ESL-TR-09-08-02

STATEWIDE AIR EMISSIONS CALCULATIONS FROM WIND AND OTHER RENEWABLES

SUMMARY REPORT

A Report to the
Texas Commission on Environmental Quality
For the Period September 2008 – August 2009

Jeff Haberl, Ph.D., P.E.; Zi Liu, Ph.D.; Juan-Carlos Baltazar-Cervantes, Ph.D.
Don Gilman, P.E.; Charles Culp, Ph.D., P.E.
Bahman Yazdani, P.E.; Dan Turner, Ph.D., P.E.; Vivek Chandrasekaran

August 2009
Revised November 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

August 31, 2009

Chairman Buddy Garcia
Texas Council on Environmental Quality
P. O. Box 13087
Austin, TX 78711-3087

Dear Chairman Garcia:

The Energy Systems Laboratory (ESL) at the Texas Engineering Experiment Station of the Texas A&M University System is pleased to provide its third annual report, "Statewide Emissions Calculations From Wind and Other Renewables," as required by the 79th Legislature. This work has been performed through a contract with the Texas Environmental Research Consortium (TERC).

In this work the ESL is required to obtain input from public/private stakeholders, and develop and use a methodology to annually report the energy savings from Wind and Other Renewables. This report summarizes the work performed by the ESL on this project from September 2008 to August 2009.

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

Sincerely,

David Claridge, P.E.
Director

Enclosure

cc: Commissioner Larry R. Soward
Commissioner Bryan W. Shaw
Executive Director Mark R. Vickery

Disclaimer

SUMMARY REPORT

Statewide Air Emissions Calculations from Wind and Other Renewables

1. EXECUTIVE SUMMARY

The 79th Legislature, through Senate Bill 20, House Bill 2481 and House Bill 2129, amended Senate Bill 5 to enhance its effectiveness by adding 5,880 MW of generating capacity from renewable energy technologies by 2015 and 500 MW from non-wind renewables.

This legislation also requires the Public Utilities Commission of Texas (PUCT) to establish a target of 10,000 megawatts of installed renewable capacity by 2025, and requires the Texas Commission on Environmental Quality (TCEQ) to develop methodology for computing emissions reductions from renewable energy initiatives and the associated credits. Table 1-1 lists the statutory mandates and total wind power generation capacity (including installed and announced) in Texas from 2001 to 2025. It shows that Texas will achieve its milestone of 10,000 MW by the end of 2009 according to the information from PUCT.

Table 1-1: Installed/Announced Wind Power Capacity and The Statutory Mandates

Installed and Announced		**SB20 Plan**	
Month-Yr	MW	Month-Yr	MW
Dec-2001	1,019		
Jan-2002	1,098		
Dec-2003	1,299		
Dec-2005	1,972		
Dec-2006	3,033	Jan-2007	2,280
Dec-2007	5,007		
Dec-2008	8,869	Jan-2009	3,272
Dec-2009	11,759		
Dec-2010	12,909	Jan-2011	4,264
Dec-2011	13,209		
Jul-2012	13,609		
		Jan-2013	5,256
		Jan-2015	**5,880**
		Jan-2025	**10,000**

In this Legislation the Energy Systems Laboratory (ESL) is to assist the 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 Implementation Plan (SIP).

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; and

- 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 degradation analysis;
- Analysis of other renewables, 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 2007 Integrated Savings report to the TCEQ.

1.1 Development of Stakeholder's meetings

Legislation passed during the regular session of the 79th Legislature directed the Energy Systems Laboratory to work with the TCEQ to develop a methodology for computing emissions reductions attributable to renewable energy and for the ESL to quantify the emissions reductions attributable to renewables for inclusion in the State Implementation Plan annually. HB 2921 directed the Texas Environmental Research Consortium (TERC) to engage the Texas Engineering Experiment Station for the development of this methodology.

During the 2008-2009 periods, Texas A&M held continuing Stakeholder's meetings and made several presentations to EPA, TCEQ and other interested parties regarding the analysis and the results. The presentations for those meetings are contained in Appendix A of this report.

1.2 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) 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.

Then, 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. Figure 1-1 shows the measured annual wind power generation in 2007 and the estimated wind power generation in 1999 using the developed method for each wind farm in the ERCOT region. The total measured wind power generation in 2007 is 8,752,498 MWh, which is 17% less than what the same wind farms would have produced in 1999. Figure 1-2 shows the same comparison but for the Ozone Season Period. The measured wind power generation in the OSP of 2007 is 20,094 MWh/day, which is 25% lower than the estimated 1999 OSD wind production.

This report also includes an uncertainty analysis that was performed on all the daily regression models for the entire year and Ozone Season 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.

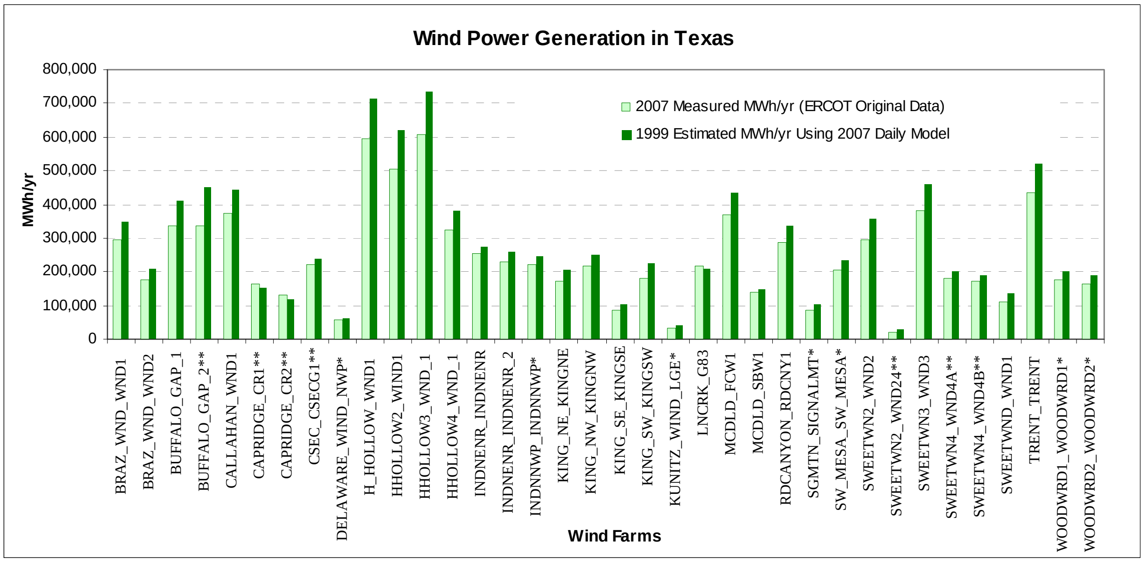


Figure 1-1: Comparison of 2007 Measured and 1999 Estimated Power Production for Each Wind Farm

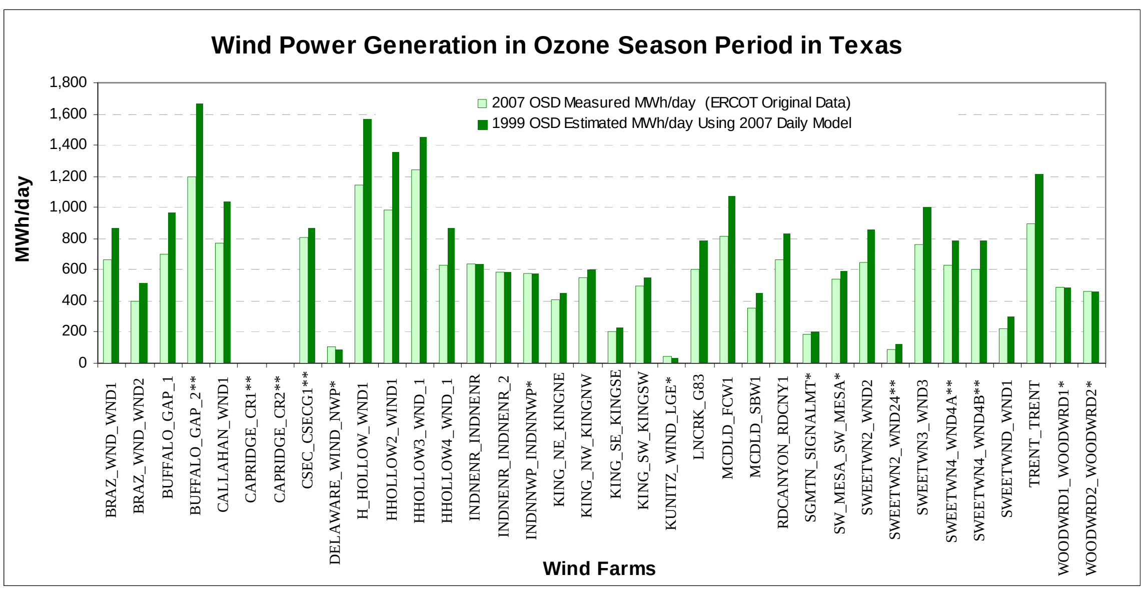


Figure 1-2: Comparison of 2007 OSD Measured and 1999 OSD Estimated Power Production for Each Wind Farm

1.3 Analysis of emissions reduction 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. Figure 1-3 and Figure 1-4 show the estimated emissions reductions from wind power in each county of Texas.

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 and presented in this report, which is based on the ERCOT congestion management zones. As the TCEQ moves the base year to more recent years, 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.

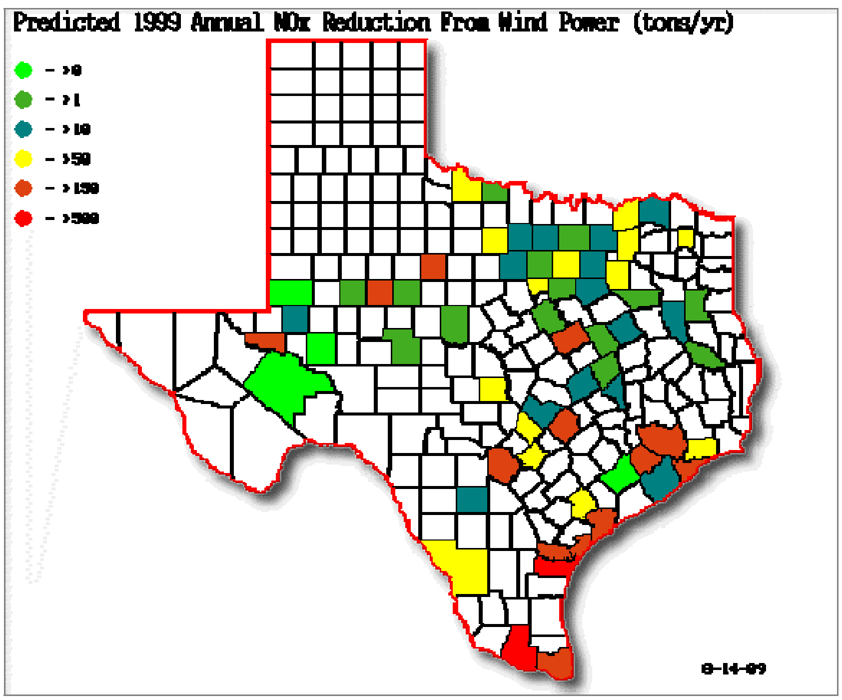


Figure 1-3: 1999 Predicted Annual NOx Reductions from Wind Power in Texas Map

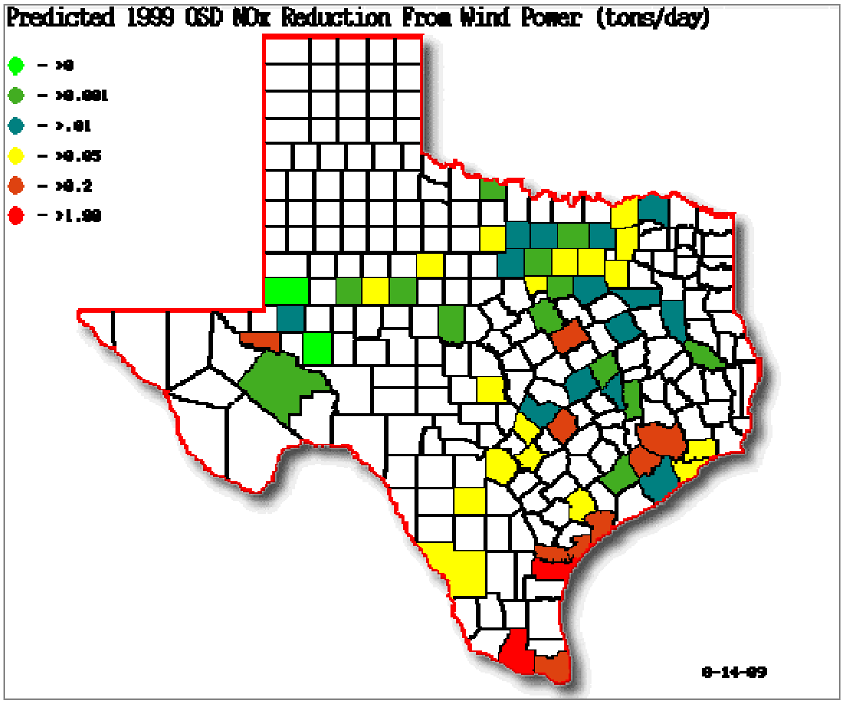


Figure 1-4: 1999 Predicted Annual NOx Reductions from Wind Power in Texas Map

1.4 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 10th, 25th, 50th, 75th, 90th, and 99th 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.

As shown in Table 1-2, of the 14 sites analyzed, ten sites showed an increase when one compares the 90th percentile of whole period to the 90th 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.

Table 1-2: Summary of 90th Percentile Hourly Wind Power Analysis for Nine Wind Farms (14 Sites) in Texas

Wind Farm	First 12-mo 90th Percentile Hourly Wind Power		Average of the Sliding 12-mo 90th Precentile Hourly Wind Power		Minimum of the Sliding 12-mo 90th Precentile Hourly Wind Power		Maximum of the Sliding 12-mo 90th Precentile Hourly Wind Power		No. of Month of Data	Capacity (MW)
	First 12-mo Ending Mo.	MW	MW	% Diff. vs. First 12-mo	MW	% Diff. vs. First 12-mo	MW	% Diff. vs. First 12-mo		
Brazos Wind Ranch	Dec-04	127.5	131.9	3.5%	125.1	-1.9%	137.2	7.6%	48	160
Indian Mesa	Dec-02	48.0	55.2	15.1%	42.1	-12.2%	66.0	37.5%	72	82.5
Delaware	Dec-02	18.6	19.2	3.5%	15.6	-15.8%	21.5	15.7%	72	30
Desert Sky	Dec-02	89.0	110.1	23.7%	83.1	-6.7%	134.4	50.9%	72	160
King Mountain-NE	Dec-02	41.8	45.0	7.7%	36.3	-13.2%	52.5	25.5%	72	79
King Mountain-NW	Dec-02	44.7	51.8	16.0%	40.2	-10.1%	63.8	42.7%	72	79
King Mountain-SE	Dec-02	21.6	22.5	4.1%	18.4	-15.0%	25.8	19.1%	72	40
King Mountain-SW	Dec-02	41.6	46.4	11.7%	38.4	-7.6%	53.4	28.5%	72	79
Sweetwater Wind 1	Dec-04	34.1	33.0	-3.2%	32.3	-5.0%	34.2	0.4%	48	37.5
Trent	Dec-02	108.8	125.4	15.2%	108.2	-0.6%	132.8	22.0%	72	150
Woodward	Dec-02	85.3	90.6	6.3%	80.4	-5.7%	100.3	17.6%	72	160
Kunitz	Dec-02	25.2	20.6	-18.1%	11.6	-54.0%	25.2	0.0%	72	35
Big Spring	Dec-02	27.2	25.6	-6.1%	23.9	-12.0%	27.2	0.0%	72	41
Southwest Mesa	Dec-02	51.1	48.0	-5.9%	38.5	-24.6%	55.3	8.2%	72	75
Weighted Average:				**8.7%**		**-9.4%**		**23.2%**	**Total:**	**1208**

1.5 Analysis of other renewable source

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 (Table 1-3).

Table 1-3: New Projects Added in This Report

Renewable Energy Source	No of New Projects identified and reported in May 2009
Solar Photo-Voltaic	114
Solar Thermal	3
Land fill gas	0
Hydro-Electric	0
Geothermal	24

1.6 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.

Each year ERCOT is required to compile a list of grid-connected sources that generate electricity from renewable energy and report them to the Legislature. Table 1-4 contains the data reported by ERCOT from 2001- 2008. Figure 1-5 is included to better illustrate the annual data collected by ERCOT.

Table 1-4: Electricity Generation by Renewable Resources (2001 to 2008)

Technology Type	2001	2002	2003	2004	2005	2006	2007	2008
Wind	565,597	2,451,484	2,515,482	3,209,629	4,221,568	6,530,928	9,339,756	16,286,383
Hydro		312,093	239,684	234,791	310,302	210,077	382,882	445,428
Landfill gas		29,412	154,206	203,443	213,777	306,087	356,339	386,606
Biomass			39,496	36,940	58,637	60,569	51,823	70,833
Solar		87	220	211	227	136	1,844	3,338
Totals	565,597	2,793,076	2,949,088	3,685,014	4,804,511	7,107,797	10,132,645	17,192,588

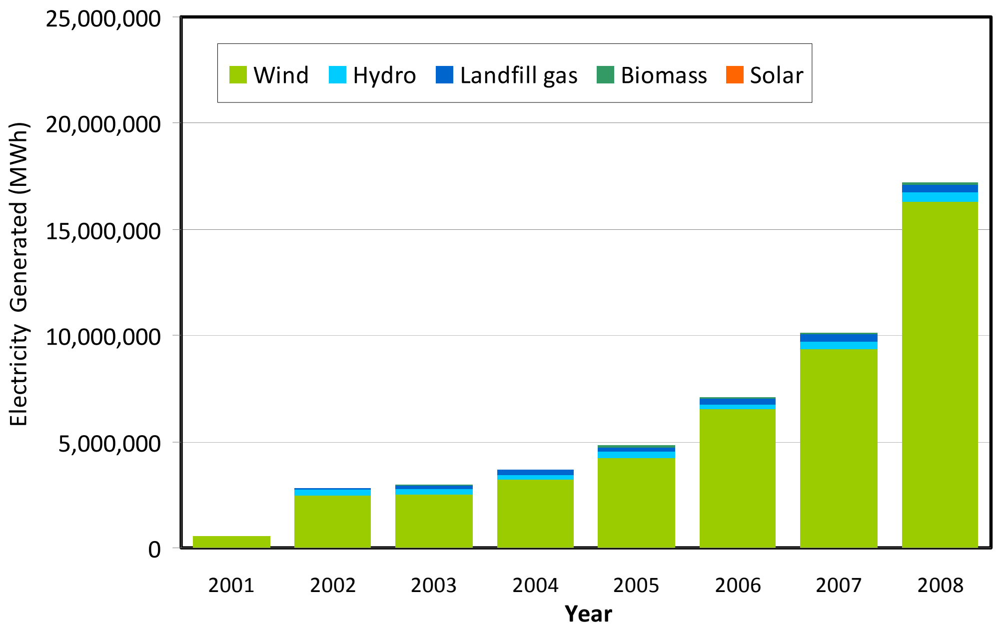


Figure 1-5: Electricity Generation by Renewable Resources (2001 to 2008)

1.7 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. As of 2007, 16,829 MW of CHP technologies were integrated into infrastructure served by the Texas electrical grid according to the database maintained by the DOE and Oak Ridge National Laboratory.

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

In this 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 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[1] (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.

In 2008, the cumulative total annual electricity savings from all programs is 20,380,240 MWh/year (12, 727 tons-NOx/year). The total cumulative OSD electricity savings from all programs is 48,602 MWh/day, which would be a 2,025 MW average hourly load reduction during the OSD period (31.38 tons-NOx/day), as shown in Figure 1-6. By 2013, the total cumulative annual electricity savings from will be 32,736,151 MWh/year (20,395 tons-NOx/year). The total cumulative OSD electricity 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 (52.10 tons-NOx/day).

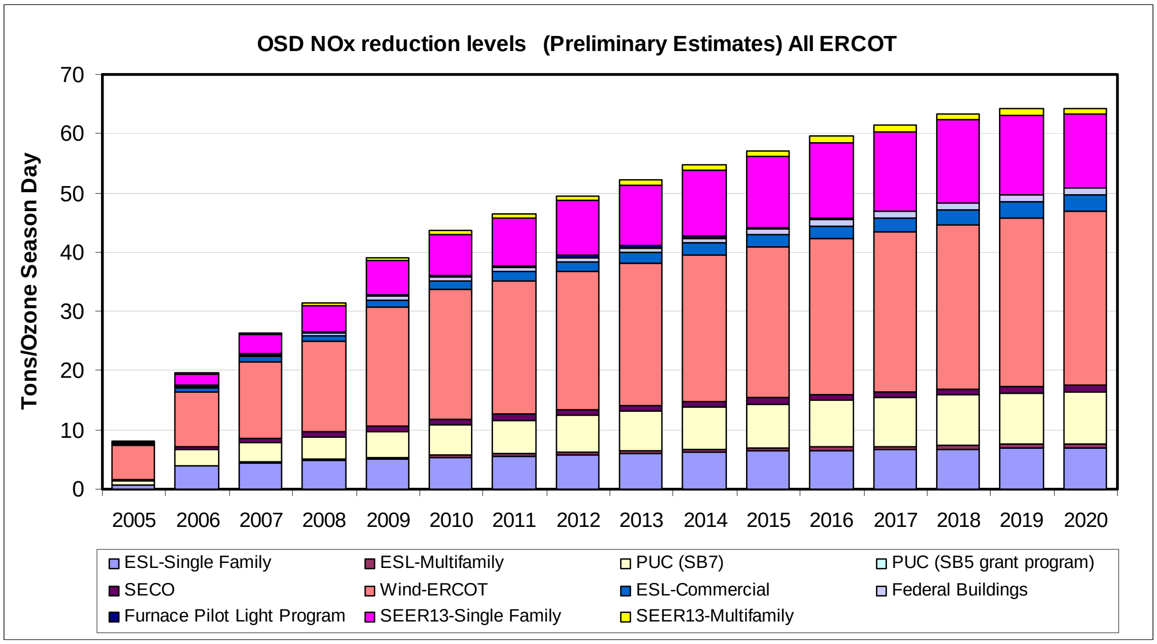


Figure 1-6: Cumulative OSD NOx Emissions Reduction Projections through 2020

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

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

2 INTRODUCTION

2.1 Statement of Work for Calculations of Emissions from Wind and Other Renewables

This summary report covers the Energy Systems Laboratory's work from September 2008 through August 2009. This work is intended to cover the basic work outline included below:

Task 1: Obtain input from public/private stakeholders.

Task 2: Develop a methodology in cooperation with the Texas Commission on Environmental Quality (TCEQ) and the U.S. Environmental Protection Agency (USEPA) for calculating emissions reductions obtained through wind and other renewable energy resources in Texas.

Task 3: Calculate annual, creditable emissions reductions for wind and other renewable energy resources for inclusion in the State SIP.

Task 4: Include emissions reductions by county from wind and renewable energy resources in the ESL's annual report to the TCEQ.

Task 5: Incorporate wind and renewable energy emissions reductions as a component of the ESL's annual *Clean Air Through Energy Efficiency Conference (CATEE)* to facilitate technical transfer.

2.2 Summary of Progress

The progress toward completing each task is provided in the following section and throughout this report.

<u>Task 1: Obtain input from public/private stakeholders.</u>

Legislation passed during the regular session of the 79th Legislature directed the Energy Systems Laboratory to work with the TCEQ to develop a methodology for computing emissions reductions attributable to renewable energy and for the ESL to quantify the emissions reductions attributable to renewables for inclusion in the State Implementation Plan annually. HB 2921 directed the Texas Environmental Research Consortium (TERC) to engage the Texas Engineering Experiment Station for the development of this methodology.

During the period from September 2008 to August 2009, several presentations were done to report the analysis methodology and the results with TCEQ, EPA, TCEQ, and other interested parties. Appendix A shows the slides that were presented in those meetings.

- March 19, 2008 – Presentation to the TCEQ about calculation of NOx emissions reductions from energy efficiency and renewable energy, Austin, Texas

- May 2008 – Presentation to the Texas Clean Air Working Group about calculation of NOx emissions reductions from energy efficiency and renewable energy, Austin, Texas

- May 22, 2008 – Presentation to the EPA Technical Forum about calculation of NOx emissions reductions from energy efficiency and renewable energy, conference call.

- September 17, 2008 – Presentation to the University of Texas Department of Architecture about calculation of NOx emissions reductions from energy efficiency and renewable energy, Austin, Texas

- September 25, 2008 – Presentation to the EPA Blue Skyways conference about calculation of NOx emissions reductions from energy efficiency and renewable energy, Kansas City, MO

- September 30, 2008 – Presentation to the Texas Senate Natural Resources Committee about the calculation of NOx emissions reductions from energy efficiency and renewable energy, Austin, Texas

Task 2: Develop a methodology in cooperation with the Texas Commission on Environmental Quality and the U.S. Environmental Protection Agency for calculating emissions reductions obtained through wind and other renewable energy resources in Texas.

This task is composed of the following subtasks:

- Review existing methodologies for calculating emissions reductions from wind energy and other renewable energy systems with USEPA, TCEQ and stakeholders. Develop acceptable methodologies for wind and renewables.
- Determine how to implement methodologies for Texas, including accounting of current installations, future sites, degradation, discounting/uncertainty, grid constraints, etc.
- Review methodologies for verifying wind energy production and renewable energy installations with TCEQ, USEPA and stakeholders. Develop acceptable methodologies for verifying installations, including documentation, EPA QAPP, etc.
- Develop draft State Guidelines for the TCEQ for EE/RE SIP credits.

Task 3: Calculate annual, creditable emissions reductions for wind and other renewable energy resources for inclusion in the State SIP.

This task is composed of the following subtasks:

- Calculate annual emissions from wind and other renewable energy projects.
- Verify annual installations of wind and renewable energy systems in Texas.
- Verify ERCOT historical data for wind production and other renewables.

Task 4: Include emissions reductions by county from wind and renewable energy resources in the ESL's annual report to the TCEQ.

This task is composed of the following subtasks:

- Report annual emissions from wind and other renewable energy projects.
- Report on verification of installations of wind and renewable energy systems in Texas.
- Develop documentation for all methods developed.

Task 5: Incorporate wind and renewable energy emissions reductions as a component of the ESL's annual *Clean Air Through Energy Efficiency Conference (CATEE)* to facilitate technical transfer.

Additional information regarding the ESL's efforts on Tasks 2, 3, 4 and 5 are listed below and presented in detail in the following sections. This work was performed during the period September 2008 through August 2009.

- Analysis of wind farms using 2007 data;
- Analysis of emissions reduction from wind farms;
- Updates of the degradation analysis to include more wind farms;
- Analysis of other renewables;
- Review of electricity savings and transmission planning study reported by ERCOT;
- Combined Heat and Power projects in Texas; and
- Preliminary reporting of NOx emissions savings in the 2008 Integrated Savings report to the TCEQ.

3 ANALYSIS ON POWER PRODUCTION FROM WIND FARMS USING 2007 DATA

3.1 Introduction

Texas can now take its place as the largest producer of wind energy in the United States. As of April 2009[2], the capacity of installed wind turbines totals was 8403 MW with another 330 MW under construction. The capacity announced for new projects is 7,631 MW by 2011. Figure 3-1 shows the total installed wind power capacity in Texas and power generation in the ERCOT region from 2001 to December 2008. Figure 3-2 shows the location of the wind farms completed, under construction and announced based on the information from the PUCT.

In this section, an analysis of 2007 data for Sweetwater III wind farm in Nolan County, Texas is provided— including the processing of weather and power generation data, modeling of daily power generation versus daily wind speed for Ozone[3] and Non-Ozone season period using the ASHRAE Inverse Model Toolkit (IMT) (Haberl et al. 2003; Kissock et al. 2003), prediction of 1999 wind power generation using developed coefficients from 2007 OSP and Non-OSP models, and the analysis on monthly capacity factors generated using the model.

Following the analysis, a summary of total predicted wind power production in the base year (1999) for all wind farms in the ERCOT region is presented. Then a comparison between the estimated wind power in 1999 and the 1999 Ozone Season Period from the 2007 and 2008 reports and the results from this year's modeling are also included in this section to show the performance the modeling procedure.

An uncertainty analysis was also performed on all the daily regression models and included in this report to show the accuracy of applying the OSP and Non-OSP linear regression models to predict the wind power generation that the wind farms would have had in the base year of 1999. The detailed analysis for each wind farm is provided in the Appendix to this report. The original data used in the analysis is included in the accompanying CD-ROM with this report.

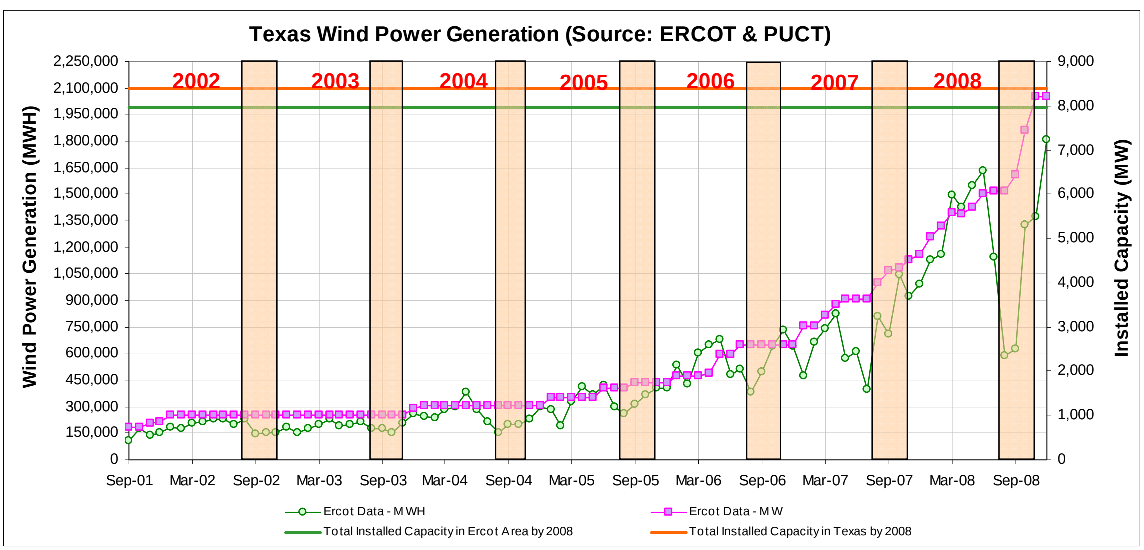
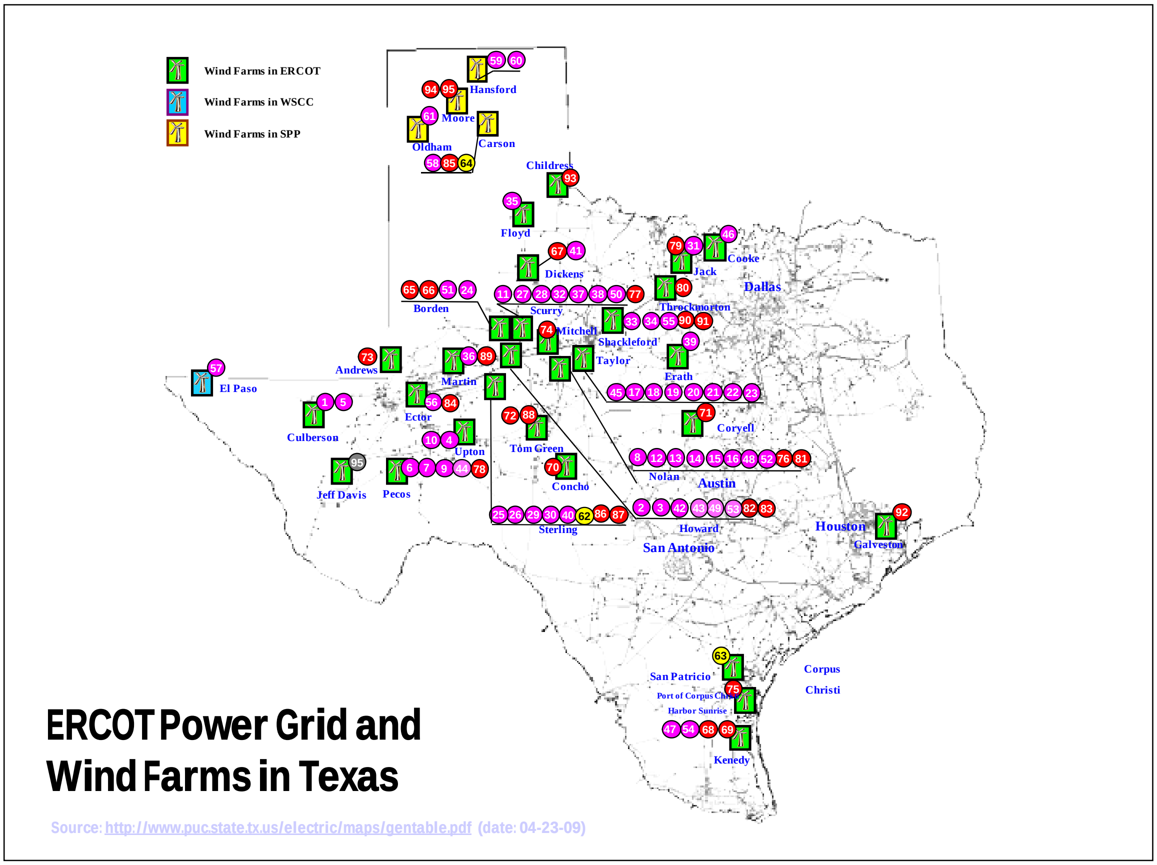


Figure 3-1: Installed Wind Power Capacity and Power Generation in the ERCOT region from 2001 to December 2008

[2] Wind project information obtained from the Public Utility Commission of Texas (www.puc.state.tx.us) as of 4/23/2009 and the Electric Reliability Council of Texas (ERCOT) as of December 2008.

[3] Ozone Season Days are from July 15 to September 15 in this report according to the information from TCEQ.



WIND PROJECTS COMPLETED:

ERCOT Region – 8,119 MW

1. Culberson, Texas Wind Power Project, 35MW, Oct-95
2. Howard, Big Spring Wind Power, 34MW, Feb-99
3. Howard, Big Spring Wind Power, 6.6MW, Jun-99
4. Upton, Southwest Mesa Wind Project, 75MW, Jun-99
5. Culberson, Delaware Mountain Wind Farm, 30MW, Jun-99
6. Pecos, Indian Mesa, 82.5MW, Jun-01
7. Pecos, Woodward Mountain Ranch, 160MW, Jul-01
8. Nolan, Trent Mesa, 150MW, Nov-01
9. Pecos, Desert Sky (Indian Mesa II), 160MW, Dec-01
10. Upton, King Mountain Wind Ranch, 278MW, Dec-01
11. Scurry, Brazos Wind Ranch, 160MW, Dec-03
12. Nolan, Sweetwater Wind 1, 37.5MW, Dec-03
13. Nolan, Sweetwater Wind 2, 91.5MW, Feb-05
14. Nolan, Sweetwater Wind 3 (Cottonwood Creek), 135MW, Dec-05
15. Nolan, Sweetwater Wind 4 (Cottonwood Creek), 300MW, May-07
16. Nolan, Sweetwater Wind 5, 80MW, Dec-07
17. Taylor, Callahan Divide Wind Energy Center, 114MW, Feb-05
18. Taylor, Buffalo Gap 1, 120MW, Sep-05
19. Taylor, Buffalo Gap 2 (Cirello 1), 233MW, Aug-07
20. Taylor, Buffalo Gap 3, 138MW, Apr-08
21. Taylor, Horse Hollow Phase 1, 213MW, Oct-05
22. Taylor, Horse Hollow Phase 2, 223.5MW, May-06
23. Taylor, Horse Hollow Phase 3, 299MW, Sep-06
24. Borden, Red Canyon 1, 84MW, May-06
25. Sterling, Forest Creek Wind Farm, 124.2MW, Dec-06
26. Sterling, Sand Bluff Wind Farm, 90MW, Dec-06
27. Scurry, Camp Springs Wind Energy Center, 130MW, Jul-07
28. Scurry, Camp Springs Energy expansion, 120MW, Jun-08
29. Sterling, Capricorn Ridge Wind, 364MW, Sep-07
30. Sterling, Capricorn Ridge Wind exp., 298 MW, May-08
31. Jack, Barton Chapel Wind 1, 120MW, Dec-07
32. Scurry, Snyder Wind Project, 63MW, Dec-07
33. Shackleford, Lone Star - Mesquite Wind, 200MW, Dec-07
34. Shackleford, Lone Star - Post Oak Wind, 200MW, May-08
35. Floyd, Whirlwind, 60MW, Dec-07
36. Martin, Stanton Wind Energy, 101MW, Jan-08
37. Scurry, Champion Wind Farm, 126MW, Jan-08
38. Scurry, Roscoe Wind Farm 1, 209MW, Jan-08
39. Erath, Silver Star Phase I, 60MW, Mar-08
40. Sterling, Goat Mountain Wind Ranch, 70MW, Mar-08
41. Dickens, McAdoo Wind Energy, 150MW, May-08
42. Howard, Panther Creek, 143MW, Jul-08
43. Howard, Ocotillo Wind Power 1, 59MW, Aug-08
44. Pecos, Sherbino Mesa Wind farm, 150MW, Sep-08
45. Taylor, South Trent Wind Farm, 98 MW, Oct-08
46. Cooke, Wolf Ridge Wind farm, 113 MW, Oct-08
47. Kenedy, Gulf Wind 1, 283MW, Nov-08
48. Nolan, Inadale, 197MW, Nov-08
49. Howard, Panther Creek 2, 115MW, Nov-08
50. Scurry, Pyron, 249MW, Nov-08
51. Borden, Bull Creek Wind Plant, 180 MW, Nov-08
52. Nolan, Turkey Track Energy Center, 170 MW, Nov-08
53. Howard, Elbow Creek Wind, 117MW, Nov-08
54. Kenedy, Penascal Wind Farm, 202MW, Nov-08
55. Shackleford, Hackberry Wind Farm, 165MW, Nov-08
56. Ector, Notrees Wind power, 153MW, Jan-09

WSCC Region – 1 MW

57. El Paso, Hueco Mountain Wind Ranch, 1.3MW, Apr-01

SPP Region – 283 MW

58. Carson, Llano Estacado Wind Ranch, 79MW, Jan-02
59. Hansford, 3MW, 2003
60. Hansford, JD Wind 1, 2, 3, 5, 40MW, Dec-06
61. Oldham, Wildorado Wind Ranch, 161MW, Apr-07

WIND PROJECTS UNDER CONSTRUCTION:

ERCOT Region – 250 MW

62. Sterling, Goat Mountain WR-phase 2, 70MW, Apr-09
63. San Patricio, Papalote Creek Wind Farm, 180MW, May-09

SPP Region – 80 MW

64. Carson, Majestic Wind power, 80MW, 2009

WIND PROJECTS ANNOUNCED:

ERCOT Region – 7,591 MW

65. Borden, Coyote Run Wind Farm, 184MW, Apr-09
66. Borden, Stephens Wind Farm, 141MW, May-09
67. Dickens, McAdoo Energy Center II, 500MW, Jun-09
68. Kenedy, Gulf Wind 2, 400 MW, Sep-09
69. Kenedy, Gulf Wind 3, 400 MW, Sep-10
70. Concho, Panther Creek 3, 200MW, Nov-09
71. Coryell, Gatesville Wind Farm, 200MW, Dec-09
72. Tom Green, Langford Wind Power, 150MW, Dec-09
73. Andrews, M-Bar Wind, 194MW, Dec-09
74. Mitchell, Loraine Wind park, 251MW, Dec-09
75. Harbor Sunrise Wind Project, 37MW, 2009
76. Nolan, Jackson Mountain Wind, 90MW, Jan-10
77. Scurry, Scurry County Wind III, 350MW, Mar-10
78. Pecos, Sherbino Mesa Wind Farm 2, 150MW, Oct-10
79. Jack, Senate Wind Project, 150MW, Nov-10
80. Throckmortan, Throckmortan Wind Farm, 400MW, Dec-10
81. Nolan, Buffalo Gap 4 and 5, 465 MW, Mar-11
82. Howard, Gun sight Mountain, 120MW, Aug-11
83. Howard, Wild horse mountain, 120MW, Dec-11
84. Ector, Pistol Hill wind energy, 300MW, Dec-11
85. Carson, B&B Panhandle Wind, 1001MW, Jun-12
86. Sterling, Sterling Energy Center, 300MW, Jun-12
87. Sterling, Sterling Energy Center, 200MW, Jun-12
88. Tom Green, For Concho Wind farm, 400MW, Jul-12
89. Martin, Lenorah Wind farm, 251MW, Sep-12
90. Shackleford, Cottonwood Wind, 100MW, Jun-13
91. Shackleford, Mesquite Wind 4, 136MW, Jun-13
92. Galveston, Galveston Offshore Wind, 300MW
93. Childress, Childress Wind Project, 101MW

SPP Region – 40MW

94. Moore, Blue Creek, 20MW
95. Moore, Channing Flats, 20MW

WIND PROJECTS RETIRED:

ERCOT Region – 7MW

95. Jeff Davis, 7MW, Ft. Davis Wind Farm, 1996

Figure 3-2: Completed and Announced Wind Projects in Texas by April 2009

3.2 Analysis of the Sweetwater-III Wind Farm Using OSP and NON-OSP Methods

In this section, the Sweetwater III wind farm was used as an example to analyze the applicability of the procedure of modeling wind power production using the 2007 measured wind power data and NOAA wind data, and predicting the electricity power to the selected base year, 1999. Sweetwater III was completed and commenced operation in late December of 2005. It is a 135-megawatt project using 90, 1.5MW GE Wind turbines located in Nolan County, Texas.

3.2.1 Weather Data, Abilene NOAA Site

In Figure 3-3, the hourly wind speed data is shown from NOAA – Abilene Regional Airport (ABI)[4] for the years 1999 and 2007. Figure 3-4 shows the daily wind speed data from NOAA - ABI for the same two years. The annual average daily wind speed of 1999 and 2007 are 11.3 mph and 10.1 mph, respectively. To differentiate the data used for the OSP and NON-OSP models, two different colors were used in these plots.

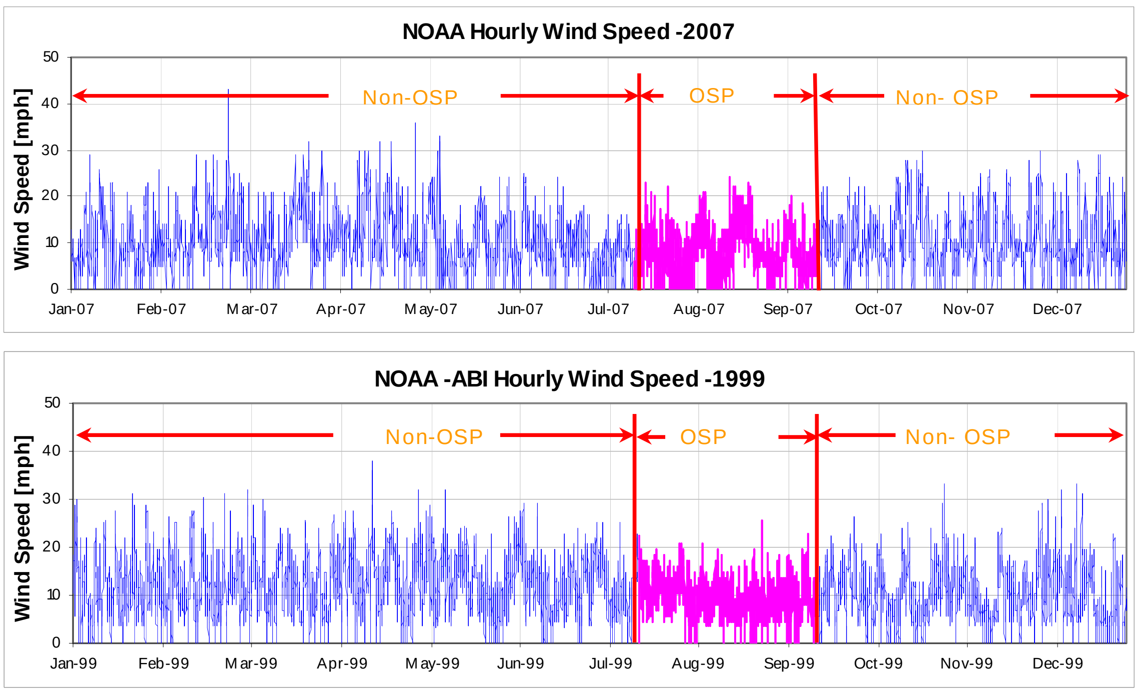
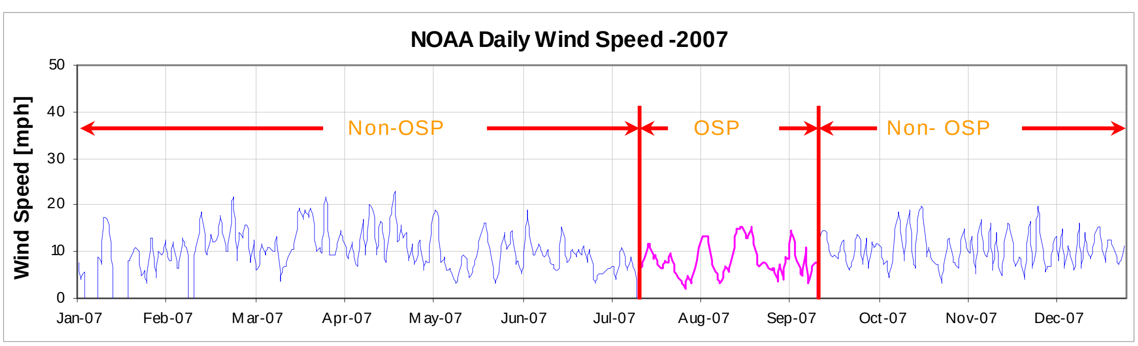


Figure 3-3: Hourly NOAA-ABI Wind Speed (1999 and 2007)



[4] NOAA wind measurements were taken at a height of 33 ft.

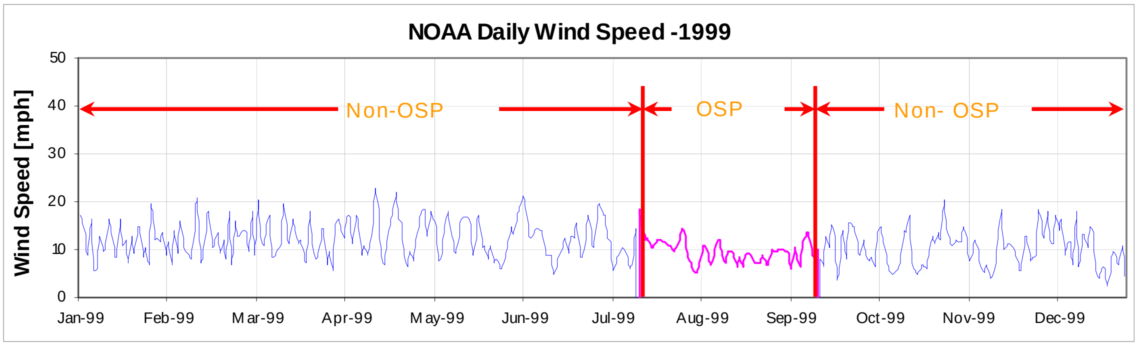


Figure 3-4: Daily NOAA-ABI Wind Speed (1999 and 2007)

3.2.2 Wind Power Data

In Figure 3-5, the hourly electricity produced and measured by ERCOT in the Ozone Season Days and the rest of the year from this wind farm is shown in the time series for 2007. Figure 3-6 shows the daily turbine power generation summed from the hourly data. In Figure 3-7, the hourly wind power data was plotted against hourly NOAA wind measurements. The data show scatter and discretization (i.e., patterning) due to the precision of the measurements. In Figure 3-8, the hourly electricity produced by the wind farm except for Ozone Season Days was summed to daily totals and plotted against the daily average wind speed. Figure 3-9 shows the daily electricity produced by the wind farm plotted against the daily average wind speed only for the Ozone Season Days. These figures also show that daily wind power data is suitable for modeling purposes.

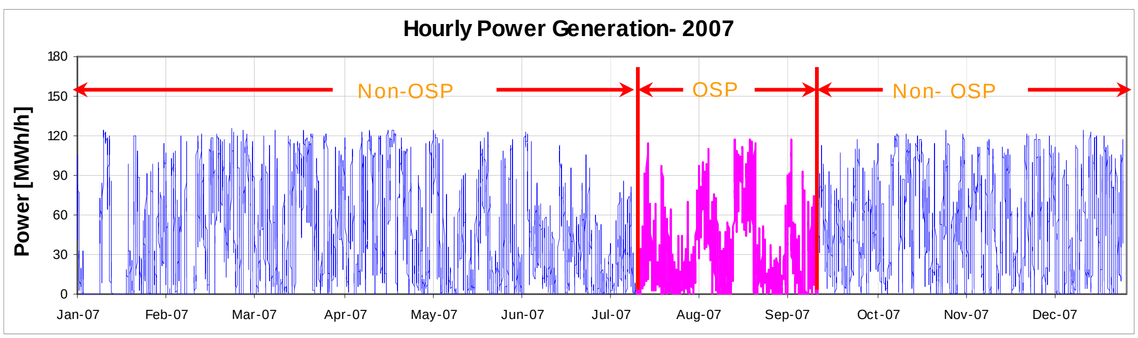


Figure 3-5: Measured Hourly Wind Power (2007), Sweetwater III Wind Farm

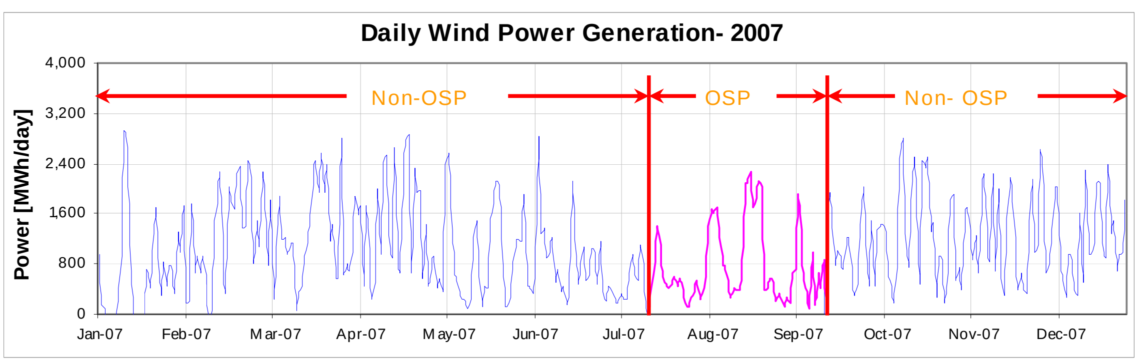


Figure 3-6: Measured Daily Wind Power (2007), Sweetwater III Wind Farm

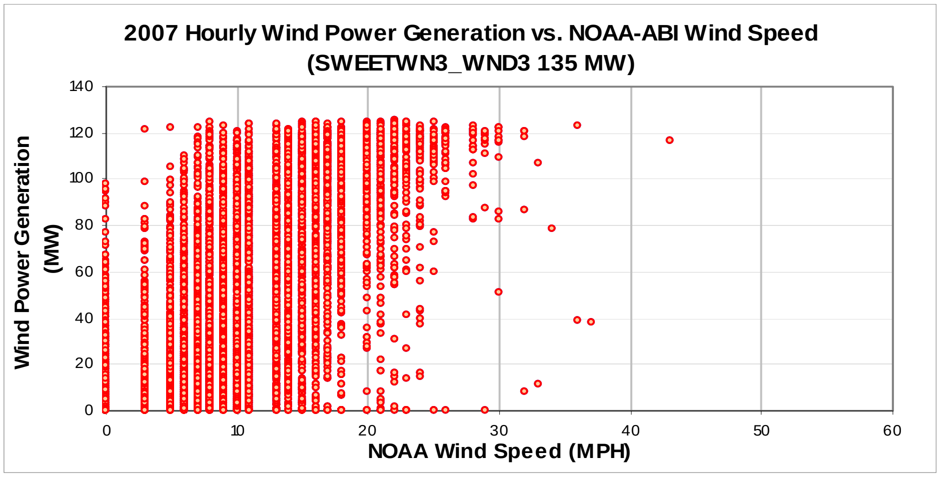


Figure 3-7: Hourly Wind Power vs. NOAA-ABI Wind Speed (2007)

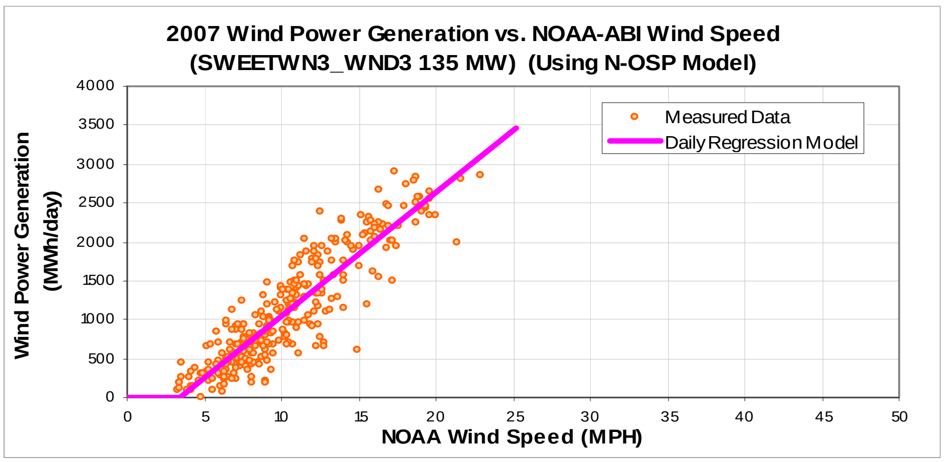


Figure 3-8: Daily Wind Power vs. NOAA-ABI Wind Speed for the Non-OSD Period

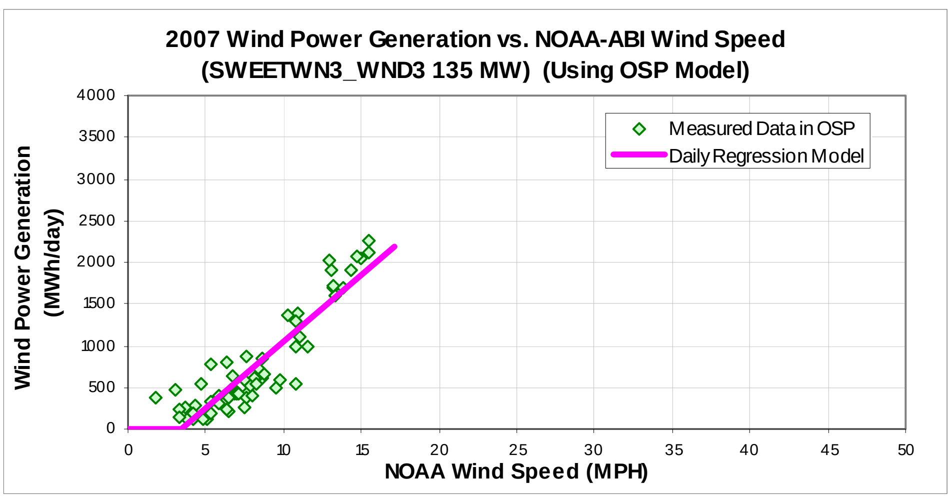


Figure 3-9: Daily Wind Power vs. NOAA-ABI Wind Speed (2007) for the OSD Period

3.2.3 Modeling of Turbine Power vs. Wind Speed

As shown in the previous sections, daily wind power and daily NOAA wind data are more appropriate for modeling base-year power production than hourly values. Figure 3-8 and Figure 3-9 show the application of a three-parameter change-point linear regression to the average daily wind power output versus average daily NOAA wind speeds for Non-OSD and OSD periods. The summary of the regression model coefficients from the NON-OSP and OSP daily models is listed in Table 3-1 and Table 3-2. These coefficients show that these two daily models are well described with a root-mean-squared error (RMSE) of 316.18 MWh/day (Non-OSP Model) and 257.29 MWh/day (OSP model) for the 2007 data.

In Table 3-3 the predicted monthly electricity production using the 3-parameter, change-point linear daily NON-OSP and OSP models for 2007 is shown to compare against the measured monthly electricity for the same period. The biggest discrepancy of -14.33% between the measured and predicted value happened in July. Figure 3-10 shows the predicted electricity production from the wind farm as a time-series trace for the Ozone Season Period (July 15 to September 15), using the OSP daily model. For most of the days, the predicted power production matches very well the measured values, demonstrating the good performance of this OSP model.

Table 3-1: Non-OSP Model Coefficients

IMT Coefficients	NOAA NON-OSP Daily Model
Ycp (MWh/day)	-537.6169
Left Slope (MWh/mph-day)	158.6613
RMSE (MWh/day)	316.1784
R2	0.8062
CV-RMSE	27.8%

Table 3-2: OSP Model Coefficients

IMT Coefficients	NOAA OSP Daily Model
Ycp (MWh/day)	-547.0923
Left Slope (MWh/mph-day)	159.6473
RMSE (MWh/day)	257.28614
R2	0.8247
CV-RMSE	33.7%

Table 3-3: Predicted Wind Power Using OSP and NON-OSP Daily Models

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	CV-RMSE
Jan-07	23	8.97	21,625	20,367	5.81%	44.43%
Feb-07	27	12.16	35,491	37,585	-5.90%	32.96%
Mar-07	31	11.82	39,630	41,450	-4.59%	23.08%
Apr-07	30	12.85	43,693	45,049	-3.10%	24.27%
May-07	31	9.32	28,565	29,169	-2.12%	26.38%
Jun-07	30	9.53	26,009	29,209	-12.30%	28.42%
Jul-07	31	6.95	15,527	17,752	-14.33%	42.29%
Aug-07	31	9.10	30,236	28,144	6.92%	28.67%
Sep-07	30	9.04	25,849	26,906	-4.09%	20.26%
Oct-07	31	11.05	40,896	37,682	7.86%	23.03%
Nov-07	30	10.37	34,766	33,217	4.46%	20.33%
Dec-07	31	10.51	38,877	35,011	9.94%	33.97%
Total	356	10.14	381,164	381,540	-0.10%	28.39%
Total in OSP (07/15-09/15)	63	8.20	48,038	48,397	-0.75%	32.07%

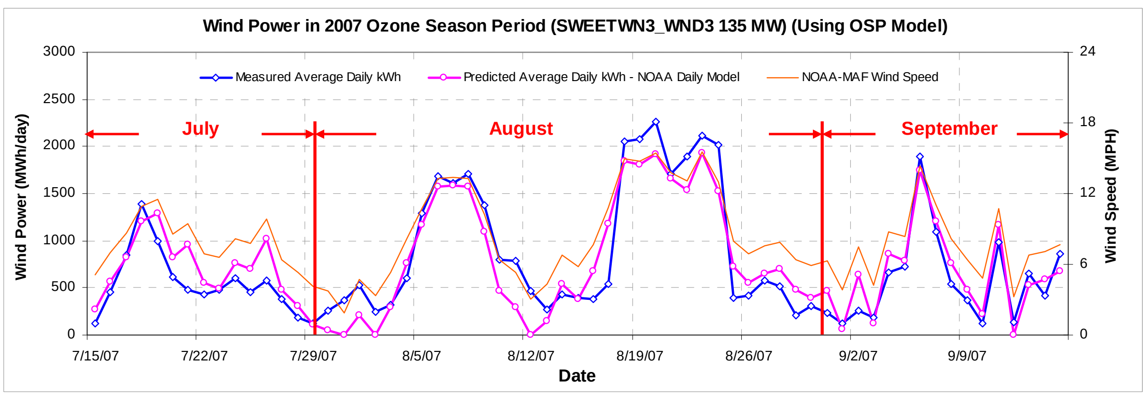


Figure 3-10: Predicted Wind Power in OSP Using NOAA-ABI Wind Speed (2007)

3.2.4 Testing of the OSP and NON-OSP Models

To test the performance of the OSP and NON-OSP daily models, the model coefficients were applied to the 2006 NOAA daily wind speed to predict the daily wind power that would have been generated in 2006. The predicted daily wind power was then summed to monthly to compare against the monthly measurements from ERCOT, as shown in Table 3-4. The test results show that both the OSP and NON-OSP models are sufficiently robust to allow for its use in projecting wind production into other weather base years with the largest observed error of -36.2% in August 2006 for using the OSD model (Figure 3-11) and the largest error of -19.9% in January 2006 for using the Non-OSP model (Figure 3-12). Due to lack of operation information from this wind farm in those periods, specific reasons for the over-prediction of the wind power production in these two months was not provided in this analysis.

Table 3-4: Predicted vs. Measured Wind Power in 2006

Month	2006 Predicted MWh/mo Daily Model	2006 Measured-ERCOT MWh/mo	2006 Diff. Daily Model
Jan	41,769	34,836	-19.9%
Feb	34,431	33,273	-3.5%
Mar	45,307	40,682	-11.4%
Apr	42,278	39,921	-5.9%
May	43,921	44,001	0.2%
Jun	28,592	26,630	-7.4%
Jul	33,243	28,497	-16.7%
Aug	26,397	19,383	-36.2%
Sep	28,917	29,729	2.7%
Oct	35,888	38,728	7.3%
Nov	34,776	42,613	18.4%
Dec	33,126	37,359	11.3%
OSD	55,710	46,015	-21.1%
Total	484,355	415,652	-16.5%

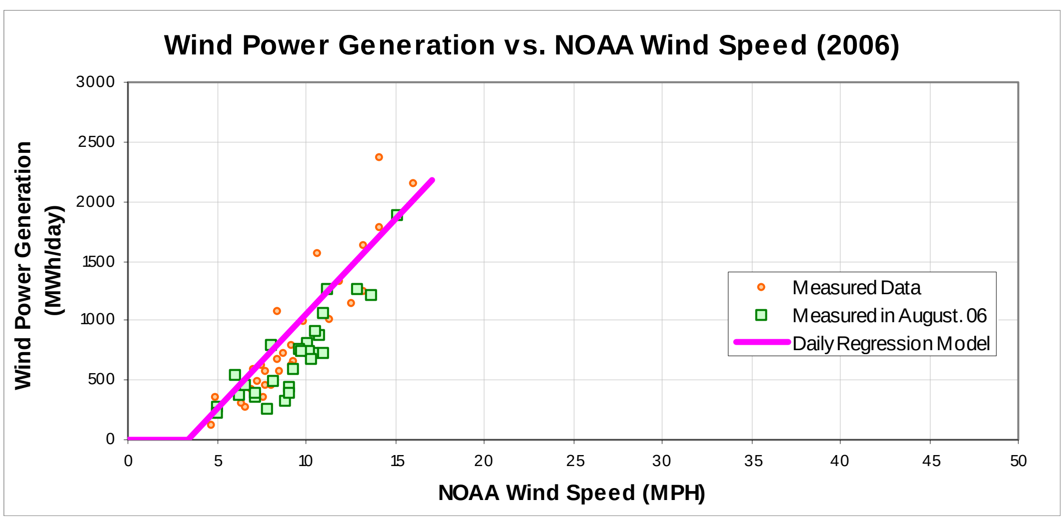


Figure 3-11: Measured and Predicted Power Production in August 2006 Using the OSP Model

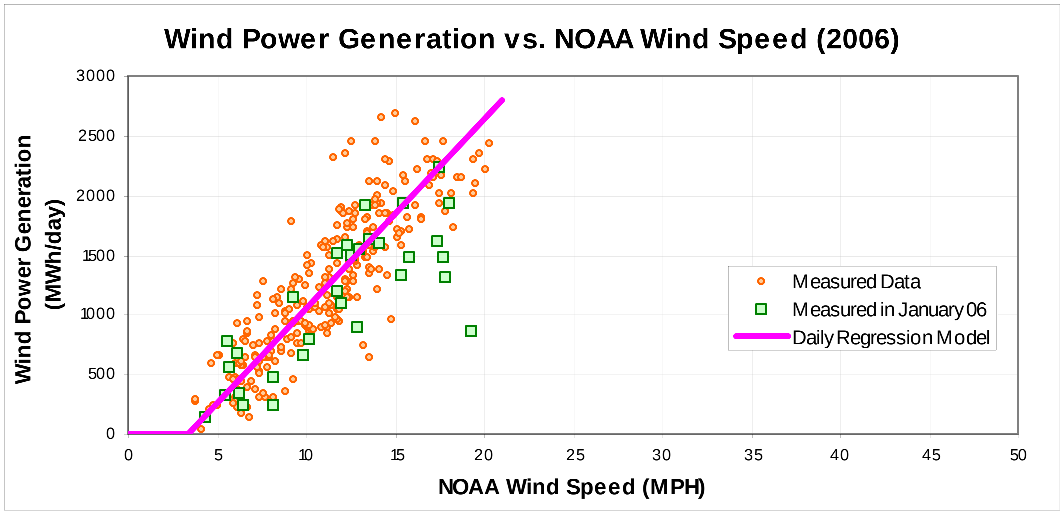


Figure 3-12: Measured and Predicted Power Production in January 2006 Using the Non-OSP Model

3.2.5 Prediction of Wind Power in Base Year 1999

The resultant coefficients (Table 3-1 and Table 3-2) from the 3-parameter models were next applied to the 1999 average daily NOAA-ABI wind speed to predict the electricity the wind farm would have produced in 1999 (Table 3-5). In Table 3-5, the estimated annual and Ozone Season Day (OSD) values are compared against the measured 2007 values to illustrate the error that would result if one were to simply use the 2007 values without normalization. Table 3-5 shows that the estimated annual power production increased 12.4% when compared against 2007. The average daily power production during the Ozone Season Period increased 31.5% as well. This may be because 1999 (an annual average of 11.3 mph) was windier than 2007 (an annual average of 10.1 mph).

Table 3-5: Predicted Power Production in 1999

1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr for Modeling
439,358	390,800
1999 OSD Estimated MWh/day (2007 Daily Model)	**2007 OSD Measured MWh/day**
1,003	763

3.3 Capacity Factor Analysis

The predicted monthly capacity factors for 2007, using the daily model and the measured monthly capacity factors for the same period, are shown in Figure 3-13. Figure 3-14 shows the predicted capacity factors using the NOAA model from January to December for the periods 1999 through 2007, as well as the measured monthly capacity factor in 2007 and the average monthly capacity factors for these nine years, using the daily NOAA model. In Figure 3-13, the model shows good agreement tracking the measured capacity factor. In comparison, in Figure 3-14, it can be seen that there is more variation in the year to year wind speeds than the uncertainty from the model. Figure 3-14 also shows the importance of weather normalizing the wind speeds back to the base year. Figure 3-15 shows a close up of the wind speeds for 1999 and 2007 for four Texas weather stations.

As seen in Table 3-6, if predicted with the daily model, the annual capacity factors for these years vary from 33.1% to 39.6% with an average of 36.4%. In the Ozone Season Period, the capacity factors are relatively lower than the annual capacity factors. Analysis also shows that the highest electricity production occurs in the spring months (Figure 3-14). It is interesting to note that the variation across the same month of these years can be more than 20% due to the significantly different wind conditions, e.g. March, May and July.

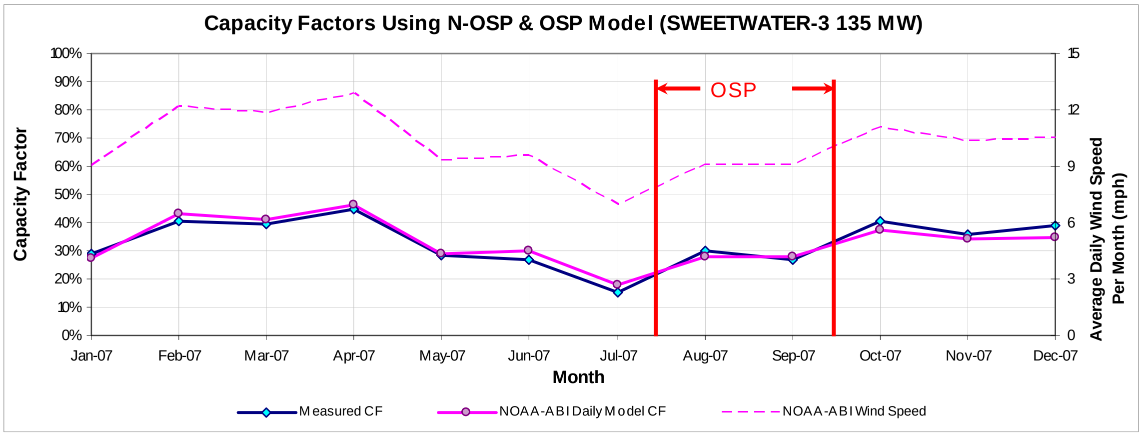


Figure 3-13: Predicted Capacity Factors Using Daily Models (2007)

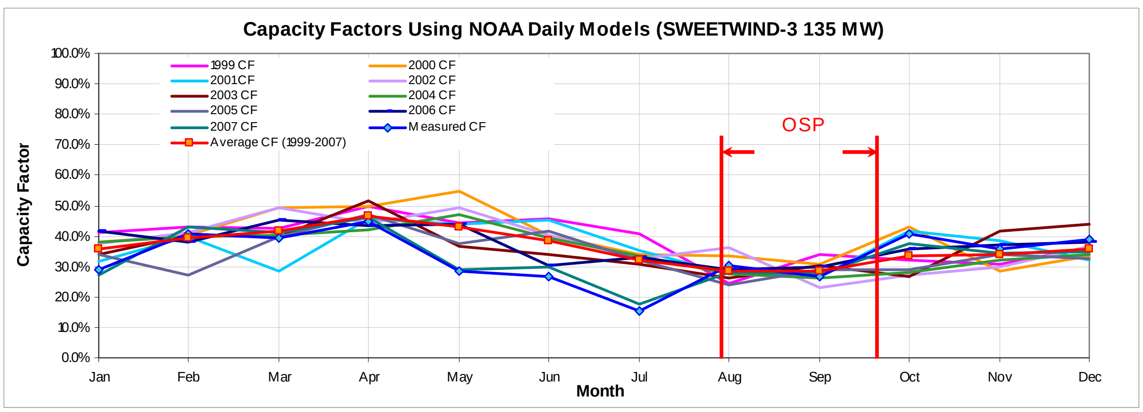


Figure 3-14: Predicted Capacity Factors Using Daily Models (1999-2007)

Figure 3-15: 1999 and 2007 Monthly Average Wind Speed for Four NOAA Weather Stations

Table 3-6: Summary of Predicted Capacity Factors (1999-2007)

	NOAA Annual Average Wind Speed (MPH)	Predicted Annual Capacity Factor	Predicted Capacity Factor in Ozone Season Period
1999	11.3	38.8%	31.0%
2000	11.5	39.6%	31.6%
2001	10.8	36.4%	30.9%
2002	11.0	37.3%	33.0%
2003	10.8	36.3%	28.0%
2004	10.7	35.7%	25.8%
2005	10.3	33.9%	27.4%
2006	11.0	37.1%	28.7%
2007	10.1	33.1%	23.7%
Average (1999-2007)	10.8	36.4%	28.9%

3.4 Summary of Wind Power Production for All Wind Farms in the Texas ERCOT Region

Table 3-7 shows the summary of the 2007 measured power production for the wind farms that were operating in 2007 in the Texas ERCOT region and the estimated 1999 power production using daily regression models (Appendix B). Table 3-8 shows the monthly average wind speed across four weather stations used in the modeling. As shown in Figure 3-16 and Figure 3-17, the estimated power production in 1999 (10,226,399 MWh/yr) increased about 17% when compared to what was measured in 2007 (8,752,498 MWh/yr). For the Ozone Season Period, the estimated average daily power production in 1999 is 25,151 MWh/day, a 25% increase from that measured in 2007 (20,094 MWh/day). This is because for all the four NOAA weather stations involved in the modeling, 1999 is windier than 2007 (Table 3-8 and Figure 3-15).

Figure 3-18 presents the comparison of the 2007 measured annual power production against the 1999 estimated annual power production for each wind farm. Figure 3-19 shows the difference between the 2007 measured average daily power production and the 1999 estimated average daily power production during the Ozone Season Period for each wind farm. For the wind farms Buffalo Gap 2, Capricorn Ridge Wind 1 & 2, Camp Springs 1, Lone Star Mesquite wind and Sweetwater Wind 4, which started operation halfway through 2006, the power production during the testing period was low and was excluded in the analysis. Therefore, only certain months of data were used in the modeling.

From this analysis it can be concluded that the use of weather normalization procedure for predicting 1999 base year production based on 2007 measured power production is more accurate than simply using the measured 2007 power production as the base year power production. Therefore, it is recommended to the TCEQ that the current discount factor be reduced to take the more accurate modeling into account.

Table 3-9 shows the summary of predicted wind power production in other years (i.e., 2000 and 2002) for all the wind farms in the ERCOT region, using the coefficients from the daily models developed using 2007 measured wind power data and NOAA wind speed data in 2000 and 2002.

Table 3-7: Summary of Power Production for All Wind Farms

Wind Unit Name	County	NOAA Weather Station	PCA	Capacity (MW)	2007 Measured (MWh/yr) (ERCOT Original Data)	1999 Estimated Using Daily Model (MWh/yr)	2007 OSP Measured (MWh/day)	1999 OSP Estimated (MWh/day)
BRAZ_WND_WND1	SCURRY	ABI	AEP-West	99	294,050	349,118	666	869
BRAZ_WND_WND2	SCURRY	ABI	AEP-West	61	175,598	208,329	401	516
BUFFALO_GAP_1	TAYLOR	ABI	AEP-West	120	337,836	410,441	701	968
BUFFALO_GAP_2**	TAYLOR	ABI	AEP-West	233	337,056	451,147	1,194	1,665
CALLAHAN_WND1	TAYLOR	ABI	AEP-West	114	371,710	441,790	772	1,037
CAPRIDGE_CR1**	STERLING	ABI	LCRA	214.5	162,091	150,290	0	0
CAPRIDGE_CR2**	STERLING	ABI	LCRA	149.5	131,787	120,091	0	0
CSEC_CSECG1**	SCURRY	LBB	AEP-West	135	223,456	236,787	805	868
*DELAWARE_WIND_NWP**	*CULBERSON*	*GDP*	*TXU*	*30*	*56,977*	*62,053*	*103*	*90*
H_HOLLOW_WND1	TAYLOR	ABI	AEP-West	213	596,024	713,071	1,143	1,573
HHOLLOW2_WIND1	TAYLOR	ABI	AEP-West	224	503,371	617,443	986	1,360
HHOLLOW3_WND_1	TAYLOR	ABI	AEP-West	299	605,475	735,630	1,240	1,683
HHOLLOW4_WND_1	TAYLOR	ABI	AEP-West	115	322,912	383,301	633	866
INDNENR_INDNENR	PECOS	FST	AEP-West	80	253,564	274,334	640	638
INDNENR_INDNENR_2	PECOS	FST	AEP-West	80	230,462	260,431	586	587
*INDNNWP_INDNNWP**	*PECOS*	*FST*	*AEP-West*	*82.5*	*219,786*	*246,998*	*575*	*576*
KING_NE_KINGNE	UPTON	MAF	AEP-West	79.3	171,480	203,501	406	456
KING_NW_KINGNW	UPTON	MAF	AEP-West	79.3	216,133	248,975	548	605
KING_SE_KINGSE	UPTON	MAF	AEP-West	40.3	85,497	101,648	208	234
KING_SW_KINGSW	UPTON	MAF	AEP-West	79.3	179,261	223,819	496	548
*KUNITZ_WIND_LGE**	*CULBERSON*	*GDP*	*LCRA*	*35*	*33,225*	*40,305*	*43*	*38*
LNCRK_G83	SHACKLEFORD	ABI	AEP-West	200	219,275	208,662	599	785
MCDLD_FCW1	STERLING	SJT	TXU	125	370,842	435,455	818	1,074
MCDLD_SBW1	STERLING	SJT	TXU	90	139,221	149,417	354	452
RDCANYON_RDCNY1	BORDEN	ABI	AEP-West	124	286,816	334,823	665	836
*SGMTN_SIGNALMT**	*HOWARD*	*MAF*	*TXU*	*41*	*86,343*	*101,909*	*186*	*208*
*SW_MESA_SW_MESA**	*UPTON*	*MAF*	*AEP-West*	*75*	*203,388*	*232,435*	*539*	*596*
SWEETWN2_WND2	NOLAN	ABI	LCRA	92	296,341	357,326	644	860
SWEETWN2_WND24**	NOLAN	ABI	LCRA	16	20,956	30,361	87	121
SWEETWN3_WND3	NOLAN	ABI	LCRA	135	381,117	457,851	763	1,003
SWEETWN4_WND4A**	NOLAN	ABI	LCRA	119	180,454	199,353	628	792
SWEETWN4_WND4B**	NOLAN	ABI	LCRA	105	173,772	189,153	601	786
SWEETWND_WND1	NOLAN	ABI	LCRA	37.5	109,611	135,245	221	299
TRENT_TRENT	NOLAN	ABI	TXU	150	434,417	522,564	898	1,216
*WOODWRD1_WOODWRD1**	*PECOS*	*FST*	*AEP-West*	*80*	*176,771*	*202,553*	*487*	*488*
*WOODWRD2_WOODWRD2**	*PECOS*	*FST*	*AEP-West*	*80*	*165,424*	*189,790*	*458*	*458*
TOTAL				4,032	8,752,498	10,226,399	20,094	25,151

**** Wind farms in Italic were built before 9/2001.***

**** Only certain months of data available for modeling**

Table 3-8: Summary of 1999 and 2007 Monthly Average Wind Speed for Four NOAA Weather Stations

Month	Wind Speed ABI (mph)		Wind Speed MAF (mph)		Wind Speed FST (mph)		Wind Speed GDP (mph)	
	1999	2007	1999	2007	1999	2007	1999	2007
Jan	11.8	9.5	10.9	9.6	12.0	9.0	21.2	22.7
Feb	12.2	12.0	11.2	11.2	11.4	11.2	22.4	23.8
Mar	12.1	11.8	11.8	10.3	11.8	11.8	21.5	16.8
Apr	13.6	12.9	13.5	12.3	13.1	13.0	20.9	22.1
May	12.4	9.3	12.8	9.7	12.6	10.0	19.9	18.6
Jun	12.7	9.5	12.8	10.0	12.0	10.2	16.3	17.1
Jul	11.7	7.0	12.3	8.0	12.3	9.3	14.8	15.1
Aug	8.4	9.1	8.0	10.0	8.8	10.5	13.5	14.2
Sep	10.4	9.0	10.1	8.9	9.9	9.8	16.8	13.8
Oct	10	11.0	9.1	10.2	10.4	10.3	14.2	17.6
Nov	9.7	10.4	8.3	8.9	9.5	8.4	18.2	19.2
Dec	10.7	10.6	10.0	8.8	10.6	9.7	20.6	22.0
Annual Average	11.3	10.2	10.9	9.8	11.2	10.3	18.3	18.6
OSP Average	9.7	8.2	9.5	9.0	10.0	10.0	13.9	14.8

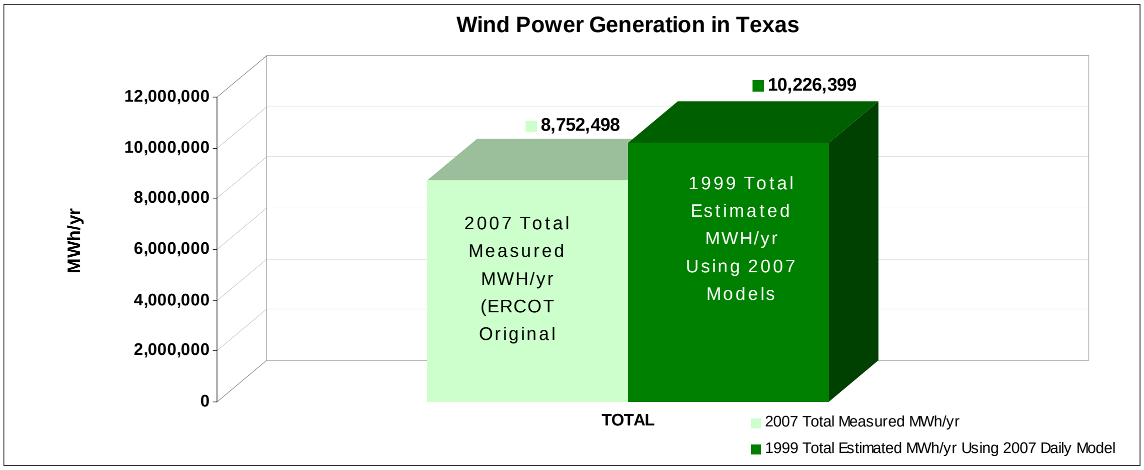


Figure 3-16: Comparison of Total 2007 Measured and 1999 Estimated Power Production

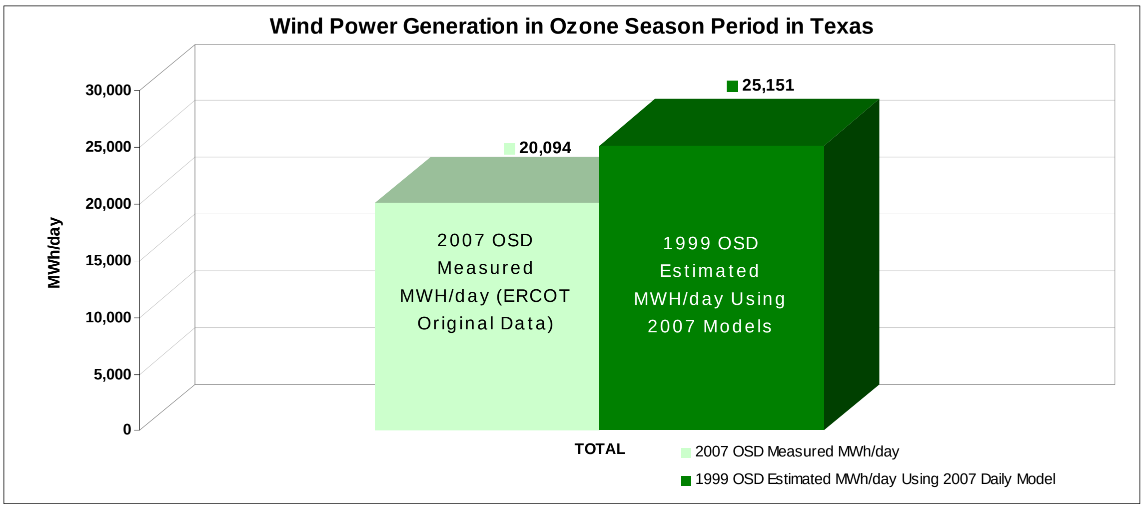


Figure 3-17: Comparison of Total 2007 OSD Measured and 1999 OSD Estimated Power Production

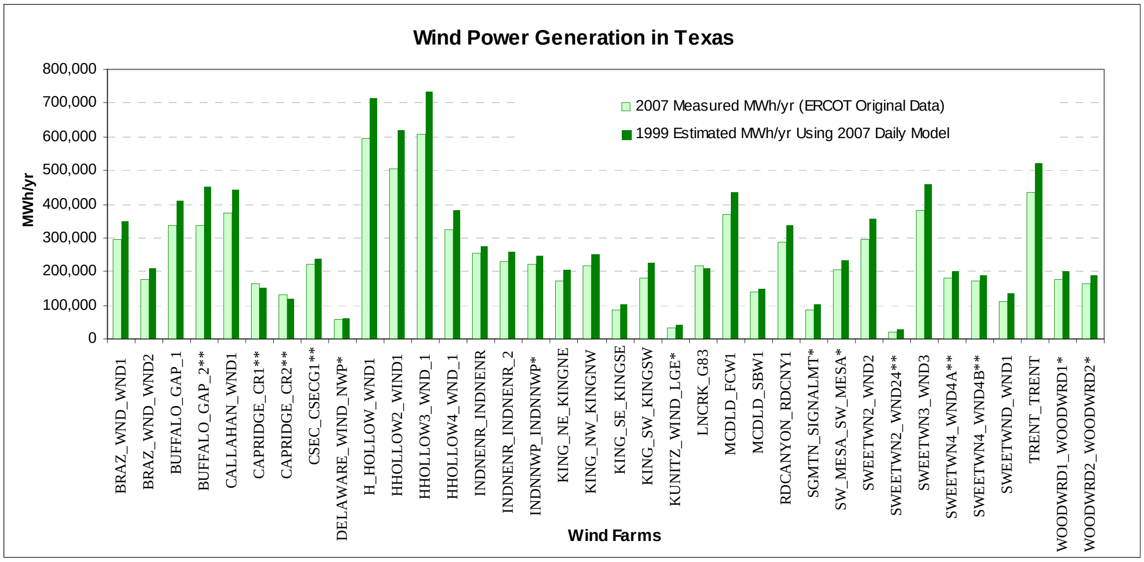


Figure 3-18: Comparison of 2007 Measured and 1999 Estimated Power Production for Each Wind Farm

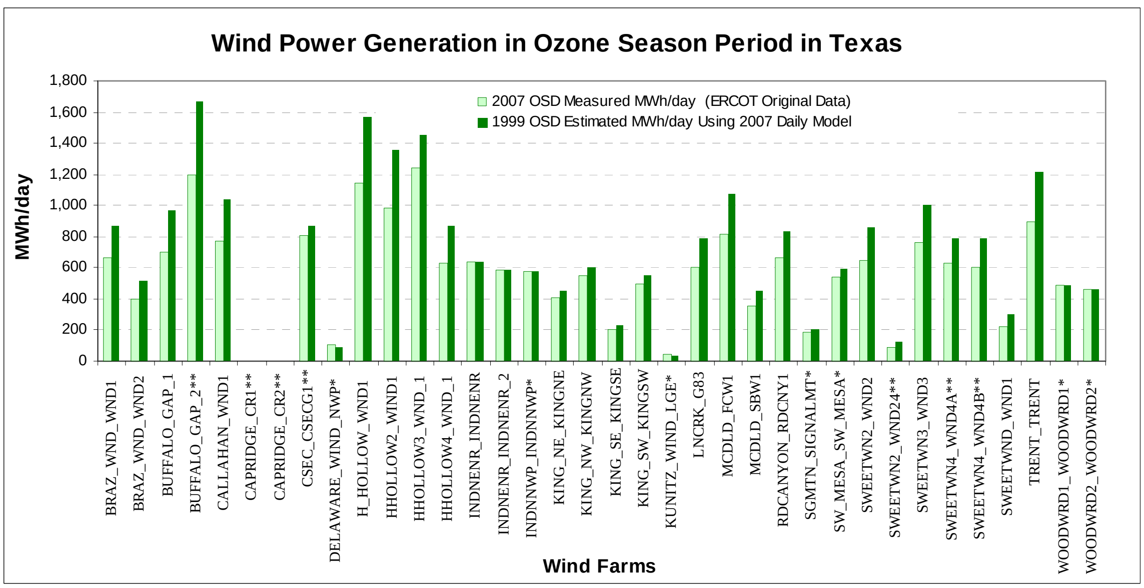


Figure 3-19: Comparison of 2007 OSD Measured and 1999 OSD Estimated Power Production for Each Wind Farm

Table 3-9: Summary of Predicted Wind Power in Base Years (1999, 2000 and 2002) for All Wind Farms in the ERCOT Region

Wind Unit Name	County	NOAA Weather Station	Capacity (MW)	PCA	Predicted Wind Power in 1999		Predicted Wind Power in 2000		Predicted Wind Power in 2002	
					Annual (MWh/yr)	OSD (MWh/day)	Annual (MWh/yr)	OSD (MWh/day)	Annual (MWh/yr)	OSD (MWh/day)
BRAZ_WND_WND1	SCURRY	ABI	99	AEP-West	349,118	869	358,509	893	336,388	925
BRAZ_WND_WND2	SCURRY	ABI	61	AEP-West	208,329	516	213,920	529	200,533	548
BUFF_GAP_UNIT1	TAYLOR	ABI	120	AEP-West	410,441	968	421,838	1,000	395,636	1,042
BUFF_GAP_UNIT2*	TAYLOR	ABI	233	AEP-West	451,147	1,665	469,526	1,721	427,512	1,795
CALLAHAN_WND1	TAYLOR	ABI	114	AEP-West	441,790	1,037	453,675	1,068	425,979	1,110
CAPRIDGE_CR1*	STERLING	ABI	215	LCRA	150,290	0	154,281	0	139,486	0
CAPRIDGE_CR2*	STERLING	ABI	150	LCRA	120,091	0	123,736	0	110,133	0
CSEC_CSECG1*	SCURRY	LBB	135	AEP-West	236,787	868	240,151	858	247,761	890
DELAWARE_WIND_NWP	CULBERSON	GDP	30	TXU	62,053	90	62,783	86	63,677	97
H_HOLLOW_WND1	TAYLOR	ABI	213	AEP-West	713,071	1,573	732,137	1,625	687,985	1,693
HHOLLOW2_WIND1	TAYLOR	ABI	224	AEP-West	617,443	1,360	633,340	1,405	592,837	1,464
HHOLLOW3_WND_1	TAYLOR	ABI	299	AEP-West	735,630	1,683	753,803	1,735	708,251	1,805
HHOLLOW4_WND_1	TAYLOR	ABI	115	AEP-West	383,301	866	392,408	894	370,043	931
INDNENR_INDNENR	PECOS	FST	80	AEP-West	274,334	638	282,482	772	279,722	766
INDNENR_INDNENR_2	PECOS	FST	80	AEP-West	260,431	587	268,030	713	265,301	707
INDNNWP_INDNNWP	PECOS	FST	82.5	AEP-West	246,998	576	253,948	692	251,366	687
KING_NE_KINGNE	UPTON	MAF	79.3	AEP-West	203,501	456	210,175	493	208,059	617
KING_NW_KINGNW	UPTON	MAF	79.3	AEP-West	248,975	605	256,202	647	255,188	790
KING_SE_KINGSE	UPTON	MAF	40.3	AEP-West	101,648	234	105,053	254	104,104	318
KING_SW_KINGSW	UPTON	MAF	79.3	AEP-West	223,819	548	230,546	586	229,167	715
KUNITZ_WIND_LGE	CULBERSON	GDP	35	LCRA	40,305	38	40,932	35	41,700	41
LNCRK_G83*	SHACKLEFORD	ABI	200	AEP-West	208,662	785	249,977	807	220,998	836
MCDLD_FCW1	STERLING	SJT	125	TXU	435,455	1,074	446,794	1,104	420,607	1,145
MCDLD_SBW1	STERLING	SJT	90	TXU	149,417	452	153,788	463	146,464	477
RDCANYON_RDCNY1	BORDEN	ABI	124	AEP-West	334,823	836	342,131	856	323,770	883
SGMTN_SIGNALMT	HOWARD	MAF	41	TXU	101,909	208	104,961	225	104,039	281
SW_MESA_SW_MESA	UPTON	MAF	75	AEP-West	232,435	596	239,297	639	239,102	782
SWEETWN2_WND2	NOLAN	ABI	92	LCRA	357,326	860	366,978	886	344,509	920
SWEETWN2_WND24*	NOLAN	ABI	16	LCRA	30,361	121	30,273	125	27,690	130
SWEETWN3_WND3	NOLAN	ABI	135	LCRA	457,851	1,003	470,039	1,032	440,571	1,069
SWEETWN4_WND4A*	NOLAN	ABI	119	LCRA	199,353	792	198,978	815	183,899	846
SWEETWN4_WND4B*	NOLAN	ABI	105	LCRA	189,153	786	188,841	808	174,855	837
SWEETWND_WND1	NOLAN	ABI	37.5	LCRA	135,245	299	139,048	308	129,870	320
TRENT_TRENT	NOLAN	ABI	150	TXU	522,564	1,216	537,474	1,254	501,788	1,304
WOODWRD1_WOODWRD1	PECOS	FST	80	AEP-West	202,553	488	208,913	597	206,618	592
WOODWRD2_WOODWRD2	PECOS	FST	80	AEP-West	189,790	458	195,671	560	193,518	555
TOTAL			4,032		10,226,401	25,153	10,530,641	26,485	9,999,127	27,918

3.5 Comparison of 1999 Estimated Wind Power in 2007 & 2008 Report and This Report

Compared to what was reported in the 2008 annual report, an increase of 48% on predicted annual wind power in 1999 was observed, from 6,919,353 MWh/yr to 10,226,399 MWh/yr. The average daily wind power in the 1999 OSD period showed a higher increase of 63%, from 15,468 MWh/day to 25,151 MWh/day. The total wind power capacity included in this year's analysis increased from 2,645 MW to 4,032 MWh (a 52% increase), which includes 233 MW from Buffalo Gap 2, 364 MW from Capricorn Ridge Wind, 135 MW from Camp Springs Wind, 200 MW from Lone Star Mesquite Wind, 125 MW from Forest Creek Wind, 90 MW from Sand Bluff Wind, 16 MW from Sweetwater 24, and 224 MW from Sweet Water 4.

Figure 3-20 (a) shows the annual comparison of measured wind power of 2005, 2006 and 2007 for all the wind farms. Table 3-10 shows the average monthly wind speed for the main four weather stations used in the analysis. In general, most of the wind farms operated at the similar output level for these three years. The total annual wind power production in 2006 for most wind farms was a little higher than in 2005 and 2007. This is consistent with the fact that the average annual wind speed from all four NOAA weather stations in 2006 is a little higher than 2005 and 2007 (Table 3-10). The ones showing a big difference were due to fewer operating months in 2005 and 2006, e.g. Callahan, Sweetwater 2, and Horse Hollow 1, which started operations in 2005, and the wind farms which started operation in 2006, e.g. Buffalo Gap 1, Horse Hollow 2, 3 & 4 and Sweetwater 3. Brazos Wind Ranch 1 & 2, due to the metering problem in 2006, showed a significant difference in measured power when compared with the 2005 and 2007 measurements.

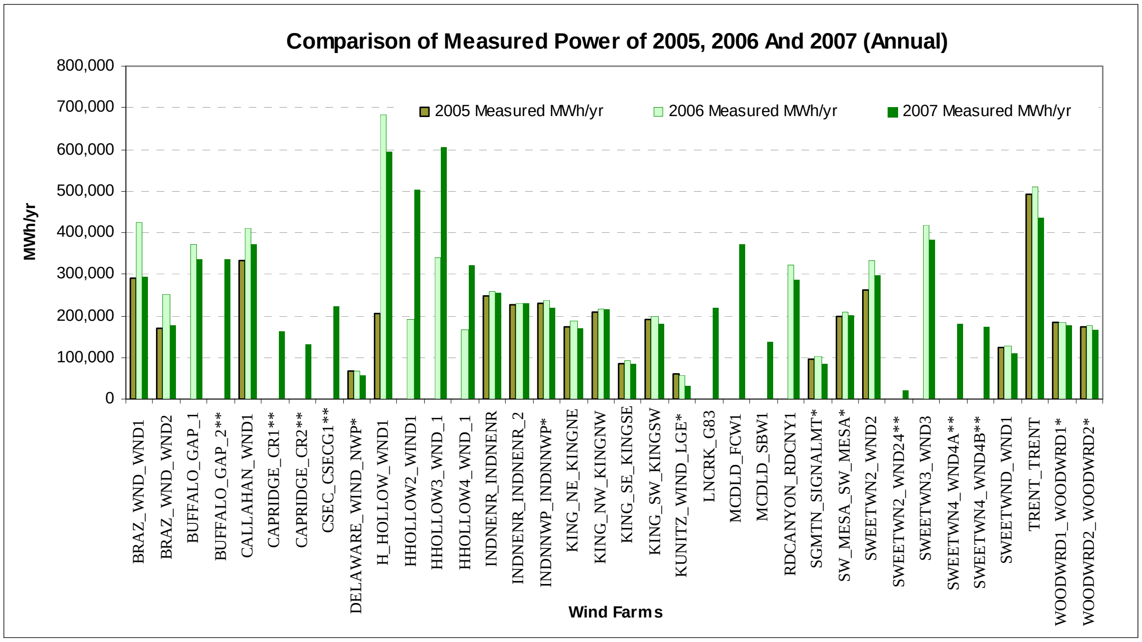
Figure 3-20 (b) shows the comparison of measured power of 2005, 2006 and 2007 for the Ozone Season Period. It is noted that for most of the wind farms, the measured average daily wind power in 2006 OSD is lower than that of 2005 and 2007, which is different than the annual trend. As shown in Table 3-12, this may be due to the opposite wind condition in the OSD period. In 2006, in four NOAA weather stations, three of them were less windy than the 2005 and 2007 in the OSD period. Since the Capricorn Ridge wind farm started operation only after the Ozone season period in 2007, it shows no value in the chart.

