	Table 8A (10, 12, 16)	Nearest City	Table B (5, 6, 8, 10)	
	ID	County	WBAN No.	Weather Station	x	x	x	TMY2File	Fchart	FchartID	PVFChart	PVFChartID	DOE_INC	x	DOE_WF	PRECODE	CZ									County
Austin	22	Bastrop	13958	Austin Camp Mabry (ATT)	NREL	Austin	13958	Austin	Austin	14	Austin	18	BAS	Austin	ATT	West	4					Austin	12	Austin	6	Bastrop
	26	Caldwell	13958	Austin Camp Mabry (ATT)	NREL	Austin	13958	Austin	Austin	14	Austin	18	CAL	Austin	ATT	West	4					Austin	12	Austin	6	Caldwell
	8	Hays	13958	Austin Camp Mabry (ATT)	NREL	Austin	13958	Austin	Austin	14	Austin	18	HAY	Austin	ATT	West	5					Austin	12	Austin	6	Hays
	40	Travis	13958	Austin Camp Mabry (ATT)	NREL	Austin	13958	Austin	Austin	14	Austin	18	TRA	Austin	ATT	West	5	1735	1688	6873	7171	Austin	12	Austin	6	Travis
	41	Williamson	13958	Austin Camp Mabry (ATT)	NREL	Austin	13958	Austin	Austin	14	Austin	18	WLL	Austin	ATT	West	5					Austin	12	Kileen/Robert-gray or **Austin**	6	Williamson
Corpus	38	Nueces	12924	Corpus Christi International Airport (CRP)	NREL	Corpus Christi	12924	Corpus Christi	Corpus Christi	52	Corpus Christi	58	NUE	Corpus Christi	CRP	East	3	889	1016	8200	8023	Corpus Christi	16	Corpus Christi or Alice	5	Nueces
	15	San Patricio	12924	Corpus Christi International Airport (CRP)	NREL	Corpus Christi	12924	Corpus Christi	Corpus Christi	52	Corpus Christi	58	SAP	Corpus Christi	CRP	East	3					Corpus Christi	16	Corpus Christi or Alice	5	San Patricio
El Paso	30	El Paso	23044	El Paso International Airport (ELP)	TCEQ	C12-El Paso UTEP	23044	El Paso	El Paso	68	El Paso	70	ELP	El Paso	ELP	West	6	2605	2708	5617	5488	El Paso	12	El Paso	10	El Paso
Dallas-Ft. Worth	27	Collin	03927	Dallas - Fort Worth International Airpor (DFW)	NREL	Overton	03927	Fort Worth	Fort Worth	78	Fort Worth	83	COL	Fort Worth	DFW	West	6					Sherman or Fort Worth	12	**Denton,** Greenville or Sherman	8	Collin
	4	Dallas	03927	Dallas - Fort Worth International Airpor (DFW)	NREL	Overton	03927	Fort Worth	Fort Worth	78	Fort Worth	83	DAL	Fort Worth	DFW	West	5		2259		6587	Fort Worth	12	Dallas	8	Dallas
	29	Denton	03927	Dallas - Fort Worth International Airpor (DFW)	NREL	Overton	03927	Fort Worth	Fort Worth	78	Fort Worth	83	DEN	Fort Worth	DFW	West	6					Shermanor Fort Worth	12	Denton	8	Denton
	31	Ellis	03927	Dallas - Fort Worth International Airpor (DFW)	NREL	Overton	03927	Fort Worth	Fort Worth	78	Fort Worth	83	ELL	Fort Worth	DFW	West	5					Fort Worth	12	Fort Worth, Dallas or Corsicana	8	Ellis
	23	Hood	03927	Dallas - Fort Worth International Airpor (DFW)	NREL	Overton	03927	Fort Worth	Fort Worth	78	Fort Worth	83	HOD	Fort Worth	DFW	West	5					Fort Worth	12	Mineral Wells or Fort Worth	8	Hood
	24	Hunt	03927	Dallas - Fort Worth International Airpor (DFW)	NREL	Overton	03927	Fort Worth	Fort Worth	78	Fort Worth	83	HNT	Fort Worth	DFW	West	6					Shermanor Fort Worth	12	Greenville	10	Hunt
	36	Johnson	03927	Dallas - Fort Worth International Airpor (DFW)	NREL	Overton	03927	Fort Worth	Fort Worth	78	Fort Worth	83	JOH	Fort Worth	DFW	West	5					Fort Worth	12	Mineral Wells or Fort Worth	8	Johnson
	10	Kaufman	03927	Dallas - Fort Worth International Airpor (DFW)	NREL	Overton	03927	Fort Worth	Fort Worth	78	Fort Worth	83	KAU	Fort Worth	DFW	West	6					Fort Worth	12	Greenville, **Dallas** or Corsicana	8	Kaufman
	39	Parker	03927	Dallas - Fort Worth International Airpor (DFW)	NREL	Overton	03927	Fort Worth	Fort Worth	78	Fort Worth	83	PAR	Fort Worth	DFW	West	6					Fort Worth	12	Mineral Wells or Fort Worth	8	Parker
	13	Rockwall	03927	Dallas - Fort Worth International Airpor (DFW)	NREL	Overton	03927	Fort Worth	Fort Worth	78	Fort Worth	83	ROC	Fort Worth	DFW	West	6					Shermanor Fort Worth	12	**Dallas** or Greenville	8	Rockwall
	17	Tarrant	03927	Dallas - Fort Worth International Airpor (DFW)	NREL	Overton	03927	Fort Worth	Fort Worth	78	Fort Worth	83	TAR	Fort Worth	DFW	West	5	2354		6174		Fort worth	12	Fort worth	8	Tarrant
Houston/Galveston	2	Brazoria	12960	Houston Bush Intercontinental (IAH)	NREL	Clear Lake	12960	Houston	Houston	96	Houston	102	BRA	Houston	IAH	East	3					Houston	10	Houston, Galveston or Bay City	5	Brazoria
	5	Fort Bend	12960	Houston Bush Intercontinental (IAH)	NREL	Clear Lake	12960	Houston	Houston	96	Houston	102	FOB	Houston	IAH	East	4					Houston	10	Houston or Bay City	5	Fort Bend
	32	Galveston	12960	Houston Bush Intercontinental (IAH)	NREL	Clear Lake	12960	Houston	Houston	96	Houston	102	GAL	Houston	IAH	East	3		1263		7378	Houston	10	Galveston	5	Galveston
	34	Harris	12960	Houston Bush Intercontinental (IAH)	NREL	Clear Lake	12960	Houston	Houston	96	Houston	102	HAR	Houston	IAH	East	4	1346	1371	7125	7357	Houston	10	Houston	5	Harris
	37	Montgomery	12960	Houston Bush Intercontinental (IAH)	NREL	Clear Lake	12960	Houston	Houston	96	Houston	102	MOG	Houston	IAH	East	4					Houston	10	Huntsville or **Houston**	5	Montgomery
	20	Waller	12960	Houston Bush Intercontinental (IAH)	NREL	Clear Lake	12960	Houston	Houston	96	Houston	102	WAL	Houston	IAH	East	4					Houston	10	Houston	5	Waller
Tyler/Longview	33	Gregg	03901	Longview E Tx Rgnl Airport (GGG)	NREL	Overton	93987	Lufkin	Lufkin	125	Lufkin	131	GRE	Lufkin	GGG	East	6					Lufkin	12	Longview	8	Gregg
	35	Harrison	03901	Longview E Tx Rgnl Airport (GGG)	NREL	Overton	93987	Lufkin	Lufkin	125	Lufkin	131	HAN	Lufkin	GGG	East	6					Lufkin	12	Longview	8	Harrison
	9	Henderson	03901	Longview E Tx Rgnl Airport (GGG)	NREL	Overton	93987	Lufkin	Lufkin	125	Lufkin	131	HDS	Lufkin	GGG	East	5					Lufkin, Waco or Fort Worth	12	Tyler, Palestine or Corsicana	8	Henderson
	14	Rusk	03901	Longview E Tx Rgnl Airport (GGG)	NREL	Overton	93987	Lufkin	Lufkin	125	Lufkin	131	RUS	Lufkin	GGG	East	5					Lufkin	12	Tyler or Longview	8	Rusk
	16	Smith	03901	Longview E Tx Rgnl Airport (GGG)	NREL	Overton	93987	Lufkin	Lufkin	125	Lufkin	131	SMI	Lufkin	GGG	East	5		1296		6562	Lufkin	12	Tyler	8	Smith
	18	Upshur	03901	Longview E Tx Rgnl Airport (GGG)	NREL	Overton	93987	Lufkin	Lufkin	125	Lufkin	131	UPS	Lufkin	GGG	East	6					Lufkin	12	Tyler or Longview	8	Upshur
Beaumont Pt. Arthur	3	Chambers	12917	Port Arthur Se Tx Rgnl Airport (BPT)	TCEQ	C34-Galveston Airport	12917	Port Arthur	Port Arthur	166	Port Arthur	172	CHA	Port Arthur	BPT	East	4					Houston or Port Arthur	10	Beaumont or **Houston**	5	Chambers
	7	Hardin	12917	Port Arthur Se Tx Rgnl Airport (BPT)	TCEQ	C34-Galveston Airport	12917	Port Arthur	Port Arthur	166	Port Arthur	172	HAD	Port Arthur	BPT	East	4					Port Arthur	10	Beaumont	6	Hardin
	25	Jefferson	12917	Port Arthur Se Tx Rgnl Airport (BPT)	TCEQ	C34-Galveston Airport	12917	Port Arthur	Port Arthur	166	Port Arthur	172	JEF	Port Arthur	BPT	East	4	1416	1677	6888	6703	Port Arthur	10	Beaumont	6	Jefferson
	11	Liberty	12917	Port Arthur Se Tx Rgnl Airport (BPT)	TCEQ	C34-Galveston Airport	12917	Port Arthur	Port Arthur	166	Port Arthur	172	LIB	Port Arthur	BPT	East	4					Houston or Port Arthur	10	Beaumont, Galveston or **Houston**	5	Liberty
	12	Orange	12917	Port Arthur Se Tx Rgnl Airport (BPT)	TCEQ	C34-Galveston Airport	12917	Port Arthur	Port Arthur	166	Port Arthur	172	ORA	Port Arthur	BPT	East	4					Port Arthur	10	Beaumont	6	Orange
San Antonio	1	Bexar	12921	San Antonio International Airport (SAT)	TCEQ	C58-Camp Bullis	12921	San Antonio	San Antonio	187	San Antonio	194	BEX	San Antonio	SAT	West	4	1579	1644	7170	7142	San Antonio	12	San Antonio	6	Bexar
	28	Comal	12921	San Antonio International Airport (SAT)	TCEQ	C58-Camp Bullis	12921	San Antonio	San Antonio	187	San Antonio	194	COM	San Antonio	SAT	West	4					San Antonio	12	San Antonio	6	Comal
	6	Guadalupe	12921	San Antonio International Airport (SAT)	TCEQ	C58-Camp Bullis	12921	San Antonio	San Antonio	187	San Antonio	194	GUA	San Antonio	SAT	West	4					San Antonio	12	San Antonio	6	Guadalupe
	21	Wilson	12921	San Antonio International Airport (SAT)	TCEQ	C58-Camp Bullis	12921	San Antonio	San Antonio	187	San Antonio	194	WIL	San Antonio	SAT	West	4					San Antonio	12	San Antonio	6	Wilson
Victoria	19	Victoria	12912	Victoria Regional Airport (VCT)	TCEQ	C58-Camp Bullis	12912	Victoria	Victoria	347	Victoria	225	VIC	Victoria	VCT	East	3	Hou	1296	Hou	7507			Victoria	5	Victoria

Table 64: Availability of Weather Data for 41 Non-attainment and Affected County (NOAA, NREL, TCEQ, ESL)