Figure 3-20 (a) shows the annual comparison of the estimated power in 1999 using the annual model of 2005 and the OSP and Non-OSP models of 2006 and 2007. Except for the wind farms that have different operation months, e.g. Horse Hollow 1, 2, 3 and 4, and Red Canyon, the predicted wind power in 1999 using the 2005 and 2006 data and model coefficients, is very close to what is predicted using the 2007 models for the majority of the wind farms—which indicates a steady operation of those wind farms. Figure 3-21 (b) shows the comparison of the estimated power in 1999 using the 2005, 2006 and 2007 models for the Ozone Season Period.

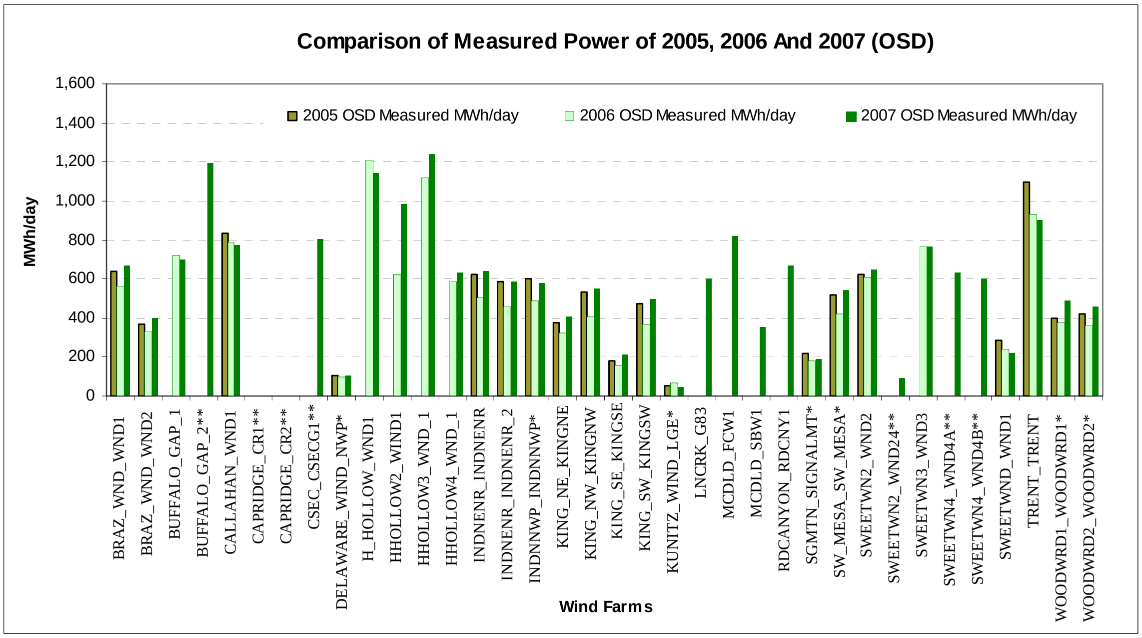
Figure 3-22 and Figure 3-23 show that, in general, the variation in the 1999 predicted wind power caused by using measured data from different years is much smaller than the difference between the 2006 and 2007 measured wind power for most of the wind farms with steady operation. This observation confirms the robust performance and importance of the weather normalization procedure. Due to the absence of detailed information on curtailment, maintenance, or other factors, the explanation on the difference in trend among individual wind farms is not included in this work.

Table 3-10: Comparison of Wind Speed of 2005, 2006 and 2007

Month	Wind Speed ABI (mph)			Wind Speed MAF (mph)			Wind Speed FST (mph)			Wind Speed GDP (mph)		
	2005	2006	2007	2005	2006	2007	2005	2006	2007	2005	2006	2007
Jan	10.3	11.9	9.5	9.7	10.6	9.6	10.2	11.1	9.0	19.1	22.4	22.7
Feb	8.9	11.1	12.0	8.9	9.9	11.2	9.2	10.2	11.2	21.5	21.2	23.8
Mar	11.5	12.6	11.8	11.1	11.9	10.3	11.1	11.7	11.8	22.3	23.7	16.8
Apr	13	12.3	12.9	12.1	12.2	12.3	12.5	12.1	13.0	19.9	22.2	22.1
May	11	12.3	9.3	10.8	10.8	9.7	11.7	12.3	10.0	17.3	17.1	18.6
Jun	11.9	9.8	9.5	12.1	12.1	10.0	12.4	10.9	10.2	15.7	14.8	17.1
Jul	9.9	10.1	7.0	10.4	10.4	8.0	10.6	10.6	9.3	16.0	14.1	15.1
Aug	8.3	9.2	9.1	9.2	9.2	10.0	8.5	8.9	10.5	12.9	13.6	14.2
Sep	9.3	9.5	9.0	9.7	9.7	8.9	9.2	9.5	9.8	14.5	15.5	13.8
Oct	9.3	10.7	11.0	9.3	9.3	10.2	9.7	10.5	10.3	16.8	17.1	17.6
Nov	10.3	10.9	10.4	9.4	9.4	8.9	10.3	11.0	8.4	19.8	19.7	19.2
Dec	10	10.8	10.6	9.5	9.5	8.8	8.6	10.4	9.7	19.5	20.8	22.0
Annual Average	10.3	10.9	10.2	10.2	10.2	9.8	10.3	10.8	10.3	18.0	18.5	18.6
OSP Average	9.0	9.2	8.2	9.7	8.9	9.0	9.3	9.2	10.0	14.5	14.2	15.8

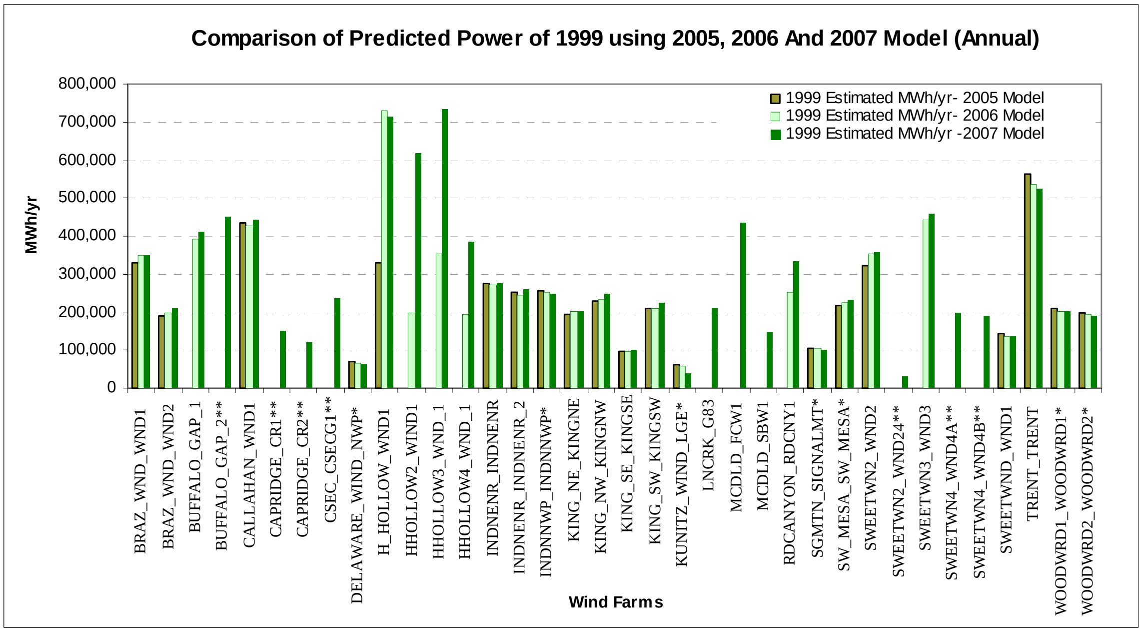


(a)

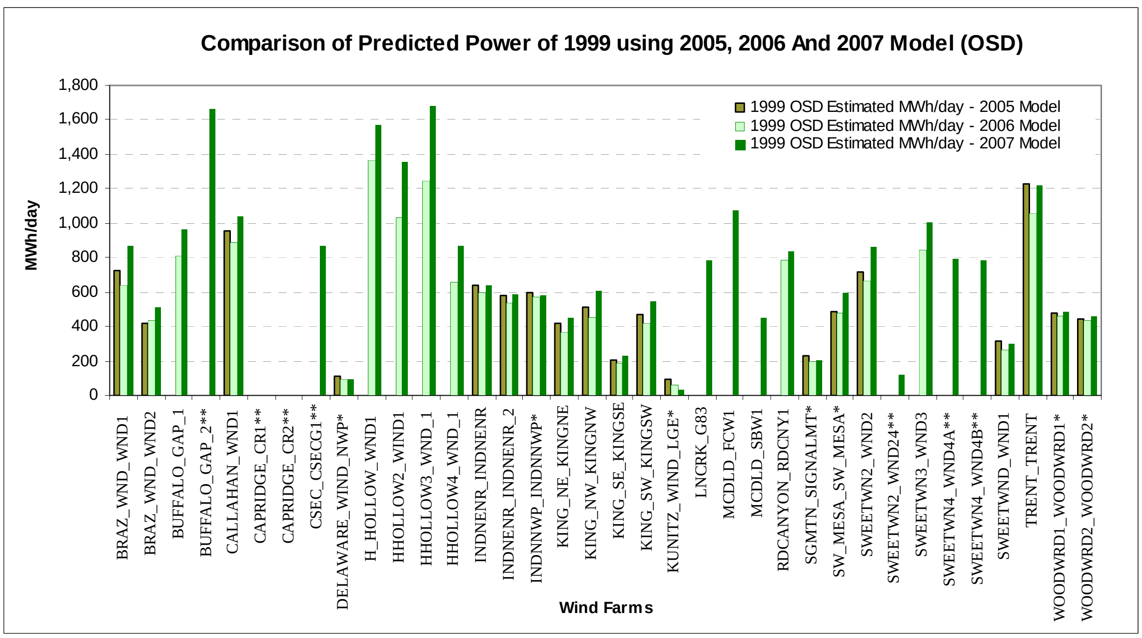


(b)

Figure 3-20: Comparison of Measured Wind Power of 2005, 2006 and 2007 (Annual and OSD)



(a)



(b)

Figure 3-21: Comparison of Estimated Power of 1999 using the 2005, 2006 and 2007 Model (Annual and OSD)

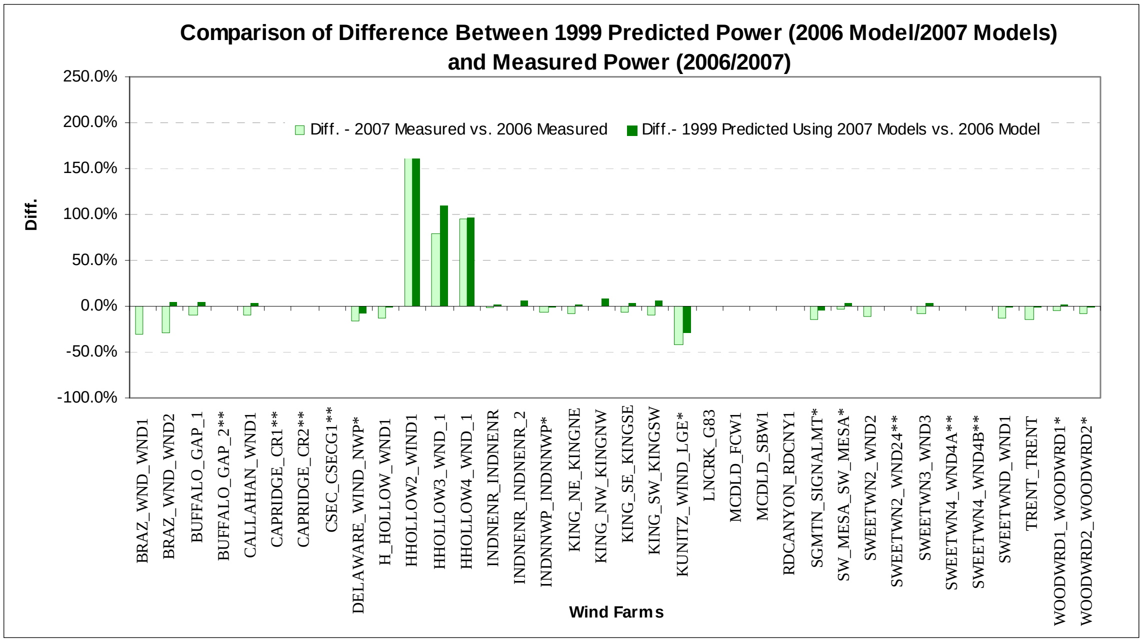


Figure 3-22: Comparison of Difference between 1999 Predicted Power and 2006/2007 Measured Power

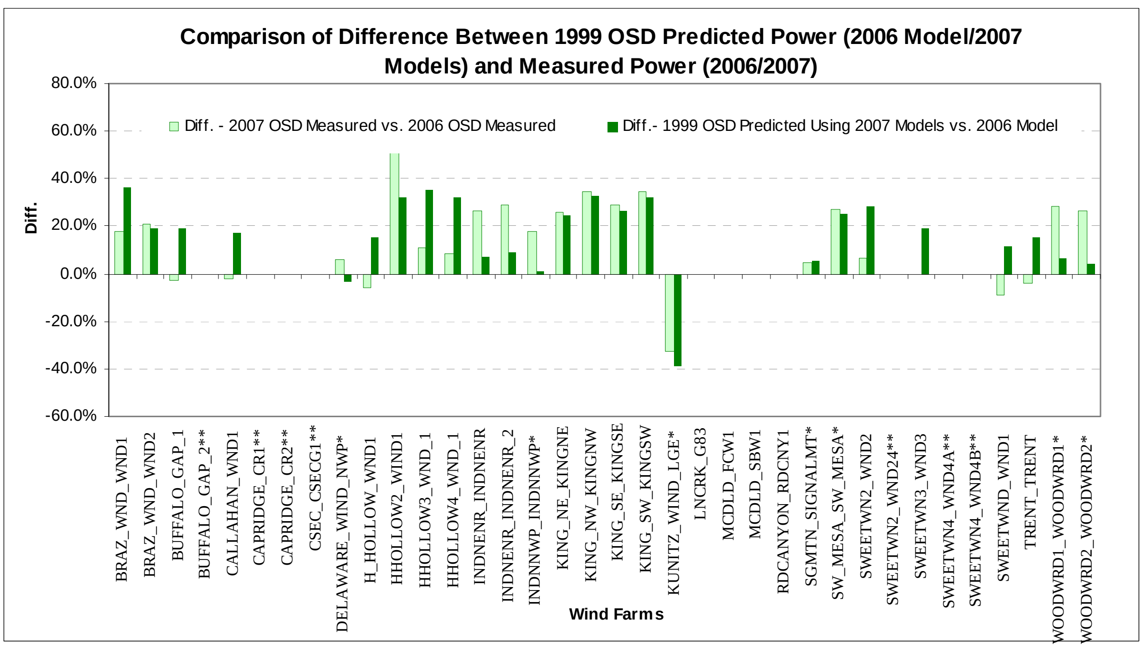


Figure 3-23: Comparison of Difference between 1999 OSD Predicted Power and 2006/2007 OSD Measured Power

3.6 Uncertainty Analysis on the 2007 Daily Regression Models

One of the advantages of using regression models is that they allow for an uncertainty analysis to be calculated, which can be used to assess the accuracy of the model. This section of the report presents an updated uncertainty analysis for the daily regressions that were applied to the 2007 data.

Assuming that the daily energy production of wind farm data can be related linearly with the daily average wind speed (see Figure 3-24) and expressed as

$$\hat{E}_i = c_o + c_1 V_i \qquad (1)$$

Where V is the daily average wind speed, $\hat{E}$ is the daily total energy production, and c_o and c_1 are the resultant coefficients of a linear regression. The subscript i presents any day over the modeling period.

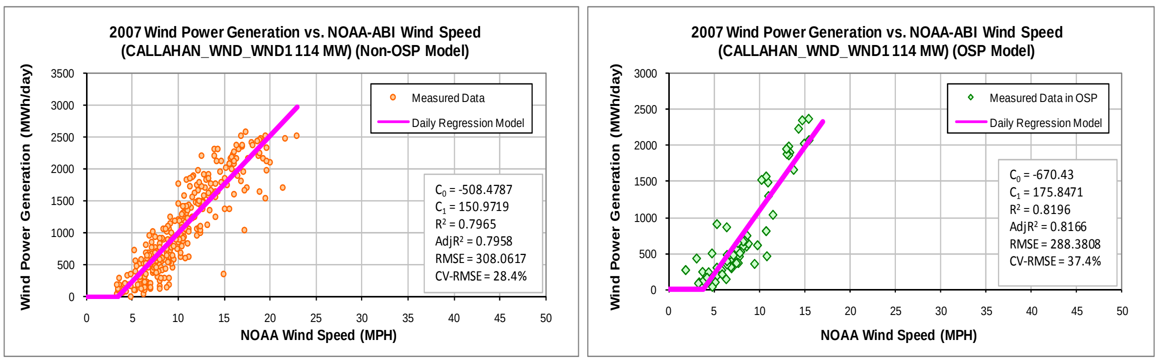


Figure 3-24: Linear Model Presentation of the Daily Wind Power Generation on the Year 2007 for Callahan Wind Farm

The primary purpose of modeling in this analysis is to back-cast the wind power production, or predict the power production in another year that would have occurred if the turbines had been installed and operating. This allows for the evaluation of the NOx reductions during the base-year weather conditions. Unfortunately, any prediction intrinsically contains an uncertainty, which is related to the prediction variance. Thus, the prediction uncertainty, $\sigma^2\left(\hat{E}_{pred,j}\right)$, assuming no autocorrelation effects in the data used to generate the linear model, can be presented for a particular observation, j, during any time a particular condition is presented as follows:

$$\sigma^2\left(\hat{E}_{pred,j}\right) = MSE\left(\hat{E}_i\right)\cdot\left[1 + \frac{1}{n} + \frac{\left(V_j - \bar{V}_n\right)^2}{\sum_{i=1}^{n}\left(V_i - \bar{V}_n\right)^2}\right] \qquad (2)$$

The mean square error, $MSE\left(\hat{E}_i\right)$, during the period of the development of the linear model can be computed by:

$$MSE\left(\hat{E}_i\right) = \left[\frac{1}{n-(k+1)}\right]\sum_{i=1}^{n}\left(E_i - \hat{E}_i\right)^2 \qquad (3)$$

Where n is the number of days in the period used for the developed model, k is the number of regressor variables in the linear model, and $\overline{V}_n$ is the mean value of the velocity on the modeling period.

The last term in the brackets of the equation 2 accounts for the increase in the variance of the energy prediction for any particular observation, j, which is different from the centroid of the modeling data. On the other hand, the second term accounts for the variance in predicting the mean energy predicted for the observation, j.

The total uncertainty for a period of interest, of m days, is then the sum of all the wind energy predicted $\hat{E}_{pred,j}$ in each individual observation.

Assuming that

$$\sum_{j=1}^{m}\sigma^2\left(\hat{E}_{pred,j}\right)=\sigma^2\left(\sum_{j=1}^{m}\left(\hat{E}_{pred,j}\right)\right)=\sigma^2\left(\hat{E}_{pred,total}\right) \quad (4)$$

And the total prediction variance or uncertainty is obtained through

$$\sigma^2\left(\hat{E}_{pred,total}\right)=MSE\left(\hat{E}_i\right)\cdot m\cdot\left[1+\frac{1}{n}+\frac{\sum_{j=1}^{m}\left(V_j-\overline{V}_n\right)^2}{m\sum_{i=1}^{n}\left(V_i-\overline{V}_n\right)^2}\right] \quad (5)$$

Thus, it is observable that the last equation is affected by the number of days that the wind energy will be predicted, the number of days used for the modeling development and the uncertainty due to the distances between the data predicted and the centroid of the modeling data. Therefore, increasing n and m yields an effective relative decrease in the uncertainty—which is expected.

Table 3-11 presents all the statistics parameters for the daily linear models of all the wind farms in the ERCOT region. Table 3-12 shows the uncertainty of applying the linear models to predict the energy generation that they would have had in the year 1999, ranging from 2% to 4.3%. The results indicate that the daily models are reasonably reliable for predicting the performance of the wind farm in the base year within the same range of wind conditions.

Also, the same table includes the uncertainty related to the predicted wind generated for the same wind farms in the 1999 Ozone Season Period using the OSP model, which consider the period of July 15 though Sep 15 – about 63 days. The uncertainty of using OSP models for predicting wind power in the 1999 OSD varies from 1.2% to 13.6% for all the wind farms.

Table 3-11: Statistical Parameters of the Determined 2007 Daily Power Production Linear Models

Wind Farm	Statistical Parameters of 2007 Non-OSP Daily Models						Statistical Parameters of 2007 OSP Daily Models					
	c_0	c_1	AdjR^2	RMSE	CV-RMSE	# Days	c_0	c_1	AdjR^2	RMSE	CV-RMSE	# Days
BRAZ_WND_WND1	-421.48	120.11	0.70	316.50	37.2%	294	-440.06	134.78	0.72	291.03	43.7%	63
BRAZ_WND_WND2	-258.19	72.29	0.71	185.86	36.7%	296	-224.00	76.20	0.73	161.67	40.3%	63
BUFF_GAP_UNIT1	-512.99	143.65	0.75	338.99	33.9%	293	-755.93	177.60	0.81	298.29	42.6%	63
BUFF_GAP_UNIT2	-1378.88	294.72	0.76	582.96	40.4%	173	-1369.73	312.58	0.81	530.11	44.4%	63
CALLAHAN_WND1	-508.48	150.97	0.80	308.06	28.4%	298	-670.43	175.85	0.82	288.38	37.4%	63
CAPRIDGE_CR1	-250.36	161.42	0.54	546.47	37.5%	100	0.00	0.00	0.00	0.00	0.0%	0
CAPRIDGE_CR2	-399.47	148.42	0.68	374.52	31.8%	107	0.00	0.00	0.00	0.00	0.0%	0
CSEC_CSECG1	-397.11	141.45	0.44	539.05	49.7%	151	-768.89	166.24	0.78	294.48	36.6%	63
H_HOLLOW_WND1	-770.93	241.20	0.79	506.32	28.9%	298	-1204.21	286.08	0.83	445.99	39.0%	63
HHOLLOW2_WIND1	-899.97	228.82	0.82	428.53	28.7%	292	-1049.72	248.22	0.82	398.28	40.4%	63
HHOLLOW3_WND_1	-925.87	258.97	0.80	521.56	29.3%	293	-1170.67	293.89	0.83	459.05	37.0%	63
HHOLLOW4_WND_1	-402.53	128.27	0.77	284.72	29.9%	297	-638.62	155.00	0.83	239.69	37.9%	63
INDNENR_INDNENR	-186.62	84.08	0.40	328.49	49.7%	285	-556.10	119.95	0.59	277.92	43.6%	63
INDNENR_INDNENR_2	-222.69	84.15	0.44	323.23	50.2%	296	-537.12	112.83	0.55	280.48	47.9%	63
KING_NE_KINGNE	-245.62	73.55	0.61	210.62	43.1%	298	-472.98	98.01	0.80	141.78	34.9%	63
KING_NW_KINGNW	-126.10	73.59	0.44	292.85	48.1%	298	-462.08	112.64	0.74	192.15	35.1%	63
KING_SE_KINGSE	-129.21	37.20	0.63	100.29	41.5%	299	-250.56	51.15	0.81	69.62	33.5%	63
KING_SW_KINGSW	-159.96	70.24	0.57	221.13	40.1%	268	-417.37	101.90	0.77	158.91	32.0%	63
LNCRK_G83	-794.52	203.29	0.73	453.18	36.2%	119	-413.29	123.40	0.78	225.34	37.6%	63
MCDLD_FCW1	-443.89	142.96	0.69	386.72	36.4%	297	-574.77	169.81	0.78	315.63	38.6%	63
MCDLD_SBW1	-30.32	41.08	0.41	194.40	49.6%	239	-133.78	60.35	0.70	132.49	37.4%	62
RDCANYON_RDCNY1	-277.39	104.25	0.70	275.05	33.5%	298	-266.15	113.50	0.72	242.99	36.5%	63
SWEETWN2_WND2	-420.66	122.53	0.76	276.19	31.7%	293	-534.44	143.64	0.82	232.42	36.1%	63
SWEETWN2_WND24	-101.88	23.27	0.86	34.04	26.2%	147	-96.64	22.40	0.78	41.72	47.9%	63
SWEETWN3_WND3	-537.62	158.66	0.81	316.18	27.8%	293	-547.09	159.65	0.82	257.29	33.7%	63
SWEETWN4_WND4A	-480.54	135.67	0.77	272.06	30.1%	143	-457.15	128.68	0.81	222.19	35.4%	57
SWEETWN4_WND4B	-443.93	126.30	0.76	261.58	33.2%	166	-408.87	123.05	0.81	207.53	34.6%	63
SWEETWND_WND1	-190.75	49.56	0.75	114.11	34.7%	290	-204.48	51.83	0.76	101.90	46.2%	63
TRENT_TRENT	-772.14	193.38	0.79	401.19	31.6%	298	-836.08	211.39	0.80	366.66	40.8%	63
DELAWARE_WIND_NWP	-104.12	15.09	0.72	62.98	35.0%	272	*-92.76*	*13.19*	*0.74*	*33.30*	*32.5%*	*61*
INDNWP_INDNWP	-233.34	81.38	0.42	314.16	51.0%	290	*-460.11*	*104.04*	*0.57*	*249.09*	*43.3%*	*63*
KUNITZ_WIND	-129.08	13.18	0.73	50.09	45.3%	253	*-68.78*	*7.63*	*0.69*	*21.03*	*48.9%*	*60*
SGMTN_SIGNALMT	-71.82	32.66	0.45	121.95	48.5%	293	*-208.40*	*43.99*	*0.68*	*86.37*	*46.4%*	*63*
SW_MESA_SW_MESA	-110.76	67.49	0.44	267.70	47.6%	301	*-470.84*	*112.66*	*0.77*	*172.30*	*32.1%*	*63*
WOODWRD1_WOODWRD1	-307.60	76.58	0.58	213.99	43.6%	291	*-487.47*	*97.94*	*0.75*	*154.88*	*31.8%*	*63*
WOODWRD2_WOODWRD2	-295.35	72.36	0.62	189.09	41.2%	291	*-446.45*	*90.86*	*0.78*	*134.98*	*29.5%*	*63*

Table 3-12: 1999 Uncertainty of the Power Generation Prediction using the Linear Daily Models

Wind Farm	1999 Non Ozone Season Period				1999 Ozone Season Period (OSP)			
	Predicted days	Total Variance	Total Estimated	Relative Uncertainty	Predicted Days	Total Variance	Total Estimated	Relative uncertainty
BRAZ_WND_WND1	302	10,798.79	349,118	3.09%	63	4,540.11	54,719.1	8.30%
BRAZ_WND_WND2	302	6,341.49	208,329	3.04%	63	2,522.22	32,497.4	7.76%
BUFF_GAP_UNIT1	302	11,565.45	410,441	2.82%	63	4,659.41	61,009.8	7.64%
BUFF_GAP_UNIT2	302	19,932.08	724,458	2.75%	63	8,280.45	61,009.8	13.57%
CALLAHAN_WND1	302	10,510.66	441,790	2.38%	63	4,504.60	65,325.9	6.90%
CAPRIDGE_CR1*	302	18,727.98	490,972	3.81%				
CAPRIDGE_CR2*	302	12,764.65	400,311	3.19%				
CSEC_CSECG1	302	18,441.19	468,181	3.94%	63	4,600.88	66,862.8	6.88%
H_HOLLOW_WND1	302	17,274.17	713,071	2.42%	63	6,966.46	99,126.7	7.03%
HHOLLOW2_WIND1	302	14,622.55	617,443	2.37%	63	6,221.23	85,700.6	7.26%
HHOLLOW3_WND_1	302	17,796.19	735,630	2.42%	63	7,170.56	106,016.5	6.76%
HHOLLOW4_WND_1	302	9,714.55	383,301	2.53%	63	3,744.04	54,574.8	6.86%
INDNENR_INDNENR	300	11,172.67	274,334	4.07%	63	4,345.52	40,223.0	10.80%
INDNENR_INDNENR_2	300	10,993.95	260,431	4.22%	63	4,385.48	36,951.9	11.87%
KING_NE_KINGNE	302	7,188.31	203,501	3.53%	62	2,197.93	28,712.3	7.65%
KING_NW_KINGNW	302	9,994.69	248,975	4.01%	63	3,002.51	38,105.6	7.88%
KING_SE_KINGSE	302	3,422.79	101,648	3.37%	62	1,079.23	14,753.1	7.32%
KING_SW_KINGSW	302	7,548.01	223,819	3.37%	63	2,483.05	34,510.7	7.20%
LNCRK_G83	302	15,514.22	523,340	2.96%	63	3,516.84	61,009.8	5.76%
MCDLD_FCW1	302	13,194.40	435,455	3.03%	63	4,924.26	61,009.8	8.07%
MCDLD_SBW1	302	6,635.85	163,514	4.06%	63	2,067.58	61,009.8	3.39%
RDCANYON_RDCNY1	302	9,384.41	334,823	2.80%	63	3,795.55	32,886.7	11.54%
SWEETWN2_WND2	302	9,423.82	357,326	2.64%	63	3,630.50	54,191.2	6.70%
SWEETWN2_WND24	302	1,164.23	58,591	1.99%	63	651.75	54,191.2	1.20%
SWEETWN3_WND3	302	10,787.66	457,851	2.36%	63	4,018.89	63,187.0	6.36%
SWEETWN4_WND4A	302	9,306.22	381,096	2.44%	63	3,471.43	63,187.0	5.49%
SWEETWN4_WND4B	302	8,945.81	358,870	2.49%	63	3,241.61	63,187.0	5.13%
SWEETWND_WND1	302	3,893.38	135,245	2.88%	63	1,591.65	18,822.3	8.46%
TRENT_TRENT	302	13,688.02	522,564	2.62%	63	5,727.31	76,631.1	7.47%
DELAWARE_WIND_NWP	*302*	*2,149.33*	*62,053*	*3.46%*	*61*	515.04	5,689.6	*9.05%*
INDNWP_INDNWP	*300*	*10,686.95*	*246,998*	*4.33%*	*63*	*3,894.64*	*36,287.1*	*10.73%*
KUNITZ_WIND_LGE	*302*	*1,710.19*	*40,305*	*4.24%*	*58*	317.72	*2,381.3*	*13.34%*
SGMTN_SIGNALMT	*302*	*4,162.86*	*101,909*	*4.08%*	*62*	*1,338.86*	*13,129.6*	*10.20%*
SW_MESA_SW_MESA	*302*	*9,136.23*	*232,435*	*3.93%*	*63*	*2,692.22*	*37,565.2*	*7.17%*
WOODWRD1_WOODWRD1	*300*	*7,279.56*	*202,553*	*3.59%*	*63*	*2,421.69*	*30,736.8*	*7.88%*
WOODWRD2_WOODWRD2	*300*	*6,432.26*	*189,790*	*3.39%*	*63*	*2,110.54*	*28,878.5*	*7.31%*

*** No data available for Ozone Season Period**

4 DEGRADATION ANALYSIS FOR WIND FARMS

The analysis contained in this section is an update of the work reported in the 2008 annual report in response to a request by the TCEQ 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. In these, nine wind farms were built before January 2002 with a total capacity of 1,010.5 MW and two wind farms started operation from January 2004 with a total capacity of 197.5MW.

In this analysis, a sliding statistical index was established for each site that uses 10th, 25th, 50th, 75th, 90th, and 99th percentiles of the hourly power generation over a 12-month sliding period[5], 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, as shown from Figure 4-1 and Figure 4-14. The 90th percentile values were chosen to present the degradation for each wind farm[6]. In addition, our analysis revealed that the maximum hourly power generation over a 12-month period was also a useful index to watch, since this facilitated a way to see if there was major operation change (i.e., shut down of wind turbines) during the studied time period.

Table 4-1 presents the summary of the degradation analysis for the eleven wind farms (14 sites). Of the 14 sites analyzed, ten sites showed an increase when one compares the 90th percentile of whole period to the 90th 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.

Table 4-2 and Figure 4-15 show the design capacity, the maximum and minimum of the observed maximum hourly wind power over the sliding 12-month period, and the observed maximum hourly wind power for the last 12-month period for the studied wind farms. It is interesting to note that the observed maximum hourly wind power generation is slightly lower than the design/announced capacity for the majority of the sites. In total, the maximum hourly wind power output during the time period is 1167 MW for eleven wind farms—40.9 MW (3.5%) lower than the design capacity. It also shows that, for some sites, the maximum hourly wind power over the last 12-month period is lower than the maximum hourly wind power measured during the time period. The total decrease from all wind farms is 44.1 MW, which is about 3.8% of total design capacity. Additional operation information will be needed from the owners of the wind farms or ERCOT to explain this observation, such as maintenance records, curtailment, etc.

[5] To calculate this, the hourly data for the 12-month period is converted into quartiles, and those quartiles are recorded in a table. Then, the oldest month is dropped from the dataset and a new month is added, and the quartiles recalculated and recorded, etc.
[6] The choice of the 90th percentile is consistent with the recommendation by Abushakra, B., Haberl, J., Claridge, D. 2004. "Overview of Literature on Diversity Factors and Schedules for Energy and Cooling Load Calculations (1093-RP)," *ASHRAE Transactions-Research,* Vol. 110, Pt. 1 (February), pp. 164-176; and in Claridge, D., Abushakra, B., Haberl, J. 2003. "Electricity Diversity Profiles for Energy Simulation of Office Buildings (1093-RP)," *ASHRAE Transactions-Research*, Vol. 110, Pt. 1 (February), pp. 365-377.

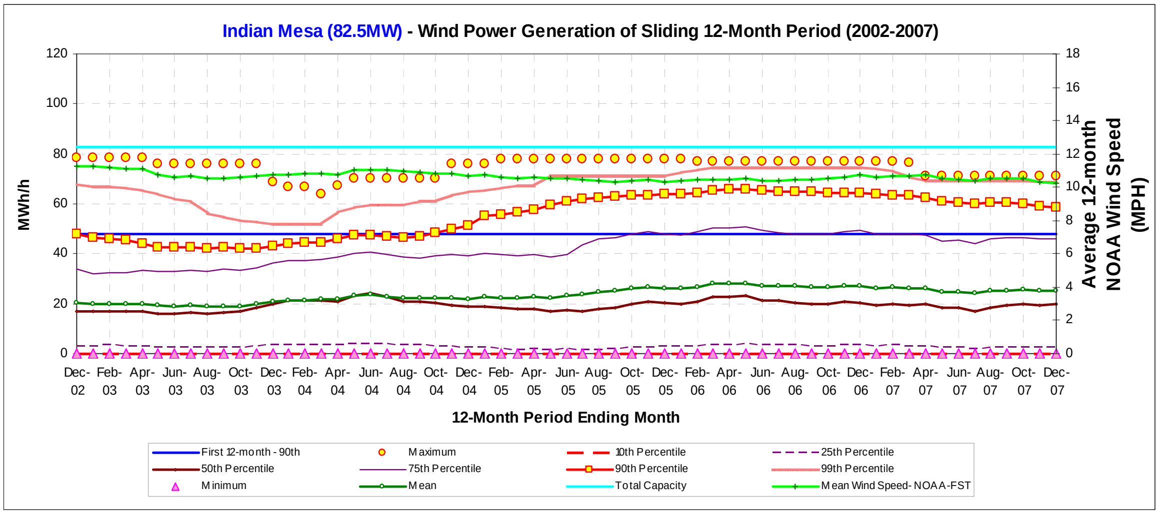


Figure 4-1: Sliding 12-month Hourly Wind Power Generation for Indian Mesa

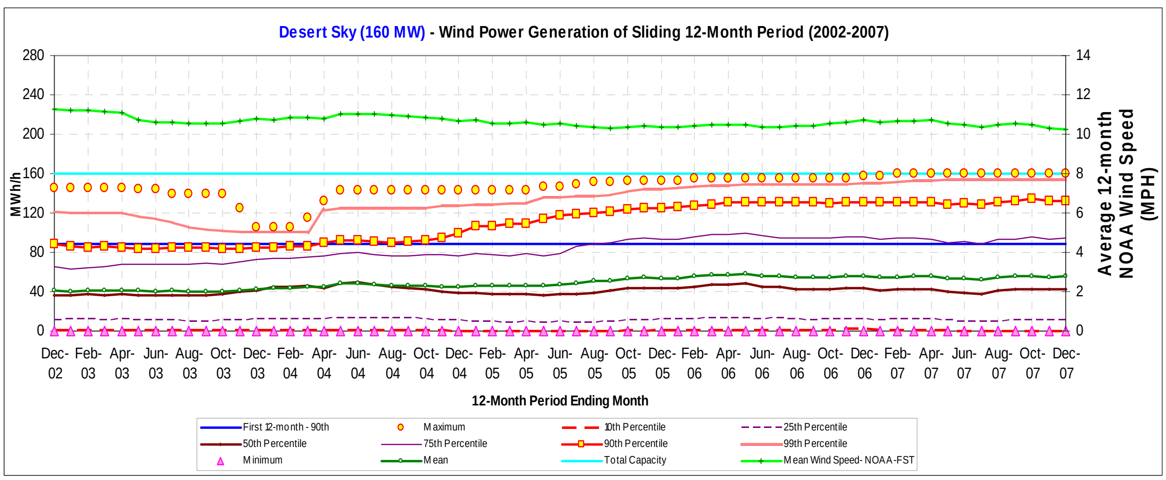


Figure 4-2: Sliding 12-month Hourly Wind Power Generation for Desert Sky

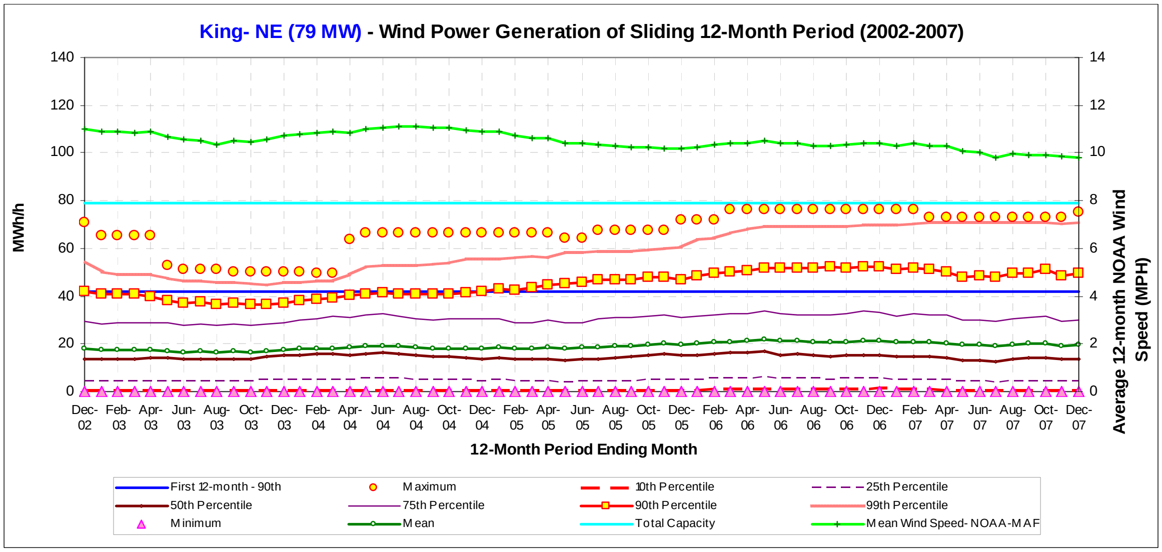


Figure 4-3: Sliding 12-month Hourly Wind Power Generation for King Mountain – NE

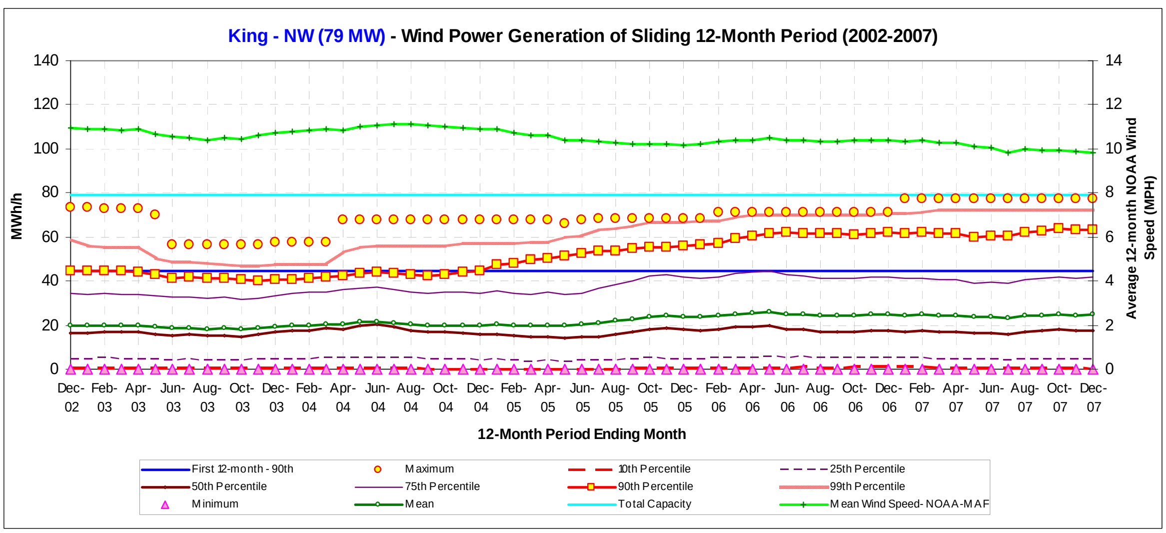


Figure 4-4: Sliding 12-month Hourly Wind Power Generation for King Mountain – NW

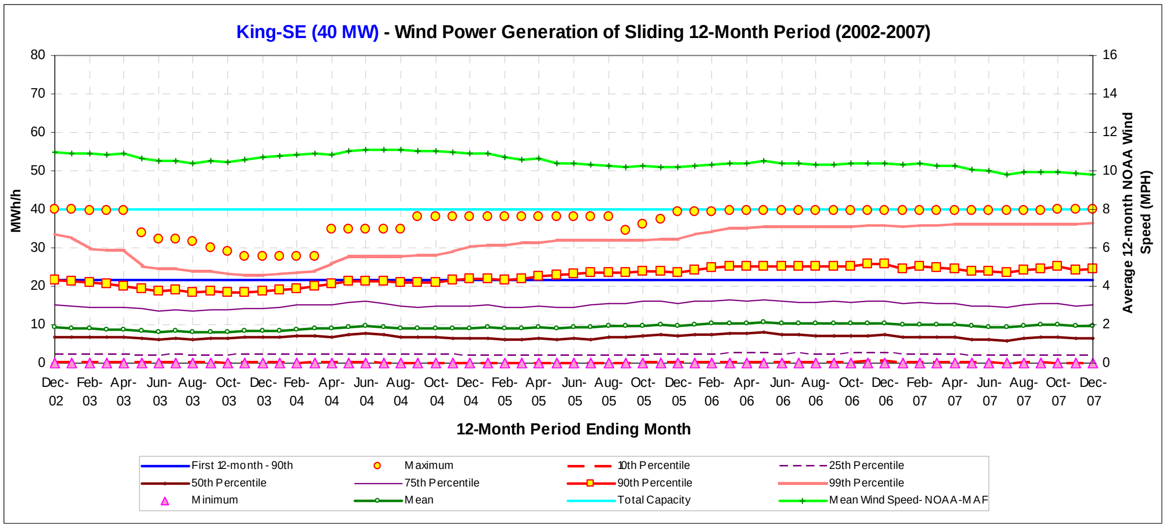


Figure 4-5: Sliding 12-month Hourly Wind Power Generation for King Mountain – SE.

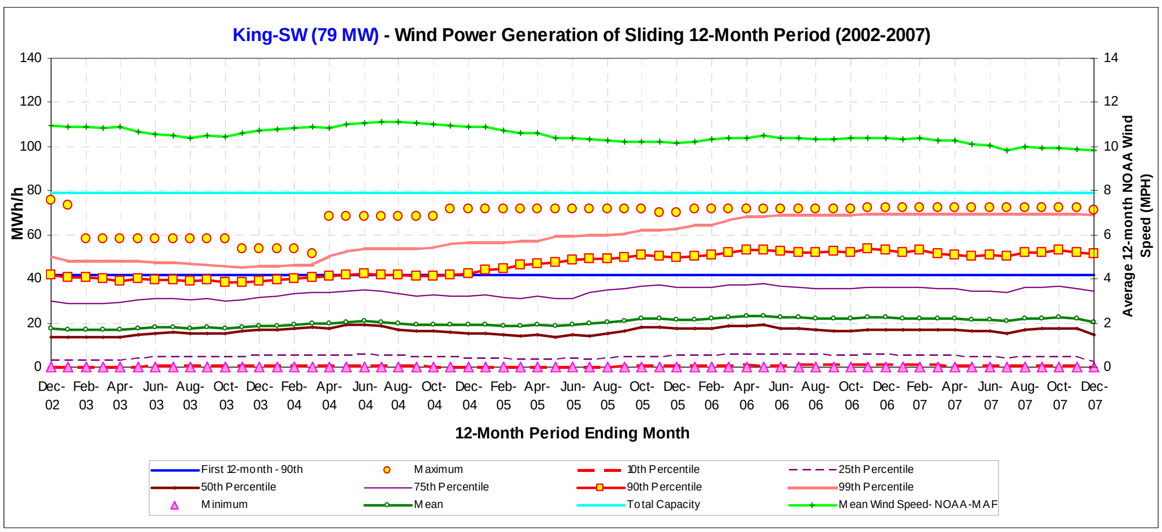


Figure 4-6: Sliding 12-month Hourly Wind Power Generation for King Mountain – SW

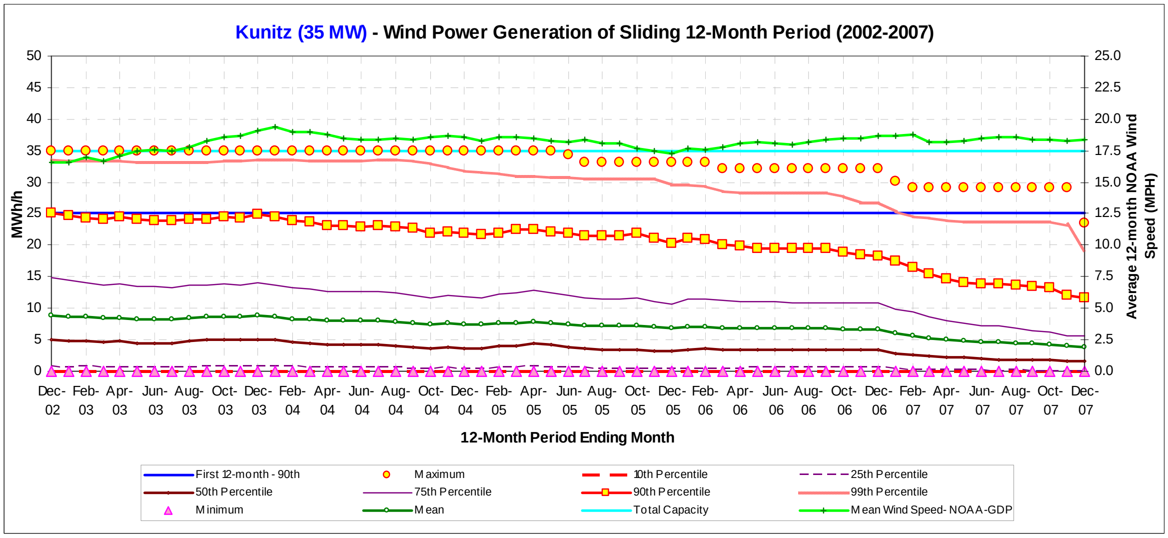


Figure 4-7: Sliding 12-month Hourly Wind Power Generation for Kunitz.

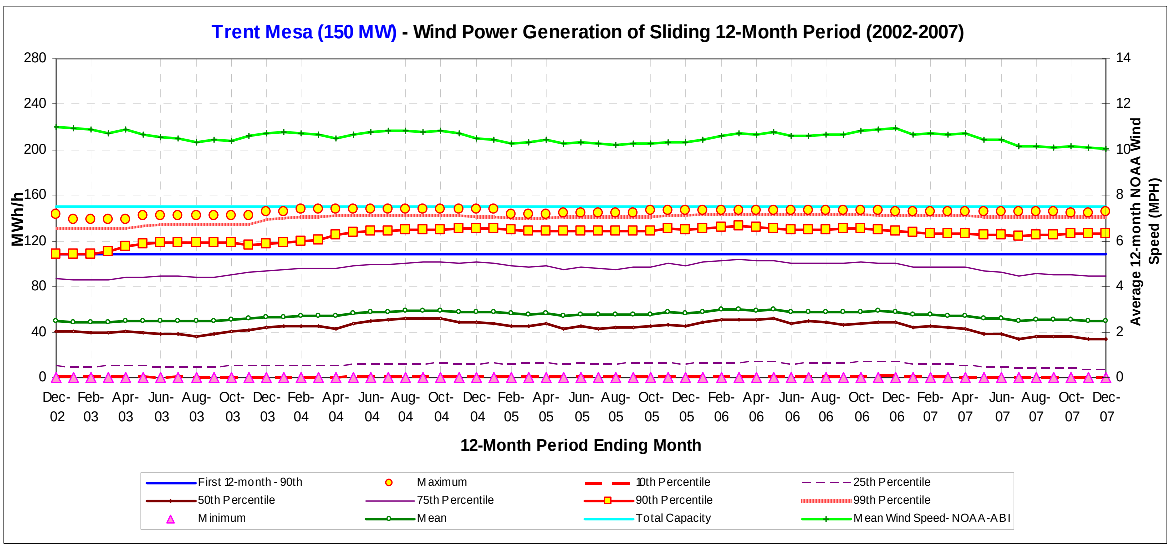


Figure 4-8: Sliding 12-month Hourly Wind Power Generation for Trent Mesa.

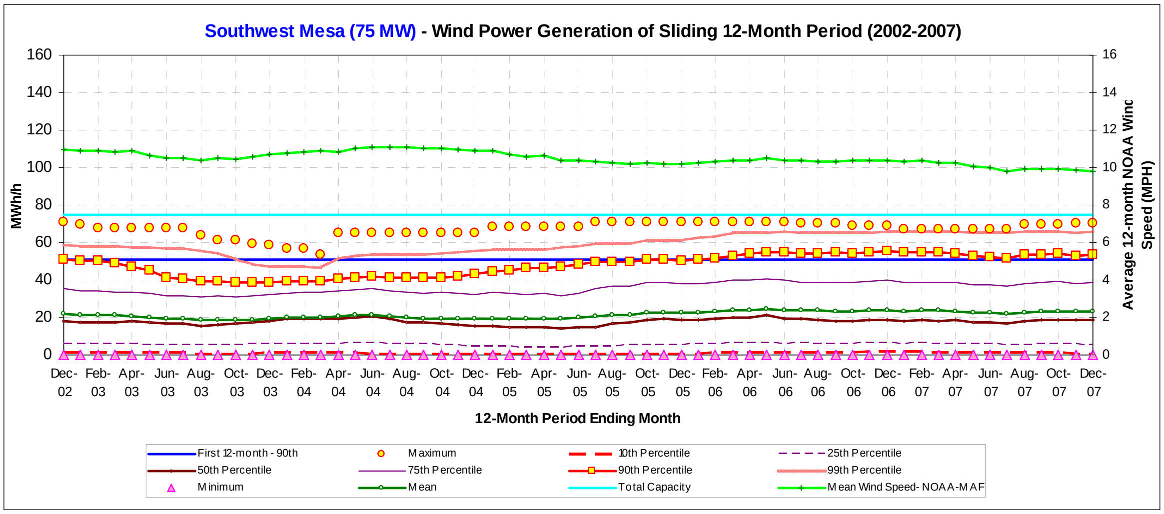


Figure 4-9: Sliding 12-month Hourly Wind Power Generation for Southwest Mesa

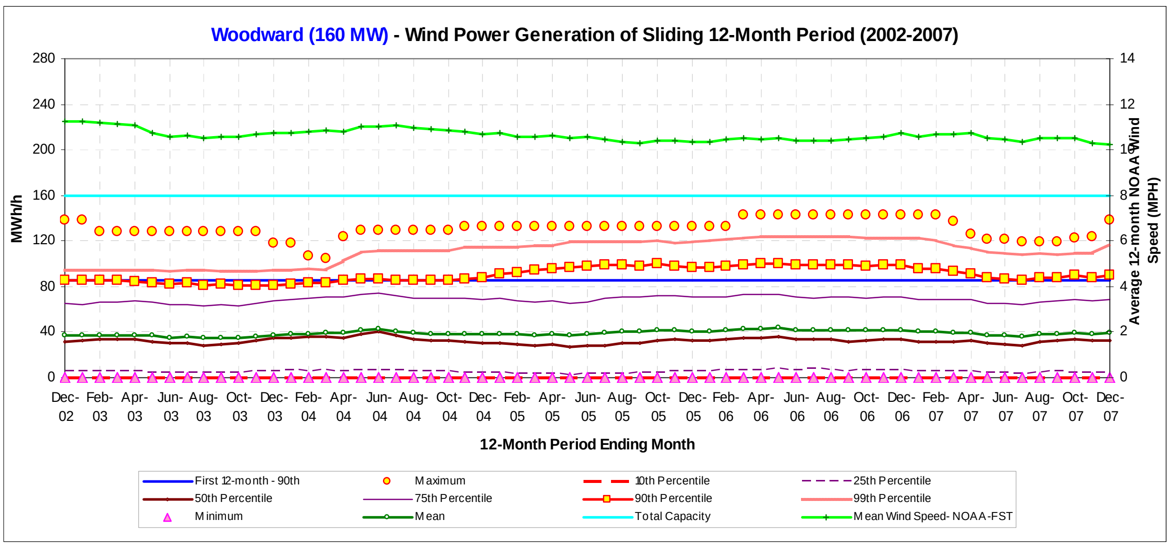


Figure 4-10: Sliding 12-month Hourly Wind Power Generation for Woodward

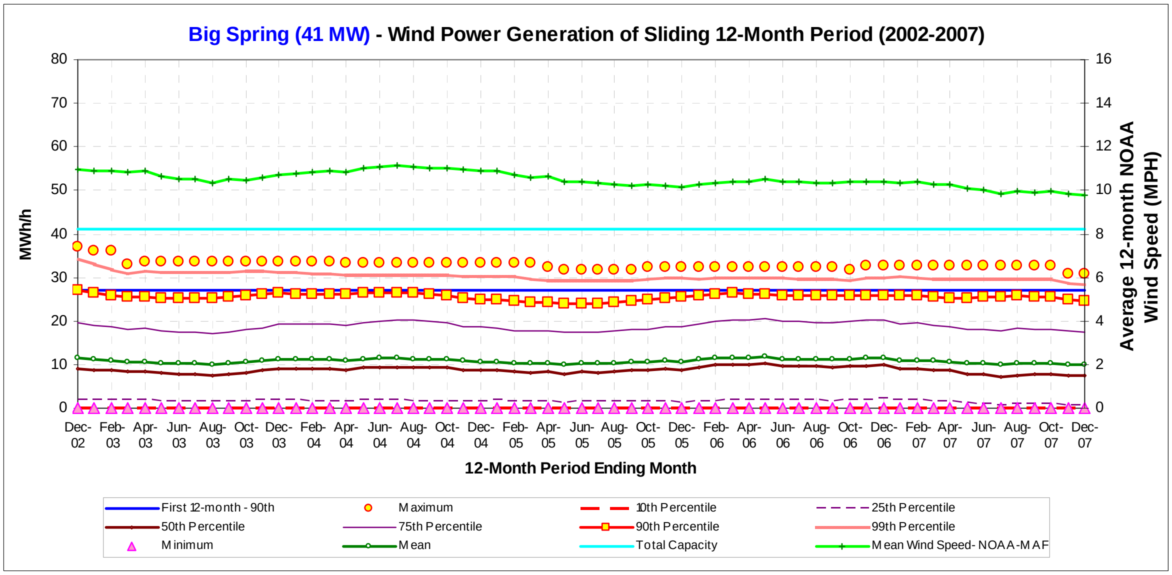


Figure 4-11: Sliding 12-month Hourly Wind Power Generation for Big Spring

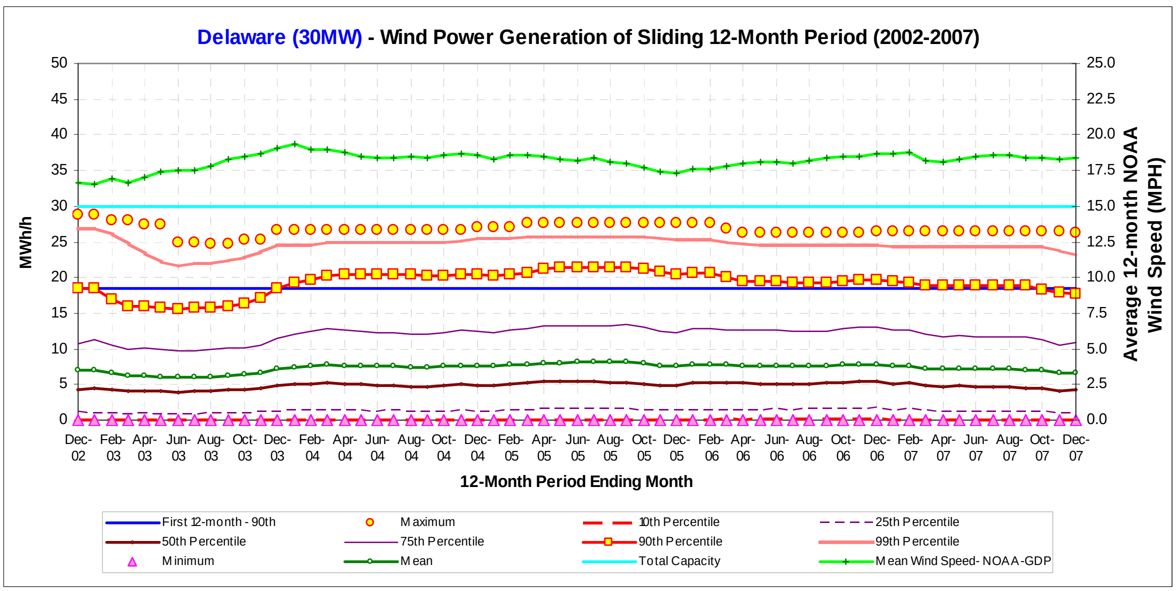


Figure 4-12: Sliding 12-month Hourly Wind Power Generation for Delaware

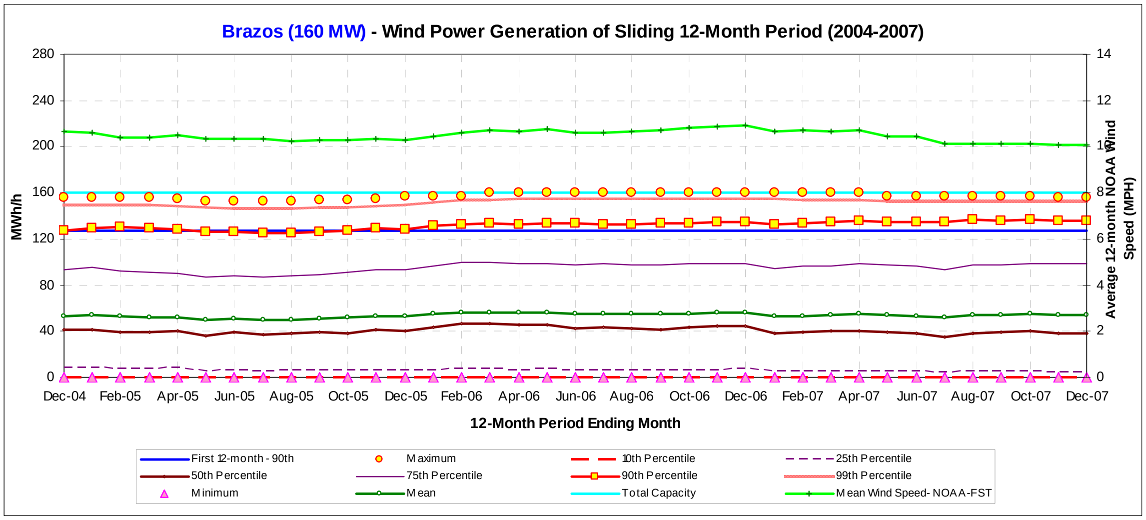


Figure 4-13: Sliding 12-month Hourly Wind Power Generation for Brazos Wind Ranch

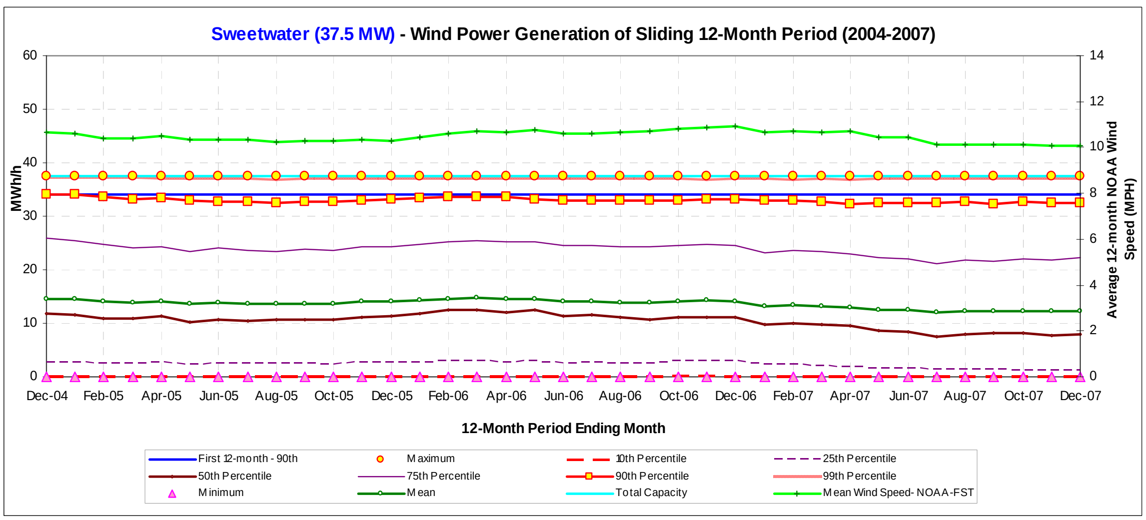


Figure 4-14: Sliding 12-month Hourly Wind Power Generation for Sweetwater Wind Farm

Table 4-1: Summary of 90th Percentile Hourly Wind Power Analysis for Nine Wind Farms in Texas

Wind Farm	First 12-mo 90th Percentile Hourly Wind Power		Average of the Sliding 12-mo 90th Precentile Hourly Wind Power		Minimum of the Sliding 12-mo 90th Precentile Hourly Wind Power		Maximum of the Sliding 12-mo 90th Precentile Hourly Wind Power		No. of Month of Data	Capacity (MW)
	First 12-mo Ending Mo.	MW	MW	% Diff. vs. First 12-mo	MW	% Diff. vs. First 12-mo	MW	% Diff. vs. First 12-mo		
Brazos Wind Ranch	Dec-04	127.5	131.9	3.5%	125.1	-1.9%	137.2	7.6%	48	160
Indian Mesa	Dec-02	48.0	55.2	15.1%	42.1	-12.2%	66.0	37.5%	72	82.5
Delaware	Dec-02	18.6	19.2	3.5%	15.6	-15.8%	21.5	15.7%	72	30
Desert Sky	Dec-02	89.0	110.1	23.7%	83.1	-6.7%	134.4	50.9%	72	160
King Mountain-NE	Dec-02	41.8	45.0	7.7%	36.3	-13.2%	52.5	25.5%	72	79
King Mountain-NW	Dec-02	44.7	51.8	16.0%	40.2	-10.1%	63.8	42.7%	72	79
King Mountain-SE	Dec-02	21.6	22.5	4.1%	18.4	-15.0%	25.8	19.1%	72	40
King Mountain-SW	Dec-02	41.6	46.4	11.7%	38.4	-7.6%	53.4	28.5%	72	79
Sweetwater Wind 1	Dec-04	34.1	33.0	-3.2%	32.3	-5.0%	34.2	0.4%	48	37.5
Trent	Dec-02	108.8	125.4	15.2%	108.2	-0.6%	132.8	22.0%	72	150
Woodward	Dec-02	85.3	90.6	6.3%	80.4	-5.7%	100.3	17.6%	72	160
Kunitz	Dec-02	25.2	20.6	-18.1%	11.6	-54.0%	25.2	0.0%	72	35
Big Spring	Dec-02	27.2	25.6	-6.1%	23.9	-12.0%	27.2	0.0%	72	41
Southwest Mesa	Dec-02	51.1	48.0	-5.9%	38.5	-24.6%	55.3	8.2%	72	75
Weighted Average:				**8.7%**		**-9.4%**		**23.2%**	**Total:**	**1208**

Table 4-2: Summary of Maximum Hourly Wind Power Analysis for Nine Wind Farms in Texas

Wind Farm	Design Capacity (A)	Maximum of the Sliding 12-mo Maximum MW-Measured (B)	Minimum of the Sliding 12-mo Maximum MW - Measured (C)	Maximum MW in Last 12-mo - Measured (D)	Difference (A-B)	Difference (B-D)
Brazos Wind Ranch	160	160.0	152.5	156.4	0.0	3.5
Indian Mesa	82.5	78.5	63.9	71.1	4.1	7.4
Delaware	30	28.9	24.8	26.3	1.1	2.6
Desert Sky	160	159.6	105.8	159.6	0.4	0.0
King Mountain-NE	79	76.2	49.8	75.3	2.8	0.9
King Mountain-NW	79	77.6	56.2	77.6	1.4	0.0
King Mountain-SE	40	40.0	27.8	40.0	0.0	0.0
King Mountain-SW	79	75.9	51.2	71.1	3.1	4.8
Sweetwater Wind 1	37.5	37.5	37.5	37.5	0.0	0.0
Trent	150	147.6	138.8	145.1	2.4	2.5
Woodward	160	142.3	104.1	138.2	17.7	4.1
Kunitz	35	35.0	23.5	23.5	0.0	11.5
Big Spring	41	37.0	30.9	30.9	4.0	6.1
South Mesa	75	71.2	53.8	70.4	3.8	0.8
Total:	**1208.0**	**1167.1**	**920.5**	**1123.0**	**40.9**	**44.1**

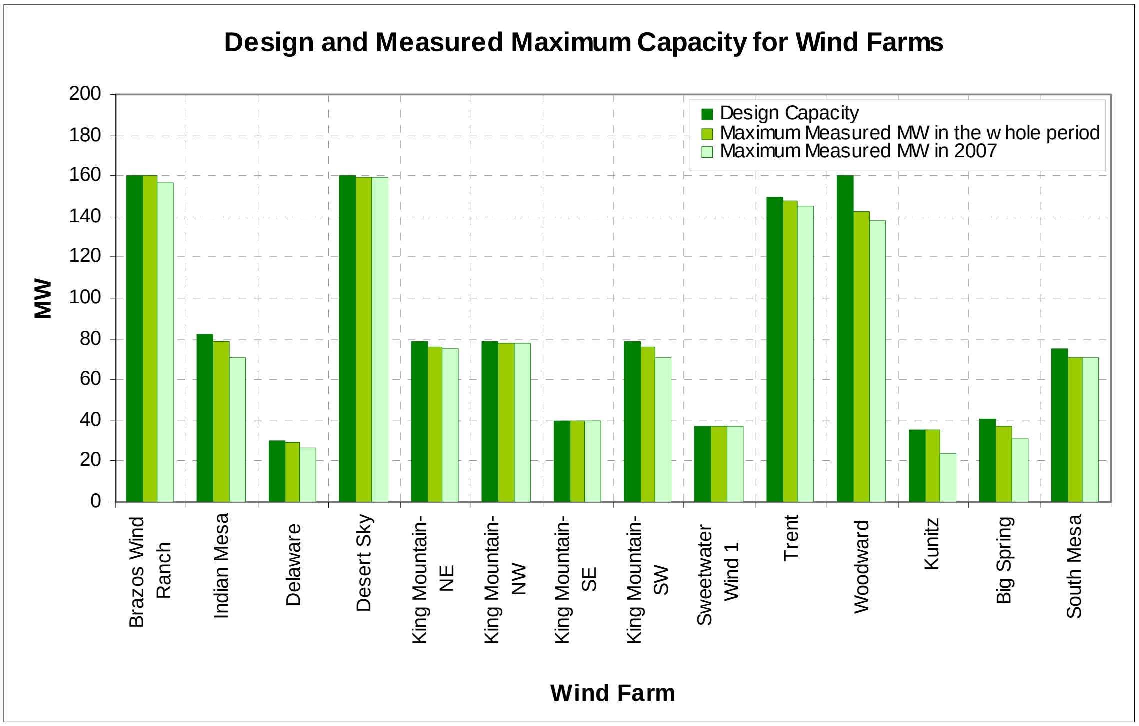


Figure 4-15: Design and Measured Maximum Capacity for Nine Wind Farms

5 CALCULATING NOX EMISSIONS REDUCTION FROM WIND POWER

5.1 Calculation of NOx Emissions from Wind Power Using 2007 eGRID

The Energy Systems Laboratory has worked closely with the TCEQ and EPA to develop creditable procedures for calculating NO_x reductions from electricity savings using the EPA's Emissions and Generation Resource Integrated Database (eGRID). Calculating NOx emissions from wind power to counties within the ERCOT region encounters some major complications. First, electricity can be generated from different primary energy sources which results in very different NOx emissions. Second, the combination of generation resources used to meet loads may vary during each day or different seasons. Third, electricity is transported over long distances by complex, interconnected transmission and distribution systems. Therefore, the generation source related to electricity usage can be difficult to trace and may occur far from the jurisdiction in which that energy is consumed. Due to the limited availability of public data and the fact that the eGRID database aggregates the emissions on the basis of PCAs[7], the decision was made by the TCEQ and EPA to calculate and assign emissions, according to the PCA where it was generated. A similar decision has been used in California (Marnay et al. 2002). This assumption does not address the deregulation of generation, but provides a good estimation of the emissions reduction from wind power electric production for the base year of 1999, which is currently in use by the TCEQ using the EPA's eGRID.

The procedure presented in this section calculates annual and peak-day, county-wide NO_x reductions from electricity savings from wind projects implemented in the Power Control Areas in ERCOT listed in the EPA's eGRID. For this purpose, a special version of eGRID[8] was developed by the EPA for the TCEQ that reflects the 2007 electricity and pollution from electric utilities in ERCOT. The NOx production for each power plant is provided from the 2007 eGRID database for ten electric utility suppliers. This eGRID matrix was utilized to assign the power plant used by the utility provider, once the utility provider had been chosen for a given county. Figure 5-1 shows a snapshot of the NOx emission distribution among Texas counties from generating one mega-watt-hour of electricity in the power control area of AEP-West, which was derived from the 2007 Annual eGRID table. For example, the counties marked in red show higher NOx emissions of above 0.08 lbs/MWh. The counties marked in green were least impacted by the NOx emissions (less than 0.0005 lbs/MWh) from the power plants assigned to AEP-West. Figure 5-2 and Figure 5-3 show the same county-wide NOx emissions distribution from TXU and LCRA.

To calculate the NOx emissions reduction from the wind projects within the ERCOT region, the total MWh wind power for each Power Control Area are summarized in Table 5-1. The assignment of PCA to each wind farm was based on the information provided by the PUCT to ESL in 2005 and 2007 as shown in Table 5-2 and Table 5-3, respectively. The total MWh production in each PCA was input in the corresponding cells in the eGRID table to calculate the total annual and OSD emissions reduction for the entire ERCOT region (Table 5-4 and Table 5-5).

According to the developed models, the total MWh savings in the base year 1999 for the wind farms within the ERCOT region is 10,226,401 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 distribution of the NOx emissions reduction in the counties within the ERCOT region is shown in Figure 5-4, Figure 5-5, Figure 5-6, and Figure 5-7. Based on the 2007 eGRID, it is shown that the counties in the gulf coast area will get emissions benefit from the wind farms located in the west. Figure 5-8 shows the average modeled power flows during 2006 for each of the Commercially Significant Constraints from ERCOT[9]. Based on modeled flows, Houston is a significant importer from the 'North Zone' and the 'South Zone,' while the 'South Zone' and the 'Northeast Zone' export significant amounts of power. So, any modifications on the generation patterns in the north area could affect the generation on the

---

[7] A Power Control Area (PCA) is defined as one grid region for which one utility controls the dispatch of electricity. Some smaller utilities are embedded in the power control areas of larger utilities. The corresponding PCA for wind farms was obtained from PUCT.
[8] This 2007 eGRID table for Texas was provided by Art Diem of the USEPA and includes emissions values for AEP, Austin Energy, Brownsville Public Utility, LCRA, Reliant, San Antonio Public Service, South Texas Coop, TMPP, TNMP, and TXU.
[9] ERCOT, "2006 State of the Market Report for the ERCOT Wholesale Electricity Markets" Available at: http://www.puc.state.tx.us/WMO/documents/annual_reports/2006annualreport.pdf

South area (Gulf coast) which has a larger emissions rate than the northern counterpart, thus giving a major emissions reduction impact. Therefore, we believe the distribution of electricity is adequately reflected in the current choice of the PCAs continued in the 2007 eGRID.

5.2 Updated Version of eGRID

The ESL has been working with the EPA and the TCEQ on a new version of eGRID for all ERCOT counties in Texas. This new version of eGRID was developed based on the ERCOT congestion management zones (Figure 5-8).[10] It uses a simplified dispatch approach of the ERCOT grid to estimate NOx emission reductions across the ERCOT region in Texas. The simplified dispatch method reduces the generation from plants that are expected to be operating in future years and reduces NOx emissions at these plants by the expected reduction in output emission rate of these plants. This method does not use an electric system planning model, or an electric system dispatch model, which could more fully reflect some of the dynamics of the electricity system than is presented here.

Based on the reduction targets identified by the legislature for investor owned utilities, this study assigns the electric generation reductions at specific fossil fuel fired plants that currently exist and to plants that are scheduled to be online in the years examined in this analysis, 2010 and 2015. This method assigns the potential energy savings targets of each affected investor owned utility in ERCOT, which are then applied to the respective congestion management (CM) zones based on the proportion of the utility’s load in each CM zone. Then it applies the energy savings to generation from each CM zone based on year 2007 generation and power flows across these zones. Next, it applies the CM zone specific reductions in generation to each plant within the CM zone based on the amount of the plant’s generation that could be affected by energy efficiency measures, which is derived from a function of the plant’s capacity factor. Then a plant specific output NOx emission rate is applied to the expected reduction in electric generation. These emission rates are based on year 2005 EPA’s eGRID emission rates and TCEQ’s most current baseline emissions inventory for year 2005 and for projected year 2018. Finally the plant specific emission reduction is summed to the county level. The potential emissions reductions are presented for each of the investor owned utilities and in aggregate for all five ERCOT utilities under the year 2010 and 2015 energy savings scenarios (Table 5-6 and Table 5-7).

As the TCEQ moves the base year to more recent years, 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.

[10] Estimation of Annual Reductions of NOx Emissions in ERCOT for the HB3693 Electricity Savings Goal, The United Sates Environmental Protection Agency and the Energy Systems Lab, December 2008

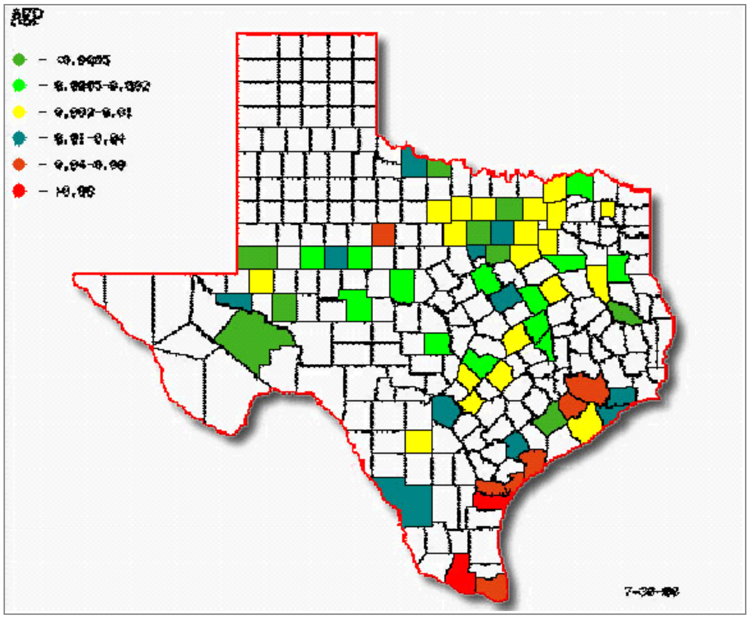


Figure 5-1: NOx Emissions (lbs/MWh) from PCA-AEP West in the 2007 Annual eGRID

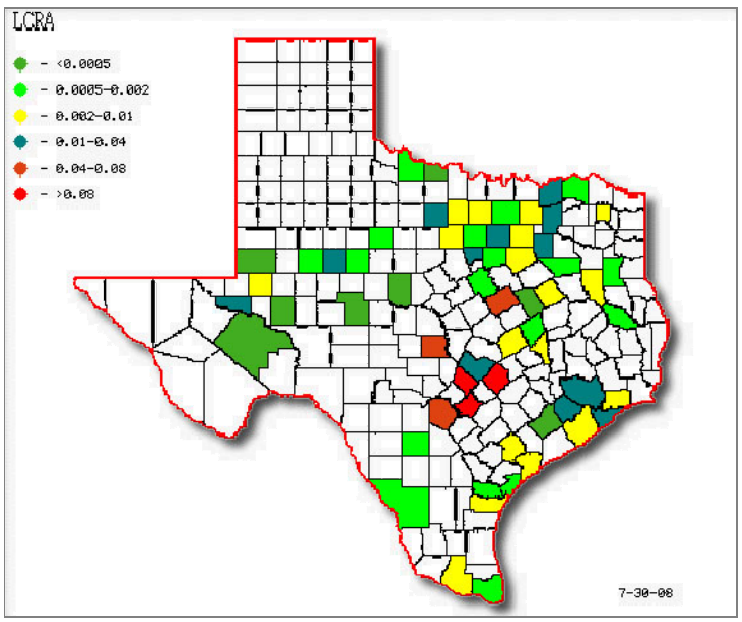


Figure 5-2: NOx Emissions (lbs/MWh) from PCA-LCRA in the 2007 Annual eGRID

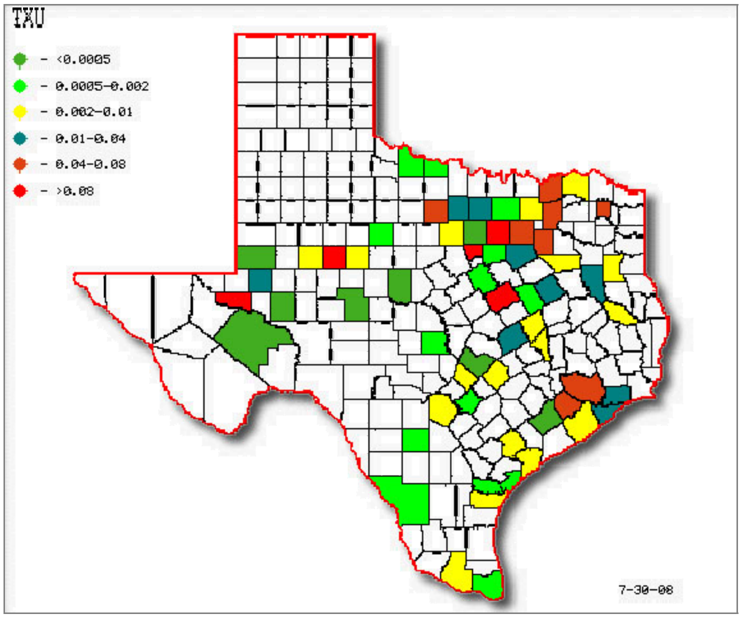


Figure 5-3: NOx Emissions (lbs/MWh) from PCA-TXU in the 2007 Annual eGRID

Table 5-1: Wind Power Production Assigned to Each PCA in the ERCOT Region

PCA	**Annual Wind Power (MWh/yr)**	**OSD Wind Power (MWh/day)**
AEP-WEST	7,275,027	18,213
TXU	1,271,399	3,041
LCRA	1,679,976	3,899
Total	10,226,401	25,153

Table 5-2: Wind Farm Information from the PUCT – 2005

Source: http://www.puc.state.tx.us/electric/maps/gentable.pdf

Map No.	Company	Facility	City (County)	Resource	Capacity (MW)	Date in Service	Interconnection	Region	PCA
7	York Research	Big Spring Wind Power	Big Spring (Howard)	Wind	34	Feb-99	TXU	ERCOT	TXU
8	FPL Energy	Southwest Mesa Wind Project	McCamey (Upton)	Wind	75	Jun-99	WTU	ERCOT	AEP-West
9	American National Wind Power	Delaware Mountain Wind Farm	Delaware Mountains (	Wind	30	Jun-99	TXU	ERCOT	TXU
10	York Research	Big Spring Wind Power	Big Spring (Howard)	Wind	6.6	Jun-99	TXU	ERCOT	TXU
33	Orion Energy/American National Win	Indian Mesa I	(Pecos)	Wind	82.5	Jun-01	WTU	ERCOT	AEP-West
35	FPL/Cielo/TXU	Woodward Mountain Ranch	McCamey (Pecos)	Wind	160	Jul-01	WTU	ERCOT	AEP-West
44	AEP	Trent Mesa	Trent Mesa (Nolan)	Wind	150	Nov-01	TXU	ERCOT	TXU
45	AEP	Desert Sky (Indian Mesa II)	Iraan (Pecos)	Wind	160	Dec-01	WTU	ERCOT	AEP-West
46	FPL/Cielo	King Mountain Wind Ranch	McCamey (Upton)	Wind	278	Dec-01	WTU	ERCOT	AEP-West
65	Cielo/Orion/Green Mountain	Brazos Wind Ranch	Fluvana (Scurry)	Wind	160	Dec-03	ONCOR	ERCOT	AEP-West
66	DKR/Babcock&Brown/Catamount	Sweetwater 1	Sweetwater (Nolan)	Wind	37.5	Dec-03	LCRA	ERCOT	LCRA
75	FPL Energy	Callahan Divide Wind Energy C	Abilene (Taylor)	Wind	114	Feb-05	AEP-TNC	ERCOT	AEP-West
Map No.	Company	Facility	City (County)	Resource	apacity (MV	ed Date in	cted Date in S	Region	
79	Clipper Windpower Dev.	Silver Star Phase I	(Eastland)	Wind	60	2005	5-Jun	ERCOT	TXU
80	DKRW Development	Sweetwater II	Sweetwater (Nolan)	Wind	89	2005	5-Dec	ERCOT	TXU
81	AES Corporation	Buffalo Gap	Abilene (Taylor)	Wind	120	1Q-05	4Q-05	ERCOT	AEP-West
84	Orion Energy		(Culberson)	Wind	175	NA	6-Dec	ERCOT	TXU

Capacity (MW)	PCA (1998 Designation)	Percent of Total Capacity
1149.5	AEP-West	66.38%
37.5	LCRA	2.17%
544.6	TXU	31.45%
1731.6	*TOTAL*	*100.00%*

Table 5-3: Wind Farm Information from the PUCT – 2007

Company	Facility	City	County	Resource	Capacity (MW)	Status	In Service	Interconnection	Region
LG&E	Texas Wind Power Project		Culberson	Wind	35	Completed	Oct-95	TXU, LCRA	ERCOT
York Research	Big Spring Wind Power	Big Spring	Howard	Wind	34	Completed	Feb-99	TU	ERCOT
York Research	Big Spring Wind Power	Big Spring	Howard	Wind	7	Completed	Jun-99	TXU	ERCOT
FPL Energy	Southwest Mesa Wind Project	McCamey	Upton	Wind	75	Completed	Jun-99	WTU	ERCOT
American National Wind Power	Delaware Mountain Wind Farm		Culberson	Wind	30	Completed	Jun-99	TXU	ERCOT
Cielo/El Paso Electric	Hueco Mountain Wind Ranch	Hueco Mtn.	El Paso	Wind	1	Completed	Apr-01	EPE	WSCC
Orion Energy/American National Wind Power	Indian Mesa		Pecos	Wind	83	Completed	Jun-01	WTU	ERCOT
FPL/Cielo/TXU	Woodward Mountain Ranch	McCamey	Pecos	Wind	160	Completed	Jul-01	WTU	ERCOT
AEP	Trent Mesa	Sweetwater	Nolan	Wind	150	Completed	Nov-01	TXU	ERCOT
AEP	Desert Sky (Indian Mesa II)	Iraan	Pecos	Wind	160	Completed	Dec-01	WTU	ERCOT
FPL/Cielo	King Mountain Wind Ranch	McCamey	Upton	Wind	278	Completed	Dec-01	WTU	ERCOT
Shell Wind Energy	Llano Estacado Wind Ranch	White Deer	Carson	Wind	79	Completed	Jan-02	SPS	SPP
Cielo/Orion/Green Mountain	Brazos Wind Ranch	Fluvana	Scurry	Wind	160	Completed	Dec-03	ONCOR	ERCOT
DKR Development	Sweetwater Wind 1	Sweetwater	Nolan	Wind	38	Completed	Dec-03	LCRA	ERCOT
Aeolus Wind			Hansford	Wind	3	Completed	2003	SPS	SPP
DKRW Development	Sweetwater Wind 2	Sweetwater	Nolan	Wind	92	Completed	Feb-05	LCRA	ERCOT
FPL Energy	Callahan Divide Wind Energy Center	Abilene	Taylor	Wind	114	Completed	Feb-05	AEP-TNC	ERCOT
AES Seawest	Buffalo Gap 1	Abilene	Taylor	Wind	120	Completed	Sep-05	AEP/TNC	ERCOT
FPL Energy	Horse Hollow Phase 1	Abilene	Taylor	Wind	213	Completed	Oct-05	AEP/TNC	ERCOT
DKRW Energy	Sweetwater Wind 3 (Cottonwood Creek)	Sweetwater	Nolan	Wind	135	Completed	Dec-05	LCRA	ERCOT
FPL Energy	Horse Hollow Phase 2	Abilene	Taylor	Wind	224	Completed	May-06	AEP/TNC	ERCOT
FPL Energy	Red Canyon 1		Borden	Wind	84	Completed	May-06	BEPC	ERCOT
FPL Energy	Horse Hollow Phase 3	Abilene	Taylor	Wind	299	Completed	Sep-06	AEP/TNC	ERCOT
Airtricity	Forest Creek Wind Farm		Sterling	Wind	124	Completed	Dec-06	TXU-ED	ERCOT
Airtricity	Sand Bluff Wind Farm		Sterling	Wind	90	Completed	Dec-06	TXU-ED	ERCOT
Deere & Company	JD Wind 1, 2, 3, 5	Gruver	Hansford	Wind	40	Completed	Dec-06	SPS	SPP
Edison Mission Group	Wildorado Wind Ranch	Wildorado	Oldham	Wind	161	Completed	Apr-07	SPS	SPP
DKRW/BabcockBrown	Sweetwater Wind 4 (Cottonwood Creek)	Sweetwater	Nolan	Wind	300	Completed	May-07	LCRA	ERCOT
Invenergy	Camp Springs Wind Energy Center		Scurry	Wind	130	Completed	Jul-07	Oncor	ERCOT
AES	Buffalo Gap 2 (Cirello 1)	Abilene	Taylor	Wind	233	Completed	Aug-07	AEP/TNC	ERCOT
FPL Energy	Capricorn Ridge Wind		Sterling	Wind	364	Completed	Sep-07	LCRA	ERCOT
DKRW/BabcockBrown	Sweetwater Wind 5	Sweetwater	Nolan	Wind	80	Completed	Dec-07	LCRA	ERCOT
Renewable Energy Systems	Whirlwind	Floydada	Floyd	Wind	60	Completed	Dec-07	AEP	ERCOT
Gamesa Energy	Barton Chapel Wind 1		Jack	Wind	120	Completed	Dec-07	Oncor	ERCOT
Enel North America/WKN USA	Snyder Wind Project	Snyder	Scurry	Wind	63	Completed	Dec-07	BCEC	ERCOT
Horizon Wind Energy	Lone Star - Mesquite Wind		Shackleford	Wind	200	Completed	Dec-07	Oncor	ERCOT
Invenergy	Stanton Wind Energy		Martin	Wind	101	Completed	Jan-08	Oncor	ERCOT
Airtricity	Champion Wind Farm		Scurry	Wind	126	Completed	Jan-08	Oncor	ERCOT
Airtricity	Roscoe Wind Farm 1		Scurry	Wind	209	Completed	Jan-08	Oncor	ERCOT
BP/Clipper Windpower	Silver Star Phase I		Erath	Wind	60	Completed	Mar-08	Oncor	ERCOT
Edison Mission Group	Goat Mountain Wind Ranch		Sterling	Wind	70	Completed	Mar-08	LCRA	ERCOT
AES	Buffalo Gap 3		Taylor	Wind	138	Completed	Apr-08	AEP/TNC	ERCOT
FPL Energy	Capricorn Ridge Wind exp.		Sterling	Wind	298	Completed	May-08	LCRA	ERCOT
Horizon Wind Energy	Lone Star - Post Oak Wind		Shackleford	Wind	200	Completed	May-08	Oncor	ERCOT
Invenergy	McAdoo Wind Energy		Dickens	Wind	150	Completed	May-08	AEP	ERCOT
Invenergy	Camp Springs Energy expansion		Scurry	Wind	120	Completed	Jun-08	Oncor	ERCOT
Airtricity	Panther Creek		Howard	Wind	143	Completed	Jul-08	Oncor	ERCOT
Duke Energy	Ocotillo Windpower 1		Howard	Wind	59	Completed	Aug-08	Oncor	ERCOT
BP Alt. Energy - NRG	Sherbino Mesa Wind Farm		Pecos	Wind	150	Completed	Sep-08		ERCOT
Babcock & Brown	South Trent Wind Farm		Taylor	Wind	98	Completed	Oct-08	Oncor	ERCOT
FPL Energy	Wolf Ridge Windfarm		Cooke	Wind	113	Completed	Oct-08		ERCOT
Babcock & Brown	Gulf Wind 1		Kenedy	Wind	283	Completed	Nov-08	AEP/TCC	ERCOT
E.On Climate & Renewables	Inadale		Nolan	Wind	197	Completed	Nov-08		ERCOT
E.On Climate & Renewables	Panther Creek 2		Howard	Wind	115	Completed	Nov-08		ERCOT
E.On Climate & Renewables	Pyron		Scurry	Wind	249	Completed	Nov-08		ERCOT
Eurus Energy Holdings	Bull Creek Wind Plant		Borden	Wind	180	Completed	Nov-08		ERCOT
Invenergy	Turkey Track Energy Center		Nolan	Wind	170	Completed	Nov-08		ERCOT
NRG Padoma Wind	Elbow Creek Wind		Howard	Wind	117	Completed	Nov-08	Oncor	ERCOT
PPM Energy	Penascal Wind Farm		Kenedy	Wind	202	Completed	Nov-08		ERCOT
Renewable Energy Systems	Hackberry Wind Farm		Shackleford	Wind	165	Completed	Nov-08		ERCOT

Table 5-4: Annual NOx Reductions Using the 1999 Base Year and the 2007 eGrid (25%)