County No.	County	Affected : A Non Attain : N	NOAA WBAN No.	NOAA	NREL Station No.	NREL	TCEQ CAMS No.	TCEQ	ESL Site No.	ESL	TRY2 WBAN No.	TRY2
1	Bastrop	A									13958	Austin
2	Bexar	A	12921	San Antonio International Airport (SAT)			C58	Camp Bullis	140	UTHSC	12921	San Antonio
2	Bexar	A	12970	San Antonio Stinson Municipal Airport (SSF)							12922	San Antonio
3	Caldwell	A									13958	Austin
4	Comal	A									12923	San Antonio
5	Ellis	A					C30	El Paso East			03936	Fort Worth
5	Ellis	A					C94	Midlothian Tower			03937	Fort Worth
6	Gregg	A	[illegible]	Longview E. Tx Rgnl Airport (GGG)							93987	Lufkin
7	Guadalupe	A	12971	New Braunfels Municipal Airport (BAZ)							12924	San Antonio
8	Harrison	A									[illegible]	Lufkin
9	Hays	A	-	SAN MARCOS : SAN MARCOS MUNICIPAL AIRPORT (HYI)							[illegible]	Lufkin
10	Johnson	A					C77	Cleburne Airport			03930	Fort Worth
11	Kaufman	A	53911	Terrell Municipal Airport (TRL)			C71	Kaufman			03939	Fort Worth
12	Nueces	A	12924	Corpus Christi International Airport (CRP)	6	Corpus Christi	C4	Corpus Christi West			12924	Corpus Christi
12	Nueces	A	-	CORPUS CHRISTI : CORPUS CHRISTI NAS/TRUAX FIELD ARPT (NGP)							12924	Corpus Christi
13	Parker	A					C76	Parker County (Fort Worth)			03940	Fort Worth
14	Rockwall	A					C69	Rockwall Heath			03941	Fort Worth
15	Rusk	A			12	Overton					93987	Lufkin
16	San Patricio	A									12924	Corpus Christi
17	Smith	A	13972	Tyler Pounds Field (TYR)			C82	Tyler Airport relocated			[illegible]	Lufkin
18	Travis	A	13904	Austin - Bergstrom International (AUS)	2	Austin	C38	Austin Audubon Society	302	S.F. Austin Building (SFA)	93990	Lufkin
18	Travis	A	13958	Austin Camp Mabry (ATT)					217	Robert E. Johnson Elec Room (West Solar)	93991	Lufkin
18	Travis	A							217	Robert E. Johnson Elec Room (South Solar)	93992	Lufkin
19	Upshur	A									[illegible]	Lufkin
20	Victoria	A	12912	Victoria Regional Airport (VCT)			C87	Victoria			12912	Victoria
21	Williamson	A	-	GEORGETOWN : GEORGETOWN MUNICIPAL AIRPORT (GTU)							[illegible]	Lufkin
22	Wilson	A									12925	San Antonio
23	Henderson	A										
24	Hood	A					C73	Granbury				
25	Hunt	A					C1006	Greenville				
26	Brazoria	N	12976	Angleton / Lake Jackson Brazos (LBX)			C1013	Lake Jackson			12960	Houston
26	Brazoria	N	[illegible]	Houston Clover Field (LVJ)							12960	Houston
27	Chambers	N									12917	Port Arthur
28	Collin	N	53914	McKinney Municipal Airport (TKI)			C31	Frisco C31			03927	Fort Worth
28	Collin	N					C68	Anna			03928	Fort Worth
29	Dallas	N	13960	Dallas Love Field (DAL)			C63	Dallas North #2 (Dallas)	156	Federal Reserve - Weather Station (FRW)	03927	Fort Worth
29	Dallas	N	03971	Dallas Redbird Airport (RBD)			C74	Sunnyvale Long Creek (Dallas)			03928	Fort Worth
29	Dallas	N					C401	Dallas Hinton St			03929	Fort Worth
30	Denton	N	03991	Denton Municipal Airport (DTO)			C56	Denton Airport South			03942	Fort Worth
31	El Paso	N	23044	El Paso International Airport (ELP)	9	El Paso	C12	El Paso UTEP	326	Valle Verde Campus (ECV)	23044	El Paso
31	El Paso	N					C37	Ascarate Park SE			23045	El Paso
31	El Paso	N					C41	El Paso Chamizal			23046	El Paso
32	Fort Bend	N	12977	Houston Sugarland Mem. (SGR)							[illegible]	Houston
33	Galveston	N	12923	Galveston Scholes Field (GLS)			C34	Galveston Airport			12960	Houston
34	Hardin	N									12918	Port Arthur
35	Harris	N	12960	Houston Bush Intercontinental (IAH)	5	Clear Lake	C8	Aldine	121	UT Health Science Center	12960	Houston
35	Harris	N	53910	Houston Hooks Memorial Airport (DWH)			C15	Channelview	901	Habitat Humanity Houses	12960	Houston
35	Harris	N	12918	Houston William P Hobby Airport (HOU)			C26	Northwest Harris County			12960	Houston
35	Harris	N					C35	Deer Park #2			12961	Houston
35	Harris	N					C45	Seabrook Friendship Park			12962	Houston
35	Harris	N					C53	Houston Bayland Park			12963	Houston
35	Harris	N					C81	Houston Regional Office			12964	Houston
35	Harris	N					C85	Karnack			12965	Houston
35	Harris	N					C403	Clinton (TCEQ, Houston)			12966	Houston
35	Harris	N					C617	Wallisville Road			12967	Houston
35	Harris	N					C1015	Lynchburg Ferry			12968	Houston
36	Jefferson	N	12917	Port Arthur Se Tx Rgnl Airport (BPT)			C28	Port Arthur West			12917	Port Arthur
36	Jefferson	N					C2	Beaumont Downtown			12920	Port Arthur
36	Jefferson	N					C64	Hamshire			12921	Port Arthur
36	Jefferson	N					C643	SETRPC 43 Jefferson County Airport			12922	Port Arthur
37	Liberty	N									12923	Port Arthur
38	Montgomery	N	53902	Conroe Montgomery County Airport (CXO)			C78	Conroe Airport Relocated			[illegible]	Houston
39	Orange	N					C9	West Orange			12924	Port Arthur
40	Tarrant	N	53907	Arlington Municipal Airport (GKY)			C61	Arlington Municipal Airport	111	University Hall (UT Arlington)	03931	Fort Worth
40	Tarrant	N	03927	Dallas - Fort Worth International Airport (DFW)			C70	Grapevine Fairway			03932	Fort Worth
40	Tarrant	N	53909	Fort Worth Alliance Airport (AFW)			C13	Fort Worth Northwest			03933	Fort Worth
40	Tarrant	N	13961	Fort Worth Meacham (FTW)			C17	Keller (Fort Worth)			03934	Fort Worth
40	Tarrant	N					C75	Eagle Mountain Lake (Fort Worth)			03935	Fort Worth
41	Waller	N									12971	Houston

Note:

	County No.	The affected and non attainment county numbers are listed orderly using table 19, p. 101, of the TERP Technical Report 2003. The other county numbers are listed alphabetically
NOAA	WBAN No.	Station's Weather Bureau Army Navy number
TRY2	WBAN No.	Station's Weather Bureau Army Navy number
NREL	Station No.	The station numbers are listed alphabetically
TCEQ	CAMS No.	The numbers are from TCEQ
ESL	Site No.	ESL's site numbers
	Y in black	The whole year's data is available
	Y in red	The data is available for partial year

Table 65: Main NOAA Weather Stations used in eCALC

ABI	Abilene Regional Airport
AMA	Amarillo International Airport
BRO	Brownsville S. Padre Island International
LBB	Lubbock International Airport
MAF	Midland International Airport
SJT	San Angelo Mathis Field
ACT	Waco Regional Airport
SPS	Wichita Falls Municipal Airport
ATT	Austin Camp Mabry
BPT	Port Arthur Se TX Rgnl Airport
CRP	Corpus Christi International Airport
DFW	Dallas - Fort Worth International Airport
ELP	El Paso International Airport
GGG	Longview E TX Rgnl Airport
IAH	Houston Bush Intercontinental
SAT	San Antonio International Airport
VCT	Victoria Regional Airport

Table 66: Summary of Weather Data Assignments for ERCOT Counties

ERCOT COUNTY	ASSIGNED WEATHER STATION
ANDERSON	GGG
ANDREWS	MAF
ANGELINA	GGG
ARANSAS	CRP
ARCHER	SPS
ATASCOSA	SAT
AUSTIN	IAH
BANDERA	SAT
BASTROP	ATT
BAYLOR	SPS
BEE	VCT
BELL	ACT
BEXAR	SAT
BLANCO	ATT
BORDEN	LBB
BOSQUE	ACT
BRAZORIA	IAH
BRAZOS	IAH
BREWSTER	SJT
BRISCOE	AMA
BROOKS	BRO
BROWN	ACT
BURLESON	IAH
BURNET	ATT
CALDWELL	ATT
CALHOUN	VCT
CALLAHAN	ABI
CAMERON	BRO
CHAMBERS	BPT
CHEROKEE	GGG
CHILDRESS	LBB
CLAY	SPS
COKE	SJT
COLEMAN	ABI
COLLIN	DFW
COLORADO	IAH
COMAL	SAT
COMANCHE	ACT
CONCHO	SJT
COOKE	SPS
CORYELL	ACT
COTTLE	SPS
CRANE	MAF
CROCKETT	SJT
CROSBY	LBB
CULBERSON	ELP
DALLAS	DFW
DAWSON	LBB
DE WITT	VCT
DELTA	DFW
DENTON	DFW
DICKENS	LBB
DIMMIT	CRP
DUVAL	CRP
EASTLAND	ABI
ECTOR	MAF
EDWARDS	SJT
ELLIS	DFW
ERATH	ABI
FALLS	ACT
FANNIN	SPS
FAYETTE	IAH
FISHER	ABI
FOARD	SPS
FORT BEND	IAH
FRANKLIN	DFW
FREESTONE	ACT
FRIO	SAT
GALVESTON	IAH
GILLESPIE	ATT
GLASSCOCK	MAF
GOLIAD	VCT
GONZALES	SAT
GRAYSON	SPS
GRIMES	IAH
GUADALUPE	SAT
HALL	AMA
HAMILTON	ACT
HARDEMAN	SPS
HARRIS	IAH
HASKELL	ABI
HAYS	ATT
HENDERSON	DFW
HIDALGO	BRO
HILL	ACT
HOOD	DFW
HOPKINS	DFW
HOUSTON	GGG
HOWARD	MAF
HUDSPETH	ELP
HUNT	SPS
IRION	SJT
JACK	ABI
JACKSON	VCT
JEFF DAVIS	MAF
JIM HOGG	BRO
JIM WELLS	CRP
JOHNSON	DFW
JONES	ABI
KARNES	VCT
KAUFMAN	DFW
KENDALL	SAT
KENEDY	BRO
KENT	LBB
KERR	ATT
KIMBLE	SJT
KING	LBB
KINNEY	SAT
KLEBERG	CRP
KNOX	SPS
LA SALLE	CRP
LAMAR	DFW
LAMPASAS	ACT
LAVACA	VCT
LEE	ATT
LEON	ACT
LIMESTONE	ACT
LIVE OAK	CRP
LLANO	ATT
LOVING	MAF
MADISON	IAH
MARTIN	MAF
MASON	ATT
MATAGORDA	VCT
MAVERICK	CRP
MCCULLOCH	SJT
MCLENNAN	ACT
MCMULLEN	CRP
MEDINA	SAT
MENARD	SJT
MIDLAND	MAF
MILAM	IAH
MILLS	ACT
MITCHELL	ABI
MONTAGUE	SPS
MONTGOMERY	IAH
MOTLEY	LBB
NACOGDOCHES	GGG
NAVARRO	ACT
NOLAN	ABI
NUECES	CRP
PALO PINTO	ABI
PARKER	DFW
PECOS	SJT
PRESIDIO	SJT
RAINS	DFW
REAGAN	MAF
REAL	ATT
RED RIVER	DFW
REEVES	MAF
REFUGIO	VCT
ROBERTSON	IAH
ROCKWALL	DFW
RUNNELS	SJT
RUSK	GGG
SAN PATRICIO	CRP
SAN SABA	ATT
SCHLEICHER	SJT
SCURRY	LBB
SHACKELFORD	ABI
SMITH	DFW
SOMERVELL	DFW
STARR	BRO
STEPHENS	ABI
STERLING	SJT
STONEWALL	LBB
SUTTON	SJT
TARRANT	DFW
TAYLOR	ABI
TERRELL	SJT
THROCKMORTON	ABI
TITUS	DFW
TOM GREEN	SJT
TRAVIS	ATT
UPTON	MAF
UVALDE	SAT
VAL VERDE	SAT
VAN ZANDT	DFW
VICTORIA	VCT
WALLER	IAH
WARD	MAF
WASHINGTON	IAH
WEBB	CRP
WHARTON	VCT
WICHITA	SPS
WILBARGER	SPS
WILLACY	BRO
WILLIAMSON	ATT
WILSON	SAT
WINKLER	MAF
WISE	DFW
YOUNG	ABI
ZAPATA	BRO
ZAVALA	CRP

Table 67: Assignment of NWS Weather Stations for all ERCOT Counties

No.	The City TMY2 Weather File is Available	County with TMY2 Weather Station					Adjacent Counties						Nearest Counties						
		County Name	Weather Zone	HDD	Table	Weather Station Assigned	No.	County Name	Weather Zone	HDD	Table	Weather Station Assigned	No.	County Name	Nearest Cities with TMY2 Files	Weather Zone	HDD	Table	Weather Station Assigned
1	Abilene	TAYLOR	6B	2584	B-8	ABI	1	CALLAHAN	6B			ABI	1	EASTLAND	Abilene (6B)	6B			ABI
							2	COLEMAN	5B			ABI	2	ERATH	Abilene (6B), Fort Worth (5B)	6B			ABI
							3	FISHER	6B			ABI	3	HASKELL	Abilene (6B), Wichita Falls (7B)	6B			ABI
							4	JONES	6B			ABI	4	JACK	Fort Worth (5B), Abilene (6B)	6B			ABI
							5	NOLAN	6B			ABI	5	MITCHELL	Abilene (6B), Midland (6B)	6B			ABI
							6	SHACKELFORD	6B			ABI	6	PALO PINTO	Fort Worth (5B), Abilene (6B)	6B	2625	B-8	ABI
													7	STEPHENS	Abilene (6B)	6B			ABI
													8	THROCKMORTON	Abilene (6B), Wichita Falls (7B)	6B			ABI
													9	YOUNG	Wichita Falls (7B), Abilene (6B), Fort Worth (5B)	6B			ABI
2	Amarillo	POTTER	9B	4258	B-13	AMA							10	BRISCOE	Amarillo (9B), Lubbock (7B)	8			AMA
													11	HALL	Amarillo (9B), Lubbock (7B)	8			AMA
3	Austin	TRAVIS	5B	1688	B-6	ATT	7	BASTROP	4B			ATT	12	GILLESPIE	San Antonio (4B), Austin (5B)	5A			ATT
							8	BLANCO	5A			ATT	13	KERR	San Antonio (4B), Austin (5B)	5A			ATT
							9	BURNET	5A			ATT	14	LEE	Austin (5B), Houston (4B)	4B			ATT
							10	CALDWELL	4B			ATT	15	LLANO	Austin (5B), San Antonio (4B),	5B			ATT
							11	HAYS	5B			ATT	16	MASON	Austin (5B), San Antonio (4B),	5B			ATT
							12	WILLIAMSON	5B			ATT	17	REAL	San Antonio (4B), Austin (5B), San Angelo (5B)	5A			ATT
													18	SAN SABA	Austin (5B), San Angelo (5B), Waco (5B)	5B			ATT
4	Brownsville	CAMERON	2B	635	B-3	BRO	13	HIDALGO	2B	778	B-3	BRO	19	BROOKS	Brownsville (2B), Corpus Christie (3B)	2B			BRO
							14	WILLACY	2B			BRO	20	JIM HOGG	Brownsville (2B), Corpus Christie (3B)	2B			BRO
													21	KENEDY	Brownsville (2B), Corpus Christie (3B)	2B			BRO
													22	STARR	Brownsville (2B)	2B			BRO
													23	ZAPATA	Brownsville (2B), Corpus Christie (3B)	2B			BRO
5	Corpus Christi	NUECES	3B	1016	B-5	CRP	15	ARANSAS	3B			CRP	24	DIMMIT	Corpus Christi (3B), San Anotonio (4B)	3C			CRP
							16	JIM WELLS	3C	1062	B-5	CRP	25	DUVAL	Corpus Christi (3B)	3C			CRP
							17	KLEBERG	2B			CRP	26	LA SALLE	Corpus Christi (3B)	3C			CRP
							18	SAN PATRICIO	3C			CRP	27	LIVE OAK	Corpus Christi (3B), Victoria (3B)	3C			CRP
													28	MAVERICK	San Anotonio (4B), Corpus Christi (3B)	3C	1441	B-5	CRP
													29	MCMULLEN	Corpus Christi (3B), Victoria (3B)	3C			CRP
													30	WEBB	Corpus Christi (3B)	3C	1025	B-5	CRP
													31	ZAVALA	San Anotonio (4B), Corpus Christi (3B)	3C			CRP
6	El Paso	EL PASO	6B	2708	B-10	ELP	19	HUDSPETH	6B			ELP	32	CULBERSON	El Paso (6B)	6B			ELP
7	Fort Worth	TARRANT	5B	2304	B-8	DFW	20	COLLIN	6B			DFW	33	DELTA	Fort Worth (5B)	6B			DFW
							21	DALLAS	5B	2259	B-8	DFW	34	FRANKLIN	Fort Worth (5B)	6B			DFW
							22	DENTON	6B	2665	B-8	DFW	35	HENDERSON	Fort Worth (5B), Lufkin (5A), Waco (5B)	5B			DFW
							23	ELLIS	5B			DFW	36	HOOD	Fort Worth (5B), Waco (5B)	5B			DFW
							24	JOHNSON	5B			DFW	37	HOPKINS	Fort Worth (5B)	6B			DFW
							25	PARKER	6B			DFW	38	KAUFMAN	Fort Worth (5B)	6B			DFW
							26	WISE	6B			DFW	39	LAMAR	Fort Worth (5B)	6B			DFW
													40	RAINS	Fort Worth (5B)	6B			DFW
													41	RED RIVER	Fort Worth (5B)	6B			DFW
													42	ROCKWALL	Fort Worth (5B)	6B			DFW
													43	SMITH	Fort Worth (5B), Lufkin (5A)	5B	2194	B-8	DFW
													44	SOMERVELL	Fort Worth (5B), Waco (5B)	5B			DFW
													45	TITUS	Fort Worth (5B)	6B			DFW
													46	VAN ZANDT	Fort Worth (5B)	6B			DFW
8	Houston	HARRIS	4B	1371	B-5	IAH	27	BRAZORIA	3B			IAH	47	AUSTIN	Houston (4B)	4B			IAH
							28	FORT BEND	4B			IAH	48	BRAZOS	Houston (4B), Austin (5B), Waco (5B)	4B			IAH
							29	GALVESTON	3B	1263	B-5	IAH	49	BURLESON	Austin (5B), Waco (5B), Houston (4B)	4B			IAH
							30	MONTGOMERY	4B			IAH	50	COLORADO	Houston (4B), Victoria (3B)	4B			IAH
							31	WALLER	4B			IAH	51	FAYETTE	Houston (4B), San Antonio (4B)	4B			IAH
													52	GRIMES	Houston (4B)	4B			IAH
													53	MADISON	Houston (4B), Waco (5B), Lufkin (5A)	4B			IAH
													54	MILAM	Austin (5B), Waco (5B), Houston (4B)	4B			IAH
													55	ROBERTSON	Waco (5B), Houston (4B)	4B			IAH
													56	WASHINGTON	Houston (4B), Austin (5B)	4B			IAH
9	Lubbock	LUBBOCK	7B	3431	B-11	LBB	32	CROSBY	7B			LBB	57	BORDEN	Lubbock (7B), Abilene (6B), Midland (6B)	7B			LBB
													58	CHILDRESS	Lubbock (7B), Wichita Falls (7B)	7B			LBB
													59	DAWSON	Lubbock (7B), Midland (6B)	7B	3159	B-11	LBB
													60	DICKENS	Lubbock (7B)	7B			LBB
													61	KENT	Lubbock (7B), Abilene (6B)	7B			LBB
													62	KING	Lubbock (7B), Abilene (6B), Wichita Falls (7B)	7B			LBB
													63	MOTLEY	Lubbock (7B)	7B			LBB
													64	SCURRY	Lubbock (7B), Midland (6B), Abilene (6B)	7B	3185	B-11	LBB
													65	STONEWALL	Abilene (6B), Lubbock (7B), Wichita Falls (7B)	7B			LBB
10	Lufkin	ANGELINA	5A	1951	B-8	GGG	33	CHEROKEE	5A			GGG	66	ANDERSON	Lufkin (5A)	5A	2005	B-8	GGG
							34	HOUSTON	5A			GGG	67	RUSK	Lufkin (5A)	5B			GGG
							35	NACOGDOCHES	5A			GGG	67						
11	Midland	MIDLAND	6B	2751	B-10	MAF	36	ANDREWS	6B			MAF	68	HOWARD	Midland (6B)	6B	2772	B-10	MAF
							37	CRANE	5B			MAF	69	JEFF DAVIS	Midland (6B), El Paso (6B)	6B			MAF
							38	ECTOR	6B			MAF	70	LOVING	Midland (6B)	6B			MAF
							39	GLASSCOCK	6B			MAF	71	REEVES	Midland (6B)	6B	2505	B-8	MAF
							40	MARTIN	6B			MAF	72	WARD	Midland (6B)	6B			MAF
							41	REAGAN	5B			MAF	73	WINKLER	Midland (6B)	6B			MAF
							42	UPTON	5B			MAF	73						
12	Port Arthur	JEFFERSON	4B	1677	B-6	BPT	43	CHAMBERS	4B			BPT	73						
13	San Angelo	TOM GREEN	5B	2414	B-8	SJT	44	COKE	6B			SJT	74	BREWSTER	El Paso (6B), San Angelo (5B)	5A			SJT
							45	CONCHO	5B			SJT	75	CROCKETT	San Angelo (5B)	5B			SJT
							46	IRION	5B			SJT	76	EDWARDS	San Angelo (5B)	5A			SJT
							47	MENARD	5B			SJT	77	KIMBLE	San Angelo (5B), Austin (5B)	5A			SJT
							48	RUNNELS	5B			SJT	78	MCCULLOCH	San Angelo (5B)	5B			SJT
							49	SCHLEICHER	5B			SJT	79	PECOS	San Angelo (5B)	5A			SJT
							50	STERLING	6B			SJT	80	PRESIDIO	El Paso (6B), San Angelo (5B)	5A			SJT
													81	SUTTON	San Angelo (5B)	5A			SJT
													82	TERRELL	San Angelo (5B)	5A			SJT
14	San Antonio	BEXAR	4B	1644	B-6	SAT	51	ATASCOSA	3C			SAT	83	FRIO	San Antonio (4B), Corpus Christi (3B)	3C			SAT
							52	BANDERA	5A			SAT	84	GONZALES	San Antonio (4B), Victoria (3B)	4B			SAT
							53	COMAL	4B			SAT	85	KINNEY	San Antonio (4B)	4B			SAT
							54	GUADALUPE	4B			SAT	86	UVALDE	San Antonio (4B)	4B			SAT
							55	KENDALL	5A			SAT	87	VAL VERDE	San Anotonio (4B), San Angelo (5B)	4B	1565	B-5	SAT
							56	MEDINA	4B			SAT	87						SAT
							57	WILSON	4B			SAT	87						
15	Victoria	VICTORIA	3B	1296	B-5	VCT	58	CALHOUN	3B			VCT	88	BEE	Corpus Christi (3B), Victoria (3B)	3B	1372	B-5	VCT
							59	DE WITT	3C			VCT	89	KARNES	Victoria (3B), San Antonio (4B), Corpus Christi (3B)	3C			VCT
							60	GOLIAD	3B			VCT	90	MATAGORDA	Victoria (3B)	3B	1370	B-5	VCT
							61	JACKSON	3B			VCT	91	WHARTON	Victoria (3B), Houston (4B)	3B			VCT
							62	LAVACA	4B			VCT	91						
							63	REFUGIO	3B			VCT	91						
16	Waco	MCLENNAN	5B	2179	B-8	ACT	64	BELL	5B	2127	B-8	ACT	92	BROWN	Abilene (6B), Waco (5B), San Angelo (5B)	5B	2199	B-8	ACT
							65	BOSQUE	5B			ACT	93	COMANCHE	Waco (5B), Abilene (6B)	5B			ACT
							66	CORYELL	5B			ACT	94	FREESTONE	Waco (5B)	5B			ACT
							67	FALLS	5B			ACT	95	HAMILTON	Waco (5B)	5B			ACT
							68	HILL	5B			ACT	96	LAMPASAS	Waco (5B), Austin (5B)	5B			ACT
							69	LIMESTONE	5B			ACT	97	LEON	Waco (5B), Lufkin (5A)	5B			ACT
													98	MILLS	Waco (5B), Austin (5B)	5B			ACT
													99	NAVARRO	Waco (5B), Fort Worth (5B)	5B	2396	B-8	ACT
17	Wichita Falls	WICHITA	7B	3042	B-10	SPS	70	ARCHER	7B			SPS	100	COOKE	Fort Worth (5B), Wichita Falls (7B)	6B			SPS
							71	BAYLOR	7B			SPS	101	COTTLE	Witchita Falls (7B), Lubbock (7B)	7B			SPS
							72	CLAY	7B			SPS	102	FANNIN	Fort Worth (5B), Wichita Falls (7B)	6B			SPS
							73	WILBARGER	7B	3186	B-10	SPS	103	FOARD	Witchita Falls (7B)	7B			SPS
													104	GRAYSON	Fort Worth (5B), Wichita Falls (7B)	6B	2890	B-10	SPS
													105	HARDEMAN	Witchita Falls (7B)	7B			SPS
													106	HUNT	Fort Worth (5B), Wichita Falls (7B)	6B	2953	B-10	SPS
													107	KNOX	Wichita Falls (7B)	7B			SPS
													108	MONTAGUE	Wichita Falls (7B), Fort Worth (5B)	6B			SPS