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	64246.7225	0.010890729	0	0.006522185	0	0.003944232	6626.213835	0.065444292	0	0.014877434	0	0.006262315	0	0.004817148	0	0.121274957	0	0.00816387	10379.53297	81252.46931	40.62623466
	Chambers	0.021762222	158320.7463	0.026955801	0	0.016072371	0	0.009076193	15247.78421	0.164940225	0	0.037472294	0	0.015055623	0	0.009553214	0	0.011518588	0	0.015818592	20111.73603	193680.2665	96.84013325
	Fort Bend	0.070431234	512389.1013	0.087239726	0	0.052016606	0	0.029374182	49347.91322	0.533812376	0	0.121275295	0	0.048726002	0	0.030918012	0	0.037278747	0	0.051195276	65089.60191	626826.6164	313.4133082
	Galveston	0.033856739	246308.6796	0.041710519	0	0.025004711	0	0.015351589	25790.29667	0.249587379	0	0.056747051	0	0.024143087	0	0.019297151	0	0.567751219	0	0.032836887	41748.77144	313847.7477	156.9238739
	Harris	0.068267332	496646.6617	0.084559408	0	0.050418468	0	0.028471701	47831.76749	0.517411736	0	0.117549281	0	0.047228963	0	0.029968099	0	0.03613341	0	0.049622373	63089.81478	607568.244	303.784122
	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	14834.76252	0.003716345	0	0.001505992	0	0.005950953	9997.456194	0.002481478	0	0.000717051	0	0.019166247	0	0.07668094	0	0.00086441	0	0.004000199	5085.847767	29918.06648	14.95903324
	Dallas	0.004539471	33024.7735	0.004683963	0	0.003352602	0	0.00774211	13006.55692	0.002085611	0	0.00068106	0	0.007502816	0	0.026717045	0	0.007524933	0	0.040370454	51326.93822	97358.26864	48.67913432
	Denton	0.00047388	3447.491751	0.000872802	0	0.000349982	0	0.001396994	2346.91577	0.000585443	0	0.000168971	0	0.00454374	0	0.018187155	0	0.000186605	0	0.000849405	1079.93281	6874.340331	3.437170166
	Tarrant	0.012162492	88482.45565	0.012266309	0	0.008982543	0	0.020308652	34118.04306	0.005316504	0	0.001752506	0	0.017326428	0	0.060216761	0	0.020603444	0	0.110647237	140676.7411	263277.2398	131.6386199
	Ellis	0.003279814	23860.73082	0.003307809	0	0.002422289	0	0.005476558	9200.484269	0.001433682	0	0.000472592	0	0.004672353	0	0.016238427	0	0.005556053	0	0.029837824	37935.76733	70996.98242	35.49849121
	Johnson	0.000286058	2081.083064	0.000526868	0	0.000211267	0	0.000843297	1416.718883	0.000353404	0	0.000101999	0	0.002742835	0	0.010978701	0	0.000112645	0	0.000512745	651.9029029	4149.70485	2.074852425
	Kaufman	0.006325453	46017.8356	0.006379446	0	0.004671629	0	0.010562096	17744.06559	0.002765	0	0.000911441	0	0.009011105	0	0.031317452	0	0.010715411	0	0.057545265	73162.96881	136924.87	68.462435
	Parker	0.000217489	1582.241771	0.000400576	0	0.000160626	0	0.000641157	1077.127498	0.000268692	0	7.75498E-05	0	0.00208537	0	0.008347076	0	8.56434E-05	0	0.000389838	495.6399969	3155.009266	1.577504633
	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	5964.757466	0.000826893	0	0.000605529	0	0.001369042	2299.957099	0.000358395	0	0.00011814	0	0.001168005	0	0.004059317	0	0.001388914	0	0.007458924	9483.265755	17747.98032	8.87399016
	Hood	0.01252711	91135.05835	0.012634039	0	0.009251829	0	0.020917482	35140.86292	0.005475887	0	0.001805044	0	0.017845854	0	0.062021991	0	0.021221112	0	0.113964315	144894.0687	271169.99	135.584995
	Hunt	0.006187558	45014.65192	0.006240374	0	0.004569788	0	0.010331844	17357.24694	0.002704724	0	0.000891572	0	0.008814664	0	0.030634735	0	0.010481817	0	0.056290785	71568.02427	133939.9231	66.96996157
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	243085.9288	0.051775843	0	0.024677545	0	0.090663423	152312.3524	0.001141841	0	1.143571754	0	0.046873844	0	0.004669544	0	0.000519582	0	0.002503865	3183.410653	398581.6919	199.2908459
	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	14553.45196	0.076378745	0	0.001477434	0	0.133848731	224862.6213	0.001237133	0	0.003554796	0	0.001061766	0	0.001855699	0	0.000401718	0	0.001835165	2333.225958	241749.2992	120.8746496
	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	32754.59839	0.171901148	0	0.003325174	0	0.301245466	506085.0767	0.002784342	0	0.008000571	0	0.002389654	0	0.004176513	0	0.000904124	0	0.004130298	5251.254438	544090.9295	272.0454647
	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	17886.3743	0.093870431	0	0.001815785	0	0.164501762	276358.9711	0.001520452	0	0.004368889	0	0.001304924	0	0.002280677	0	0.000493717	0	0.00225544	2867.563855	297112.9092	148.5564546
	Travis	0.000510007	3710.314601	0.299602906	0	0.000376663	0	0.033939476	57017.4969	0.000334709	0	0.000906121	0	0.000271138	0	0.000471744	0	0.000103327	0	0.000467336	594.1700374	61321.98154	30.66099077
	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	4990.412491	0.00069182	0	0.000506616	0	0.001145408	1924.258397	0.000299851	0	9.88414E-05	0	0.000977211	0	0.003396227	0	0.001162035	0	0.006240507	7934.171364	14848.84225	7.424421126
	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	1655568.573	0.004556851	0	0.168069652	0	0.007612767	12789.26411	0.001680888	0	0.001626796	0	0.046792036	0	0.007246366	0	0.001609426	0	0.008283395	10531.49634	1678889.334	839.4446669
	San Patricio	0.050313351	366030.9709	0.001007478	0	0.037158653	0	0.001683113	2827.588562	0.000371629	0	0.00035967	0	0.010345288	0	0.001602105	0	0.000355829	0	0.001831382	2328.41689	371186.9764	185.5934882
Victoria Area	Victoria	0.021836736	158862.8338	0.002215582	0	0.016127403	0	0.003612695	6069.240426	0.001199621	0	0.000555389	0	0.52545648	0	0.032412721	0	0.000476855	0	0.002254849	2866.812042	167798.8863	83.89944316
Other ERCOT counties	Andrews	2.47421E-05	179.9993101	2.49533E-05	0	1.82731E-05	0	4.13138E-05	69.40612313	1.08153E-05	0	3.56511E-06	0	3.5247E-05	0	0.000122499	0	4.19135E-05	0	0.000225089	286.1778208	535.5832541	0.267791627
	Angelina	0.00031082	2261.223196	0.000313473	0	0.000229554	0	0.000519	871.9074284	0.000135867	0	4.47864E-05	0	0.000442787	0	0.001538876	0	0.000526534	0	0.002827658	3595.080039	6728.210663	3.364105332
	Bosque	0.000595392	4331.490998	0.001096604	0	0.000439723	0	0.001755208	2948.707427	0.000735562	0	0.000212298	0	0.005708837	0	0.02285067	0	0.000234455	0	0.001067208	1356.847117	8637.045542	4.318522771
	Brazos	0.001939725	14111.55254	0.003572622	0	0.001432574	0	0.005718288	9606.585768	0.002396384	0	0.000691644	0	0.018598805	0	0.074445136	0	0.000763829	0	0.003476855	4420.468467	28138.60677	14.06930339
	Calhoun	0.082699809	601643.3112	0.001655986	0	0.061077496	0	0.002766524	4647.693447	0.000610844	0	0.000591187	0	0.0170045	0	0.002633372	0	0.000584875	0	0.003010234	3827.207419	610118.212	305.059106
	Cameron	0.048371747	351905.7479	0.000968599	0	0.297964476	0	0.001618161	2718.47124	0.000357288	0	0.00034579	0	0.009946061	0	0.001540279	0	0.000342098	0	0.001760709	2238.562723	356862.7818	178.4313909
	Cherokee	0.003503899	25490.95785	0.003533808	0	0.002587786	0	0.00585073	9829.085225	0.001531635	0	0.00050488	0	0.00499158	0	0.017347879	0	0.005935657	0	0.031876422	40527.63738	75847.68046	37.92384023
	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	9448.709151	2.6007E-05	0	0.000959212	0	4.34478E-05	72.99126041	9.59321E-06	0	9.2845E-06	0	0.000267053	0	4.13567E-05	0	9.18536E-06	0	4.72752E-05	60.10566243	9581.806074	4.790903037
	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	25722.65824	0.003565928	0	0.002611307	0	0.005903911	9918.426822	0.001545556	0	0.00050947	0	0.005036951	0	0.017505563	0	0.00598961	0	0.032166163	40896.01387	76537.09893	38.26854947
	Fannin	0.007056315	51334.87744	0.007116546	0	0.005211403	0	0.011782473	19794.26934	0.003084477	0	0.001016752	0	0.010052276	0	0.034935966	0	0.011953503	0	0.064194222	81616.44258	152745.5894	76.37279468
	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	26751.56457	0.003708565	0	0.00271576	0	0.006140067	10315.1639	0.001607379	0	0.000529848	0	0.005238429	0	0.018205785	0	0.006229194	0	0.033452809	42531.85442	79598.58289	39.79929144
	Frio	0.008588335	62480.36342	0.000871383	0	0.006342868	0	0.001420864	2387.017393	0.000471808	0	0.000218433	0	0.206660746	0	0.012747844	0	0.000187546	0	0.000886827	1127.510154	65994.89097	32.99744548
	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	1371542.264	0.003775086	0	0.139235931	0	0.006306735	10595.16141	0.001392518	0	0.001347706	0	0.03876448	0	0.006003193	0	0.001333316	0	0.006862311	8724.732134	1390862.158	695.431079
	Howard	0.000555113	4038.462209	0.000559851	0	0.000409976	0	0.000926915	1557.194887	0.000242653	0	7.99868E-05	0	0.000790802	0	0.002748377	0	0.00094037	0	0.005050094	6420.681911	12016.33901	6.008169503
	Jack	0.002121449	15433.59495	0.002139557	0	0.001566784	0	0.003542346	5951.056093	0.000927334	0	0.000305682	0	0.00302217	0	0.010503338	0	0.003593766	0	0.019299698	24537.60832	45922.25936	22.96112968
	Jones	0.040718722	296229.7886	0.000815354	0	0.030072592	0	0.001362147	2288.37456	0.00030076	0	0.000291082	0	0.008372468	0	0.001296587	0	0.000287974	0	0.001482142	1884.393666	300402.5569	150.2012784
	Lamar	0.000950838	6917.370655	0.000958954	0	0.000702236	0	0.001587687	2667.27622	0.000415633	0	0.000137007	0	0.001354543	0	0.004707619	0	0.001610734	0	0.008650166	10997.80915	20582.45603	10.29122801
	Limestone	0.000719757	5236.24977	0.000891528	0	0.000531572	0	0.000300183	504.3003424	0.00545518	0	0.001239347	0	0.000497945	0	0.00031596	0	0.000380962	0	0.000523179	665.1691305	6405.719243	3.202859621
	Llano	0.001238174	9007.748499	0.047274044	0	0.000914447	0	0.082844655	139177.0107	0.000765714	0	0.002200214	0	0.000657172	0	0.001148571	0	0.000248641	0	0.001135861	1444.132476	149628.8917	74.81444583
	McLennan	0.024534317	178487.8116	0.024743738	0	0.018119687	0	0.040966843	68823.30285	0.010724513	0	0.003535175	0	0.034951066	0	0.121469933	0	0.041561501	0	0.22319886	283774.7153	531085.8298	265.5429149
	Milam	0.002245405	16335.38058	0.002264571	0	0.001658332	0	0.003749326	6298.776563	0.000981518	0	0.000323543	0	0.003198756	0	0.011117048	0	0.00380375	0	0.02042738	25971.34186	48605.499	24.3027495
	Mitchell	0.014943169	108711.9506	0.015070721	0	0.011036196	0	0.024951762	41918.35527	0.006532002	0	0.002153177	0	0.02128772	0	0.07398395	0	0.025313952	0	0.135944204	172839.2687	323469.5745	161.7347873
	Nolan	0.000564654	4107.870733	0.000569473	0	0.000417022	0	0.000942846	1583.958193	0.000246823	0	8.13615E-05	0	0.000804394	0	0.002795613	0	0.000956532	0	0.005136889	6531.033335	12222.86226	6.11143113
	Palo Pinto	0.003206998	23330.99838	0.005906709	0	0.002368511	0	0.009454195	15882.81916	0.003962005	0	0.001143513	0	0.030749889	0	0.123082087	0	0.001262858	0	0.005748375	7308.475972	46522.2935	23.26114675
	Pecos	4.09677E-05	298.0409555	4.13174E-05	0	3.02565E-05	0	6.84069E-05	114.9219252	1.79079E-05	0	5.90308E-06	0	5.83617E-05	0	0.000202832	0	6.93999E-05	0	0.0003727	473.8502114	886.8130921	0.443406546
	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	5366.843407	0.000835096	0	0.00054483	0	0.000735917	1236.32281	0.003149678	0	0.000730875	0	0.00076086	0	0.001866305	0	0.191632518	0	0.003397737	4319.878537	10923.04475	5.461522377
	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	41441.73364	0.005745061	0	0.004207073	0	0.009511781	15979.56162	0.002490043	0	0.000820806	0	0.008115023	0	0.028203184	0	0.00964985	0	0.051822854	65887.50267	123308.7979	61.65439897
	Tom Green	0.001482448	10784.84907	2.96846E-05	0	0.001094854	0	4.95918E-05	83.31293877	1.09498E-05	0	1.05974E-05	0	0.000304817	0	4.72049E-05	0	1.04843E-05	0	5.39604E-05	68.60519117	10936.7672	5.4683836
	Upton	3.11661E-05	226.7344035	3.14322E-05	0	2.30176E-05	0	5.20405E-05	87.42675691	1.36234E-05	0	4.49076E-06	0	4.43986E-05	0	0.000154304	0	5.27959E-05	0	0.000283531	360.4811455	674.642306	0.337321153
	Ward	0.018559529	135021.0651	0.01871795	0	0.013707039	0	0.030990277	52062.91437	0.008112796	0	0.002674262	0	0.026439509	0	0.091888626	0	0.03144012	0	0.16884373	214667.6793	401751.6587	200.8758294
	Webb	0.020014327	145604.7639	0.000400768	0	0.014781473	0	0.000669531	1124.796527	0.000147832	0	0.000143074	0	0.004115289	0	0.000637307	0	0.000141547	0	0.000728512	926.2292494	147655.7896	73.82789481
	Wharton	0.00014434	1050.075142	0.000178787	0	0.000106601	0	6.01986E-05	101.1321608	0.001093979	0	0.000248538	0	9.98576E-05	0	6.33625E-05	0	7.6398E-05	0	0.000104918	133.3927142	1284.600017	0.642300008
	Wichita	0.000207633	1510.537134	0.000209406	0	0.000153346	0	0.000346701	582.4496009	9.07612E-05	0	2.99181E-05	0	0.00029579	0	0.001027996	0	0.000351734	0	0.001888925	2401.577123	4494.563858	2.247281929
	Wilbarger	0.028616818	208188.114	0.000573025	0	0.021134796	0	0.000957307	1608.252789	0.000211372	0	0.00020457	0	0.005884109	0	0.000911232	0	0.000202386	0	0.001041639	1324.337992	211120.7048	105.5603524
	Wise	0.002844488	20693.72271	0.002882008	0	0.002100781	0	0.00476997	8013.434714	0.001256075	0	0.000413241	0	0.004181914	0	0.014614274	0	0.004797945	0	0.025761411	32753.02178	61460.17921	30.7300896
	Young	0.006235856	45366.02085	0.006289085	0	0.004605458	0	0.010412491	17492.73165	0.002725836	0	0.000898531	0	0.008883468	0	0.030873859	0	0.010563634	0	0.056730171	72126.65971	134985.4122	67.49270611
	Total	1.121837219	8161395.659	1.172570094	0	1.090766584	0	1.189130767	1997710.85	1.629360006	0	1.542362643	0	1.359385821	0	1.231642808	0	1.221806085	0	1.528786947	1943697.562	12102804.07	6051.402035
Energy Savings by PCA (MWh)		7275026.643		0		0		1679975.748		0		0		0		0		0		1271398.585			

Table 5-5: OSD NOx Reductions using the 1999 Base Year and the 2007 eGrid (25%)

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	0.00957217	174.3359978	0.011806715	0	0.007069474	0	0.004263638	16.6224114	0.071001767	0	0.016140391	0	0.006781035	0	0.005179719	0	0.126288049	0	0.008771659	26.6765377	217.6349469	0.108817473
	Chambers	0.021881395	398.5214524	0.027103415	0	0.016160386	0	0.009125896	35.57863083	0.165843463	0	0.037677498	0	0.01513807	0	0.009605529	0	0.011581666	0	0.015905217	48.3712547	482.4713379	0.241235669
	Fort Bend	0.055695513	1014.371161	0.068987309	0	0.041133619	0	0.023228475	90.55958428	0.422127404	0	0.095901908	0	0.038531479	0	0.024449302	0	0.029479235	0	0.040484129	123.1211155	1228.051861	0.61402593
	Galveston	0.027555985	501.871613	0.033893644	0	0.020351324	0	0.012791501	49.8695269	0.201446635	0	0.045812515	0	0.019823685	0	0.01677514	0	0.594656509	0	0.028709453	87.31174167	639.0528815	0.319526441
	Harris	0.077360573	1408.952548	0.09582276	0	0.057134232	0	0.032264145	125.7864596	0.586331222	0	0.1332069	0	0.053519883	0	0.033959864	0	0.040946397	0	0.056232096	171.0141378	1705.753146	0.852876573
	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	0.001763649	32.12098236	0.003151138	0	0.001302533	0	0.005050143	19.68871546	0.002085751	0	0.00060408	0	0.015958397	0	0.063788818	0	0.000846136	0	0.004013208	12.20504438	64.0147422	0.032007371
	Dallas	0.005045553	91.89363953	0.005305276	0	0.003726366	0	0.008757286	34.14155364	0.002413087	0	0.000782263	0	0.009310387	0	0.033672029	0	0.008209179	0	0.044002183	133.8202906	259.8554837	0.129927742
	Denton	0.000635758	11.57892919	0.001170951	0	0.000469535	0	0.001874207	7.306868365	0.000785431	0	0.000226691	0	0.006095882	0	0.024399888	0	0.00025035	0	0.001139562	3.465658887	22.35145644	0.011175728
	Tarrant	0.015572243	283.6141326	0.015705165	0	0.011500796	0	0.026002176	101.3732644	0.006806985	0	0.002243821	0	0.022183886	0	0.077098512	0	0.026379614	0	0.141667156	430.840892	815.828289	0.407914145
	Ellis	0.003502824	63.79622169	0.003532723	0	0.002586991	0	0.005848935	22.80292309	0.001531165	0	0.000504725	0	0.004990048	0	0.017342555	0	0.005933836	0	0.031866639	96.9134394	183.5125842	0.091756292
	Johnson	0.000337176	6.14091922	0.000621017	0	0.00024902	0	0.000993991	3.875219173	0.000416556	0	0.000120226	0	0.003232969	0	0.012940552	0	0.000132774	0	0.00060437	1.838022405	11.8541608	0.00592708
	Kaufman	0.006492753	118.2511953	0.006548174	0	0.004795187	0	0.01084145	42.26696879	0.002838131	0	0.000935547	0	0.009249437	0	0.032145758	0	0.01099882	0	0.059067263	179.6365011	340.1546652	0.170077333
	Parker	0.000475952	8.668410699	0.000876616	0	0.000351511	0	0.0014031	5.470189419	0.000588002	0	0.000169709	0	0.0045636	0	0.01826665	0	0.000187421	0	0.000853118	2.594519242	16.73311936	0.00836656
	Rockwall	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Henderson	0.000950271	17.30709541	0.000958382	0	0.000701818	0	0.001586741	6.186140103	0.000415385	0	0.000136926	0	0.001353736	0	0.004704812	0	0.001609773	0	0.00864501	26.29137115	49.78460666	0.024892303
	Hood	0.012327882	224.5252336	0.012433111	0	0.00910469	0	0.020584816	80.25289738	0.0053888	0	0.001776337	0	0.017562038	0	0.061035609	0	0.020883617	0	0.112151856	341.0783906	645.8565216	0.322928261
	Hunt	0.006351211	115.6733325	0.006405424	0	0.004690653	0	0.010605108	41.3455536	0.00277626	0	0.000915153	0	0.0090478	0	0.031444984	0	0.010759047	0	0.057779603	175.7204455	332.7393316	0.166369666
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	0.031128114	566.9300718	0.048234164	0	0.0229895	0	0.084461674	329.2861145	0.001063735	0	1.065346769	0	0.043667482	0	0.004350128	0	0.000484041	0	0.002332591	7.093919495	903.3101058	0.451655053
	Comal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Guadalupe	0.002007611	36.56420777	0.076651484	0	0.00148271	0	0.134326688	523.6921192	0.00124155	0	0.00356749	0	0.001065557	0	0.001862326	0	0.000403153	0	0.001841718	5.601068284	565.8573952	0.282928698
	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	0.004469515	81.40236979	0.170648096	0	0.003300936	0	0.299049574	1165.888232	0.002764046	0	0.007942252	0	0.002372235	0	0.004146069	0	0.000897533	0	0.00410019	12.46957775	1259.760179	0.62988009
	Caldwell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hays	0.002469353	44.97382664	0.094281013	0	0.001823727	0	0.165221279	644.1391737	0.001527102	0	0.004387998	0	0.001310631	0	0.002290653	0	0.000495876	0	0.002265306	6.889291177	696.0022915	0.348001146
	Travis	0.000507609	9.244983056	0.298194277	0	0.000374892	0	0.033779905	131.6958682	0.000333135	0	0	0	0.000269863	0	0.000469526	0	0.000102841	0	0.000465139	1.414588256	142.3554395	0.07117772
	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	0.223524525	4071.007198	0.00447587	0	0.165082827	0	0.007477478	29.15203459	0.001651016	0	0.001597886	0	0.045960479	0	0.007117588	0	0.001580824	0	0.008136188	24.74393088	4124.903164	2.062451582
	San Patricio	0.055330886	1007.730294	0.001107949	0	0.040864326	0	0.001850962	7.216245751	0.00040869	0	0.000395538	0	0.01137698	0	0.001761876	0	0.000391315	0	0.002014018	6.125071152	1021.071611	0.510535806
Victoria Area	Victoria	0.020604752	375.2702027	0.002090584	0	0.015217528	0	0.003408874	13.28999252	0.001131941	0	0.000524055	0	0.495811308	0	0.030584062	0	0.000449952	0	0.002127635	6.470605357	395.0308006	0.1975154
Other ERCOT counties	Andrews	2.56527E-05	0.467206791	2.58716E-05	0	1.89456E-05	0	4.28342E-05	0.166995478	1.12134E-05	0	3.69632E-06	0	3.65442E-05	0	0.000127007	0	4.3456E-05	0	0.000233373	0.709738223	1.343940492	0.00067197
	Angelina	0.00032149	5.855235687	0.000324234	0	0.000237435	0	0.000536817	2.092858879	0.000140531	0	4.63239E-05	0	0.000457988	0	0.001591705	0	0.000544609	0	0.002924729	8.894743512	16.84283808	0.008421419
	Bosque	0.000939453	17.11006267	0.001730301	0	0.000693828	0	0.002769496	10.79728303	0.001160623	0	0.000334979	0	0.009007821	0	0.036055459	0	0.000369939	0	0.001683919	5.121167923	33.02851362	0.016514257
	Brazos	0.001913926	34.85795541	0.003525105	0	0.00141352	0	0.005642234	21.99706791	0.002364512	0	0.000682445	0	0.018351436	0	0.073454996	0	0.00075367	0	0.003430612	10.43324309	67.28826642	0.033644133
	Calhoun	0.088525246	1612.292491	0.001772635	0	0.065379841	0	0.0029614	11.54544912	0.000653873	0	0.000632831	0	0.01820231	0	0.002818869	0	0.000626074	0	0.003222277	9.799652032	1633.637592	0.816818796
	Cameron	0.054672288	995.735371	0.001094762	0	0.285623104	0	0.001828931	7.130351425	0.000403825	0	0.00039083	0	0.011241561	0	0.001740904	0	0.000386657	0	0.001990046	6.052164979	1008.917887	0.504458944
	Cherokee	0.003512995	63.98147348	0.003542982	0	0.002594504	0	0.005865919	22.86913833	0.001535611	0	0.000506191	0	0.005004538	0	0.017392915	0	0.005951066	0	0.031959174	97.19485714	184.0454689	0.092022734
	Coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Coleman	0.001355099	24.68015171	2.71346E-05	0	0.001000801	0	4.53316E-05	0.176731851	1.00092E-05	0	9.68705E-06	0	0.000278632	0	4.31498E-05	0	9.58362E-06	0	4.9325E-05	0.150008079	25.00689164	0.012503446
	Crockett	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Ector	0.003629264	66.09904712	0.003660242	0	0.002680373	0	0.006060061	23.62603063	0.001586434	0	0.000522944	0	0.005170172	0	0.017968562	0	0.006148027	0	0.033016916	100.4116831	190.1367609	0.09506838
	Fannin	0.007628516	138.93663	0.007693632	0	0.005633999	0	0.012737922	49.66064141	0.003334599	0	0.001099201	0	0.010867422	0	0.037768948	0	0.012922821	0	0.069399776	211.0599393	399.6572108	0.199828605
	Fayette	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Freestone	0.003774434	68.743009	0.003806652	0	0.002787588	0	0.006302464	24.57107185	0.001649892	0	0.000543862	0	0.005376978	0	0.018687305	0	0.006393948	0	0.034337593	104.4281505	197.7422313	0.098871116
	Frio	0.014763838	268.8908146	0.001497957	0	0.010903753	0	0.002442547	9.522623667	0.000811065	0	0.000375499	0	0.355261637	0	0.021914272	0	0.000322402	0	0.001524506	4.636356239	283.0497945	0.141524897
	Grimes	0.000554424	10.09761677	0.001021149	0	0.000409467	0	0.001634436	6.372088068	0.000684949	0	0.00019769	0	0.005316025	0	0.021278368	0	0.000218322	0	0.000993776	3.022291157	19.49199599	0.009745998
	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	0.239736996	4366.281656	0.004800509	0	0.177056459	0	0.008019827	31.26646249	0.001770766	0	0.001713782	0	0.049294041	0	0.007633834	0	0.001695483	0	0.008726314	26.53863436	4424.086753	2.212043376
	Howard	0.000585081	10.65596006	0.000590075	0	0.000432108	0	0.000976955	3.808799821	0.000255752	0	8.43049E-05	0	0.000833494	0	0.002896748	0	0.000991136	0	0.005322723	16.18756899	30.65232887	0.015326164
	Jack	0.002177558	39.65942827	0.002196145	0	0.001608224	0	0.003636037	14.17561838	0.000951861	0	0.000313767	0	0.003102103	0	0.010781137	0	0.003688816	0	0.01981015	60.24700988	114.0820565	0.057041028
	Jones	0.042500124	774.0462001	0.000851025	0	0.031388236	0	0.00142174	5.542859666	0.000313918	0	0.000303816	0	0.008738755	0	0.001353312	0	0.000300572	0	0.001546985	4.704719187	784.293779	0.392146889
	Lamar	0.00107998	19.66946688	0.001089199	0	0.000797614	0	0.001803327	7.03053141	0.000472084	0	0.000155616	0	0.001538517	0	0.005347007	0	0.001829503	0	0.00982503	29.88007183	56.58007012	0.028290035
	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	22.64688504	0.047475864	0	0.000918351	0	0.083198331	324.3607872	0.000768983	0	0.002209607	0	0.000659977	0	0.001153474	0	0.000249702	0	0.00114071	3.469150769	350.4768231	0.175238412
	McLennan	0.023031368	419.4656784	0.023227961	0	0.017009692	0	0.038457253	149.9311926	0.01006754	0	0.003318614	0	0.032809997	0	0.114028801	0	0.039015483	0	0.209525912	637.2142508	1206.611122	0.603305561
	Milam	0.001652492	30.09650606	0.001666598	0	0.001220439	0	0.002759294	10.75750718	0.000722342	0	0.000238109	0	0.002354105	0	0.008181524	0	0.002799346	0	0.015033406	45.71988495	86.57389819	0.043286949
	Mitchell	0.016961453	308.9155304	0.017106233	0	0.012526789	0	0.028321847	110.4168381	0.00741424	0	0.002443993	0	0.024162925	0	0.083976519	0	0.028732956	0	0.154305373	469.2764829	888.6088514	0.444304426
	Nolan	0.000603273	10.98728776	0.000608422	0	0.000445544	0	0.001007331	3.927227524	0.000263704	0	8.69262E-05	0	0.00085941	0	0.002986817	0	0.001021953	0	0.005488224	16.69089201	31.60540729	0.015802704
	Palo Pinto	0.003074879	56.00215819	0.00566337	0	0.002270935	0	0.00906471	35.34008987	0.003798781	0	0.001096403	0	0.029483083	0	0.118011463	0	0.001210832	0	0.005511559	16.7618589	108.104107	0.054052053
	Pecos	4.22618E-05	0.769705323	4.26225E-05	0	3.12122E-05	0	7.05678E-05	0.275118664	1.84736E-05	0	6.08954E-06	0	6.02052E-05	0	0.000209239	0	7.15921E-05	0	0.000384473	1.169266584	2.214090571	0.001107045
	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	0.000359257	6.543084231	0.000406685	0	0.000265328	0	0.000358385	1.397217729	0.001533867	0	0.00035593	0	0.000370532	0	0.000908875	0	0.09332343	0	0.00165467	5.032213283	12.97251524	0.006486258
	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	0.587143301	3.25131E-05	0	2.38092E-05	0	5.38302E-05	0.209864835	1.40919E-05	0	4.6452E-06	0	4.59255E-05	0	0.000159611	0	5.46116E-05	0	0.000293282	0.891934902	1.688943038	0.000844472
	Ward	0.019807626	360.7523002	0.0199767	0	0.014628815	0	0.033074321	128.9450494	0.008658368	0	0.002854101	0	0.028217522	0	0.098067981	0	0.033554415	0	0.180198187	548.0222067	1037.719556	0.518859778
	Webb	0.014180046	258.2583174	0.000283942	0	0.010472596	0	0.000474359	1.849359394	0.000104738	0	0.000101367	0	0.002915661	0	0.000451529	0	0.000100285	0	0.000516147	1.569716202	261.677393	0.130838697
	Wharton	0.00015439	2.81187374	0.000191235	0	0.000114024	0	6.43902E-05	0.25103446	0.001170153	0	0.000265844	0	0.000106811	0	6.77744E-05	0	8.17175E-05	0	0.000112223	0.341296209	3.40420441	0.001702102
	Wichita	0.000219843	4.0039553	0.000221719	0	0.000162364	0	0.000367089	1.431148779	9.60984E-05	0	3.16774E-05	0	0.000313184	0	0.001088447	0	0.000372417	0	0.002000002	6.082446093	11.51755017	0.005758775
	Wilbarger	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Wise	0.002918471	53.1535235	0.002955932	0	0.002155421	0	0.004892446	19.07391221	0.001287753	0	0.000423725	0	0.004280539	0	0.014952843	0	0.004924352	0	0.026440527	80.41144228	152.638878	0.076319439
	Young	0.00549666	100.1095657	0.005543579	0	0.004059529	0	0.009178198	35.78253802	0.002402716	0	0.000792019	0	0.007830425	0	0.027214083	0	0.009311425	0	0.050005398	152.0773813	287.9694851	0.143984743
	Total	**1.143037355**	**20817.90931**	**1.154658244**	**0**	**1.089429227**	**0**	**1.180868675**	**4603.788176**	**1.539350626**	**0**	**1.443063194**	**0**	**1.48172714**	**0**	**1.269705424**	**0**	**1.151968562**	**0**	**1.517782624**	**4615.909838**	**30037.60732**	**15.01880366**
Energy Savings by PCA (MWh)		18212.79875		0		0		3898.645357		0		0		0		0		0		3041.21932			

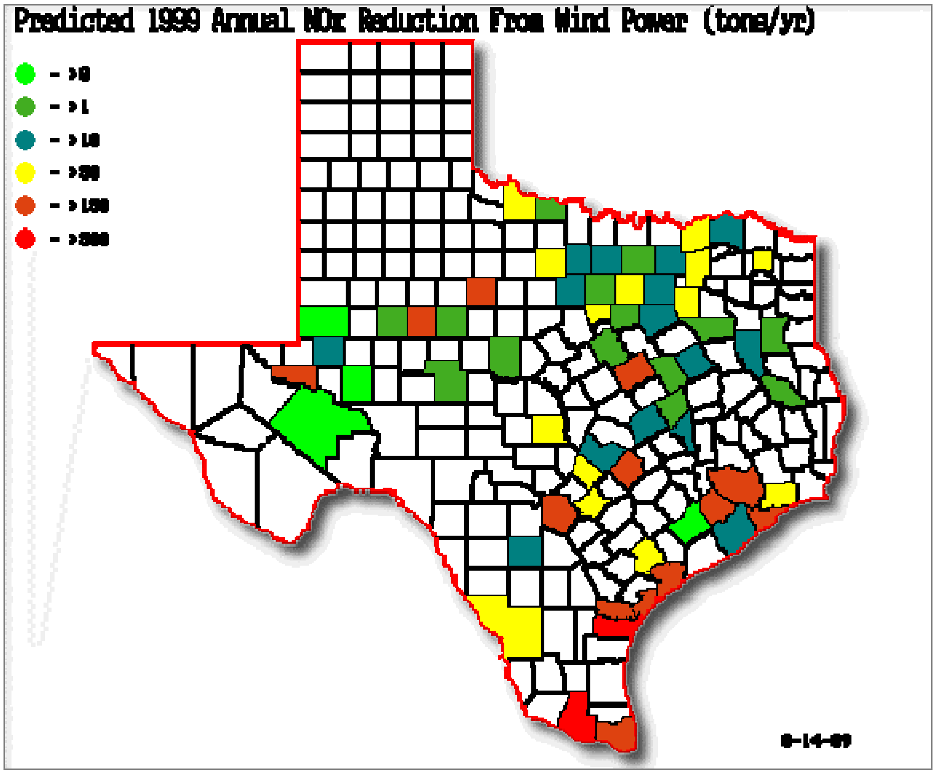


Figure 5-4: 1999 Predicted Annual NOx Reductions from Wind Power in Texas Map

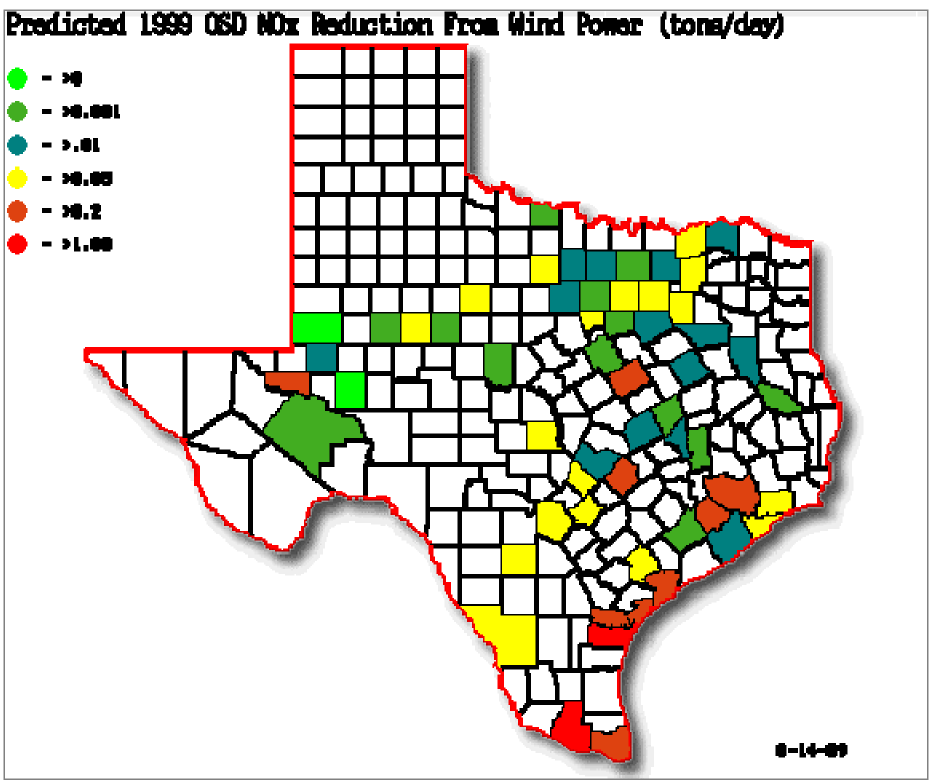


Figure 5-5: 1999 Predicted OSD NOx Reductions from Wind Power in Texas Map

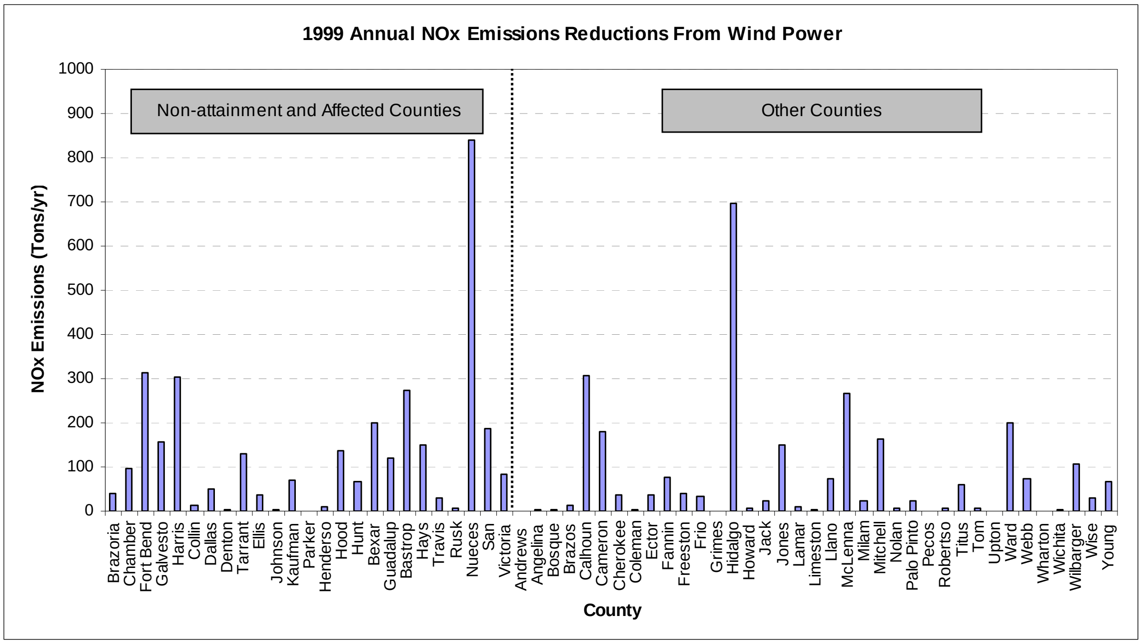


Figure 5-6: 1999 Predicted Annual NOx Reductions from Wind Power

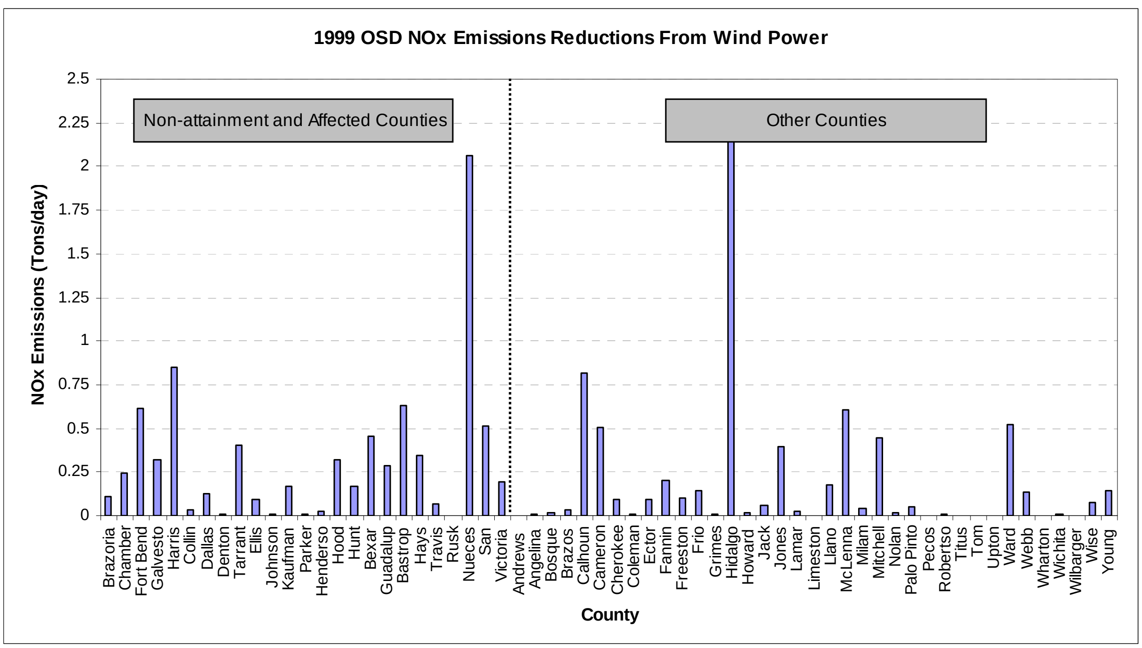


Figure 5-7: 1999 Predicted OSD NOx Reductions from Wind Power

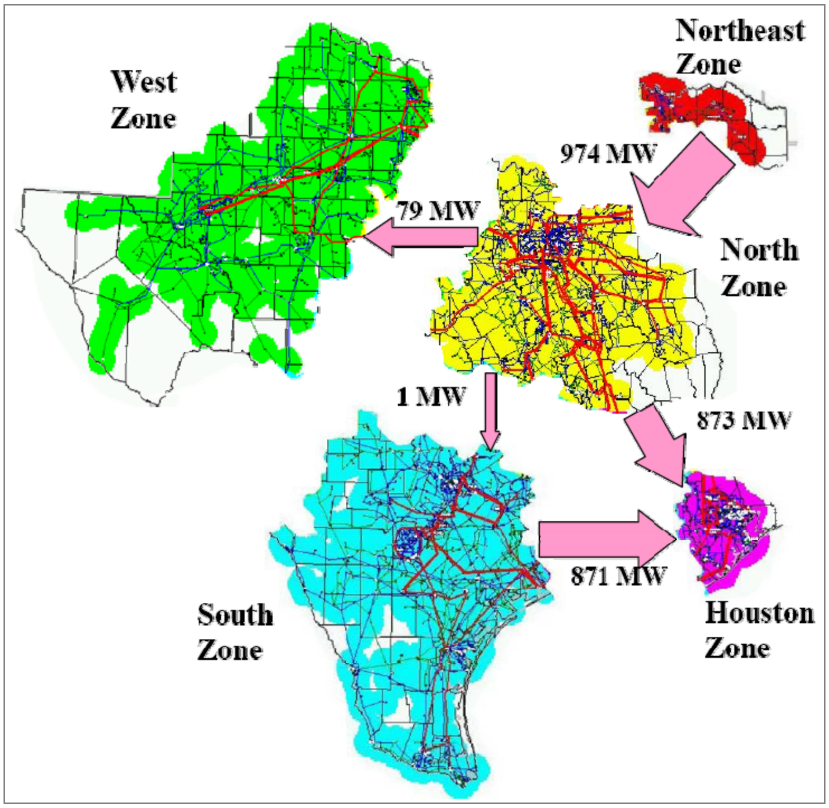


Figure 5-8: Average Modeled Flows on Commercially Significant Constrains for 2006

Table 5-6: Distribution of the Emission Reductions per CM Zone for each County (Year 2010)

County	CM Zones H (lb/MWh)*	H lb	N (lb/MWh)*	N lb	W (lb/MWh)*	W lb	S (lb/MWh)*	S lb	Total (lbs)	Total (Tons)
Andrews	0.000004	1.740	0.000023	4.897	0.003900	130.146	0.000000	0.019	136.8028	0.0684
Atascosa	0.000204	94.703	0.000014	2.930	0.000001	0.022	0.001627	130.854	228.5091	0.1143
Bastrop	0.003378	1,570.200	0.000228	48.577	0.000011	0.367	0.026980	2,169.605	3788.7491	1.8944
Bexar	0.013891	6,456.359	0.000937	199.738	0.000045	1.510	0.110936	8,920.999	15578.6051	7.7893
Bosque	0.002220	1,032.054	0.013621	2,904.167	0.000658	21.954	0.000139	11.175	3969.3500	1.9847
Brazoria	0.056203	26,123.269	0.000007	1.520	0.000000	0.011	0.000527	42.342	26167.1433	13.0836
Brazos	0.002409	1,119.647	0.011231	2,394.456	0.000542	18.101	0.004783	384.623	3916.8262	1.9584
Calhoun	0.000947	439.972	0.000064	13.611	0.000003	0.103	0.007560	607.926	1061.6125	0.5308
Cameron	0.006354	2,953.170	0.000429	91.361	0.000021	0.691	0.050742	4,080.508	7125.7301	3.5629
Chambers	0.020450	9,505.171	0.000003	0.553	0.000000	0.004	0.000192	15.407	9521.1349	4.7606
Cherokee	0.002739	1,273.160	0.016803	3,582.633	0.000812	27.083	0.000171	13.786	4896.6619	2.4483
Coke	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.0000	0.0000
Collin	0.001293	601.065	0.007933	1,691.378	0.000383	12.786	0.000081	6.508	2311.7371	1.1559
Dallas	0.002483	1,153.917	0.015230	3,247.086	0.000736	24.546	0.000155	12.495	4438.0449	2.2190
Denton	0.000127	58.873	0.000777	165.667	0.000038	1.252	0.000008	0.637	226.4306	0.1132
Ector	0.001922	893.118	0.000660	140.794	0.091135	3,041.027	0.014653	1,178.311	5253.2503	2.6266
Ellis	0.002992	1,390.679	0.018354	3,913.326	0.000887	29.583	0.000187	15.059	5348.6469	2.6743
Fannin	0.000004	1.885	0.000025	5.304	0.000001	0.040	0.000000	0.020	7.2488	0.0036
Fayette	0.005187	2,410.781	0.010322	2,200.682	0.000499	16.636	0.028399	2,283.760	6911.8595	3.4559
Fort Bend	0.031346	14,569.784	0.000004	0.848	0.000000	0.006	0.000294	23.616	14594.2536	7.2971
Freestone	0.004764	2,214.467	0.029227	6,231.438	0.001412	47.106	0.000298	23.979	8516.9894	4.2585
Frio	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.0000	0.0000
Galveston	0.022662	10,533.291	0.000003	0.613	0.000000	0.005	0.000212	17.073	10550.9817	5.2755
Goliad	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.0000	0.0000
Grimes	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.0000	0.0000
Guadalupe	0.003203	1,488.704	0.000216	46.055	0.000010	0.348	0.025579	2,057.000	3592.1074	1.7961
Harris	0.148691	69,111.694	0.000019	4.022	0.000001	0.030	0.001393	112.021	69227.7678	34.6139
Hays	0.000833	387.239	0.000056	11.980	0.000003	0.091	0.006654	535.062	934.3715	0.4672
Henderson	0.000691	321.073	0.004238	903.489	0.000205	6.830	0.000043	3.477	1234.8689	0.6174
Hidalgo	0.005372	2,496.710	0.000362	77.240	0.000017	0.584	0.042899	3,449.801	6024.3347	3.0122
Hood	0.005077	2,359.836	0.031145	6,640.503	0.001504	50.199	0.000318	25.553	9076.0903	4.5380
Howard	0.000241	112.072	0.000764	162.907	0.128394	4,284.322	0.000949	76.314	4635.6151	2.3178
Hunt	0.008846	4,111.780	0.004707	1,003.501	0.000227	7.586	0.065282	5,249.745	10372.6119	5.1863
Jack	0.003078	1,430.801	0.018884	4,026.229	0.000912	30.436	0.000193	15.493	5502.9592	2.7515
Johnson	0.000726	337.259	0.004451	949.035	0.000215	7.174	0.000045	3.652	1297.1199	0.6486
Kaufman	0.005972	2,775.718	0.036634	7,810.780	0.001769	59.045	0.000374	30.056	10675.5988	5.3378
Lamar	0.004000	1,859.268	0.024539	5,231.919	0.001185	39.551	0.000250	20.133	7150.8695	3.5754
Limestone	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.0000	0.0000
Llano	0.004031	1,873.818	0.000272	57.970	0.000013	0.438	0.032197	2,589.127	4521.3529	2.2607
McLennan	0.005658	2,629.665	0.034707	7,399.793	0.001676	55.939	0.000354	28.475	10113.8712	5.0569
Milam	0.001269	589.649	0.000086	18.242	0.000004	0.138	0.010132	814.740	1422.7685	0.7114
Mitchell	0.000031	14.469	0.000191	40.714	0.032426	1,082.006	0.000002	0.157	1137.3460	0.5687
Nolan	0.000029	13.598	0.000179	38.264	0.030474	1,016.888	0.000002	0.147	1068.8972	0.5344
Nueces	0.012858	5,976.301	0.000867	184.886	0.000042	1.398	0.102687	8,257.684	14420.2686	7.2101
Palo Pinto	0.003613	1,679.295	0.022164	4,725.483	0.001071	35.722	0.000226	18.184	6458.6840	3.2293
Parker	0.000001	0.571	0.000008	1.608	0.000000	0.012	0.000000	0.006	2.1980	0.0011
Pecos	0.000002	0.916	0.000012	2.577	0.002052	68.473	0.000000	0.010	71.9753	0.0360
Reagan	0.000006	2.751	0.000036	7.742	0.006166	205.744	0.000000	0.030	216.2668	0.1081
Robertson	0.003951	1,836.228	0.005575	1,188.745	0.000269	8.986	0.024617	1,979.599	5013.5587	2.5068
Rusk	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.0000	0.0000
San Patricio	0.001510	701.827	0.000102	21.712	0.000005	0.164	0.012059	969.741	1693.4447	0.8467
Scurry	0.000027	12.461	0.000164	35.064	0.027926	931.838	0.000002	0.135	979.4977	0.4897
Tarrant	0.000474	220.400	0.002909	620.199	0.000141	4.688	0.000030	2.387	847.6746	0.4238
Titus	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.0000	0.0000
Travis	0.005179	2,406.985	0.000349	74.464	0.000017	0.563	0.041358	3,325.824	5807.8359	2.9039
Upton	0.000003	1.182	0.000016	3.327	0.002649	88.408	0.000000	0.013	92.9292	0.0465
Victoria	0.002119	984.984	0.000143	30.472	0.000007	0.230	0.016924	1,360.991	2376.6777	1.1883
Ward	0.000200	92.737	0.001224	260.958	0.207834	6,935.095	0.000012	1.004	7289.7940	3.6449
Webb	0.004202	1,952.964	0.000283	60.418	0.000014	0.457	0.033557	2,698.485	4712.3240	2.3562
Wharton	0.002110	980.503	0.000142	30.333	0.000007	0.229	0.016847	1,354.798	2365.8632	1.1829
Wichita	0.000012	5.631	0.000074	15.845	0.012619	421.077	0.000001	0.061	442.6130	0.2213
Wilbarger	0.017971	8,352.932	0.110243	23,504.881	0.005325	177.685	0.001125	90.447	32125.9453	16.0630
Wise	0.001020	474.180	0.006258	1,334.328	0.000302	10.087	0.000064	5.135	1823.7299	0.9119
Young	0.007105	3,302.593	0.043588	9,293.391	0.002105	70.253	0.000445	35.761	12701.9989	6.3510
Total	**0.441687**	**205,296.100**	**0.481501**	**102,660.654**	**0.568671**	**18,975.696**	**0.684564**	**55,049.947**	**381,982.398**	**190.99120**
Energy Savings (MWh)	437,747.6		200,800.3		31,426.4		75,735.6			
Total Energy Savings (MWh)	745,709.8									
% T&D Loss	6.18	%								

* (lb/MWh) are pounds of NOx reduced from one megawatt-hour of electricity savings in that CM Zone.
(lb) are mass of projected NOx emissions reductions from multiplying the total energy savings for the CM Zone at the bottom of the chart by the (lb/MWh) factor in the column to the left.

Table 5-7: Distribution of the Emission Reductions per CM Zone for each County (Year 2015)

County	CM Zones: H (lb/MWh)*	H lb	N (lb/MWh)*	N lb	W (lb/MWh)*	W lb	S (lb/MWh)*	S lb	Total (lbs)	Total (Tons)
Andrews	0.000004	3.596	0.000023	15.655	0.003900	417.998	0.000000	0.035	437.2851	0.2186
Atascosa	0.000202	194.058	0.000014	9.287	0.000001	0.071	0.001614	242.418	445.8337	0.2229
Bastrop	0.003350	3217.538	0.000226	153.981	0.000011	1.169	0.026753	4019.366	7392.0548	3.6960
Bexar	0.013774	13229.894	0.000929	633.142	0.000045	4.809	0.110002	16526.858	30394.7029	15.1974
Bosque	0.002149	2064.419	0.013185	8986.465	0.000637	68.252	0.000135	20.210	11139.3454	5.5697
Brazoria	0.052595	50518.480	0.001053	717.602	0.000051	5.450	0.000068	10.223	51251.7555	25.6259
Brazos	0.002346	2252.898	0.010872	7409.883	0.000525	56.278	0.004740	712.139	10431.1973	5.2156
Calhoun	0.000939	901.558	0.000063	43.146	0.000003	0.328	0.007496	1126.232	2071.2635	1.0356
Cameron	0.006300	6051.418	0.000425	289.602	0.000021	2.200	0.050315	7559.466	13902.6855	6.9513
Chambers	0.019075	18321.635	0.000002	1.649	0.000000	0.013	0.000179	26.849	18350.1453	9.1751
Cherokee	0.002651	2546.704	0.016265	11085.866	0.000786	84.196	0.000166	24.931	13741.6977	6.8708
Coke	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.0000	0.0000
Collin	0.001252	1202.311	0.007679	5233.689	0.000371	39.750	0.000078	11.770	6487.5200	3.2438
Dallas	0.002403	2308.182	0.014742	10047.574	0.000712	76.311	0.000150	22.596	12454.6625	6.2273
Denton	0.000123	117.764	0.000752	512.631	0.000036	3.893	0.000008	1.153	635.4412	0.3177
Ector	0.001906	1830.818	0.000659	449.376	0.091135	9767.029	0.014529	2182.922	14230.1454	7.1151
Ellis	0.002896	2781.777	0.017766	12109.144	0.000858	91.968	0.000181	27.232	15010.1212	7.5051
Fannin	0.000004	3.770	0.000024	16.411	0.000001	0.125	0.000000	0.037	20.3426	0.0102
Fayette	0.005104	4902.695	0.009997	6813.496	0.000483	51.748	0.028158	4230.482	15998.4210	7.9992
Fort Bend	0.029238	28083.898	0.000004	2.528	0.000000	0.019	0.000274	41.154	28127.6000	14.0638
Freestone	0.004612	4429.600	0.028290	19282.157	0.001366	146.447	0.000289	43.364	23901.5672	11.9508
Frio	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.0000	0.0000
Galveston	0.021138	20303.381	0.000003	1.828	0.000000	0.014	0.000198	29.753	20334.9758	10.1675
Goliad	0.017491	16800.188	0.000002	1.512	0.000000	0.011	0.000164	24.619	16826.3314	8.4132
Grimes	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.0000	0.0000
Guadalupe	0.003176	3050.543	0.000214	145.990	0.000010	1.109	0.025364	3810.755	7008.3963	3.5042
Harris	0.138692	133215.829	0.000018	11.993	0.000001	0.091	0.001299	195.215	133423.1280	66.7116
Hays	0.000826	793.501	0.000056	37.975	0.000003	0.288	0.006598	991.246	1823.0094	0.9115
Henderson	0.000669	642.243	0.004102	2795.699	0.000198	21.233	0.000042	6.287	3465.4619	1.7327
Hidalgo	0.005326	5116.075	0.000359	244.840	0.000017	1.860	0.042538	6391.029	11753.8035	5.8769
Hood	0.004914	4720.382	0.030147	20547.941	0.001456	156.060	0.000308	46.211	25470.5944	12.7353
Howard	0.000240	230.645	0.000764	520.730	0.128394	13760.193	0.000941	141.388	14652.9560	7.3265
Hunt	0.008756	8410.184	0.004569	3114.040	0.000221	23.651	0.064732	9725.418	21273.2926	10.6366
Jack	0.002980	2862.033	0.018279	12458.501	0.000883	94.621	0.000186	28.018	15443.1741	7.7216
Johnson	0.000702	674.619	0.004309	2936.633	0.000208	22.304	0.000044	6.604	3640.1592	1.8201
Kaufman	0.005781	5552.271	0.035460	24169.171	0.001713	183.563	0.000362	54.354	29959.3589	14.9797
Lamar	0.003872	3719.095	0.023753	16189.311	0.001147	122.957	0.000242	36.408	20067.7705	10.0339
Limestone	0.000172	164.730	0.001052	717.073	0.000051	5.446	0.000011	1.613	888.8621	0.4444
Llano	0.003998	3839.690	0.000270	183.756	0.000013	1.396	0.031926	4796.563	8821.4046	4.4107
McLennan	0.009476	9101.765	0.033595	22897.785	0.001623	173.907	0.000380	57.124	32230.5814	16.1153
Milam	0.001258	1208.265	0.000085	57.824	0.000004	0.439	0.010046	1509.371	2775.8985	1.3879
Mitchell	0.000031	29.900	0.000191	130.154	0.032426	3475.139	0.000002	0.293	3635.4857	1.8177
Nolan	0.000029	28.100	0.000179	122.321	0.030474	3265.995	0.000002	0.275	3416.6916	1.7083
Nueces	0.012750	12246.195	0.000860	586.065	0.000042	4.451	0.101823	15298.015	28134.7255	14.0674
Palo Pinto	0.003497	3359.096	0.021453	14622.228	0.001036	111.055	0.000219	32.884	18125.2628	9.0626
Parker	0.000001	1.143	0.000007	4.976	0.000000	0.038	0.000000	0.011	6.1682	0.0031
Pecos	0.000002	1.892	0.000012	8.237	0.002052	219.919	0.000000	0.019	230.0664	0.1150
Reagan	0.000006	5.685	0.000036	24.749	0.006166	660.799	0.000000	0.056	691.2891	0.3456
Robertson	0.003897	3742.805	0.005402	3681.717	0.000261	27.962	0.024409	3667.169	11119.6535	5.5598
Rusk	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.0000	0.0000
San Patricio	0.001497	1438.132	0.000101	68.825	0.000005	0.523	0.011958	1796.523	3304.0024	1.6520
Scurry	0.000027	25.750	0.000164	112.091	0.027926	2992.837	0.000002	0.252	3130.9295	1.5655
Tarrant	0.000459	440.867	0.002816	1919.105	0.000136	14.575	0.000029	4.316	2378.8630	1.1894
Titus	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.0000	0.0000
Travis	0.005135	4932.217	0.000346	236.041	0.000017	1.793	0.041010	6161.353	11331.4027	5.6657
Upton	0.000003	2.443	0.000016	10.635	0.002649	283.943	0.000000	0.024	297.0448	0.1485
Victoria	0.002101	2018.358	0.000142	96.592	0.000007	0.734	0.016782	2521.343	4637.0270	2.3185
Ward	0.000200	191.642	0.001224	834.220	0.207834	22273.828	0.000012	1.876	23301.5659	11.6508
Webb	0.004166	4001.870	0.000281	191.517	0.000014	1.455	0.033274	4999.158	9193.9994	4.5970
Wharton	0.002092	2009.174	0.000141	96.153	0.000007	0.730	0.016706	2509.871	4615.9274	2.3080
Wichita	0.000012	11.636	0.000074	50.651	0.012619	1352.396	0.000001	0.114	1414.7965	0.7074
Wilbarger	0.017395	16708.378	0.106711	72731.982	0.005154	552.394	0.001089	163.568	90156.3224	45.0782
Wise	0.000987	948.503	0.006058	4128.859	0.000293	31.358	0.000062	9.285	5118.0059	2.5590
Young	0.006878	6606.181	0.042191	28756.867	0.002038	218.406	0.000430	64.672	35646.1265	17.8231
Total	**0.441552**	**424118.419**	**0.468411**	**319259.869**	**0.568038**	**60877.526**	**0.678325**	**101912.488**	**906,168.302**	**453.08415**
Energy Savings (MWh)	904,611.9		641,911.0		100,933.8		141,496.8			

Total Energy Savings (MWh)	1,788,953.5
% T&D Loss	6.18 %

* (lb/MWh) are pounds of NOx reduced from one megawatt-hour of electricity savings in that CM Zone.
(lb) are mass of projected NOx emissions reductions from multiplying the total energy savings for the CM Zone at the bottom of the chart by the (lb/MWh) factor in the column to the left.

6 OTHER RENEWABLE SOURCES

Renewable energy projects throughout the state of Texas were found to determine NOx emissions reduction. Five specific categories were determined to base the search in—including solar photovoltaic, solar thermal, geothermal, hydroelectric, and landfill gas-fired power plants. The criterion for each project to be included in the data collection was that the installation date was after the year 2000 and the project was installed within the state of Texas. However, projects installed before the year 2000 were also included in order to provide a complete record.

6.1 Implementation

As previously reported, this is an updated version of the earlier report published in July 2007. Many newly-located and renewable-energy projects are included in this section in the five main categories.

The information was collected using the following modes:

- Information from the internet: websites of environmental agencies like ERCOT, EIA, NREL which publish information that is available to the general public;
- Information from the websites of manufacturers, distributors, consultants related with renewable energy products; and
- Some information was collected by personally emailing individuals, who were either manufacturers, distributors, or consultants.

It was essentially the same methodology/protocol followed for data collection used in the previous report. In most cases, the information obtained was very limited. They did not contain some system specification data. Therefore, we contacted manufacturers, consultants, and distributors or officers in environmental agencies to collect more information; their responses are also included. Table 6-1 shows the number of new projects in each category that are added in this report.

6.2 Renewable Energy Projects

6.2.1 Solar Photovoltaic

From the website of “Soltrex” details of about 16 new solar photo voltaic projects were obtained. The website of Soltrex is the main source of information since it provides all detailed specifications of each of the projects monitored. Some other websites like SECO seem to provide system specification data, they turn out to be links to the Soltrex website in the end.

The website of the company “Meridian Solar” reports about 56 new projects. This website provides only information like capacity and location

Apart from these sources another website of a company, ”Standard Renewable Energy” reports about 47 projects installed in the state of Texas with only the important details like capacity and location . The website of “South West Photo-Voltaic” reported one new project

However, the information provided in the website of Soltrex and Standard Renewable energy was limited and insufficient for emission reduction calculations.

The number of projects per county is presented in Figure 6-1. A summary of the different projects and their outputs of ESL’s emissions calculator (*e*CALC) can be found in Table 6-2 and Table 6-3, respectively. The annual and OSD electric savings per county, due to these projects, are presented in Figure 6-6 and Figure 6-7, and the corresponding emissions reductions are shown in Figure 6-8 and Figure 6-9.

6.2.2 Solar Thermal

Apart from the projects reported by Techsun solar, which were included in the previous report, we were able to locate six more projects for this year's report. The source of information is a solar heating equipment manufacturer – "Alternative Power Solutions." Their website provided some case studies which are included in this information.

The number of projects collected per county is presented in Figure 6-2. A summary of the different projects and their outputs from *e*CALC can be found in Table 6-4 and Table 6-5, respectively. The annual and OSD electric savings per county, due to these projects, are presented in Figure 6-10 and Figure 6-11, and the respective emission reductions are shown in Figure 6-12 and Figure 6-13. The special projects for parabolic solar concentrators are listed in Table 6-6.

6.2.3 Hydroelectric

Apart from the 45 projects reported in the previous report no new projects were identified as far as Hydro electric power plants are concerned. No new hydro electric projects were installed in the state of Texas after the year 2000.

All of the hydroelectric projects located, and their information, are presented in Table 6-7. A Texas map, which shows the location of the different projects per county, is located in Figure 6-3.

6.2.4 Geothermal

Information provided by "Image Engineering Group," a consultant group, details about 120 different geothermal heat pump projects installed in the state of Texas in different schools and organizations. They have been listed in Table 6-8. However, in-depth details were not available.

Mr. Don Penn, of Image Engineering Group was contacted via email for additional details, through a reference from Dr. Greg Tinkler, a consulting engineer with RLB Consulting Engineers. Mr. Penn kindly responded to our queries in time and provided us with a detailed spread sheet listing out all the projects done by the company and included details like capacity, location area covered etc. These additional details have been updated for about 75 projects reported in the last report. The spread sheet also listed some 24 new projects and the details which have been included in this updated report.

Also, FHP manufacturing, a geothermal heat pump manufacturer, provides information about some 50 different projects installed in the state of Texas—this information was also included in the report.

The resulting information can be found in Table 6-8 with a corresponding map in Figure 6-4 which shows the number of projects in different counties.

6.2.5 Landfill Gas-Fired Power Plants

The Environmental Protection Agency (EPA) has a project data base for Landfill Methane Outreach Program (LMOP). This formed the main source of information for the previous report. We were unable to locate any new projects for this report.

The implemented, candidate and potential projects are listed in Table 6-9, Table 6-10, and Table 6-11**,** respectively. Figure 6-5 shows the location of these operational projects implemented throughout Texas.

6.3 Results

We were able to considerably increase the number of renewable energy projects identified in the state of Texas. Some141 new projects were identified, located, and included in this report (which were not included in the 2008 annual report)—the details are presented in Table 6-1. This report also updates the details of about 75 geothermal projects, which were reported in the previous report. The emission reduction calculations presented in the previous report were also included in this report.

Table 6-1: New Projects Added in This Report

Renewable Energy Source	No of New Projects identified and reported in May 2009
Solar Photo-Voltaic	114
Solar Thermal	3
Land fill gas	0
Hydro-Electric	0
Geothermal	24

6.4 References

Useful information was obtained from the following websites:

- http://www.soltrex.com/systems.cfm?state=tx
- http://www.meridiansolar.com/portfolio_commercial/commerical.html
- http://www.sre3.com/projectGallery.jsp
- http://www.sre3.com/index.jsp
- http://apowersolutions.com/pdf/Commercial%20Solar%20Pool%20Heating%20Case%20Studies.pdf
- http://www.eia.doe.gov/cneaf/electricity/page/eia860.html
- http://www.iegltd.com/project.refer.geo.master.pdf
- http://www.iegltd.com/html/information.html
- http://geoheat.oit.edu/state/tx/tx.htm
- http://data.memberclicks.com/site/treia/Maria_RichardsSchools.pdf
- http://www.southwestpv.com/SolarSite/SolarSiteMain.aspx
- http://www.fhp-mfg.com/

Table 6-2: Solar Photovoltaic Cell Projects: Data and Information

Project No	Solar Project	City/Town	County	County for ECALC	Date	PV Modules	Capacity (kW)	Total Area (sqft)	Slope	Azimuth (South=180)
1	Giddings Middle School	Giddings, TX	Lee	Bastrop	Jun-05	GE Energy GEPV-050-M	1	121.4	30	180
2	La Grange Intermediate School	La Grange, TX	Fayette	Bastrop	May-05	GE Energy GEPV-050-M	1	121.4	30	180
3	Schulenburg Elementary School	Schulenburg, TX	Fayette	Bastrop	Jun-05	GE Energy GEPV-050-M	1	121.4	30	180
4	Smithville Junior High School	Smithville, TX	Bastrop	Bastrop	Jun-05	GE Energy GEPV-050-M	1	121.4	30	180
5	Bastrop Intermediate School	Bastrop, TX	Bastrop	Bastrop	May-07	Sharp Electronics NE-170-U1	1.02	84	35	180
6	Eagle Pass High School - CC Winn Campus	Eagle Pass, TX	Maverick	Bexar	Feb-02	Siemens SP 75	0.9	81.84	25	180
7	East Central ISD	San Antonio, TX	Bexar	Bexar	Nov-03	Shell SP-140-PC	1.12	113.92	60	180
8	James Madison High School	San Antonio, TX	Bexar	Bexar	Feb-02	Siemens SP 75	0.9	81.84	25	180
9	John Jay High School	San Antonio, TX	Bexar	Bexar	Dec-01	Siemens SP 75	0.9	81.84	60	180
10	Roosevelt High School	San Antonio, TX	Bexar	Bexar	Mar-04	Shell SP140PC	1.12	113.92	30	180
11	Utopia ISD	Utopia, TX	Uvalde	Bexar	Jun-05	GE Energy GEPV-050-M	1	121.4	30	180
12	City Public Services of San Antonio, Northsid	San Antonio, TX	Bexar	Bexar	Jul-02	MSX-120	17.28	1699.2	30*	180*
13	Del Rio High School	Del Rio, TX	Kinney	Bexar	Jul-99	ASE Americas ASE-300-DG/50	4.56	418.08	25	180
14	Kendall Elementary School	Boerne, TX	Kendall	Bexar	Apr-07	Sharp Electronics NE-170-U2	1.02	84	35	180
15	Uvalde Junior High School	Uvalde, TX	Uvalde	Bexar	Jul-99	ASE Americas ASE-300-DG/50	4.56	418.08	25	180
16	City Public Services Primary Control Center	San Antonio, TX	Bexar	Bexar	Jun-04	BP MSX-120	17.28	1699.2	30*	N/A
17	Institute of Texan Cultures	San Antonio, TX	Bexar	Bexar	N/A	N/A	15	N/A	N/A	N/A
18	Ft. Sam Houston Bldg. 1350	San Antonio, TX	Bexar	Bexar	Apr-06	N/A	181	N/A	N/A	N/A
19	Bexar County Jail Annex	San Antonio, TX	Bexar	Bexar	N/A	N/A	N/A	N/A	N/A	N/A
20	Alvin High School	Alvin, TX	Brazoria	Brazoria	Nov-03	Shell SP-140-PC	1.12	113.92	30	180
21	El Campo Middle School	El Campo, TX	Wharton	Brazoria	Jul-99	ASE Americas ASE-300-DG/50	4.56	418.08	25	180
22	Bluebonnet Elementary School	Lockhart, TX	Caldwell	Caldwell	Jul-05	GE Energy GEPV-050-M	1	121.4	30	180
23	Flatonia Elementary School	Flatonia, TX	Gonzales	Caldwell	May-07	Sharp Electronics NE-170-U1	1.02	84	35	180

Table 6-2: Solar Photovoltaic Cell Projects: Data and Information (cont.)

Project No	Solar Project	City/Town	County	County for ECALC	Date	PV Modules	Capacity (kW)	Total Area (sqft)	Slope	Azimuth (South=180)
24	Waelder ISD	Waelder, TX	Gonzales	Caldwell	May-07	Sharp Electronics NE-170-U5	1.02	64.08	35	180
25	Blue Ridge ISD	Blue Ridge, TX	Collin	Collin	Oct-03	Siemens SP 75	0.9	81.84	25	180
26	McKinney Green Building	McKinney, TX	Collin	Collin	Mar-06	ASE-300-DG-FT	45	3749.76	30*	N/A
27	Canyon High School	New Braunfels, TX	Comal	Comal	Feb-04	Shell SP140PC	1.12	113.92	20	230
28	Dallas ISD Environmental Education Center	Seagoville, TX	Dallas	Dallas	Feb-04	Shell Solar SP140PC	1.12	113.92	30	180
29	The Winston School	Dallas, TX	Dallas	Dallas	N/A	BP XXXXXXX	71	N/A	0	N/A
30	Childress High School	Childress, TX	Childress	Denton	Jul-99	ASE Americas ASE-300-DG/50	4.56	418.08	25	180
31	Cordova Middle School	El Paso, TX	El Paso	El Paso	Jan-03	Shell SP140PC	1.12	113.92	25	180
32	Gene Roddenberry Planetarium	El Paso, TX	El Paso	El Paso	Jun-02	4-kW ASE SunSine AC	3.42	313.44	25	180
33	Monahans High School	Monahans, TX	Ward	El Paso	Dec-01	Siemens SP 75	0.9	81.84	60	180
34	Presidio High School	Presidio, TX	Presidio	El Paso	Dec-99	ASE Americas ASE-300-DG/50	4.56	418.08	25	180
35	Weimar High School	Weimar, TX	Colorado	Fort Bend	May-05	GE Energy GEPV-050-M	1	121.4	30	180
36	Univeresity of Texas Medical Branch at Galveston	Galveston, TX	Galveston	Galveston	Mar-02	Solarex SX-80U	19.2	1892.88	30*	180*
37	Pine Tree Junior High School	Longview, TX	Gregg	Gregg	Mar-00	ASE Americas ASE-300-DG/50	4.56	417.92	25	180
38	Marion Middle School	Marion, TX	Guadalupe	Guadalupe	May-05	GE Energy GEPV-050-M	1	121.4	30	180
39	Seabrook Intermediate School	Seabrook, TX	Harris	Harris	Nov-03	Shell SP-140-PC	1.12	113.92	60	180
40	NASA Johnson Space Center	Houston, TX	Harris	Harris	Oct-04	MSX-121	9.72	955.8	30*	180*
41	UT Health Science Center	Houston, TX	Harris	Harris	Feb-00	Solarex SJ-7500	1.5	271	30*	180*
42	Aircraft Obstruction Light	Houston, TX	Harris	Harris	N/A	SX65U	N/A	162.6	30*	180*
43	Learning Center at Sheldon Lake State Park	Houston, TX	Harris	Harris	N/A	BP Solar	170	108.4	40	180*
44	Learning Center at Sheldon Lake State Park	Houston, TX	Harris	Harris	N/A	N/A	N/A	81.3	25	180*
45	Hempstead Middle School	Hempstead, TX	Washington	Harris	Apr-07	Sharp Electronics NE-170-U1	1.02	84	35	180
46	Houston Ship Channel	Houston, TX	Harris	Harris	Sep-00	BP SX65U	0.78	72	30*	N/A

Table 6-2: Solar Photovoltaic Cell Projects: Data and Information (cont.)

Project No	Solar Project	City/Town	County	County for ECALC	Date	PV Modules	Capacity(kW)	Total Area (sqft)	Slope	Azimuth (South=180)
47	La Grange Intermediate School	La Grange, TX	Fayette	Bastrop	05/01/05	GE Energy GEPV-050-M	1	6.07	30	180
48	Weimar High School	Weimar, TX	Colorado	Fort Bend	5/5/2008	GE Energy GEPV-050-M	1	121.4	30	180
49	Marion Middle School	Marion, TX	Guadalupe	Guadalupe	5/5/2008	GE Energy GEPV-050-M	1	121.4	30	180
50	Giddings Middle School	Giddings, TX	Lee	Bastrop	6/5/2008	GE Energy GEPV-050-M	1	121.4	30	180
51	Schulenburg Elementary School	Schulenburg, TX	Fayette	Bastrop	6/5/2008	GE Energy GEPV-050-M	1	121.4	30	180
52	Smithville Junior High School	Smithville, TX	Bastrop	Bastrop	6/5/2008	GE Energy GEPV-050-M	1	121.4	30	180
53	Utopia ISD	Utopia, TX	Uvalde	Bexar	6/5/2008	GE Energy GEPV-050-M	1	121.4	30	180
54	Brenham Middle School	Brenham, TX	Washington	Montgomery	6/5/2008	GE Energy GEPV-050-M	1	121.4	30	180
55	Cuero Junior High School	Cuero, TX	DeWitt	Victoria	6/5/2008	GE Energy GEPV-050-M	1	121.4	30	180
56	Bluebonnet Elementary School	Lockhart, TX	Caldwell	Caldwell	7/5/2008	GE Energy GEPV-050-M	1	121.4	30	180
57	McKinney Green Building	McKinney, TX	Collin	Collin	3/6/2008	ASE-300-DG-FT	45	3749.76	30*	N/A
58	Ft. Sam Houston Bldg. 1350	San Antonio, TX	Bexar	Bexar	4/6/2008	N/A	181	N/A	N/A	N/A
59	Bedichek Middle Shool	Austin, TX	Travis	Travis	10/6/2008	Sharp ND-L3EJEA	4.059	352.44	30	180
60	Blanton Elementary School	Austin, TX	Travis	Travis	10/6/2008	Sharp ND-L3EJEA	4.059	352.44	30	180
61	Cunningham elementary School	Austin, TX	Travis	Travis	10/6/2008	Sharp ND-L3EJEA	4.059	352.44	30	180
62	Garza High School	Austin, TX	Travis	Travis	10/6/2008	Sharp ND-L3EJEA	4.059	352.44	30	180
63	Martin Middle School	Austin, TX	Travis	Travis	10/6/2008	Sharp ND-L3EJEA	4.059	352.44	30	180
64	Murchison Middle School	Austin, TX	Travis	Travis	10/6/2008	Sharp ND-L3EJEA	4.059	352.44	30	180
65	O'Henry Middle School	Austin, TX	Travis	Travis	10/6/2008	Sharp ND-L3EJEA	4.059	352.44	30	180
66	Pond Springs Elementary School	Austin, TX	Travis	Travis	10/6/2008	Sharp ND-L3EJEA	4.059	352.44	30	180
67	Westwood High School	Austin, TX	Travis	Travis	10/6/2008	Sharp ND-L3EJEA	4.059	352.44	30	225
68	Zilker Elementary School	Austin TX	Travis	Travis	10/6/2008	Sharp ND-L3EJEA	4.059	352.44	30	180
69	Davis Elementary School	Round Rock, TX	Williamson	Williamson	10/6/2008	Sharp ND-L3EJEA	4.059	352.44	30	180

Table 6-2: Solar Photovoltaic Cell Projects: Data and Information (cont.)

Project No	Solar Project	City/Town	County	County for ECALC	Date	PV Modules	Capacity (kW)	Total Area (sqft)	Slope	Azimuth (South=180)
70	Bedichek Middle Shool	Austin, TX	Travis	Travis	Oct-06	Sharp ND-L3EJEA	4.059	352.44	30	180
71	Blanton Elementary School	Austin, TX	Travis	Travis	Oct-06	Sharp ND-L3EJEA	4.059	352.44	30	180
72	Cunningham elementary School	Austin, TX	Travis	Travis	Oct-06	Sharp ND-L3EJEA	4.059	352.44	30	180
73	Garza High School	Austin, TX	Travis	Travis	Oct-06	Sharp ND-L3EJEA	4.059	352.44	30	180
74	Harper School	Harper, TX	Gillespie	Travis	Mar-07	Sharp Electronics NE-170-U1	1.02	84	35	180
75	Llano Junior High School	Llano, TX	Llano	Travis	Apr-07	Sharp Electronics NE-170-U5	1.02	84	35	180
76	Martin Middle School	Austin, TX	Travis	Travis	Oct-06	Sharp ND-L3EJEA	4.059	352.44	30	180
77	Murchison Middle School	Austin, TX	Travis	Travis	Oct-06	Sharp ND-L3EJEA	4.059	352.44	30	180
78	O'Henry Middle School	Austin, TX	Travis	Travis	Oct-06	Sharp ND-L3EJEA	4.059	352.44	30	180
79	Pond Springs Elementary School	Austin, TX	Travis	Travis	Oct-06	Sharp ND-L3EJEA	4.059	352.44	30	180
80	San Marcos Electric Utility	San Marcos, TX	Travis	Travis	Apr-07	Sharp Electronics NE-170-U5	1.02	64.08	35	180
81	Sonora High School	Sonora, TX	Sutton	Travis	Dec-99	ASE Americas ASE-300-DG/50	4.56	418.08	15	220
82	Vliet Residence	Austin, TX	Travis	Travis	Jan-99	Siemens SP 75	1.8	163.92	20	260
83	Westwood High School	Austin, TX	Travis	Travis	Oct-06	Sharp ND-L3EJEA	4.059	352.44	30	225
84	Zilker Elementary School	Austin TX	Travis	Travis	Oct-06	Sharp ND-L3EJEA	4.059	352.44	30	180
85	Courtyard Tennis Club	Austin, TX	Travis	Travis	N/A	N/A	23	N/A	N/A	N/A
86	Escarpment Village	Austin, TX	Travis	Travis	N/A	N/A	7	N/A	N/A	N/A
87	IBM	Austin, TX	Travis	Travis	N/A	N/A	22	N/A	N/A	N/A
88	Hines Pool and Spa	Austin, TX	Travis	Travis	N/A	N/A	21	N/A	N/A	N/A
89	Centex Beverage Inc.	Austin, TX	Travis	Travis	N/A	N/A	22	N/A	N/A	N/A
90	Lake Austin Marina	Austin , TX	Travis	Travis	N/A	N/A	21	N/A	N/A	N/A
91	Habitat Suites	Austin, TX	Travis	Travis	N/A	N/A	17	N/A	N/A	N/A
92	Palmer events Center	Austin, TX	Travis	Travis	N/A	N/A	36	N/A	N/A	N/A

Table 6-2: Solar Photovoltaic Cell Projects: Data and Information (cont.)

Project No	Solar Project	City/Town	County	County for ECALC	Date	PV Modules	Capacity(kW)	Total Area (sqft)	Slope	Azimuth (South=180)
93	Hines Pool and Spa	Austin, TX	Travis	Travis	N/A	N/A	21	N/A	N/A	N/A
94	Centex Beverage Inc.	Austin, TX	Travis	Travis	N/A	N/A	22	N/A	N/A	N/A
95	Lake Austin Marina	Austin , TX	Travis	Travis	N/A	N/A	21	N/A	N/A	N/A
96	Habitat Suites	Austin, TX	Travis	Travis	N/A	N/A	17	N/A	N/A	N/A
97	Palmer events Center	Austin, TX	Travis	Travis	N/A	N/A	36	N/A	N/A	N/A
98	LCRA Environmental Laboratory	Austin, TX	Travis	Travis	N/A	N/A	22	N/A	N/A	N/A
99	Austin Bergstrom International Airport	Austin, TX	Travis	Travis	N/A	N/A	32	N/A	N/A	N/A
100	Sand Hill power Plant, Control Building	Austin, TX	Travis	Travis	N/A	N/A	15	N/A	N/A	N/A
101	Spring Terrace	Austin, TX	Travis	Travis	N/A	N/A	18	N/A	N/A	N/A
102	American YouthWorks	Austin, TX	Travis	Travis	N/A	N/A	21	N/A	N/A	N/A
103	Town Lake Trail Foundation	Austin, TX	Travis	Travis	N/A	N/A	0.5	N/A	N/A	N/A
104	Garden Terrace	Austin, TX	Travis	Travis	N/A	N/A	21	N/A	N/A	N/A
105	Vintage Creek learning Center	Austin, TX	Travis	Travis	N/A	N/A	11	N/A	N/A	N/A
106	Ebeneezer Baptist Church	Austin, TX	Travis	Travis	N/A	N/A	8.4	N/A	N/A	N/A
107	Sierra Ridge	Austin, TX	Travis	Travis	N/A	N/A	17	N/A	N/A	N/A
108	Westcave Preserve	Round Mountain, TX	Llano	Travis	N/A	N/A	1.7	N/A	N/A	N/A
109	St. Andrews Episcopal School	Austin, TX	Travis	Travis	N/A	N/A	22	N/A	N/A	N/A
110	St. Gabriel Catholic Church	Austin, TX	Travis	Travis	N/A	N/A	21	N/A	N/A	N/A
111	Hornsby Bend Birding Shelter	Austin, TX	Travis	Travis	N/A	N/A	0.3	N/A	N/A	N/A
112	Casa Verde	Austin, TX	Travis	Travis	N/A	N/A	1.5	N/A	N/A	N/A
113	Solar Powered Water Purification	Matagorda Island, TX	Calhoun	Victoria	N/A	BP585U	N/A	111.23	30*	180*
114	Austin Clint Small middle school	Austin TX	Travis	Travis	9/12/2008	Kyrocera 6T130	3.12	N/A	30	180
115	City Hall, Austin, Texas	Austin, TX	Travis	Travis	xxx-04	PROSOL (type-austin)***	9.74	894.3	30*	180*
116	Austin Dessau Elementary	Austin TX	Travis	Travis	9/12/2008	Kyrocera 6T130	3.12	N/A	30	180
117	Austin Gus Garcia Middle School	Austin TX	Travis	Travis	9/12/2008	Kyrocera 6T131	3.12	N/A	30	180
118	Austin Lake Travis Elementary	Austin TX	Travis	Travis	9/12/2008	Kyrocera 6T132	3.12	N/A	30	180

Table 6-2: Solar Photovoltaic Cell Projects: Data and Information (cont.)

Project No	Solar Project	City/Town	County	County for ECALC	Date	PV Modules	Capacity(kW)	Total Area (sqft)	Slope	Azimuth (South=180)
119	Austin Lake Travis High School	Austin TX	Travis	Travis	9/12/2008	Kyrocera 6T132	3.12	N/A	30	180
120	Greenville ISD Bowie elementary	Greenville, TX	Hunt		2/9/2009	Sharp NE170	4.08	336	32	180
121	Greenville ISD Carver elementary	Greenville, TX	Hunt		2/9/2009	Sharp NE170	4.08	336	32	180
122	Greenville ISD Crockett elementary	Greenville, TX	Hunt		2/9/2009	sharp SH170	4.08	336	32	180
123	Greenville ISDLamar elementary	Greenville, TX	Hunt		2/9/2009	sharp SH170	4.08	336	32	180
124	Greenville ISD Middle Sxhool	Greenville, TX	Hunt		2/9/2009	sharp SH170	4.08	336	32	180
125	Greenville ISD Travis Elementary	Greenville, TX	Hunt		2/9/2009	sharp SH170	4.08	336	32	180
126	Manor Middle Sxhool	Manor,TX	Travis	Travis	10/24/2007	Sharp NE170	1.02	84	35	180
127	McKinney Roughs Nature Center	Cedar Creek, TX	Henderon		3/24/2008	Sharp NE170	1.02	84	35	180
128	San Saba Middle School	San Saba, TX	San Saba		6/18/2007	Sharp NE170	1.02	84	35	180
	Note: (*) = Assumed									
129	Villas on 6th	Austin, TX	Travis	Travis	N/A	N/A	9.1	N/A	N/A	N/A
130	Installation for a an electronics equipment	Austin, TX	Travis	Travis	N/A	N/A	9.1	N/A	N/A	N/A
131	Solar Decathlon	Austin,TX	Travis	Travis	N/A	N/A	3.7	N/A	N/A	N/A
132	Bracken Cave	Bracken ,TX	Comal		N/A	N/A	0.5	N/A	N/A	N/A
133	Residential project #163 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
134	Residential project #157 by Meridian Energy	Plano, TX	Collin	Collin	N/A	N/A	2	N/A	N/A	N/A
135	Residential project #126 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	1.9	N/A	N/A	N/A
136	Residential project #224 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	1.75	N/A	30	115
137	Residential project #228 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3.34	N/A	15	210
138	Residential project #229 by Meridian Energy	Austin, TX	Travis	Travis	N/A	Sharp 167W	3.34	N/A	12	175
139	Residential project #233 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3.34	N/A	30	185
140	Residential project #234 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	6.68	N/A	15	120
141	Residential project #238 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	4	N/A	30	180
142	Residential project #243 by Meridian Energy	Austin, TX	Travis	Travis	N/A	sharp 165W	3.3	N/A	28	170
143	Residential project #246 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	2.7	N/A	28	170
144	Residential project #247 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	45	210

Table 6-2: Solar Photovoltaic Cell Projects: Data and Information (cont.)

Project No	Solar Project	City/Town	County	County for ECALC	Date	PV Modules	Capacity(kW)	Total Area (sqft)	Slope	Azimuth (South=180)
145	Residential project #252 by Meridian Energy	Austin, TX	Travis	Travis	N/A	sharp 170w	3.1	N/A	20	200
146	Residential project #268 by Meridian Energy	Austin, TX	Travis	Travis	N/A	sanyo 200w	3.2	N/A	25	210
147	Residential project #272 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3.1	N/A	20	200
148	Residential project #219 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
149	Residential project #221 by Meridian Energy	Del Valle, TX	Travis	Travis	N/A	N/A	3.1	N/A	N/A	N/A
150	Residential project #239 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3.1	N/A	N/A	N/A
151	Residential project #244 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
152	Residential project #256 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
153	Residential project #266 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
154	Residential project #281 by Meridian Energy	New Braunfels, TX	Guadalupe	Guadalupe	N/A	N/A	3	N/A	N/A	N/A
155	Residential project #289 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
156	Residential project #214 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
157	Residential project #212 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
158	Residential project #210 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
159	Residential project #208 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
160	Residential project #207 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
161	Residential project #206 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
162	Residential project #205 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	1	N/A	N/A	N/A
163	Residential project #204 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
164	Residential project #200 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
165	Residential project #195 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	2	N/A	N/A	N/A
166	Residential project #194 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
167	Residential project #192 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
168	Residential project #190 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
169	Residential project #188 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
170	Residential project #187 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	1.3	N/A	N/A	N/A

Table 6-2: Solar Photovoltaic Cell Projects: Data and Information (cont.)

Project No	Solar Project	City/Town	County	County for ECALC	Date	PV Modules	Capacity(kW)	Total Area (sqft)	Slope	Azimuth (South=180)
171	Residential project #184 by Meridian Energy	Frisco, TX	collin	collin	N/A	N/A	6	N/A	N/A	N/A
172	Residential project #183 by Meridian Energy	Spicewood, TX	Burnet		N/A	N/A	1.8	N/A	N/A	N/A
173	Residential project #181 by Meridian Energy	San Antonio, TX	Bexar	Bexar	N/A	N/A	3	N/A	N/A	N/A
174	Residential project #180 by Meridian Energy	Llano, TX	Llano		N/A	N/A	3	N/A	N/A	N/A
175	Residential project #165 by Meridian Energy	Blanco, TX	Blanco		N/A	N/A	1	N/A	N/A	N/A
176	Residential project #119 by Meridian Energy	Wimberly, TX	Hays		N/A	N/A	1.4	N/A	N/A	N/A
177	Residential project #102 by Meridian Energy	Mexia, TX	Limestone		N/A	N/A	1.5	N/A	N/A	N/A
178	Residential project #279 by Meridian Energy	Fischer, TX	Comal	Comal	N/A	N/A	6	N/A	N/A	N/A
179	Residential project #105 by Meridian Energy	Brenham, TX	Washington		N/A	N/A	3.2	N/A	N/A	N/A
180	Residential project #127 by Meridian Energy	Jonestown, TX	Travis	Travis	N/A	N/A	1.08	N/A	N/A	N/A
181	Residential project #161 by Meridian Energy	Alpine, TX	Brewster		N/A	N/A	3.96	N/A	N/A	N/A
182	Residential project #174 by Meridian Energy	Ft.Davis, TX	Jeff Davis		N/A	N/A	2.64	N/A	N/A	N/A
183	Residential project #162 by Meridian Energy	Spicewood, TX	Burnet		N/A	N/A	0.15	N/A	N/A	N/A
184	Residential project #160 by Meridian Energy	Elgin, TX	Travis	Travis	N/A	N/A	0.308	N/A	N/A	N/A
185	Tarrant regional water district	Ft Worth, TX	Travis		N/A	N/A	238	N/A	N/A	N/A
186	City of Austin, Service center# 5	Austin, TX	Travis	Travis	N/A	N/A	23.4	N/A	N/A	N/A
187	City of Austin, Service center# 6	Austin, TX	Travis	Travis	N/A	N/A	55900	N/A	N/A	N/A
188	City of Austin, fire station #27	Austin, TX	Travis	Travis	N/A	N/A	4.16	N/A	N/A	N/A
189	City of Austin, St.John's	Austin, TX	Travis	Travis	N/A	N/A	4.94	N/A	N/A	N/A
190	City of Austin, Far South Austin Public Health	Austin, TX	Travis	Travis	N/A	N/A	5.72	N/A	N/A	N/A
191	waco chamber of commerce building	Austin, TX	Travis	Travis	N/A	N/A	9.6	N/A	N/A	N/A
192	Houston Code Building	Houston, TX	Harris	Harris	N/A	N/A	6.6	N/A	N/A	N/A
193	city of houston annex building	Houston, TX	Harris	Harris	N/A	N/A	6.6	N/A	N/A	N/A
194	Kirby junior high school, Wichita falls	Wichita Falls, TX	Wichita		N/A	N/A	1	N/A	N/A	N/A
195	Garnell Construction	Wichita Falls, TX	Wichita		N/A	N/A	4.2	N/A	N/A	N/A
196	Green Builders	Austin, TX	Travis	Travis	N/A	N/A	2.8	N/A	N/A	N/A

Table 6-2: Solar Photovoltaic Cell Projects: Data and Information (cont.)

Project No	Solar Project	City/Town	County	County for ECALC	Date	PV Modules	Capacity(kW)	Total Area (sqft)	Slope	Azimuth (South=180)
197	Green Builders	Austin, TX	Travis	Travis	N/A	N/A	1.6	N/A	N/A	N/A
198	Children's museum of Houston	Houston, TX	Harris	Harris	N/A	N/A	8.8	N/A	N/A	N/A
199	Chipotle Mexican Grill	Austin, TX	Travis	Travis	N/A	N/A	3.2	N/A	N/A	N/A
200	Discovery Green	Houston, TX	Harris	Harris	N/A	N/A	49.9	N/A	N/A	N/A
201	Jason's Deli	Austin, TX	Travis	Travis	N/A	N/A	8.8	N/A	N/A	N/A
202	Tejas securities building	Austin, TX	Travis	Travis	N/A	N/A	22.4	N/A	N/A	N/A
203	Jason's Deli	Beaumont, TX	Jefferson		N/A	N/A	7.7	N/A	N/A	N/A
204	Chipotle Mexican Grill	Austin, TX	Travis	Travis	N/A	N/A	3.8	N/A	N/A	N/A
205	Residential project by Standard Renewable Energy	Dallas, TX	Dallas	Dallas	N/A	N/A	3.5	N/A	N/A	N/A
206	Residential project by Standard Renewable Energy	Carrollton, TX	Denton		N/A	N/A	2	N/A	N/A	N/A
207	Residential project by Standard Renewable Energy	Galveston, TX	Galveston		N/A	N/A	3.8	N/A	N/A	N/A
208	Residential project by Standard Renewable Energy	Austin, TX	Travis	Travis	N/A	N/A	3.1	N/A	N/A	N/A
209	Residential project by Standard Renewable Energy	Bellaire, TX	Harris		N/A	N/A	3.2	N/A	N/A	N/A
210	Residential project by Standard Renewable Energy	Austin, TX	Travis	Travis	N/A	N/A	3.1	N/A	N/A	N/A
211	Residential project by Standard Renewable Energy	Austin, TX	Travis	Travis	N/A	N/A	3.2	N/A	N/A	N/A
212	Residential project by Standard Renewable Energy	Galveston, TX	Galveston		N/A	N/A	3.2	N/A	N/A	N/A
213	Residential project by Standard Renewable Energy	Austin, TX	Travis	Travis	N/A	N/A	3.2	N/A	N/A	N/A
214	Residential project by Standard Renewable Energy	Austin, TX	Travis	Travis	N/A	N/A	3.2	N/A	N/A	N/A
215	Residential project by Standard Renewable Energy	Austin, TX	Travis	Travis	N/A	N/A	3.2	N/A	N/A	N/A
216	Residential project by Standard Renewable Energy	Austin, TX	Travis	Travis	N/A	N/A	3.2	N/A	N/A	N/A
217	Residential project by Standard Renewable Energy	Houston, TX	Harris	Harris	N/A	N/A	3.4	N/A	N/A	N/A
218	Residential project by Standard Renewable Energy	Houston, TX	Harris	Harris	N/A	N/A	3.4	N/A	N/A	N/A
219	Residential project by Standard Renewable Energy	Houston, TX	Harris	Harris	N/A	N/A	3.5	N/A	N/A	N/A
220	Residential project by Standard Renewable Energy	Dallas, TX	Dallas	Dallas	N/A	N/A	3.1	N/A	N/A	N/A
221	Residential project by Standard Renewable Energy	Shavano Park, TX	Bexar		N/A	N/A	4.6	N/A	N/A	N/A
222	Residential project by Standard Renewable Energy	Katy, TX	Harris		N/A	N/A	4.8	N/A	N/A	N/A

Table 6-2: Solar Photovoltaic Cell Projects: Data and Information (cont.)

Project No	Solar Project	City/Town	County	County for ECALC	Date	PV Modules	Capacity(kW)	Total Area (sqft)	Slope	Azimuth (South=180)
223	Residential project by Standard Renewable Energy	Houston, TX	Harris	Harris	N/A	N/A	4.8	N/A	N/A	N/A
224	Residential project by Standard Renewable Energy	Dallas, TX	Dallas	Dallas	N/A	N/A	4.6	N/A	N/A	N/A
225	Residential project by Standard Renewable Energy	Wimberly, TX	Hays		N/A	N/A	5.1	N/A	N/A	N/A
226	Residential project by Standard Renewable Energy	Houston, TX	Harris	Harris	N/A	N/A	6	N/A	N/A	N/A
227	Residential project by Standard Renewable Energy	Austin, TX	Travis	Travis	N/A	N/A	6.4	N/A	N/A	N/A
228	Residential project by Standard Renewable Energy	Austin, TX	Travis	Travis	N/A	N/A	6.4	N/A	N/A	N/A
229	Residential project by Standard Renewable Energy	Austin, TX	Travis	Travis	N/A	N/A	6.4	N/A	N/A	N/A
230	Residential project by Standard Renewable Energy	Houston, TX	Harris	Harris	N/A	N/A	6.1	N/A	N/A	N/A
231	Residential project by Standard Renewable Energy	Texas City, TX	Galveston		N/A	N/A	8.5	N/A	N/A	N/A
232	Colorado acres	Webb county, Tx	Webb		N/A	N/A	7.2	N/A	N/A	N/A

Table 6-3: Solar Photovoltaic Cell Projects: Energy and NOx Reductions

Proj. No	Project	County For Ecalc	Annual Energy Savings (for base year conditions) and Emissions Reduction In lbs/year							Annual Energy Savings (for base year conditions) and Average Emissions Reduction In lbs/day Per Ozone Season						
			Annual Energy Consumptio	1999			2007			Annual Energy Consumpti	1999			2007		
				NO_x	SO_x	CO_2	NO_x	SO_x	CO_2		NO_x	SO_x	CO_2	NO_x	SO_x	CO_2
1	Vliet Residence	Travis	2415	9.27	5.22	3465	3.92	2.17	3109	8	0.03	0.02	11	0.01	0	9
2	Del Rio High School	Bexar	6165	16.26	5.85	9155	10.17	10.1	10013	19	0.05	0.02	28	0.03	0.02	30
3	Uvalde Junior High School	Bexar	6165	16.26	5.85	9155	10.17	10.1	10013	19	0.05	0.02	28	0.03	0.02	30
4	El Campo Middle School	Brazoria	5513	13.31	11.41	8670	9.54	7.4	7790	17	0.04	0.03	26	0.03	0.02	23
5	Childress High School	Denton	6284	24.12	13.98	9081	10.22	5.71	8103	20	0.08	0.04	28	0.03	0.01	24
6	Central High School	Williamson	6151	23.62	13.29	8824	9.99	5.53	7917	19	0.07	0.04	27	0.03	0.01	23
7	Abilene School District Planetarium	Hood	6284	24.12	19.98	9081	10.22	5.71	8103	20	0.08	0.04	28	0.03	0.01	24
9	Martin High School	Nueces	5373	14.91	3.09	7478	6.45	2.15	6320	18	0.05	0.01	25	0.02	0	20
11	Calallen High School	Nueces	5567	15.45	3.2	7748	6.68	2.23	6549	17	0.05	0.01	24	0.02	0	20
12	Spring Hill Junior High School	Smith	5749	22.35	12.69	8258	9.4	5.26	7408	18	0.07	0.04	26	0.03	0.01	22
15	Sonora High School	Travis	6131	23.54	13.25	8795	9.96	5.51	7891	20	0.07	0.04	28	0.03	0.01	24
16	UT Health Science Center	Harris	3545	5.92	5.01	3835	4.26	3.33	3464	11	0.02	0.01	11	0.01	0.01	10
17	Mission High School	Nueces	5565	15.45	3.2	7746	6.68	2.23	6546	17	0.05	0.01	24	0.02	0	20
19	Rio Hondo High School	Nueces	5565	15.45	3.2	7746	6.68	2.23	6546	17	0.05	0.01	24	0.02	0	20
20	Houston Ship Channel	Harris	942	1.57	1.33	1019	1.13	0.89	920	3	0	0	3	0	0	3
21	Maplewood Elementary School	Travis	2408	9.25	5.2	3455	3.91	2.17	3100	7	0.03	0.02	11	0.01	0	9
22	Brooksmith ISD	Hood	670	2.57	1.49	969	1.09	0.61	864	1	0.01	0	2	0	0	2
23	Hamlin ISD	Parker	1230	4.78	2.71	1766	2.01	1.13	1585	4	0.01	0.01	6	0.01	0	5
24	Ira ISD	Parker	1047	4.07	2.31	1504	1.71	0.96	1349	3	0.01	0.01	4	0	0	3
25	John Jay High School	Bexar	1013	2.67	0.96	1505	1.67	1.66	1646	3	0.01	0	4	0	0	4
27	Holliday ISD	Parker	1047	4.07	2.31	1504	1.71	0.96	1349	3	0.01	0.01	4	0	0	3
28	River Road ISD	Parker	1047	4.07	2.31	1504	1.71	0.96	1349	3	0.01	0.01	4	0	0	3
29	Eagle Pass High School - CC Winn	Bexar	1207	3.18	1.15	1792	1.99	1.98	1960	4	0.01	0	6	0.01	0	6
30	James Madison High School	Bexar	1207	3.18	1.15	1792	1.99	1.98	1960	4	0.01	0	6	0.01	0	6
31	Univeresity of Texas Medical Branch	Galveston	24763	59.8	51.24	38942	42.85	33.23	34990	74	0.18	0.15	116	0.12	0.08	101
33	City Public Services of San Antonio, Northside	Bexar	24895	65.67	23.63	36970	41.08	40.79	40436	75	0.2	0.07	112	0.12	0.08	120

Table 6-3: Solar Photovoltaic Cell Projects: Energy and NOx Reductions (cont.)

Proj. No	Project	County For Ecalc	Annual Energy Savings (for base year conditions) and Emissions Reduction In lbs/year							Annual Energy Savings (for base year conditions) and Average Emissions Reduction In lbs/day Per Ozone Season						
			Annual Energy Consumptio	1999			2007			Annual Energy Consumpti	1999			2007		
				NO_x	SO_x	CO_2	NO_x	SO_x	CO_2		NO_x	SO_x	CO_2	NO_x	SO_x	CO_2
35	Blue Ridge ISD	Collin	1230	4.72	2.73	1777	2	1.12	1586	4	0.01	0.01	6	0.01	0	5
36	Bryker Woods Elementary School	Travis	1404	5.39	3.03	2014	2.28	1.26	1807	4	0.01	0.01	5	0.01	0	5
37	East Central ISD	Bexar	1411	3.72	1.34	2096	2.33	2.31	2292	4	0.01	0	6	0.01	0	6
38	Alvin High School	Brazoria	1490	3.6	3.08	2344	2.58	2	2106	4	0.01	0.01	7	0.01	0	6
39	Seabrook Intermediate School	Harris	1255	2.1	1.77	1358	1.51	1.18	1226	3	0.01	0	4	0	0	3
40	Kealing Middle School	Travis	1404	5.39	3.03	2014	2.28	1.26	1807	4	0.01	0.01	5	0.01	0	5
41	Canyon High School	Comal	1681	4.43	1.6	2496	2.77	2.75	2730	5	0.01	0.01	8	0.01	0.01	8
42	Dallas ISD Environmental Education	Dallas	1704	6.62	3.76	2448	2.79	1.56	2196	5	0.02	0.01	7	0.01	0	6
43	Junction High School	Travis	1404	5.39	3.03	2014	2.28	1.26	1807	4	0.01	0.01	5	0.01	0	5
44	Roosevelt High School	Bexar	1669	4.4	1.58	2478	2.75	2.73	2711	5	0.01	0	7	0.01	0.01	8
45	City Public Services Primary Control	Bexar	24895	65.67	23.63	36970	41.08	40.79	40436	75	0.2	0.07	112	0.12	0.08	120
46	NASA Johnson Space Center	Harris	12504	20.87	17.66	13.53	15.04	11.75	12216	37	0.06	0.05	40	0.04	0.03	35
47	La Grange Intermediate School	Bastrop	1774	6.9	3.92	2548	2.9	1.62	2286	5	0.02	0.01	8	0.01	0	7
48	Weimar High School	Fort Bend	1588	3.84	3.25	2490	2.77	2.16	2249	5	0.01	0.01	7	0.01	0.01	7
49	Marion Middle School	Guadalupe	1779	4.69	1.69	2641	2.94	2.91	2889	5	0.01	0.01	8	0.01	0.01	9
50	Giddings Middle School	Bastrop	1774	6.9	3.92	2548	2.9	1.62	2286	5	0.02	0.01	8	0.01	0	7
51	Schulenburg Elementary School	Bastrop	1774	6.9	3.92	2548	2.9	1.62	2286	5	0.02	0.01	8	0.01	0	7
52	Smithville Junior High School	Bastrop	1774	6.9	3.92	2548	2.9	1.62	2286	5	0.02	0.01	8	0.01	0	7
53	Utopia ISD	Bexar	1779	4.69	1.69	2641	2.94	2.91	2889	5	0.01	0.01	8	0.01	0.01	9
54	Brenham Middle School	Montgomery	1588	2.65	2.24	1718	1.91	1.49	1552	5	0.01	0.01	5	0.01	0	4
55	Cuero Junior High School	Victoria	1624	4.51	0.93	2260	1.95	0.65	1910	5	0.01	0	7	0.01	0	6
56	Bluebonnet Elementary School	Caldwell	1774	4.93	1.02	2469	2.13	0.71	2087	5	0.01	0	7	0.01	0	6
57	McKinney Green Building	Collin	56096	215.35	124.75	81061	91.21	50.98	72330	171	0.66	0.38	248	0.28	0.07	213
59	Bedichek Middle Shool	Travis	5150	19.78	11.13	7389	8.37	4.63	6629	16	0.06	0.03	22	0.03	0.01	19
60	Blanton Elementary School	Travis	5150	19.78	11.13	7389	8.37	4.63	6629	16	0.06	0.03	22	0.03	0.01	19
61	Cunningham elementary School	Travis	5150	19.78	11.13	7389	8.37	4.63	6629	16	0.06	0.03	22	0.03	0.01	19

Table 6-3: Solar Photovoltaic Cell Projects: Energy and NOx Reductions (cont.)

Proj. No	Project	County For Ecalc	Annual Energy Savings (for base year conditions) and Emissions Reduction In lbs/year							Annual Energy Savings (for base year conditions) and Average Emissions Reduction In lbs/day Per Ozone Season						
			Annual Energy Consumptio	1999			2007			Annual Energy Consumpti	1999			2007		
				NO_x	SO_x	CO_2	NO_x	SO_x	CO_2		NO_x	SO_x	CO_2	NO_x	SO_x	CO_2
62	Garza High School	Travis	5150	19.78	11.13	7389	8.37	4.63	6629	16	0.06	0.03	22	0.03	0.01	19
63	Martin Middle School	Travis	5150	19.78	11.13	7389	8.37	4.63	6629	16	0.06	0.03	22	0.03	0.01	19
64	Murchison Middle School	Travis	5150	19.78	11.13	7389	8.37	4.63	6629	16	0.06	0.03	22	0.03	0.01	19
65	O'Henry Middle School	Travis	5150	19.78	11.13	7389	8.37	4.63	6629	16	0.06	0.03	22	0.03	0.01	19
66	Pond Springs Elementary School	Travis	5150	19.78	11.13	7389	8.37	4.63	6629	16	0.06	0.03	22	0.03	0.01	19
67	Westwood High School	Travis	5150	19.78	11.13	7389	8.37	4.63	6629	16	0.06	0.03	22	0.03	0.01	19
68	Zilker Elementary School	Travis	5150	19.78	11.13	7389	8.37	4.63	6629	16	0.06	0.03	22	0.03	0.01	19
69	Davis Elementary School	Williamson	5150	19.78	11.13	7389	8.37	4.63	6629	16	0.06	0.03	22	0.03	0.01	19
70	Brenham Jr. High School	Harris	826	1.38	1.17	893	0.99	0.78	807	2	0	0	3	0	0	2
71	Harper School	Travis	1212	4.65	2.62	1739	1.97	1.09	1560	4	0.01	0.01	5	0.01	0	4
72	Kendall Elementary School	Bexar	1215	3.21	1.15	1805	2.01	1.99	1974	4	0.01	0	5	0.01	0	6
73	Leonard Shanklin Elementary School	Caldwell	1212	3.36	0.7	1687	1.46	0.49	1426	4	0.01	0	5	0	0	4
74	Hempstead Middle School	Harris	1083	1.81	1.53	1171	1.3	1.02	1058	3	0.01	0	3	0	0	3
75	Llano Junior High School	Travis	1212	4.65	2.62	1739	1.97	1.09	1560	4	0.01	0.01	5	0.01	0	4
76	San Marcos Electric Utility	Travis	925	3.55	2	1326	1.5	0.83	1190	3	0.01	0.01	4	0	0	3
77	Lampasas Middle School	Williamson	1212	4.65	2.62	1739	1.97	1.09	1560	4	0.01	0.01	5	0.01	0	4
78	Bastrop Intermediate School	Bastrop	1212	4.71	2.67	1741	1.98	1.11	1562	4	0.01	0.01	5	0.01	0	4
79	Flatonia Elementary School	Caldwell	1212	3.36	0.7	1687	1.46	0.49	1426	4	0.01	0	5	0	0	4
80	Waelder ISD	Caldwell	925	2.57	0.53	1287	1.11	0.37	1088	3	0.01	0	4	0	0	3
84	Aircraft Obstruction Light	Harris	2127	3.65	3	2301	2.56	2	2078	6	0.01	0.01	7	0.01	0	6
85	Learning Center at Sheldon Lake State Park	Harris	1372	2.29	1.94	1484	1.65	1.29	1340	4	0.01	0.01	4	0	0	4
86	Learning Center at Sheldon Lake State Park	Harris	1072	1.79	1.51	1160	1.29	1.01	1048	3	0.01	0	4	0	0	3
88	Solar Powered Water Pumping	Montgomery	3545	5.92	5.01	3835	4.26	3.33	3464	11	0.02	0.01	11	0.01	0.01	10
89	Solar Powered Reverse Osmosis in	Nueces	8187	22.73	4.7	11395	9.83	3.28	9630	25	0.07	0.01	35	0.03	0.01	28
113	Solar Powered Water Purification	Victoria	1488	4.13	0.86	2071	1.79	0.6	1750	4	0.01	0	6	0.01	0	5
114	City Hall, Austin, Texas	Travis	13069	50.19	28.24	18747	21.23	11.75	16821	39	0.15	0.09	57	0.06	0.02	49
	TOTAL		**362212**	**9074.6**	**594.79**	**465535**	**8558.3**	**360.65**	**449179**	**1101**	**7999.2**	**1.72**	**1446**	**8029.6**	**0.62**	**1310**

Table 6-4: Solar Thermal Projects

Project No	City	County	County for eCalc	Project Purpose	Model	Collector Area (sqft)	Number of collectors	Total Area (sqft)	Slope (degree)	Azimuth (i.e. South=0, West (-) and East (+))	Fluid
1	Austin	Travis	Travis	Domestic Hot Water (DHW)	N/A	N/A	2	N/A	N/A	0	Antifreeze
2	Austin	Travis	Travis	Domestic Hot Water (DHW)	SS HX Drainback	26.25	3	78.75	20	0	Water
3	Round Rock	Willamson	Willamson	Domestic Hot Water (DHW)	SS HX Drainback	26.25	2	52.5	20	-90	Water
4	Springs	Hays	Hays	Domestic Hot Water (DHW)	SS HX Drainback	26.25	2	52.5	20	20	Water
5	San Antonio	Bexar	Bexar	Domestic Hot Water (DHW)	SS HX Drainback	26.25	2	52.5	20	0	Water
6	San Antonio	Bexar	Bexar	Pool Heating System	FS collector	32	8	256	20	-45	Water
7	N/A	N/A	N/A	Domestic Hot Water (DHW)	SS HX Drainback	26.25	3	78.75	20	-45	Water
8	N/A	N/A	N/A	Domestic Hot Water (DHW)	SS HX Drainback	26.25	2	52.5	20	-45	Water
9	Midland	Midland	N/A	Pool Heating System-city of midland aquatic center	HC 50 collectors-make:APS	50	256	12800	N/A	N/A	Water
10	Lubbock	Lubbock	N/A	Pool Heating System-Lubbock TX State School	HC 50 collectors-make:APS	50	36	1800	N/A	N/A	Water
11	Corpus Christi	Nueces	N/A	Pool Heating System-Corpus Christi TX State School	HC 50 collectors-make:APS	50	36	1800	N/A	N/A	Water
12	Richmond	Fort Bend	N/A	Pool Heating System-Richmond TX State School	HC 50 collectors-make:APS	50	36	1800	N/A	N/A	Water
13	Elpaso	Elpaso	N/A	Elpaso recreation facility	HC 50 collectors-make:APS	50	120	6000	N/A	N/A	Water
14	Elpaso	Elpaso	N/A	Elpaso recreation facility	HC 50 collectors-make:APS	50	128	6400	N/A	N/A	Water
15	edinburg	Hidalgo	N/A	Pool heating system for Gym spa	make : APS	N/A	34	600+	N/A	N/A	Water
16	pearland	Brazoria	N/A	Pool heating system-residential	make : APS	N/A	7	N/A	N/A	N/A	water
17	cleveland	Liberty	N/A	Domestic Hot Water (DHW)	make : APS	N/A	N/A	N/A	N/A	N/A	water

Table 6-5: Solar Thermal Projects Emissions Reductions

		Annual Energy Savings (for base year conditions) and Emissions Reduction							Average per Ozone Season Day (for base year conditions) and Emissions Reduction						
		Annual Energy Consumption (kWh/yr)	1999			2007			Annual Energy Consumption (kWh/yr)	1999			2007		
Project	County for ECALC		NO_x	SO_x	CO_2	NO_x	SO_x	CO_2		NO_x	SO_x	CO_2	NO_x	SO_x	CO_2
2	Travis	4134	15.87	8.93	5930	6.71	3.72	5320	14	0.05	0.03	20	0.02	0.01	17
3	Willamson	3211	12.33	6.94	4606	5.22	2.89	4133	13	0.05	0.03	18	0.02	0	16
4	Hays	3469	9.16	2.44	4791	4.41	1.14	4234	12	0.03	0.01	17	0.02	0	15
5	Bexar	3469	9.15	3.29	5152	5.73	5.68	5635	12	0.03	0.01	18	0.02	0.01	19
6	Bexar	26235	69.2	24.9	38960	43.3	42.98	42.612	87	0.23	0.08	130	0.14	0.09	140
TOTAL		**40518**	**115.71**	**46.5**	**59439**	**65.37**	**56.41**	**19364.6**	**138**	**0.39**	**0.16**	**203**	**0.22**	**0.11**	**207**

Table 6-6: Solar Thermal Special Project

Special Case	
Location	Fort Sam Houston, San Antonio TX
Date	3-Jun
Collector	Roof Mounted Parabolic Trough
Number of collectors	129
Total Aperture area (sqft)	4515
Maximum operation temperature (°F)	400
Annual Energy Consumption (KWh/yr)	270583
Annual Energy Consumption OSD (KWh/yr) (KWh/yr)	741.3

Table 6-7: Hydropower Plant Information

No.	Utility Name	Plant Name	County	Initial Year Of Operation	Capacity in MW	STATUS
1	Guadalupe Blanco River Auth	Abbott TP 3	Victoria	1927	1.4	operational
2	Guadalupe Blanco River Auth	Abbott TP 3	Victoria	1927	1.4	operational
3	Guadalupe Blanco River Auth	Dunlap TP 1	Guadalupe	1927	1.8	operational
4	Guadalupe Blanco River Auth	Dunlap TP 1	Guadalupe	1927	1.8	operational
5	Guadalupe Blanco River Auth	Nolte	Williamson	1927	1.2	operational
6	Guadalupe Blanco River Auth	Nolte	Williamson	1927	1.2	operational
7	Guadalupe Blanco River Auth	H 4	Guadalupe	1931	2.4	operational
8	Guadalupe Blanco River Auth	H 5	Guadalupe	1931	2.4	operational
9	Guadalupe Blanco River Auth	TP 4	Guadalupe	1932	2.4	operational
10	Maverick Cty Water Control & Improvement	Eagle Pass	Maverick	1932	3.2	operational
11	Maverick Cty Water Control & Improvement	Eagle Pass	Maverick	1932	3.2	operational
12	Maverick Cty Water Control & Improvement	Eagle Pass	Maverick	1932	3.2	operational
13	Lower Colorado River Authority	Buchanan	Burnet	1938	18.3	operational
14	Lower Colorado River Authority	Buchanan	Burnet	1938	18.3	operational
15	Lower Colorado River Authority	Buchanan	Burnet	1938	11.2	operational
16	Lower Colorado River Authority	Inks	Burnet	1938	15	operational
17	Lower Colorado River Authority	Austin	Lampasas	1941	8	operational
18	Lower Colorado River Authority	Austin	Lampasas	1941	8	operational
19	Lower Colorado River Authority	Marshall Ford	Travis	1941	34	operational
20	Lower Colorado River Authority	Marshall Ford	Travis	1941	34.5	operational
21	Lower Colorado River Authority	Marshall Ford	Travis	1941	34	operational
22	Brazos River Authority	Morris Sheppard	Palo Pinto	1942	12.5	operational
23	Brazos River Authority	Morris Sheppard	Palo Pinto	1942	12.5	operational
24	USCE-Tulsa District	Denison	Grayson	1945	35	operational
25	USCE-Tulsa District	Denison	Grayson	1949	35	operational
26	Lower Colorado River Authority	Granite Shoals	Burnet	1951	30	operational
27	Lower Colorado River Authority	Granite Shoals	Burnet	1951	30	operational
28	Lower Colorado River Authority	Marble Falls	Burnet	1951	15	operational
29	Lower Colorado River Authority	Marble Falls	Burnet	1951	15	operational
30	USCE-Fort Worth District	Whitney	Bosque	1953	15	operational
31	USCE-Fort Worth District	Whitney	Bosque	1953	15	operational
32	International Bound & Wtr Comm	Falcon Dam & Power	Zapata	1954	10.5	operational
33	International Bound & Wtr Comm	Falcon Dam & Power	Zapata	1954	10.5	operational
34	International Bound & Wtr Comm	Falcon Dam & Power	Zapata	1954	10.5	operational
35	USCE-Fort Worth District	Sam Rayburn	Jasper	1965	26	operational
36	USCE-Fort Worth District	Sam Rayburn	Jasper	1965	26	operational
37	Entergy Gulf States Inc	Toledo Bend	Newton	1969	40.5	operational
38	Entergy Gulf States Inc	Toledo Bend	Newton	1969	40.5	operational
39	International Bound & Wtr Comm	Amistad Dam & Power	Valverde	1983	33	operational
40	International Bound & Wtr Comm	Amistad Dam & Power	Valverde	1983	33	Operational
41	Guadalupe Blanco River Auth	Canyon	Randall	1989	3	Operational
42	Guadalupe Blanco River Auth	Canyon	Randall	1989	3	Operational
43	USCE-Fort Worth District	Robert D Willis	Harris	1989	4	Operational
44	USCE-Fort Worth District	Robert D Willis	Harris	1989	4	Operational
45	City of Garland	Lewisville	Denton	1992	2.8	Operational
				Total	669.2	

Table 6-8: Geothermal Heat Pump Energy Projects

No	Project	County	Implementation Date	Capacity (ton)	Area (sqft)
1	Birdville High School Campus	Denton	2001	N/A	N/A
2	Texas Motor Speedway	Denton	1998	N/A	N/A
3	George W. Bush's ranch	McLennan	2001	14	N/A
4	Esperanza del Sol, Dallas (Hope of the Sun)	Dallas	1994	18	15,276
5	Hillside Oaks, East Dallas	Dallas	1997	366	276,120
6	Pease Elementary School, Austin	Travis	1997	90	39,162
7	Brooke Elementary School	Travis	1997	150	51,605
8	Govalle Elementary School	Travis	1997	230	89,319
9	Bailey Middle School, Austin	Travis	1997	512	200,000
10	Home in Iowa Park	Wichita	1997	1	1,668
11	The Home of the Future	Dallas	1997	13	4,573
12	Birdville Athletic Complex / Stadium	Tarrant	post 1992	N/A	60,000
13	Frisco ISD Administration Building and Network Operations Center	Collin	post 1992	N/A	20,000+
14	Aubrey Athletic Complex / Stadium	Denton	post 2002	64	25,807
15	Lake Dallas Athletic Complex / Stadium	Denton	post 2001	63	43,500
16	Wakeland High School	Collin	post 1992	1010.25	335,932
17	Lovejoy High School	Collin	post 2004	792.5	216,290
18	Grand Prairie High Ninth Grade Center	Dallas	post 2000	598	150,000+
19	South Grand Prairie High Ninth Grade Center	Dallas	post 2001	atleast 133	100,000+
20	Renovations to HVAC System at South Grand Prairie High School	Dallas	post 2001	69	12,500
21	Renovations to HVAC System at South Grand Prairie High School	Dallas	post 2002	64	49,000
22	David Daniels Elementary	Dallas	post 1992	N/A	70,000+
23	Edelweiss Daniels Elementary	Dallas	post 2000	305	72,872
24	Crockett Elementary	Dallas	post 2000	305	72,872
25	Kirby Elementary	Dallas	post 2000	305	72,872
26	Renovations to HVAC System at Lee Middle School	Dallas	post 1992	214	136,600 +
27	Rebuild of Lee Middle School (Fire Damage)	Dallas	post 2000	64	2,800
28	Renovations/Additions to Adams Middle School	Dallas	post 1992	N/A	N/A
29	Renovations/Additions to North Oaks Middle School	Tarrant	post 1992	N/A	71,000+
30	Renovations/Additions to North Richland Middle School	Tarrant	post 1992	273	80,000+
31	Watauga Middle School	Tarrant	post 2000	N/A	80,000+
32	HVAC Renovation for Watauga Middle School	Tarrant	post 1992	23	1987 added
33	Renovations to HVAC System at Eisenhower Elementary	Dallas	post 1992	N/A	N/A
34	Renovations/Additions to Rayburn Elementary	Dallas	post 1992	N/A	38,000+
35	Renovations/Additions to Watauga Elementary School	Tarrant	post 1992	N/A	56,000+
36	Renovations/Additions to Smithfield Elementary School	Tarrant	post 1992	N/A	56,000+
37	Renovations to David E. Smith Elementary School	Tarrant	2003	30	45,000+
38	Renovations/Additions to Green Valley Elementary School	Tarrant	post 2000	8	50,000+
39	Renovations/Additions to Richland Elementary School	Tarrant	post 1992	221	38,000+
40	Renovations/Additions to Birdville Elementary School	Tarrant	post 1992	N/A	32,000+
41	Renovations/Additions to Grace Hardeman Elementary	Tarrant	post 2000	12	N/A
42	W.A. Porter Elementary School	Tarrant	post 2000	N/A	48,000+
43	Renovations/Additions to W.A. Porter Elementary School	Tarrant	post 2000	12	1963 added
44	Haltom Middle School	Tarrant	post 1992	N/A	109,000
45	HVAC Renovation for Haltom Middle School	Tarrant	post 2000	22	6730 added
46	HVAC Renovation for Richland Middle School`	Tarrant	post 1992	N/A	91,000
47	HVAC Renovation for North Oaks Middle School	Tarrant	post 1992	N/A	70,000
48	HVAC Renovation for North Richland Middle School	Tarrant	post 1992	N/A	75,000
49	Holiday Heights Elementary	Tarrant	post 2000	N/A	40,000
50	HVAC Renovation for Holiday Heights Elementary	Tarrant	post 2000	12	2923 added

Table 6-8: Geothermal Heat Pump Energy Projects (cont.)

No	Project	County	Implementation Date	Capacity (ton)	Area (sqft)
51	HVAC Renovation for Watuaga Elementary	Tarrant	post 1992	N/A	40,000
52	HVAC Renovation for David E. Smith Elementary	Tarrant	post 1992	N/A	35,000
53	HVAC Renovation for West Birdville Elementary	Tarrant	post 1992	N/A	42,000
54	HVAC Renovation for Glenview Elementary	Tarrant	post 1992	N/A	40,000
55	HVAC Renovation for South Birdville Elementary	Tarrant	post 1992	149	38,000
56	HVAC Renovation for WT Francisco Elementary	Tarrant	post 2000	26	31,000
57	HVAC Renovation for Foster Village Elementary	Tarrant	post 2000	12	66,000
58	Snow Heights Elementary	Tarrant	post 2000	124	33,000
59	Renovations/Additions to Snow Heights Elementary School	Tarrant	post 2000	8	1963 added
60	HVAC Renovation for OH Stowe Elementary	Tarrant	post 1992	N/A	40,000
61	Jackson Middle School	Dallas	post 2000	365	100,000+
62	Renovations to HVAC System at Jackson Middle School	Dallas	post 2000	N/A	N/A
63	Renovations/Additions to Richland Elementary School	Tarrant	post 1992	N/A	38,000+
64	Renovations/Additions to Birdville Elementary School	Tarrant	post 1992	N/A	32,000+
65	HVAC Renovation for Rayburn Elementary School	Dallas	post 1992	N/A	N/A
66	HVAC Renovation for North Oaks Middle School	Tarrant	post 1992	204	70,000
67	HVAC Renovation for Watuaga Elementary	Tarrant	post 2000	26	40,000
68	Anchor Church	Tarrant	post 1992	N/A	40,000+
69	Little Elm Elementary	Denton	post 2001	218	70,000+
70	Griffen Parc Middle School	Collin	2004	383	151,566
71	Riddle Elementary	Collin	2003	238	70,000+
72	Boals Elementary	Collin	2003	238	74,300
73	Lake Dallas Middle School	Denton	post 2003	537.5	250,000+
74	North Elementary	Tarrant	post 1992	N/A	110,000+
75	Isbell Elementary	Collin	2004	279	75,904
76	Bledsoe Elementary	Collin	2005	279	75,904
77	Roach Middle School	Collin	post 1992	N/A	120,000+
78	Fowler Middle School	Collin	2006	488	138,651
79	North Star Elementary	Tarrant	post 1992	N/A	70,000+
80	Hometown Elementary School	Tarrant	post 1992	N/A	70,000+
81	Liberty High School	Collin	2007	1051	306,179
82	Ashley Elementary	Collin	2005	279	75,325
83	Ogle Elementary	Collin	2006	279	75,904
84	Sem Elementary	Collin	post 1992	N/A	70,000+
85	Corbell Elementary	Collin	2005	279	76,814
86	Taylor Elementary	Collin	post 1992	N/A	70,000+
87	Middle School #5	Tarrant	post 1992	N/A	1,40,000+
88	Intermediate School #5	Tarrant	post 1992	N/A	1,20,000+
89	Liberty Elementary	Tarrant	post 1992	N/A	70,000+
90	Stafford Middle School	Collin	2008	509	142,108
91	Scoggins Middle School	Collin	2008	512	124,108
92	Elementary #10	Tarrant	post 1992	N/A	70,000+
93	Elementary #11	Tarrant	post 1992	N/A	70,000+
94	Elementary #12	Tarrant	post 1992	N/A	70,000+
95	Elementary #13	Tarrant	post 1992	N/A	70,000+
96	Middle School #4	Tarrant	2006	624	151,417
97	Robertson Elementary	Collin	2007	291	75,902
98	Mooneyham Elementary	Collin	2007	291	75,902
99	Carrol Elementary	Collin	2007	291.5	75,902
100	Brookstone Elementary	Collin	2008	291.5	75,902

Table 6-8: Geothermal Heat Pump Energy Projects (cont.)

No	Project	County	Implementation Date	Capacity (ton)	Area (sqft)
101	Tadlock Elementary	Collin	2008	306.5	77,184
102	Aubrey Intermediate/Middle School	Denton	post 2004	209.5	80,000+
103	Florence Hill Elementary	Dallas	post 2003	160	70,000+
104	Garner Elementary	Dallas	post 2004	160	70,000+
105	Bowie Elementary	Dallas	post 2004	44	25,000+
106	High School #5	Collin	post 1992	N/A	300,000+
107	High School #6	Collin	post 1992	N/A	300,000+
108	Memorial Stadium Field House	Collin	2004	27	10,000+
109	Rogers Elementary	Collin	post 2006	221	63,000+
110	Camp Wisdom Elementary	Dallas	post 1992	N/A	70,000+
111	Additions to Anderson Elementary	Collin	2003	30	9,000+
112	Additions to Borchardt Elementary	Collin	post 1992	N/A	9,000+
113	Bright Elementary	Collin	2004	30	9,000+
114	Additions to Christi Elementary	Collin	2004	29.5	9,000+
115	Additions to Curtsinger Elementary	Collin	post 1992	N/A	9,000+
116	Additions to Fisher Elementary	Collin	2003	30	9,000+
117	Additions to Shawnee Trail Elementary	Collin	post 1992	N/A	9000 +
118	CATE Center (Career and Technology)	Collin	2008	401.5	100, 000+
119	CTE at Centennial High School (Career and Technology)	Collin	2007	16	9000+
120	Staley Middle School Field House	Collin	2004	12	6000+
121	West Transportation Facility	Collin	2008	80	26,148
122	McKinney Lofts	Dallas	N/A	N/A	N/A
123	Havana Club Apartments	Bexar	N/A	N/A	N/A
124	Hogg Palace Lofts	Harris	N/A	N/A	N/A
125	South Main Baptist Church	Harris	N/A	N/A	N/A
126	The Tower	Tarrant	N/A	N/A	N/A
127	Edgemere	Dallas	N/A	N/A	N/A
128	Radisson Carlson Park	Bexar	N/A	N/A	N/A
129	Biggs Field Project	El Paso	N/A	N/A	N/A
130	Denison Housing Authority	Grayson	N/A	N/A	N/A
131	Fort Sam Houston Barracks	Bexar	N/A	N/A	N/A
132	Fort Sam Houston Building 905/906	Bexar	N/A	N/A	N/A
133	Fort Walters	Palo pinto	N/A	N/A	N/A
134	Drury Inn & Suites	Bexar	N/A	N/A	N/A
135	Lexington Hotel Suites	Tarrant	N/A	N/A	N/A
136	Arnold Middle School	Dallas	N/A	N/A	N/A
137	Shaner Hotel	Bexar	N/A	N/A	N/A
138	Holiday Inn Northwest	Bexar	N/A	N/A	N/A
139	2ND Home Suites	Dallas	N/A	N/A	N/A
140	Homewood Suites	Bexar	N/A	N/A	N/A
141	Air Dynamics	Dallas	N/A	N/A	N/A
142	Radiatas	Webb	N/A	N/A	N/A
143	Hensley Field Operations Center	Dallas	N/A	N/A	N/A
144	Southwest Plaza Base Bldg	Dallas	N/A	N/A	N/A
145	Air Performance	Dallas	N/A	N/A	N/A
146	Meadwest VA Co.	Harris	N/A	N/A	N/A
147	Gap #1550 Mockingbird Station	Dallas	N/A	N/A	N/A
148	Kirby Building	Dallas	N/A	N/A	N/A
149	USSA Towers	Bexar	N/A	N/A	N/A
150	Trinity Towers	Nueces	N/A	N/A	N/A

Table 6-8: Geothermal Heat Pump Energy Projects (cont.)

No	Project	County	Implementation Date	Capacity (ton)	Area (sqft)
151	Sonny Bryans BBQ	Dallas	N/A	N/A	N/A
152	L'Etoile Restaurant	Bexar	N/A	N/A	N/A
153	Sweeny Ind.Sch. Dist.Warehouse	Brazoria	N/A	N/A	N/A
154	Freylands Elementary	Chambers	N/A	N/A	N/A
155	Mustang Mech. Montwood High	El Paso	N/A	N/A	N/A
156	Boerne Elementary School	Kendall	N/A	N/A	N/A
157	City View Schools	Wichita	N/A	N/A	N/A
158	Montwood High School Addition	El Paso	N/A	N/A	N/A
159	Montwood High School Auditorium	El Paso	N/A	N/A	N/A
160	The Island on Lake Travis	Travis	N/A	N/A	N/A
161	Allen Campus	Brazos	N/A	N/A	N/A
162	Judson Lofts	Bexar	N/A	N/A	N/A
163	pink elemtary school	collin	2005	286	75,904
164	Griffin middle school	collin	2002	N/A	N/A
165	Joslin Elementary	Travis	1991	N/A	N/A
166	Brent wood Elementary	Travis	1991	N/A	N/A
167	Walnut Creek Elementary	Travis	1991	N/A	N/A
168	Sims Elementary	Travis	1991	N/A	N/A
169	F R Rice Elementary	Travis	1991	N/A	N/A
170	T A Brown Elementary	Travis	1991	N/A	N/A
171	Canyon Ridge Middle School	William son	2004	N/A	N/A
172	Vista Ridge High School	William son	2004	N/A	N/A
173	Pleasant Hill Elemtary	William son	2005	N/A	N/A
174	Good Night Middle school	Hays	1985	N/A	N/A
175	Santa Teresa Elementary	Hays	N/A	125	N/A
176	Santa Teresa Middle School	Hays	N/A	200	N/A
177	Esconreras primary kindergarten	Hays	N/A	105	N/A
178	Mullendore Elementary	Tarrant	post 1995	N/A	N/A
179	O.H. Stowe Elementary	Tarrant	post 1995	N/A	N/A
180	Austin Elementary School GPISD	Dallas	post 2000	91	atleast 21,100
181	Fannin Elementary School GPISD	Dallas	2004	220.5	N/A
182	Peaster Elementary	Parker	post 1995	N/A	N/A
183	Frisco Elementary School #15	collin	post 1995	N/A	N/A
184	Lone Star Elementary - Frisco ISD	collin	post 1995	N/A	N/A
185	Woodland Springs Elementary - Keller ISD	Tarrant	post 1995	N/A	N/A
186	Bette Perot Elementary - Keller ISD	Tarrant	post 1995	N/A	N/A
187	Granbury Middle School East Site	Hood	post 1995	N/A	N/A
188	Frisco Elementary #18 - Shaddock	collin	post 2007	N/A	N/A
189	Shiver Road Elementary #18 Keller ISD	Tarrant	post 2007	N/A	N/A
190	Woodland Springs Elementary #17 Keller ISD	Tarrant	post 2007	N/A	N/A
191	McDonwell Elementary (Keller ISD)	Tarrant	post 2007	N/A	N/A
192	Keller Intermediate School #5 Keller ISD	Tarrant	post 2007	N/A	N/A
193	Shady Shores Elementary	Denton	post 2007	392.75	75,904
194	Alta Vista Middle School #5 Keller ISD	Tarrant	post 2007	N/A	N/A
195	Brewer High School (White Settlement ISD)	Tarrant	post 2007	N/A	N/A
196	Leaky High school	Gillespie	N/A	120	N/A
197	Canutillo High School	El Paso	N/A	1200	N/A
198	Lubbock Christian University	Lubbock	N/A	N/A	N/A
199	Rice University	Harris	N/A	N/A	N/A
200	brown building lofts	Travis	N/A	N/A	N/A

Table 6-8: Geothermal Heat Pump Energy Projects (cont.)

No	Project	County	Implementation Date	Capacity (ton)	Area (sqft)
201	Wheeler county Court House	wheeler	N/A	N/A	N/A
202	Ballinger housing authority	runnels	N/A	N/A	N/A
203	Project under category miscellaneous cited by FHP manufacturing	Travis	N/A	N/A	N/A
204	Foreman independent school district	Bowie	N/A	N/A	N/A
205	Timber Creek High School #4	Tarrant	post '2008	116.5	361,141
206	Ed Wilkie Middle School #5: Geothermal Design Services	Travis	post '2008	643	
207	William & Abbie Allen Elementary School	Collin	post '2008	339	83,960
208	Career & Technology Education Center	N/A	post '2008	799	247,880
209	Early Childhood School	Collin	post '2008	385	54,861
210	Burleson Elementary School #11	N/A	post '2008	283.5	
211	Killeen Police Headquarters: Geothermal Design	Bell	post '2008	208	88,663
212	Burleson High School #2	Tarrant	post '2008	2126	490,447
213	Secondary Instructional Facility	Travis	post '2008	745	184,824
214	Lamar & Norma Hunt Middle School #10	Collin	post '2008	512	147,096
215	Elizabeth Cash Maus Middle School #11	Collin	post '2008	512	147,096
216	Robert Cobb Middle School #12	Collin	post '2008	512	147,096
217	ES	Collin	post '2008	310	77,184
218	Aubrey High School	Denton	post '2008	225	N/A
219	DFW Airport: EAD Annex	Travis	post 2009	18	N/A
220	2009 Capital Improvements @ Various Campuses	Travis	post 2009	147.5	N/A
221	Pre-Kindergarten School	Denton	post 2009	164	60,391
222	George & Debra Purefoy Elementary School #30	N/A	post 2009	304	N/A
223	Elementary School #14: Geothermal Design Services	N/A	post 2009	Y	N/A
224	Patricia Dean Boswell McCall Elementary School	Parker	2007	367	89,642
225	Aubrey Intermediate:Add/Reno	Denton	2007	234	69,519
226	Sam Carter Service Center	Collin	2007	116	49,377
227	Dr. Monaco Elementary School	Denton	2007	263	74,544
228	Caprock Elementary School #20	Tarrant	2007	303.5	92,768
229	Trinity Springs Middle School: Add.	Tarrant	2007	120.5	36,136
230	Milam Elementary School: 2007 Bond HVAC Replacement	Dallas	2008	131	N/A
231	Truman Middle School: HVAC Retrofit Phase 2	Dallas	under progress	146	N/A
232	Alta Vista Elementary School	Tarrant	under progress	572.5	N/A
233	Sandshell Elementary School #21	Travis	under progress	278	N/A
234	Corinth Primary	Denton	under progress	238	N/A
235	All Saints Episcopal School	Travis	under progress	337	N/A
236	Alliance for Children	Travis	under progress	33	N/A
237	Faithbridge Presbyterian Church	Collin	under progress	165	N/A
238	Heritage High School	Collin	2007	1041.5	325,693

Table 6-9: Landfill Gas-Fired Power Plants: Operational

Project No	Landfill Name	City	County	Waste In Place (tons)	Landfill Owner Organization	Project Status	Project Start Date	MW Capacity	LFG Flow to Project (SCFD)	Emission Reductions (MTCO2)
1	McCarty Road LF	Houston	Harris	28,918,718	Allied Waste Services	Operational	1/1/1986	N/A	N/A	0.797
2	DFW Gas Recovery	Lewisville	Denton	N/A	WM Renewable Energy LLC	Operational	May-88	3	N/A	N/A
3	DFW Gas Recovery	Lewisville	Denton	N/A	WM Renewable Energy LLC	Operational	May-88	3	N/A	N/A
4	Dallas-Fort Worth LF	Dallas	Denton	18,388,100	Waste Management, Inc.	Operational	1/1/1992	6.6	N/A	0.286
5	Sunset Farms	Austin	Travis	N/A	Gas Recovery Systems Inc	Operational	Dec-96	1	N/A	N/A
6	Sunset Farms	Austin	Travis	N/A	Gas Recovery Systems Inc	Operational	Dec-96	1	N/A	N/A
7	Sunset Farms	Austin	Travis	N/A	Gas Recovery Systems Inc	Operational	Dec-96	1	N/A	N/A
8	Sunset Farms	Austin	Travis	9,600,000	Allied Waste Services	Operational	12/1/1996	3	1.5	0.13
9	Austin Community LF	Austin	Travis	10,380,188	Waste Management, Inc.	Shutdown	1/1/1998	N/A	N/A	N/A
10	City of Brownwood Landfill	Brownwood	Brown	1,300,100	City of Brownwood	Operational	1/1/1998	N/A	N/A	0.035
11	McCommas Bluff LF/City of Dallas	Dallas	Dallas	26,470,000	City of Dallas, TX	Operational	1/1/2000	N/A	N/A	0.772
12	Rosenberg Landfill	Rosenberg	Fort Bend	2,649,100	Fort Bend County, TX	Operational	1/1/2000	N/A	1	0.082
13	Castle Road Landfill	Garland	Dallas	4,012,500	City of Garland	Operational	5/1/2000	N/A	N/A	0.089
14	Arlington LF	Arlington	Tarrant	13,981,144	City of Arlington	Operational	6/1/2001	5	1.584	0.217
15	BFI - Tessman Road Landfill	San Antonio	Bexar	11,300,000	Allied Waste Services	Operational	10/10/2002	5.4	2.9	0.234
16	Coastal Plains LF	Alvin	Galveston	6,546,410	Waste Management, Inc.	Operational	1/10/2003	6.7	N/A	0.289
17	Sanifill Of Texas-Baytown LF	Baytown	Chambers	6,290,000	Waste Management, Inc.	Operational	1/24/2003	3.9	1.73	0.169
18	Blue Bonnet LF	Houston	Harris	2,526,000	Waste Management, Inc.	Operational	3/1/2003	1.9	0.928	0.084
19	City of Conroe LF	Conroe	Montgomery	3,146,000	City of Conroe	Operational	3/1/2003	2.9	N/A	0.126
20	Atascosita	Atascosita	Harris	N/A	Viridis Energy	Operational	3-Mar	1.3	N/A	N/A
21	Atascosita	Atascosita	Harris	N/A	Viridis Energy	Operational	3-Mar	1.3	N/A	N/A
23	Atascosita	Atascosita	Harris	N/A	Viridis Energy	Operational	3-Mar	1.3	N/A	N/A
24	Atascosita	Atascosita	Harris	N/A	Viridis Energy	Operational	3-Mar	1.3	N/A	N/A
25	Coastal Plains	Alvin	Galveston	N/A	Viridis Energy	Operational	3-Mar	1.3	N/A	N/A
26	Coastal Plains	Alvin	Galveston	N/A	Viridis Energy	Operational	3-Mar	1.3	N/A	N/A
27	Coastal Plains	Alvin	Galveston	N/A	Viridis Energy	Operational	3-Mar	1.3	N/A	N/A
28	Coastal Plains	Alvin	Galveston	N/A	Viridis Energy	Operational	3-Mar	1.3	N/A	N/A
29	BFI - Tessman Road Landfill	San Antonio	Bexar	11,300,000	Allied Waste Services	Operational	5/1/2003	2.7	1.45	0.117
30	Security Recycling and Disposal LF	Cleveland	Montgomery	4,014,800	Waste Management, Inc.	Operational	5/1/2003	5	N/A	0.217

Table 6-9: Landfill Gas-Fired Power Plants: Operational (cont.)

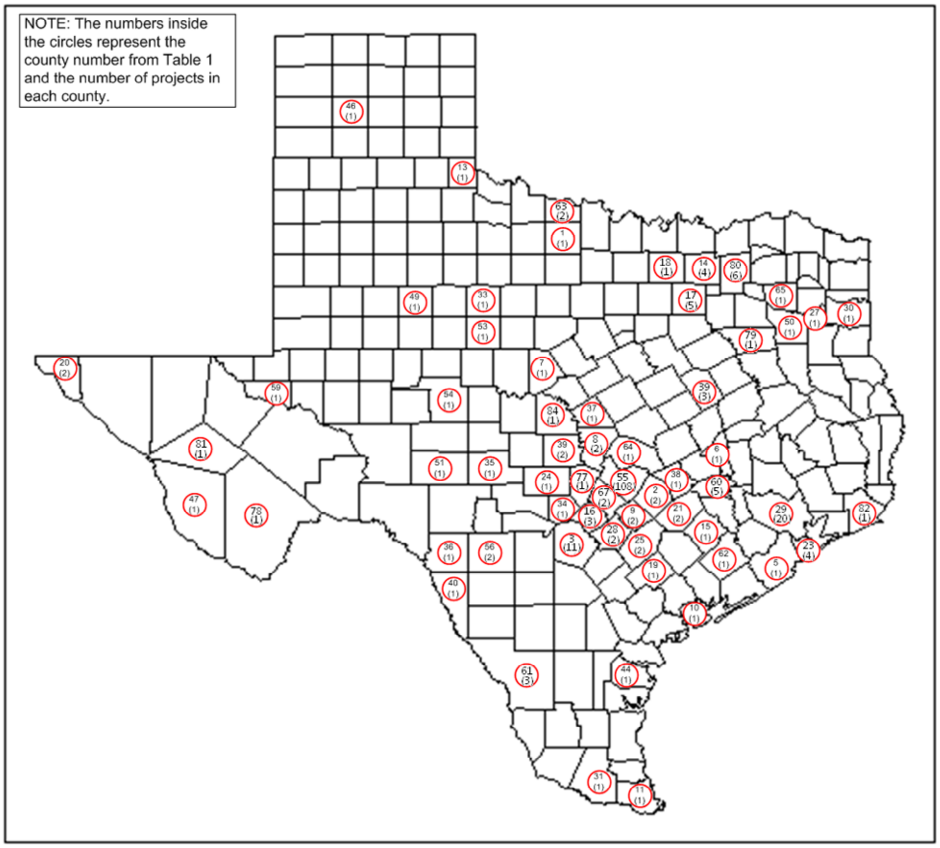
Project No	Landfill Name	City	County	Waste In Place (tons)	Landfill Owner Organization	Project Status	Project Start Date	MW Capacity	LFG Flow to Project (SCFD)	Emission Reductions (MTCO2)
31	BFI Tessman Rd Landfill	San Antonio	Bexar	N/A	Energy Developments Inc	Operational	3-May	1.4	N/A	N/A
32	WMI/Atascocita LF	Humble	Harris	9,628,700	Waste Management, Inc.	Operational	6/1/2003	8.5	3.09	0.368
33	Bluebonnet	Houston	Harris	N/A	Viridis Energy	Operational	3-Aug	1	N/A	N/A
34	Bluebonnet	Houston	Harris	N/A	Viridis Energy	Operational	3-Aug	1	N/A	N/A
35	Bluebonnet	Houston	Harris	N/A	Viridis Energy	Operational	3-Aug	1	N/A	N/A
36	Bluebonnet	Houston	Harris	N/A	Viridis Energy	Operational	3-Aug	1	N/A	N/A
37	Conroe	Conroe	Montgomery	N/A	Viridis Energy	Operational	3-Aug	1	N/A	N/A
38	Conroe	Conroe	Montgomery	N/A	Viridis Energy	Operational	3-Aug	1	N/A	N/A
39	Conroe	Conroe	Montgomery	N/A	Viridis Energy	Operational	3-Aug	1	N/A	N/A
40	Baytown	Baytown	Chambers	N/A	Viridis Energy	Operational	3-Dec	1.3	N/A	N/A
41	Baytown	Baytown	Chambers	N/A	Viridis Energy	Operational	3-Dec	1.3	N/A	N/A
42	Security	Houston	Montgomery	N/A	Viridis Energy	Operational	3-Dec	1.3	N/A	N/A
43	Security	Houston	Montgomery	N/A	Viridis Energy	Operational	3-Dec	1.3	N/A	N/A
45	Sunset Farms	Austin	Travis	N/A	Gas Recovery Systems Inc	Operational	4-Jan	1	N/A	N/A
46	WMI/Atascocita LF	Humble	Harris	9,628,700	Waste Management, Inc.	Operational	1/1/2004	1.7	0.62	0.074
47	City of Austin LF	Austin	Travis	4,858,500	City of Austin, TX	Operational	2/1/2004	0.2	N/A	0.009
48	City of Waco LF	Woodway	McLennan	2,225,000	City of Waco	Operational	3/1/2004	1.5	1	0.065
49	Atascosita	Atascosita	Harris	N/A	Viridis Energy	Operational	4-Jul	1.7	N/A	N/A
50	Denton Sanitary Landfill	Denton	Denton	2,266,664	City of Denton, TX	Operational	2/1/2005	N/A	0.432	0.035
51	Covel Gardens LF	San Antonio	Bexar	12,007,000	Waste Management, Inc.	Operational	12/1/2005	9.6	N/A	0.416
52	Fort Worth Regional LF	Haltom City	Tarrant	N/A	Allied Waste Services	Construction	3/15/2006	1.6	0.72	0.069
53	McCommas Bluff LF/City of Dallas	Dallas	Dallas	26,470,000	City of Dallas, TX	Construction	7/1/2006	22	N/A	0.953
54	Denton Sanitary Landfill	Denton	Denton	2,266,664	City of Denton, TX	Construction	9/1/2006	1.5	0.86	0.065

Table 6-10: Landfill Gas-Fired Power Plants: Candidates

Proj. No	Landfill Name	County	Waste In Place (tons)	Year Landfill Opened	Landfill Closure Year	Landfill Owner Organization
1	Skyline LF	Ellis	8,191,000	1942	2040	Waste Management, Inc.
2	Trinity Oaks Landfill	Dallas	6,838,600	1969	2003	Allied Waste Services
3	J.C. Elliot LF	Nueces	5,717,100	1972	2005	City of Corpus Christi, TX
4	Galveston County LF	Galveston	7,822,500	1973	2025	Allied Waste Services
5	Mill Creek LF	Tarrant	4,815,500	1973	2002	Allied Waste Services
6	City of Lubbock LF	Lubbock	2,177,800	1975	2008	City of Lubbock
7	City of Pampa LF	Gray	1,176,200	1975	2007	City of Pampa
8	Colorado City Landfill	Mitchell	1,545,200	1975	2020	City of Colorado City
9	Comal County LF	Comal	3,817,620	1975	2010	Waste Management, Inc.
10	Amarillo LF	Potter	7,031,400	1976	2050	City of Amarillo
11	C&T Landfill	Hidalgo	3,844,000	1976	2004	Duncan Disposal, Inc.
12	City Of Sweetwater LF	Nolan	1,283,800	1976	2040	City of Sweetwater
13	City Of Weatherford LF	Parker	1,079,000	1976	2060	IESI, Inc.
14	Fort Worth Southeast Landfill	Tarrant	5,299,400	1976	2036	City of Fort Worth, TX
15	SLF	Colorado	1,980,400	1976	2002	Safety Clean
16	Austin Community LF	Travis	10,380,188	1977	2001	Waste Management, Inc.
17	City of Grand Prairie LF	Dallas	2,835,800	1977	2021	City of Grand Prairie
18	City of Nacogdoches Landfill	Nacogdoches	1,296,200	1977	2033	City of Nacogdoches
19	Westside Sanitary LF	Tarrant	9,955,600	1977	2005	Waste Management, Inc.
20	Whispering Pines LF	Harris	6,405,000	1978	2017	Allied Waste Services
21	City of Perryton Landfill	Ochiltree	1,631,100	1979	2006	City of Perryton
22	City of McKinney LF	Collin	3,957,000	1980	2004	City of McKinney
23	Nelson Gardens LF	Bexar	11,800,000	1980	1993	City of San Antonio
24	Camelot Landfill	Denton	6,044,700	1981	2019	City of Farmers Branch
25	City of Irving Landfill	Dallas	2,063,900	1981	2065	City of Irving, TX
26	Hillside Landfill	Grayson	2,526,400	1981	2023	Waste Management, Inc.
27	Sprint Fort Bend County LF	Fort Bend	1,664,372	1981	2020	The Sprint Companies
28	Williamson County LF	Williamson	2,134,700	1981	2040	Waste Management, Inc.
29	BFI - Abilene Landfill	Jones	7,921,300	1982	2067	Ray Knowles
30	City of Victoria Landfill	Victoria	2,556,000	1982	2040	City of Victoria
31	City of Wichita Falls LF	Wichita	4,073,200	1982	2021	City of Wichita Falls
32	North Texas Waste/Maxwell Creek LF	Collin	6,083,700	1982	2004	District
33	Pine Hill LF	Gregg	12,141,700	1982	2060	4S Oil Company
34	City of Beaumont LF	Jefferson	2,868,800	1983	2021	City of Beaumont
35	Clint LF	El Paso	4,904,400	1983	2006	City of El Paso
36	Royal Oaks Landfill	Cherokee	1,044,200	1983	2030	Allied Waste Services
37	Turkey Creek LF	Johnson	3,733,200	1983	2025	Allied Waste Services
38	McCombs LF	El Paso	4,137,100	1984	2046	City of El Paso
39	CSC Disposal and Landfill	Ellis	4,254,250	1985	2100	Republic Services, Inc.
40	Lacy-Lakeview LF	McLennan	1,306,200	1985	2020	Waste Management, Inc.
41	City of Laredo LF	Webb	3,180,000	1986	2015	City of Laredo
42	City of Port Arthur Landfill	Jefferson	1,802,100	1986	2044	City of Port Arthur
43	Southwest Landfill (Amarillo)	Randall	3,393,200	1987	2025	Allied Waste Services
44	Sprint LF	Harris	2,041,600	1987	2005	Landfill Owner
45	Altair Disposal Services LLC	Colorado	9,195,000	1988	2004	Clean Harbors
46	Greenwood Farms Landfill	Smith	3,087,300	1989	2020	City of Tyler
47	Texas Disposal Systems LF	Travis	4,408,900	1990	2050	Texas Disposal Systems
48	Golden Triangle Landfill	Jefferson	2,310,400	1991	2021	Allied Waste Services
49	Blue Ridge LF	Fort Bend	4,113,900	1993	2025	Allied Waste Services
50	Brazoria County Disposal LF	Brazoria	6,279,700	1993	2050	Republic Services, Inc.
51	WMI/E & D Waste Systems Inc. LF	Galveston	3,202,900	1994	2022	Waste Management, Inc.
52	Charter Waste Landfill	Ector	1,300,000	N/A	N/A	Republic Services, Inc.
53	City of Temple Landfill	Bell	3,600,000	N/A	N/A	City of Temple
54	Eastside Landfill	Tarrant	N/A	N/A	N/A	Waste Management, Inc.

Table 6-11: Landfill Gas-Fired Power Plants: Potential

Proj. No.	Landfill Name	City	County	(tons)	Opened	Closure Year	Landfill Owner Organization
1	Pleasant Oaks Landfill	Mount Pleasant	Titus	N/A	1960	2012	City of Mount Pleasant
2	Sinton	Sinton	San Patricio	N/A	1972	2002	Allied Waste Services
3	City of Richardson LF	Richardson	Collin	825,218	1975	1990	City of Richardson
4	City of Cleburne Landfill	Cleburne	Johnson	1,583,200	1976	N/A	Landfill Owner
5	Itasca Landfill	Itasca	Hill	N/A	1977	2017	Allied Waste Services
6	Quail Canyon	Lubbock	Lubbock	200,200	1977	1993	Allied Waste Services
7	Hutchins Landfill	Hutchins	Dallas	1,000,000	1978	1992	Allied Waste Services
8	Maloy Landfill	Commerce	Hunt	610,000	1979	2030	Republic Services, Inc.
9	Mexia Landfill	Mexia	Limestone	N/A	1983	2019	Allied Waste Services
10	Pecan Prairie Landfill	Kingston	Hunt	1,479,900	1984	1998	Waste Management, Inc.
11	Trashaway San Angelo Landfill	San Angelo	Tom Green	790,000	1984	N/A	Republic Services, Inc.
12	Kerrville Landfill	Kerrville	Kerr	N/A	1985	2006	City of Kerrville
13	Lewisville Landfill	Lewisville	Denton	N/A	1986	2003	Allied Waste Services
14	ECD Landfill	Ennis	Ellis	N/A	1988	2089	Allied Waste Services
15	Bell Processing Inc. LF	Wichita Falls	Wichita	N/A	1990	2001	Bell Processing Inc
16	Laidlaw/Wilmer LF	Wilmer	Dallas	686,400	1992	2001	Landfill Owner
17	BFI LF	Abilene	Taylor	745,888	1993	1997	Pine Street Salvage Company
18	City of Corsicana LF	Corsicana	Navarro	788,100	1993	2100	Landfill Owner
19	Gulfwest Facility	Anahuac	Chambers	N/A	1993	2017	Allied Waste Services
20	Bell County/Sparks LF	Belton	Bell	343,200	1994	2001	Bell County
21	Ellis County LF	Palmer	Ellis	892,320	1994	N/A	Waste Management, Inc.
22	El Centro Landfill	Robstown	Nueces	N/A	2000	2013	Allied Waste Services
23	Best Pak Disposal Inc. LF	Pattison	Waller	N/A	N/A	2001	Waste Management, Inc.
24	Hazelwood Enterprises, Inc. LF	N/A	N/A	N/A	N/A	N/A	Landfill Owner
25	New Boston Landfill	New Boston	Bowie	N/A	N/A	N/A	N/A
26	Newton County Landfill	Mauriceville	Newton	N/A	N/A	N/A	N/A
27	North County C&D Landfill	League City	Galveston	N/A	N/A	N/A	Republic Services, Inc.
28	Paris Landfill	Paris	Lamar	N/A	N/A	N/A	N/A
29	Rio Grande Valley	Donna	Hidalgo	N/A	N/A	N/A	Allied Waste Services



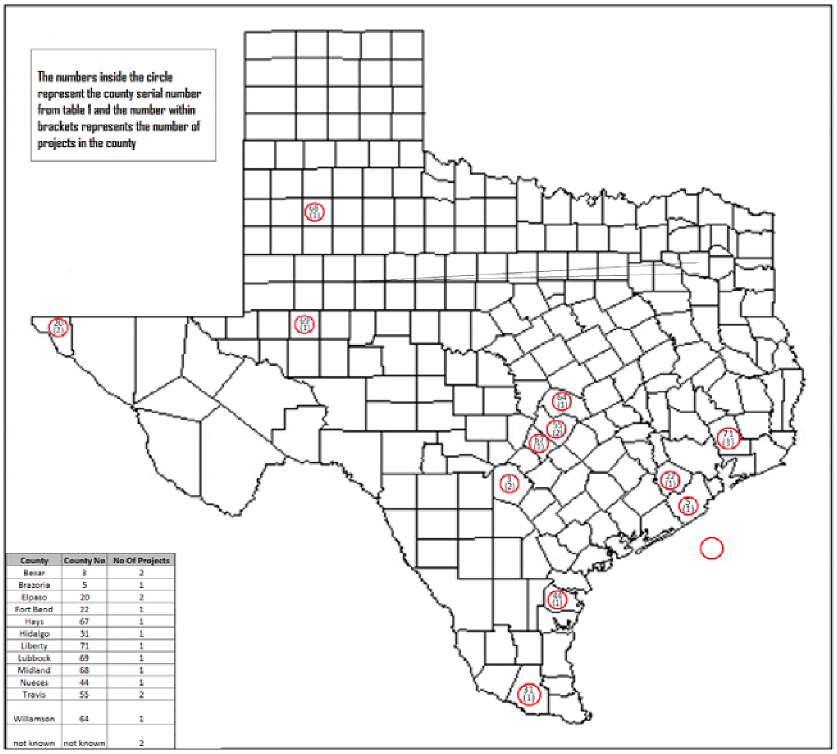
County	County No	No Of Projects
Archer	1	1
Bastrop	2	2
Bexar	3	11
Blanco	77	1
Brazoria	5	1
Brazos	6	1
Brewster	78	1
Brown	7	1
Burnet	8	2
Caldwell	9	2
Calhoun	10	1
Cameron	11	1
Childress	13	1
collin	14	4
Colorado	15	1
Comal	16	3

County	County No	No Of Projects
Dallas	17	5
Denton	18	1
DeWitt	19	1
El Paso	20	2
Fayette	21	2
Galveston	23	4
Gillespie	24	1
Gonzales	25	2
Gregg	27	1
Guadalupe	28	2
Harris	29	20
Harrison	30	1
Hays	67	2
Henderson	79	1
Hidalgo	31	1

County	County No	No Of Projects
Hunt	80	6
Jeff Davis	81	1
Jefferson	82	1
Jones	33	1
Kendall	34	1
Kimble	35	1
Kinney	36	1
Lampasas	37	1
Lee	38	1
Limestone	39	1
Llano	39	3
Maverick	40	1
Nueces	44	1
Potter	46	1
Presidio	47	1

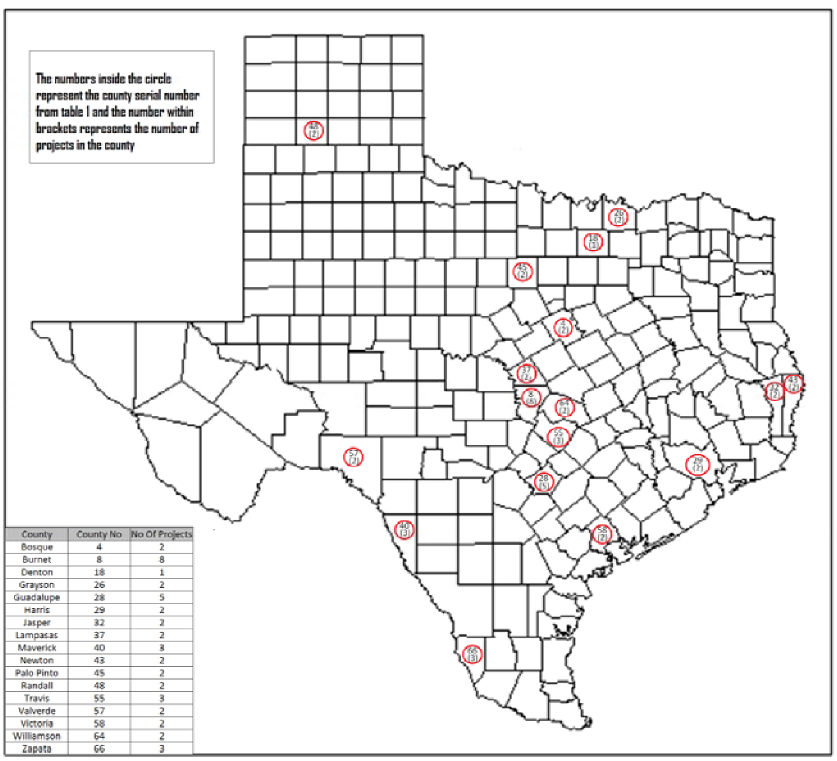
County	County No	No Of Projects
San Saba	84	1
Scurry	49	1
Smith	50	1
Sutton	51	1
Taylor	53	1
Tom Green	54	1
Travis	55	108
Uvalde	56	2
Ward	59	1
Washington	60	5
Webb	61	3
Wharton	62	1
Wichita	63	2
Williamson	64	1
Wood	65	1

Figure 6-1: Solar Photovoltaic Projects throughout Texas



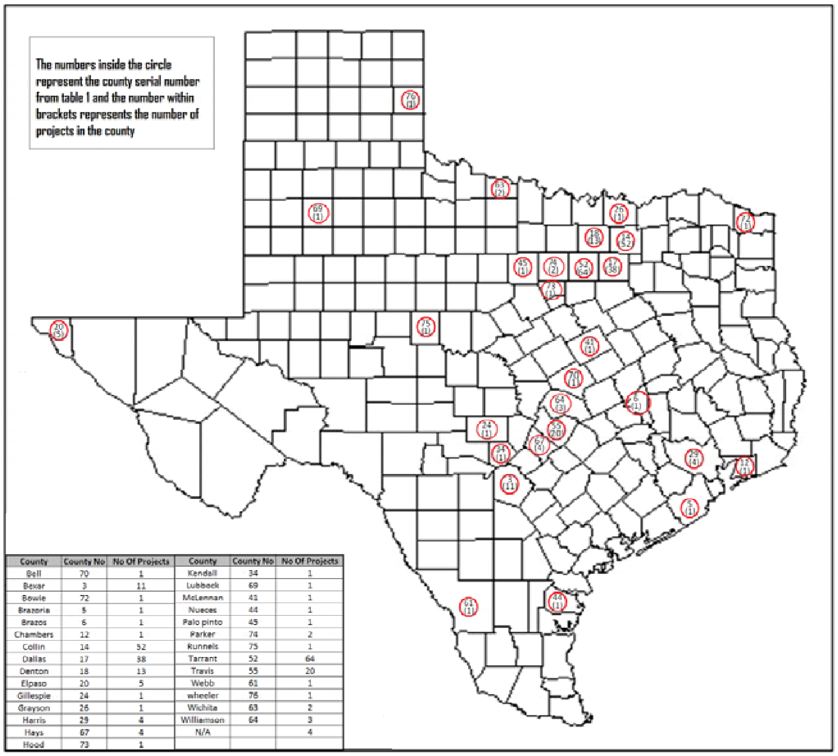
County	County No	No Of Projects
Bexar	3	2
Brazoria	5	1
Elpaso	20	2
Fort Bend	22	1
Hays	67	1
Hidalgo	31	1
Liberty	71	1
Lubbock	69	1
Midland	68	1
Nueces	44	1
Travis	55	2
Williamson	64	1
not known	not known	2

Figure 6-2: Solar Thermal Projects throughout Texas



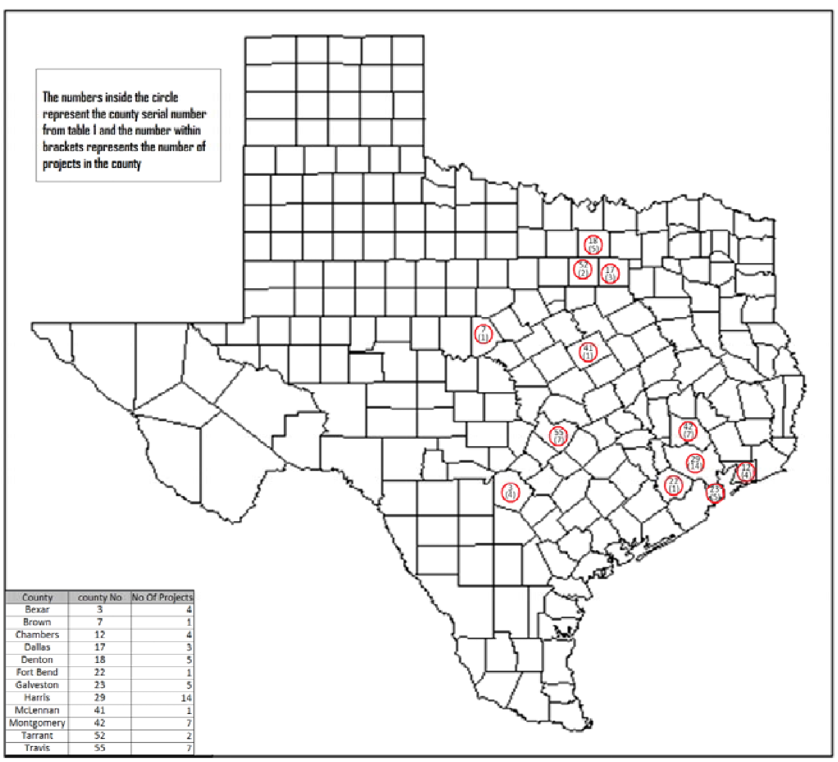
County	County No	No Of Projects
Bosque	4	2
Burnet	8	8
Denton	18	1
Grayson	26	2
Guadalupe	28	5
Harris	29	2
Jasper	32	2
Lampasas	37	2
Maverick	40	3
Newton	43	2
Palo Pinto	45	2
Randall	48	2
Travis	55	3
Valverde	57	2
Victoria	58	2
Williamson	64	2
Zapata	66	3

Figure 6-3: Hydropower Plants throughout Texas



County	County No	No Of Projects	County	County No	No Of Projects
Bell	70	1	Kendall	34	1
Bexar	3	11	Lubbock	69	1
Bowie	72	1	McLennan	41	1
Brazoria	5	1	Nueces	44	1
Brazos	6	1	Palo pinto	45	1
Chambers	12	1	Parker	74	2
Collin	14	52	Runnels	75	1
Dallas	17	38	Tarrant	52	64
Denton	18	13	Travis	55	20
Elpaso	20	5	Webb	61	1
Gillespie	24	1	wheeler	76	1
Grayson	26	1	Wichita	63	2
Harris	29	4	Williamson	64	3
Hays	67	4	N/A		4
Hood	73	1			

Figure 6-4: Geothermal Projects Installed throughout Texas



County	county No	No Of Projects
Bexar	3	4
Brown	7	1
Chambers	12	4
Dallas	17	3
Denton	18	5
Fort Bend	22	1
Galveston	23	5
Harris	29	14
McLennan	41	1
Montgomery	42	7
Tarrant	52	2
Travis	55	7

Figure 6-5: Landfill Gas-Fired Power Projects Installed throughout Texas

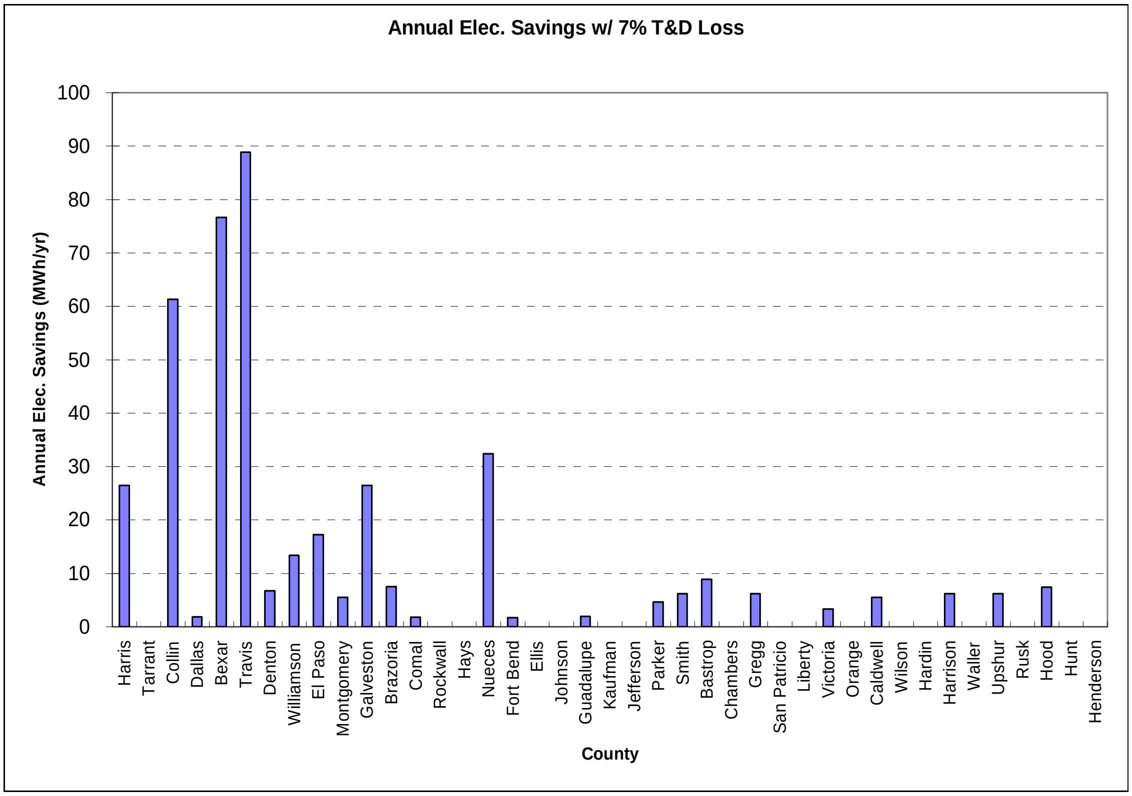


Figure 6-6: Annual Electric Savings per County from PV Projects

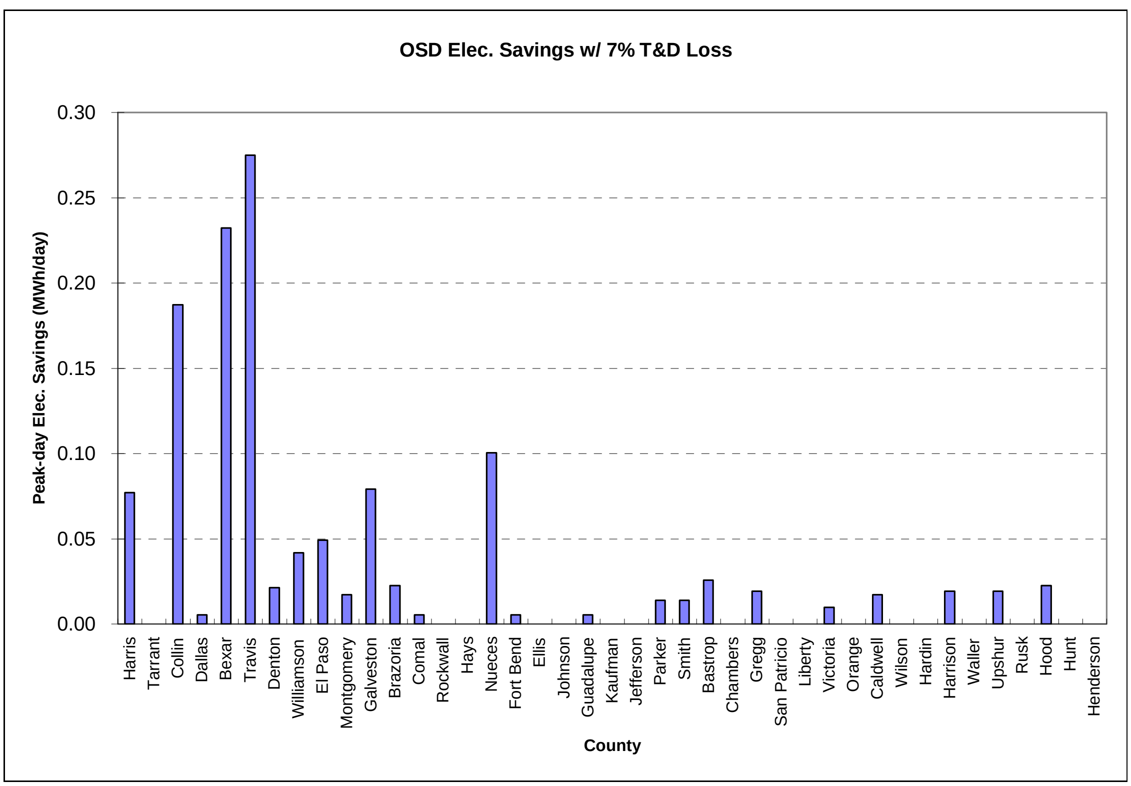


Figure 6-7: Ozone Season Day Electric Savings per County from PV Projects

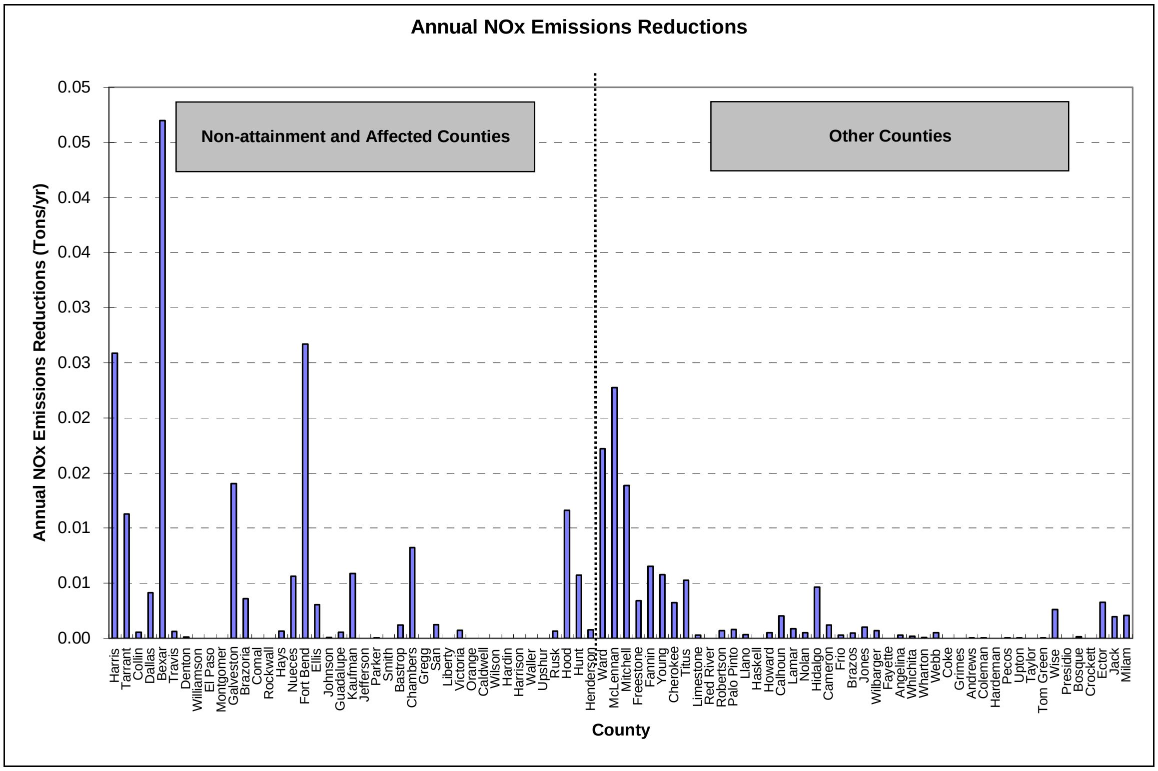


Figure 6-8: NOx Emissions Reductions per County from PV Projects

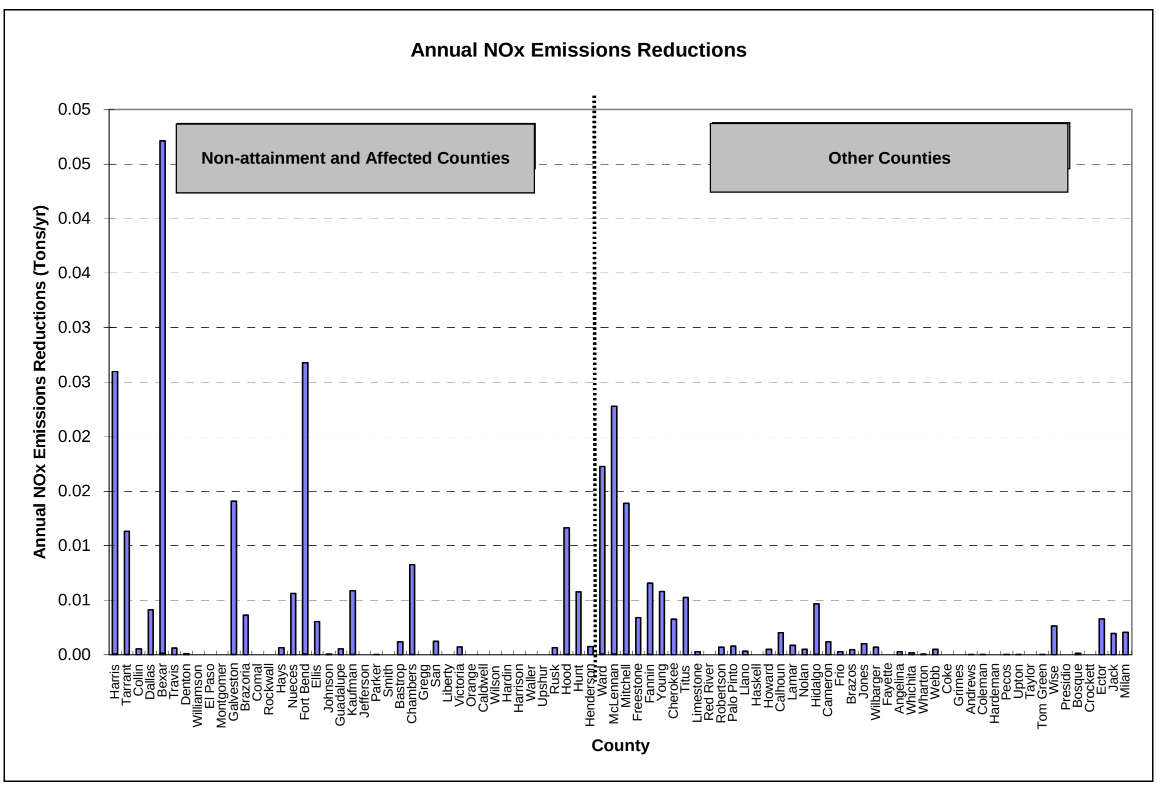


Figure 6-9: Ozone Season Day NOx Emissions Reductions per County from PV Projects

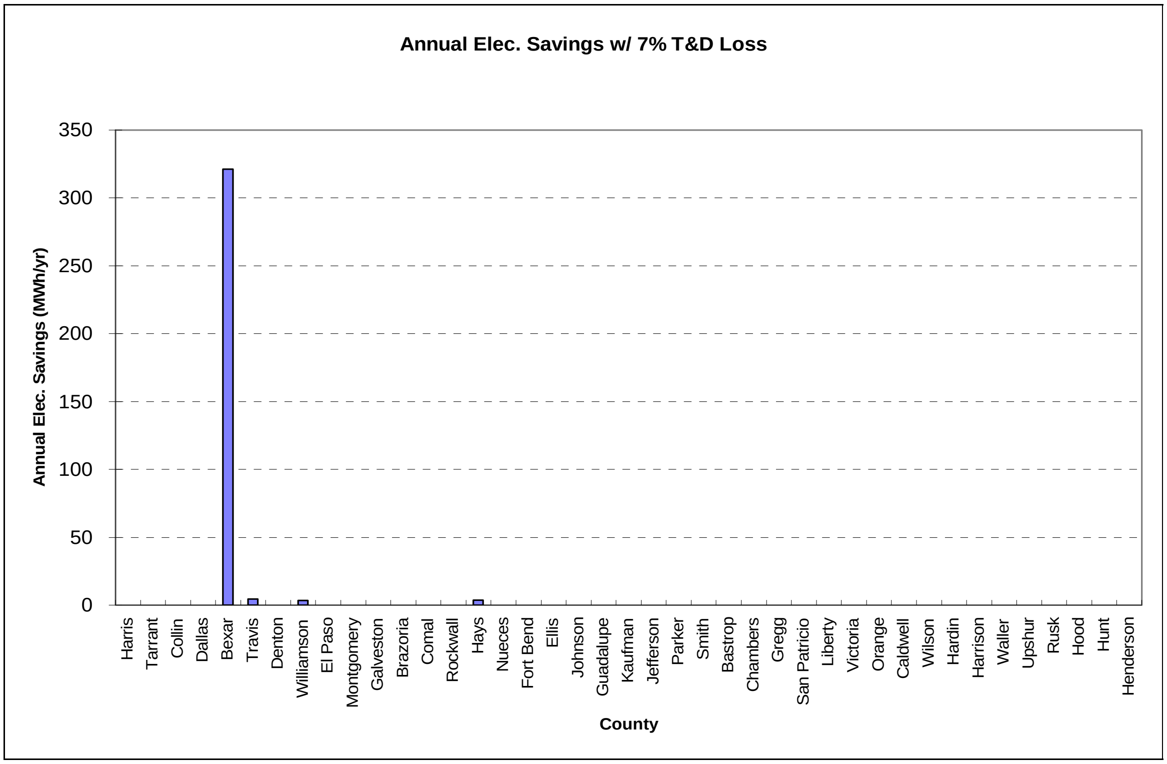


Figure 6-10: Annual Electric Savings per County from Solar Thermal Projects

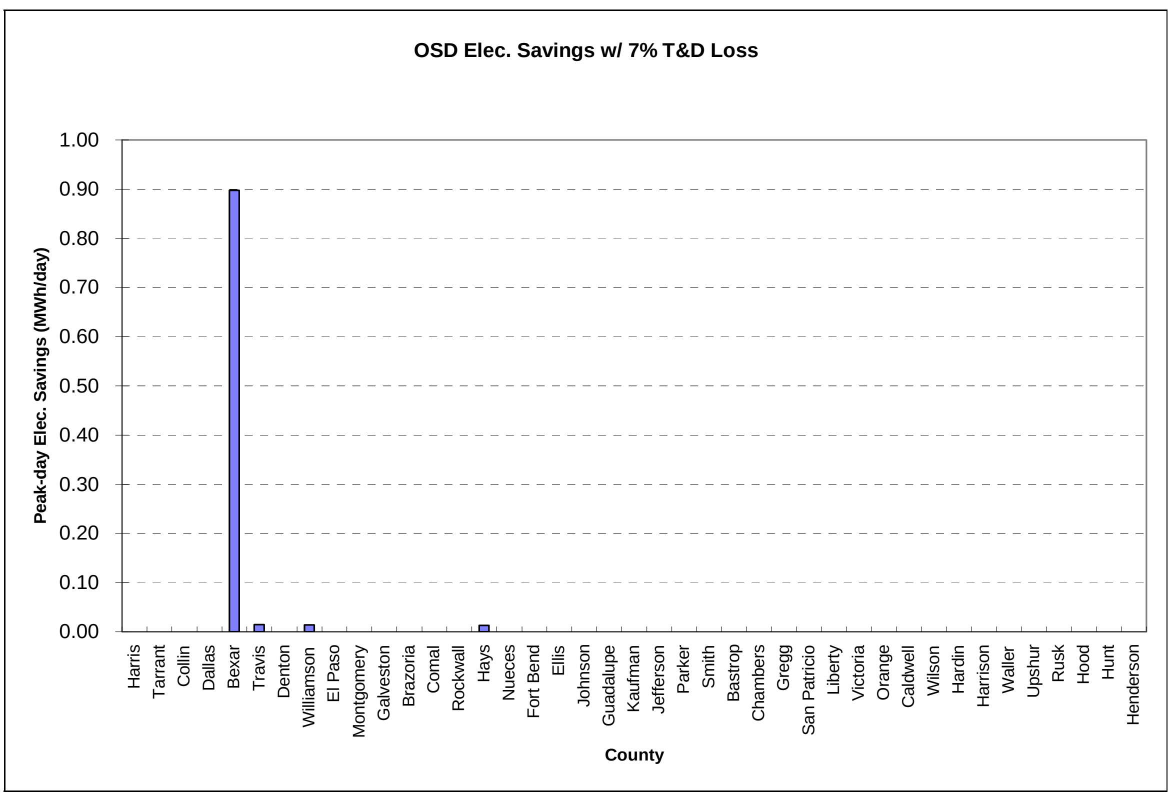


Figure 6-11: Ozone Season Day Electric Savings per County from Solar Thermal Projects

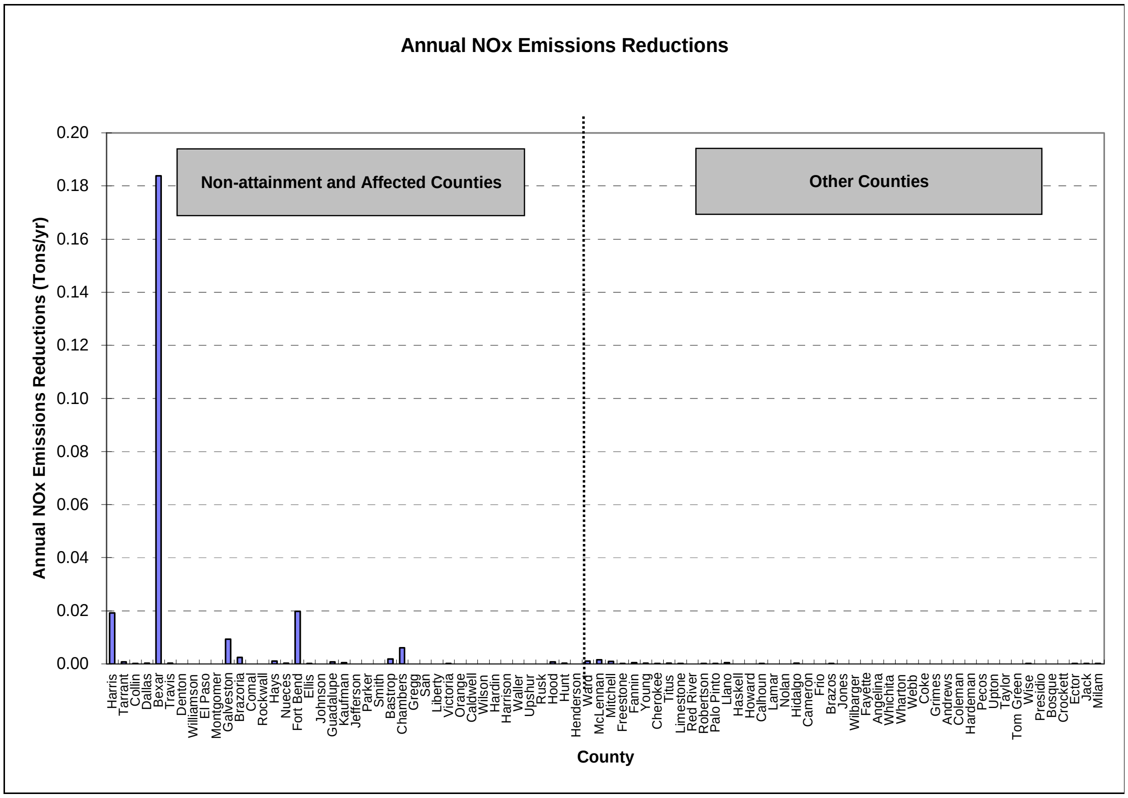


Figure 6-12*:* NOx Emissions Reductions per County from Solar Thermal Projects

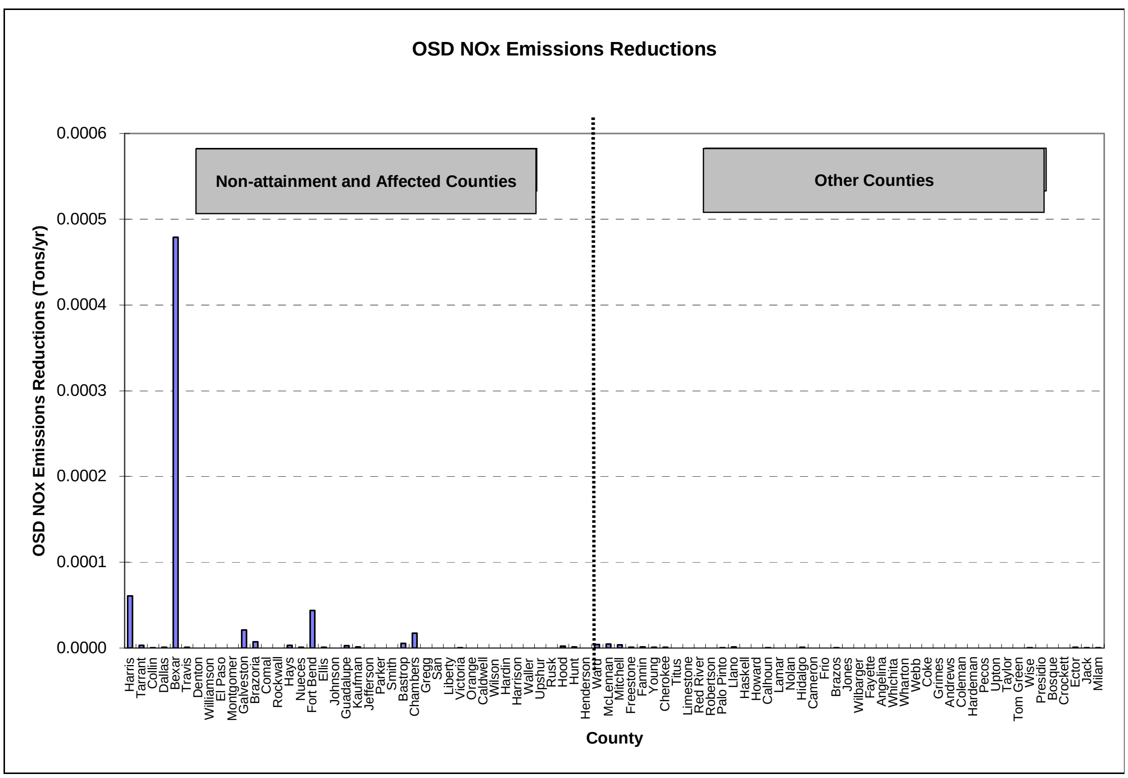


Figure 6-13: Ozone Season Day NOx Emissions Reduction per County from Solar Thermal Projects

7 REVIEW OF ERCOT'S RENEWABLE ENERGY CREDIT PROGRAM INFORMATION

7.1 Introduction

In this section, the information posted on ERCOT's Renewable Energy Credit Program site www.texasrenewables.com was reviewed for use in the ESL's report to the TCEQ. In particular, the information posted under the "Public Reports" tab was downloaded and assembled into an appropriate format for review. This includes ERCOT's 2001- 2008 reports to the Legislature, which were converted into tabular format for analysis and inserted into this report. Similarly, information from ERCOT's listing of REC generators was inspected to determine how it compared with other sources of information the ESL has assembled. Table 7-1 to Table 7-5 contains the list of REC generators that ERCOT has assembled up until the end of 2008.

7.2 Summary of Renewable Projects in Texas

Each year ERCOT is required to compile a list of grid-connected sources that generate electricity from renewable energy and report them to the Legislature. Table 7-6 contains the data reported by ERCOT from 2001- 2008 and Table 7-7 summarizes the same.

Figure 7-1, Figure 7-2 and Figure 7-3 have been included to better illustrate the annual data collected by ERCOT. In the figures and tables it is clear to see that the electricity generated by wind each year is the largest single source of renewable energy in Texas—which has grown from 565,597 MWh in 2001 to 16,286,383 MWh in 2008. This is followed by landfill gas: which has grown from 29,412 MWh in 2002 to 386,606 MWh in 2008; hydroelectric: 30,639 (2001) to 445,428 (2008); biomass: 39,496 MWh (2003) to70,833 MWh in 2008 and lastly solar: 87 MWh (2002) to 3,338 MWh (2008).