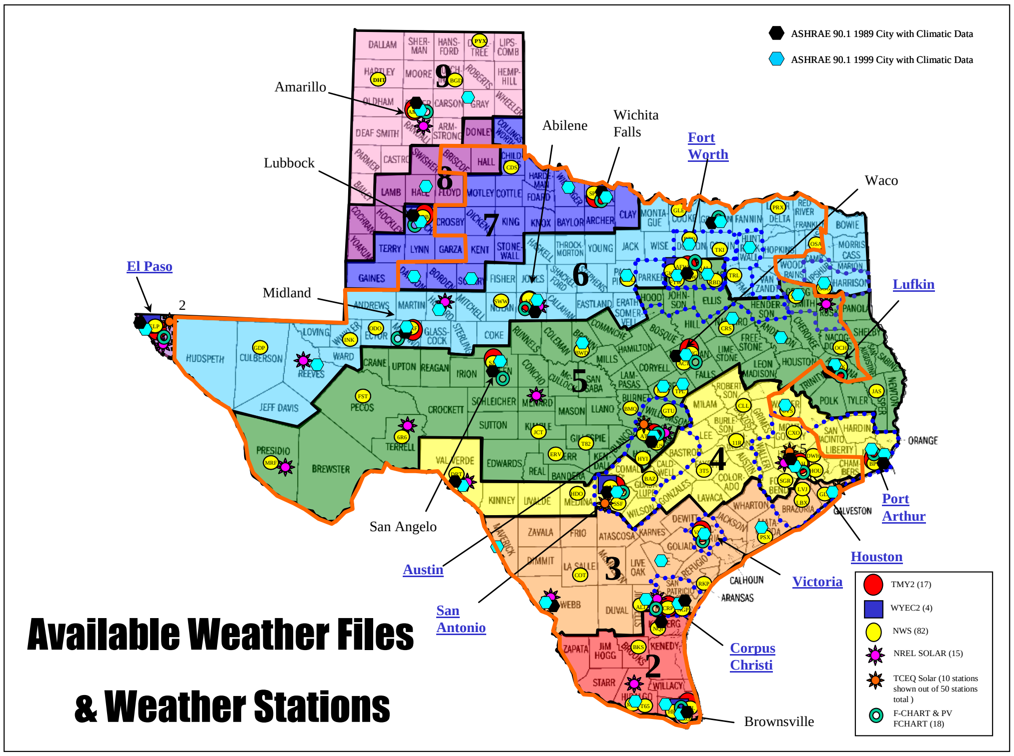


Figure 97: Available Weather Stations in Texas for all ERCOT Counties

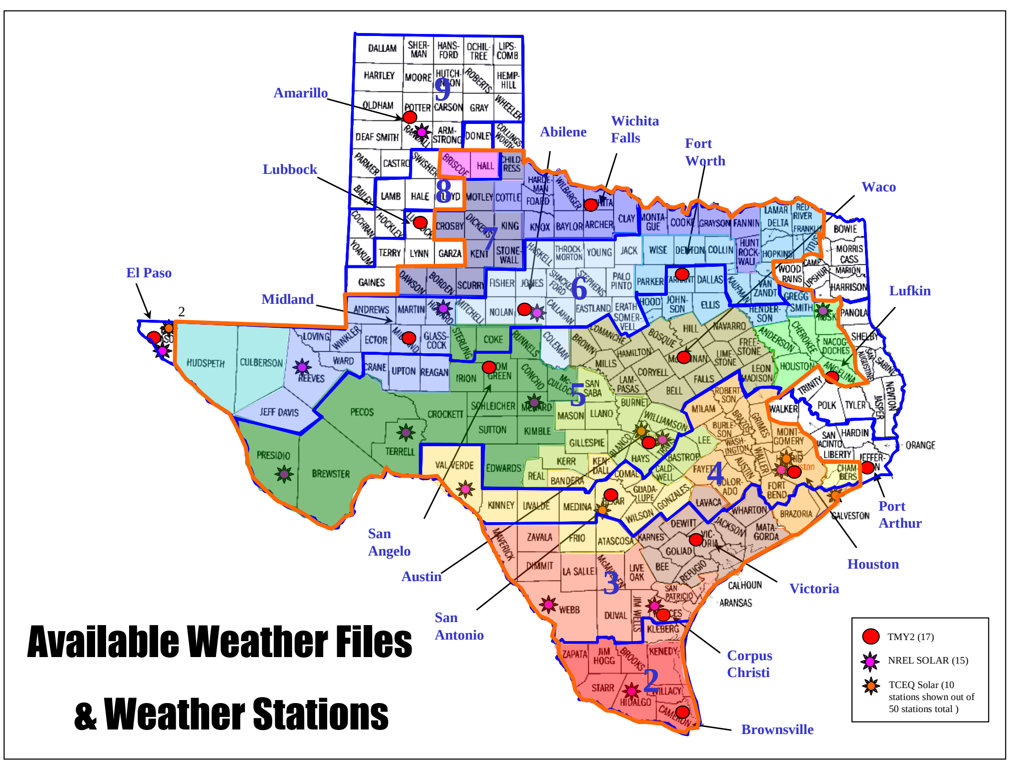


Figure 98: Grouping of Weather Stations in Texas for all ERCOT Counties

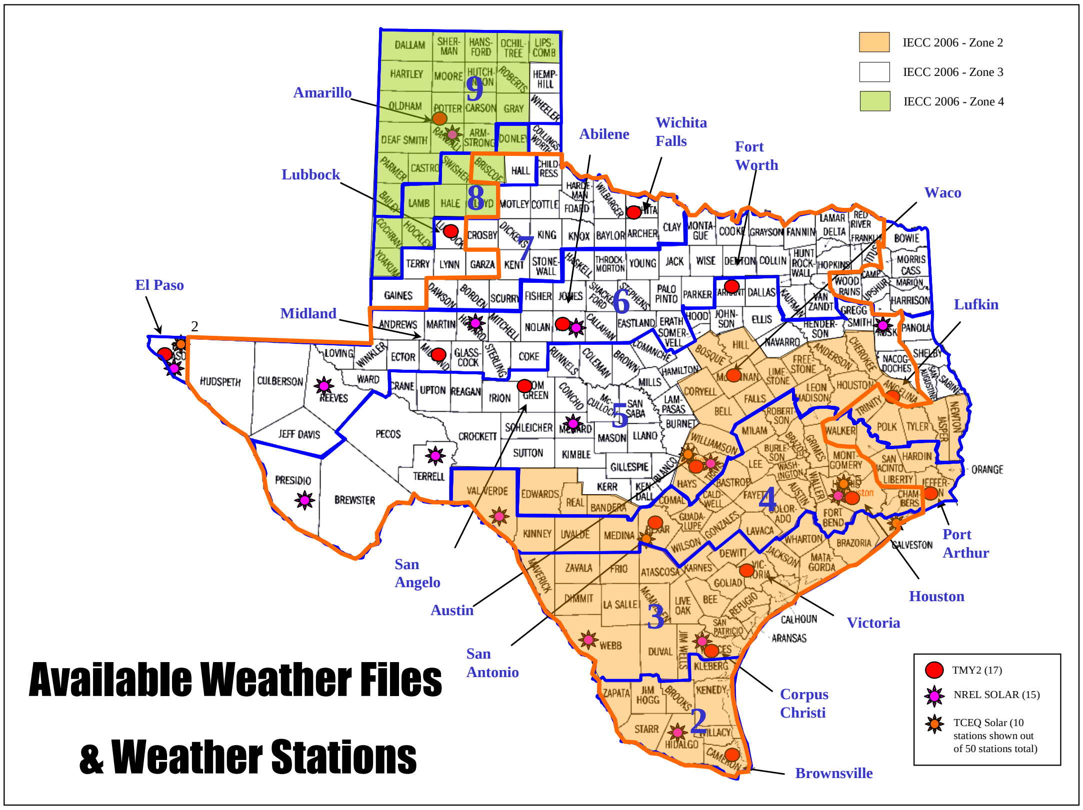


Figure 99: Available Weather Stations in Texas for all ERCOT Counties Showing 2000/2001 and 2006 Climate Zones

List of Available Weather Files and Weather Stations of Texas

Texas Weather Stations (NOAA)

1	Abilene Regional Airport (ABI)
2	Alice International Airport (ALI)
3	Amarillo International Airport (AMA)
4	Angleton / Lake Jackson Brazori (LBX)
5	Arlington Municipal Airport (GKY)
6	Austin - Bergstrom International (AUS)
7	Austin Camp Mabry (ATT)
8	Borger Hutchinson County Airport (BGD)
9	BRENHAM: BRENHAM MUNICIPAL AIRPORT (11R)
10	Brownsville S Padre Isl International (BRO)
11	BROWNWOOD: BROWNWOOD REGIONAL AIRPORT (BWD)
12	Burnet Municipal Airport (BMQ)
13	Childress Municipal Airport (CDS)
14	College Station (CLL)
15	Conroe Montgomery County Airport (CXO)
16	Corpus Christi International Airport (CRP)
17	CORPUS CHRISTI: CORPUS CHRISTI NAS/TRUAX FIELD ARPT (NGP)
18	Corsicana Campbell Field (CRS)
19	Cotulla La Salle Co Airport (COT)
20	Dalhart Municipal Airport (DHT)
21	Dallas - Fort Worth International Airport (DFW)
22	Dallas Love Field (DAL)
23	Dallas Redbird Airport (RBD)
24	Del Rio International Airport (DRT)
25	Denton Municipal Airport (DTO)
26	Dryden Terrell County Airport (6R6)
27	El Paso International Airport (ELP)
28	FALFURRIAS : BROOKS COUNTY AIRPORT (BKS)
29	Fort Stockton Pecos County Airport (FST)
30	Fort Worth Alliance Airport (AFW)
31	Fort Worth Meacham (FTW)
32	FREDERICKSBURG: GILLESPIE COUNTY AIRPORT (T82)
33	GAINESVILLE : GAINESVILLE MUNICIPAL AIRPORT (GLE)
34	Galveston Scholes Field (GLS)
35	GEORGETOWN : GEORGETOWN MUNICIPAL AIRPORT (GTU)
36	Harlingen Rio Grande Valley I (HRL)
37	Hondo Municipal Airport (HDO)
38	Houston Bush Intercontinental (IAH)
39	Houston Clover Field (LVJ)
40	Houston Hooks Memorial Airport (DWH)
41	Houston Sugarland Mem (SGR)
42	Houston William P Hobby Airport (HOU)
43	Huntsville Municipal Airport (UTS)
44	JASPER : JASPER COUNTY-BELL FIELD AIRPORT (JAS)
45	Junction Kimble County Airport (JCT)
46	KERRVILLE : KERRVILLE MUNI/LOUIS SCHREINER FLD AIRPORT (ERV)
47	KILLEEN : KILLEEN MUNICIPAL AIRPORT (ILE)
48	KINGSVILLE : KINGSVILLE NAS AIRPORT (NQI)
49	LA GRANGE : FAYETTE REGIONAL AIR CENTER AIRPORT (3T5)
50	Longview E Tx Rgnl Airport (GGG)
51	Lubbock International Airport (LBB)
52	Lufkin Angelina Cty Airport (LFK)
53	MARFA : MARFA MUNICIPAL AIRPORT (MRF)
54	McAllen Miller International Airport (MFE)
55	McKinney Municipal Airport (TKI)
56	Midland International Airport (MAF)
57	Mineral Wells Airport (MWL)
58	MOUNT PLEASANT : MOUNT PLEASANT REGIONAL AIRPORT (OSA)
59	NACOGDOCHES : A L MANGHAM JR REGIONAL AIRPORT (OCH)
60	New Braunfels Municipal Airport (BAZ)
61	Odessa Schlemeyer Field (ODO)
62	Palacios Municipal Airport (PSX)
63	PARIS : COX FIELD AIRPORT (PRX)
64	PERRYTON : PERRYTON OCHILTREE COUNTY AIRPORT (PYX)
65	Pine Springs Guadalupe Mounta (GDP)
66	Port Arthur Se Tx Rgnl Airport (BPT)
67	Port Isabel Cameron County Airport (PIL)
68	Rockport Aransas Co Airport (RKP)
69	San Angelo Mathis Field (SJT)
70	San Antonio International Airport (SAT)
71	San Antonio Stinson Municipal Airport (SSF)
72	SAN MARCOS : SAN MARCOS MUNICIPAL AIRPORT (HYI)
73	SWEETWATER : AVENGER FIELD AIRPORT (SWW)
74	TEMPLE: DRAUGHON-MILLER CNTRL TEXAS REGIONAL ARPT (TPL)
75	Terrell Municipal Airport (TRL)
76	Tyler Pounds Field (TYR)
77	Victoria Regional Airport (VCT)
78	WACO : MC GREGOR EXECUTIVE AIRPORT (PWG)
79	Waco Regional Airport (ACT)
80	WESLACO : MID VALLEY AIRPORT (T65)
81	Wichita Falls Municipal Airport (SPS)
82	Wink Winkler Co Airport (INK)

Texas TMY2 Weather Files

1	Abilene
2	Amarillo
3	Austin
4	Brownsville
5	Corpus Christi
6	El Paso
7	Fort Worth
8	Houston
9	Lubbock
10	Lufkin
11	Midland
12	Port Arthur
13	San Angelo
14	San Antonio
15	Victoria
16	Waco
17	Wichita Falls

Texas WYEC2 Weather Files

1	El Paso
2	Brownsville
3	Fort Worth
4	San Antonio

NREL Solar Stations

1	Abilene
2	Austin
3	Big Spring
4	Canyon
5	Clear Lake
6	Corpus Christi
7	Del Rio
8	Edinburg
9	El Paso
10	Laredo
11	Menard
12	Overton
13	Pecos
14	Presidio
15	Sanderson

TCEQ Solar Stations

1	Bexar
2	Travis
3	El Paso (2)
4	Galveston
5	Harris (5)

FCHART and PV FCHART (New Weather File)

1	ABILENE
2	AMARILLO
3	AUSTIN
4	BROWNSVILLE
5	CORPUS CHRISTI
6	EL PASO
7	FORT WORTH
8	HOUSTON
9	LUBBOCK
10	LUFKIN
11	MIDLAND-ODESSA
12	PORT ARTHUR
13	SAN ANGELO
14	SAN ANTONIO
15	SHERMAN
16	VICTORIA
17	WACO
18	WICHITA FALLS

Figure 100: List of Available Weather Files in Texas (Listed by Symbol)

9 PLANNED VERIFICATION TO THE EMISSIONS CALCULATOR (eCALC)

As part of the analysis effort, verification and validation efforts are planned for each of the major analysis areas in the emissions calculator, including: on-site inspections, and calibrated simulations.

9.1 On-site Inspections

On-site inspection work continued in 2008, including residential and commercial buildings to determine if specific energy-conserving features are being installed properly.

9.2 Calibrated Simulations

Calibrated simulations are planned for two commercial sites and one residential site to help confirm the accuracy of the code-compliant DOE-2 simulations. For each site, existing data loggers, installed from previous projects were restarted and the data from the sensors checked for accuracy. These sites include a standard office building, a K-12 school in College Station, Texas.

9.2.1 Standard Office building

The calibrated simulation of a standard office building using the Texas A&M University Systems Building in College Station, Texas, continues. Figure 101 to Figure 108 show the related information from this site. This building is currently being monitored as part of the campus energy conservation program and includes the channels shown in Figure 107. The goal with this site is to develop a calibrated simulation of the actual building (Figure 103), and a representative building (Figure 104), and then compare/contrast the savings differences between the calibrated model vs the representative model.