Table 7-1: ERCOT REC Generator List – Biomass

Company Name	Name Of Power Generating Company	Power Generating Company Code	Generator Site Name	Generator Site Code	Facility Identification Number	Unit Contact Information	Technology Type	Facility Noncompetitive Certification Data
Bio Energy (Austin) LLC	Bio Energy Austin LLC	DG_WALZE	DG_WALZE	DG_WALZE	38	Dennis Bollinger	Biomass	25512
Biofuels Power Corporation	Biofuels Power Inc.	20174	BFP Conroe	35861	116	Christopher Dufour	Biomass	35861
Biofuels Power Corporation	Biofuels Power Corporation	20174	Oak Ridge North	DG_RA	118	Chris Dufour	Biomass	34211
MeadWestvaco Texas LP	MeadWestvaco Texas LP	Evadale Opertions	MeadWestvaco Evadale Pulp and Paper Mill	Evadale Texas	63	Angela Robinson	Biomass	31646
Rio Grande Valley Sugar Growers, Inc.	RGVSugar	RGVSugar	RGVSugar	RGVSugar	97	Steve Bearden	Biomass	33421
Snider Industries, LLP	Snider Industries, LLP	Snider_1	Snider_1	Snider_1	109	Julianna Parr	Biomass	35526

Table 7-2: ERCOT REC Generator List – Hydro

Company Name	Name Of Power Generating Company	Power Generating Company Code	Generator Site Name	Generator Site Code	Facility Identification Number	Unit Contact Information	Technology Type	Facility Noncompetitive Certification Data
Guadalupe-Blanco River Authority	Guadalupe-Blanco River Authority	05-631-1608-3000	DG-MCQUEENEY	DG_MCQUE	4	Allen Ognoskie	Hydro	20028
Guadalupe-Blanco River Authority	Guadalupe-Blanco River Authority	05-631-1608-3000	DG_LAKEWOOD TAP	DG_LKWDT	11	Allen Ognoskie	Hydro	20028
Guadalupe-Blanco River Authority	Guadalupe-Blanco River Authority	05-631-1608-3000	CANYON	DG_CANYON	12	Allen Ognoskie	Hydro	20028
Maverick County Water Control	Maverick County Water	Maverick County	Maverick County Water	20141	92	Maverick County Water	Hydro	34674
Small Hydro of Texas, Inc.	Small Hydro of Texas, Inc.	71	DG_CUERO CSW	CUECPL	13	Linda A. Parker	Hydro	24191

Table 7-3: ERCOT REC Generator List – Solar

Company Name	Name Of Power Generating Company	Power Generating Company Code	Generator Site Name	Generator Site Code	Facility Identification Number	Unit Contact Information	Technology Type	Facility Noncompetitive Certification Data
Renewable Ventures	Nuon Renewable Ventures	NRV	Green Mountain Solar at Upper Kirby	USAPV003	19	Nuon Renewable Ventures	Solar	26410
Renewable Ventures	Nuon Renewable Ventures	NRV	Green Mountain Solar at The Winston School	USAPV002	20	Nuon Renewable Ventures	Solar	26411
The University of Texas - Houston	University of Texas - Houston	UTHSC	University Center Tower	University Center Tower	42	Rahsaan Arscott	Solar	No. 77027
Aeolus Wind	Aeolus Wind, LLC	Aeolus Wind, LLC	North Texas	NA	51	Sarah Adams	Wind	NA

Table 7-4: ERCOT REC Generator List – Landfill Gas

Company Name	Name Of Power Generating Company	Power Generating Company Code	Generator Site Name	Generator Site Code	Facility Identification Number	Unit Contact Information	Technology Type	Facility Noncompetitive Certification Data
Bio Energy (Texas), LLC	Bio Energy (Texas) LLC	32079	Covel Gardens Landfill Gas Power Station	DG_MEDIN	61	John M. Love	Landfill gas	20140
Cromeco, Inc.	Cromeco, Inc.	Cromeco, Inc.	Cromeco, Inc.	Cromeco, Inc.	76	Steve Cromeens	Landfill gas	29520
Fortistar	G2 Energy (FW Regional) LLC	77-998-1765	DG_RDLML_1 Unit	FW Regional	64	John Bean	Landfill gas	32558
G2 Energy (Trinity Oaks) LLC	G2 Energy (Trinity Oaks) LLC	828961529	Trinity Oaks LFG Generating Facility	DG KLBRG	136	Massimo Passini	Landfill gas	36679
Gas Recovery Systems, Inc.	Gas Recovery Systems	20066	Sunset Farms Electric	Sunset Farms Electric	37	Paul Hesson	Landfill gas	24199
Renovar Arlington, Ltd.	Renovar Arlington, Ltd.	Rnvr-1	Village Creek	Vcreek	53	Lisette Cowger	Landfill gas	31083
Renovar Arlington, Ltd.	Renovar Arlington, Ltd.	Rnvr-2	Village Creek	Vcreek	54	Lisette Cowger	Landfill gas	31083
Viridis Energy, LP - Baytown	Viridis Energy, LP - Baytown	01-62-16561	BAYTOWN	TRM	33	Mr Luong Nguyen	Landfill gas	26811
Viridis Energy, LP - Blue Bonnet	Viridis Energy, LP - Blue Bonnet	93-01-27472	BLUE BONNET	LB	34	Mr Luong Nguyen	Landfill gas	26809
Viridis Energy, LP - Coastal Plains	Viridis Energy, LP - Coastal Plains	93-01-16145	COASTAL PLAINS	ALVIN	32	Mr Luong Nguyen	Landfill gas	26812
Viridis Energy, LP - Conroe	Viridis Energy, LP - Conroe	Conroe	Conroe	Conroe	35	Mr Luong Nguyen	Landfill gas	26808
Viridis Energy, LP - Security	Viridis Energy, LP - Security	SECURITY	SECURITY	SECURITY	36	Mr Luong Nguyen	Landfill gas	26810
Viridis Energy, LP Atascocita	Viridis Energy, LP - Atascocita	93-01-87393	ATASCOCITA	HB	29	Mr Luong Nguyen	Landfill gas	26813
WM Renewable Energy, LLC	WM Renewable Energy, L.L.C.	Skyline	Skyline	DG_FERIS	83	Scott Burnell	Landfill gas	20161
WM Renewable Energy, LLC	WM Renewable Energy II, LLC	Austin	Austin	DG_SPRIN	95	Steven Korsgaard	Landfill gas	20161

Table 7-5: ERCOT REC Generator List – Wind

Company Name	Name Of Power Generating Company	Power Generating Company Code	Generator Site Name	Generator Site Code	Facility Identification Number	Unit Contact Information	Technology Type	Facility Noncompetitive Certification Data
American Wind Power Center	American Wind Power Center	Lubbock	AWPC	AWPC#1	60	Coy F. Harris	Wind	32470
Brazos Wind, LP	Brazos Wiind LP	Brazos Wind	Green Mountain Energy Wind Farm at Brazos	BRAZ_WND1	44	Scott McBride	Wind	29025
Brazos Wind, LP	Brazos Wind LP	Brazos Wind	Green Mountain Energy Wind Farm at Brazos	BRAZ_WND2	45	Scott McBride	Wind	29025
Buffalo Gap Wind Farm 2, LLC	Buffalo Gap Wind Farm 2, LLC	603768792	Buffalo Gap Wind Farm	BUFF_GAP	81	William Barnes	Wind	33477
Buffalo Gap Wind Farm 3, LLC	Buffalo Gap Wind Farm 3, LLC	Buffalo Gap Wind Farm 3, LLC	Buffalo Gap Wind Farm	BUFF_GAP	110	Fang Qing	Wind	35247
Buffalo Gap Wind Farm LLC	Buffalo Gap Wind Farm, LLC	Buffalo Gap	Buffalo Gap Wind Farm	Buffalo Gap	56	Gabe Vaca	Wind	31412
Bull Creek Wind LLC	Bull Creek Wind LLC	Bull Creek Wind LLC	Bull Creek Wind LLC	Bull Creek Wind LLC	131	Michael Adcock	Wind	36239
Callahan Divide	FPL Energy Callahan Divide	30385	Callahan Wind Energy	30385	55	David Gonzalez	Wind	30385
Capricorn Ridge Wind II, LLC	Capricorn Ridge Wind II, LLC	CR4	CR4	CR4	114	Daniel Sexton	Wind	20210
Capricorn Ridge Wind, LLC	Goat Mountain Wind LP	Goat Mountain Wind	Capridge	Capridge	93	Garson Knapp	Wind	34549
Champion Wind Farm, LLC	Airtricity Champion Wind Farm, LLC	242	Champion Wind Farm	TKWSW	99	Audrey Fogarty	Wind	20182
Delaware Mountain Wind Farm LP	DELAWARE MOUNTAIN WIND FARM LP	16	DELAWARE MOUNTAIN	DELAWARE	9	Linda Brandi	Wind	23705
Desert Sky Wind Farm 1 LP	Indian Mesa Power Parners I, L.P.	999	Indian Mesa I Wind Power	INDNENR	16	Richard Walker	Wind	24921
Desert Sky Wind Farm 2 LP	Indian Mesa Power Parners II, L.P.	999	Indian Mesa II Wind Power	INDNENR	17	Richard Walker	Wind	24922
ECR Panther Creek Wind Farm I and II, LLC	ECR Panther Creek Wind Farm I, LLC.	259	PANTHER CREEK	PC_NORTH	113	Crystal Walton	Wind	20208
ECR Panther Creek Wind Farm I and II, LLC	EC and R Panther Creek Wind Farm II, LLC	259	PANTHER CREEK	PC_SOUTH	126	Dean Tuel	Wind	35779
ECR Panther Creek Wind Farm III, LLC	ECR Panther Creek Creek Wind Farm III, LLC	ECR Panther Creek Creek Wind Farm III, LLC	PANTHER3	PANTHER3	141	Dean Tuel	Wind	20239
El Paso Electric Company	El Paso Electric	EPE	Hueco Mountain Wind Ranch	EPE1	1	Monica Garcia	Wind	23631
Elbow Creek Wind Project, LLC	Elbow Creek Wind Project LLC	Elbow Creek	Elbow Creek	Elbow Creek	127	Scott McBride	Wind	Elbow Creek
Forest Creek Wind Farm, LLC	Airtricity Forest Creek Wind Farm, LLC	210	Forest Creek Wind Farm	MCDLD	74	John Franklin	Wind	20166
FPL Energy Horse Hollow Wind II, LP	FPL Energy Horse Hollow II, LP	Horse Hollow II	Horse Hollow II	Horse Hollow II	69	John Mantyh	Wind	32524
FPL Energy Upton Wind I, L.P.	FPL Energy Upton Wind I, LP	94	KING MOUNTAIN SW	KING_SW	6	Jesse Nevarez	Wind	Unknown
FPL Energy Upton Wind II, LP	FPL Energy Upton Wind II, LP	96	KING MOUNTAIN NW	KING_NW	7	Jesse Nevarez	Wind	Unknown
FPL Energy Upton Wind IV, LP	FPL Energy Upton Wind IV, LP	96	KING MOUNTAIN SE	KING_SE	15	Jesse Nevarez	Wind	Unknown

Table 7-5: ERCOT REC Generator List – Wind (cont.)

Company Name	Name Of Power Generating Company	Power Generating Company Code	Generator Site Name	Generator Site Code	Facility Identification Number	Unit Contact Information	Technology Type	Facility Noncompetitive Certification Data
FPL Pecos Wind 1 LP, LLC	FPL Pecos Wind I & II, LP	93	WOODWARD1	WOODWRD1	2	Jesse Nevarez	Wind	Unknown
FPL Pecos Wind 2 LP, LLC	FPL Energy Pecos Wind I&II, LP	93	WOODWARD 2	WOODWRD2	8	Jesse Nevarez	Wind	24296
Goat Wind, LP	Goat Wind, LP	809226603	GOAT WIND LP	GOAT WIND	98	Johnny Johnson	Wind	35439
Hackberry Wind, LLC	Hackberry Wind LLC	HWFLLC	Hackberry Wind Farm	HWF	124	Matthew Burt	Wind	20185
High Plains Wnd Power LLC	High Plains Wind Power LLC	20197	High Plains Wind Power	High Plains Wind Power	111	Steven Maller	Wind	34994
Iberdrola Renewables, Inc.	Barton Chapel Wind LLC	Barton Chapel	Barton Chapel	Barton Chapel	138	Bobby Clark	Wind	36825
Iberdrola Renewables, Inc.	Penascal Wind Power LLC	Penascal	Penascal	Penascal	139	Dan Pitts	Wind	36829
Inadale Wind Farm, LLC	Inadale Wind Farm, LLC	Inadale Wind Farm, LLC	Inadale Wind Farm, LLC	INDL_INADALE1	134	Dean Tuel	Wind	36500
Indian Mesa, L.P.	NWP INDIAN MESA WIND FARM LP	17	INDIAN MESA NWP	INDNNWP	10	Linda Brandi	Wind	23745
JD Wind 1	JD Wind 1	20137	JD Wind 1	JD Wind 1	65	Steve Maller	Wind	32802
JD Wind 10 LLC	JD Wind 10	20195	JD Wind 10	JD Wind 10	106	Steven Maller	Wind	34992
JD Wind 11 LLC	JD Wind 11	20196	JD Wind 11	JD Wind 11	107	Steven Maller	Wind	34993
JD Wind 2	JD Wind 2	20138	JD Wind 2	JD Wind 2	66	Steve Maller	Wind	32803
JD Wind 3	JD Wind 3	20139	JD Wind 3	JD Wind 3	67	Steve Maller	Wind	32804
JD Wind 4	JD Wind 4	20153	JD Wind 4	JD Wind 4	75	Steven Maller	Wind	33760
JD Wind 5	JD Wind 5	20154	JD Wind 5	JD Wind 5	71	Steven Maller	Wind	32912
JD Wind 6	JD Wind 6	20155	JD Wind 6	JD Wind 6	72	Steven Maller	Wind	32913
JD Wind 7 LLC	JD Wind 7	20193	JD Wind 7	JD Wind 7	108	Steven Maller	Wind	34990
JD Wind 8 LLC	JD Wind 8	20194	JD Wind 8	JD Wind 8	105	Steven Maller	Wind	34991
JD Wind 9 LLC	JD Wind 9	20189	JD Wind 9	JD Wind 9	104	Steve Maller	Wind	34924
Llano Estacado	Llano Estacado Wind Ranch at White Deer	Shell	White Deer	White Deer Wind	18	Craig Dencklau	Wind	23633
Majestic Wind Power LLC	Majestic Wind Power LLC	Majestic Wind Power LLC	Majestic Wind Power LLC	Majestic Wind Power LLC	117	Kim Takayesu	Wind	35871
McAdoo Wind Energy LLC	McAdoo Wind Energy LLC	McAdoo Wind	McAdoo Wind Energy Center	MWEC	119	Scott Ebner	Wind	35935
Mesquite Wind, LLC	Mesquite Wind LLC	Horizon Wind	Horizon Wind	Horizon Wind	68	Brian Hayes	Wind	32936
Noble Great Plains Windpark, LLC	Noble Great Plains Windpark, LLC	Noble Great Plains Windpark, LLC	Noble Great Plains Windpark, LLC	Noble Great Plains Windpark, LLC	120	Harry Silton	Wind	20227
Notrees Windpower, LP	Notrees Windpower LP	Notrees	Notrees Windfarm	NWF	137	Jason Allen	Wind	36350
Ocotillo Windpower, LP	Ocotillo Windpower LP	Ocotillo Windpower	Ocotillo Windfarm	OWF	122	Jason Allen	Wind	35453

Table 7-5: ERCOT REC Generator List – Wind (cont.)

Company Name	Name Of Power Generating Company	Power Generating Company Code	Generator Site Name	Generator Site Code	Facility Identification Number	Unit Contact Information	Technology Type	Facility Noncompetitive Certification Data
Post Oak Wind, LLC	Post Oak Wind	Post Oak Wind	Post Oak Wind	Post Oak Wind	78	Brian Hayes	Wind	33801
Post Wind Farm LP	Post Wind Farm, LP	Post Wind	Post Wind	Post Wind	70	John Cote	Wind	32525
PYCO Industries, Inc.	PYCO Industries, Inc.	70047	PYCO Industries Plant #2	2	125	PYCO Industries, Inc. Wind Farm	Wind	36175
Pyron Wind Farm, LLC	Pyron Wind Farm, LLC	Pyron Wind Farm, LLC	Pyron Wind Farm, LLC	PYR_PYRON1	135	Dean Tuel	Wind	36501
Roscoe Wind Farm, LLC	Airtricity Roscoe Wind Farm, LLC	243	Roscoe Wind Farm	TKWSW1	100	Audrey Fogarty	Wind	20180
Sand Bluff Wind Farm, LLC	Airtricity Sand Bluff Wind Farm, LLC	211	Sand Bluff Wind Farm	MCDLD	77	Phil Dutton	Wind	20165
Scurry County Wind II LLC	Scurry County Wind II LLC	scurry county wind II	Camp Springs Energy Center	CSEC	101	Scott Ebner	Wind	35290
Scurry County Wind, L.P.	Scurry County Wind, L.P.	scurry county wind	Camp Springs Energy Center	CSEC	80	Scott Ebner	Wind	33902
Sherbino I Wind Farm LLC	Sherbino I Wind Farm, LLC	20220	Sherbino I Wind Farm	KEO	121	James Holly	Wind	35887
Silver Star I Power Partners, LLC	Silver Star I Power Partners LLC	20186	Silver Star Wind	FLTCK	123	James C Holly	Wind	35551
Snyder Wind Farm, LLC	Snyder Wind Farm, LLC	20187	Snyder Wind Farm	ENAS	96	Eric Barreveld	Wind	34754
South Trent Wind LLC	South Trent Wind LLC	35778	South Trent Wind Farm	STWF	115	Kim Takayesu	Wind	35750
Sunray Wind, LLC	Sunray Wind, LLC	20234	Sunray Wind, LLC Wind Farm	Sunray Wind, LLC	132	William Root	Wind	36672
Sweetwater Wind Power LLC	Sweetwater Wind power LLC	137899477	Sweetwater Wind 1	SWEETWND	43	Kim Takayesu	Wind	28924
Sweetwater Wind Power LLC	Sweetwater Wind Power	Sweet Wind 2	Sweetwater Wind 2	SWEETWND2	52	Kim Takayesu	Wind	30462
Sweetwater Wind Power LLC	Sweetwater Wind Power	603943148	Sweetwater Wind 3 LLC_AE	SWEETWND3	58	Kim Takayesu	Wind	31983
Sweetwater Wind Power LLC	Sweetwater Wind Power	603943148-3000	Sweetwater Wind 3 LLC_CPS	SWEETWND3	59	Kim Takayesu	Wind	31983
Sweetwater Wind Power LLC	Sweetwater Wind 4 LLC	Sweetwater Wind 4 LLC	Sweetwater Wind 4 LLC	Sweetwater Wind 4 LLC	79	Kim Takayesu	Wind	34058
Sweetwater Wind Power LLC	Sweetwater Wind 5 LLC	Sweetwater Wind 5 LLC	Sweetwater Wind 5 LLC	SWEETWN5	82	Kim Takayesu	Wind	34709
Texas Gulf Wind LLC	Texas Gulf Wind LLC	Texas Gulf Wind LLC	Texas Gulf Wind LLC	TGW	112	Kim Takayesu	Wind	35810
Texas State Technical College	Texas State Technical College West Texas	TSTC	TSTC West Texas	DG ROSC2	133	Ray Fried	Wind	20240
Trent Wind Farm, L.P.	Trent Wind Farm, L.P.	70	TRENT MESA WIND FARM	TRENT	5	Richard Walker	Wind	24322
Turkey Track Wind Energy LLC	Turkey Track Wind Energy LLC	Turkey Track Wind	Turkey Track Wind Energy Center	TTWEC	128	Scott Ebner	Wind	36369
Upton Wind III, LP	FPL Energy Upton Wind III, LP	96	KING MOUNTAIN NE	KING_NE	14	Jesse Nevarez	Wind	20063
Whirlwind Energy, LLC	Whirlwind Energy, LLC	WELLC	Whirlwind Energy Center	WEC	103	Matthew Burt	Wind	20172
Wolf Ridge Wind, LLC	Wolf Ridge Wind, LLC	C41483	WOLF RIDGE	WLFRIDGE	129	Rory Robinson	Wind	36015

Table 7-6: Electricity Generation by Renewable Sources (MWh, ERCOT: 2001 – 2008 by Quarter)

Technology Type	Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total MWh
Biomass	2001					
Hydro	2001					
Landfill gas	2001					
Solar	2001	0	0	11293	19346	30639
Wind	2001	0	0	201,118	364,479	565,597
Totals		0	0	212,411	383,825	596,236

Technology Type	Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total MWh
Biomass	2002					
Hydro	2002	105,817	69,165	80,154	56,956	312,093
Landfill gas	2002	8,216	7,073	6,986	7,137	29,412
Solar	2002	0	29	37	21	87
Wind	2002	611,708	716,896	622,262	500,618	2,451,484
Totals		725,741	793,163	709,439	564,732	2,793,076

Technology Type	Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total MWh
Biomass	2003	8,876	11,253	10,999	8,368	39,496
Hydro	2003	92,680	52,592	71,699	22,713	239,684
Landfill gas	2003	29,995	44,629	39,920	39,662	154,206
Solar	2003	32	70	69	49	220
Wind	2003	561,994	670,248	617,794	665,446	2,515,482
Totals		693,577	778,792	740,481	736,238	2,949,088

Technology Type	Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total MWh
Biomass	2004	6,274	11,459	11,482	7,725	36,940
Hydro	2004	55,638	52,735	52,350	74,067	234,791
Landfill gas	2004	52,801	47,964	53,659	49,018	203,443
Solar	2004	31	67	70	44	211
Wind	2004	815,010	1,014,396	610,157	770,066	3,209,629
Totals		929,755	1,126,621	727,718	900,920	3,685,014

Table 7-6: Electricity Generation by Renewable Sources (MWh, ERCOT: 2001 – 2008 by Quarter) – (cont.)

Technology Type	Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total MWh
Biomass	2005	13,921	15,069	14,764	14,883	58,637
Hydro	2005	108,974	106,893	61,189	33,246	310,302
Landfill gas	2005	52,118	51,193	56,166	54,301	213,777
Solar	2005	46	69	67	46	227
Wind	2005	801,232	1,246,182	869,508	1,304,646	4,221,568
Totals		976,291	1,419,406	1,001,694	1,407,122	4,804,511

Technology Type	Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total MWh
Biomass	2006	16,327	10,479	17,152	16,610	60,569
Hydro	2006	55,000	83,064	44,870	27,143	210,077
Landfill gas	2006	69,191	78,650	75,665	82,580	306,087
Solar	2006	26	43	41	26	136
Wind	2006	1,478,927	1,584,166	1,376,540	2,091,295	6,530,928
Totals		1,619,471	1,756,402	1,514,268	2,217,654	7,107,797

Technology Type	Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total MWh
Biomass	2007	13,052	15,061	11,991	11,720	51,823
Hydro	2007	66,084	120,486	139,965	56,346	382,882
Landfill gas	2007	84,367	86,372	85,612	99,987	356,339
Solar	2007	339.1	502.73	541.03	461.03	1,844
Wind	2007	1,961,152	2,029,806	2,020,869	3,327,929	9,339,756
Totals		2,124,994	2,252,228	2,258,979	3,496,444	10,132,645

Technology Type	Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total MWh
Biomass	2008	21,154	14,019	12,564	23,095	70,833
Hydro	2008	98,510	177,051	78,751	91,116	445,428
Landfill gas	2008	105,217	97,361	88,470	95,558	386,606
Solar	2008	446	862	992	1038	3,338
Wind	2008	4,030,973	4,737,188	2,639,509	4,878,713	16,286,383
Totals		4,256,300	5,026,481	2,820,287	5,089,520	17,192,589

Table 7-7: Electricity Generation by Renewable Sources (MWh, ERCOT: 2001 – 2008 by Quarter)

Technology Type	2001	2002	2003	2004	2005	2006	2007	2008
Wind	565,597	2,451,484	2,515,482	3,209,629	4,221,568	6,530,928	9,339,756	16,286,383
Hydro		312,093	239,684	234,791	310,302	210,077	382,882	445,428
Landfill gas		29,412	154,206	203,443	213,777	306,087	356,339	386,606
Biomass			39,496	36,940	58,637	60,569	51,823	70,833
Solar		87	220	211	227	136	1,844	3,338
Totals	565,597	2,793,076	2,949,088	3,685,014	4,804,511	7,107,797	10,132,645	17,192,588

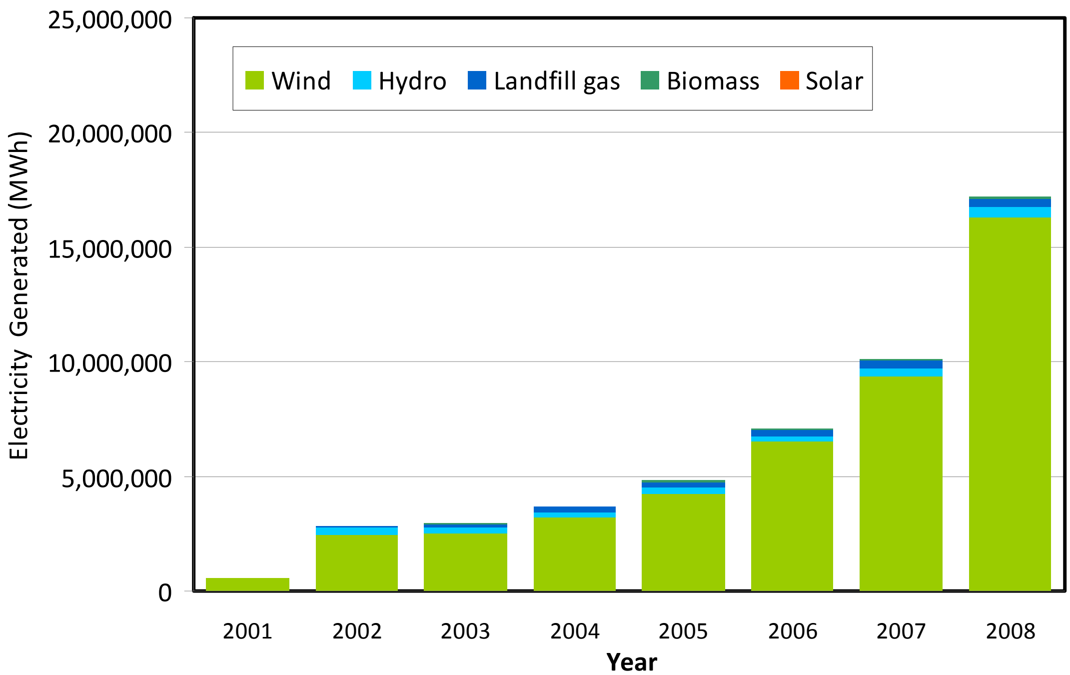


Figure 7-1: Electricity Generation by Renewable Sources (ERCOT: 2001 – 2008 Annual)

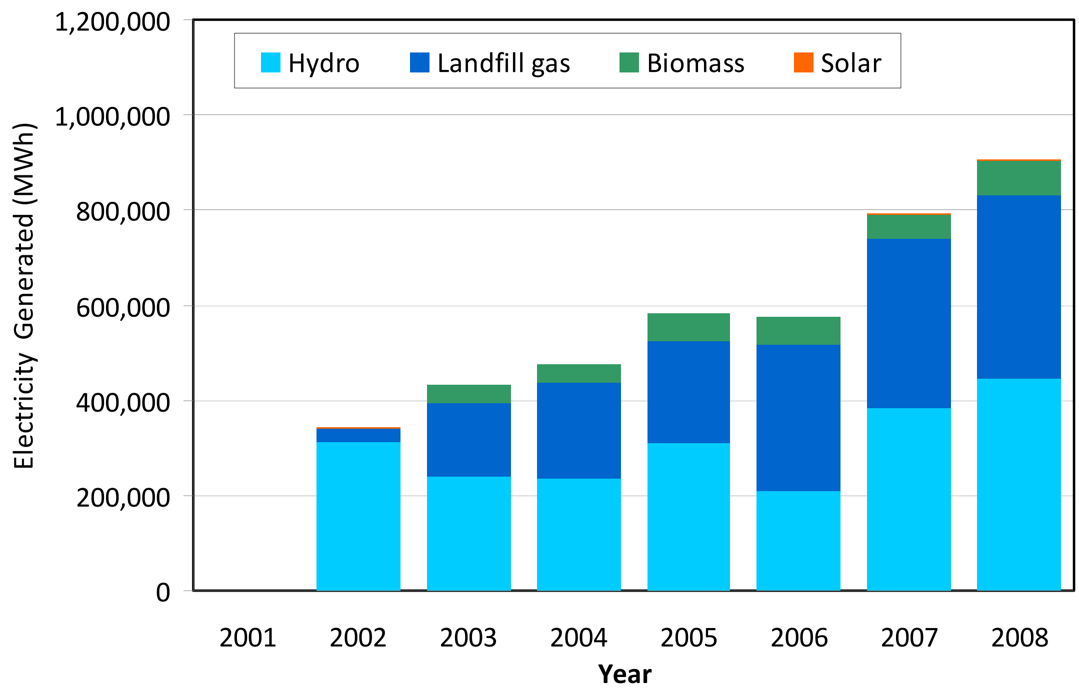


Figure 7-2: Electricity Generation by Renewable Sources Other Than Wind (ERCOT: 2001 – 2008 Annual)

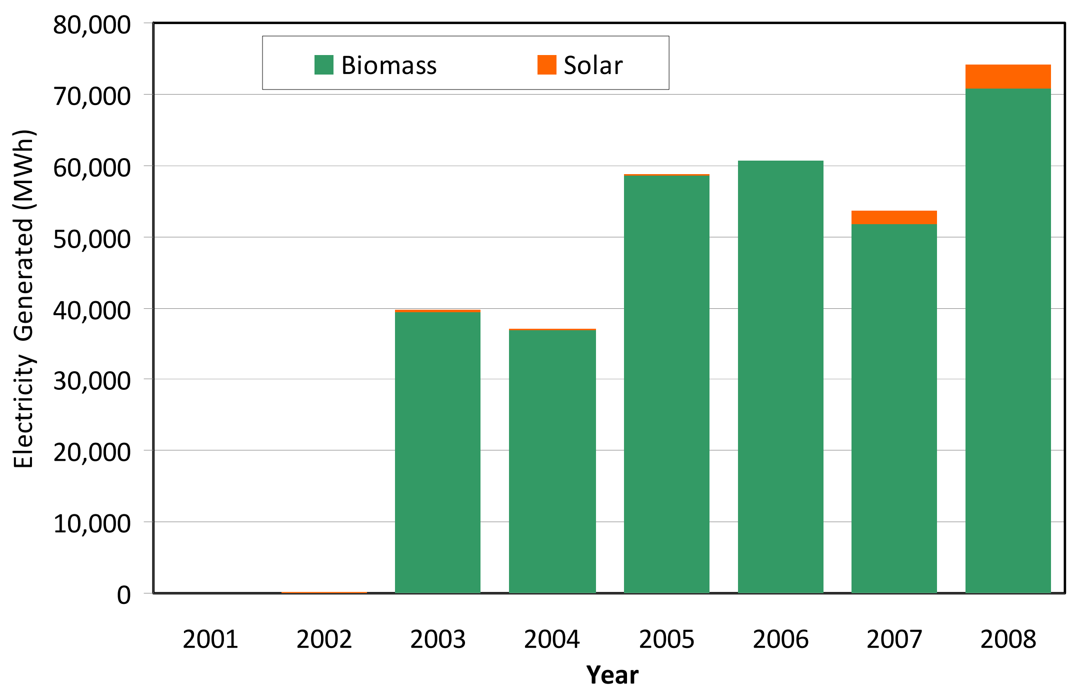


Figure 7-3: Electricity Generation by Renewable Sources from Solar and Biomass (ERCOT: 2001 – 2008 Annual)

8 COMBINED HEAT AND POWER PROJECTS IN TEXAS

Texas leads the United States in Combined Heat and Power (CHP) applications, which is also known as cogeneration. About 23% of all CHP generation capacity in the US is located in Texas[11]. This capacity produces 20% of the electricity in Texas[12]. In Texas, typical power plants built by electric utilities are steam plants that are 25% - 35% efficient. The natural gas combined cycle power plants operate at about 50% efficiency. CHP technologies generate electrical and thermal energy in a single, integrated system close to the point of customer energy demand. A typical CHP system consists of a prime mover to generate electricity, a heat recovery system to capture heat, a control system, an exhaust system, and an acoustic enclosure. The thermal energy recovered in a CHP system can be used for heating or cooling in industry or buildings. Thus, CHP facilities are a major energy conservation technique with a high efficiency falling to the 70% - 85% range.

As of 2007, 16,829 MW of CHP technologies were integrated into infrastructure served by the Texas electrical grid according to the database maintained by DOE and Oak Ridge National Laboratory. Table 8-1 summarizes all of the CHP projects that began operation from 1921 to 2007 in Texas[13], including the operation year, capacity, city located, type of prime mover and type of primary fuel, etc., for each CHP project. A report from Summit Blue Consulting LLC (Summit Blue Consulting LLC, 2008) identified 135 facilities currently operating CHP systems capable of generating 17,333 MW of power as of 2008. Figure 8-1 shows the map of existing CHP installations in Texas provided in the same report.

The ESL is working on developing a procedure to calculate annually creditable NOx emissions reductions from CHP facilities for the State Implementation Plan (SIP) credits. As part of this work, the ESL has sent a survey form to many CHP facilities in the Texas and is currently waiting for responses. Figure 8-2 shows the details of this survey form. Once the ESL gets the response back from the CHP facilities, the work on calculating annually creditable NOx emission reductions will be initiated and the results will be included in the future report when ready.

[11] USDOE, Energy Information Agency (EIA), 2005 data
[12] USDOE, Energy Information Agency (EIA), 2006 data
[13] Information obtained from the website of Energy and Environmental Analysis Inc. http://www.eea-inc.com/chpdata/States/TX.html

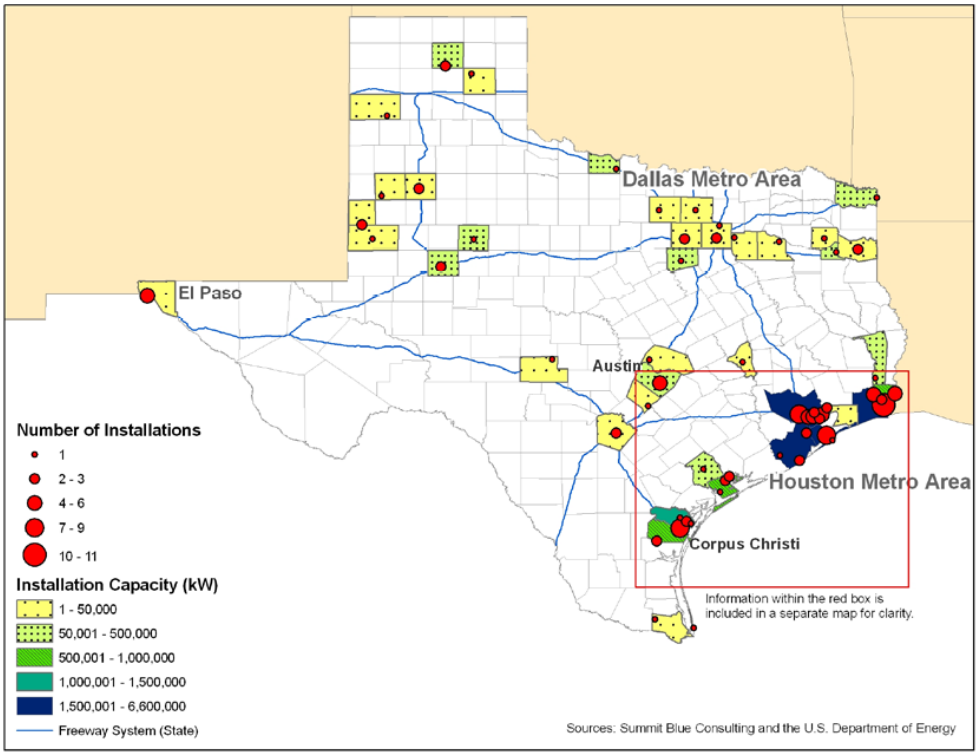


Figure 8-1: Map of Existing CHP Installations in Texas

(Source: "Combined Heat and Power in Texas: Status, Potential, and Policies to Foster Investment", Summit Blue Consulting LLC, December 2008.)

Figure 8-2: ESL CHP Survey Form

About Currently Installed System

1 Type of system:

- ○ Recip Engine- Rich burn ○ Recip Engine- Lean Burn ○ Recip Engine- Diesel ○ Microturbine
- ○ Combustion Turbine ○ Back Pressure Steam Turbine ○ Fuel Cell
- ○ Others [ ]

2 Electricity generating capacity: [ ] kW/ Unit

3 Number of identical units in system: [ ]

4 How many hours per year does the CHP system operate?

Average number of hours per year [ ]

5 Does the CHP provide Heating or Cooling or both?

○ Heating Only ○ Cooling Only ○ Heating and Cooling

If heating and cooling: How many of the total hours are in cooling mode?

Average number of hours per year [ ]

If heating and cooling: Does the system provide Simultaneous Heating and Cooling?

○ Yes ○ No

6 Fuel type:

- ○ Natural Gas ○ Diesel Fuel ○ Distillate Oil ○ Coal
- ○ Propane ○ Biomass ○ Other (Including Renewables)

7 Electricity generating efficiency: [ ] %

8 Base power to heat ratio: Power to Heat Ratio [ ]

9 Does the system incorporate Duct Burners?

○ Yes ○ No

If Yes,

a) What is the total fuel input capacity of the burners for each CHP unit?

[ ] MMBtu/hr

b) During the hours the CHP is operating, how much do the duct burners operate?

As the percentage of CHP operating hours [ ] %

If Applicable:

10 Type of absorption chiller used and its Coefficient of Performance:

Type [ ] COP [ ]

11 Cooling capacity of the system: [ ] Cooling Tons

About Displaced System

Dispaced Thermal: 1. Type of system:

- ○ Gas Boiler ○ Distillate oil boiler ○ Residual oil boiler
- ○ Coal Boiler ○ Propane Boiler ○ Electric Resistance or Heat pump
- ○ Others [ ]

2. Generating efficiency of the displaced boiler: [ ] **%**

Displaced Cooling: 1. Type of system

- ○ Roof Top Unit ○ Reciprocating Compressor, Air Cooled
- ○ Rotary Screw Compressor, Air Cooled ○ Centrifugal Compressor, Water Cooled
- ○ Others [ ]

2. Efficiency of the cooling system: **COP:** [ ]

or kW/ton: [ ]

General Information

Company Name: ______

Address: ______

Contact Person: ______

Email Address: ______

Phone Number: ______

Note: The collected information in this survey will be kept confidential and will not be disclosed. It will be only used for the purposes of the determination, as state/county, of the emissions reduction that the CHP technology provides.

Energy Systems Laboratory
Texas Engineering Experiment Station
Texas A&M University

Table 8-1: CHP units located in Texas as of 2007

State	City	Organization Name	Facility Name	Application	Op Year	Prime Mover	Capacity (kw)	Fuel Type	SIC4	NAICS
TX	Freeport	Dow Chemical	Dow Chemical Freeport Energy Center	Chemicals	2007	CC	224,000	NG	2819	325188
TX	Pineland	Temple Inland	Temple Inland	Wood Products	2007	B/ST	978	WOOD	2421	321113
TX	Austin	Dell Childrens Hospital	Dell Childrens Hospital	Hospitals/Healthcare	2006	CT	4,600	NG	8062	62211
TX	Fort Worth	Kaufman County Paper Recycling	Paper Recycling	Solid Waste Facilities	2006	CT	4,000	NG	4953	562212
TX	Galveston	Moody Gardens	Moody Gardens	Museums/Zoos	2005	FCEL	200	NG	8422	71213
TX	Snyder	Kinder Morgan Production Company	EG178 Facility / Snyder Gas Plant	Oil/Gas Extraction	2005	CC	132,000	NG	1311	211111
TX	Austin	Austin Energy	Domain Industrial Park	Misc. Manf.	2004	CT	5,000	NG	3999	339999
TX	Texas City	South Houston Green Power LP / Green Power 2 / Cinergy	BP Texas City Refinery	Refining	2004	CC	580,000	NG	2911	32411
TX	Deer Park	Calpine - Deer Park Energy Center	Shell Chemical Company	Refining	2003	CC	792,000	NG	2911	32411
TX	Addis	Calpine - Central LP	Baytown Energy Center LP / Bayer Corporation	Refining	2002	CC	913,000	NG	2911	32411
TX	Corpus Christi	Calpine - Corpus Christi Energy Center	Citgo Refining	Refining	2002	CC	523,000	NG	2911	32411
TX	Channelview	Reliant Energy Power OPS I Inc	Reliant Energy Channelview LP / Equistar	Chemicals	2001	CT	293,000	NG	2800	325
TX	Deer Park	BP Amoco Chemicals Company / INEOS Olefins & Polymers	BP Solvay Polyethylene North America	Refining	2001	CT	20,000	OTR	2911	32411
TX	Fort Worth	Arlington Lanfill	Village Creek Municipal WWTP	Wastewater Treatment	2001	CT	10,600	BIOMASS	4952	22132
TX	Harrison	Calpine - Channel Energy Center	Lyondell-CITGO Refining L.P.	Refining	2001	CC	527,000	NG	2911	32411
TX	Longview	Eastex CoGeneration LP	Eastex Cogeneration Facility / Eastman Chemical	Chemicals	2001	CC	467,700	NG	2800	325
TX	Orange	SRW Cogeneration LP	SRW Cogeneration Limited Partnership / Conoco Global/ DuPont	Chemicals	2001	CC	420,000	NG	2800	325
TX	Port Arthur	BASF Corp	NROC Cogeneration Facility	Chemicals	2001	CT	83,200	NG	2899	325998
TX	Baytown	LCY Elastomers / Enichem Americas, Inc.	LCY Elastomers	Chemicals	2000	CT	5,300	NG	2800	325
TX	El Paso	Leviton Manufacturing Inc	Leviton Manufacturing Co	Electronics	2000	ERENG	1,800	OIL	3612	335311
TX	Gregory	LG&E Power Inc./Gregory Power Partners	Reynolds Metals Sherwin Alumina Plant	Chemicals	2000	CC	412,000	NG	2819	325188
TX	Orange	E.I. Du Pont De Nemours & Company	Du Pont Sabine River Works	Chemicals	2000	CC	220,000	NG	2800	325
TX	Port Arthur	Premcor Refining Group / Air Products And Chemicals, Inc.	Clark Refining & Marketing / Premcor	Refining	2000	CC	40,600	NG	2911	32411
TX	Port Arthur	BASF / Fina Petrochemicals LP	Steam Cracker Cogen Project	Refining	2000	CT	70,900	NG	2911	32411
TX	Borger	Borger Energy Associates LP	Black Hawk Station	Chemicals	1999	CT	253,800	NG	2869	325199
TX	Freeport	BASF Corp	Freeport Project	Chemicals	1999	CC	86,700	NG	2819	325188
TX	Gregory/Ingleside	Occidental Energy Ventures & Conoco Global Power	Ingleside Cogeneration Facility	Chemicals	1999	CC	440,000	NG	2869	325199
TX	Sabine	Reliant Energy / Air Liquide / Bayer	Bayer Corporation Rubber Plant	Rubber/Plastics	1999	CC	100,000	NG	3039	326299
TX	Houston	Toshiba Manufacturing	Manufacturing Facility	Misc. Manf.	1998	FCEL	200	NG	3900	339999
TX	Pasadena	Calpine - Pasadena I & II	Chevron/Philips Petroleum	Chemicals	1998	CC	751,000	NG	2800	325
TX	San Antonio	Lackland AFB Hospital	Lackland AFB Hospital	Hospitals/Healthcare	1998	CT	10,400	NG	8062	62211
TX	Sweeny	Sweeny Cogeneration LP	Phillips Sweeny Complex	Refining	1998	CT	470,000	NG	2911	32411
TX	Cleburne	Tenaska IV Texas Partners Ltd.	Steam Host Is Distilled Water	Chemicals	1996	CC	267,000	NG	2899	325998
TX	El Paso	R.E. Thomason Hospital	Thomason Hospital Central Plant	Hospitals/Healthcare	1996	ERENG	2,400	NG	8062	62211
TX	Texas City	Union Carbide Corporation	Union Carbide Chemicals & Plastics Co	Chemicals	1996	CC	84,500	NG	2821	325211
TX	Deer Park	Houston Lighting & Power	Dupont Cogeneration Project	Chemicals	1995	CC	162,000	NG	2869	325199
TX	Freeport	Dow Chemical USA. - Texas Division	Oyster Creek Project	Chemicals	1994	CC	424,000	NG	2819	325188
TX	Pecos	Freeport Mcmoran	Freeport Mcmoran	Refining	1994	CT	5,200	NG	2911	32411
TX	Dallas	Dallas County	Lew Sterrett/North Tower Cogen Facility	General Gov't	1993	CT	1,000	NG	9111	92111
TX	Port Neches	Air Liquide America	Port Neches Plant	Chemicals	1993	CT	41,200	NG	2813	32512
TX	Port Neches	Huntsman Petrochemicals	JCO Oxides Olefins Plant	Chemicals	1993	CT	71,260	NG	2819	325188
TX	Fort Worth	Kimmon Quartz Ltd.	Fossil Creek Project	Stone/Clay/Glass	1992	ERENG	550	NG	3211	327211
TX	Seminole	Union Oil Company Of California/Unocal	North Riley Unit	Refining	1992	ERENG	2,000	NG	2911	32411
TX	Texas City	S&L Cogeneration	S&L Cogeneration	Chemicals	1992	CC	52,000	NG	2813	32512
TX	Alvin	Solutia, Inc.	Chocolate Bayou Plant	Chemicals	1990	B/ST	55,300	NG	2899	325998
TX	Austin	Texas Department Of Mental Health	Austin State Hospital	Hospitals/Healthcare	1990	CT	2,200	NG	8062	62211

Table 8-1: CHP units located in Texas as of 2007 (cont.)

State	City	Organization Name	Facility Name	Application	Op Year	Prime Mover	Capacity (kw)	Fuel Type	SIC4	NAICS
TX	Beaumont	E.I. Du Pont De Nemours & Company	Beaumont Petrochemical Plant	Chemicals	1990	CT	33,800	NG	2822	325212
TX	Houston	Valero Refing Co. / Hill Petroleum Company	Hill Petroleum Refinery	Refining	1990	CT	16,200	NG	2911	32411
TX	Houston	ICC Technologies, Inc.	Aire-Technics, Inc.	Machinery	1990	ERENG	150	NG	3569	333999
TX	Lubbock	City of Lubbock	Brandon	Utilities	1990	CT	21,000	NG	4939	221112
TX	Lubock	Texas Tech University	Texas Tech University	Colleges/Univ.	1990	B/ST	935	NG	8221	61131
TX	South Padre Island	American Private Power, Inc.	310 Padre Boulevard	Hotels	1990	ERENG	240	OIL	7011	72111
TX	Baytown	Exxon Chemical Company	Exxon Baytown Olefins Plant	Refining	1989	CC	439,500	NG	2911	32411
TX	Corpus Christi	CCPC Chemical, Inc. / Occidental	CCPC Chemical, Inc.	Chemicals	1989	CT	37,880	NG	2824	325222
TX	Corpus Christi	Equistar Chemicals LP	Corpus Christi Plant	Refining	1989	CT	45,000	NG	2911	32411
TX	Houston	Rice University	Rice University Power Plant	Colleges/Univ.	1989	CC	7,000	NG	8221	61131
TX	Paris	Tenaska III Texas Partners	Campbell Soup (Texas), Inc.	Food Processing	1989	CC	223,000	NG	2032	311422
TX	Port Lavaca	BP Amoco Chemicals Company	BP Chemicals Green Lake Plant	Refining	1989	B/ST	35,000	OTR	2911	32411
TX	San Marcos	Southwest Texas State University	Southwest Texas State University	Colleges/Univ.	1989	ERENG	6,000	NG	8221	61131
TX	Austin	Minnesota Mining & Manufacturing Co.	3M Research Development & Admin. Center	Office Buildings	1988	ERENG	14,300	NG	6512	53112
TX	Corpus Christi	Koch Refining Company	Koch Refining Company	Refining	1988	CT	49,000	NG	2911	32411
TX	Denton	American Private Power, Inc.	Sheraton Hotel, 2211 I35 East North	Hotels	1988	ERENG	115	NG	7011	72111
TX	Denver City	BP Amoco Chemicals Company	Wasson Field Cogeneration Facility (II)	Chemicals	1988	CT	20,660	NG	2813	32512
TX	Fort Worth	Alcon Laboratories, Inc.	Alcon Laboratories, Inc.	Primary Metals	1988	CT	3,500	NG	3300	331
TX	Houston	Shell Oil Company	Westhollow Technology Center	Oil/Gas Extraction	1988	CT	3,725	NG	1311	211111
TX	Mont Belvieu	Chevron USA., Inc.	Warren Petroleum Company	Oil/Gas Extraction	1988	CT	10,000	NG	1311	211111
TX	Port Arthur	Fina Oil & Chemical Company	Fina Oil & Chemical Company	Refining	1988	CC	37,130	NG	2911	32411
TX	Waco	Baylor University	Baylor University	Colleges/Univ.	1988	CT	3,300	NG	8221	61131
TX	Beaumont	Goodyear Tire & Rubber Company	Beaumont/East Chemical Plant	Chemicals	1987	CC	23,000	NG	2822	325212
TX	Big Springs	Power Resources, Inc.	Fina Oil & Chemical/American Petrofina	Refining	1987	CC	200,000	NG	2911	32411
TX	El Paso	Tenet Hospital Ltd	Providence Memorial Hospital	Hospitals/Healthcare	1987	ERENG	4,200	NG	8062	62211
TX	Liberty Hill	Gabriel Mills Energy Company	Greenhouse Project	Agriculture	1987	ERENG	2,000	NG	182	111419
TX	Pasadena	Air Products & Chemicals, Inc.	Air Products Manufacturing Corp	Chemicals	1987	CT	3,460	NG	2816	325131
TX	Point Comfort	Formosa Plastics Corporation, USA	Point Comfort Project	Chemicals	1987	CC	524,800	NG	2821	325211
TX	Texas City	Texas City Cogeneration.	Union Carbide - Texas City Plant	Chemicals	1987	CC	450,000	NG	2869	325199
TX	Victoria	E.I. Du Pont De Nemours & Company	Du Pont Nylon/Polyethyelene Plant	Chemicals	1987	CT	75,000	NG	2821	325211
TX	Wichita Falls	Wichita Falls Energy Company	Vetrotex/Certainteed Corporation	Stone/Clay/Glass	1987	CC	80,000	NG	3229	327212
TX	Yates	Marathon	Marathon	Refining	1987	CT	5,600	NG	2911	32411
TX	Big Spring	Fina Oil & Chemical Company	Big Spring Texas Refinery	Refining	1986	B/ST	1,500	NG	2911	32411
TX	Borger	Sid Richardson Carbon & Gas Company	Sid Richardson Carbon & Gas Company	Chemicals	1986	B/ST	30,000	WAST	2895	325182
TX	El Paso	Phelps Dodge Corporation	Phase II Cogeneration Facility	Primary Metals	1986	CT	19,600	NG	3331	331411
TX	El Paso	Bruce Foods Corporation	Ashley's Division	Food Processing	1986	ERENG	220	NG	2033	311421
TX	El Paso	Hospital Corporation Of America	Vista Hills Medical Center	Hospitals/Healthcare	1986	ERENG	180	NG	8062	62211
TX	Houston	Uncle Ben's, Inc.	Uncle Ben's Rice	Food Processing	1986	B/ST	1,000	BIOMASS	2044	311212
TX	Pasadena	AES Corporation	AES Deepwater Inc	Chemicals	1986	B/ST	143,000	WAST	2869	325199
TX	Alvin	BP Amoco Chemicals Company	Chocolate Bayou Facility	Refining	1985	CT	36,300	NG	2911	32411
TX	Channelview/Houston	Cogen Lyondell, Inc.	ARCO Chemicals/Lyondell Petrochemical	Refining	1985	CC	564,000	NG	2911	32411
TX	Gilmer	Dean Lumber Company	Dean Lumber Company	Wood Products	1985	B/ST	540	WOOD	2421	321113
TX	Pasadena	Clear Lake Cogeneration L.P. / Calpine	Hoechst Celanese Chemical Company	Chemicals	1985	CC	345,000	NG	2821	325211
TX	Texas City	South Houston Green Power / BP-Amoco Oil Company	Amoco Oil Company/Power 4	Refining	1985	CC	170,000	NG	2911	32411
TX	Corpus Christi	Coastal Refining & Marketing	Coastal Refining & Marketing Inc	Refining	1984	CT	46,800	NG	2911	32411

Table 8-1: CHP units located in Texas as of 2007 (cont.)

State	City	Organization Name	Facility Name	Application	Op Year	Prime Mover	Capacity (kw)	Fuel Type	SIC4	NAICS
TX	Mt. Belvieu	Enterprise Products Company	Enterprise Products Company	Refining	1984	CT	25,700	NG	2911	32411
TX	Pasadena	Crown Central Petroleum Corporation	Crown Central Petroleum Corporation	Refining	1984	B/ST	6,000	WAST	2911	32411
TX	Pasadena	Air Liquide America Corp	Bayou Cogeneration Plant	Chemicals	1984	CT	300,000	NG	2813	32512
TX	Sundown	BP Amoco Chemicals Company	Mallet Cogeneration Facility	Oil/Gas Extraction	1984	CT	18,000	NG	1311	211111
TX	Borger	Engineered Carbons, Inc.	Engineered Carbons Division	Chemicals	1983	B/ST	20,000	WAST	2895	325182
TX	Corpus Christi	Valero Refining Company	Saber Refining	Refining	1983	B/ST	67,700	WAST	2911	32411
TX	Marshall	Snider Industries, Inc	Snider Industries Inc	Wood Products	1983	B/ST	5,000	WOOD	2421	321113
TX	Port Arthur	Port Arthur Steam Energy / Great Lakes Carbon Corp	Premcor Refining Group	Refining	1983	B/ST	15,000	WAST	2911	32411
TX	Port Lavaca	Carbide/Graphite Group Inc	Seadrift Coke LP	Refining	1983	B/ST	7,600	WAST	2911	32411
TX	Bishop	Hoechst Celanese Corporation	Hoechst Celanese Corporation	Chemicals	1982	CC	44,200	NG	2823	325221
TX	Deer Park	Owl Energy Resources Inc / Oxy Vinyls	Houston Chemical Complex Battleground Site	Chemicals	1982	CC	270,000	NG	2810	325998
TX	Houston	Texas Petrochemicals Corp	Texas Petrochemicals Houston Plant	Refining	1982	B/ST	35,000	NG	2911	32411
TX	Richardson	University Of Texas System	Univerity Of Texas At Dallas	Colleges/Univ.	1980	ERENG	3,500	NG	8221	61131
TX	San Antonio	University Of Texas System	University Of Texas At San Antonio	Colleges/Univ.	1980	ERENG	3,500	NG	8221	61131
TX	Pampa	Hoechst Celanese Corporation	Celanese Pampa Plant	Chemicals	1979	B/ST	30,000	COAL	2821	325211
TX	Dallas	Lone Star Energy/Enserch/TXU	Univ. Of Texas Health Science Center	Colleges/Univ.	1978	ERENG	4,600	NG	8221	61131
TX	Port Arthur	Chevron USA., Inc.	Chevron's Port Arthur Refinery	Refining	1975	CC	62,000	NG	2911	32411
TX	Santa Rosa	Rio Grande Valley Sugar Growers	Rio Grande Valley Sugar Growers	Food Processing	1973	B/ST	7,500	BIOMASS	2061	311311
TX	Texarkana	International Paper Company	Texarkana Mill	Pulp and Paper	1972	B/ST	65,000	WAST	2621	322121
TX	Houston	Rhone Poulenc Chemical Company	Houston Facility	Chemicals	1970	B/ST	7,500	NG	2834	325412
TX	Orange	Inland-Orange, Inc.	Orange Pulp & Paper Mill	Pulp and Paper	1967	B/ST	49,000	WAST	2652	322213
TX	Hereford	Holly Sugar Corporation	Holly Sugar Corporation	Food Processing	1965	B/ST	4,100	NG	2063	311313
TX	Seadrift	Seadrift Cogeneration	Union Carbide Corporation	Chemicals	1964	CC	156,000	NG	2813	32512
TX	Taft	Arco Oil & Gas Company	Taft Gasoline Plant	Refining	1964	CT	1,400	NG	2911	32411
TX	Texas City	BP Amoco Chemicals Company	Texas City Refinery Facilitiy	Refining	1964	CC	117,900	NG	2911	32411
TX	Texas City	Hill Petroleum Company	Hill Petroleum Company	Refining	1963	CT	16,200	NG	2911	32411
TX	Dallas	Rock Tenn Company	Rock Tenn Company	Pulp and Paper	1959	B/ST	4,000	NG	2631	32213
TX	Bridgeport	Liquid Energy	Liquid Energy	Refining	1958	ERENG	1,520	NG	2911	32411
TX	Point Comfort	Alcoa World Alumina LLC	Point Comfort Operations	Chemicals	1958	B/ST	63,100	NG	2819	331311
TX	Beaumont	ExxonMobil Corp	Mobil Beaumont Refinery	Refining	1957	B/ST	600,000	NG	2911	32411
TX	Port Arthur	Star Enterprise	Texaco Refining And Marketing Inc.	Refining	1957	CC	158,200	NG	2911	32411
TX	Evadale	Westvaco / Temple-Inland Forest Products Corporatin	Evandale Pulp & Paperboard	Pulp and Paper	1954	B/ST	48,200	WAST	2631	32213
TX	Corpus Chritsi	Reynolds Metals Co	Reynolds Metals Co Sherwin Plant	Primary Metals	1953	B/ST	39,000	OTR	3341	331314
TX	Corpus Christi	American Chrome & Chemicals Co	American Chrome & Chemicals Co	Chemicals	1952	B/ST	610	NG	2819	325188
TX	Freeport	Dow Chemical USA. - Texas Division	Energy Systems And Technical Services	Chemicals	1952	CC	1,228,600	NG	2819	325188
TX	Baytown	ExxonMobil Corp	Exxon Baytown Refinery	Refining	1950	B/ST	160,000	NG	2911	32411
TX	Grand Saline	Morton Salt Company	Morton Salt Company	Chemicals	1949	B/ST	3,990	NG	2899	325998
TX	Deer Park	Shell Oil Company	Shell Manufacturing Complex	Refining	1943	CC	250,000	NG	2911	32411
TX	College Station	Texas A&M University	Cogeneration Facility	Colleges/Univ.	1935	CT	40,000	NG	8221	61131
TX	Austin	University Of Texas At Austin	University Of Texas At Austin	Colleges/Univ.	1933	CC	120,000	NG	8221	61131
TX	Marshall	Norit Americas Inc	Norit Americas Inc.Marshall Plant	Chemicals	1921	B/ST	2,000	COAL	2810	325998

9 REPORTING OF NOX EMISSIONS CREDITS TO THE TCEQ (PRELIMINARY)

9.1 Introduction

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 this sixth annual report, Energy Efficiency/Renewable Energy (EE/RE) Impact in the Texas Emissions Reduction Plan (Preliminary Report) to the Texas Commission on Environmental Quality.

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 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[14] (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.

In 2008, the cumulative total annual electricity savings from all programs is 20,380,240 MWh/year (12, 727 tons-NOx/year). The total cumulative OSD electricity savings from all programs is 48,602 MWh/day, which would be a 2,025 MW average hourly load reduction during the OSD period (31.38 tons-NOx/day). By 2013, the total cumulative annual electricity savings from will be 32,736,151 MWh/year (20,395 tons-NOx/year). The total cumulative OSD electricity 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 (52.10 tons-NOx/day). A summary of the savings for 2008 and 2013 is presented in the table below.

	2008	2013
Annual Electricity Savings (MWh/yr)	20,380,240	32,736,151
Annual Emissions reductions (tons NOx/yr)	12,727	20,395
OSD Electricity Savings (MWh/day)	48,602	80,866
OSD Emissions reductions (tons NOx/day)	31.38	52.10

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

9.2 Legislative Background

In 2001, the Texas Emissions Reduction Plan (TERP), established by the 77th Texas Legislature with the enactment of Senate Bill 5 (SB 5), identified that Energy Efficiency and Renewable Energy (EE/RE) measures make an important contribution to a comprehensive approach for meeting the minimum federal ambient air quality standards. In 2003 through 2007, the 78th, 79th and 80th Legislatures enhanced the use of EE/RE programs for meeting the TERP. The 78th Legislature enhanced the use of EE/RE programs for meeting TERP goals by requiring the Texas Commission on Environmental Quality (TCEQ) to promote EE/RE as a means to improve air quality standards and to develop a methodology for computing emissions reduction for use in the State Implementation Plan (SIP) from EE/RE programs.

The 79th Legislature expanded the scope of the SIP-eligible credits by adding savings from the State Renewable Portfolio Standards from the generation of electricity from renewable sources; specifically requiring the TCEQ to develop methods to quantify emissions reductions from renewable energy; and required the Laboratory to develop at least 3 alternative methods for achieving a 15 percent greater potential energy savings in residential, commercial and industrial construction. In the 80th Legislature several new energy efficiency initiatives were introduced, including: requiring 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; requiring the Laboratory to develop a standardized report format to be used by providers of home energy ratings; and encouraging the Laboratory to cooperate with an industry organization or trade association to develop guidelines for home energy ratings, including training.

9.3 Calculation of Integrated NOx Emissions Reductions from Multiple State Agencies Participating in the Texas Emissions Reduction Plan (TERP)

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 Senate Bill 5 Program
- Electricity generated by wind farms in Texas (ERCOT)[15]
- 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

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

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 2008. The PUC also reported the savings from the Senate Bill 5 grant program which was conducted in 2002 and 2003.

The Texas State Energy Conservation Office (SECO) funds energy-efficiency programs are directed towards school districts, government agencies, city and county governments, private industries and residential energy consumers. For the 2008 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 2008, 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 residential furnaces, and reductions from the installation of SEER 13 air conditioners in existing residences.*

9.4 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 9-1, 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[16]. 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 Senate Bill 5 and Senate Bill 7

[16] 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 year's 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.

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 9-1 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[17]. No growth was assumed for Federal buildings, pilot lights, PUC programs and SECO entries.

Figure 9-1 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[18]. 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).

The SECO electricity savings were submitted as annual savings by project[19]. 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 9-1. 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.

9.5 Calculation Procedure

ESL Single-family and Multi-family. The calculation of the annual and OSD electricity savings reported for the years 2002 through 2008 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. From 2005 to 2008, 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 2008, 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 2008 through 2020[20]. 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[21].

[17] 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.
[18] 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.
[19] 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.
[20] This would include the appropriate discount and degradation factors for each year.
[21] Haberl et al., 2005, pp. 197.

For the 2008 annual and OSD NOx emissions calculations, the US EPA's 2007 eGRID were used[22]. An example of the eGRID spreadsheet[23] is given in Table 9-2. 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 9-3. NOx emissions reduction is provided in Table 9-4.

ESL-Commercial Buildings. The annual and OSD electricity savings for 2002 through 2008 for commercial buildings were obtained from the annual reports for 2005 and 2007 submitted by the Laboratory to TCEQ[24]. These savings were also tabulated by county and program. Using the calculated values through 2008, savings were then projected to 2020 by incorporating the different adjustment factors mentioned above[25]. In the projected 2008 cumulative electricity savings, it was assumed that the same amount of electricity savings from 2008 would be achieved for each year after 2008 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[26]. 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[27].

PUC-Senate Bill 7. For the PUC Senate Bill 7 program savings, the annual electricity savings for 2001 through 2008 were obtained from the Public Utilities Commission[28]. Using these values savings were

[22] 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.
[23] 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.
[24] 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).
[25] This also includes the appropriate discount and degradation factors for each year.
[26] 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.
[27] These use the NOx/MBtu values provided in the US EPA AP 42 guideline.
[28] In a similar fashion to the previous programs, to obtain the Ozone Season Day (OSD) savings, the annual electricity savings were divided by 365.

projected through 2020 by incorporating the different adjustment factors mentioned above. Similar savings were assumed for each year after 2008 until 2020. The 2008 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 was 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-Senate Bill 5 Grants Program. To calculate the annual electricity savings from the PUC's Senate Bill 5 program, electricity savings were also obtained from the Public Utilities Commission[29]. The annual and average day electricity savings were then proportioned according to the PCA and program. Using the actual reported numbers through 2008, savings through 2020 were projected incorporating the different adjustment factors mentioned above[30]. The 2008 annual and OSD eGRID were used to calculate the NOx emissions savings for PUC-Senate Bill 5 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 2008 were obtained from the State Energy Conservation Office[31]. These submittals included information gathered from SECO's website[32] and paper submittals[33]. The annual and average day electricity values were 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 to the previous programs, it was assumed that the same amount of electricity savings will be achieved for each year after 2005 until 2020. The 2008 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 2008 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 2008, savings through 2020 were projected incorporating the different adjustment factors mentioned above. The 2008 annual and OSD eGRID were then used to calculate the NOx emissions reduction for the electricity generated by Texas' wind farms[34]. The total electricity savings for each PCA was 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.

---

[29] 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.

[30] 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.

[31] 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.

[32] This web site was developed for SECO by the Laboratory, at the request of the TCEQ.

[33] 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.

[34] 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.

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 2008, the savings through 2020 were projected by incorporating the appropriate adjustment factors[35]. 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.

9.6 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 Table 9-1 for 2001 through 2020 as shown in Table 9-3. 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 9-4. In Table 9-3 and Table 9-4 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 9-2 as stacked bar charts and in Figure 9-3 for the individual components.

In 2008 (Table 9-3), the cumulative annual electricity savings[36] 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[37] 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[38] 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

[35] 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".
[36] This includes the savings from 2001 through 2008.
[37] 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.
[38] 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.

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 (Table 9-4) the cumulative annual NOx emissions reduction[39] 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.

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.

9.7 Summary

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 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[40] (OSD) NOx reductions. The NOx emissions reduction from all these programs were calculated using estimated emissions factors for 2009 from the US Environmental Protection Agency (US EPA) eGRID database, which had been specially prepared for this purpose.

[39] These NOx emissions reduction were calculated with the US EPA's 2007 eGRID for annual (25% capacity factor) and Ozone Season Day OSD.
[40] An ozone season day (OSD) represents the daily average emissions during the period that runs from mid-July to mid -September.

In 2008, the cumulative total annual electricity savings from all programs is 22,929,144 MWh/year (12,727 tons-NOx/year). The total cumulative OSD electricity savings from all programs is 48,602 MWh/day, which would be a 2,025 MW average hourly load reduction during the OSD period (31.38 tons-NOx/day). By 2013, the total cumulative annual electricity savings from will be 35,285,055 MWh/year (20,395 tons-NOx/year). The total cumulative OSD electricity 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 (52.10 tons-NOx/day).

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.

Table 9-1: 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

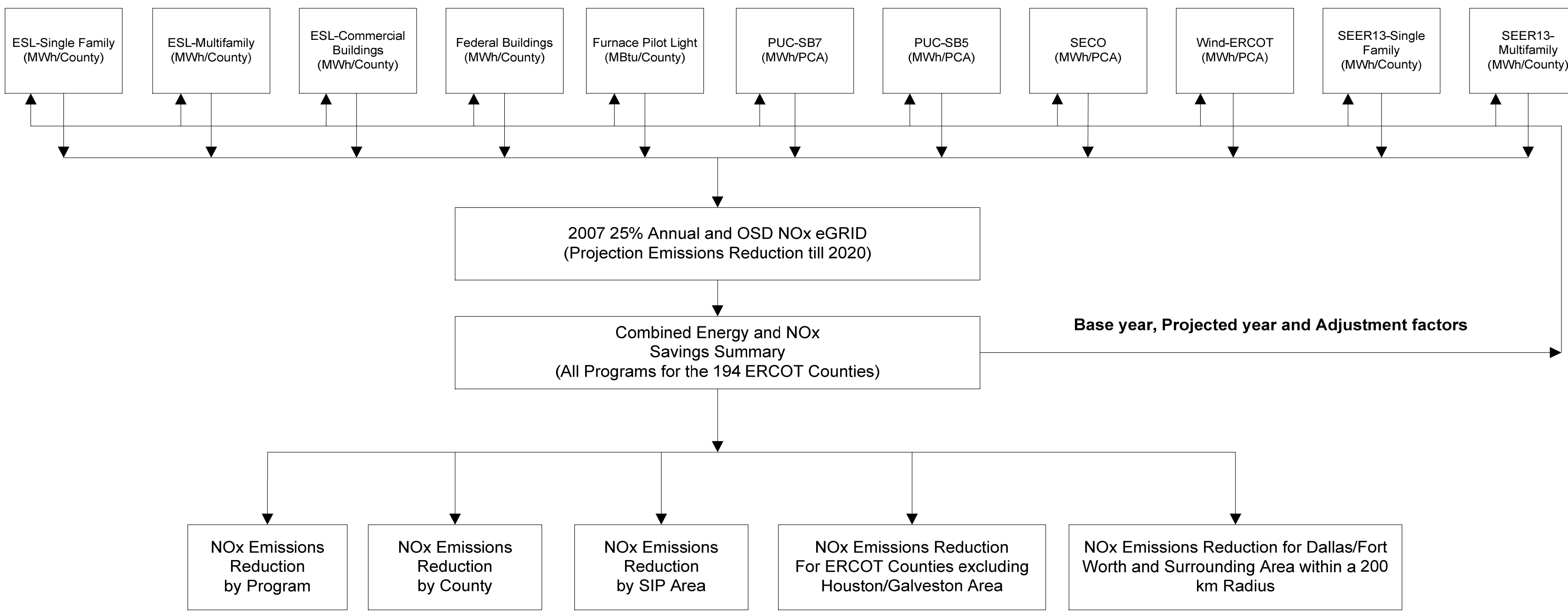


Figure 9-1: Process Flow Diagram of the NOx Emissions Reduction Calculations

Table 9-2: 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 9-3: 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 9-4: 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

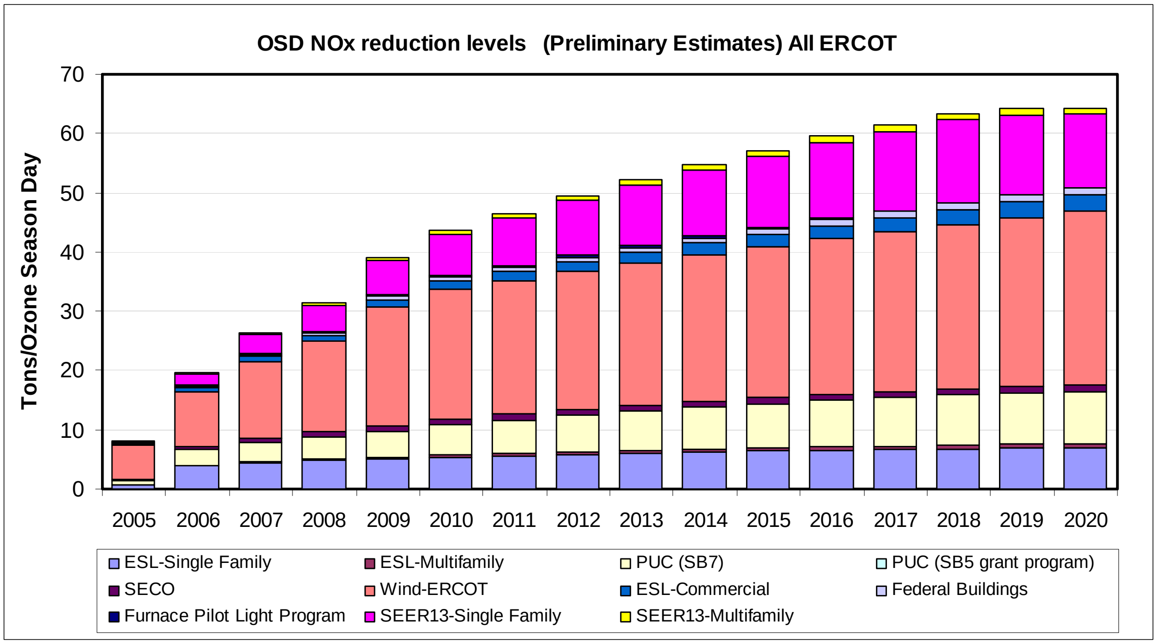


Figure 9-2: Cumulative OSD NOx Emissions Reduction Projections through 2020

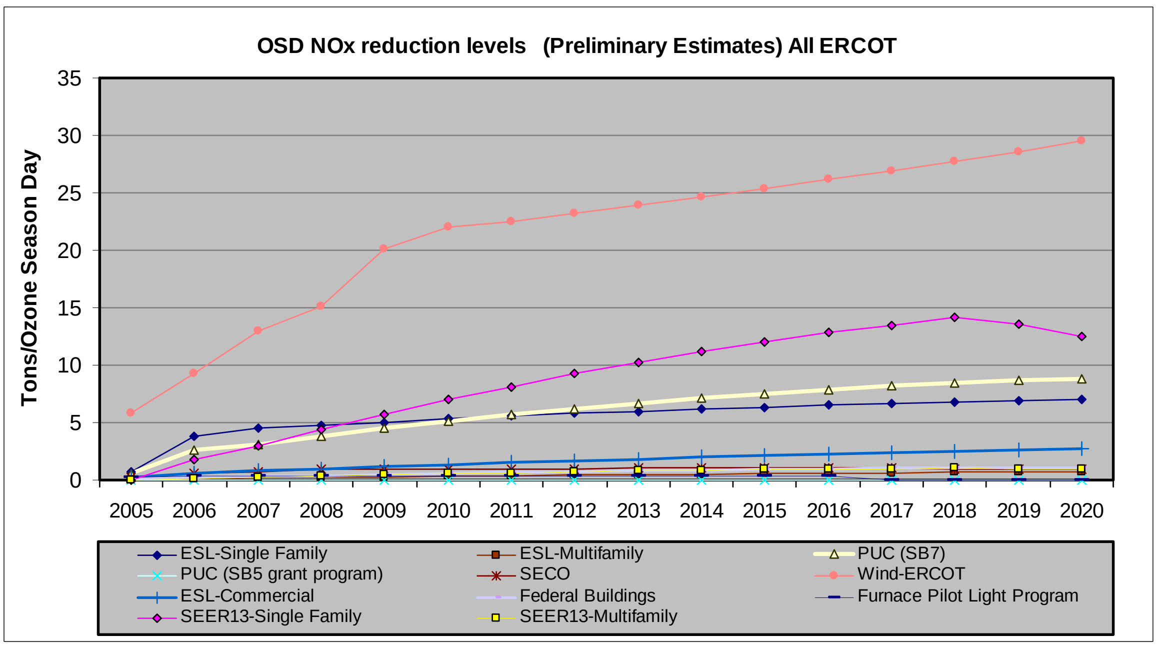


Figure 9-3: Cumulative OSD NOx Emissions Reduction Projections through 2020

References

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

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

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.

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.

Haberl, J., Culp, C., Yazdani, B., Gilman, D., Fitzpatrick, T., Muns, S., Verdict, M., Ahmed, M., Liu, Z., Baltazar-Cervantes, J-C, Mukhopadhyay, J., Degelman, L, Turner, D. 2007. "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-07-12-01.

Haberl, J. S., Liu, Z., Baltazar-Carvantes, J. C., Subbarao, K., Gilman, D., Culp, C., Yazdani, B., Turner, W. D., Chandrasekaran, V. 2008. "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 2007 – December 2007, Energy Systems Laboratory, Report ESL-TR-08-08-01.

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

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

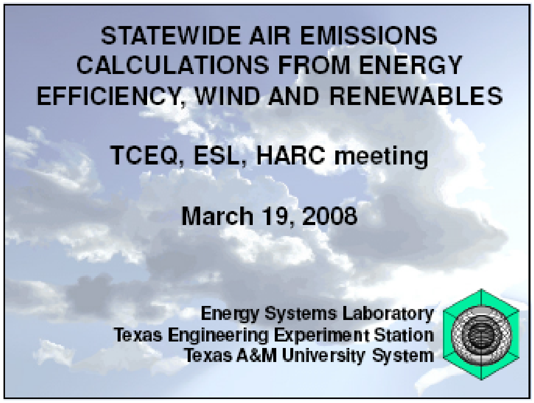
PUC 2007, Public Utility Commission of Texas, available at: http://www.puc.state.tx.us/

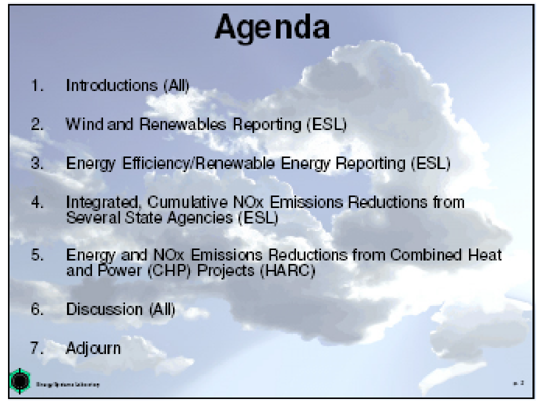
USDOE 2004. Building Energy Standards Program: Determination Regarding Energy Efficiency Improvements in the Energy Standard for Buildings, Except Low-Rise Residential Buildings, ASHRAE/IESNA Standard 90.1-1999. Docket No. (Docket No. EE-DET-02-001). Washington, D.C. <http://www.energycodes.gov/implement/pdfs/FR_com_notice.pdf>

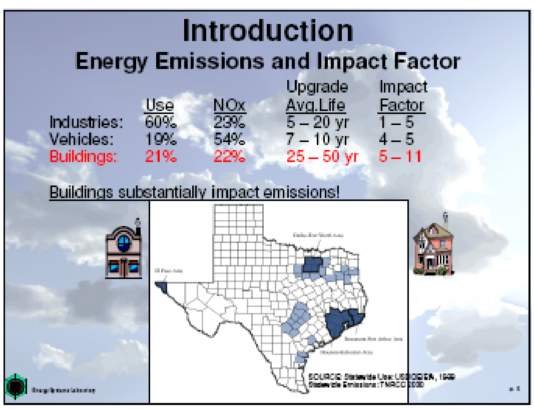
10 APPENDIX A

10.1 Presentation in March 2008

March 19, 2008 – Presentation to the TCEQ about the calculation of NOx emissions reductions from energy efficiency and renewable energy, Austin, Texas







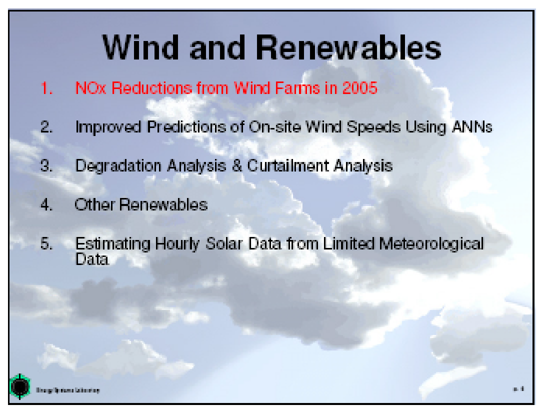
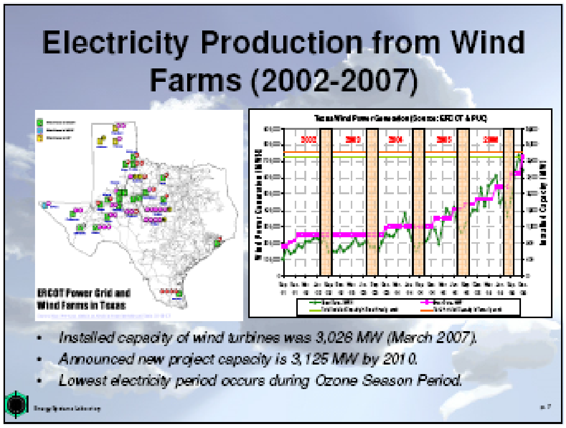
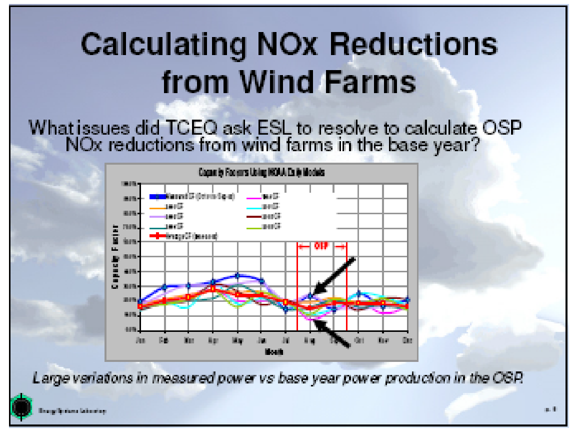
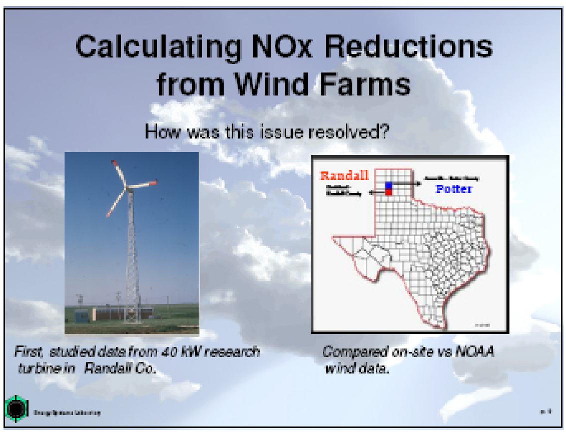
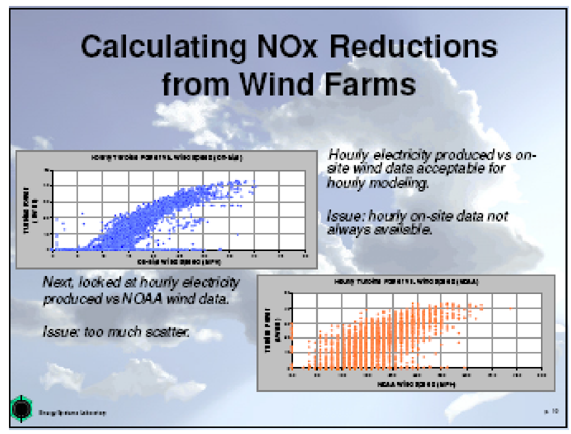


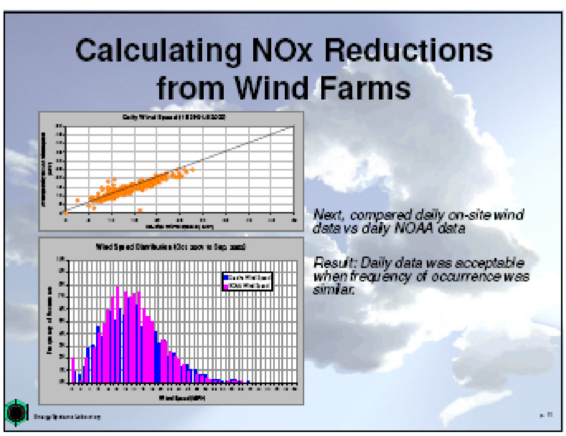
Figure 10-1: Slides presented on March 19, 2008 (Part 1)











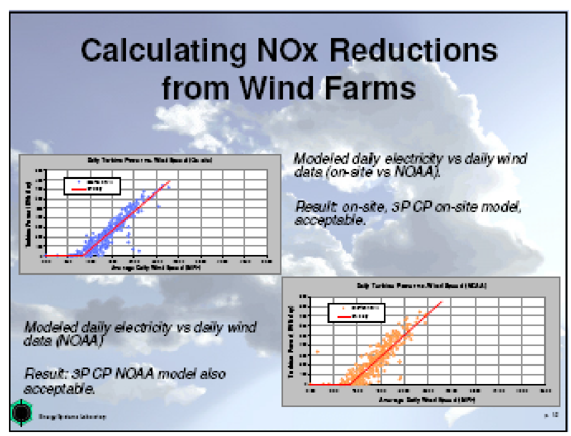
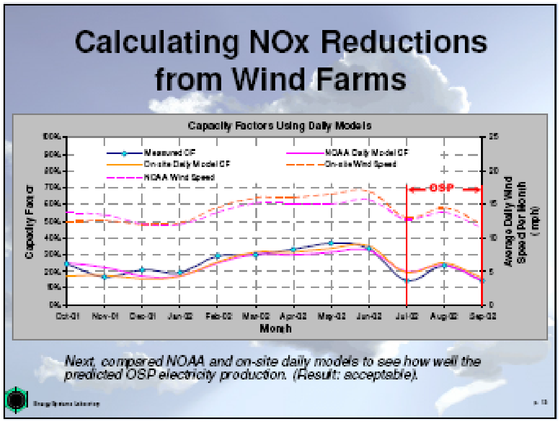
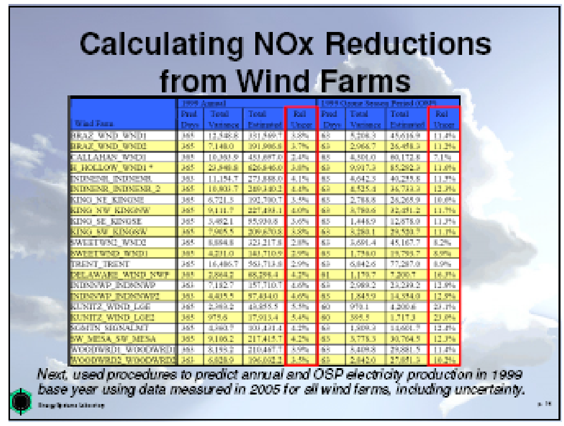
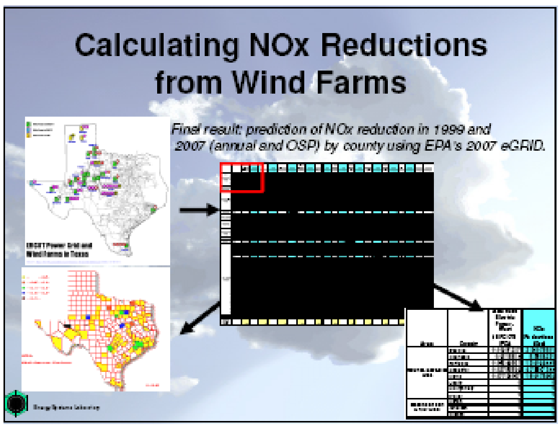
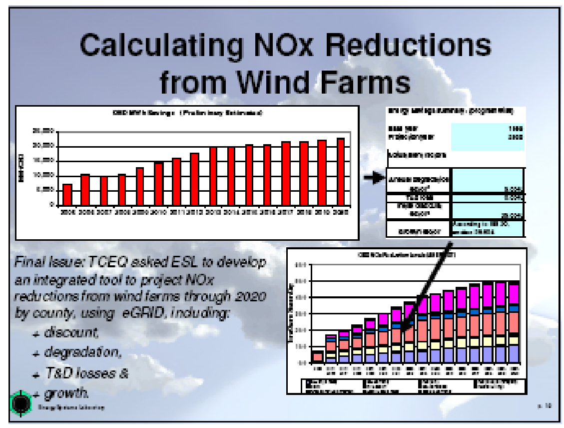


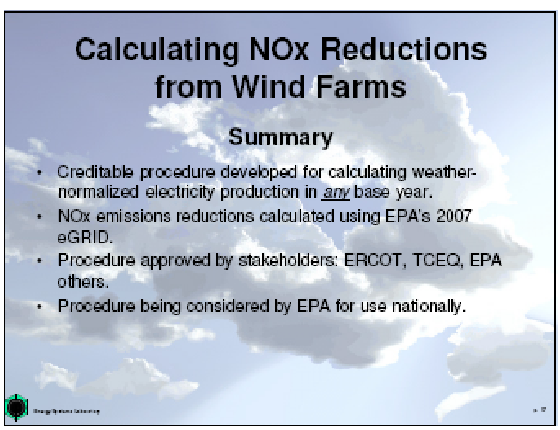
Figure 10-2: Slides presented on March 19, 2008 (Part 2)











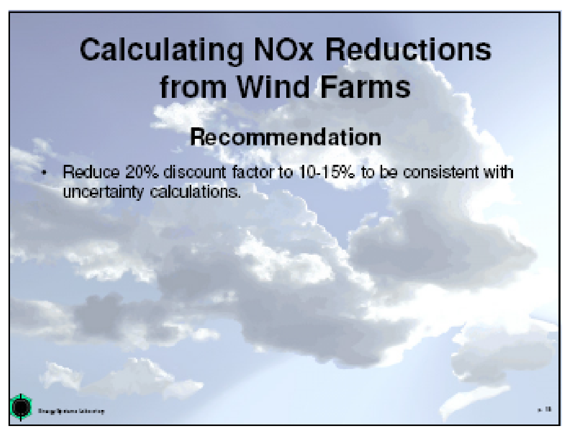
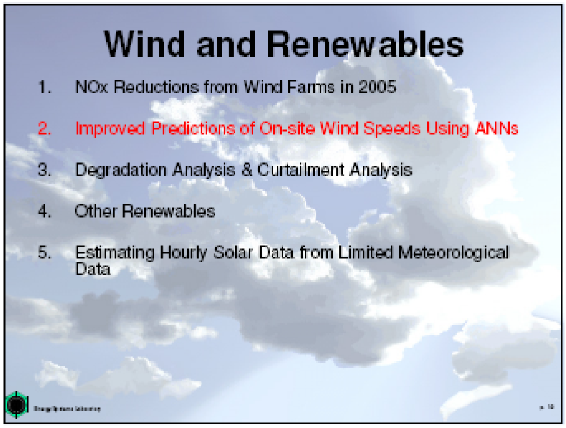
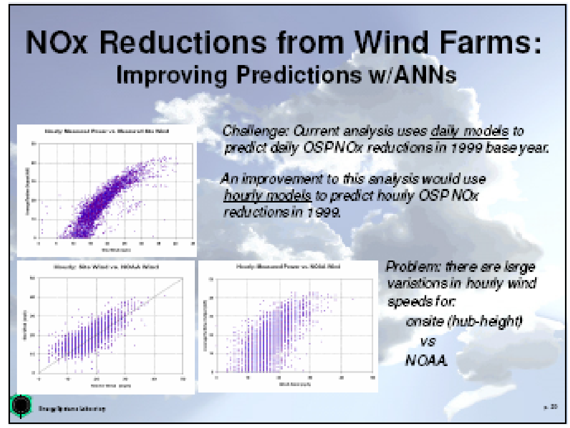
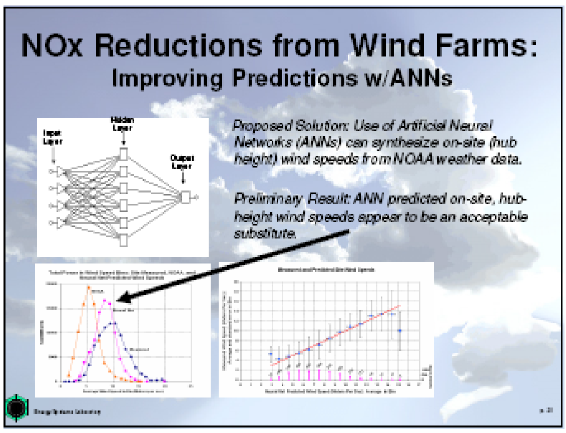
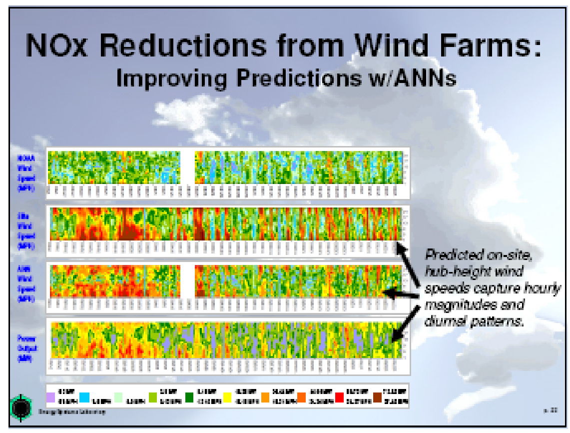


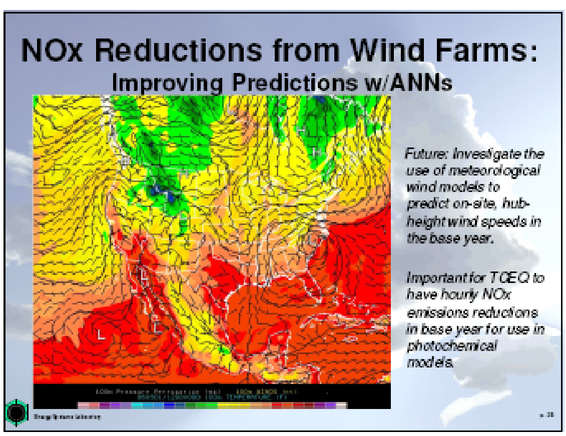
Figure 10-3: Slides presented on March 19, 2008 (Part 3)











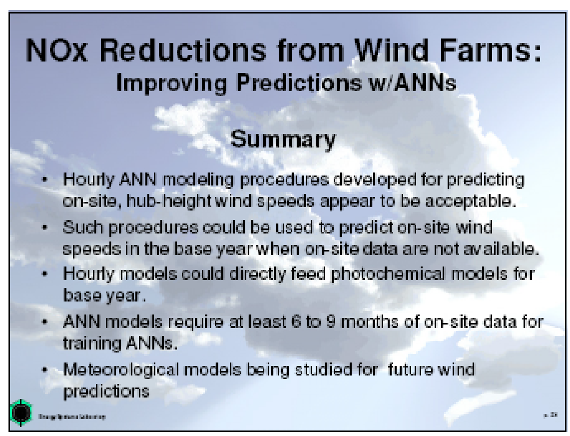
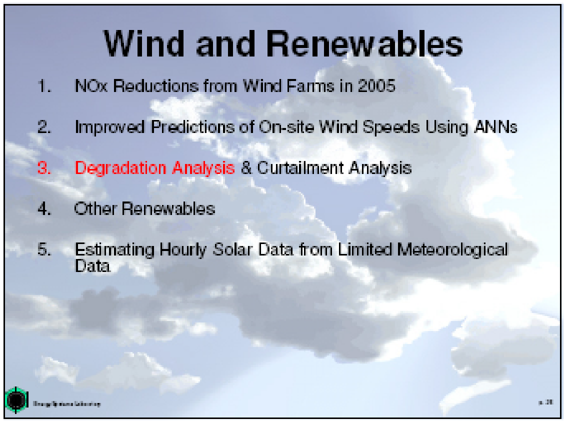
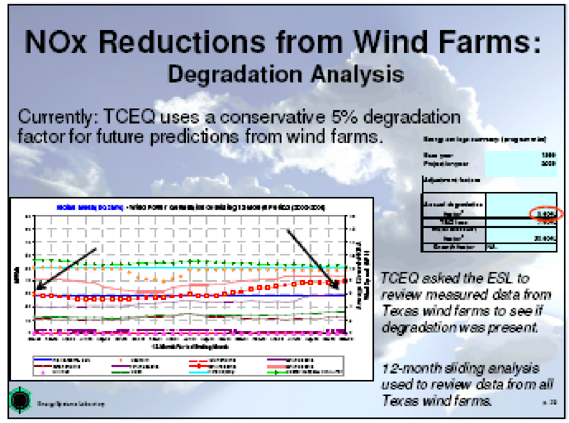
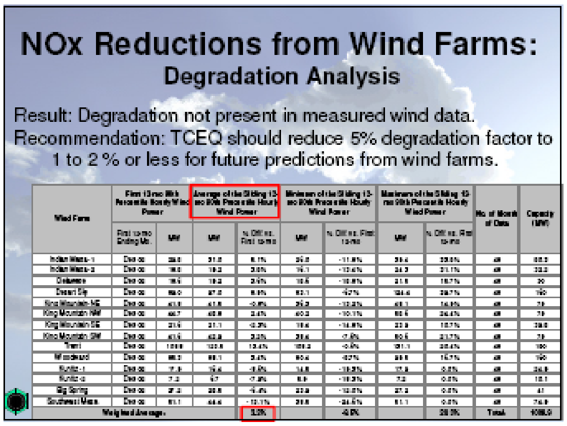
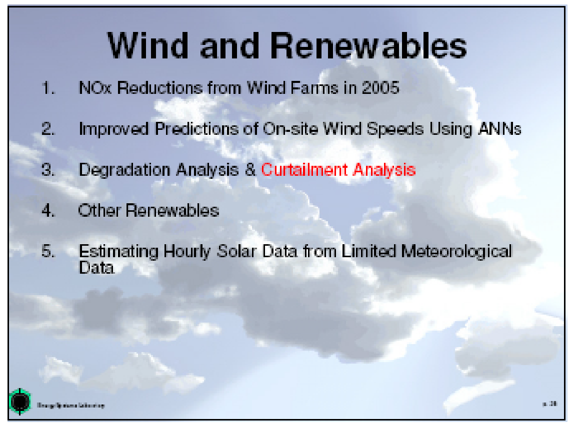


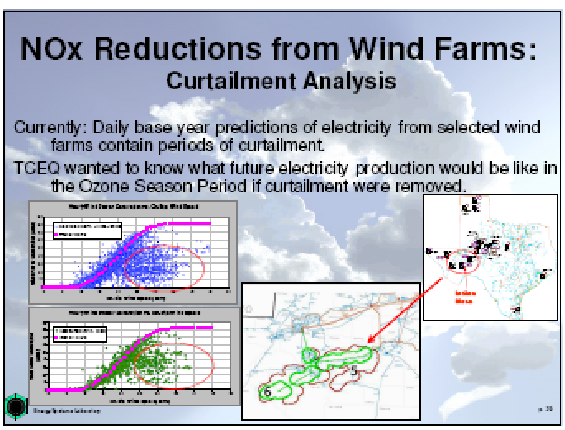
Figure 10-4: Slides presented on March 19, 2008 (Part 4)











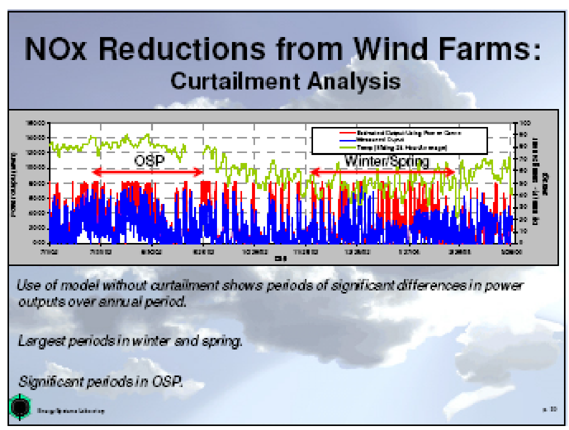


Figure 10-5: Slides presented on March 19, 2008 (Part 5)

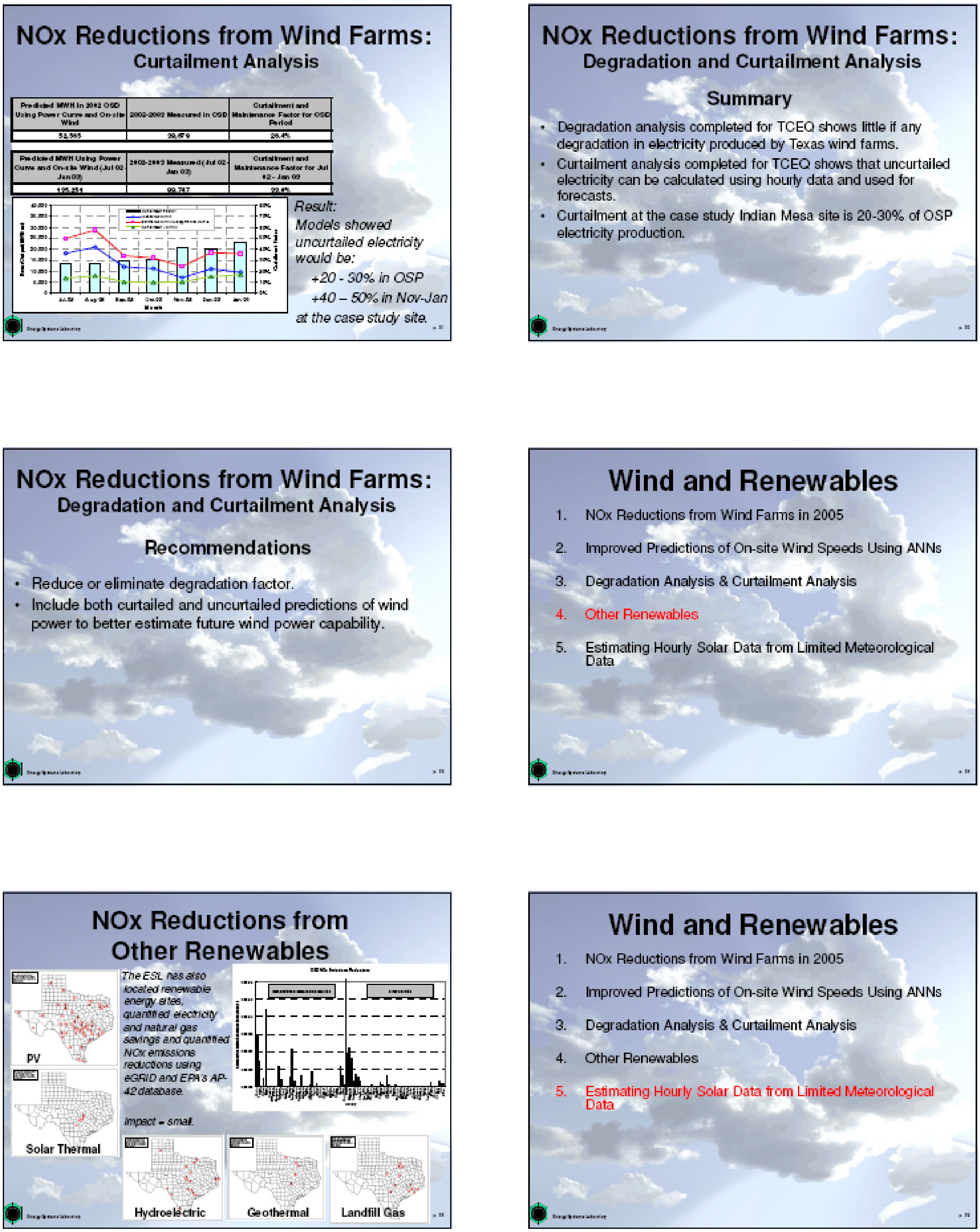
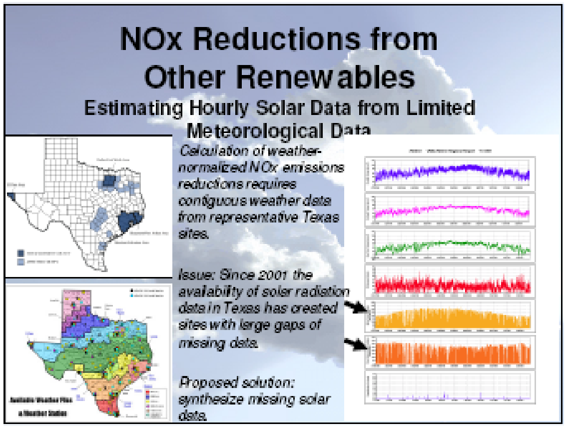
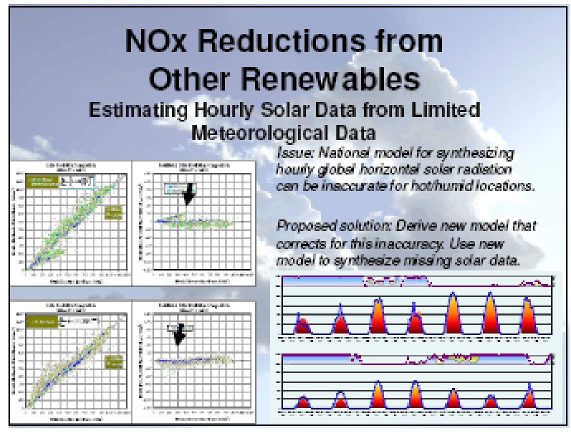
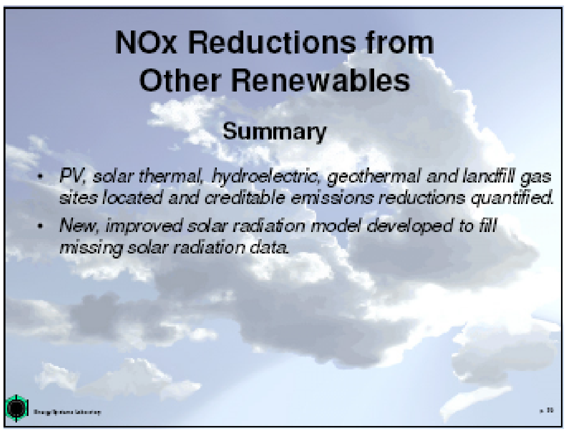
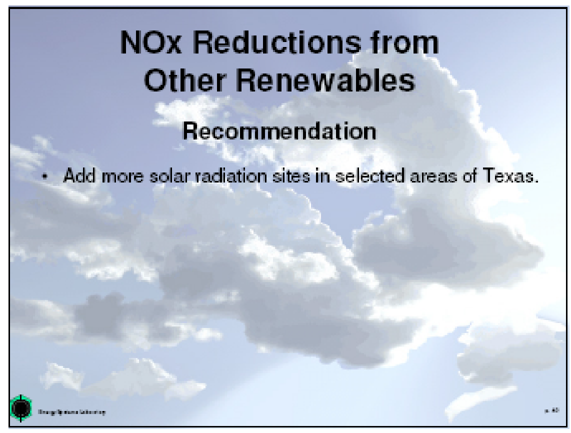


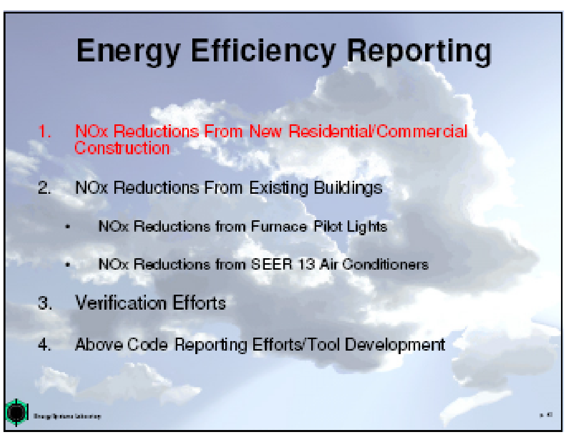
Figure 10-6: Slides presented on March 19, 2008 (Part 6)











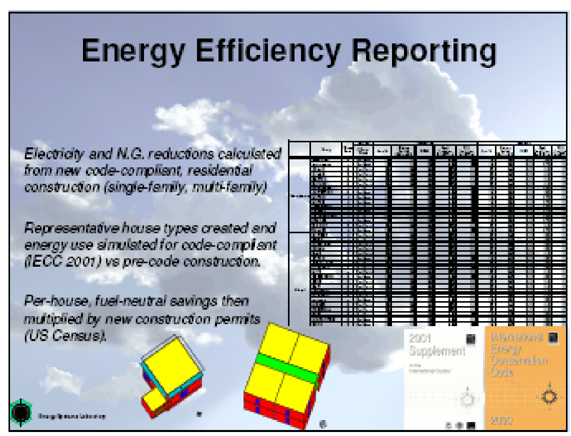
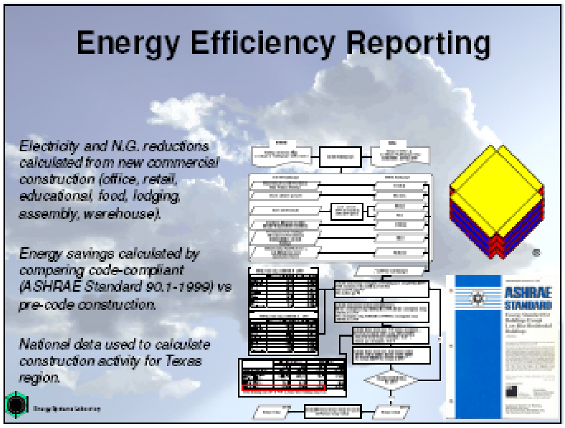
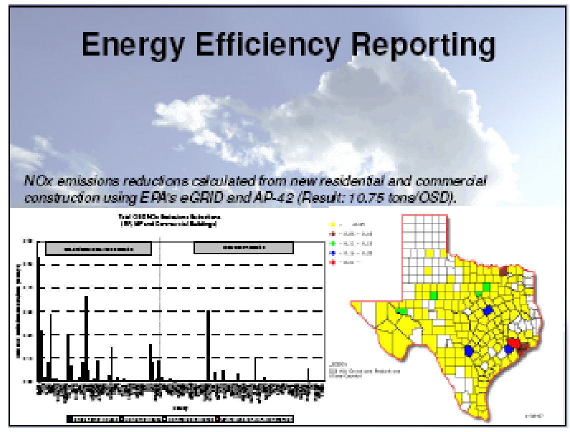
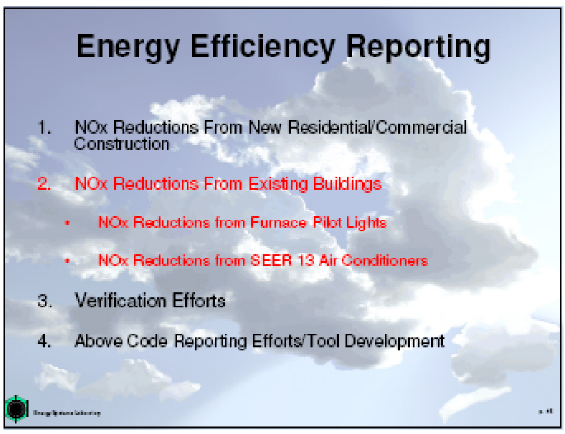
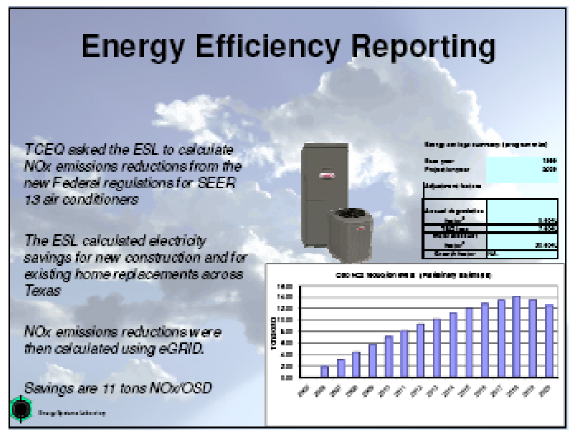


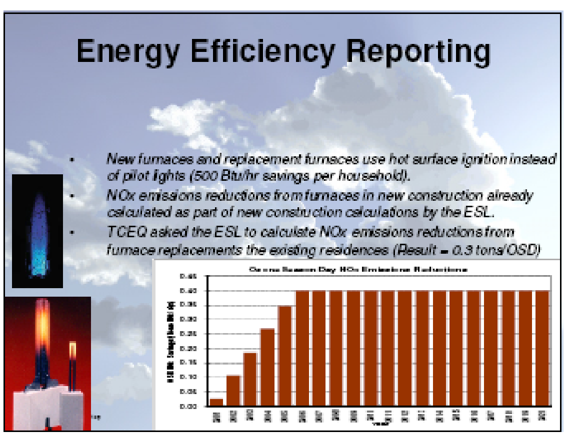
Figure 10-7: Slides presented on March 19, 2008 (Part 7)











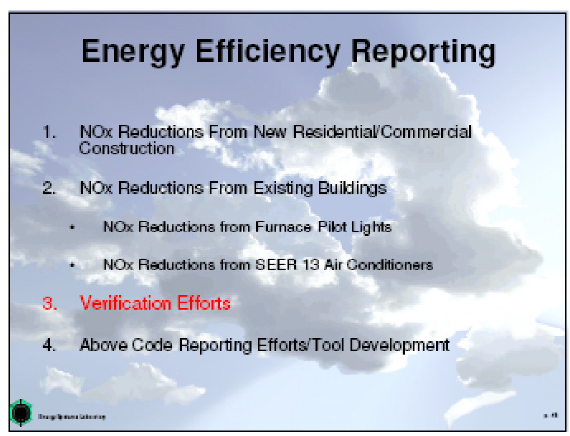
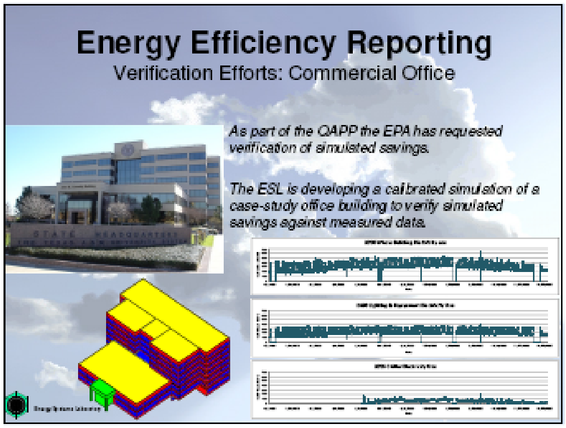
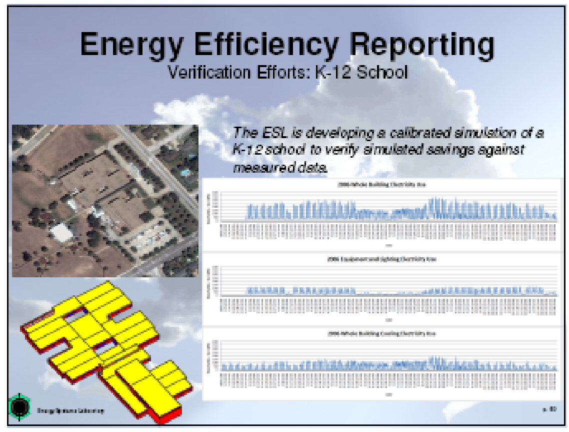
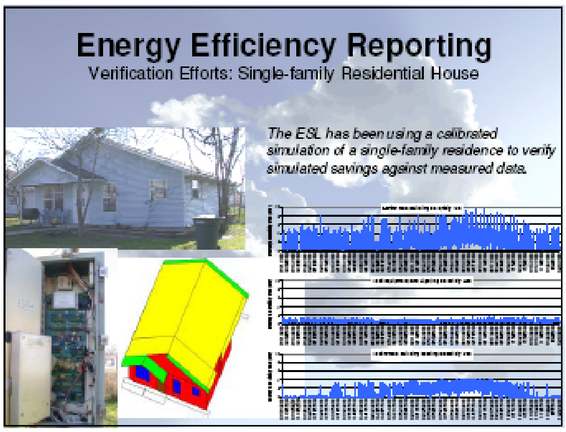
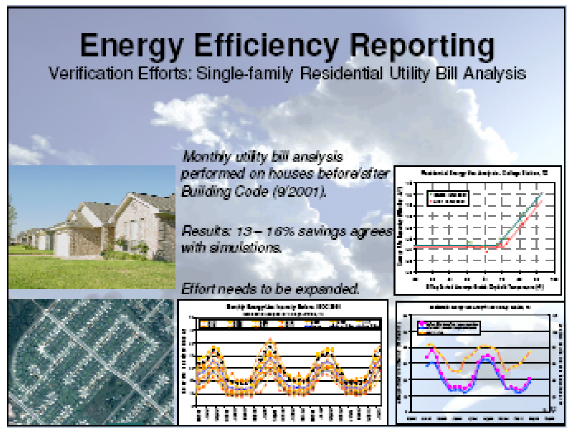


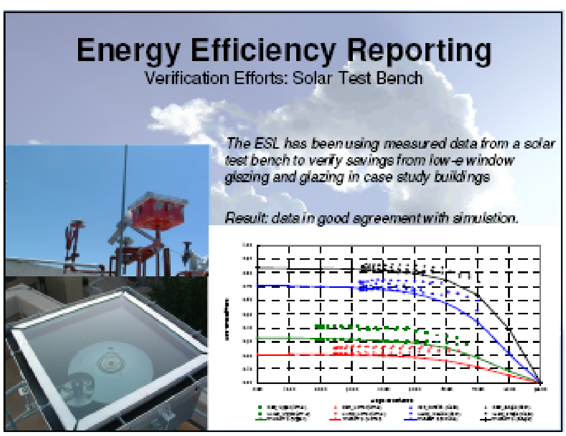
Figure 10-8: Slides presented on March 19, 2008 (Part 8)











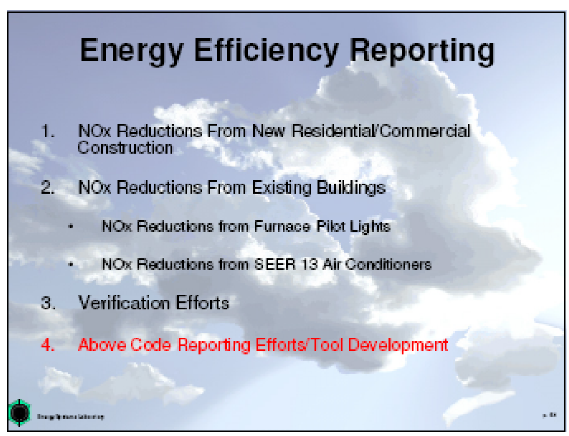
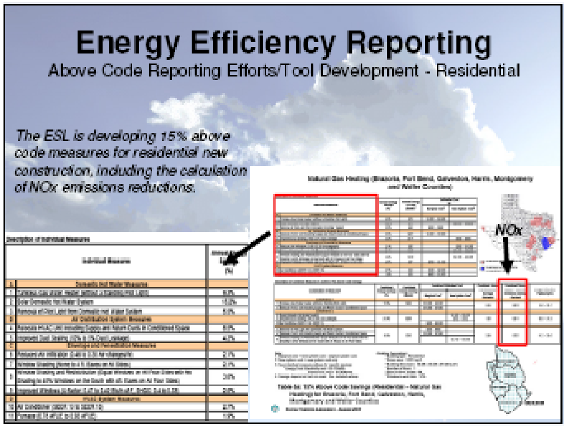
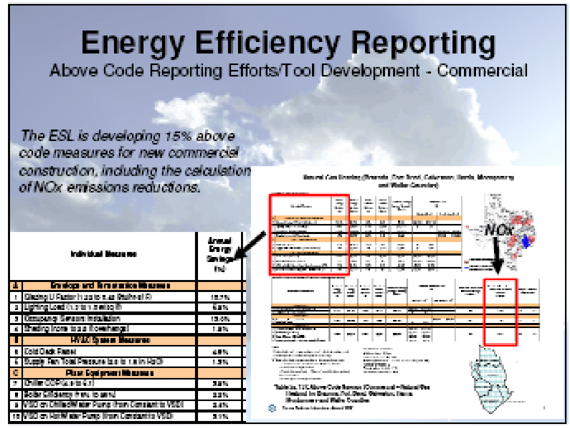
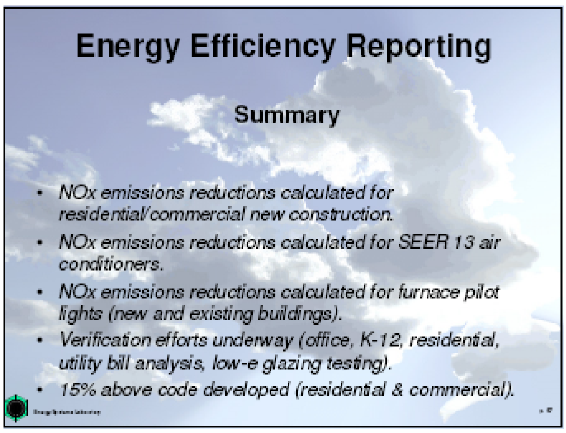
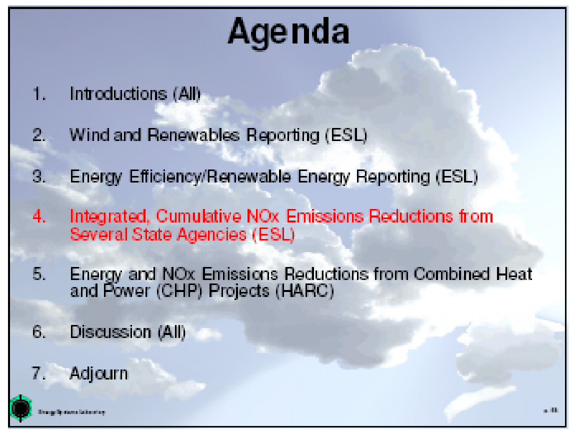


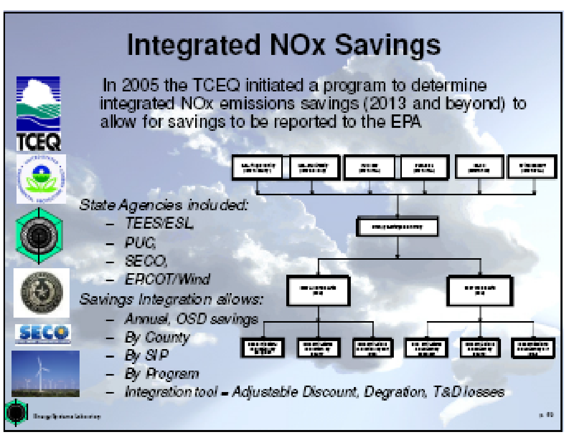
Figure 10-9: Slides presented on March 19, 2008 (Part 9)











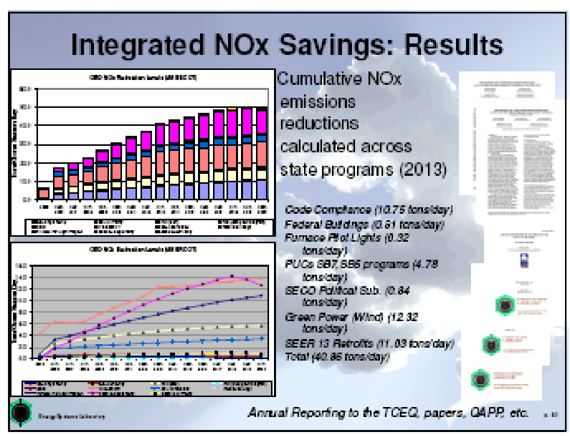
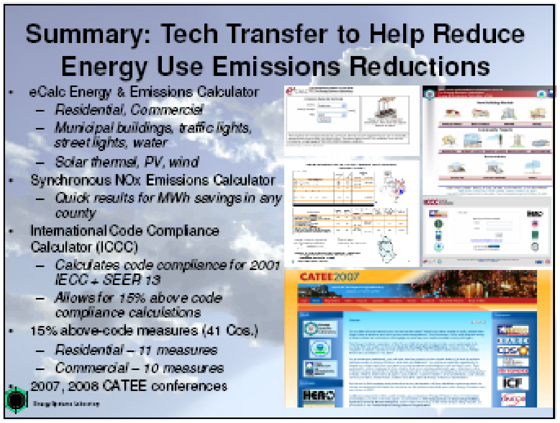
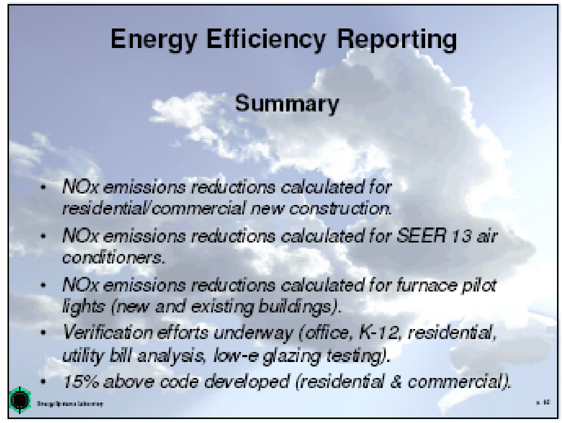
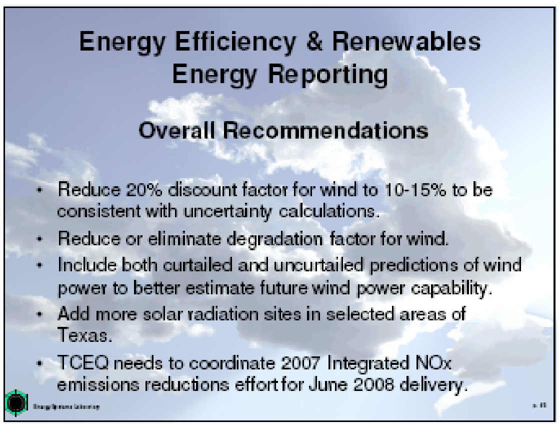


Figure 10-10: Slides presented on March 19, 2008 (Part 10)







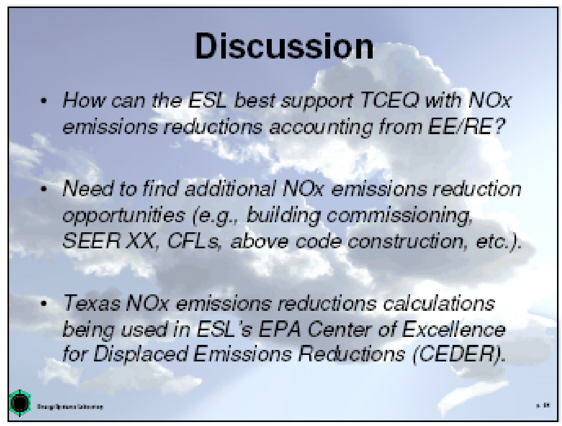
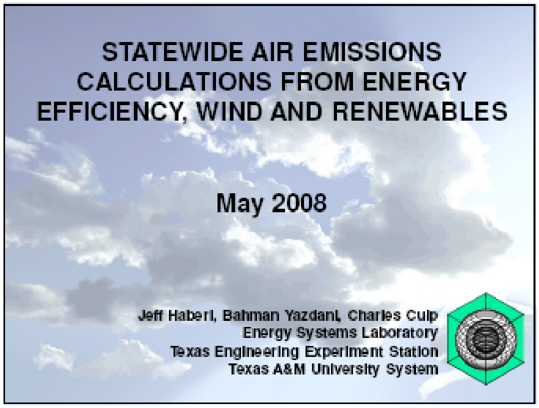
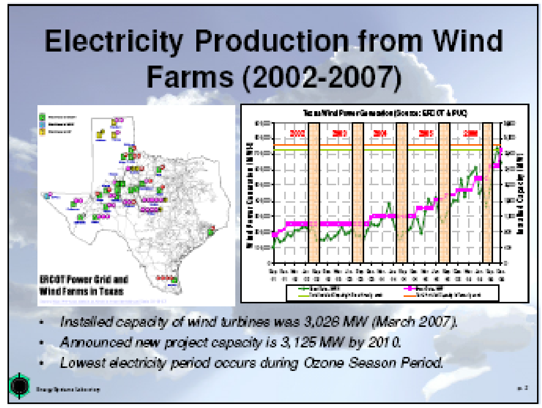


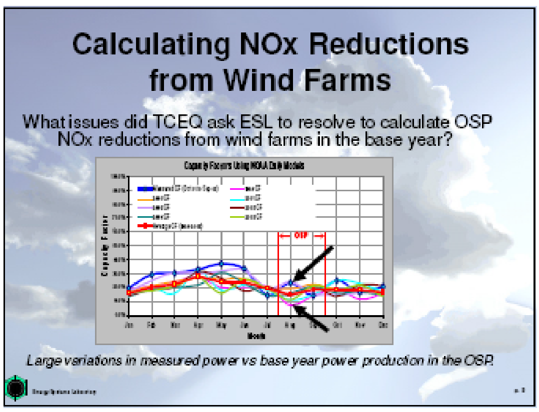
Figure 10-11: Slides presented on March 19, 2008 (Part 11)

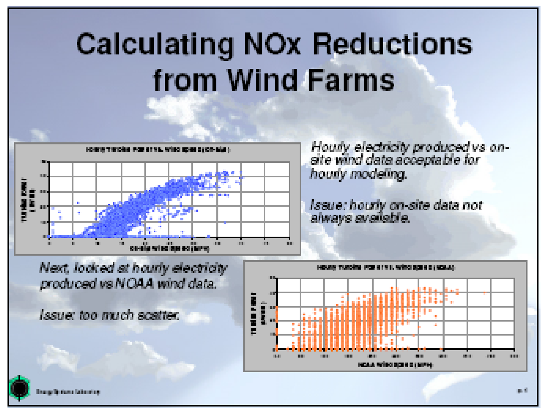
10.2 Presentation in May 2008

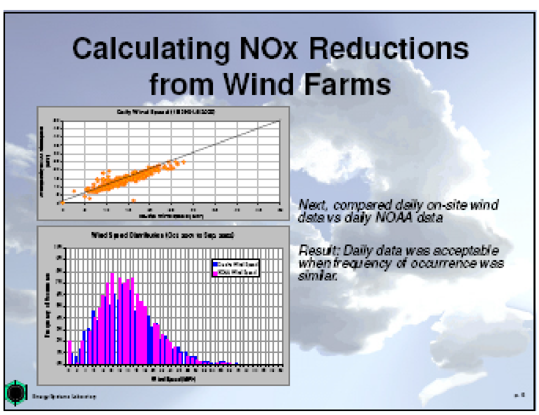
May 2008 – Presentation to the Texas Clean Air Working Group about the calculation of NOx emissions reductions from energy efficiency and renewable energy, Austin, Texas











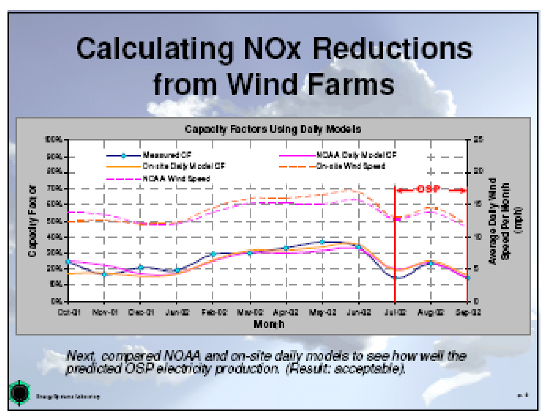
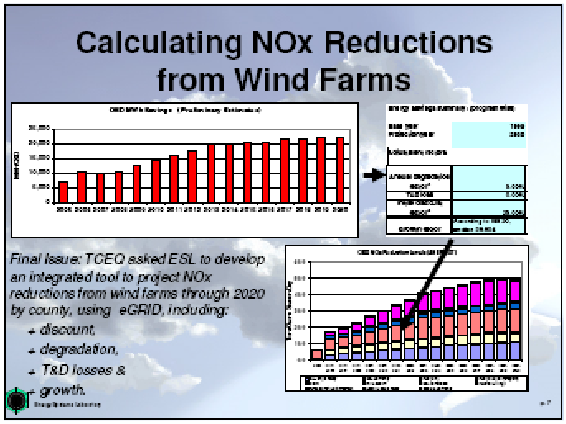
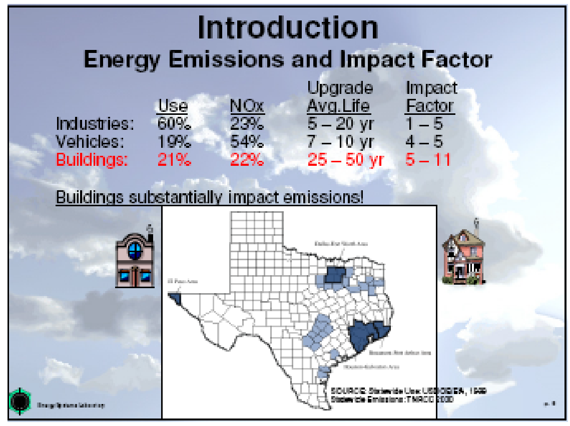
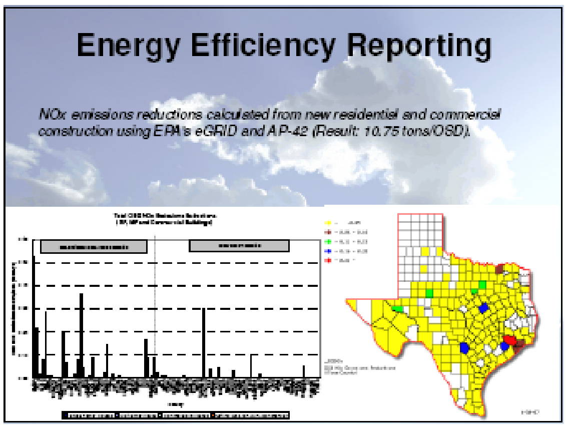
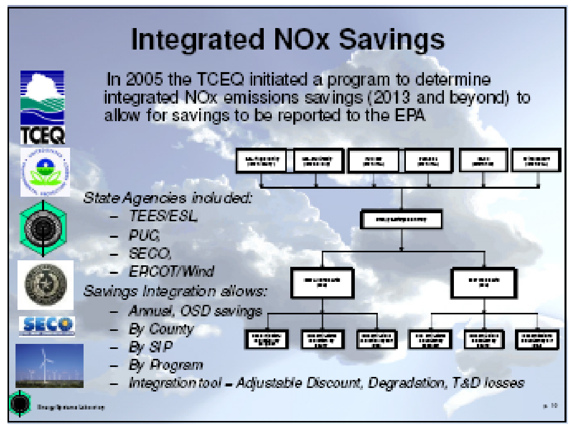


Figure 10-12: Slides presented in May, 2008 (Part 1)









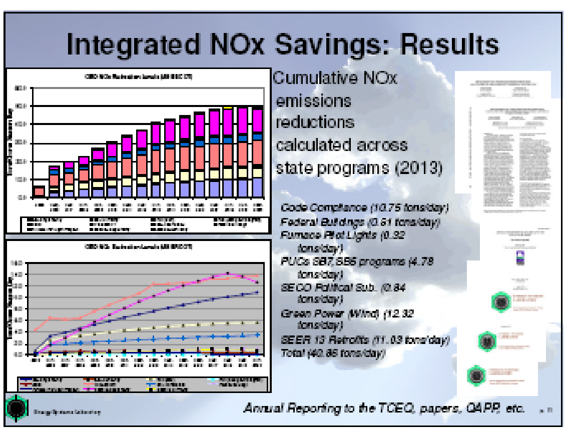


Figure 10-13: Slides presented in May, 2008 (Part 2)

10.3 Presentation on May 22, 2008

May 22, 2008 – Presentation to the EPA Technical Forum about calculation of NOx emissions reductions from energy efficiency and renewable energy, conference call.

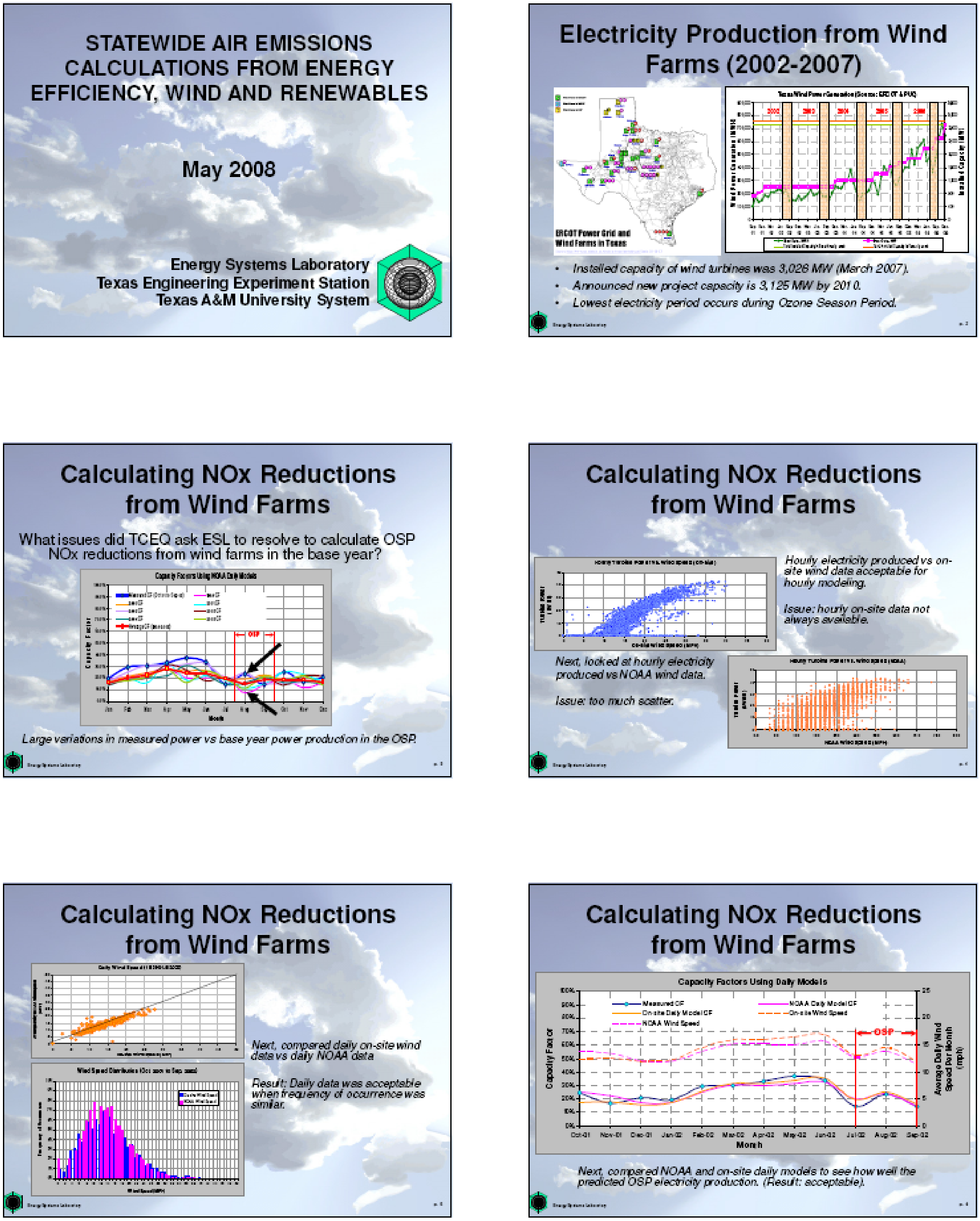
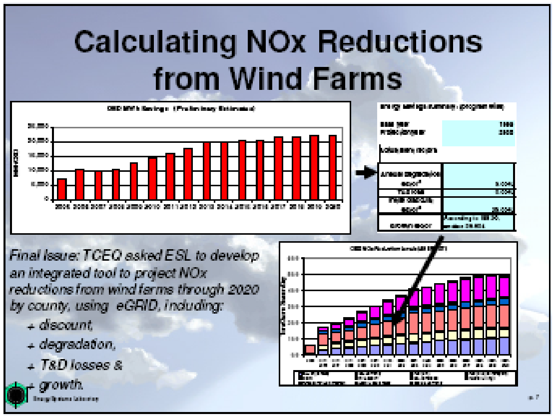
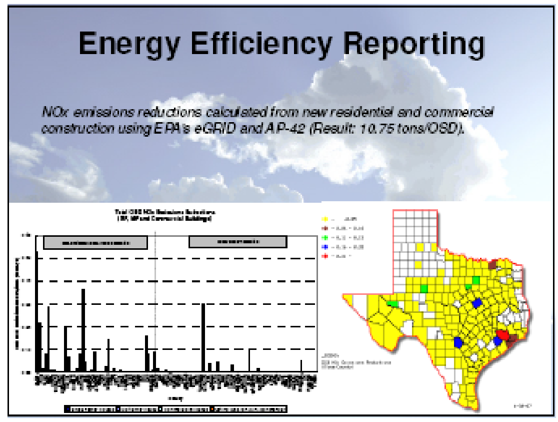
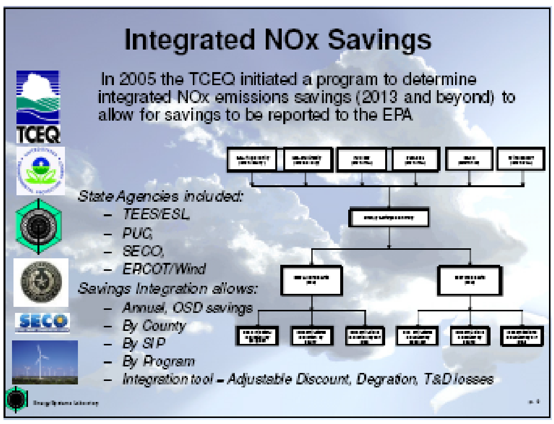


Figure 10-14: Slides presented on May 22, 2008 (Part 1)







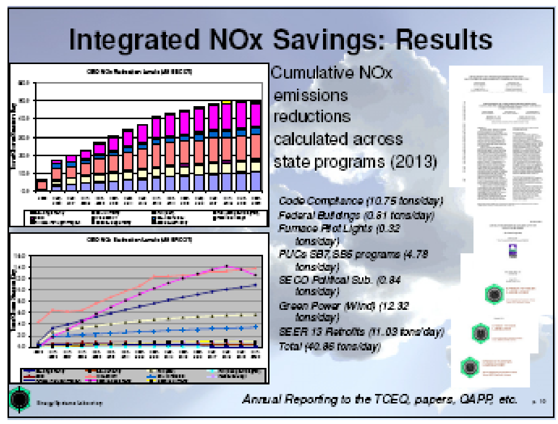
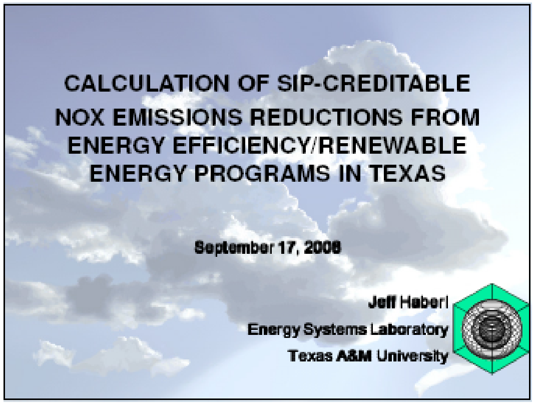
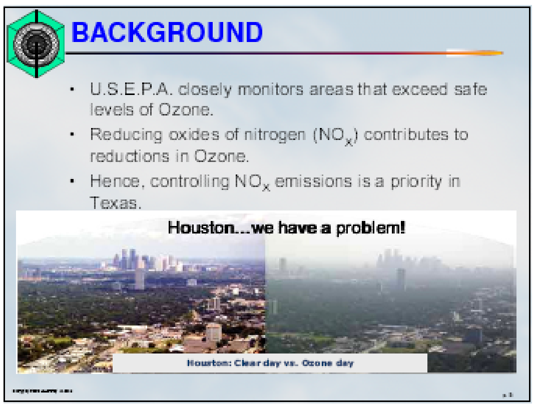


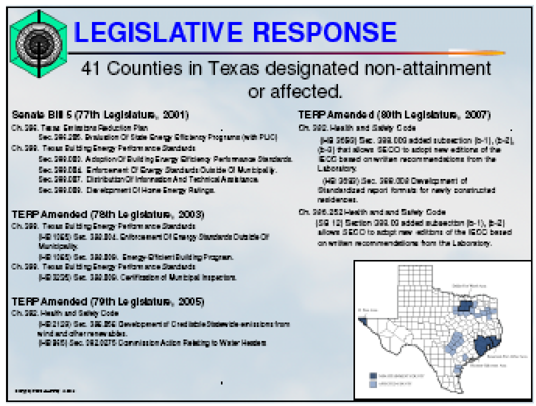
Figure 10-15: Slides presented on May22, 2008 (Part 2)

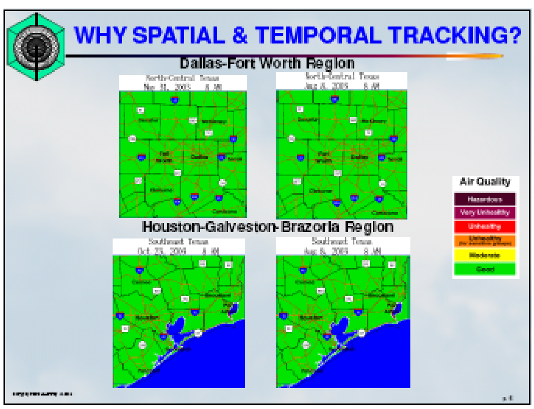
10.4 Presentation on September 17, 2008

September 17, 2008 – Presentation to the University of Texas Department of Architecture about the calculation of NOx emissions reductions from energy efficiency and renewable energy, Austin, Texas









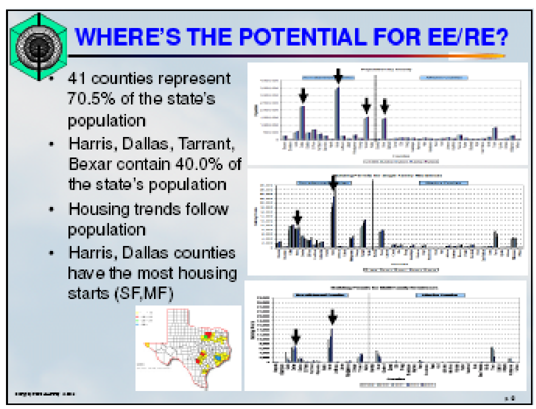
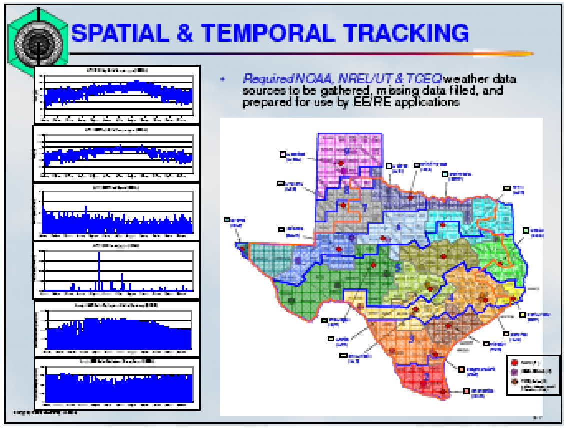
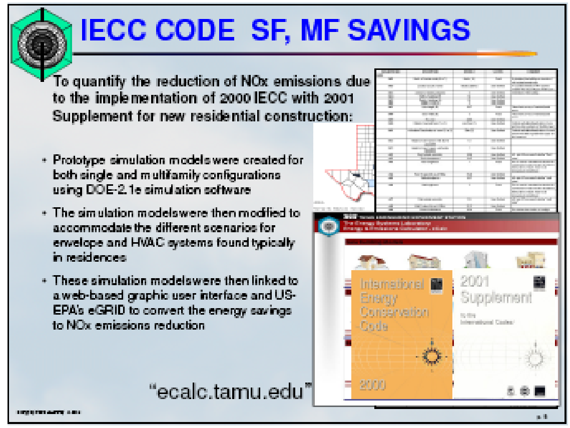
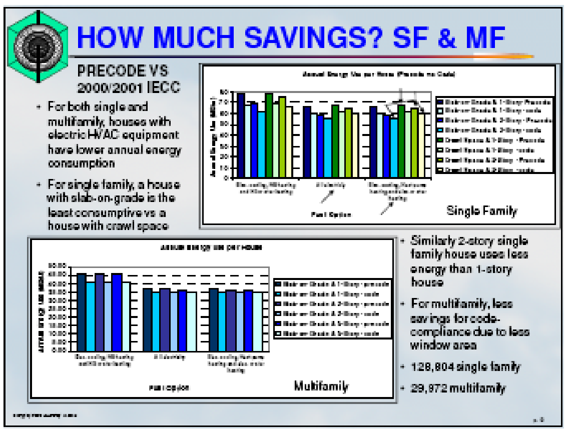
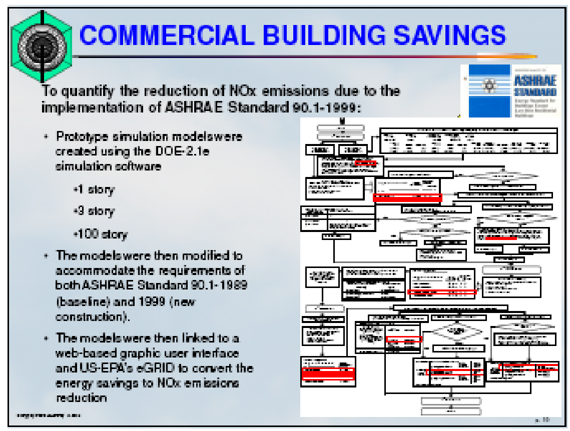


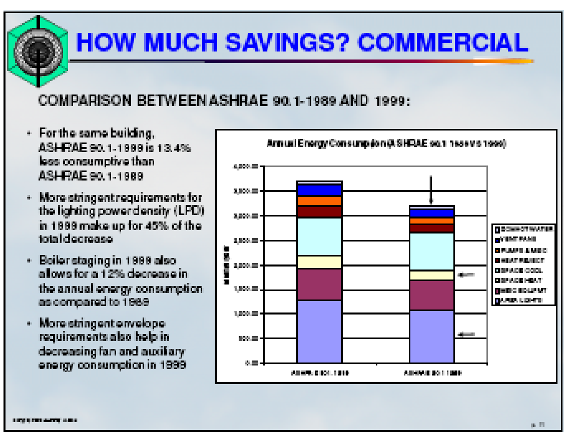
Figure 10-16: Slides presented on September 17, 2008 (Part 1)











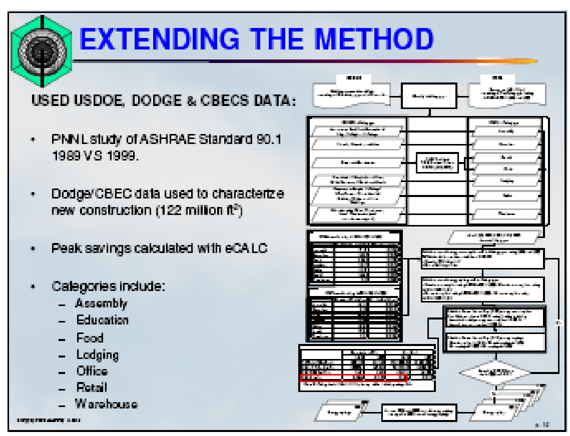
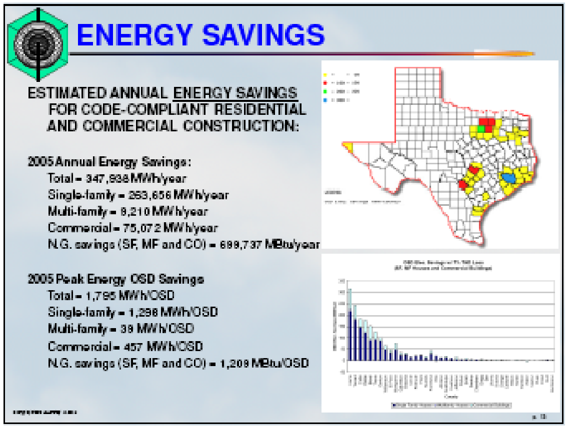
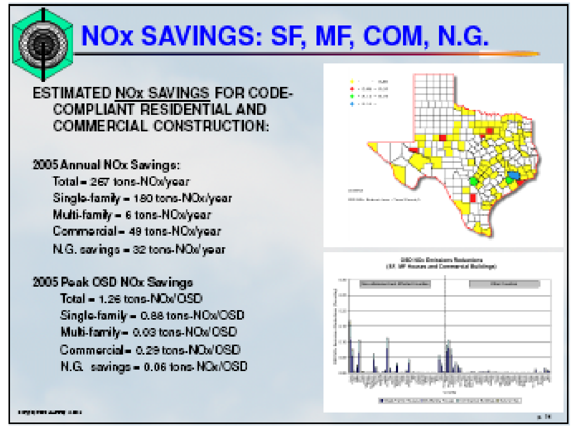
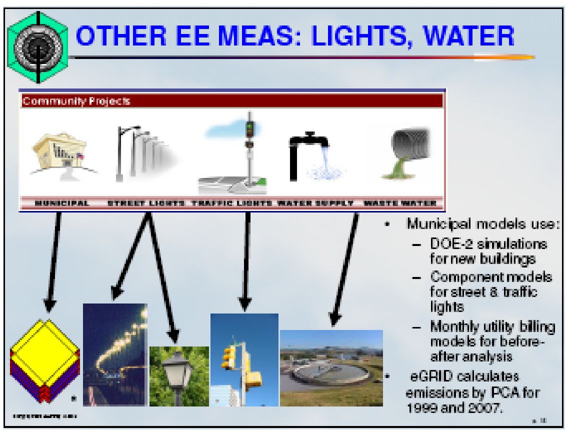
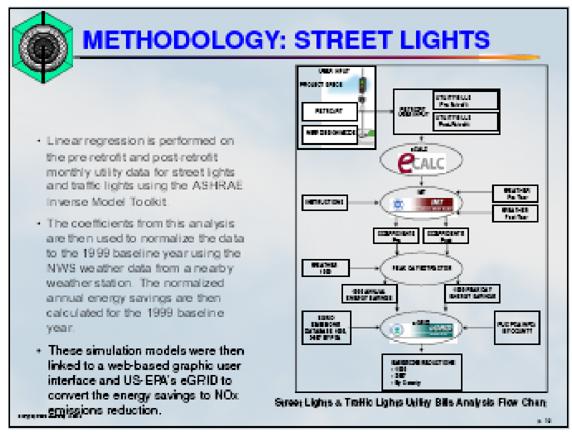


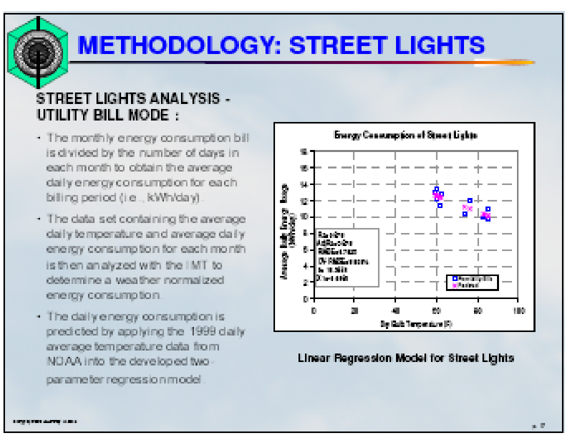
Figure 10-17: Slides presented on September 17, 2008 (Part 2)











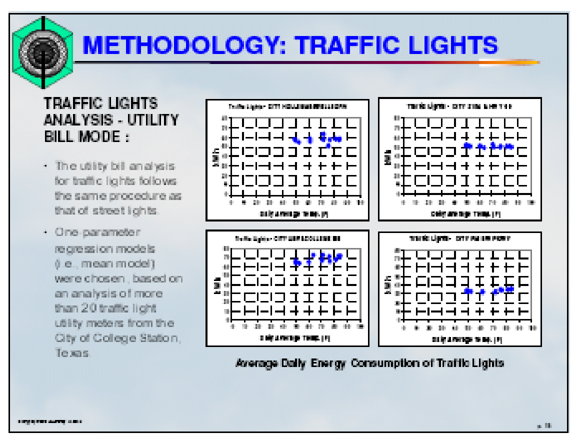
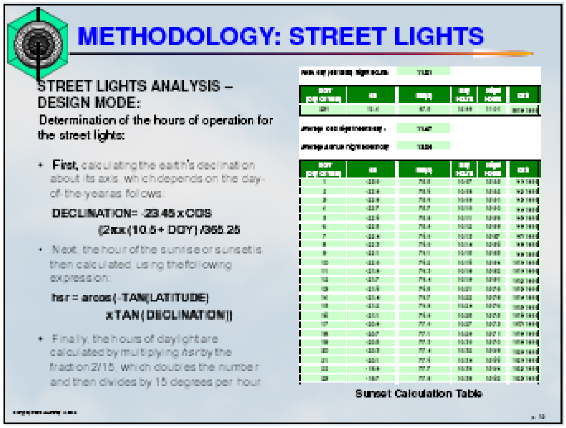
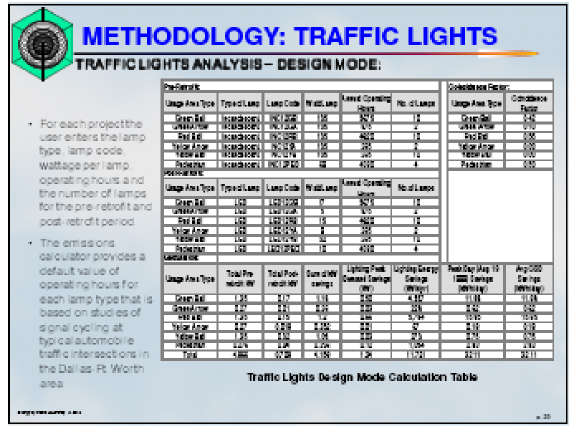
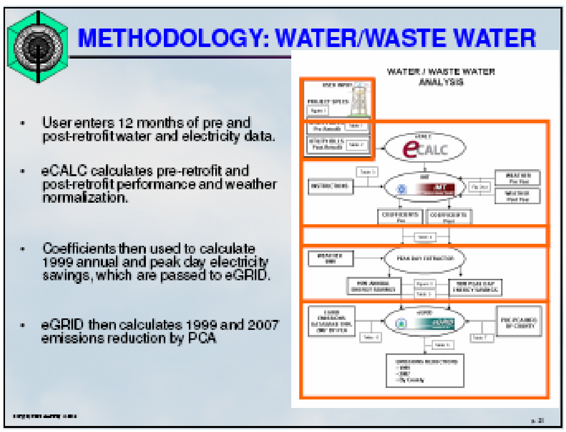
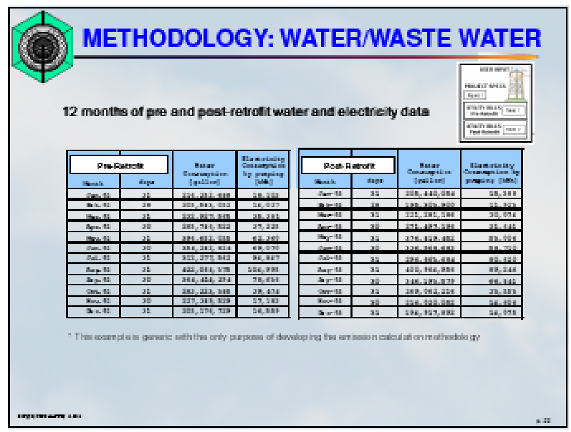


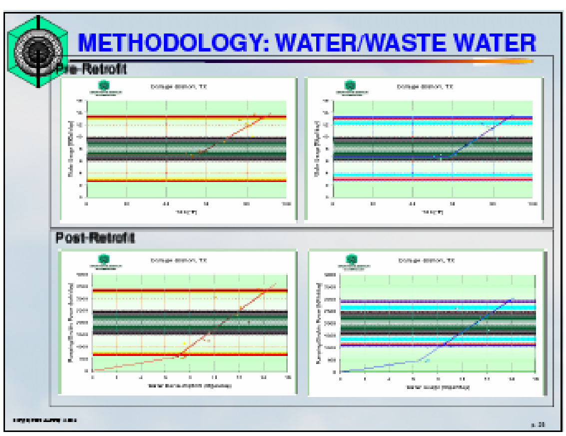
Figure 10-18: Slides presented on September 17, 2008 (Part 3)











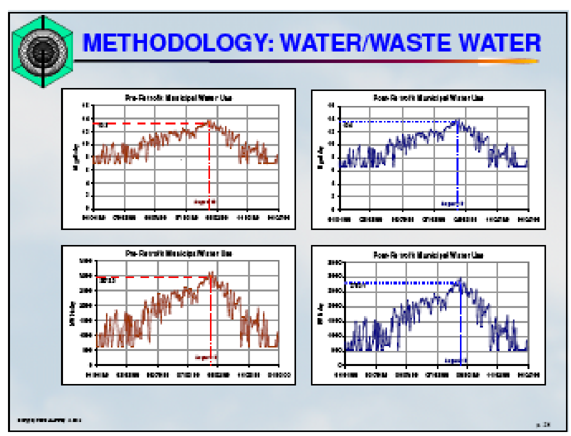
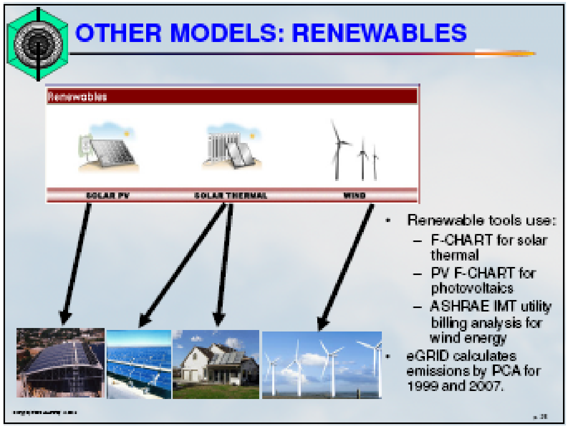
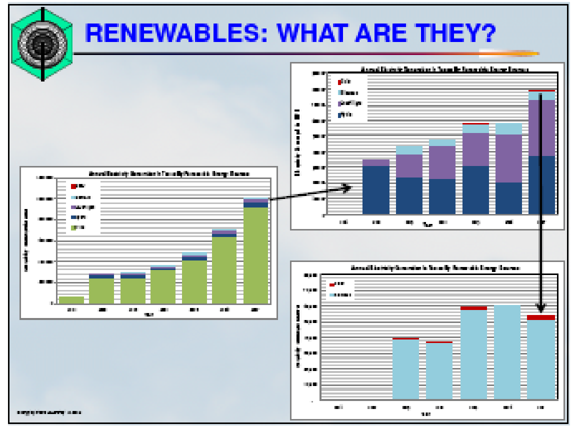
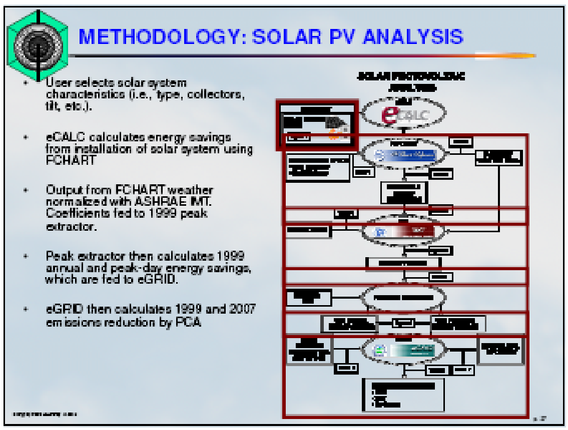
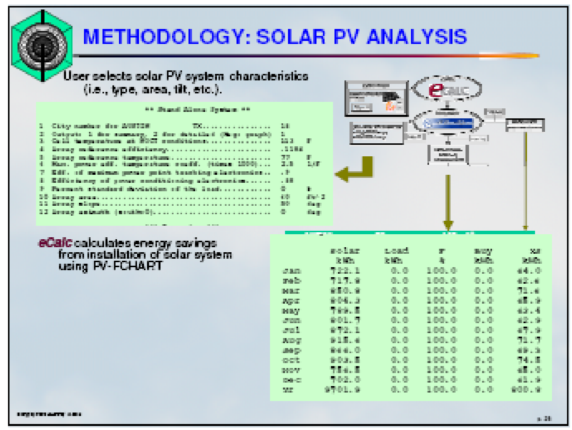


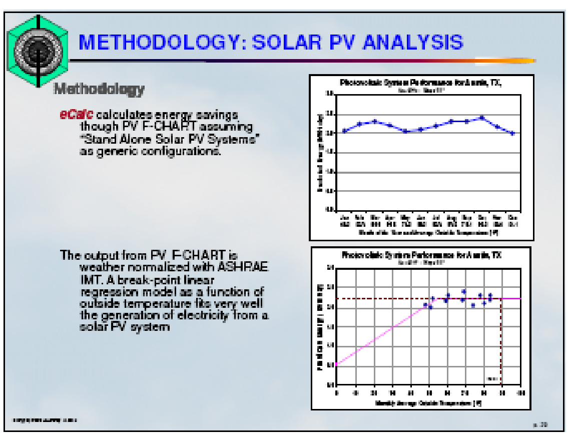
Figure 10-19: Slides presented on September 17, 2008 (Part 4)











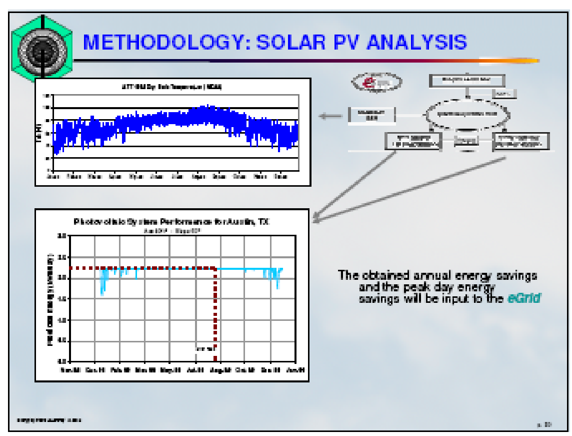
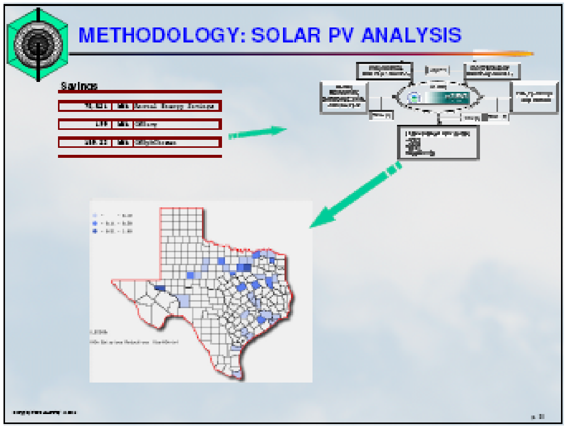
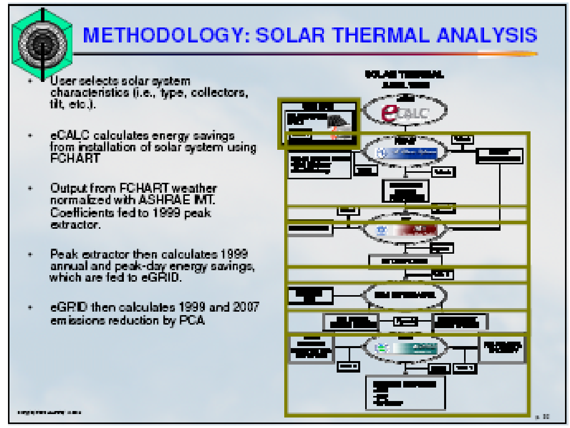
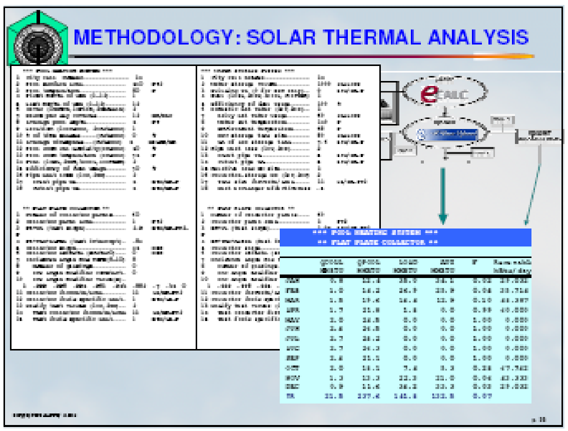
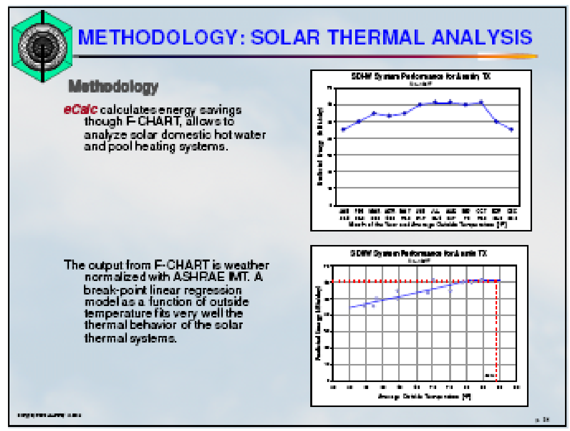


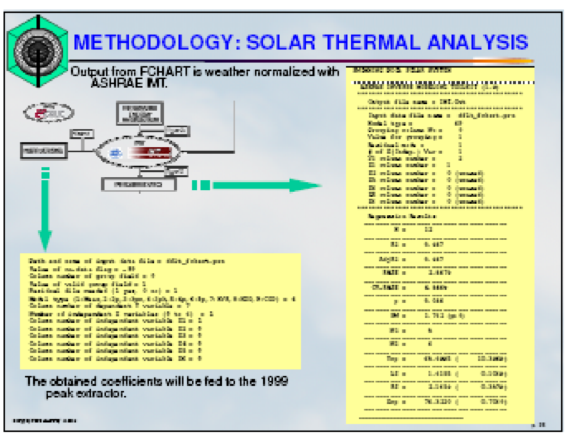
Figure 10-20: Slides presented on September 17, 2008 (Part 5)











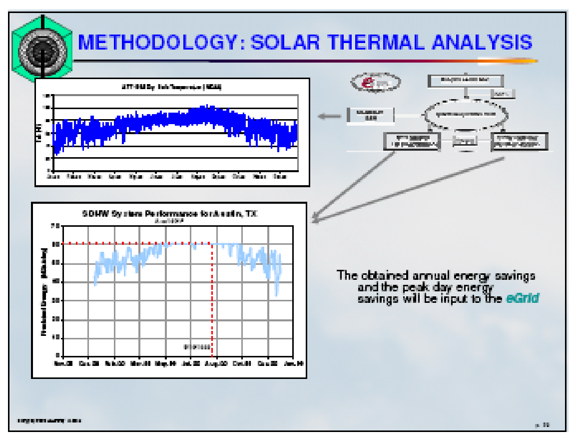
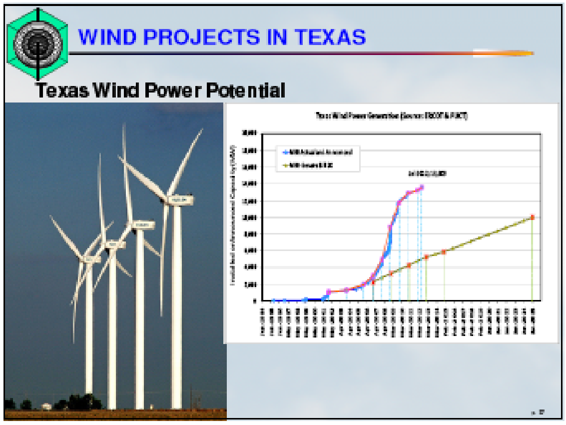
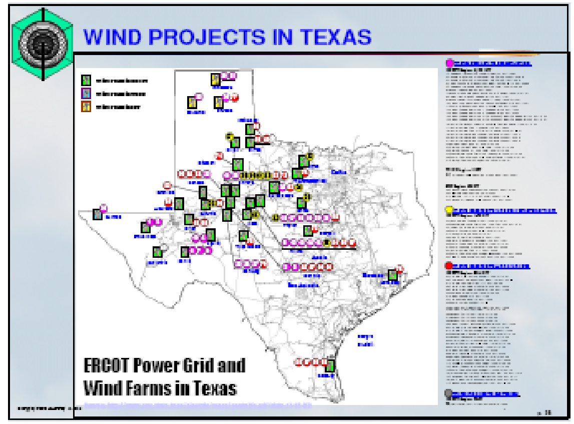
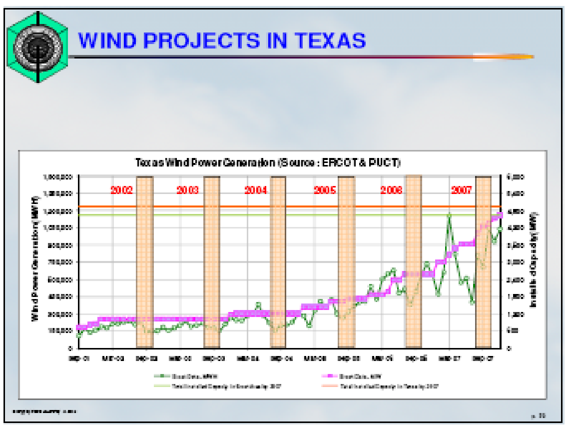
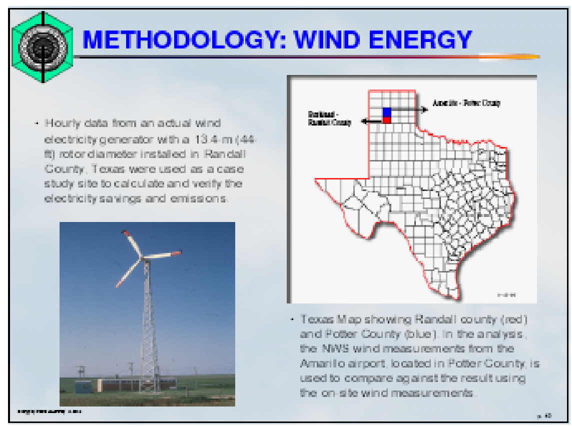


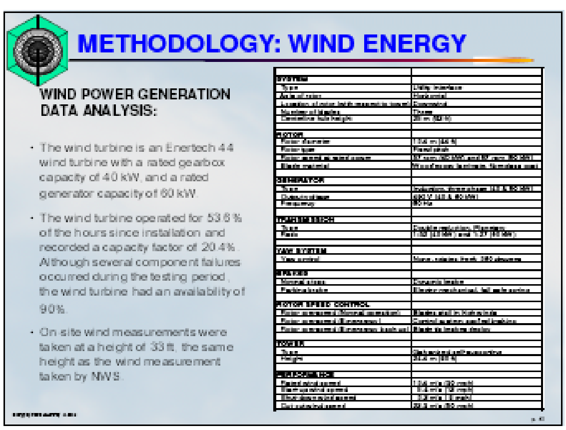
Figure 10-21: Slides presented on September 17, 2008 (Part 6)











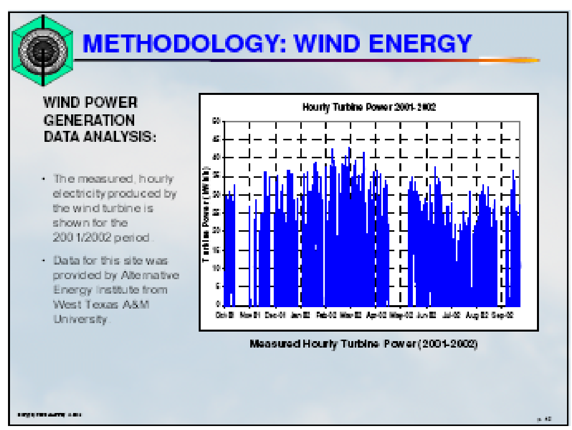
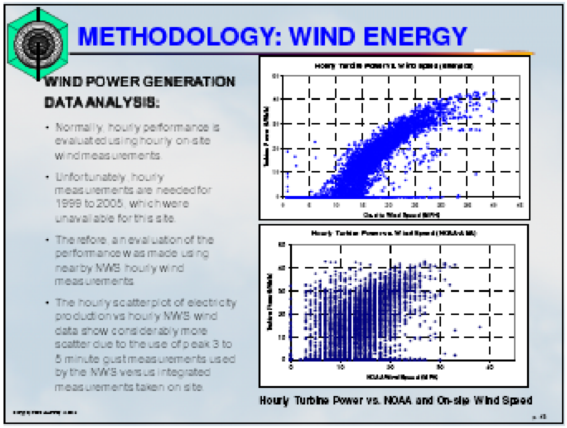
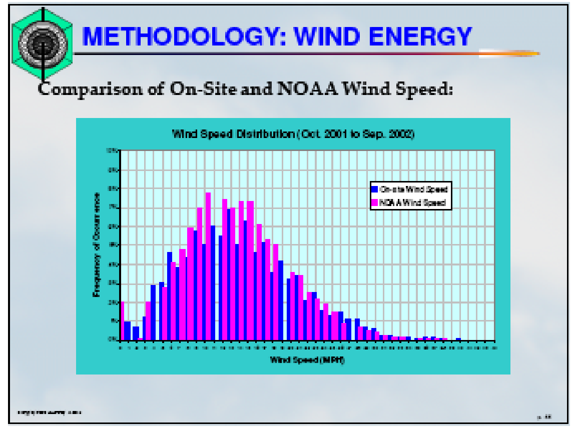
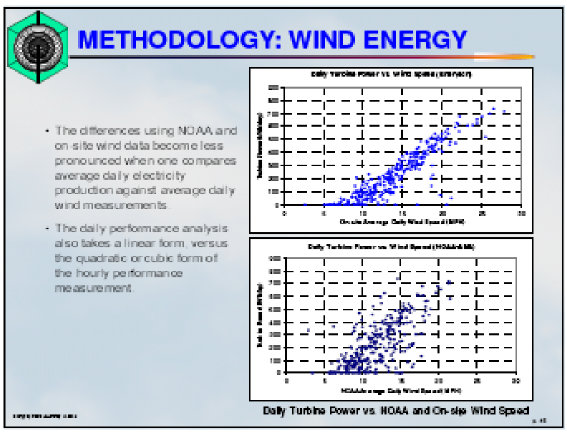
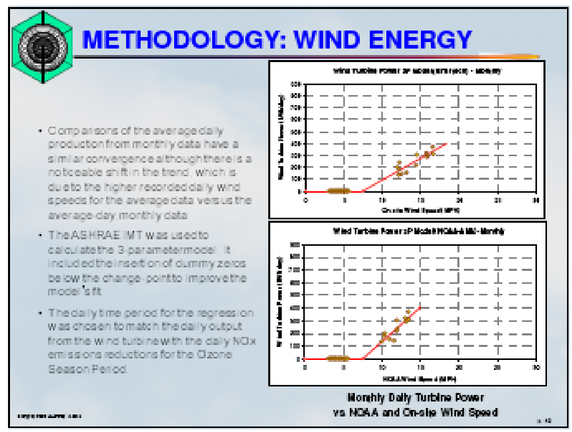


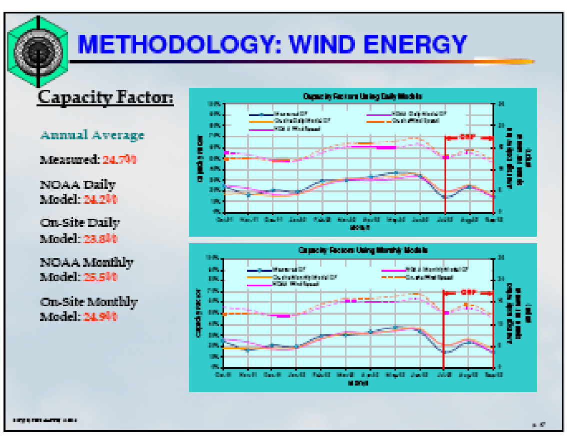
Figure 10-22: Slides presented on September 17, 2008 (Part 7)











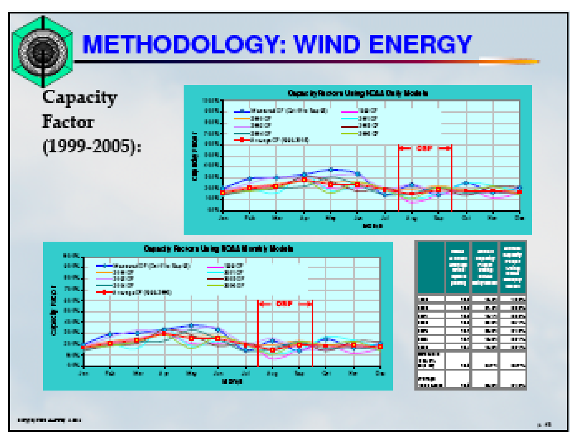
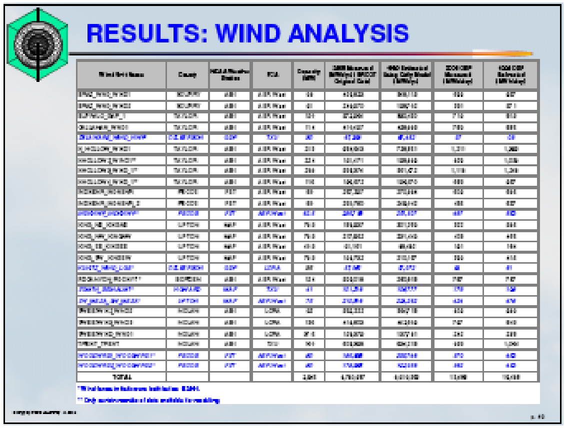
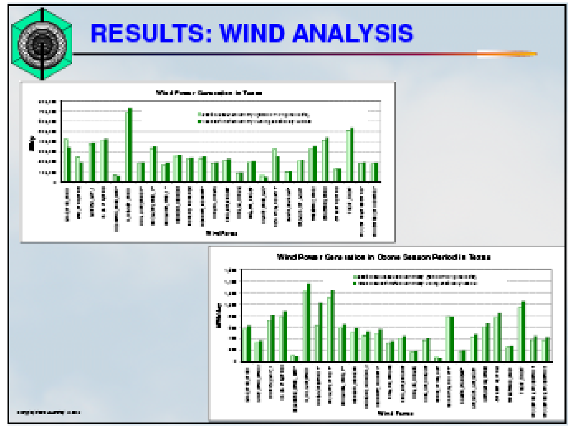
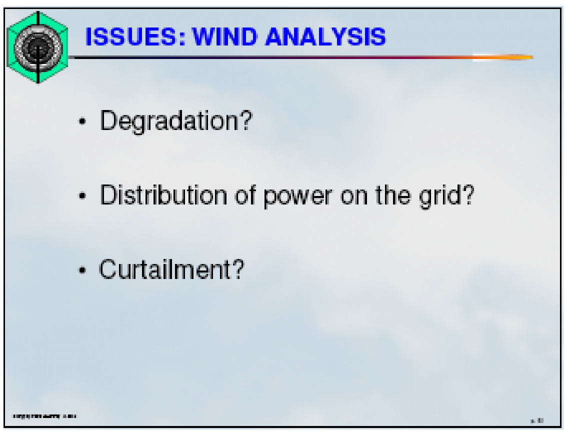
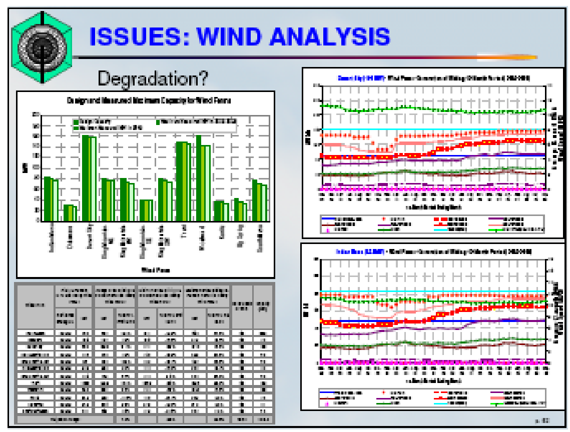


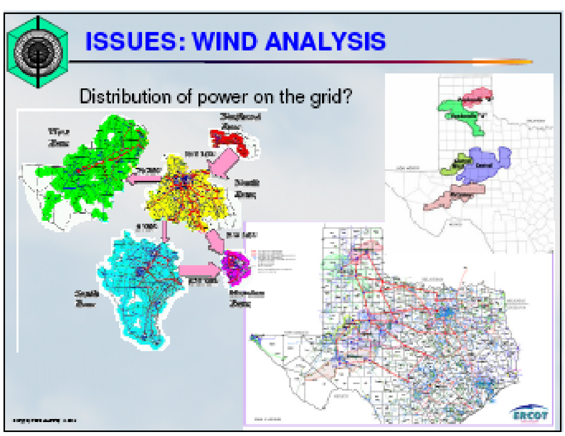
Figure 10-23: Slides presented on September 17, 2008 (Part 8)











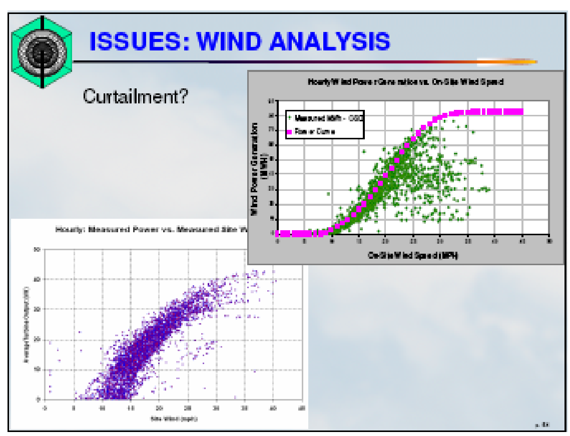
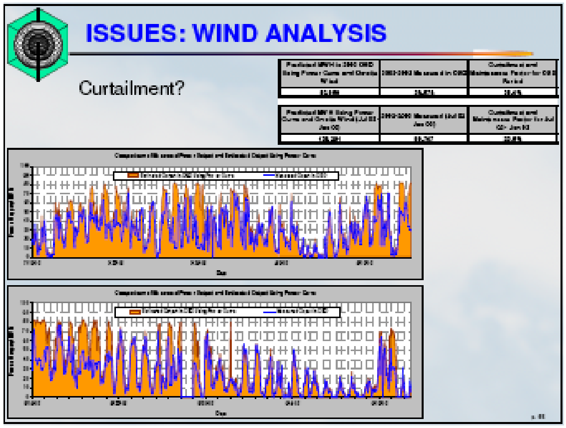
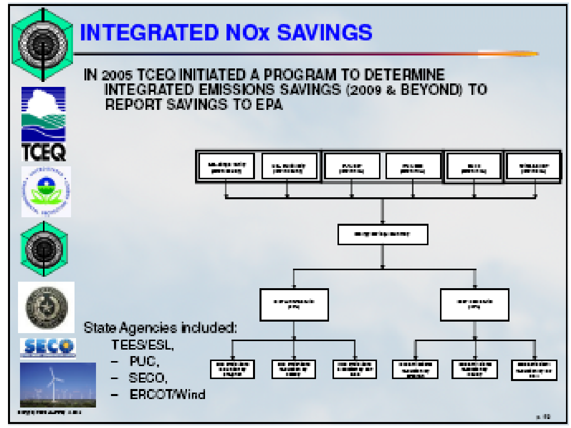
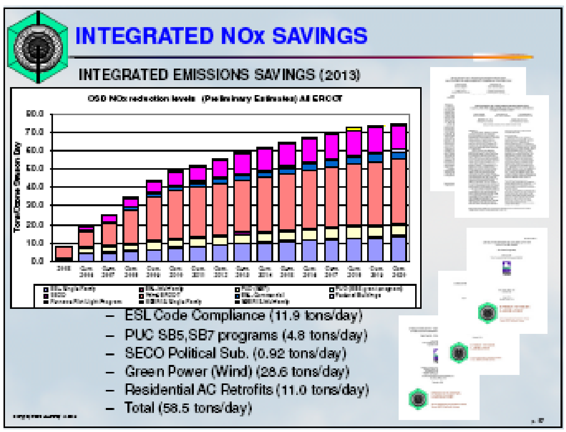
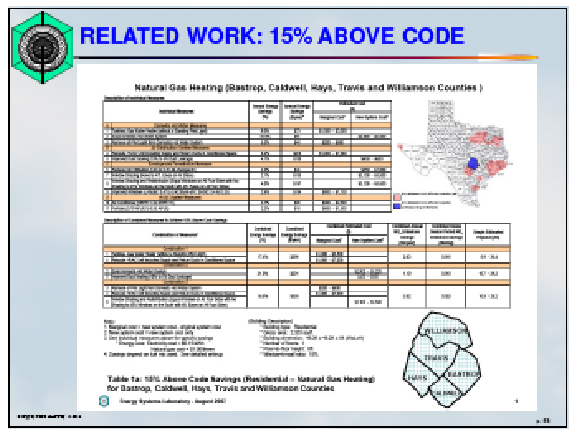


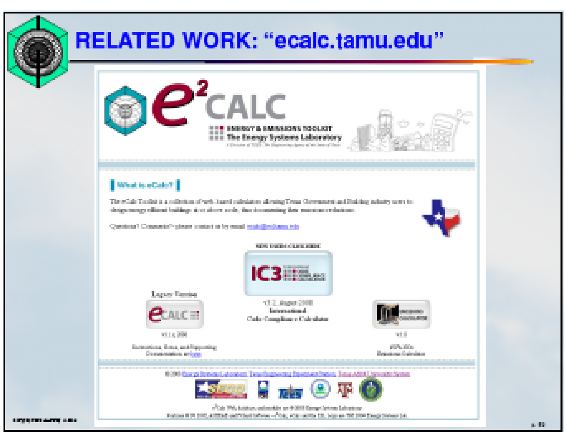
Figure 10-24: Slides presented on September 17, 2008 (Part 9)











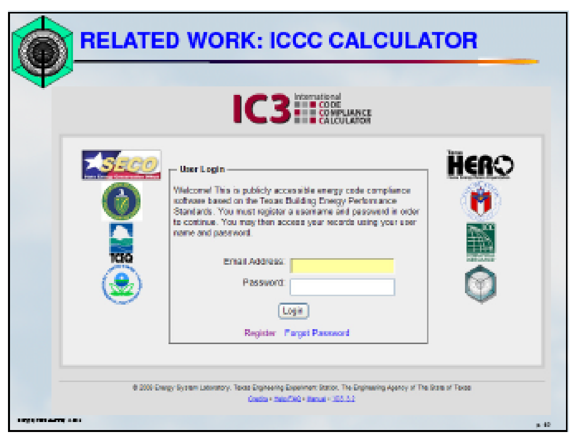
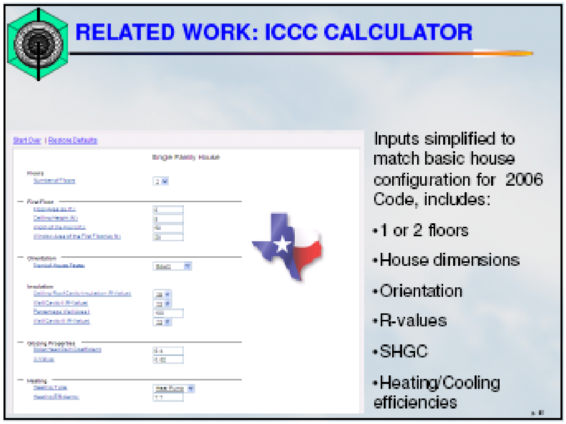
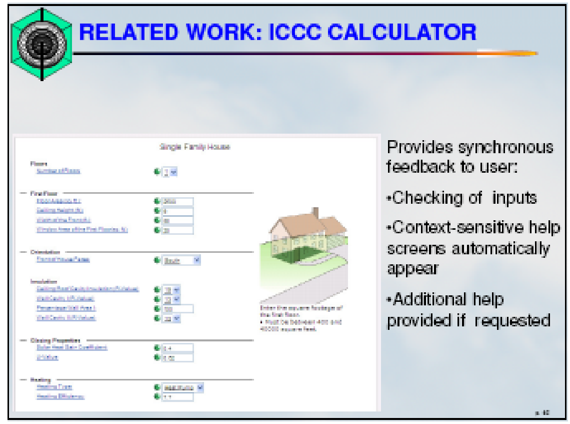
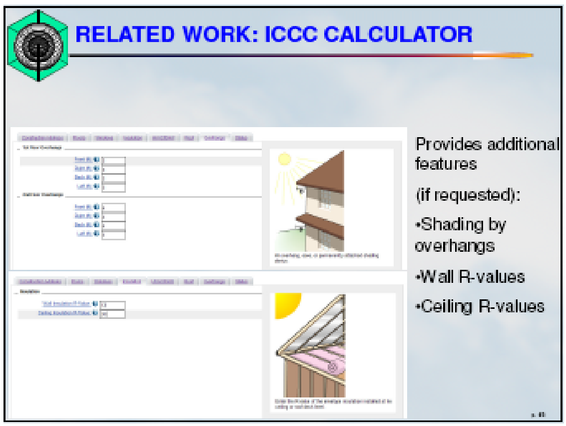
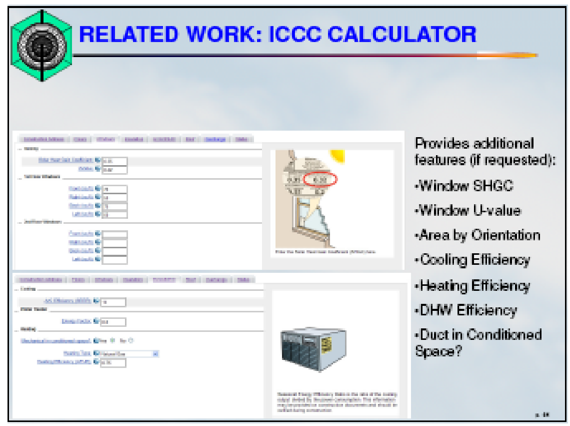


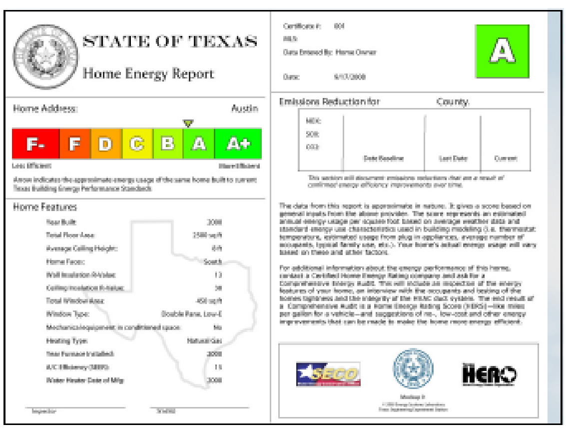
Figure 10-25: Slides presented on September 17, 2008 (Part 10)











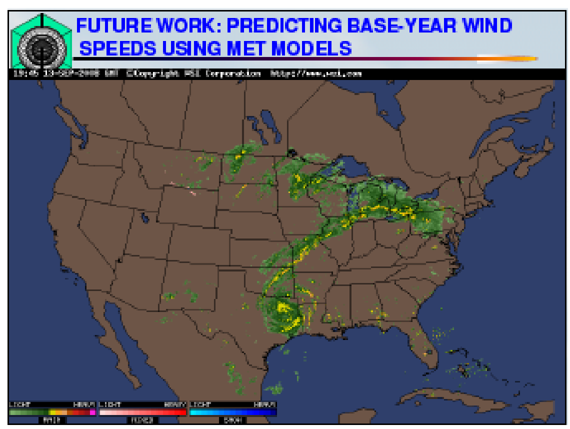


Figure 10-26: Slides presented on September 17, 2008 (Part 11)