9.2.2 Soolyeon Cho's Thesis

In May of 2008, Soolyeon Cho's thesis entitled, "Methodology to Develop and Test an Easy-To-Use Procedure for the Preliminary Selection of High-Performance Systems for Office Buildings in Hot and Humid Climates" developed a procedure using the John Connally Building in College Station, Texas.

Figure 101: Standard Office Building (Texas A&M University Systems Building, College Station, Texas)

Figure 102: Standard Office Building (Texas A&M University Systems Building, College Station, Texas)

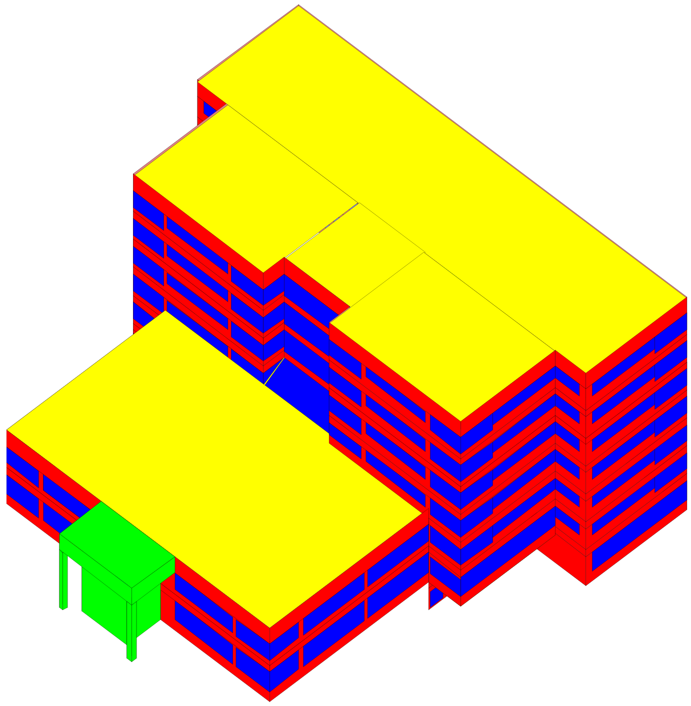


Figure 103: Computer Simulation (DOE-2.1E) of Case Study Office Building

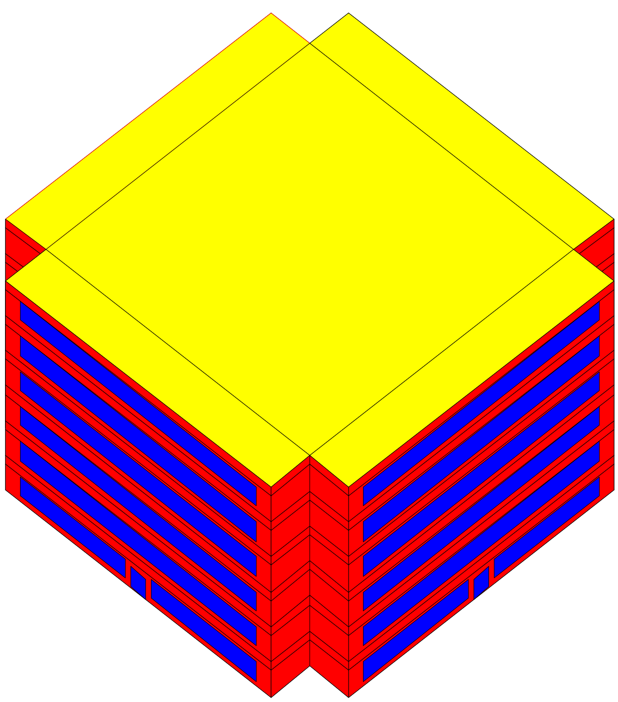


Figure 104: Computer Simulation (DOE-2.1E) of Base Case Office Building

Figure 105: Air Handling Unit in the 5th Floor of the John Connally Building

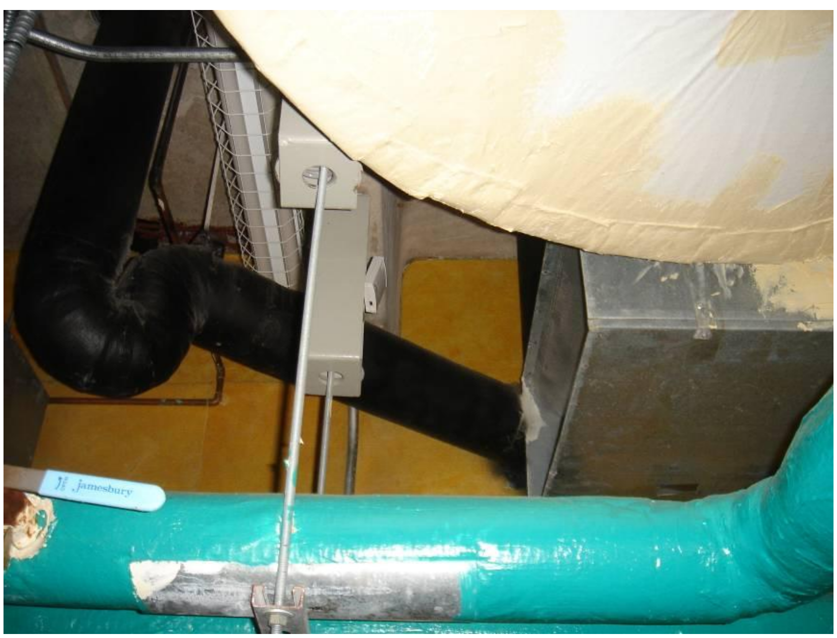


Figure 106: Installation of a Portable Logger to Measure the Return Air Temperature of an AHU on the 5th Floor

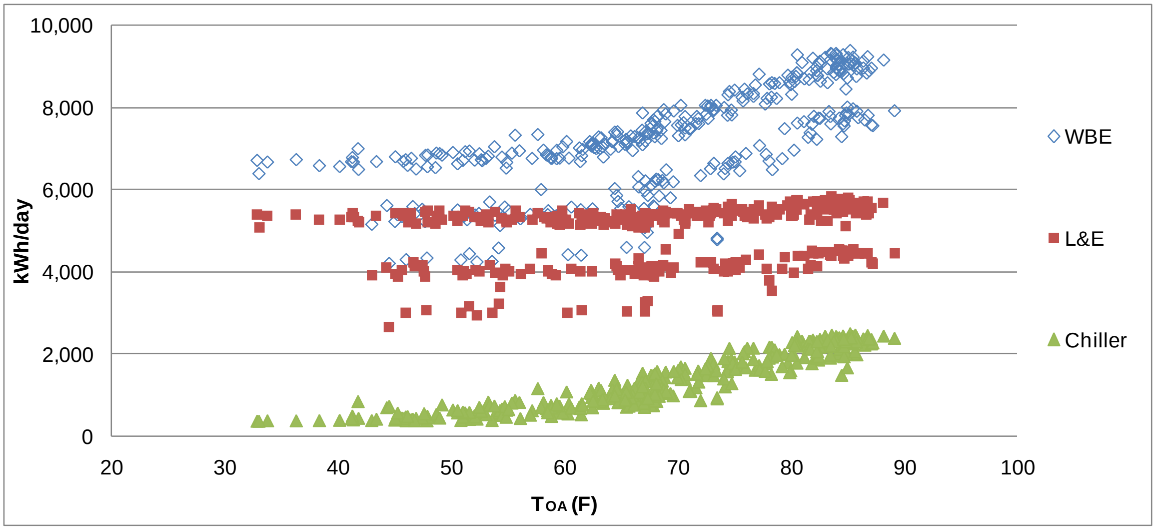
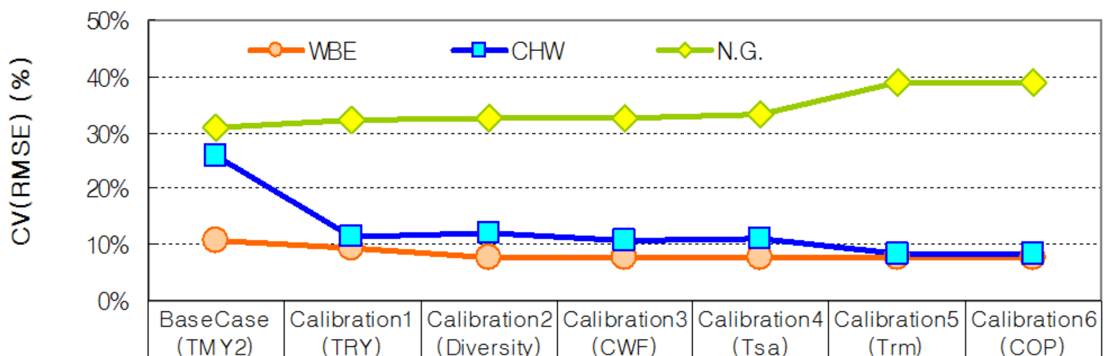
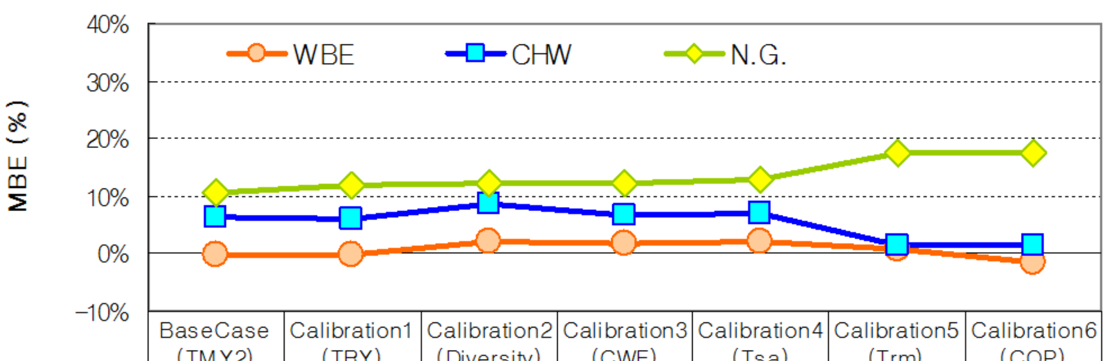


Figure 107: 2008 Scatter Plots from the Data logger Installed in the Case Study Office Building



	BaseCase (TMY2)	Calibration1 (TRY)	Calibration2 (Diversity)	Calibration3 (CWF)	Calibration4 (Tsa)	Calibration5 (Trm)	Calibration6 (COP)
WBE	10.6%	9.5%	7.8%	7.8%	7.9%	7.7%	7.7%
CHW	26.0%	11.3%	12.0%	10.9%	11.2%	8.5%	8.5%
N.G.	31.0%	32.1%	32.5%	32.5%	33.3%	39.0%	39.0%



	BaseCase (TMY2)	Calibration1 (TRY)	Calibration2 (Diversity)	Calibration3 (CWF)	Calibration4 (Tsa)	Calibration5 (Trm)	Calibration6 (COP)
WBE	-0.1%	-0.2%	2.1%	1.7%	1.9%	0.7%	-1.4%
CHW	6.4%	6.0%	8.6%	6.6%	7.1%	1.6%	1.6%
N.G.	10.6%	12.0%	12.2%	12.2%	12.9%	17.5%	17.5%

Figure 108: Goodness of fit indicators for measured versus simulated data from office building

9.2.3 K-12 Elementary School

To expand the capabilities of the emissions calculator, which currently covers office and retail type buildings, K-12 schools were identified as the next largest category of buildings that needed to be included in the emissions reductions calculations. To begin to prepare for this new model, in cooperation with the College Station Independent School District (CSISD), the Laboratory collected representative characteristic shaping data for the school (Figure 109) and then developed a calibrated simulation of the school (Figure 110). Next, a representative shaping model was developed that could be used for an automated school generation (Figure 111 and Figure 112). Finally, actual measured data were gathered from the school to allow for the calibration of the simulation and comparison against the representative model shown in Figure 113, Figure 114, and Figure 115.

Figure 109: Photo of Case Study Elementary School

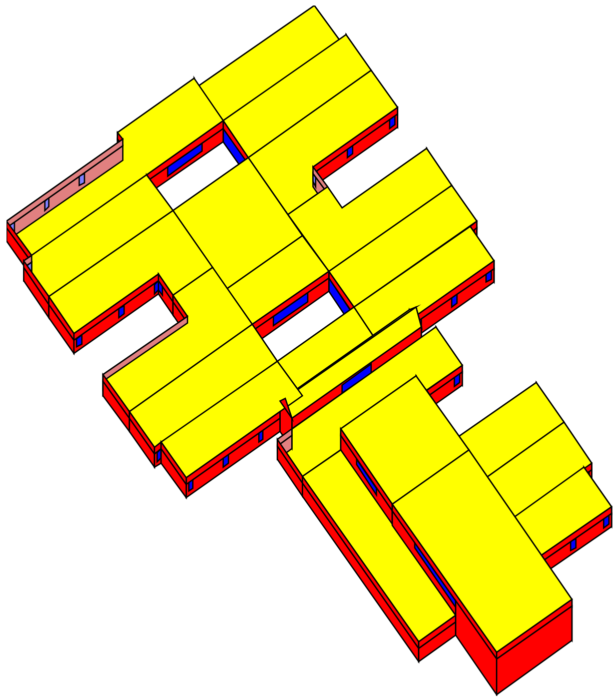


Figure 110: Computer Simulation (DOE-2.1E) of Case Study Elementary School

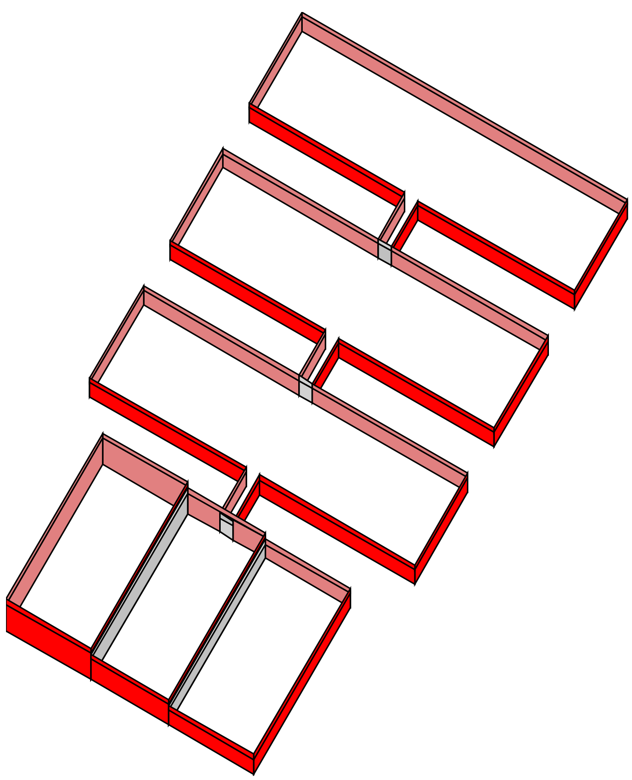


Figure 111: Computer Simulation (DOE-2.1E) of Base Case School Building

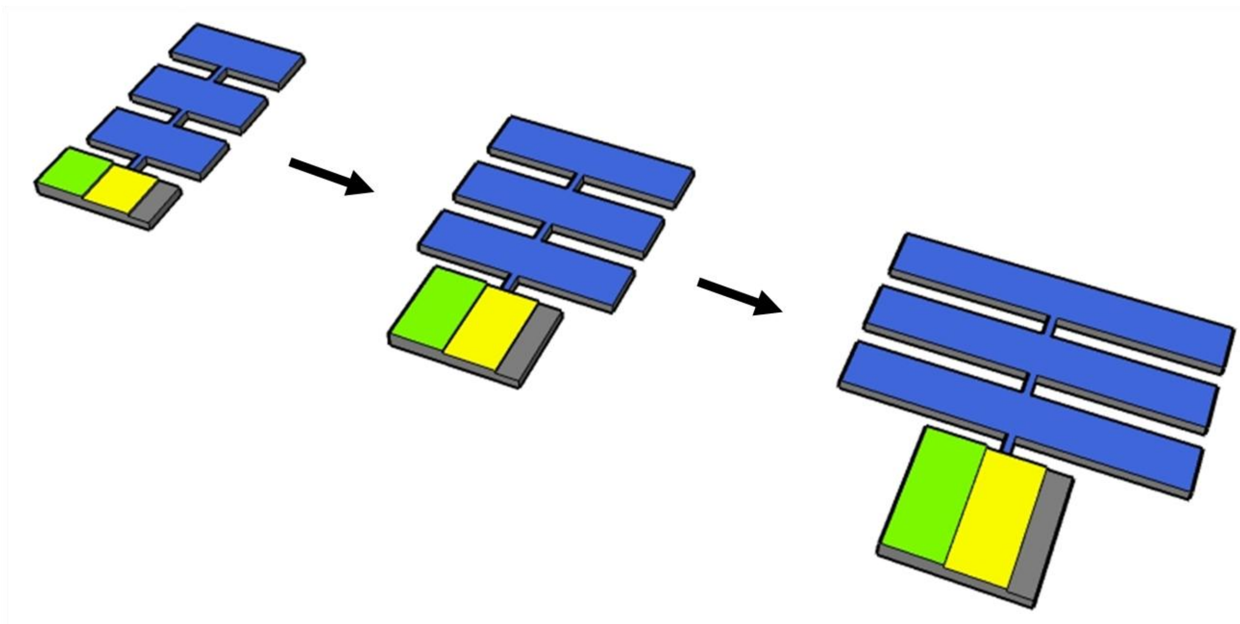


Figure 112: Concept of Base Case School Building

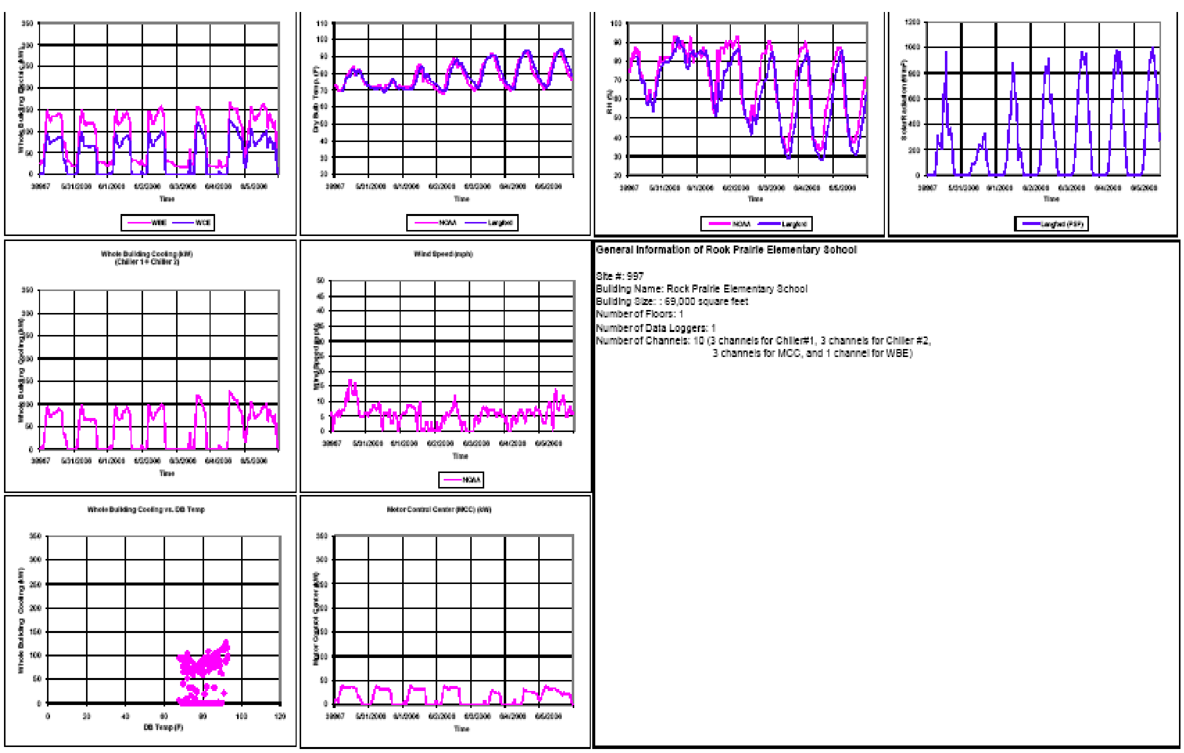


Figure 113: Inspection plots for elementary school

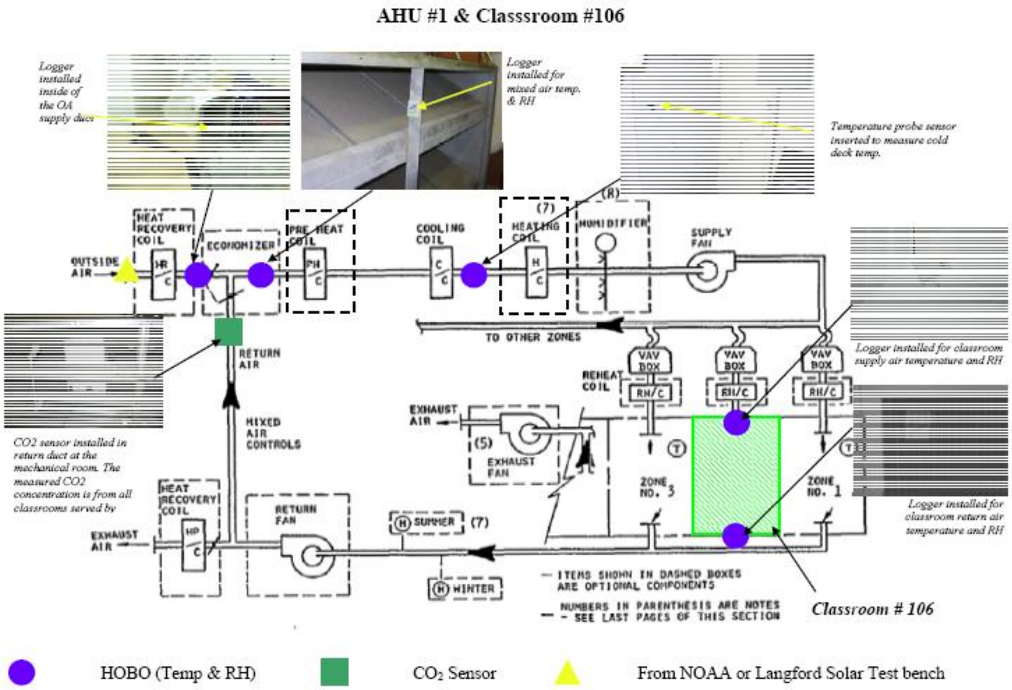


Figure 114: Detailed monitoring diagram for K-12 school

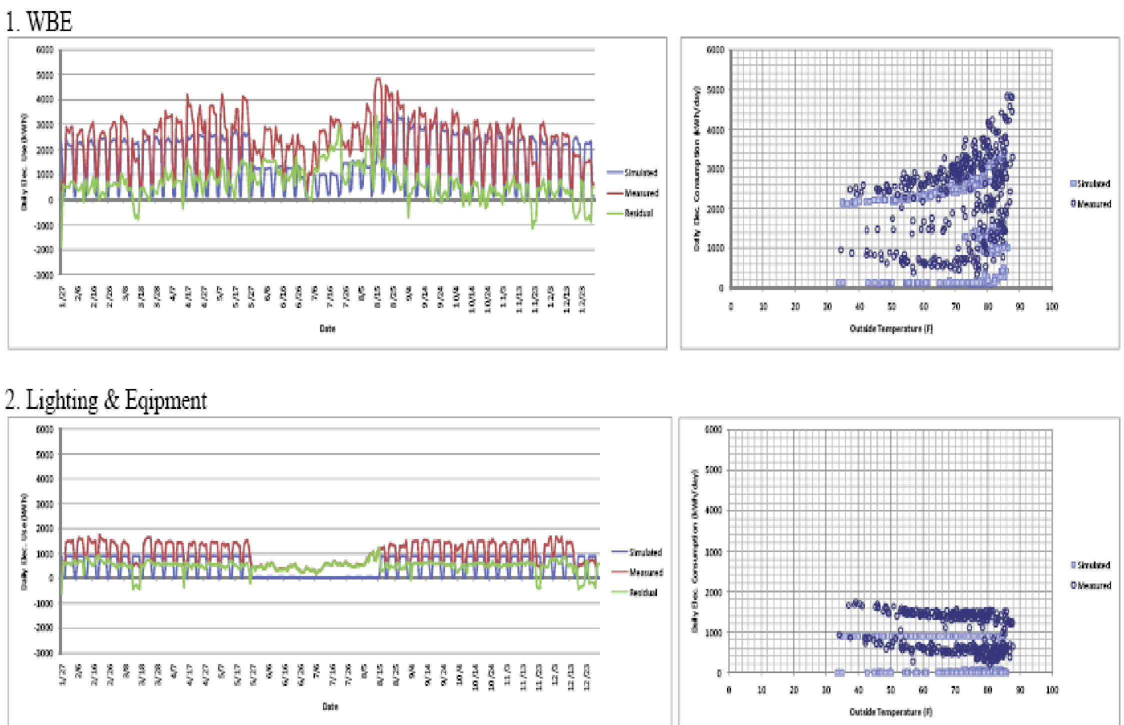


Figure 115: Analysis of data from K-12 school

9.2.4 Solar Test Bench

In 2008 the Laboratory continued with the monitoring of the data from the Solar Test Bench to accommodate the testing of energy-efficient glazing for purposes of verifying the calibrated simulations. Figure 116 shows photos of the instrumentation at the test bench. Figure 117 and Figure 118 show weekly inspection plots from the solar test bench.