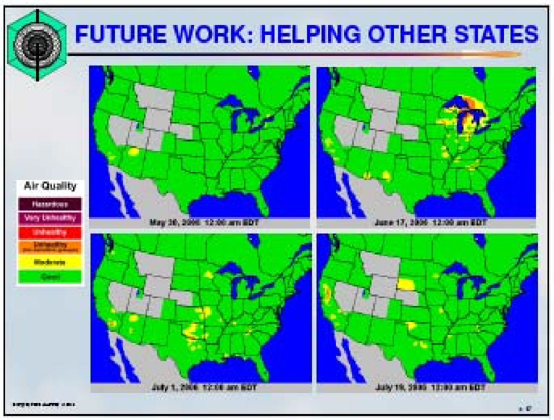
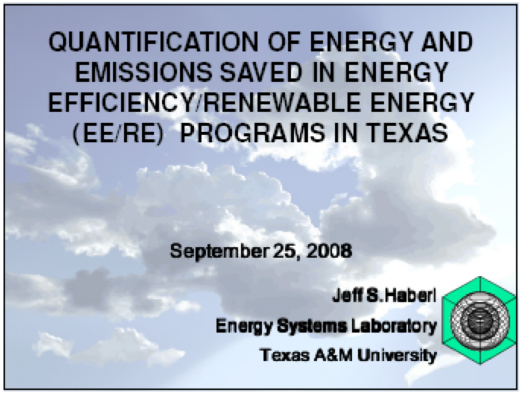
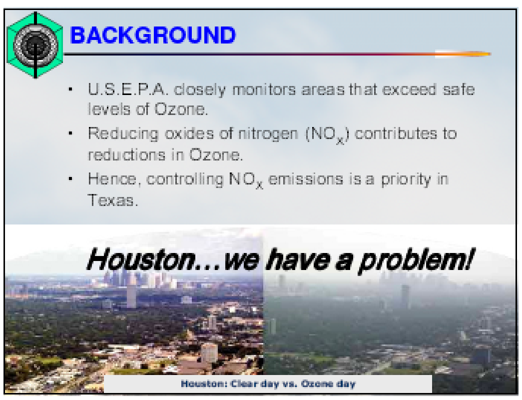


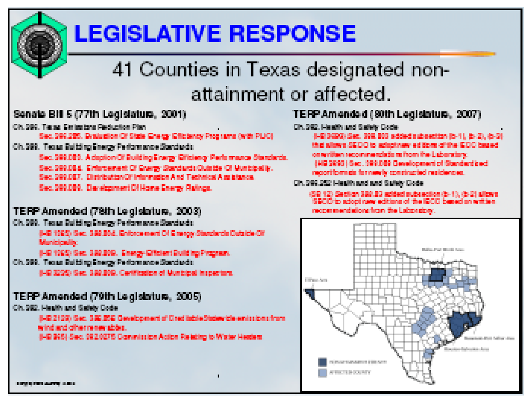
Figure 10-27: Slides presented on September 17, 2008 (Part 12)

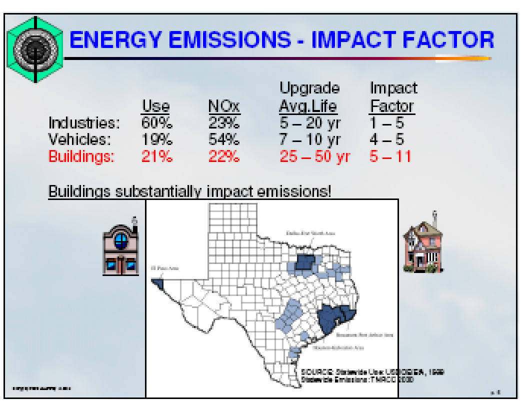
10.5 Presentation on September 25, 2008

September 25, 2008 – Presentation to the EPA Blue Skyways conference about calculation of NOx emissions reductions from energy efficiency and renewable energy, Kansas City, MO









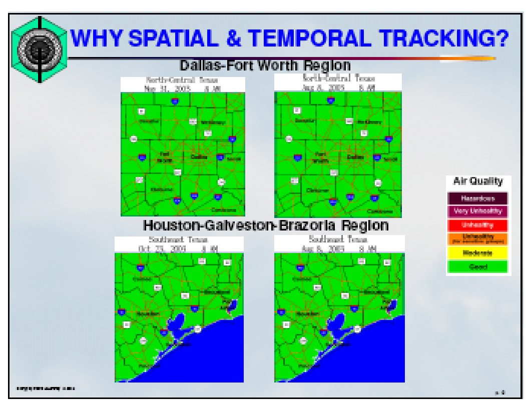
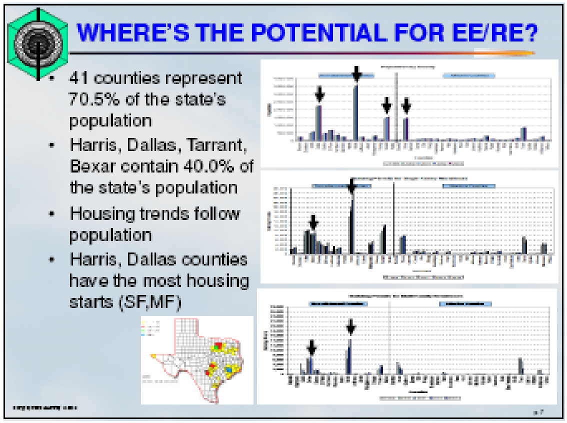
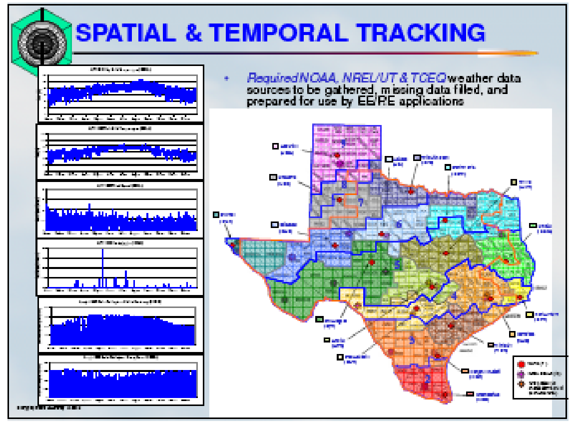
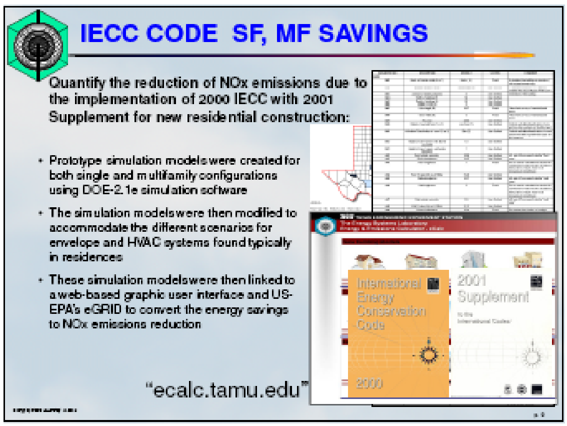
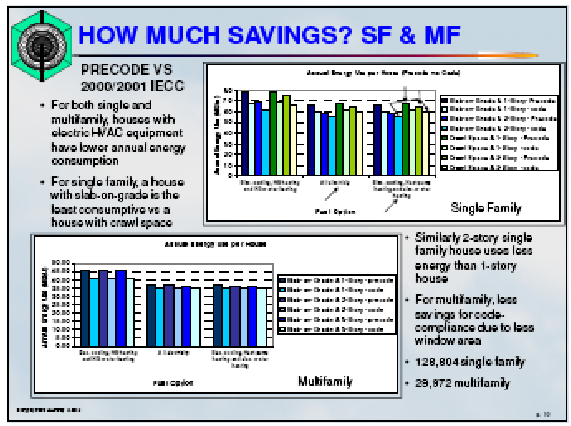


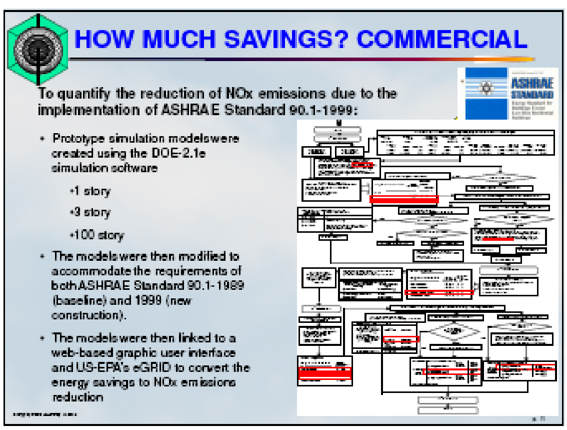
Figure 10-28: Slides presented on September 25, 2008 (Part 1)











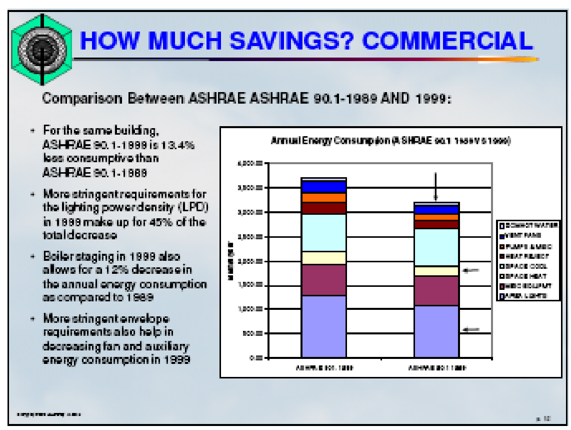
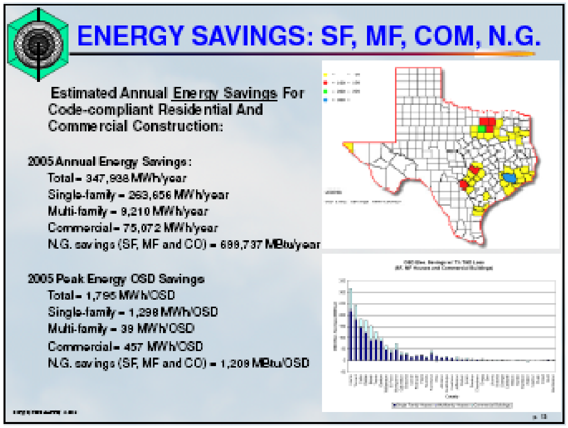
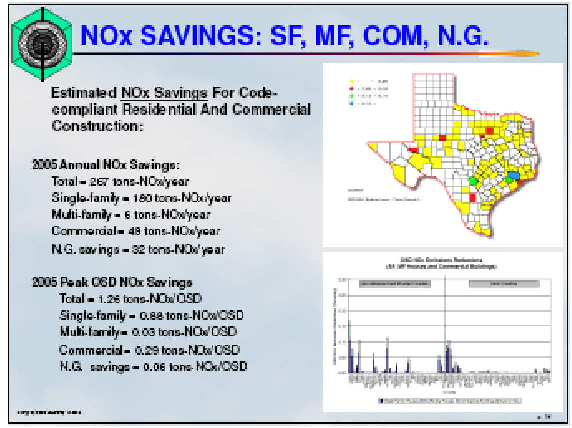
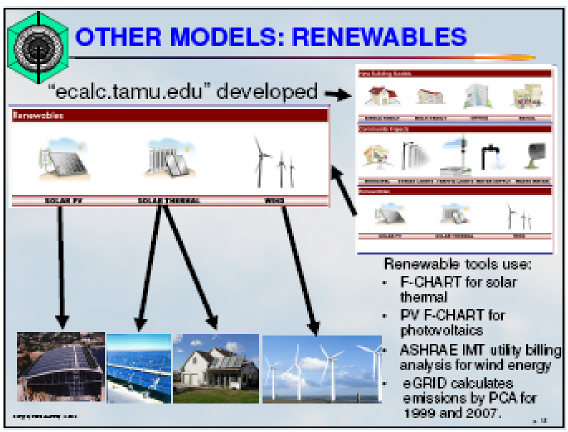
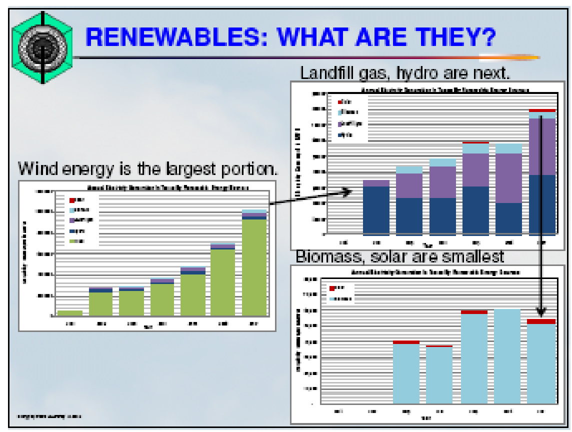


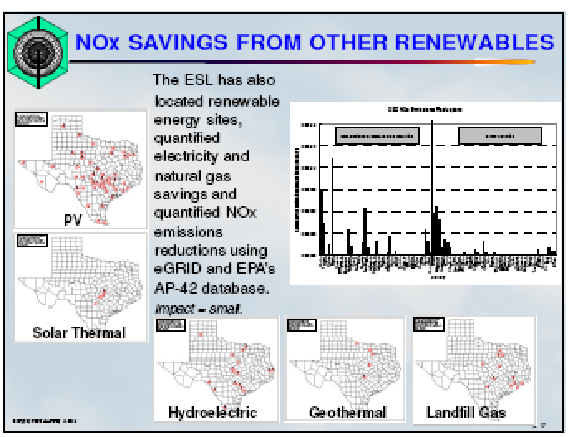
Figure 10-29: Slides presented on September 25, 2008 (Part 2)











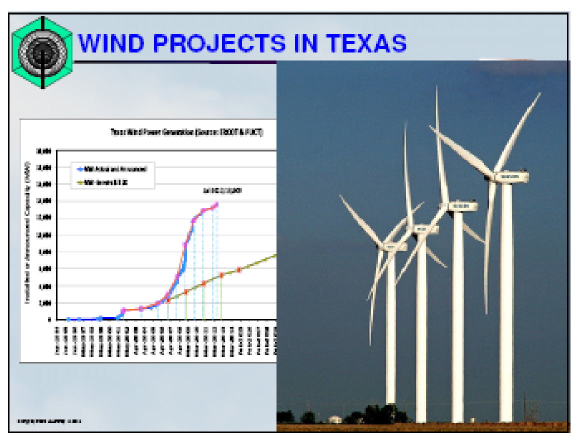
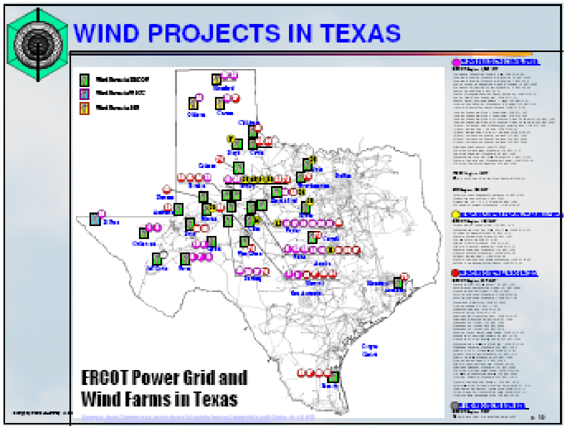
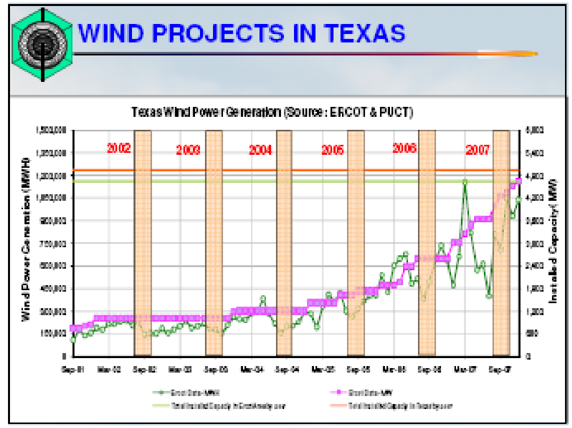
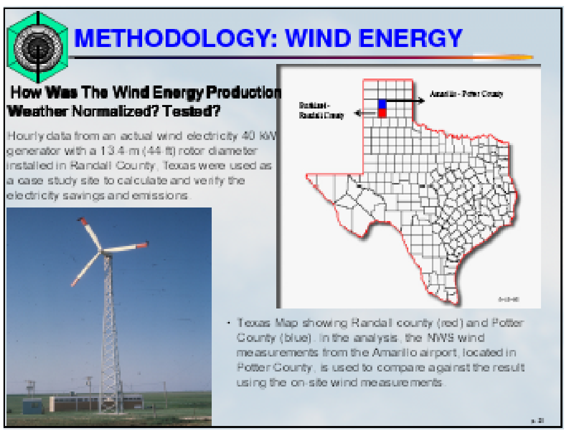
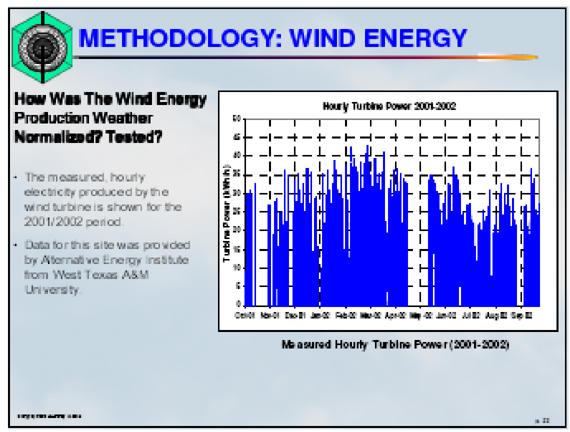


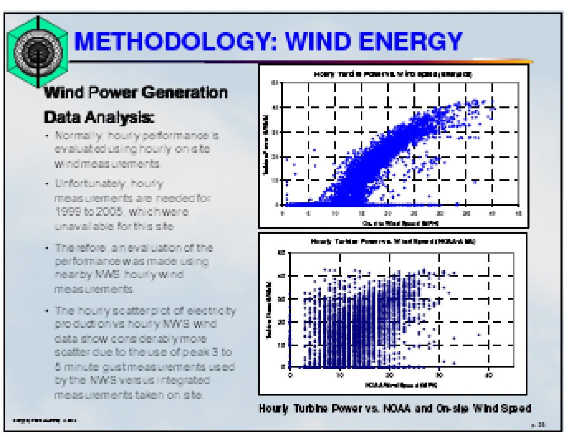
Figure 10-30: Slides presented on September 25, 2008 (Part 3)











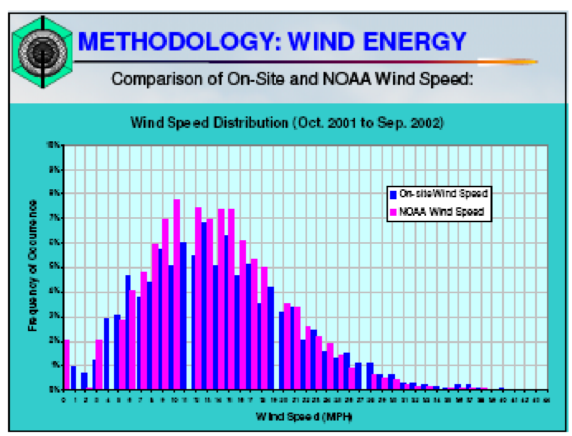


Figure 10-31: Slides presented on September 25, 2008 (Part 4)

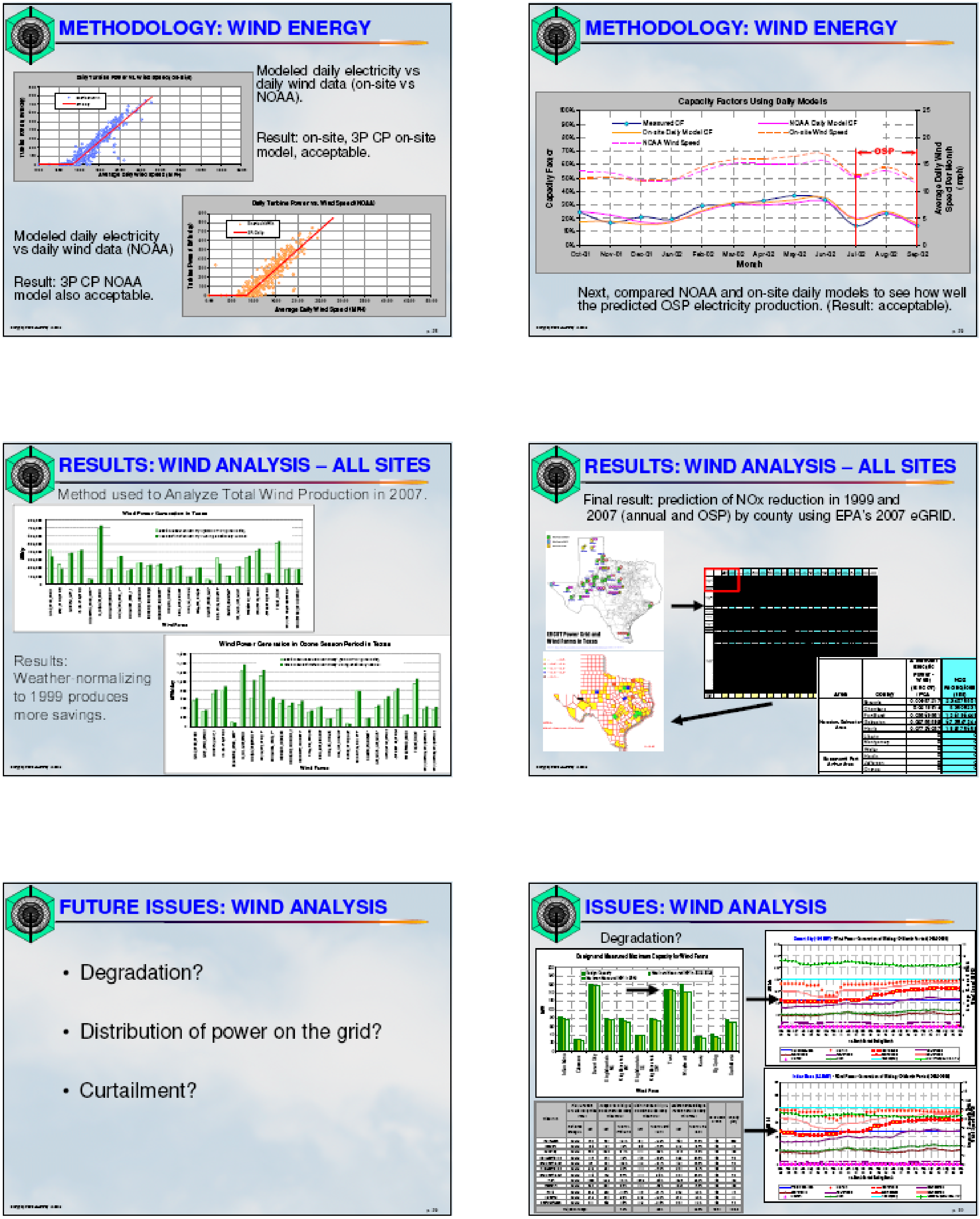
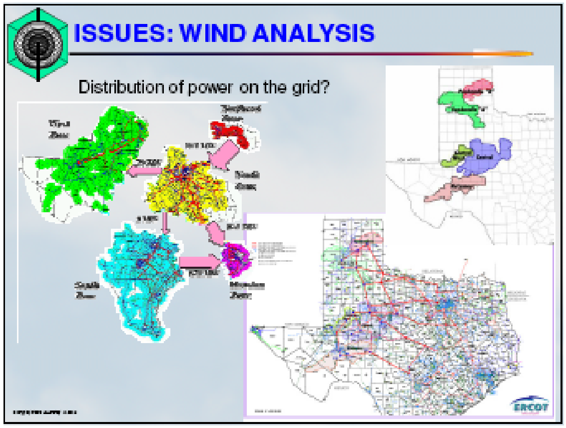
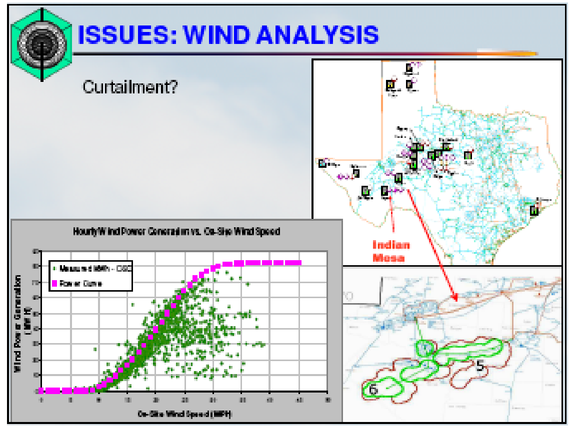
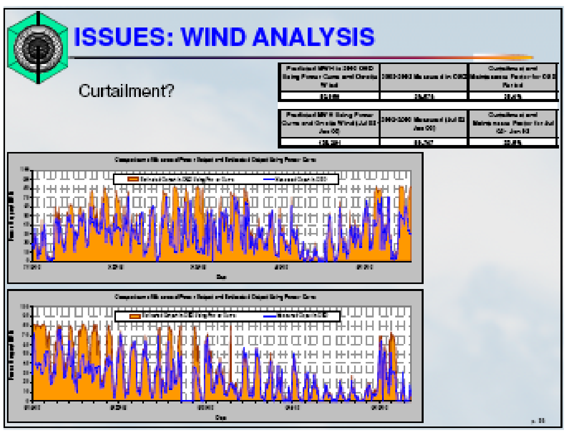
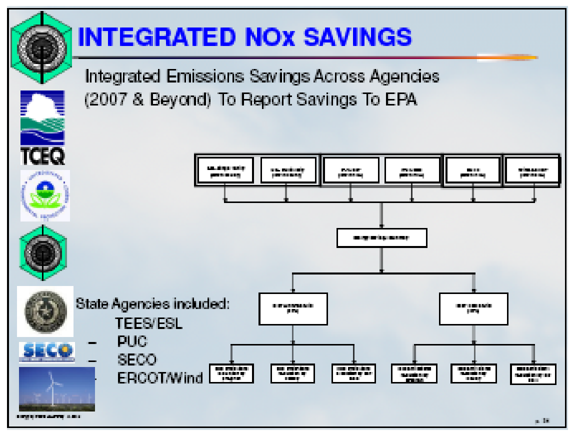


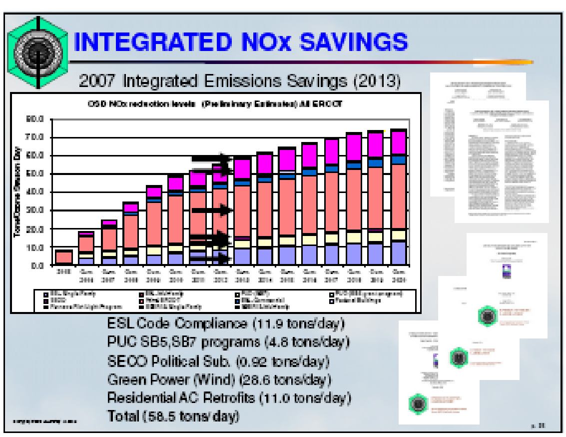
Figure 10-32: Slides presented on September 25, 2008 (Part 5)











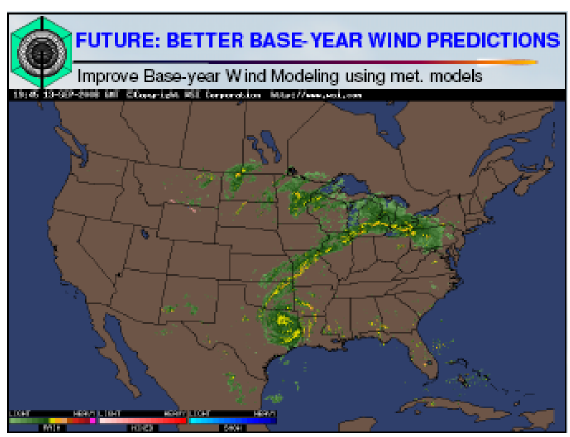


Figure 10-33: Slides presented on September 25, 2008 (Part 6)

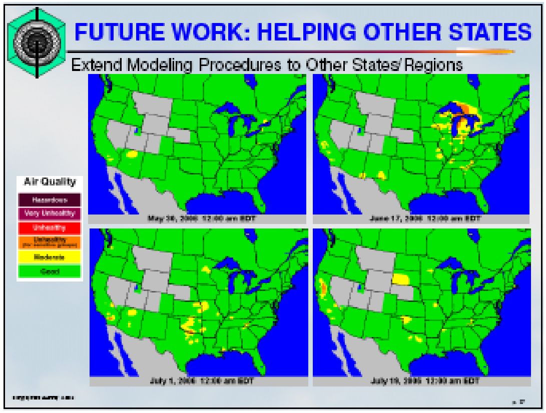
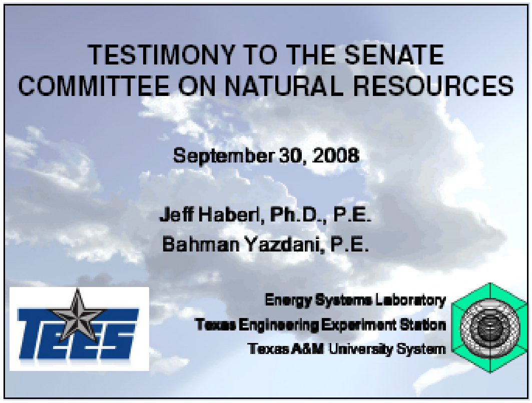
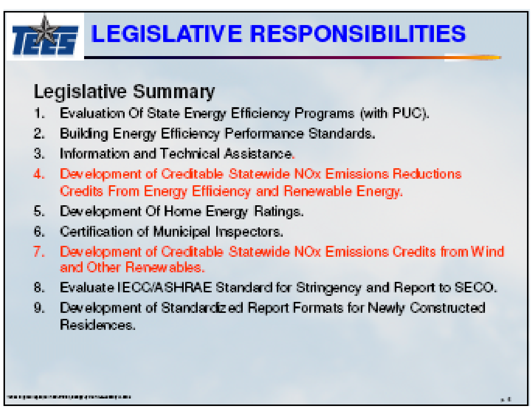


Figure 10-34: Slides presented on September 25, 2008 (Part 7)

10.6 Presentation on September 30, 2008

September 30, 2008 – Presentation to the Texas Senate Natural Resources Committee about the calculation of NOx emissions reductions from energy efficiency and renewable energy, Austin, Texas





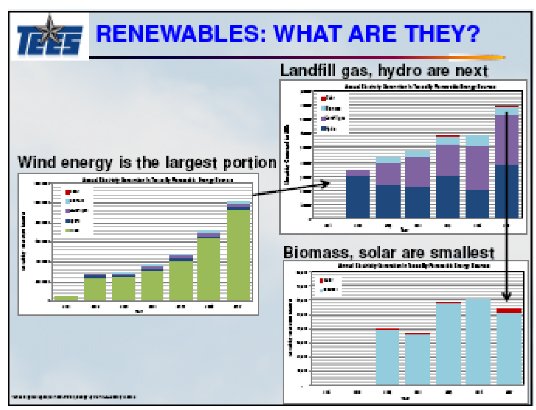
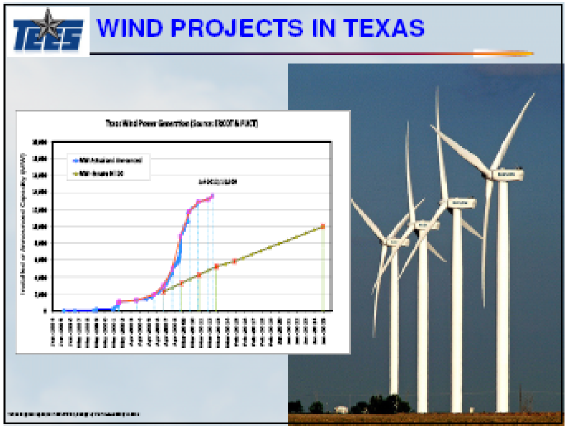
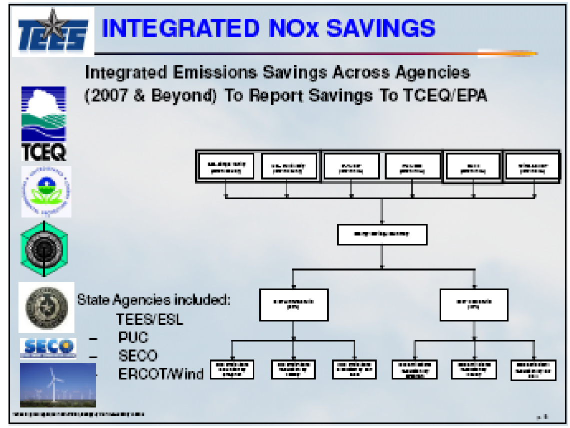
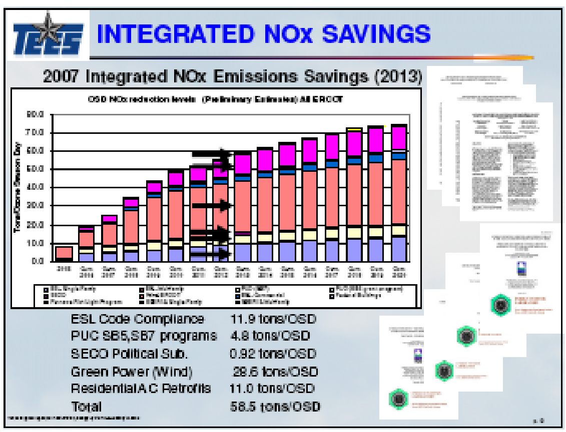
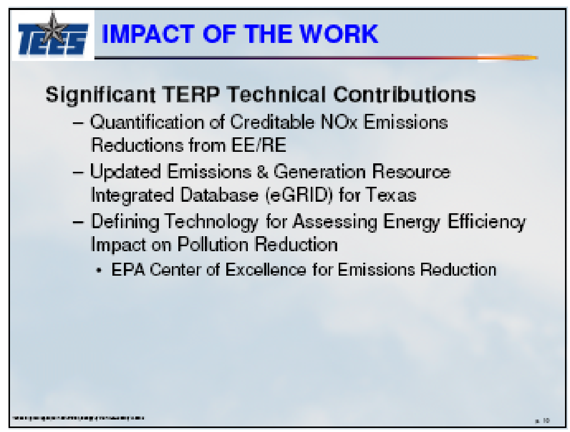


Figure 10-35: Slides presented on September 30, 2008 (Part 1)









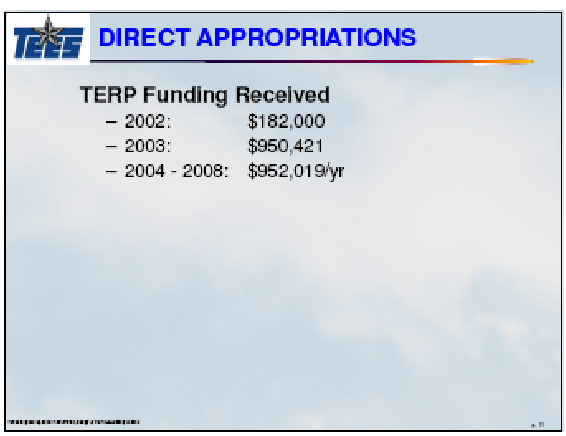


Figure 10-36: Slides presented on September 25, 2008 (Part 2)

11 APPENDIX B

In this section, the linear regression models developed, based on 2007 wind power generation data, are presented for each wind farm. The estimated 1999 annual and OSP power production using 2007 daily models and the resulting emissions reduction are also shown in details for each wind farm. A listing of the wind farms analyzed in this year's report is illustrated in Table 11-1.

No.	Wind Farms
1	Brazos Wind Ranch
2	Buffalo Gap 1
3	Callahan Divide Wind Energy Center
4	Horse Hollow 1
5	Horse Hollow 2
6	Horse Hollow 3
7	Horse Hollow 4
8	Desert Sky
9	King Mountain Wind Ranch (KING_NE)
10	King Mountain Wind Ranch (KING_NW)
11	King Mountain Wind Ranch (KING_SE)
12	King Mountain Wind Ranch (KING_SW)
13	Sweetwater Wind 2
14	Sweetwater Wind 3
15	Sweetwater Wind 4
16	Trent Mesa
17	Delaware Mountain Wind Farm
18	Indian Mesa I
19	Texas Wind Power Project
20	Big Spring Wind Power
21	Southwest Mesa Wind Project
22	Woodward Mountain Ranch (WOODWRD1)
23	Woodward Mountain Ranch (WOODWRD1)
24	Buffalo Gap2
25	Capricorn Ridge Wind
26	Camp Springs Wind Energy Center
27	Lone Star – Mesquite Wind
28	Forest Creek Wind Farm
29	Sand Bluff Wind Farm

Table 11-1: Listing of Wind Farms Analyzed for Base-year Calculations

11.1 Brazos Wind Ranch

Table 11-2: Site Information for Brazos Wind Ranch

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station
BRAZ_WIND	WIND	Fluvana	SCURRY	Dec-03	160	Cielo/Orion/Green Mountain	Brazos Wind Ranch	Mitsubishi 1000 (160)	ERCOT	AEP-West	ONCOR	ABI

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
BRAZ_WND_WND1	BRAZ_WIND	99
BRAZ_WND_WND2	BRAZ_WIND	61

11.1.1 Brazos Wind Ranch – BRAZ_WND_WND1

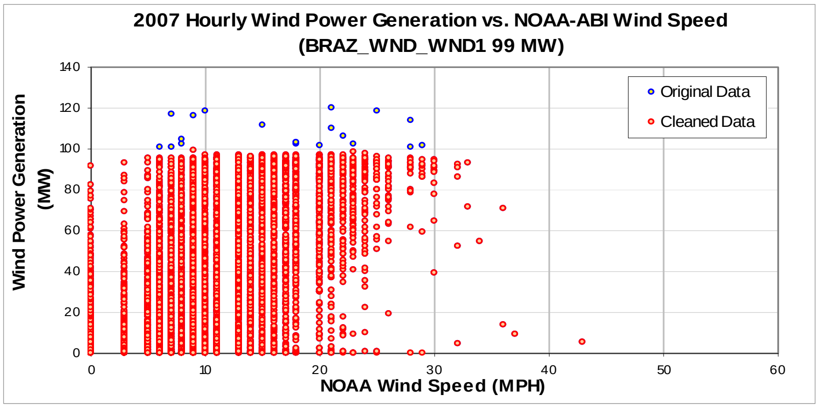


Figure 11-1: BRAZ_WND_WND1 - Hourly Wind Power vs. NOAA Wind Speed (2007)

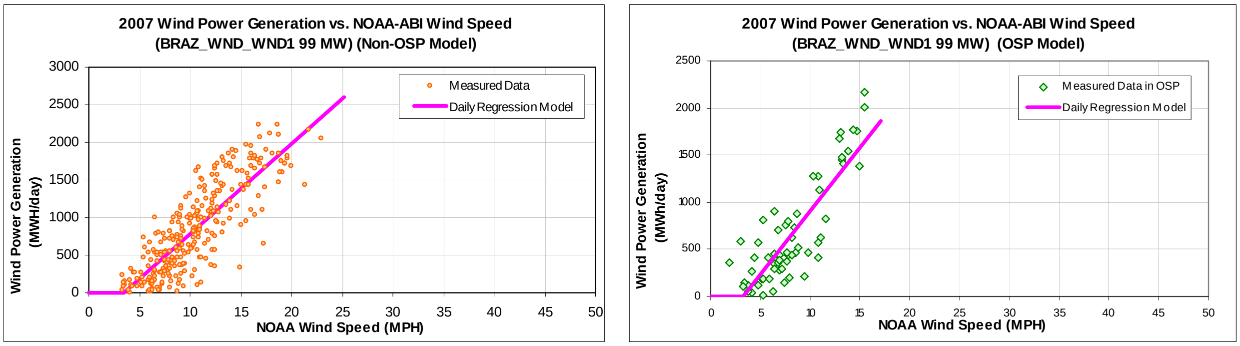


Figure 11-2: BRAZ_WND_WND1 - Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non OSP Model)

Table 11-3: BRAZ_WND_WND1 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-421.4768
Left Slope (MWh/mph-day)	120.1077
RMSE (MWh/day)	316.5002
R2	0.7010
CV-RMSE	37.2%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-440.0611
Left Slope (MWh/mph-day)	134.78
RMSE (MWh/day)	291.0298
R2	0.7238
CV-RMSE	43.7%

Table 11-4: BRAZ_WND_WND1 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07	25	9.47	19,034	17,885	6.03%	32%	30%
Feb-07	27	11.99	26,972	27,490	-1.92%	42%	43%
Mar-07	31	11.82	27,909	30,929	-10.82%	38%	42%
Apr-07	30	12.85	30,084	33,667	-11.91%	42%	47%
May-07	31	9.32	19,636	21,658	-10.30%	27%	29%
Jun-07	30	9.53	19,316	21,688	-12.28%	27%	30%
Jul-07	31	6.95	12,702	14,493	-14.10%	17%	20%
Aug-07	31	9.10	27,452	24,402	11.11%	37%	33%
Sep-07	30	9.04	22,570	21,314	5.57%	32%	30%
Oct-07	31	11.05	31,882	28,091	11.89%	43%	38%
Nov-07	30	10.37	26,318	24,710	6.11%	37%	35%
Dec-07	30	10.64	27,871	25,709	7.76%	39%	36%
Total	357	10.16	291,745	292,035	-0.10%	34%	34%
Total in OSP (07/15-09/15)	63	8.20	41,929	42,154	-0.54%	28%	28%

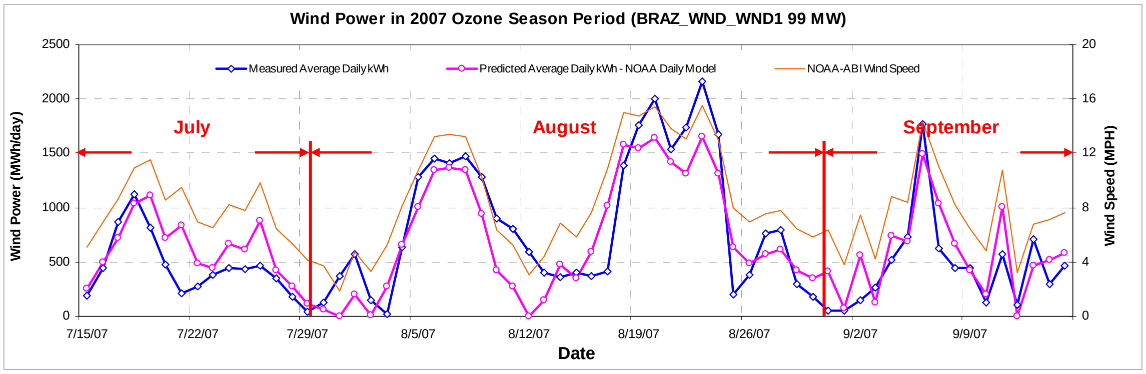


Figure 11-3: BRAZ_WND_WND1 - Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

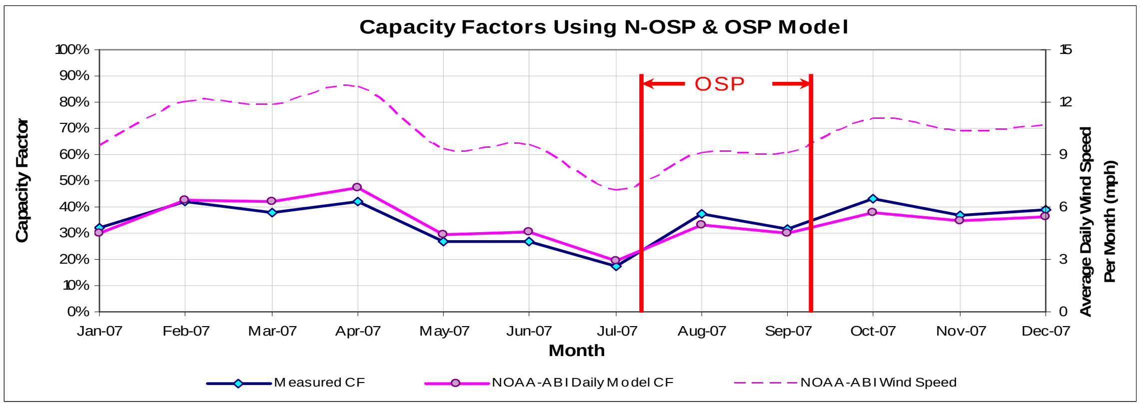


Figure 11-4: BRAZ_WND_WND1 – Predicted Capacity Factors Using Daily Models (2007)

Table 11-5: BRAZ_WND_WND1 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr
349,118	298,283

OSD

1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day
869	666

Note: The 2007 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 365 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.1.2 Brazos Wind Ranch – BRAZ_WND_WND2

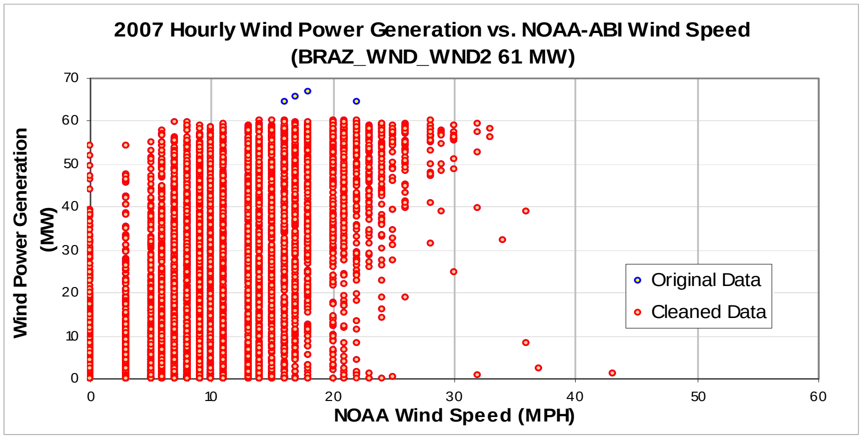


Figure 11-5: BRAZ_WND_WND2 - Hourly Wind Power vs. NOAA Wind Speed (2007)

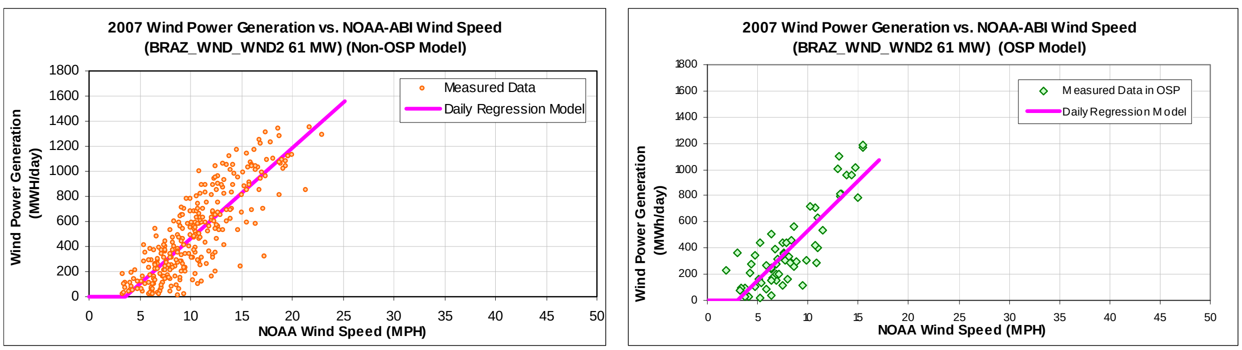


Figure 11-6: BRAZ_WND_WND2 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-6: BRAZ_WND_WND2 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-258.1860
Left Slope (MWh/mph-day)	72.2890
RMSE (MWh/day)	185.8624
R2	0.7106
CV-RMSE	36.7%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-224.0026
Left Slope (MWh/mph-day)	76.1986
RMSE (MWh/day)	161.6706
R2	0.7307
CV-RMSE	40.3%

Table 11-7: BRAZ_WND_WND2 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07	26	9.39	11,991	10,941	8.76%	32%	29%
Feb-07	28	12.04	16,136	17,144	-6.25%	39%	42%
Mar-07	31	11.82	17,355	18,475	-6.46%	38%	41%
Apr-07	30	12.85	18,367	20,128	-9.59%	42%	46%
May-07	31	9.32	12,226	12,906	-5.57%	27%	28%
Jun-07	30	9.53	11,521	12,922	-12.16%	26%	29%
Jul-07	31	6.95	7,392	8,722	-18.00%	16%	19%
Aug-07	31	9.10	16,167	14,547	10.02%	36%	32%
Sep-07	30	9.04	13,693	12,817	6.40%	31%	29%
Oct-07	31	11.05	19,452	16,772	13.78%	43%	37%
Nov-07	30	10.37	14,609	14,737	-0.88%	33%	34%
Dec-07	30	10.64	16,396	15,338	6.45%	37%	35%
Total	359	10.17	175,304	175,449	-0.08%	33%	33%
Total in OSP (07/15-09/15)	63	8.20	25,267	25,351	-0.33%	27%	27%

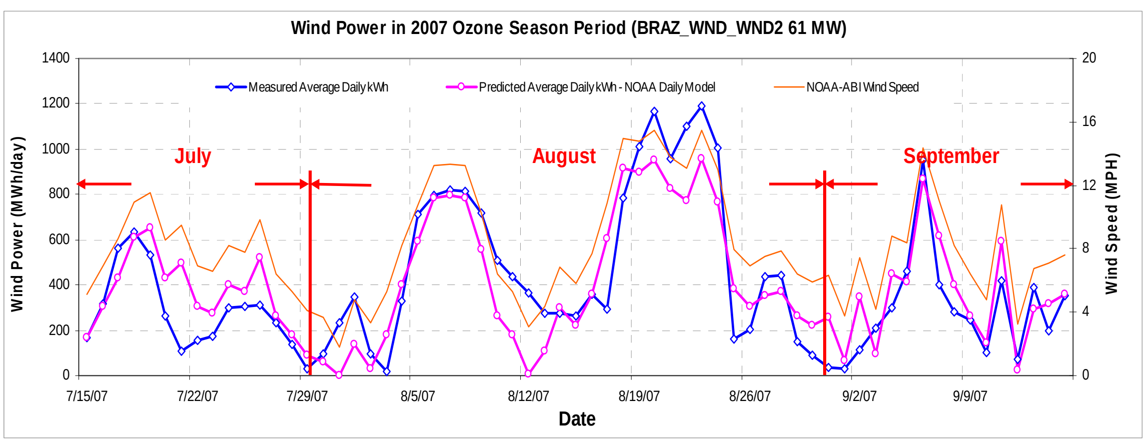


Figure 11-7: BRAZ_WND_WND2 – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

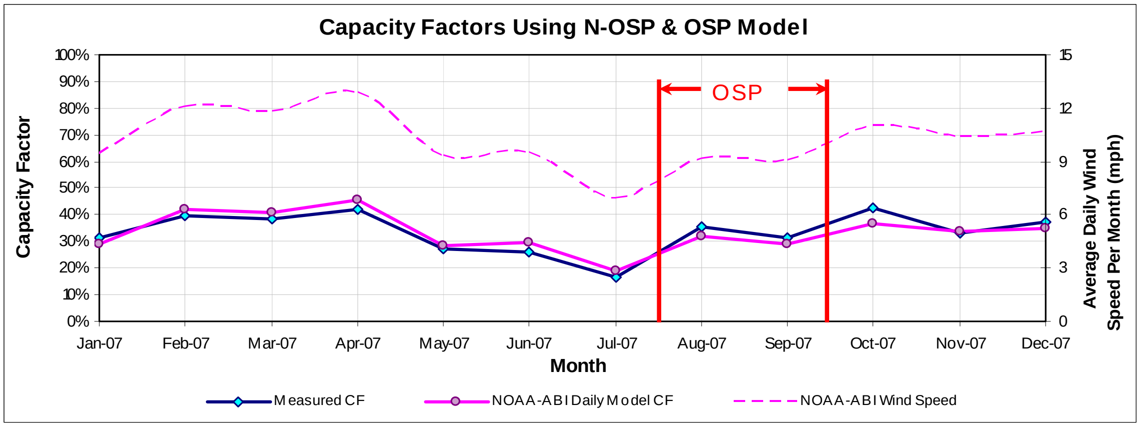


Figure 11-8: BRAZ_WND_WND2 – Predicted Capacity Factors Using Daily Models (2007)

Table 11-8: BRAZ_WND_WND2 – Predicted Power Production in 1999

Annual		OSD	
1999 Estimated MWh/yr (2007 Daily Model)	**2007 Measured MWh/yr**	**1999 OSD Estimated MWh/day (2007 Daily Model)**	**2007 OSD Measured MWh/day**
208,329	178,234	516	401

Note: The 2007 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 365 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.2 Buffalo Gap 1- BUFF_GAP_UNIT1 120 MW)

Table 11-9: Site Information for Buffalo Gap 1

GENSITECODE_ ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station
BUFF_CAP	WIND	Abilene	TAYLOR	Sep-05	120	AES Corporation	Buffalo Gap1	Vestas 1.8 MW (67)	ERCOT	AEP-West	AEP-TNC	ABI

SUBGENCODE_ERCOT	GENSITECODE_ ERCOT	Capacity (MW)
BUFF_GAP_UNIT1	BUFF_CAP	120

11.2.1 Buffalo Gap 1 – BUFF_GAP_UNIT1 120 MW)

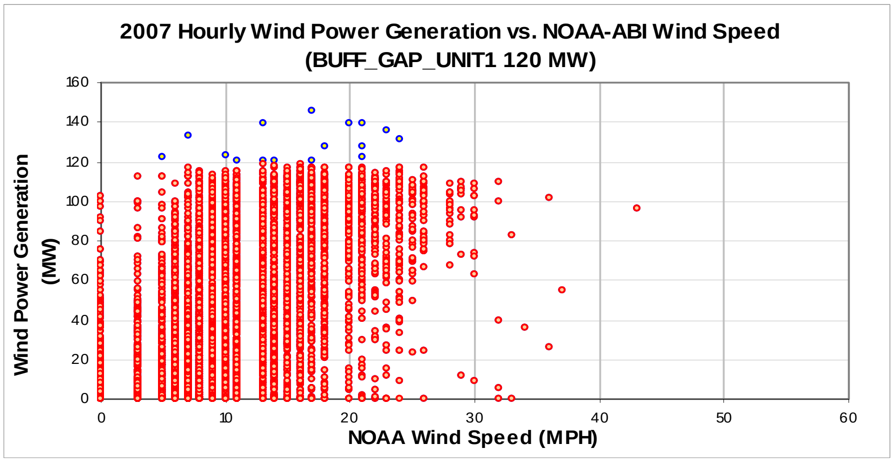


Figure 11-9: BUFF_GAP_UNIT1 – Hourly Wind Power vs. NOAA Wind Speed (2007)

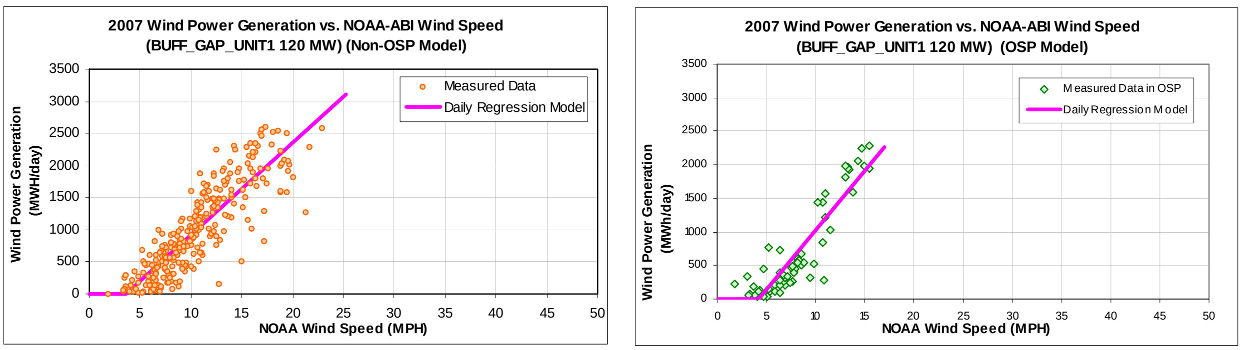


Figure 11-10: BUFF_GAP_UNIT1 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-10: BUFF_GAP_UNIT1 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-512.9856
Left Slope (MWh/mph-day)	143.6510
RMSE (MWh/day)	338.9861
R2	0.7515
CV-RMSE	33.9%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-755.9293
Left Slope (MWh/mph-day)	177.5969
RMSE (MWh/day)	298.2919
R2	0.8124
CV-RMSE	42.6%

Table 11-11: BUFF_GAP_UNIT1 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07	27	8.61	22,636	19,802	12.52%	29%	25%
Feb-07	23	12.82	26,797	30,548	-14.00%	40%	46%
Mar-07	31	11.82	34,028	36,716	-7.90%	38%	41%
Apr-07	30	12.85	37,900	40,000	-5.54%	44%	46%
May-07	31	9.32	22,775	25,649	-12.62%	26%	29%
Jun-07	30	9.53	23,387	25,681	-9.81%	27%	30%
Jul-07	31	6.95	14,093	15,624	-10.87%	16%	18%
Aug-07	31	9.10	28,919	27,036	6.51%	32%	30%
Sep-07	30	9.04	23,852	24,033	-0.76%	28%	28%
Oct-07	31	11.05	35,735	33,330	6.73%	40%	37%
Nov-07	30	10.37	34,807	29,287	15.86%	40%	34%
Dec-07	31	10.51	32,088	30,885	3.75%	36%	35%
Total	356	10.12	337,016	338,592	-0.47%	33%	33%
Total in OSP (07/15-09/15)	63	8.20	44,157	45,358	-2.72%	24%	25%

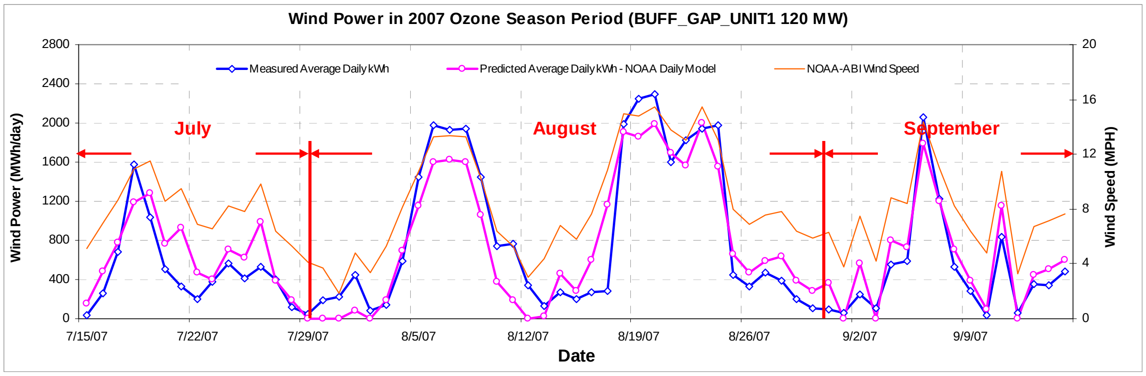


Figure 11-11: BUFF_GAP_UNIT1 – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

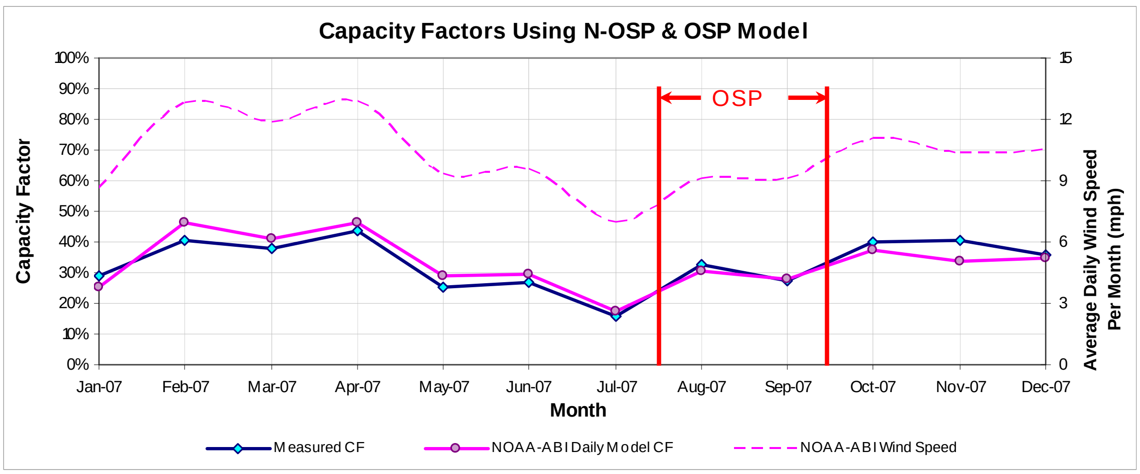


Figure 11-12: BUFF_GAP_UNIT1 – Predicted Capacity Factors Using Daily Models (2007)

Table 11-12: BUFF_GAP_UNIT1 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr
410,441	345,536

OSD

1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day
968	701

Note: The 2007 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 365 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.3 Callahan Divide Wind Energy Center

Table 11-13: Site Information for Callahan Divide Wind Energy Center

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station
CALLAHAN	WIND	Abilene	TAYLOR	Feb-07	114	FPL Energy	Callahan Divide Wind Energy Center	GE Wind 1500 (76)	ERCOT	AEP-West	AEP-TNC	ABI

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
CALLAHAN_WND1	CALLAHAN	114

11.3.1 Callahan Divide – CALLAHAN_WND1

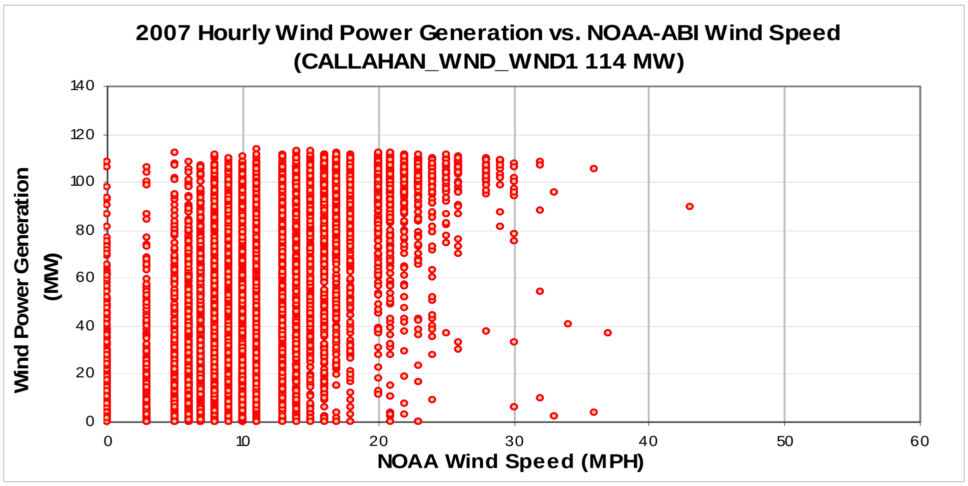


Figure 11-13: CALLAHAN_WND1 – Hourly Wind Power vs. NOAA Wind Speed (2007)

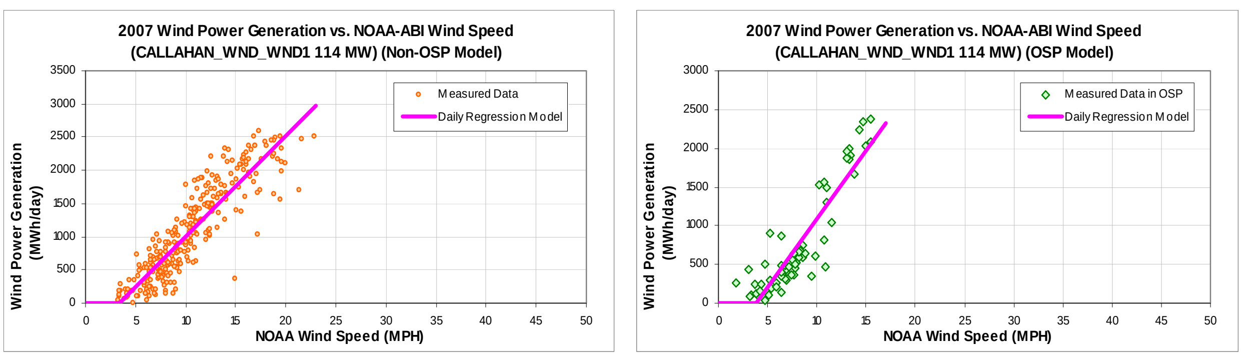


Figure 11-14: CALLAHAN_WND1 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-14: CALLAHAN_WND1 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-508.4787
Left Slope (MWh/mph-day)	150.9719
RMSE (MWh/day)	308.0617
R2	0.7965
CV-RMSE	28.4%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-670.43
Left Slope (MWh/mph-day)	175.8471
RMSE (MWh/day)	288.3808
R2	0.8196
CV-RMSE	37.4%

Table 11-15: CALLAHAN_WND1 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07	27	9.22	25290.46	23864.98	5.64%	34%	32%
Feb-07	28	12.04	35598.91	36665.27	-3.00%	46%	48%
Mar-07	31	11.82	37067.78	39536.89	-6.66%	44%	47%
Apr-07	30	12.85	39244.03	42957.87	-9.46%	48%	52%
May-07	31	9.32	25179.73	27848.10	-10.60%	30%	33%
Jun-07	30	9.53	26789.93	27885.85	-4.09%	33%	34%
Jul-07	31	6.95	15738.17	17429.04	-10.74%	19%	21%
Aug-07	31	9.10	31287.40	29032.70	7.21%	37%	34%
Sep-07	30	9.04	26102.97	26177.70	-0.29%	32%	32%
Oct-07	31	11.05	38048.96	35949.60	5.52%	45%	42%
Nov-07	30	10.37	35599.08	31699.25	10.95%	43%	39%
Dec-07	31	10.51	35809.09	33409.59	6.70%	42%	39%
Total	361	10.14	371756.52	372456.86	-0.19%	38%	38%
Total in OSP (07/15-09/15)	63	8.20	48639.21	49328.02	-1.42%	28%	29%

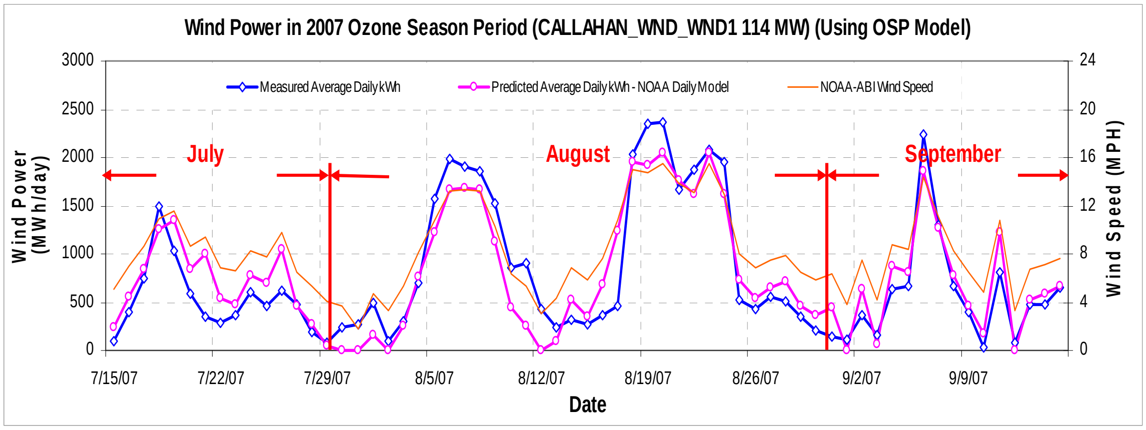


Figure 11-15: CALLAHAN_WND1 – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

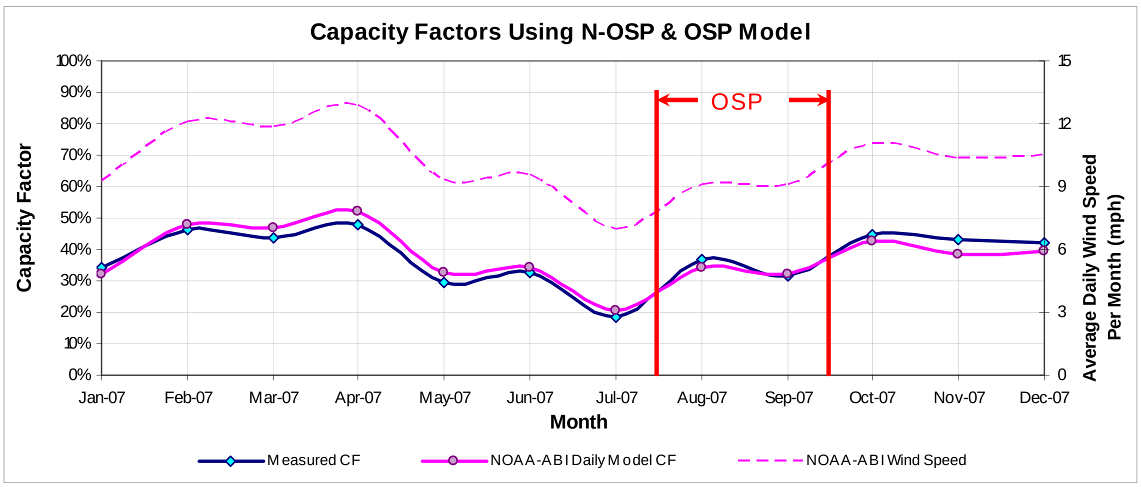


Figure 11-16: CALLAHAN_WND1 – Predicted Capacity Factors Using Daily Models (2007)

Table 11-16: CALLAHAN_WND1 – Predicted Power Production in 1999

Annual		OSD	
1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr for Modeling	1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day for Modeling
441,790	375,876	1,037	772

Note: The 2007 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 365 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.4 Horse Hollow 1

Table 11-17: Site Information for Horse Hollow 1

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
H_HOLLOW	WIND	Abilene	TAYLOR	Oct-05	213	FPL Energy	Horse Hollow 1	GE Energy 1.5 MW (142)	ERCOT	AEP-West	AEP-TNC	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
H_HOLLOW_WND1	H_HOLLOW	213

11.4.1 Horse Hollow 1 – H_HOLLOW_WND1

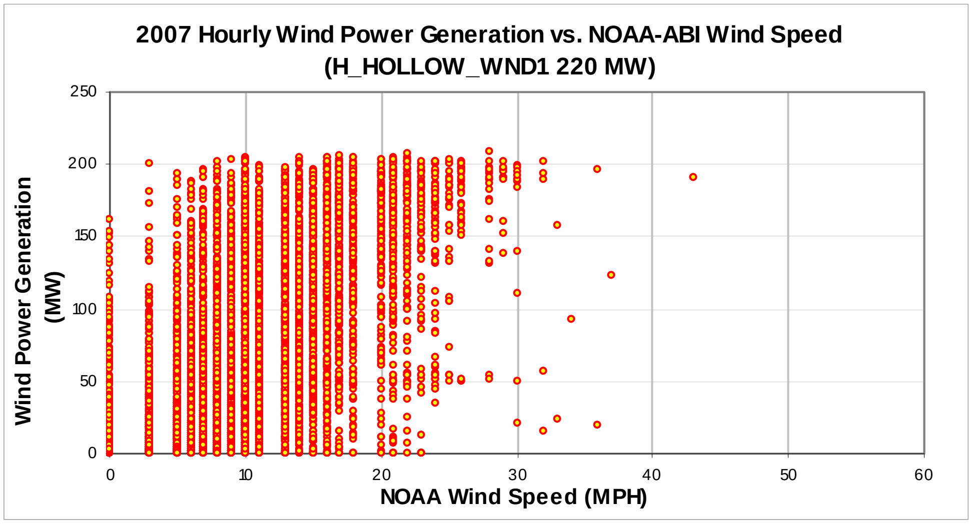
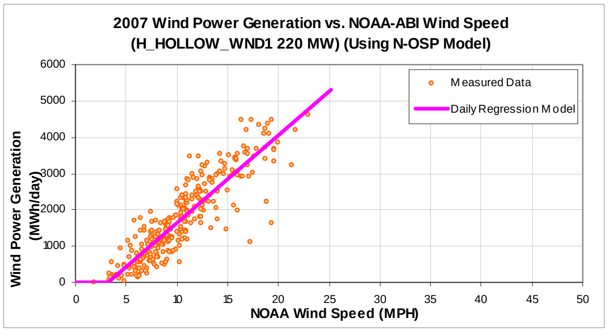


Figure 11-17: H_HOLLOW_WND1 – Hourly Wind Power vs. NOAA Wind Speed (2007)



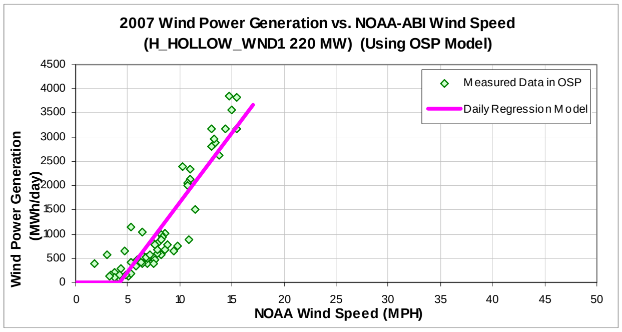


Figure 11-18: H_HOLLOW_WND1 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-18: H_HOLLOW_WND1 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-770.9260
Left Slope (MWh/mph-day)	241.2034
RMSE (MWh/day)	506.3179
R2	0.7895
CV-RMSE	28.9%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-1204.21
Left Slope (MWh/mph-day)	286.0818
RMSE (MWh/day)	445.9872
R2	0.8341
CV-RMSE	39.0%

Table 11-19: H_HOLLOW_WND1 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07	29	8.77	45,784	39,321	14.12%	30%	26%
Feb-07	28	12.04	62,790	59,740	4.86%	42%	40%
Mar-07	30	11.71	62,813	61,595	1.94%	40%	39%
Apr-07	29	12.73	67,036	66,697	0.50%	44%	44%
May-07	31	9.32	39,289	45,759	-16.47%	24%	28%
Jun-07	30	9.53	39,005	45,796	-17.41%	25%	29%
Jul-07	31	6.95	21,488	27,052	-25.89%	13%	17%
Aug-07	31	9.10	47,572	43,941	7.63%	29%	27%
Sep-07	30	9.04	38,027	41,259	-8.50%	24%	26%
Oct-07	31	11.05	56,672	58,721	-3.61%	35%	36%
Nov-07	30	10.37	56,346	51,889	7.91%	36%	33%
Dec-07	31	10.51	57,464	54,663	4.87%	35%	33%
Total	361	10.07	594,286	596,432	-0.36%	31%	31%
Total in OSP (07/15-09/15)	63	8.20	71,979	73,805	-2.54%	22%	22%

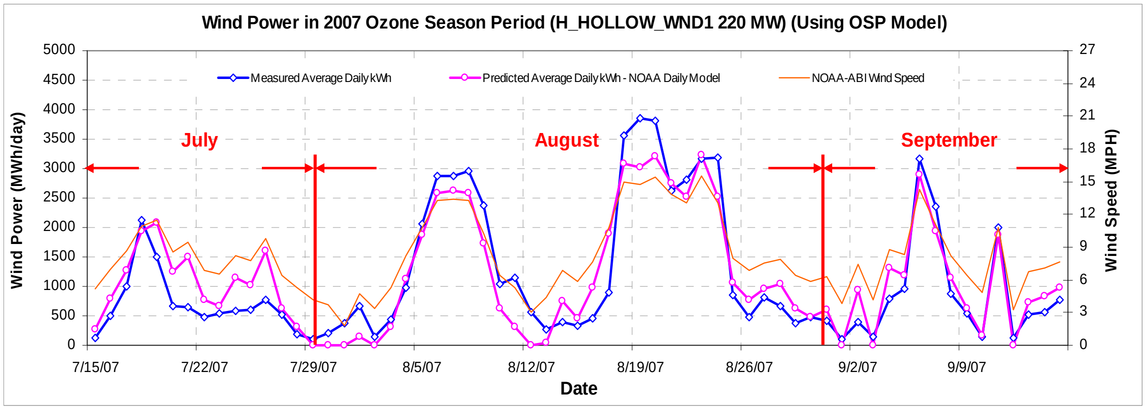


Figure 11-19: H_HOLLOW_WND1 – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

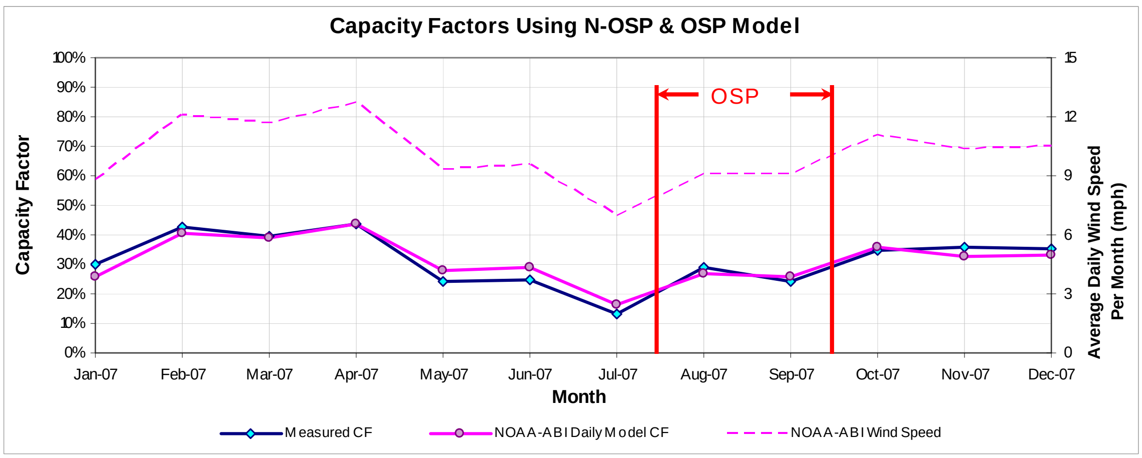


Figure 11-20: H_HOLLOW_WND1 – Predicted Capacity Factors Using Daily Models (2007)

Table 11-20: H_HOLLOW_WND1 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr for Modeling
713,071	600,871

OSD

1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day for Modeling
1,573	1,143

Note: The 2007 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 365 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.5 Horse Hollow 2

Table 11-21: Site Information for Horse Hollow 2

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station
HHOLLOW2_WIND1	WIND	Abilene	Taylor	Jul-06	224	FPL Energy	Horse Hollow Phase 2	Mitsubishi 1000 (160)	ERCOT	AEP-West	AEP/ TNC	ABI

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
HHOLLOW2_WIND1	HHOLLOW2_WIND1	224

11.5.1 Horse Hollow 2 – H_HOLLOW2_WIND1

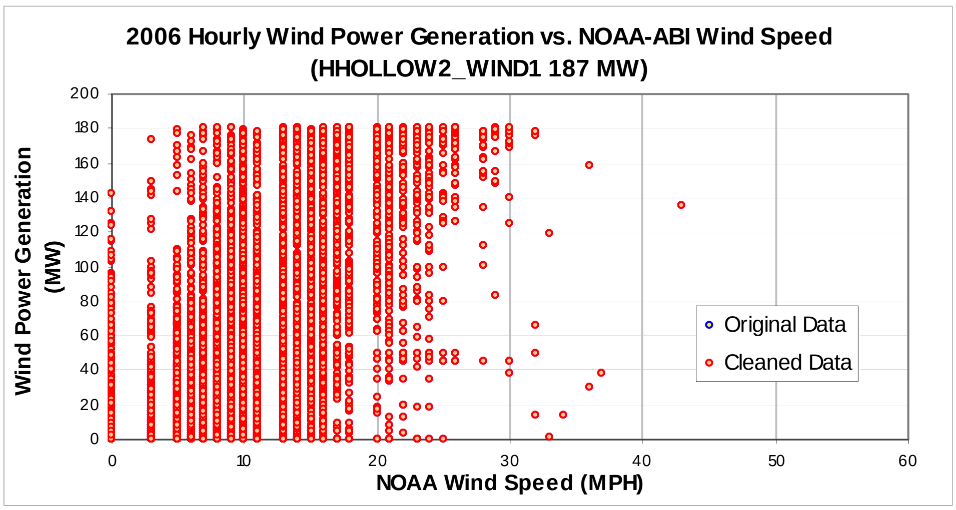


Figure 11-21: H_HOLLOW2_WIND1 – Hourly Wind Power vs. NOAA Wind Speed (2007)

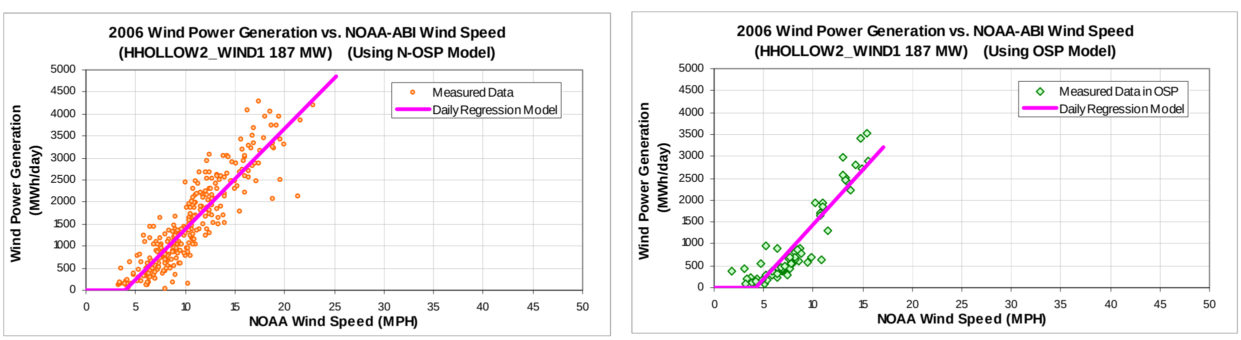


Figure 11-22: H_HOLLOW2_WIND1 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-22: H_HOLLOW2_WIND1 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-899.9714
Left Slope (MWh/mph-day)	228.8232
RMSE (MWh/day)	428.5336
R2	0.8169
CV-RMSE	28.7%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-1049.7244
Left Slope (MWh/mph-day)	248.2213
RMSE (MWh/day)	398.2780
R2	0.8260
CV-RMSE	40.4%

Table 11-23: H_HOLLOW2_WIND1 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07	26	9.39	35,522	32,564	8.33%	30%	28%
Feb-07	27	11.91	47,738	49,296	-3.26%	39%	41%
Mar-07	31	11.82	54,832	55,917	-1.98%	39%	40%
Apr-07	30	12.85	61,861	61,231	1.02%	46%	45%
May-07	30	9.05	34,139	35,490	-3.96%	25%	26%
Jun-07	30	9.53	33,677	38,505	-14.34%	25%	29%
Jul-07	31	6.95	18,209	22,003	-20.84%	13%	16%
Aug-07	31	9.10	40,582	37,984	6.40%	29%	27%
Sep-07	30	9.04	32,559	35,369	-8.63%	24%	26%
Oct-07	29	10.47	45,161	43,474	3.74%	35%	33%
Nov-07	30	10.37	47,336	44,167	6.69%	35%	33%
Dec-07	30	10.36	46,178	44,109	4.48%	34%	33%
Total	355	10.05	497,793	500,110	-0.47%	31%	31%
Total in OSP (07/15-09/15)	63	8.20	62,146	63,769	-2.61%	22%	23%

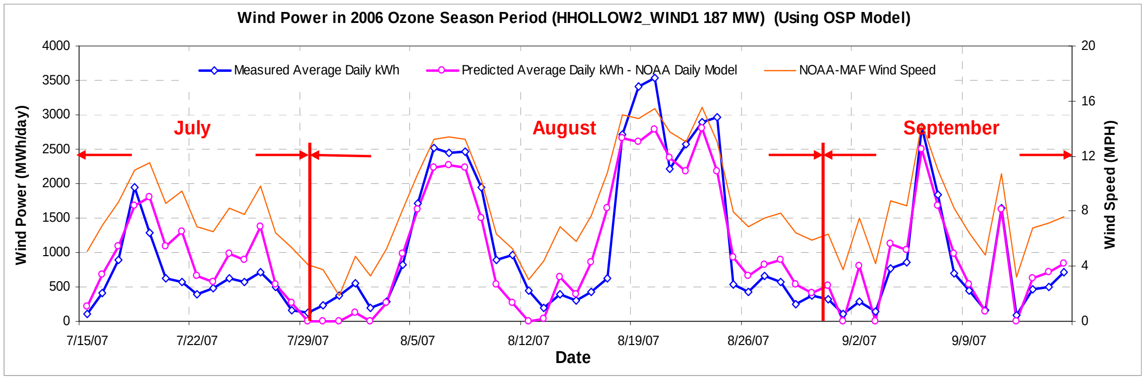


Figure 11-23: H_HOLLOW2_WIND1 – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

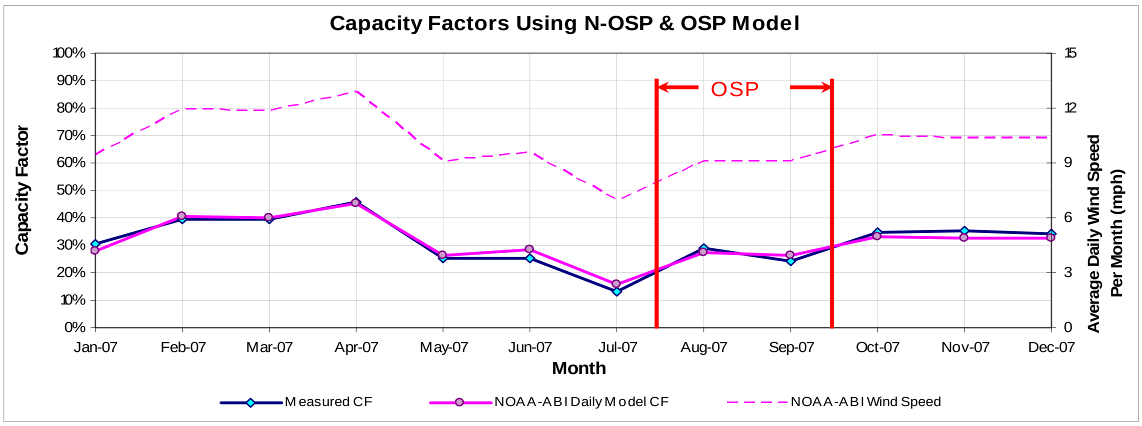


Figure 11-24: H_HOLLOW2_WIND1 – Predicted Capacity Factors Using Daily Models (2007)

Table 11-24: H_HOLLOW2_WIND1 – Predicted Power Production in 1999

Annual		OSD	
1999 Estimated MWh/yr (2007 Daily Model)	**2007 Measured MWh/yr for Modeling**	**1999 OSD Estimated MWh/day (2007 Daily Model)**	**2007 OSD Measured MWh/day for Modeling**
617,443	**511,815**	**1,360**	**986**

Note: The 2007 Measured MWh/yr presented in the above table includes only validated data and it was also adjusted to 365 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.6 Horse Hollow 3

Table 11-25: Site Information for Horse Hollow 3

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station
HHOLLOW3_WND_1	WIND	Abilene	Taylor	May-06	160	FPL Energy	Horse Hollow Phase 4	Mitsubishi 1000 (160)	ERCOT	AEP-West	AEP/ TNC	MAF

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
HHOLLOW3_WND_1	HHOLLOW3_WND_1	299

11.6.1 Horse Hollow 3 – H_HOLLOW3_WIND1

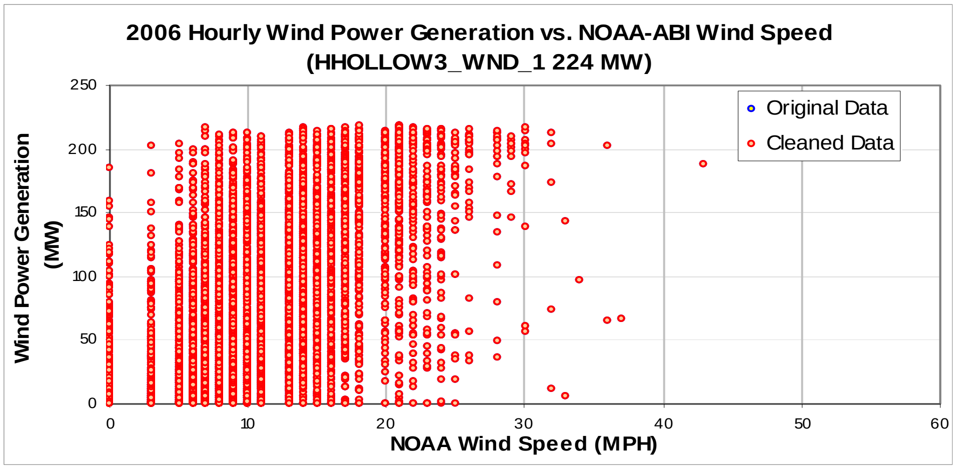


Figure 11-25: H_HOLLOW3_WIND1 – Hourly Wind Power vs. NOAA Wind Speed (2007)

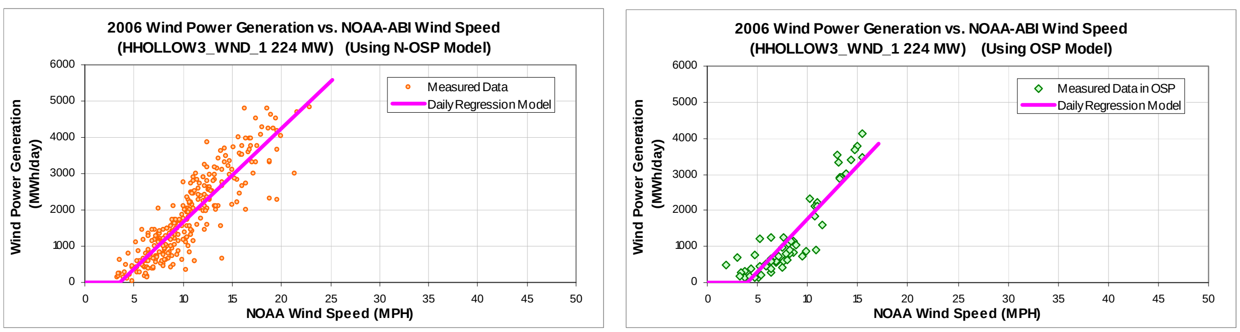


Figure 11-26: H_HOLLOW3_WIND1 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-26: H_HOLLOW3_WIND1 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-925.8684
Left Slope (MWh/mph-day)	258.9679
RMSE (MWh/day)	521.5584
R2	0.7966
CV-RMSE	29.3%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-1170.6726
Left Slope (MWh/mph-day)	293.8913
RMSE (MWh/day)	459.0538
R2	0.8335
CV-RMSE	37.0%

Table 11-27: H_HOLLOW3_WIND1 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07	27	9.22	43,205	39,497	8.58%	30%	27%
Feb-07	27	11.91	58,936	58,292	1.09%	41%	40%
Mar-07	31	11.82	66,997	66,156	1.26%	40%	40%
Apr-07	30	12.85	73,352	72,078	1.74%	45%	45%
May-07	30	9.05	38,986	42,668	-9.44%	24%	26%
Jun-07	30	9.53	39,200	46,265	-18.02%	24%	29%
Jul-07	31	6.95	22,309	27,935	-25.21%	13%	17%
Aug-07	31	9.10	50,904	47,067	7.54%	31%	28%
Sep-07	30	9.04	41,974	43,010	-2.47%	26%	27%
Oct-07	30	10.77	59,294	55,952	5.64%	37%	35%
Nov-07	30	10.37	53,765	52,765	1.86%	33%	33%
Dec-07	29	10.16	50,565	49,482	2.14%	32%	32%
Total	356	10.05	599,489	601,166	-0.28%	31%	31%
Total in OSP (07/15-09/15)	63	8.20	78,128	79,581	-1.86%	23%	23%

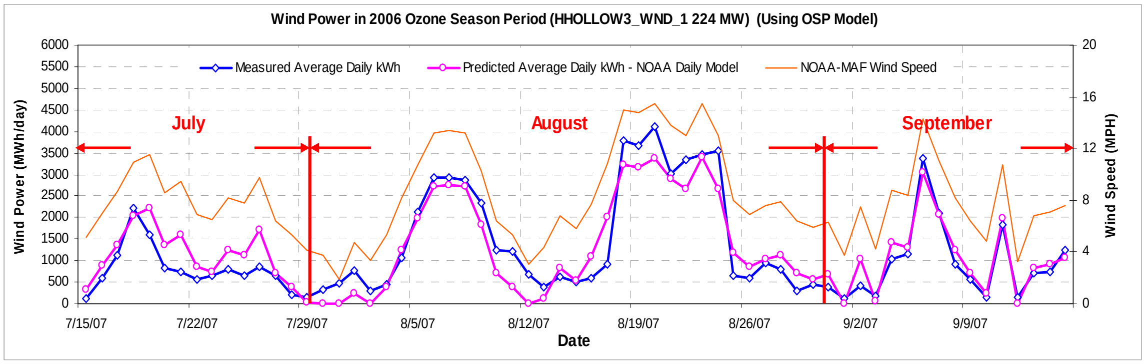


Figure 11-27: H_HOLLOW3_WIND1 – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

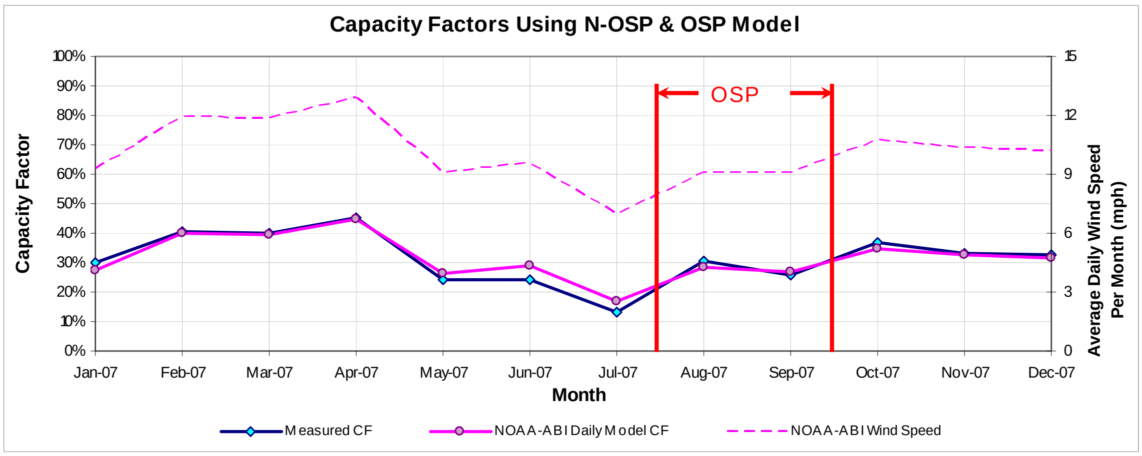


Figure 11-28: H_HOLLOW3_WIND1 – Predicted Capacity Factors Using Daily Models (2007)

Table 11-28: H_HOLLOW3_WIND1 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr for Modeling
735,630	614,644

OSD

1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day for Modeling
1,683	1,240

Note: The 2007 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 365 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.7 Horse Hollow 4

Table 11-29: Site Information for Horse Hollow 4

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station
HOLLOW4_WND	WIND	Abilene	Taylor	May-06	115	FPL Energy	Horse Hollow Phase 4	Mitsubishi 1000 (160)	ERCOT	AEP-West	AEP/ TNC	ABI

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
HOLLOW4_WND	HOLLOW4_WND	112

11.7.1 Horse Hollow 4 – H_HOLLOW4_WIND1

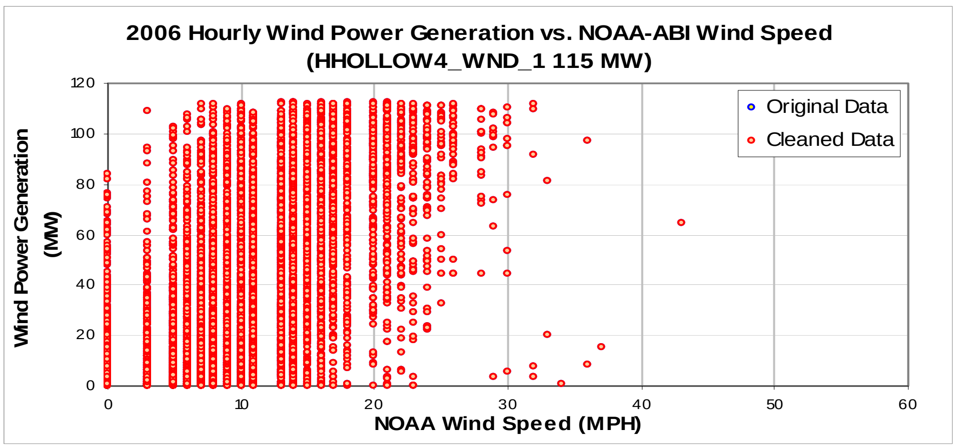
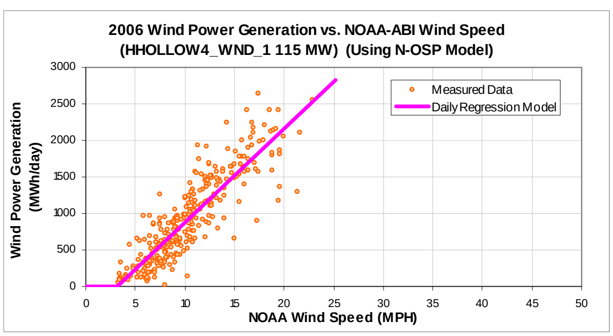


Figure 11-29: H_HOLLOW4_WIND1 – Hourly Wind Power vs. NOAA Wind Speed (2007)



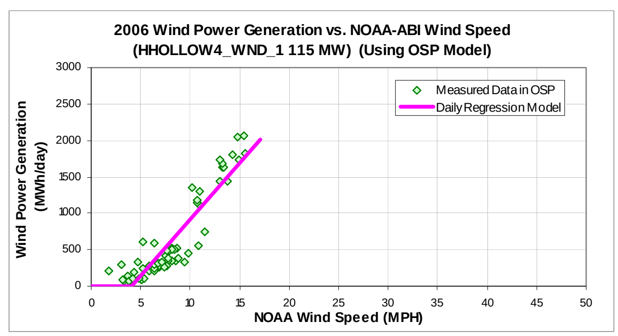


Figure 11-30: H_HOLLOW4_WIND1 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-30: H_HOLLOW4_WIND1 – Model Coefficients.