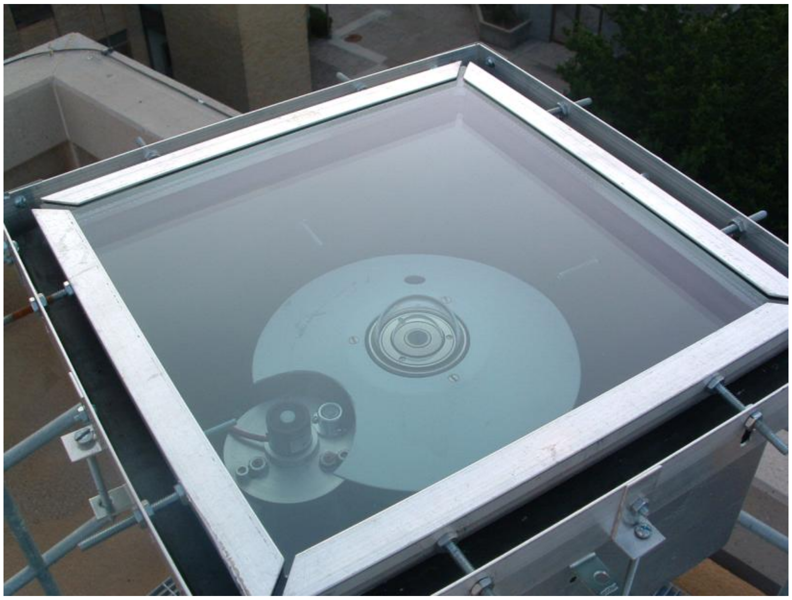


Figure 116: Photos of the Laboratory's Solar Test Bench

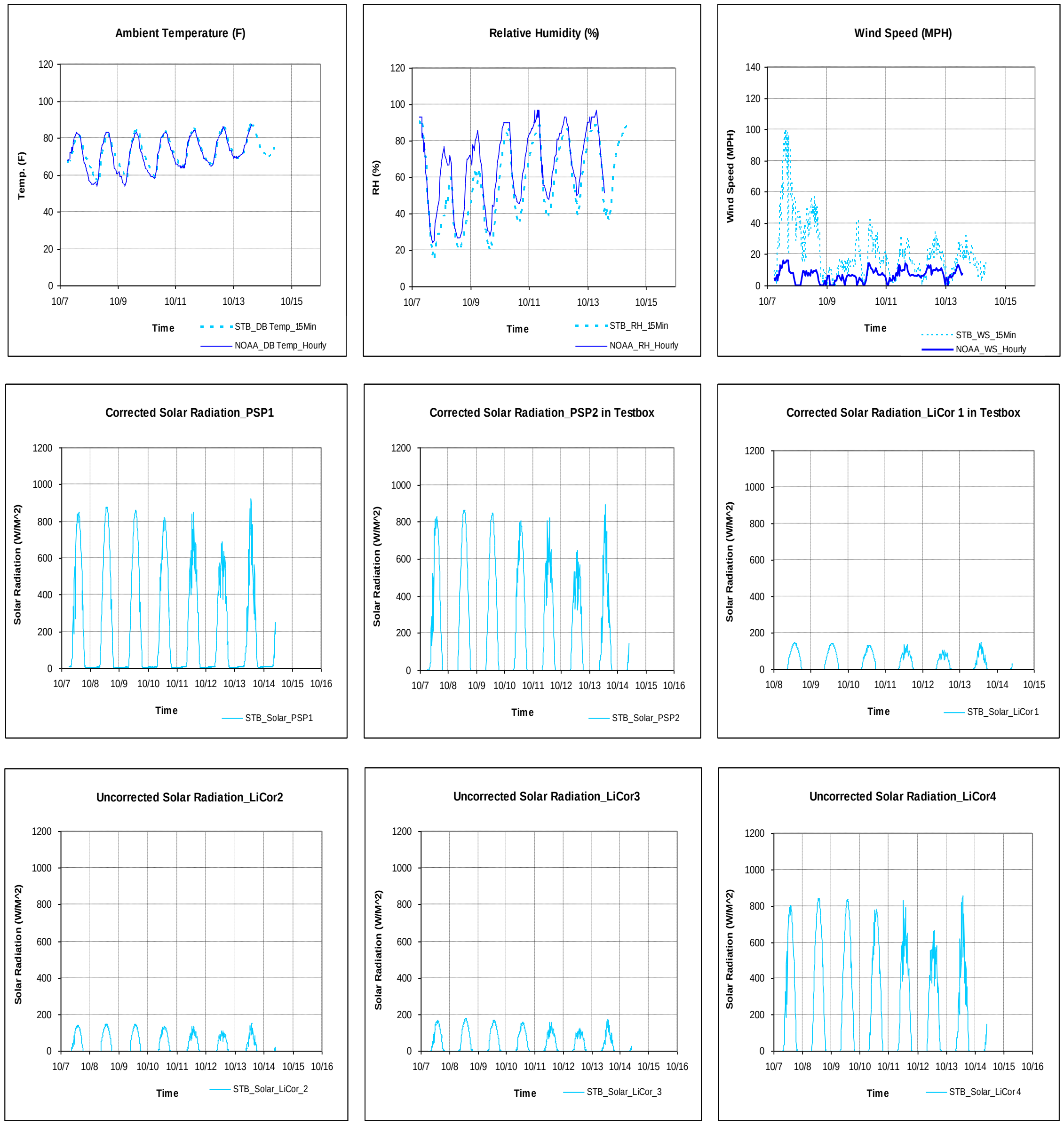


Figure 117: 2008 Weekly Inspection Plots from the Laboratory's Solar Test Bench

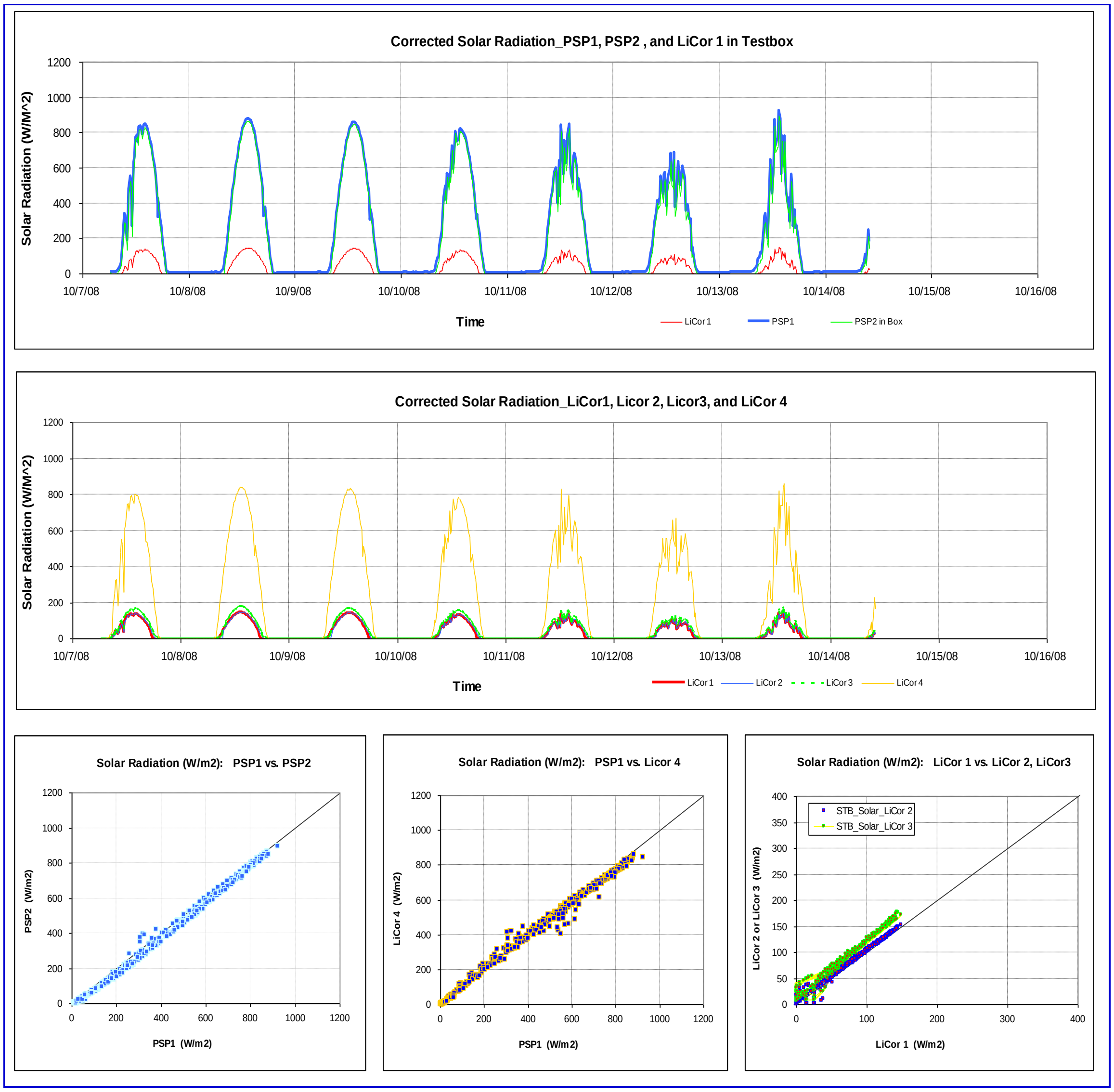


Figure 118: 2008 Weekly Inspection Plots from the Laboratory's Solar Test Bench

10 REFERENCES

ASHRAE, 1993. ANSI/ASHRAE Standard 136-1993 (RA 2006) - A Method of Determining Air Change Rates in Detached Dwellings. Atlanta, GA: American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc.

ASHRAE 90.1 1989 Energy Standard for Buildings Except Low-Rise Residential Buildings. American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc., Atlanta, GA.

ASHRAE 90.1 1999 Energy Standard for Buildings Except Low-Rise Residential Buildings. American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc., Atlanta, GA.

ASHRAE 2004. "Advanced Energy Design Guide for Small Office Buildings," American Society of Heating, Refrigeration and Air-conditioning Engineers, Atlanta, GA.

ASHRAE, 2004. ANSI/ASHRAE/IESNA Standard 90.1-2004, Energy Standards for Buildings Except Low-Rise Residential Buildings. American Society of Heating and Refrigerating and Air-conditioning Engineers, Inc., Atlanta, GA.

ASHRAE, 2007. ANSI/ASHRAE/IESNA Standard 90.1-2007, Energy Standards for Building Except Low-Rise Residential Buildings. American Society of Heating and Refrigerating and Air-conditioning Engineers, Inc., Atlanta, GA.

ASHRAE Standards Addenda, 2008, available at: http://www.ashrae.org/technology/page/132

CBECS 1995, 1999, 2003. USDOE Commercial Building Energy Characteristics Survey. U.S.D.O.E. Energy Information Agency Report.

Cho, S., Mukhopadhyay, J., Culp, C., Haberl, J. S., Yazdani, B., 2007. "Recommendations for 15% Above-Code Energy-Efficiency Measures for Commercial Office Buildings," *Energy Systems Laboratory Report No. ESL-TR-07-09-01*, Texas A&M University.

Cho, Soolyoen. Methodology to Develop and Test an Easy-to-Use Procedure for the Preliminary Selection of High-Performance Systems for Office Buildings in Hot and Humid Climates. Diss. Texas A&M University, 2008.

Dodge. 2005. MarkeTrack: McGraw-Hill Construction Analytics. McGraw-Hill Construction Information Group, 148 Princeton-Hightstown Rd., Hightstown, N.J. http://dodge.construction.com.

Haberl, J., Culp, C., Yazdani, B., Fitzpatrick, and Turner, D., 2002, "Texas's senate Bill 5 Legislation for Reducing Pollution in Non-attainment and Affected Areas," Annual Report to the Texas Natural Resource Conservation Commission, July, Energy Systems Laboratory Report ESL-TR-02/07-01.

Haberl, J., Culp, C., Yazdani, B., Fitzpatrick, T., Bryant, J., Turner, D., 2003, "Energy Efficiency/Renewable Energy Impact in the Texas Emissions Reduction Plan (TERP)," Volume II – Technical Report, Annual Report to the Texas Commission on Environmental Quality, September 2002 to August 2003, Energy Systems Laboratory Report ESL-TR-03/12-04.

Haberl, J., Culp, C., Yazdani, B., Gilman, D., Fitzpatrick, T., Muns, S., Verdict, M., Ahmed, M., Liu, B., Baltazar-Cervantes, J.C., Bryant, J., Degelman, L., Turner, D. 2004. "Energy Efficiency/Renewable Energy Impact in the Texas Emissions Reduction Plan (TERP)", Volume II – Technical Report, Annual Report to the Texas Commission on Environmental Quality, September 2003 to August 2004, Energy Systems Laboratory Report ESL-TR-04/12-04.

Haberl, J., Culp, C., Yazdani, B., Gilman, D., Fitzpatrick, T., Muns, S., Verdict, M., Ahmed, M., Liu, B., Baltazar-Cervantes, J.C., Bryant, J., Degelman, L., and Turner, D. 2006. "Energy Efficiency/Renewable

Energy Impact in the Texas Emissions Reduction Plan (TERP)", Volume II – Technical Report, Annual Report to the Texas Commission on Environmental Quality, September 2004 to December 2005, Energy Systems Laboratory, Report ESL-TR-06-06-08.

ICC. 1999. 2000 International Energy Conservation Code. Falls Church, VA: International Code Council, Inc.

ICC. 2001. 2001 Supplement to the International Energy Conservation Code. Falls Church, VA: International Code Council, Inc.

Kats, G.H. et al. 1996. "Energy Efficiency as a Commodity," *ACEEE Summer Study on Energy Efficiency in Buildings*.

LBL. 1993. DOE-2 BDL Summary Version 2.1E. LBL Report No. 349346. Berkley, CA: Lawrence Berkeley Laboratory.

Malhotra, M. 2005. An Analysis of Maximum Residential Energy-Efficiency in Hot and Humid Climates. MS Thesis, College Station, TX: Texas A&M University.

Malhotra, M. and J. Haberl. 2006. An Analysis of Maximum Residential Energy Efficiency in Hot and Humid Climates. Proceedings of the Fifteenth Symposium on Improving Building Systems in Hot and Humid Climates. Orlando, FL.

Malhotra, M., J. Mukhopadhyay, B. Liu, J. Haberl, C. Culp, B. Yazdani. 2007. Recommendations for 15% Above-Code Energy Efficiency Measures for Single-Family Residences. Energy Systems Laboratory Report No. ESL-TR-07-09-01.

Means, R. 2006. "Building Construction Cost Data" *R.S. Means,* Kingston, Massachusetts.

NAECA. 2006. National Appliance Energy Conservation Act.

NAHB 1999. Builder Practices Survey Reports, National Association of Home Builders, Research Center, Upper Marlboro, Maryland (September).

NAHB. 2003. The Builders Practices Survey Reports. National Association of Home Builders. Upper Marlboro, MD: NAHB Research Center.

NREL. 2001. Building America house performance analysis procedures. (NREL/TP-550-27754) Golden, CO: National Renewable Energy Laboratory. p. 34.

Public Utility Commission of Texas, PUC, 2007, available at: http://www.puc.state.tx.us/

Texas State Energy Conservation Office (SECO), 2007, available at: http://www.seco.cpa.state.tx.us/

11 BIBLIOGRAPHY

ACEEE. 2004. The Most Energy-Efficient Appliances. Washington, DC: American Council for An Energy Efficient Economy.

Ahmed, M., Gilman, D., Mukhopadhyay, J., Haberl, J., Culp, C. 2005a. "Development of a Web-based Emissions Reduction Calculator for Code-compliant Single-family and Multi-family Construction," *Proceedings of the 5th International Conference for Enhanced Building Operations*, Pittsburg, PA (October).

Ahmed, M., Gilman, D., Kim, S., Haberl, J., Culp, C. 2005b. "Development of a Web-based Emissions Reduction Calculator for Code-compliant Commercial Construction," *Proceedings of the 5th International Conference for Enhanced Building Operations*, Pittsburg, PA (October).

ARI 2001. Unpublished ARI Internal Report by Karim Amrane, Ph.D., Air Conditioning and Refrigeration Institute, Arlington, VA (July).

ASHRAE Task Group on Energy Requirements. 1975. Procedures for determining heating and cooling loads for computerized energy calculations; algorithms for building heat transfer subroutines. Atlanta: American Society of Heating Refrigeration and Air-Conditioning Engineers, Inc.

ASHRAE 1989. Energy Efficient Design of New Buildings Except Low-rise Residential Buildings. ASHRAE Standard 90.1-1989.

ASHRAE 2004. Energy Efficient Design of New Buildings Except Low-rise Residential Buildings. ASHRAE Standard 90.1-2004.

Baltazar-Cervantes, J.C., Liu, Z., Gilman, D., Haberl, J., Culp, C. 2005a. "Development of a Web-based Emissions Reduction Calculator for Retrofits to Municipal Water Supply and WasteWater Facilities," *Proceedings of the 5th International Conference for Enhanced Building Operations*, Pittsburg, PA (October).

Baltazar-Cervantes, J.C., Gilman, D., Haberl, J., Culp, C. 2005b. "Development of a Web-based Emissions Reduction Calculator for Solar Thermal and Solar Photovoltaic Installations," *Proceedings of the 5th International Conference for Enhanced Building Operations*, Pittsburg, PA (October).

Bankrate. 2005. Federal Discount Rate. Bankrate, Inc. Retrieved June 23, 2005, from: www.bankrate.com.

Dodge. 2005. MarkeTrack: McGraw-Hill Construction Analytics. McGraw-Hill Construction Information Group, 148 Princeton-Hightstown Rd., Hightstown, N.J. <http://dodge.construction.com>

Erbs, D., Klein, G., Duffie, S. 1982. "Estimation of the diffuse fraction for hourly, daily and monthly-average global radiation," *Solar Energy*, Vol. 28, pp. 293-301.

Haberl, J., Culp, C., Yazdani, B., Gilman, D., Fitzpatrick, T., Muns, S., Verdict, M., Ahmad, M., Liu, B., Baltazar-Cervantes, J.C., Bryant, J., Degelman, L., Turner, D. 2004a. "Energy Efficiency/Renewable Energy Impact in the Texas Emissions Reductions Plan (TERP)," Vol. III – Appendix, Annual Report to the Texas Commission on Environmental Quality, September 2003 to August 2004, Energy Systems Laboratory Report No. ESL-TR-04-12-05 (December).

Haberl, J., Culp, C., Yazdani, B., Gilman, D., Fitzpatrick, T., Muns, S., Verdict, M., Ahmad, M., Liu, B., Baltazar-Cervantes, J.C., Bryant, J., Degelman, L., Turner, D. 2004b. "Energy Efficiency/Renewable Energy Impact in the Texas Emissions Reductions Plan (TERP)," Vol. II – Technical Report, Annual Report to the Texas Commission on Environmental Quality, September 2003 to August 2004, Energy Systems Laboratory Report No. ESL-TR-04-12-04 (December).

Haberl, J., Culp, C., Yazdani, B., Gilman, D., Fitzpatrick, T., Muns, S., Verdict, M., Ahmad, M., Liu, B., Baltazar-Cervantes, J.C., Bryant, J., Degelman, L., Turner, D. 2004c. "Energy Efficiency/Renewable Energy Impact in the Texas Emissions Reductions Plan (TERP)," Vol. I – Summary Report, Annual Report to the Texas Commission on Environmental Quality, September 2003 to August 2004, Energy Systems Laboratory Report No. ESL-TR-04-12-01 (December).

Haberl, J., Im, P., Culp, C. 2004. "NOx Emissions Reductions From Implementation of the 2000 IECC/IRC Conservation Code to Residential Construction in Texas," *Proceedings of the 14th Symposium on Improving Building Systems in Hot and Humid Climates*, Texas A&M University, Richardson, Texas, accepted for publication (February), pp. 139-150.

Haberl, J., Cho, S. 2004a. "Literature Review of Uncertainty of Analysis Methods: F-Chart Program," Energy Systems Laboratory Report, No. ESL-TR-04-08-04 (October).

Haberl, J., Cho, S. 2004b. "Literature Review of Uncertainty of Analysis Methods: PV F-Chart Program," Energy Systems Laboratory Report, No. ESL-TR-04-10-02 (October).

Haberl, J., Cho, S. 2004c. "Literature Review of Uncertainty of Analysis Methods: ASHRAE Inverse Model Toolkit (IMT)," Energy Systems Laboratory Report, No. ESL-TR-04-10-03 (October).

Haberl, J., Cho, S. 2004d. "Literature Review of Uncertainty of Analysis Methods: Cool Roofs," Energy Systems Laboratory Report, No. ESL-TR-04-10-04 (October).

Haberl, J., Cho, S. 2004e. "Literature Review of Uncertainty of Analysis Methods: DOE-2 Program," Energy Systems Laboratory Report, No. ESL-TR-04-11-01 (November).

Haberl, J.S. 1993. "Economic Calculations for ASHRAE Handbook," Energy Systems Laboratory Report, No. ESL-TR-93-04-07 (April).

Haberl, J., Culp, C., Yazdani, B., Fitzpatrick, T., Bryant, J., and Turner, D. 2003. "Energy Efficiency/Renewable Energy Impact in the Texas Emissions Reductions Plan (TERP). Volume II - Technical Report, Annual Report to the Texas Commission on Environmental Quality, September 2002 to August 2003," Energy Systems Laboratory Report ESL-TR-03-12-04.

Haberl, J., Im, P., Culp, C., Yazdani, B., Fitzpatrick, T., Bryant, J., Turner, D. 2005. "A Simulation Methodology to Estimate NOx Emissions Reductions From the Implementation of the 2000 IECC/IRC Conservation Code in Texas," *IBPSA Newsletter*, Vol. 15, No. 2, pp. 39-48 (October).

IESNA. 2000. The IES Lighting Handbook, Reference and Application, 9th Edition. New York: Illuminating Engineering Society of North America.

Inflationdata. 2005. Current Inflation Rate. Financial Trend Forecaster®. Retrieved June 23, 2005, from: inflationdata.com/inflation.

Im, P. 2003. "A Methodology to Evaluate Energy Savings and NOx Emissions Reduction from the Adoption of the 2000 IECC to New Residences in Non-attainment and Affected Counties in Texas," *Master's Thesis,* Department of Architecture, Texas A&M University (December).

Kissock, K., Haberl, J.S., Claridge, D.E. 2002. "Development of a Toolkit for Calculating Linear, Change-point Linear and Multiple-Linear Inverse Building Energy Analysis Models," Final Report for ASHRAE Research Project, No. 1050-RP.

Klein, S.A., Beckman, W.A. 1985. "PV F-Chart User's Manual: DOS Version," F-Chart Software, 4406 Fox Bluff Road, Middleton, Wisc. 53562, www.fchart.com.

Klein, S.A., Beckman, W.A. 1993. "F-Chart Solar Energy System Analysis: Version 6.17W," F-Chart Software, 4406 Fox Bluff Road, Middleton, Wisc. 53562, www.fchart.com.

Kootin-Sanwu, V. 2004. “Development of Energy Efficient Housing for Low-Income Families,” *Ph.D. Dissertation*, Department of Architecture, Texas A&M University (May).

LBNL. 1981. “DOE-2 Reference Manual Version 2.1A. LBL-8706 Rev. 1,” Lawrence Berkeley National Laboratory, Berkeley, CA, and Los Alamos Scientific Laboratory, Santa Fe, NM.

Mukhopadhyay, J. 2005. “Analysis of improved fenestration for code-compliant residential buildings in hot and humid climates,” *Masters Thesis,* Department of Architecture, Texas A&M University.

Liu, Z., Gilman, D., Haberl, J., Culp, C. 2005a. “Development of a Web-based Emissions Reduction Calculator for Street Light and Traffic Light Retrofits,” *Proceedings of the 5th International Conference for Enhanced Building Operations,* Pittsburg, PA (October).

Liu, Z., Baltazar-Cervantes, J.C., Gilman, D., Haberl, J., Culp, C. 2005b. “Development of a Web-based Emissions Reduction Calculator for Green Power Purchases from Texas Wind Energy Providers,” *Proceedings of the 5th International Conference for Enhanced Building Operations*, Pittsburg, PA (October).

LBNL 1995. Residential Sector End-use Forecasting With EPRI REEPS 2.1: Summary Input Assumptions and Results, J. Koomey, R. Brown, R. Richey, F. Johnson, A. Sanstad, and L. Shown, Lawrence Berkeley National Laboratory Report No. LBL-34044-UC-1600 (December).

LBNL 2000. “DOE-2.1e, ver. 107,” Documentation Update Package #2, Simulation Research Group, Lawrence Berkeley National Laboratory, University of California at Berkeley, Berkeley, CA (March).

Malhotra, M. 2005. “An Analysis of Maximum Residential Energy Efficiency in Hot and Humid Climates,” *M.S. Thesis,* Department of Architecture, Texas A&M University.

Malhotra, M. and Haberl, J. 2006. “An Analysis of Building Envelope Upgrades for Residential Energy Efficiency in Hot and Humid Climates,” Conference Paper for Presentation at SimBuild 2006, Second National Conference of IBPSA-USA. Cambridge, MA (in preparation).

NAHB 2000. Builder Practices Survey Reports, National Association of Home Builders, Research Center, Upper Marlboro, Maryland (September).

NREL. 1995. Users Manual for TMY2’s (Typical Meteorogical Years). NREL/SP-463-7668, and TMY2s, Typical Meteorological Years Derived from the 1961-1990. National Solar Radiation Data Base, June 1995 [CD-ROM]. Golden, Colorado: National Renewable Energy Laboratory.

NOAA 1993. Automated Surface Observing System Guide for Pilots, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, National Weather Service (April).

NREL 1995. User’s Manual for TMY2s (Typical Meteorological Years), NREL/SP-463-7668, National Renewable Energy Laboratory (June).

Ottinger, R.L., Wooley, D.R., Robinson, N.A., Hodas, D.R., and Babb, S.E. 1991. *Environmental Costs of Electricit*y. Oceana Publications, Inc., New York, N.Y.

Parker, D.S., Dunlop, J.P., Barkaszi, S.F., Sherwin, J.R., Anello, M.T., and Sonne, J.K. 2000. “Towards Zero Energy Demand: Evaluation of Super Efficient Building Technology with Photovoltaic Power for New Residential Housing,” *Proceedings of the 2000 ACEEE Summer Study of Energy Efficiency in Buildings*, 1.207-1.223.

RECenter 2005. Texas Real Estate Research Center, College of Business, Texas A&M University, College Station, Texas. URL: recenter.tamu.edu.

Reilly, M., Winkelmann, D., Arasteh, D., and Caroll, W. 1992. "Modeling windows in DOE-2.1e. Proceedings of Thermal Performance of the Exterior Envelopes of Buildings VI," American Society of Heating Refrigeration and Air-Conditioning Engineers, 1992.

Song, S. 2006. "Development of New Methodologies for Evaluating the Energy Performance of New Commercial Buildings," Texas A&M University, in preparation, (August).

U.S. Census 1999. County Population Estimates for July 1, 1999 and Population Change for July 1, 1998 to July 1, 1999, CO-99-1, U.S. Department of Commerce, March 9, 1999, URL: www.census.org.

USCB. 2002. Square Footage by Household and Unit Size, Income, and Costs—Occupied Units. American Housing Survey for the United States: 2001, p. 84. U.S. Census Bureau, Current Housing Reports, Series H150/01. Washington, DC: U.S. Government Printing Office.

USDOE 2004. Building Energy Standards Program: Determination Regarding Energy Efficiency Improvements in the Energy Standard for Buildings, Except Low-Rise Residential Buildings, ASHRAE/IESNA Standard 90.1-1999. Docket No. (Docket No. EE-DET-02-001). Washington, D.C. http://www.energycodes.gov/implement/pdfs/FR_com_notice.pdf