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-402.5325
Left Slope (MWh/mph-day)	128.2688
RMSE (MWh/day)	284.7249
R2	0.7672
CV-RMSE	29.9%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-638.6235
Left Slope (MWh/mph-day)	154.9950
RMSE (MWh/day)	239.6907
R2	0.8363
CV-RMSE	37.9%

Table 11-31: H_HOLLOW4_WIND1 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07	26	9.39	24,349	20,855	14.35%	34%	29%
Feb-07	28	12.04	30,848	31,977	-3.66%	40%	41%
Mar-07	31	11.82	34,539	34,505	0.10%	40%	40%
Apr-07	30	12.85	36,994	37,382	-1.05%	45%	45%
May-07	31	9.32	21,331	24,564	-15.16%	25%	29%
Jun-07	30	9.53	20,584	24,577	-19.40%	25%	30%
Jul-07	31	6.95	11,383	14,836	-30.33%	13%	17%
Aug-07	31	9.10	26,198	24,207	7.60%	31%	28%
Sep-07	30	9.04	20,895	22,378	-7.10%	25%	27%
Oct-07	31	11.05	31,074	31,457	-1.23%	36%	37%
Nov-07	30	10.37	32,811	27,817	15.22%	40%	34%
Dec-07	31	10.51	31,957	29,299	8.32%	37%	34%
Total	360	10.16	322,962	323,855	-0.28%	33%	33%
Total in OSP (07/15-09/15)	63	8.20	39,867	40,760	-2.24%	23%	23%

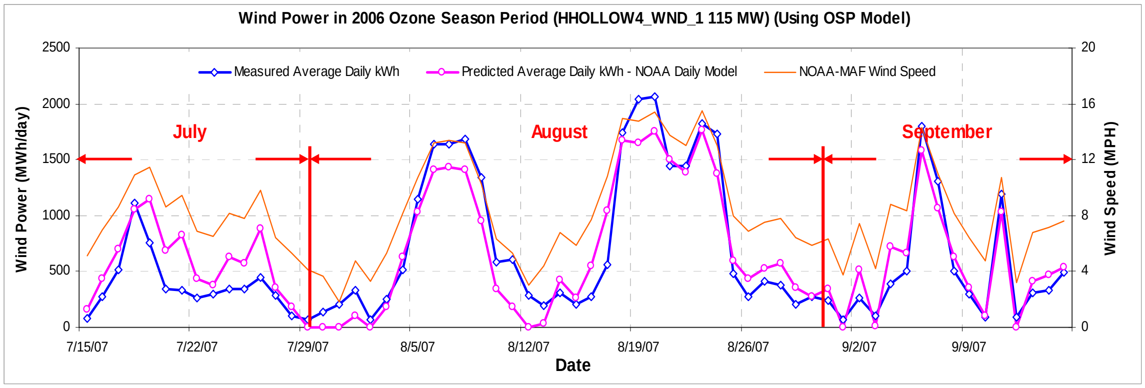


Figure 11-31: H_HOLLOW4_WIND1 – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

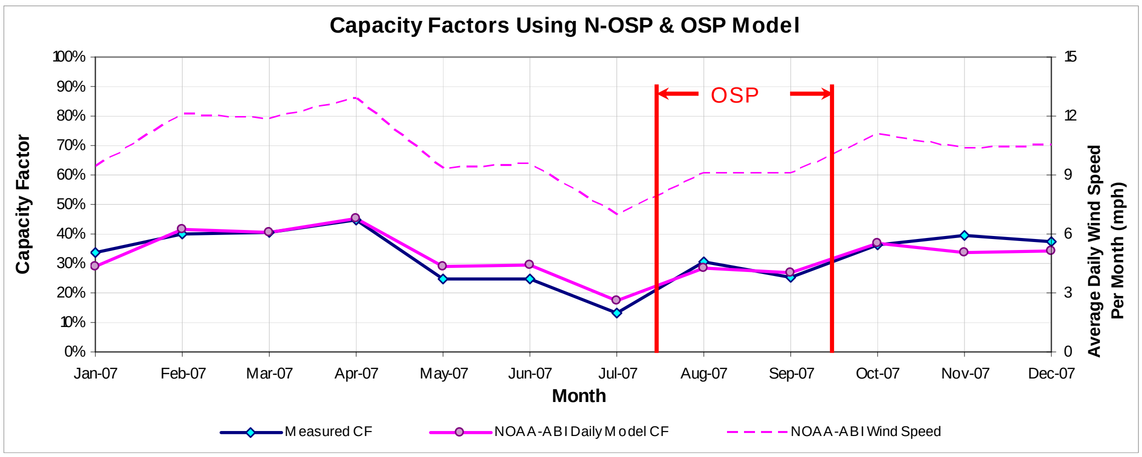


Figure 11-32: H_HOLLOW4_WIND1 – Predicted Capacity Factors Using Daily Models (2007)

Table 11-32: H_HOLLOW4_WIND1 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr for Modeling
383,301	327,448

OSD

1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day for Modeling
866	633

Note: The 2007 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 365 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.8 _Desert Sky

Table 11-33: Site Information for Desert Sky

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Intercon-nection	Weather Station
INDNENR	WIND	Iraan	PECOS	Dec-01	160.5	AEP	Desert Sky (Indian Mesa II)	Enron 1500 (107)	ERCOT	TXU	WTU	FST

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
INDNENR_INDNENR	INDNENR	
INDNENR_INDNENR_2	INDNENR	

11.8.1 Desert Sky – INDNENR_INDNENR

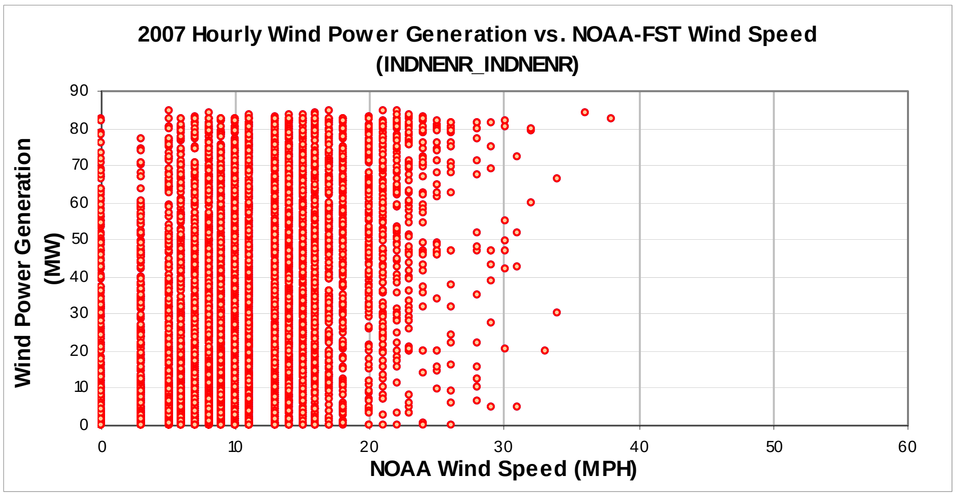
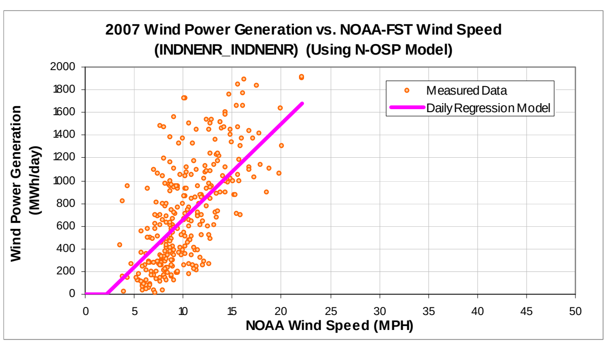


Figure 11-33: INDNENR_INDNENR – Hourly Wind Power vs. NOAA Wind Speed (2007)



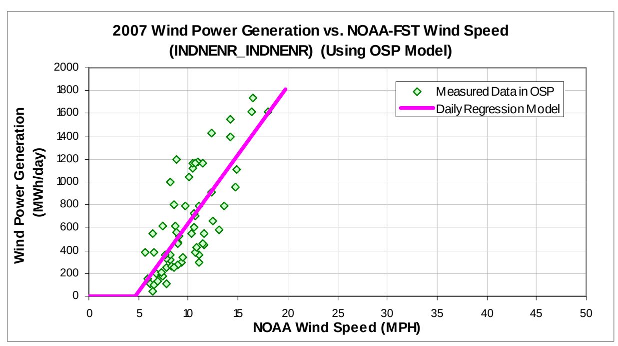


Figure 11-34: INDNENR_INDNENR – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model).

Table 11-34: INDNENR_INDNENR – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-186.6197
Left Slope (MWh/mph-day)	84.0785
RMSE (MWh/day)	328.4896
R2	0.3979
CV-RMSE	49.7%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-556.1006
Left Slope (MWh/mph-day)	119.9466
RMSE (MWh/day)	277.9246
R2	0.5940
CV-RMSE	43.6%

Table 11-35: INDNENR_INDNENR – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07	29	8.96	15,559	16,438	-5.65%	26%	28%
Feb-07	27	11.21	21,095	20,413	3.23%	38%	37%
Mar-07	31	11.67	25,710	24,623	4.23%	41%	39%
Apr-07	30	12.99	24,686	27,159	-10.02%	40%	44%
May-07	28	10.00	17,491	18,324	-4.76%	31%	32%
Jun-07	30	10.19	20,332	20,097	1.16%	33%	33%
Jul-07	31	9.33	13,844	18,290	-32.12%	22%	29%
Aug-07	31	10.51	24,683	21,851	11.47%	39%	35%
Sep-07	30	9.77	20,911	18,264	12.66%	34%	30%
Oct-07	31	10.27	25,502	20,990	17.69%	40%	33%
Nov-07	30	8.38	20,160	15,546	22.89%	33%	25%
Dec-07	31	9.67	20,619	19,420	5.82%	33%	31%
Total	359	10.24	250,590	241,415	3.66%	34%	33%
Total in OSP (07/15-09/15)	63	9.95	40,340	40,185	0.39%	31%	31%

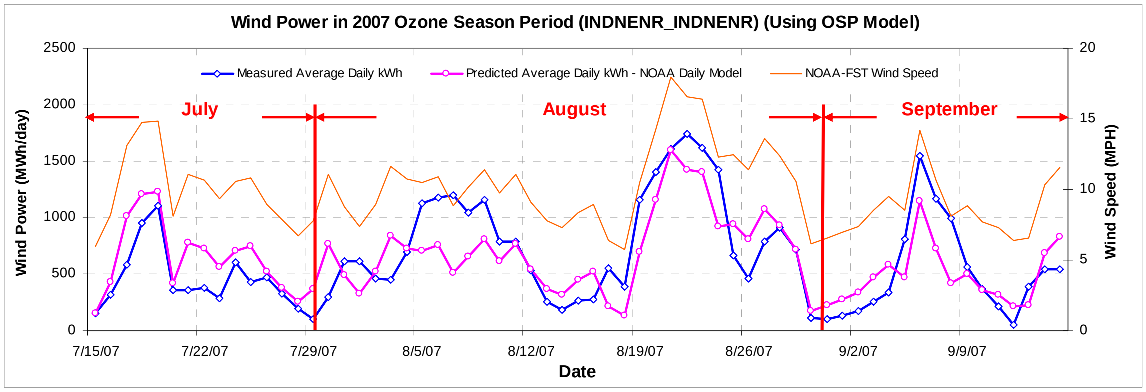


Figure 11-35: INDNENR_INDNENR – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

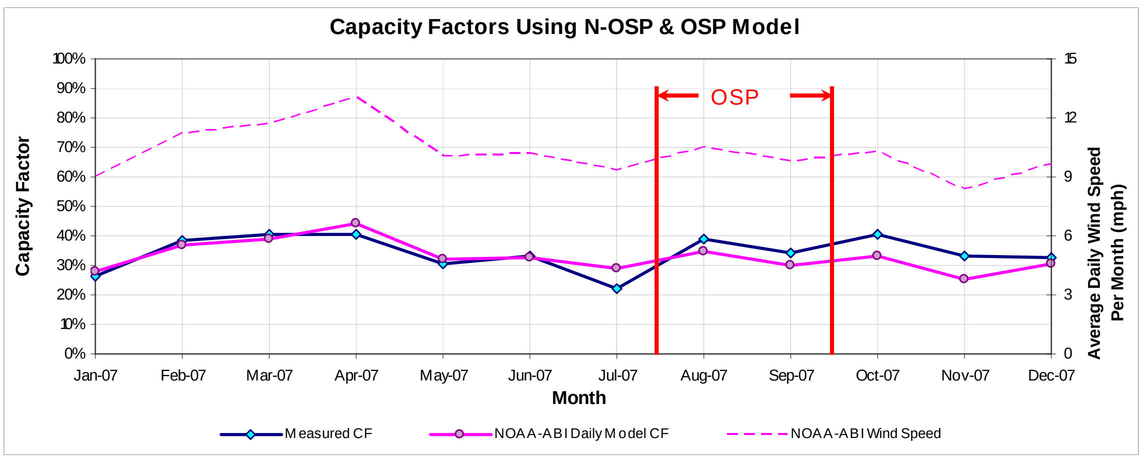


Figure 11-36: INDNENR_INDNENR – Predicted Capacity Factors Using Daily Models (2007)

Table 11-36: INDNENR_INDNENR – Predicted Power Production in 1999

Annual		OSD	
1999 Estimated MWh/yr (2007 Daily Model)	**2007 Measured MWh/yr for Modeling**	**1999 OSD Estimated MWh/day (2007 Daily Model)**	**2007 OSD Measured MWh/day for Modeling**
274,334	254,779	638	640

Note: The 2007 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 365 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.8.2 Desert Sky – INDNENR_INDNENR_2

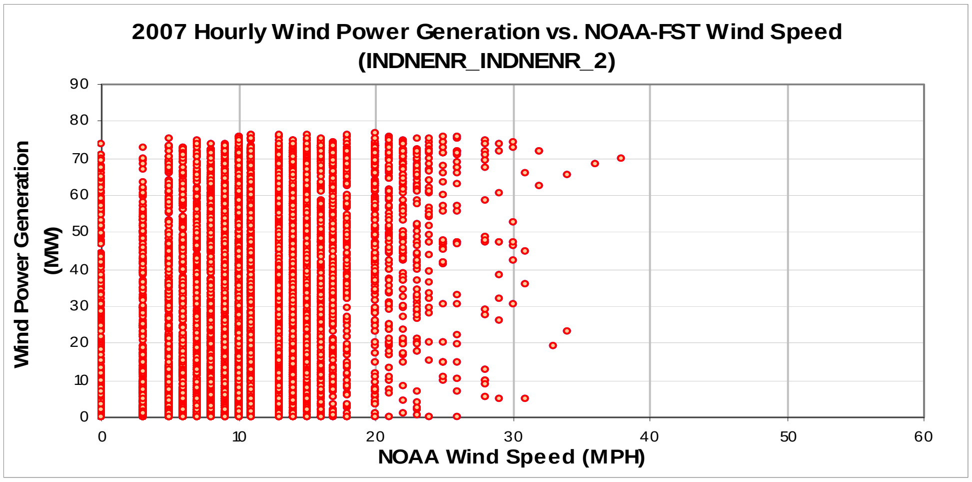


Figure 11-37: INDNENR_INDNENR_2 – Hourly Wind Power vs. NOAA Wind Speed (2007)

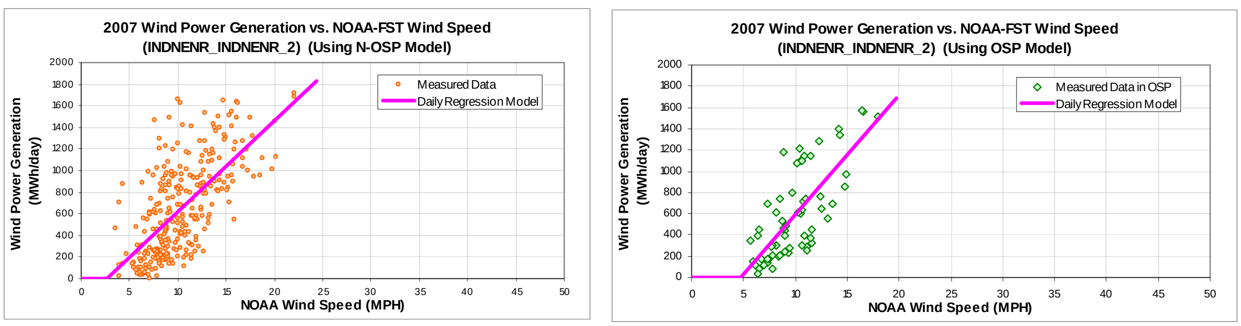


Figure 11-38: INDNENR_INDNENR_2 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-37: INDNENR_INDNENR_2 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-222.6937
Left Slope (MWh/mph-day)	84.1524
RMSE (MWh/day)	323.2276
R2	0.44
CV-RMSE	50.2%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-537.1206
Left Slope (MWh/mph-day)	112.8273
RMSE (MWh/day)	280.4806
R2	0.5597
CV-RMSE	47.9%

Table 11-38: INDNENR_INDNENR_2 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07	29	8.96	14,130	15,411	-9.07%	25%	28%
Feb-07	27	11.21	18,499	19,461	-5.20%	36%	38%
Mar-07	31	11.67	23,554	23,531	0.10%	40%	40%
Apr-07	30	12.99	22,328	26,106	-16.92%	39%	45%
May-07	28	10.00	15,531	17,334	-11.61%	29%	32%
Jun-07	30	10.19	18,422	19,038	-3.34%	32%	33%
Jul-07	31	9.33	12,692	16,916	-33.29%	21%	28%
Aug-07	31	10.51	23,108	20,119	12.93%	39%	34%
Sep-07	30	9.77	19,702	17,076	13.33%	34%	30%
Oct-07	31	10.27	23,300	19,895	14.61%	39%	33%
Nov-07	30	8.38	18,315	14,482	20.92%	32%	25%
Dec-07	31	9.67	18,114	18,324	-1.16%	30%	31%
Total	359	10.24	227,694	227,694	0.00%	33%	33%
Total in OSP (07/15-09/15)	63	9.95	36,916	36,916	0.00%	31%	31%

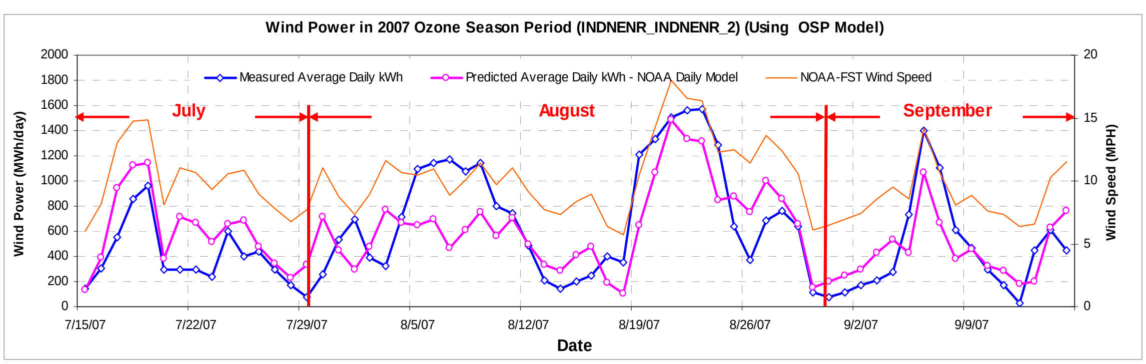


Figure 11-39: INDNENR_INDNENR_2 – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

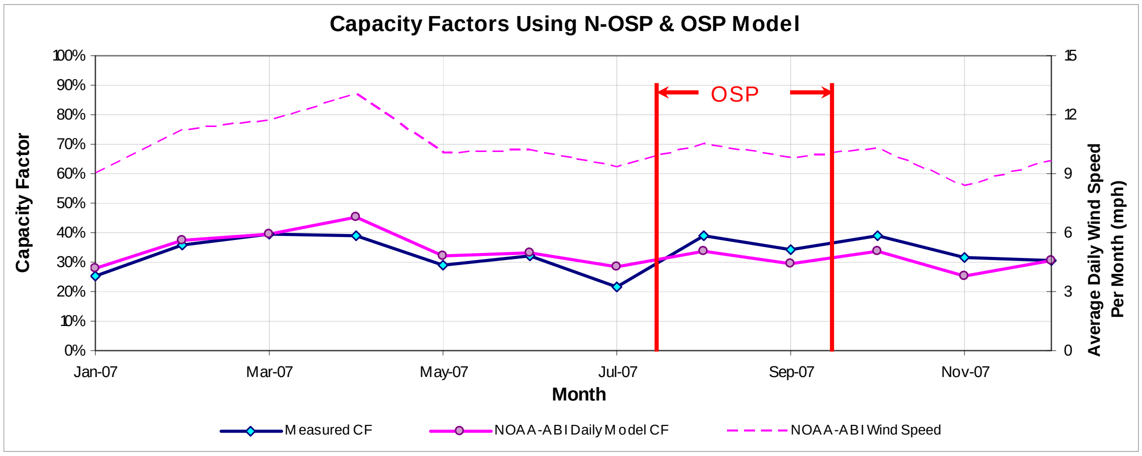


Figure 11-40: INDNENR_INDNENR_2 – Predicted Capacity Factors Using Daily Models (2007)

Table 11-39: INDNENR_INDNENR_2 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr for Modeling
260,431	231,500

OSD

1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day for Modeling
587	586

Note: The 2007 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 365 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.9 King Mountain Wind Ranch (KING_NE)

Table 11-40: Site Information for King Mountain Wind Ranch (KING_NE)

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station
KING_NE	WIND	McCamey	UPTON	Dec-01	79.3	FPL/Cielo	King Mountain Wind Ranch	Bonus 1300 (61)	ERCOT	AEP-West	WTU	MAF

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
KING_NE_KINGNE	KING_NE	79.3

11.9.1 King Mountain – KING_NE_KINGNE

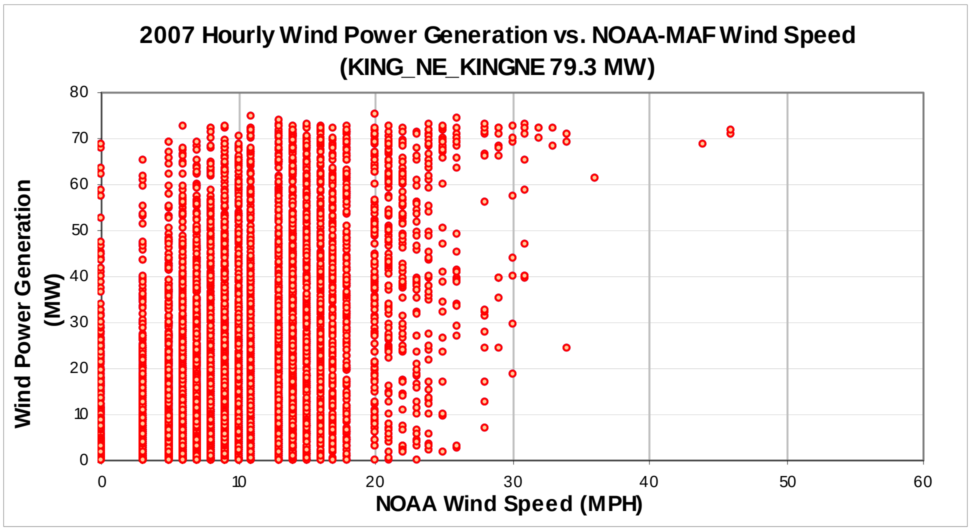
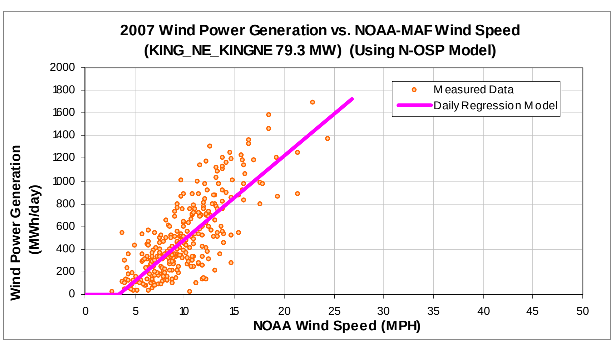


Figure 11-41: KING_NE_KINGNE – Hourly Wind Power vs. NOAA Wind Speed (2007)



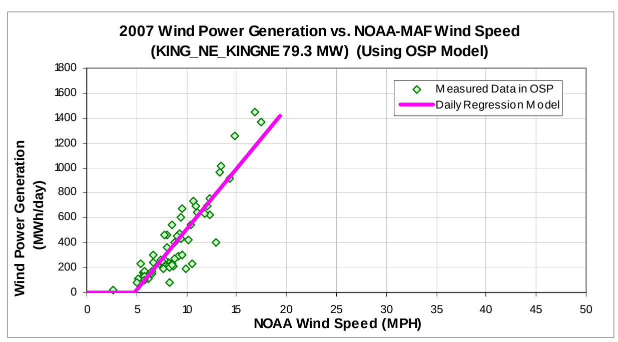


Figure 11-42: KING_NE_KINGNE – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-41: KING_NE_KINGNE – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-245.6178
Left Slope (MWh/mph-day)	73.5588
RMSE (MWh/day)	210.6222
R2	0.6076
CV-RMSE	43.1%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-472.9793
Left Slope (MWh/mph-day)	98.0132
RMSE (MWh/day)	141.7817
R2	0.7989
CV-RMSE	34.9%

Table 11-42: KING_NE_KINGNE – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07	28	9.58	11,110	12,853	-15.68%	21%	24%
Feb-07	28	11.24	15,385	16,281	-5.82%	29%	31%
Mar-07	31	10.28	17,267	15,830	8.33%	29%	27%
Apr-07	30	12.32	19,355	19,812	-2.36%	34%	35%
May-07	31	9.65	13,741	14,402	-4.81%	23%	24%
Jun-07	29	9.98	13,099	14,170	-8.18%	24%	26%
Jul-07	31	8.01	8,503	10,128	-19.11%	14%	17%
Aug-07	31	9.98	16,172	15,672	3.09%	27%	27%
Sep-07	30	8.89	12,915	11,978	7.26%	23%	21%
Oct-07	31	10.21	17,487	15,675	10.36%	30%	27%
Nov-07	30	8.90	10,664	12,315	-15.48%	19%	22%
Dec-07	31	8.80	15,605	12,447	20.24%	26%	21%
Total	361	9.81	171,303	171,562	-0.15%	25%	25%
Total in OSP (07/15-09/15)	63	8.97	25,570	25,785	-0.84%	21%	22%

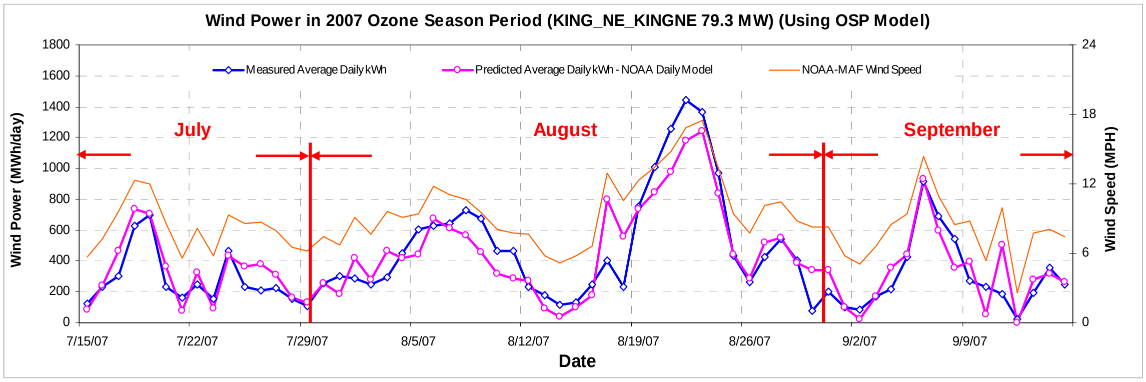


Figure 11-43: KING_NE_KINGNE – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

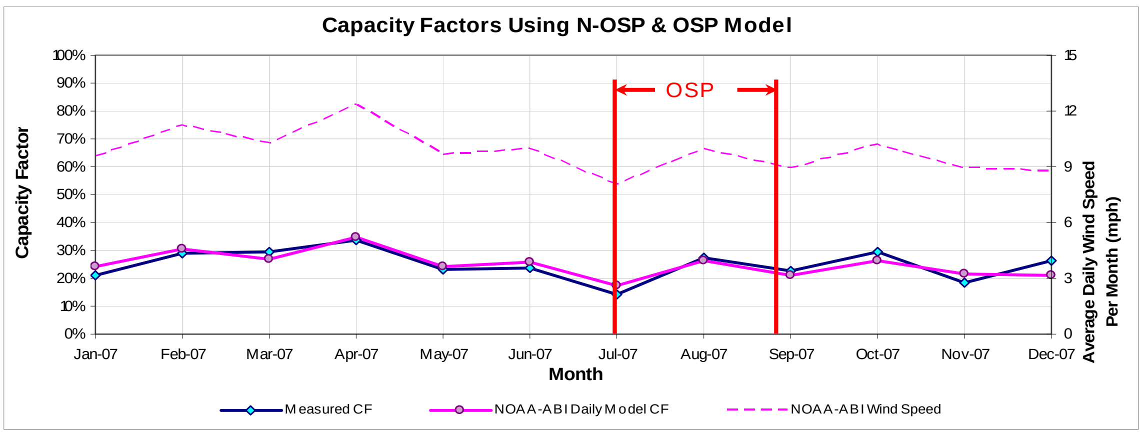


Figure 11-44: KING_NE_KINGNE – Predicted Capacity Factors Using Daily Models (2007)

Table 11-43: KING_NE_KINGNE – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr for Modeling
203,501	173,201

OSD

1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day for Modeling
456	406

Note: The 2007 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 365 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.10 King Mountain Wind Ranch (KING_NW)

Table 11-44: Site Information for King Mountain Wind Ranch (KING_NW)

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconne-ction	Weather Station
KING_NW	WIND	McCamey	UPTON	Dec-01	79.3	FPL/Cielo	King Mountain Wind Ranch	Bonus 1300 (61)	ERCOT	AEP-West	WTU	MAF

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
KING_NW_KINGNW	KING_NW	79.3

11.10.1 King Mountain – KING_NW_KINGNW

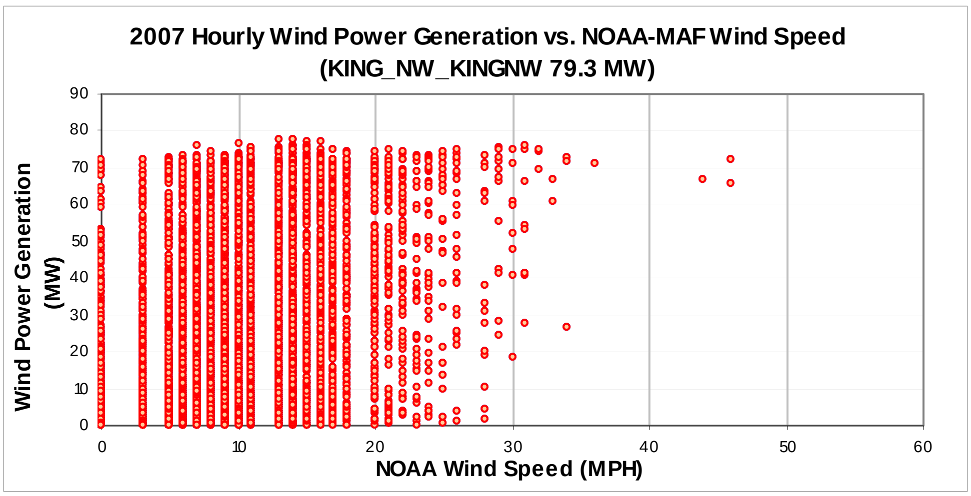


Figure 11-45: KING_NW_KINGNW – Hourly Wind Power vs. NOAA Wind Speed (2007)

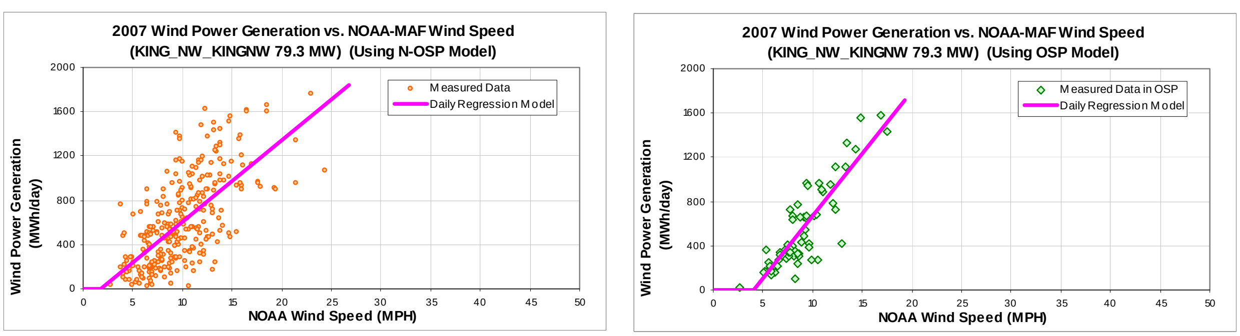


Figure 11-46: KING_NW_KINGNW – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-45: KING_NW_KINGNW – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-126.0973
Left Slope (MWh/mph-day)	73.5897
RMSE (MWh/day)	292.8510
R2	0.4449
CV-RMSE	48.1%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-462.0813
Left Slope (MWh/mph-day)	112.6409
RMSE (MWh/day)	192.1530
R2	0.7407
CV-RMSE	35.1%

Table 11-46: KING_NW_KINGNW – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07	28	9.58	13,816	16,208	-17.31%	26%	30%
Feb-07	28	11.24	15,817	19,638	-24.15%	30%	37%
Mar-07	31	10.28	20,757	19,545	5.84%	35%	33%
Apr-07	30	12.32	23,266	23,409	-0.61%	41%	41%
May-07	31	9.65	18,650	18,116	2.86%	32%	31%
Jun-07	29	9.98	17,252	17,645	-2.28%	31%	32%
Jul-07	31	8.01	11,391	13,983	-22.76%	19%	24%
Aug-07	31	9.98	21,409	20,537	4.07%	36%	35%
Sep-07	30	8.89	18,406	15,632	15.07%	32%	27%
Oct-07	31	10.21	22,584	19,390	14.14%	38%	33%
Nov-07	30	8.90	16,417	15,865	3.36%	29%	28%
Dec-07	31	8.80	16,197	16,161	0.22%	27%	27%
Total	361	9.81	215,962	216,129	-0.08%	31%	31%
Total in OSP (07/15-09/15)	63	8.97	34,520	34,686	-0.48%	29%	29%

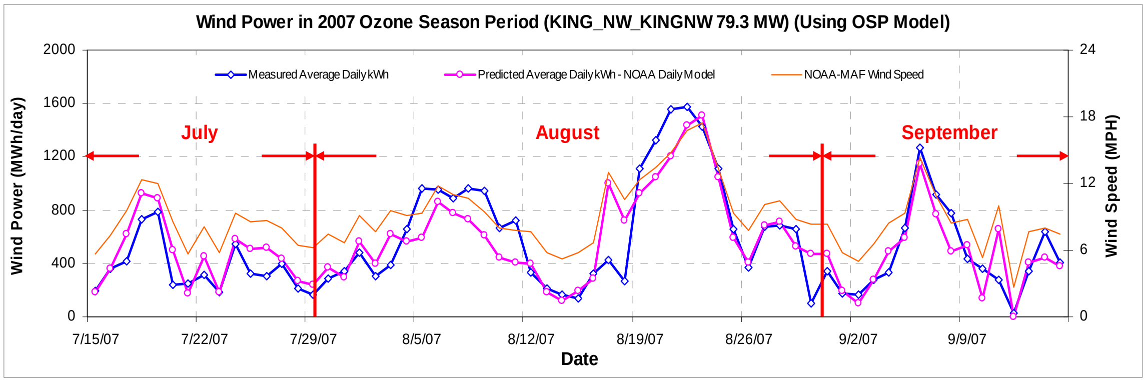


Figure 11-47: KING_NW_KINGNW – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

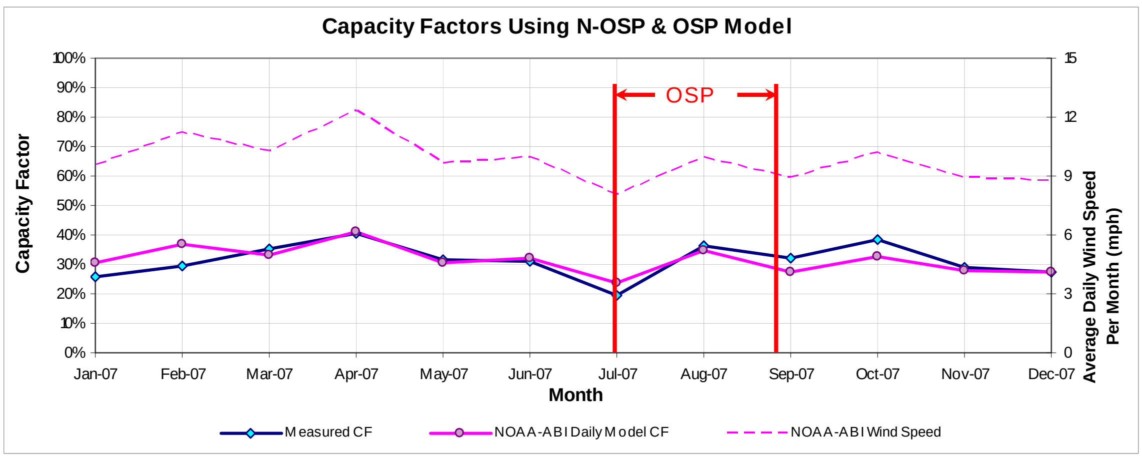


Figure 11-48: KING_NW_KINGNW – Predicted Capacity Factors Using Daily Models (2007)

Table 11-47: KING_NW_KINGNW – Predicted Power Production in 1999

Annual		OSD	
1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr for Modeling	1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day for Modeling
248,975	218,355	605	548

Note: The 2007 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 365 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.11 King Mountain Wind Ranch (KING_SE)

Table 11-48: Site Information for King Mountain Wind Ranch (KING_SE)

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Intercon-nection	Weather Station
KING_SE	WIND	McCamey	UPTON	Dec-01	40.3	FPL/Cielo	King Mountain Wind Ranch	Bonus 1300 (61)	ERCOT	AEP-West	WTU	MAF

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
KING_SE_KINGSE	KING_SE	40.3

11.11.1 King Mountain – KING_SE_KINGSE

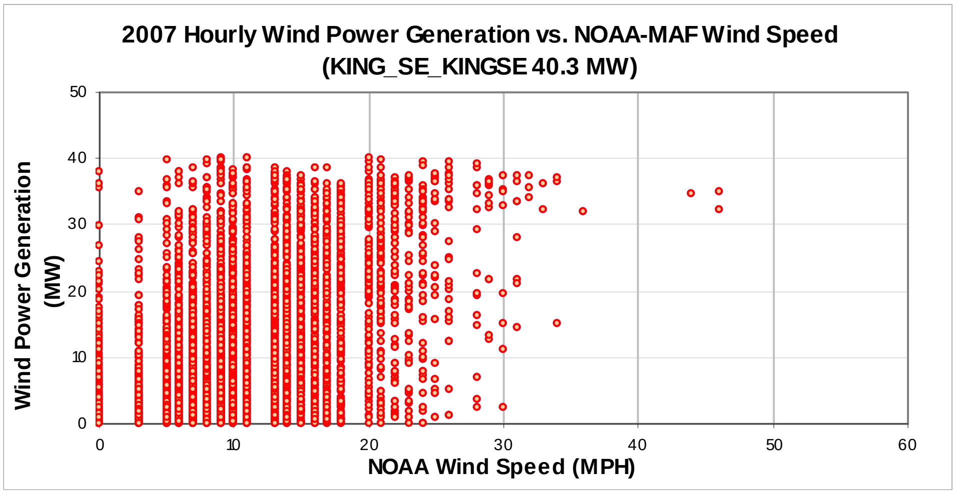
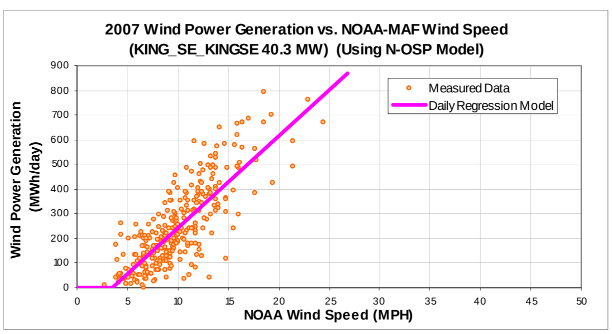


Figure 11-49: KING_SE_KINGSE – Hourly Wind Power vs. NOAA Wind Speed (2007)



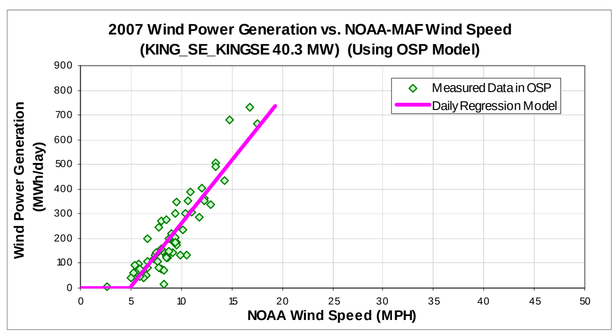


Figure 11-50: KING_SE_KINGSE – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-49: KING_SE_KINGSE – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-129.2091
Left Slope (MWh/mph-day)	37.2001
RMSE (MWh/day)	100.2904
R2	0.6358
CV-RMSE	41.5%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-250.5625
Left Slope (MWh/mph-day)	51.1504
RMSE (MWh/day)	69.6177
R2	0.8178
CV-RMSE	33.5%

Table 11-50: King Mountain – KING_ SE – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07	29	9.48	5,514	6,477	-17.47%	20%	23%
Feb-07	28	11.24	7,999	8,094	-1.19%	30%	30%
Mar-07	31	10.28	8,599	7,850	8.70%	29%	26%
Apr-07	30	12.32	9,451	9,869	-4.43%	33%	34%
May-07	31	9.65	6,383	7,128	-11.68%	21%	24%
Jun-07	29	9.98	6,386	7,021	-9.95%	23%	25%
Jul-07	31	8.01	4,394	5,074	-15.47%	15%	17%
Aug-07	31	9.98	8,271	8,063	2.52%	28%	27%
Sep-07	30	8.89	6,389	6,008	5.97%	22%	21%
Oct-07	31	10.21	8,232	7,772	5.59%	27%	26%
Nov-07	30	8.90	5,715	6,083	-6.44%	20%	21%
Dec-07	31	8.80	8,105	6,140	24.24%	27%	20%
Total	362	9.80	85,438	85,581	-0.17%	24%	24%
Total in OSP (07/15-09/15)	63	8.97	13,109	13,226	-0.89%	22%	22%

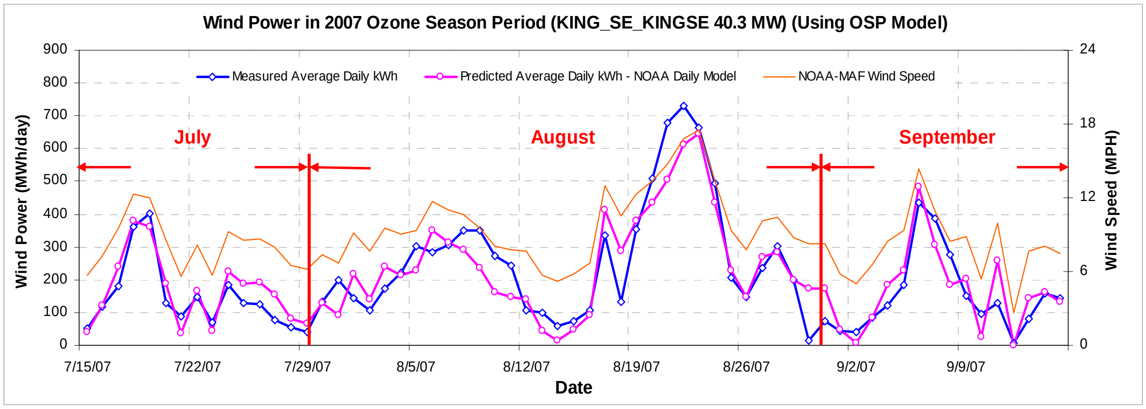


Figure 11-51: KING_SE_KINGSE – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

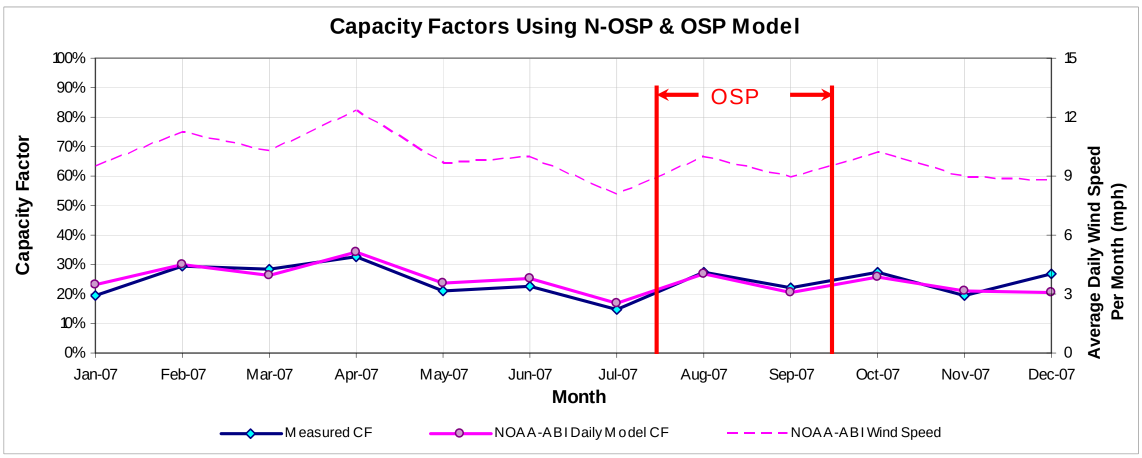


Figure 11-52: KING_SE_KINGSE – Predicted Capacity Factors Using Daily Models (2007)

Table 11-51: KING_SE_KINGSE - Predicted Power Production in 1999

Annual		OSD	
1999 Estimated MWh/yr (2007 Daily Model)	**2007 Measured MWh/yr for Modeling**	**1999 OSD Estimated MWh/day (2007 Daily Model)**	**2007 OSD Measured MWh/day for Modeling**
101,648	**86,146**	**234**	**208**

Note: The 2007 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 365 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.12 King Mountain Wind Ranch (KING_SW)

Table 11-52: Site Information for King Mountain Wind Ranch (KING_SW)

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station
KING_SW	WIND	McCamey	UPTON	Dec-01	79.3	FPL/Cielo	King Mountain Wind Ranch	Bonus 1300 (61)	ERCOT	AEP-West	WTU	MAF

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
KING_SW_KINGSW	KING_SW	79.3

11.12.1 King Mountain – KING_SW_KINGSW

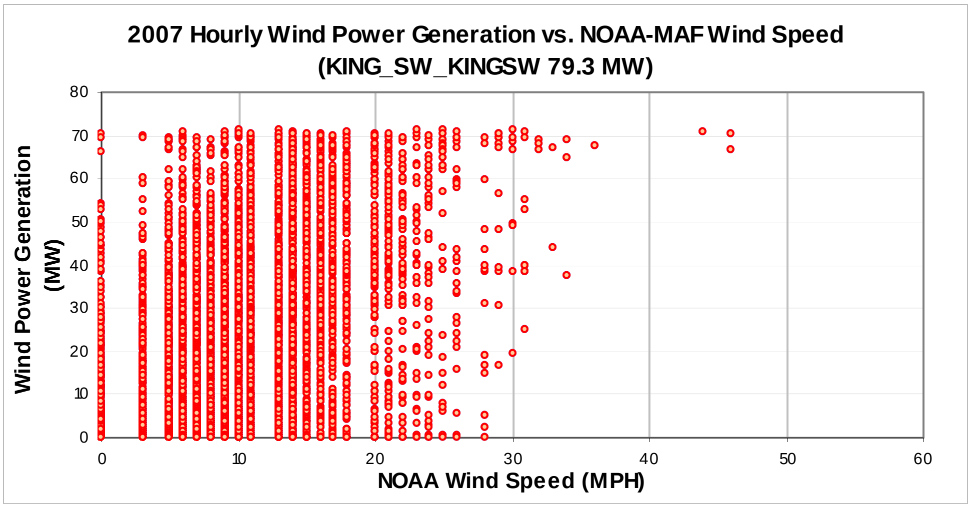


Figure 11-53: KING_SW_KINGSW – Hourly Wind Power vs. NOAA Wind Speed (2007)

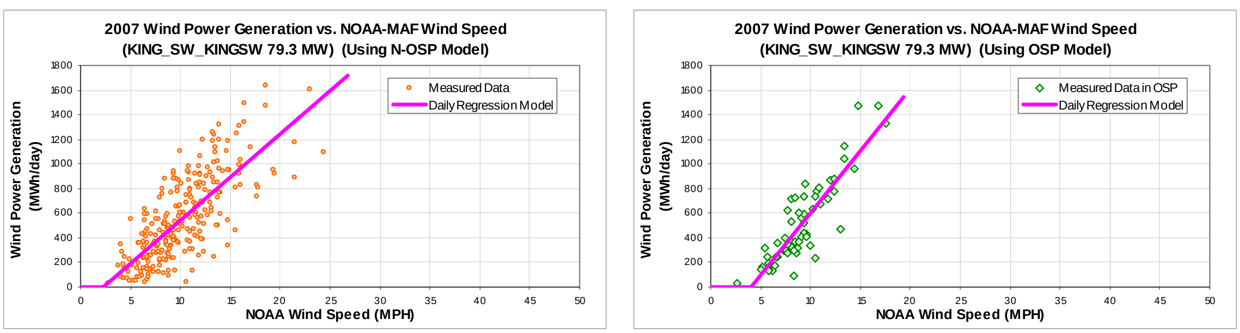


Figure 11-54: KING_SW_KINGSW – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-53: KING_SW_KINGSW – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-159.9608
Left Slope (MWh/mph-day)	70.2392
RMSE (MWh/day)	221.1290
R2	0.5702
CV-RMSE	40.1%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-417.3697
Left Slope (MWh/mph-day)	101.8961
RMSE (MWh/day)	158.9090
R2	0.7737
CV-RMSE	32.0%

Table 11-54: KING_SW_KINGSW – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07	28	9.58	13,140	14,361	-9.29%	25%	27%
Feb-07	28	11.24	14,820	17,635	-18.99%	28%	33%
Mar-07	31	10.28	18,945	17,427	8.01%	32%	30%
Apr-07	30	12.32	21,058	21,155	-0.46%	37%	37%
May-07	31	9.65	16,790	16,063	4.33%	28%	27%
Jun-07	29	9.98	15,373	15,693	-2.08%	28%	28%
Jul-07	31	8.01	10,709	12,429	-16.07%	18%	21%
Aug-07	31	9.98	19,146	18,598	2.86%	32%	32%
Sep-07	30	8.89	15,914	14,003	12.01%	28%	25%
Oct-07	31	10.21	19,027	17,279	9.19%	32%	29%
Nov-07	30	8.90	13,346	13,955	-4.56%	23%	24%
Dec-07	1	11.63	838	657	21.61%	44%	34%
Total	331	9.91	179,106	179,255	-0.08%	28%	28%
Total in OSP (07/15-09/15)	63	8.97	31,267	31,417	-0.48%	26%	26%

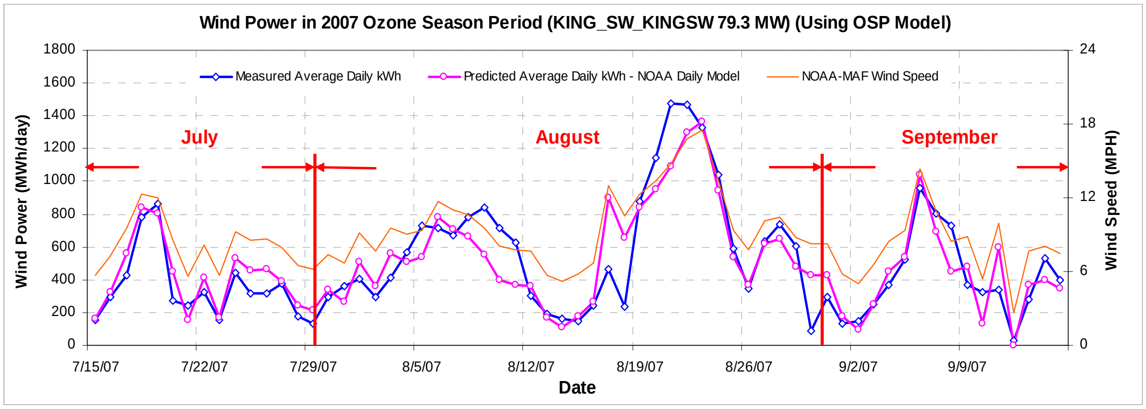


Figure 11-55: KING_SW_KINGSW – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

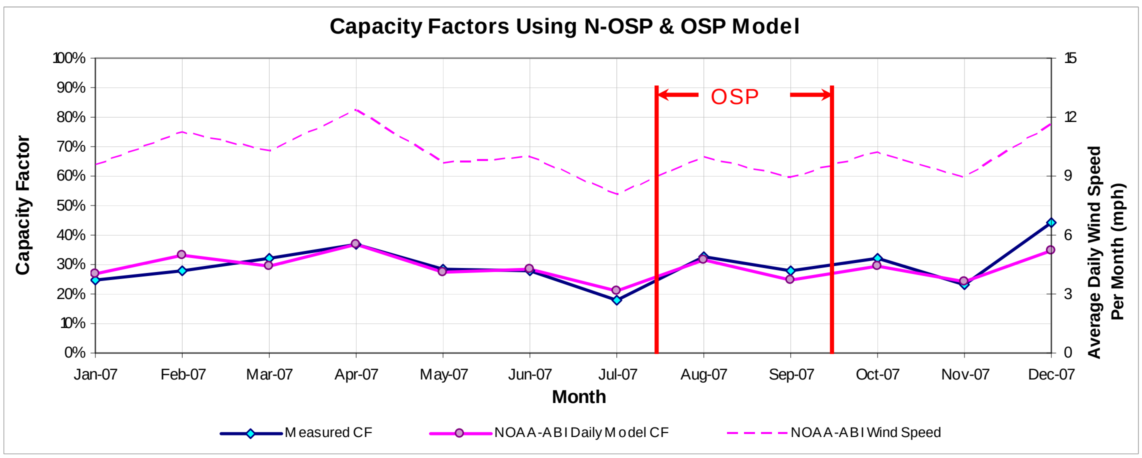


Figure 11-56: KING_SW_KINGSW - Predicted Capacity Factors Using Daily Models (2007)

Table 11-55: KING_SW_KINGSW – Predicted Power Production in 1999

Annual		OSD	
1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr for Modeling	1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day for Modeling
223,819	197,503	548	496

Note: The 2007 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 365 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.13 Red Canyon

Table 11-56: Site Information for Red Canyon 1

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station
Red Canyon	WIND		BORDEN	Apr-06	84	FPL Energy	Red Canyon1		ERCOT		BEPC	ABI

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
Red Canyon 1	Red Canyon	84

11.13.1 Red Canyon 1 – RDCANYON_RDCNY1

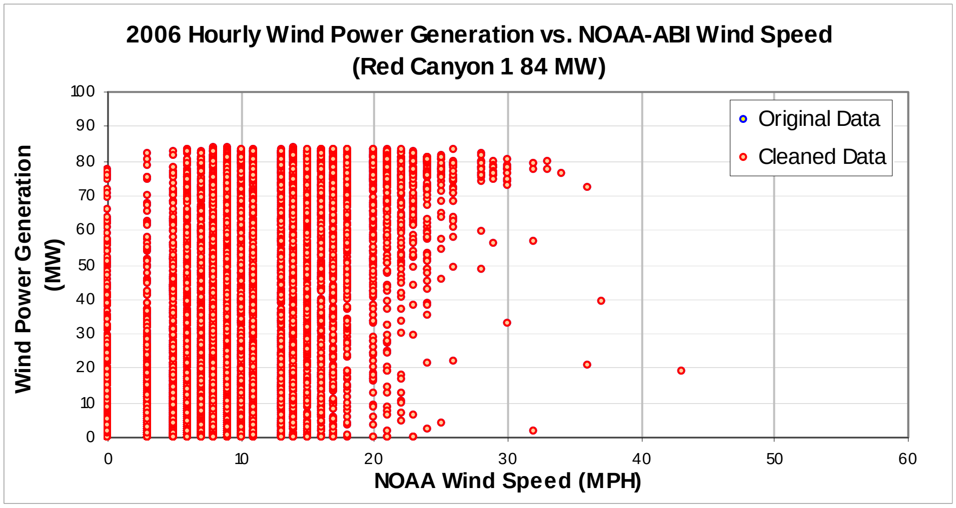
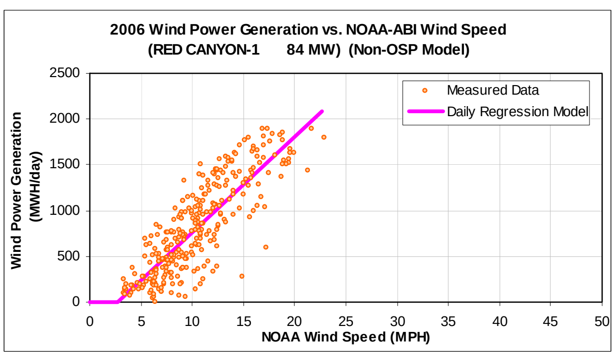


Figure 11-57: RDCANYON_RDCNY1 – Hourly Wind Power vs. NOAA Wind Speed (2006)



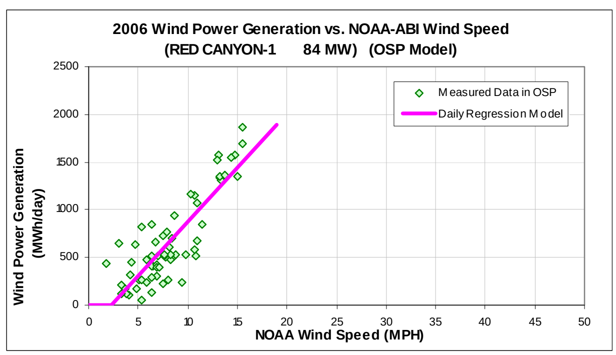


Figure 11-58: RDCANYON_RDCNY1 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-57: RDCANYON_RDCNY1 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-277.3935
Left Slope (MWh/mph-day)	104.2544
RMSE (MWh/day)	275.0539
R2	0.7014
CV-RMSE	33.5%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-266.1538
Left Slope (MWh/mph-day)	113.4990
RMSE (MWh/day)	242.9929
R2	0.7272
CV-RMSE	36.5%

Table 11-58: RDCANYON_RDCNY1 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07	27	9.17	18,794	18,332	2.46%	35%	34%
Feb-07	28	12.04	26,698	27,384	-2.57%	47%	49%
Mar-07	31	11.82	27,759	29,588	-6.59%	44%	47%
Apr-07	30	12.85	29,673	31,877	-7.43%	49%	53%
May-07	31	9.32	20,037	21,509	-7.34%	32%	34%
Jun-07	30	9.53	19,235	21,469	-11.61%	32%	35%
Jul-07	31	6.95	13,709	15,252	-11.26%	22%	24%
Aug-07	31	9.10	26,261	23,761	9.52%	42%	38%
Sep-07	30	9.04	22,614	21,169	6.39%	37%	35%
Oct-07	31	11.05	30,046	27,111	9.77%	48%	43%
Nov-07	30	10.37	24,539	24,102	1.78%	41%	40%
Dec-07	31	10.51	27,488	25,357	7.75%	44%	41%
Total	361	10.14	286,853	286,911	-0.02%	39%	39%
Total in OSP (07/15-09/15)	63	N/A	41,888	41,946	N/A	N/A	N/A

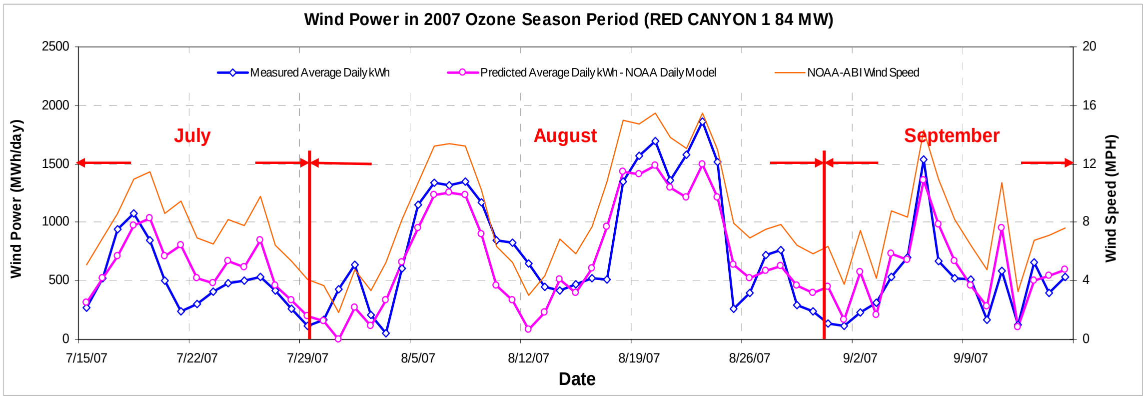


Figure 11-59: RDCANYON_RDCNY1 – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

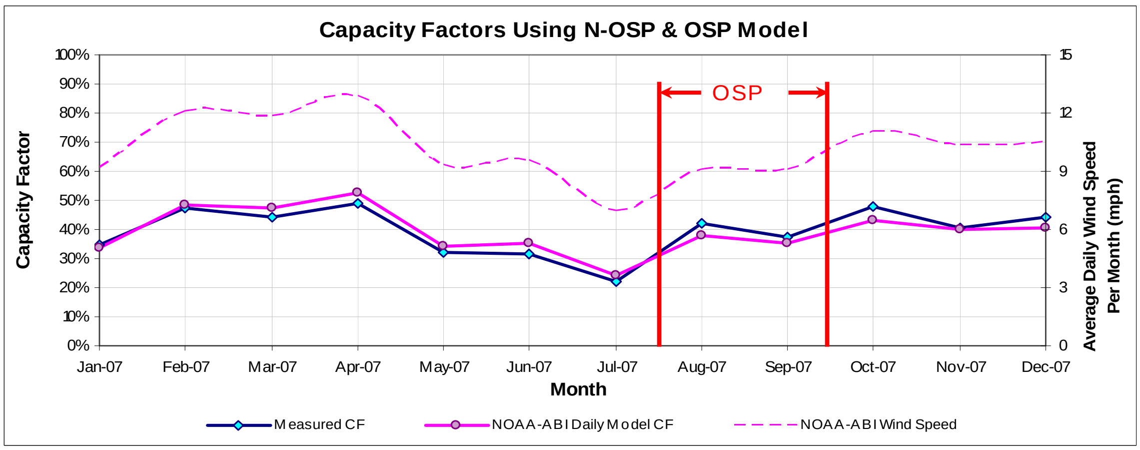


Figure 11-60: RDCANYON_RDCNY1 – Predicted Capacity Factors Using Daily Models (2007)

Table 11-59: RDCANYON_RDCNY1 – Predicted Power Production in 1999

Annual		OSD	
1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr for Modeling	1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day for Modeling
334,823	290,032	836	665

Note: The 2007 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 365 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.14 Sweetwater Wind 2

Table 11-60: Site Information for Sweetwater Wind 2

GENSITECODE_ ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Intercon-nection	Weather Station
SWEETWN2	WIND	Sweetwater	NOLAN	Feb-05	91.5	DKRW Development	Sweetwater Wind 2	GE Wind 1500 (61)	ERCOT	TXU	TXU	ABI

SUBGENCODE_ ERCOT	GENSITECOD E_ERCOT	Capacity (MW)
SWEETWN2_W ND2	SWEETWN2	91.5

11.14.1 Sweetwater Wind 2 – SWEETWN2_WND2

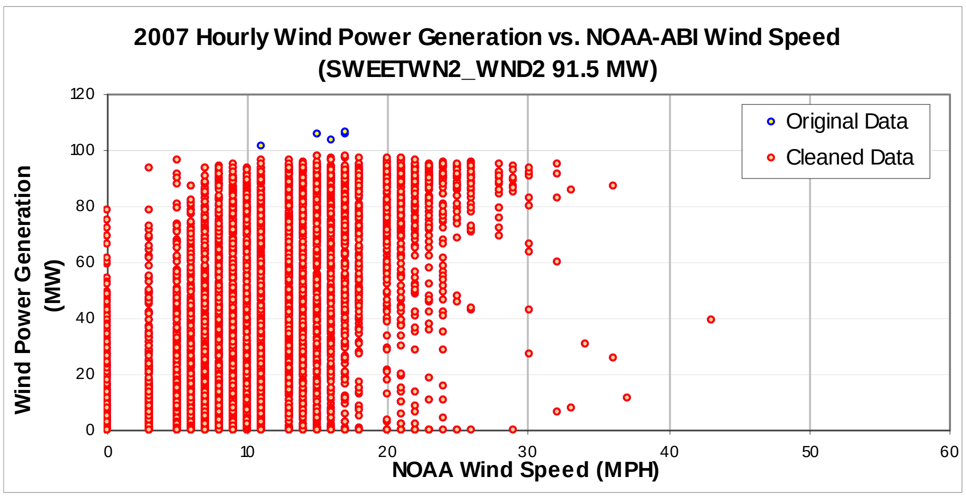


Figure 11-61: SWEETWN2_WND2 – Hourly Wind Power vs. NOAA Wind Speed (2007)

Figure 11-62: SWEETWN2_WND2 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-61: SWEETWN2_WND2 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-420.6577
Left Slope (MWh/mph-day)	122.5278
RMSE (MWh/day)	276.1915
R2	0.7647
CV-RMSE	31.7%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-534.4376
Left Slope (MWh/mph-day)	143.6373
RMSE (MWh/day)	232.4217
R2	0.8235
CV-RMSE	36.1%

Table 11-62: SWEETWN2_WND2 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07	23	8.97	15,512	15,603	-0.59%	31%	31%
Feb-07	27	12.16	26,557	28,877	-8.74%	45%	49%
Mar-07	31	11.82	28,679	31,841	-11.02%	42%	47%
Apr-07	30	12.85	33,142	34,625	-4.47%	50%	53%
May-07	31	9.32	21,794	22,364	-2.62%	32%	33%
Jun-07	30	9.53	20,685	22,395	-8.26%	31%	34%
Jul-07	31	6.95	13,107	14,286	-8.99%	19%	21%
Aug-07	31	9.10	25,848	24,097	6.77%	38%	35%
Sep-07	30	9.04	20,720	21,359	-3.09%	31%	32%
Oct-07	31	11.05	31,076	28,936	6.89%	46%	43%
Nov-07	30	10.37	29,188	25,488	12.68%	44%	39%
Dec-07	31	10.51	29,909	26,868	10.17%	44%	39%
Total	356	10.14	296,216	296,738	-0.18%	38%	38%
Total in OSP (07/15-09/15)	63	8.20	40,561	41,055	-1.22%	29%	30%

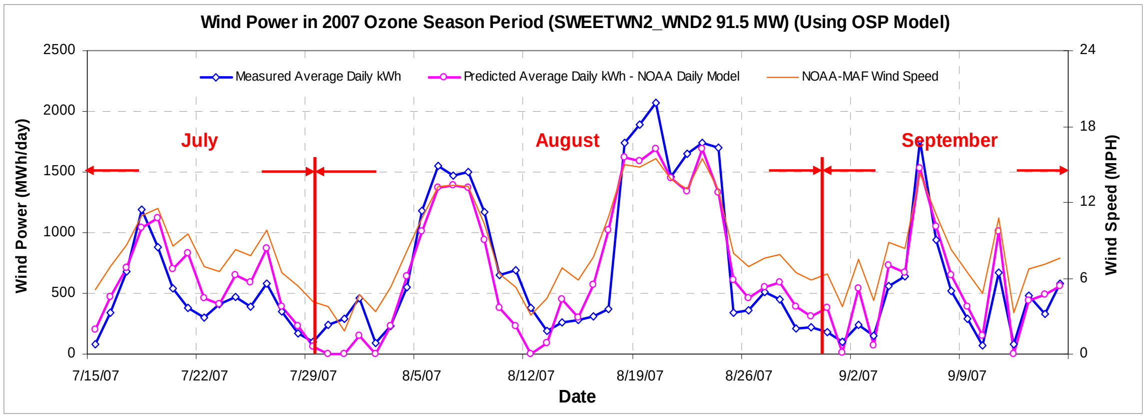


Figure 11-63: SWEETWN2_WND2 – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

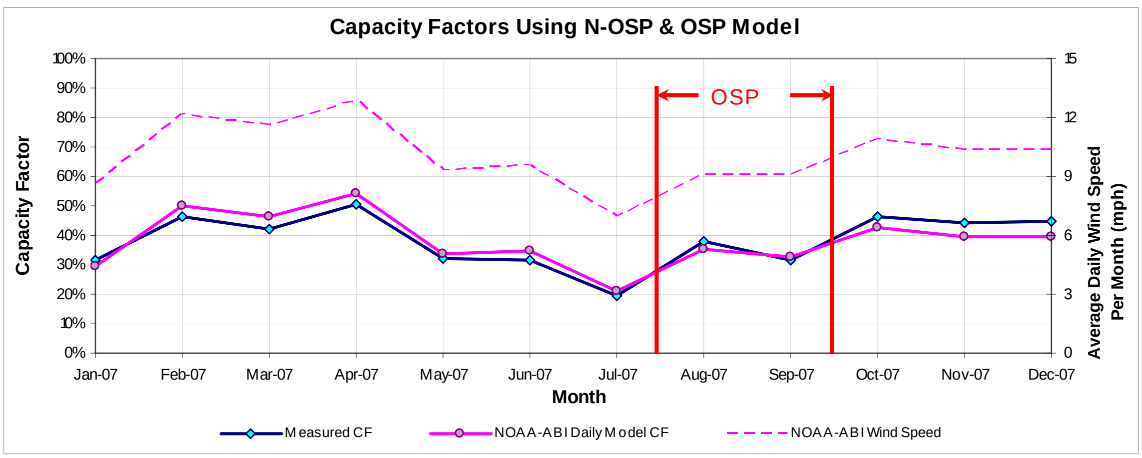


Figure 11-64: SWEETWN2_WND2 – Predicted Capacity Factors Using Daily Models (2007)

Table 11-63: SWEETWN2_WND2 – Predicted Power Production in 1999

Annual		OSD	
1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr for Modeling	1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day for Modeling
357,326	303,705	860	644

Note: The 2007 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 365 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.15 Sweetwater Wind 3

Table 11-64: Site Information for Sweetwater Wind 3

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station
SWEETWN3	WIND	Sweetwater	NOLAN	Feb-05	135	DKRW Development	Sweetwater Wind 3	GE Wind 1500 (61)	ERCOT	TXU	TXU	ABI

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
SWEETWN3_WND3	SWEETWN3	135

11.15.1 Sweetwater Wind 3 – SWEETWN3_WND3

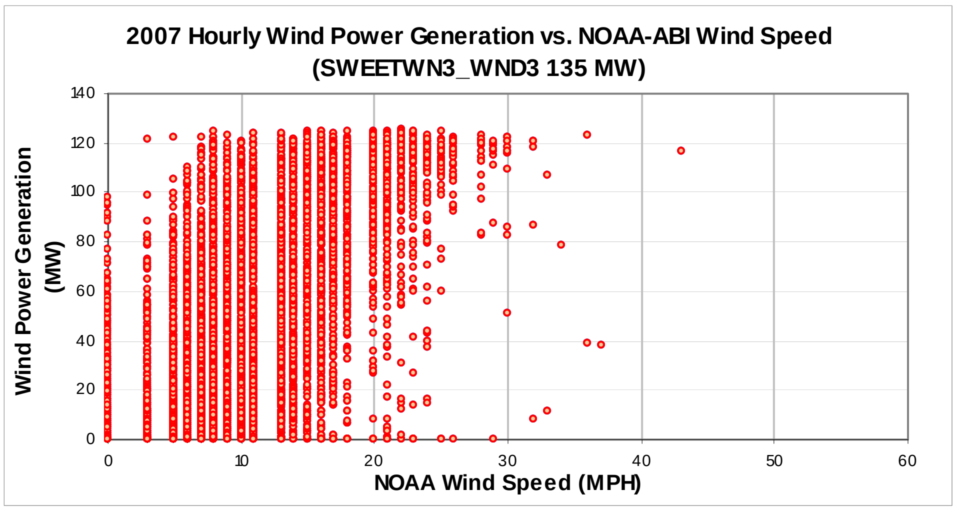


Figure 11-65: SWEETWN3_WND3 – Hourly Wind Power vs. NOAA Wind Speed (2007)

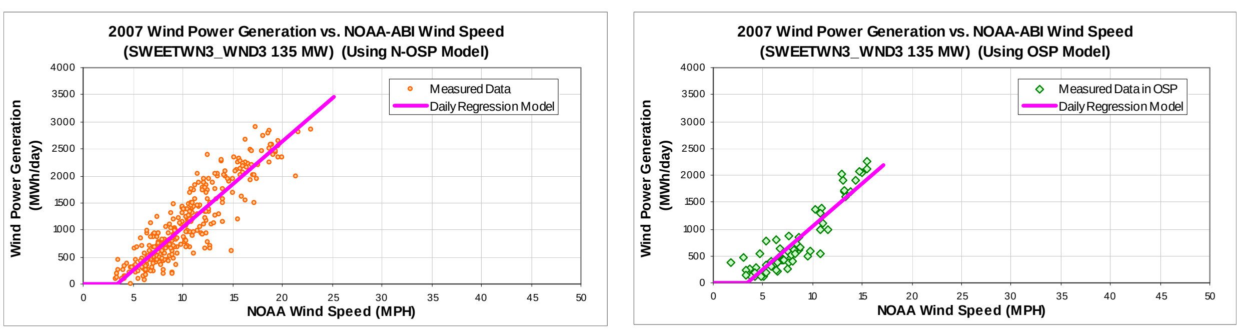


Figure 11-66: SWEETWN3_WND3 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-65: SWEETWN3_WND3 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-537.6169
Left Slope (MWh/mph-day)	158.6613
RMSE (MWh/day)	316.1784
R2	0.8062
CV-RMSE	27.8%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-547.0923
Left Slope (MWh/mph-day)	159.6473
RMSE (MWh/day)	257.2861
R2	0.8247
CV-RMSE	33.7%

Table 11-66: SWEETWN3_WND3 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07	23	8.97	21,625	20,367	5.81%	29%	27%
Feb-07	27	12.16	35,491	37,585	-5.90%	41%	43%
Mar-07	31	11.82	39,630	41,450	-4.59%	39%	41%
Apr-07	30	12.85	43,693	45,049	-3.10%	45%	46%
May-07	31	9.32	28,565	29,169	-2.12%	28%	29%
Jun-07	30	9.53	26,009	29,209	-12.30%	27%	30%
Jul-07	31	6.95	15,527	17,752	-14.33%	15%	18%
Aug-07	31	9.10	30,236	28,144	6.92%	30%	28%
Sep-07	30	9.04	25,849	26,906	-4.09%	27%	28%
Oct-07	31	11.05	40,896	37,682	7.86%	41%	38%
Nov-07	30	10.37	34,766	33,217	4.46%	36%	34%
Dec-07	31	10.51	38,877	35,011	9.94%	39%	35%
Total	356	10.14	381,164	381,540	-0.10%	33%	33%
Total in OSP (07/15-09/15)	63	8.20	48,038	48,397	-0.75%	24%	24%

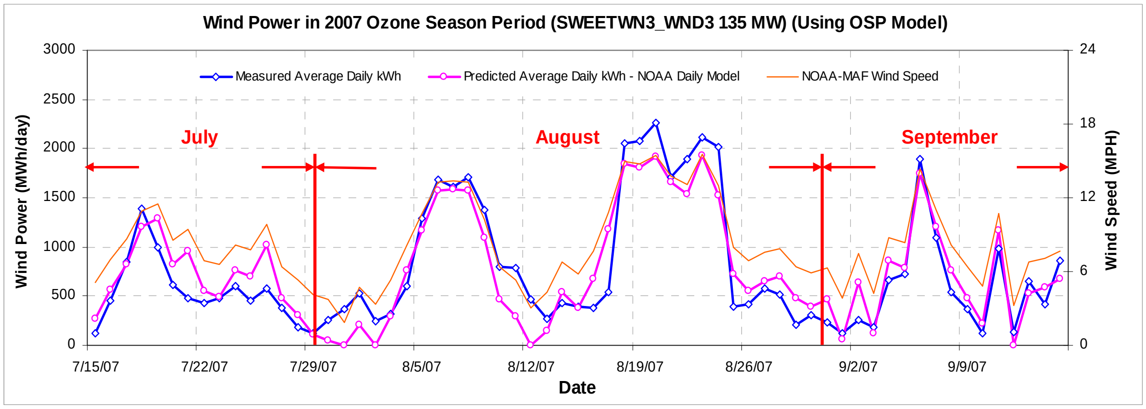


Figure 11-67: SWEETWN3_WND3 – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

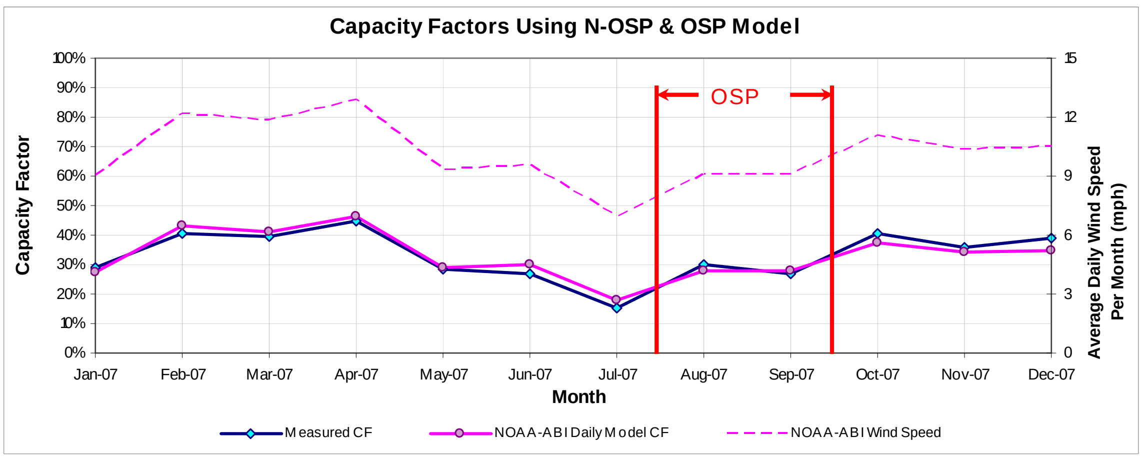


Figure 11-68: SWEETWN3_WND3 – Predicted Capacity Factors Using Daily Models (2007)

Table 11-67: SWEETWN3_WND3 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr for Modeling
457,851	390,800

OSD

1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day for Modeling
1,003	763

Note: The 2007 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 365 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.16 Sweetwater Wind 1

Table 11-68: Site Information for Sweetwater Wind 1

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station
SWEETWND	WIND	Sweetwater	NOLAN	Dec-03	37.5	DKR Development	Sweetwater Wind 1	GE Wind 1500 (25)	ERCOT	LCRA	LCRA	ABI

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
SWEETWND_WND1	SWEETWND	37.5

11.16.1 Sweetwater Wind 1 – SWEETWND_WND1

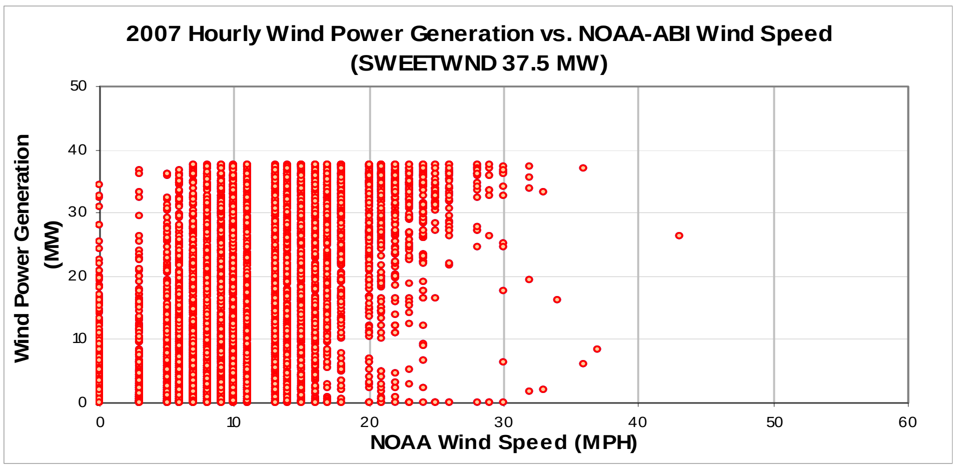
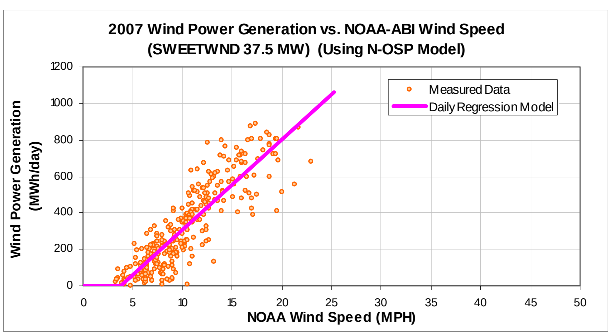


Figure 11-69: SWEETWND_WND1 – Hourly Wind Power vs. NOAA Wind Speed (2007)



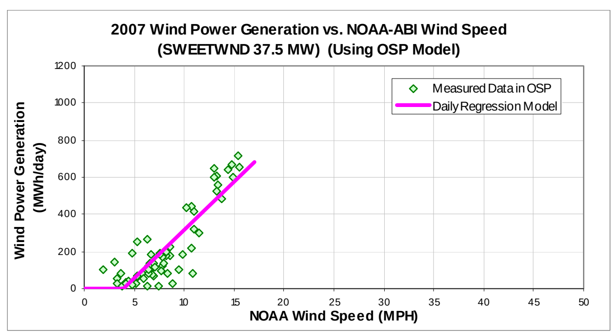


Figure 11-70: SWEETWND_WND1 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-69: SWEETWND_WND1 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-190.7497
Left Slope (MWh/mph-day)	49.5612
RMSE (MWh/day)	114.1072
R2	0.7544
CV-RMSE	34.7%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-204.4797
Left Slope (MWh/mph-day)	51.8314
RMSE (MWh/day)	101.8964
R2	0.7597
CV-RMSE	46.2%

Table 11-70: SWEETWND_WND1 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH)	Measured Power Generation (MWh)	Predicted Power Generation Using Daily Model (MWh)	Diff.	CV-RMSE	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07	23	8.97	6,183	5,853	5.35%	45.51%	30%	28%
Feb-07	28	12.04	11,182	11,369	-1.68%	34.90%	44%	45%
Mar-07	30	11.58	10,349	11,492	-11.04%	33.08%	38%	43%
Apr-07	28	12.77	9,818	12,383	-26.13%	46.49%	39%	49%
May-07	31	9.32	8,400	8,464	-0.77%	31.02%	30%	30%
Jun-07	30	9.53	7,901	8,461	-7.09%	24.04%	29%	31%
Jul-07	31	6.95	4,556	4,936	-8.34%	47.18%	16%	18%
Aug-07	31	9.10	9,289	8,358	10.02%	35.28%	33%	30%
Sep-07	30	9.04	7,477	7,815	-4.52%	31.73%	28%	29%
Oct-07	31	11.05	12,484	11,086	11.20%	27.40%	45%	40%
Nov-07	30	10.37	10,225	9,692	5.21%	37.09%	38%	36%
Dec-07	30	10.36	11,356	9,679	14.77%	36.56%	42%	36%
Total	353	10.09	109,220	109,589	-0.34%	35.76%	34%	34%
Total in OSP (07/15-09/15)	63	8.20	13,904	14,148	-1.76%	43.55%	25%	25%

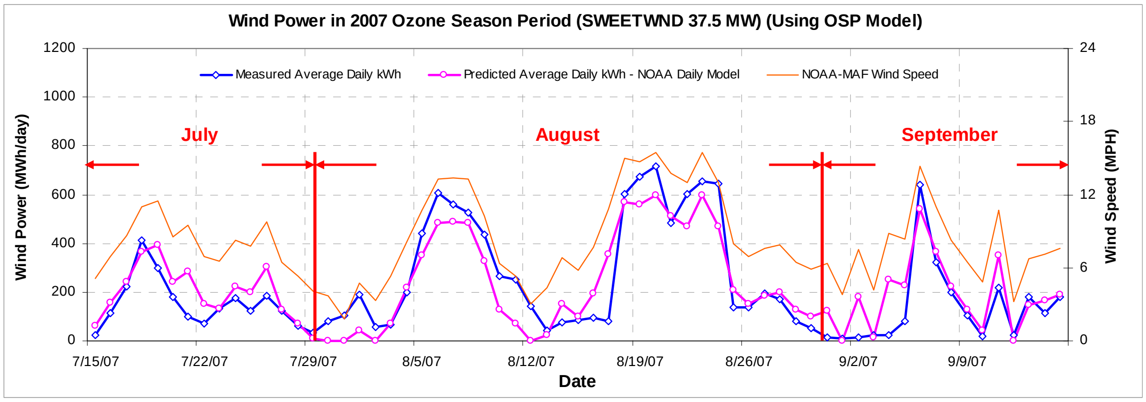


Figure 11-71: SWEETWND_WND1 – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

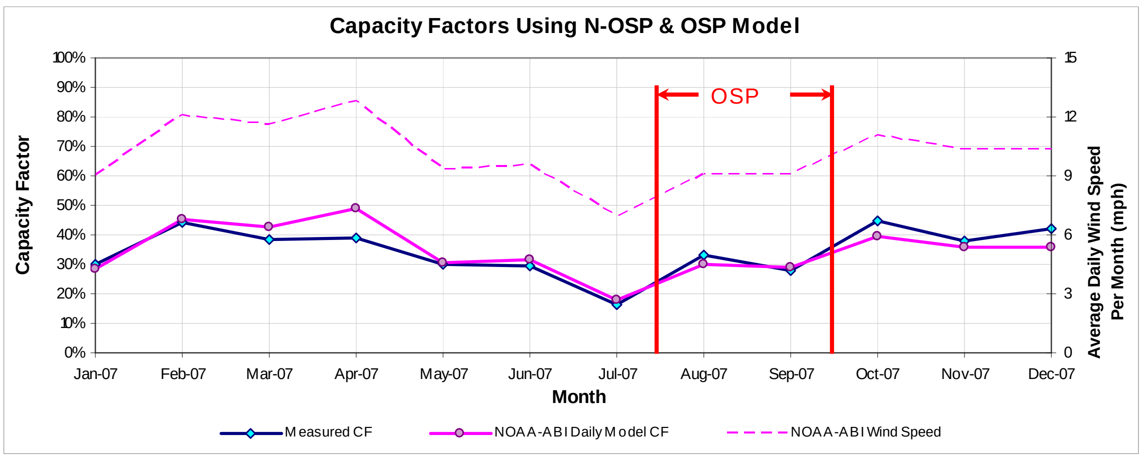


Figure 11-72: SWEETWND_WND1 – Predicted Capacity Factors Using Daily Models (2007)

Table 11-71: SWEETWND_WND1 – Predicted Power Production in 1999

Annual		OSD	
1999 Estimated MWh/yr (2007 Daily Model)	**2007 Measured MWh/yr for Modeling**	**1999 OSD Estimated MWh/day (2007 Daily Model)**	**2007 OSD Measured MWh/day for Modeling**
135,245	**112,933**	**299**	**221**

Note: The 2006 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 365 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.17 Trent Mesa

Table 11-72: Site Information for Trent Mesa

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Intercon-nection	Weather Station
TRENT	WIND	Trent Mesa	NOLAN	Nov-01	150	AEP	Trent Mesa	Enron 1500 (100)	ERCOT	TXU	TXU	ABI

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
TRENT_TRENT	TRENT	150

11.17.1 Trent Mesa – TRENT_TRENT

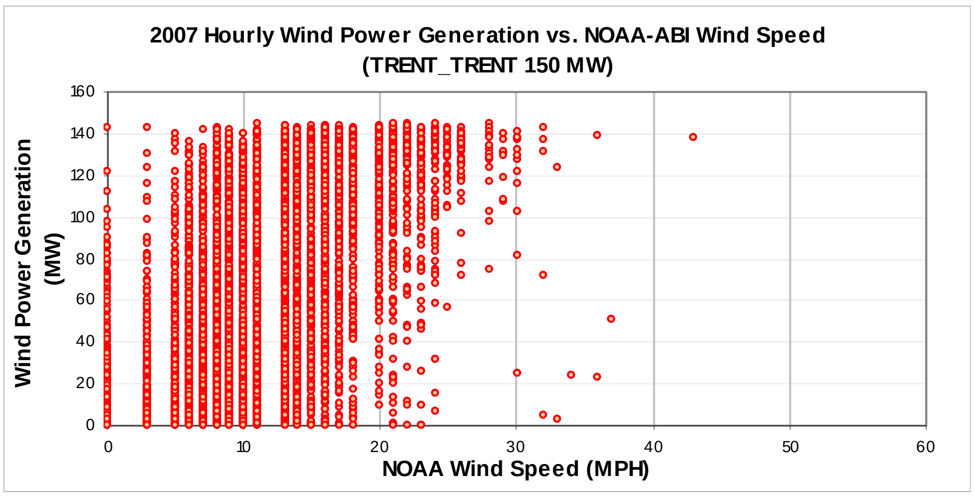
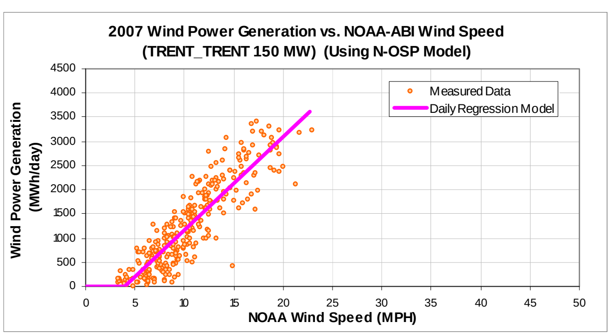


Figure 11-73: TRENT_TRENT – Hourly Wind Power vs. NOAA Wind Speed (2007)



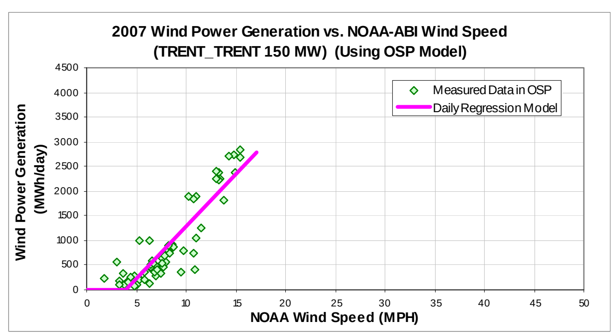


Figure 11-74: TRENT_TRENT – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-73: TRENT_TRENT – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-772.1434
Left Slope (MWh/mph-day)	193.3838
RMSE (MWh/day)	401.1883
R2	0.7911
CV-RMSE	31.6%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-836.0781
Left Slope (MWh/mph-day)	211.3899
RMSE (MWh/day)	366.6579
R2	0.8024
CV-RMSE	40.8%

Table 11-74: TRENT_TRENT – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07	27	9.22	29,753	27,394	7.93%	31%	28%
Feb-07	28	12.04	42,258	43,583	-3.13%	42%	43%
Mar-07	31	11.82	41,774	46,898	-12.27%	37%	42%
Apr-07	30	12.85	45,646	51,401	-12.61%	42%	48%
May-07	31	9.32	30,986	32,245	-4.06%	28%	29%
Jun-07	30	9.53	28,946	32,207	-11.27%	27%	30%
Jul-07	31	6.95	18,926	19,377	-2.38%	17%	17%
Aug-07	31	9.10	36,735	34,027	7.37%	33%	30%
Sep-07	30	9.04	29,809	30,548	-2.48%	28%	28%
Oct-07	31	11.05	46,186	42,423	8.15%	41%	38%
Nov-07	30	10.37	40,782	36,980	9.32%	38%	34%
Dec-07	31	10.51	42,655	39,050	8.45%	38%	35%
Total	361	10.14	434,457	436,133	-0.39%	33%	34%
Total in OSP (07/15-09/15)	63	8.20	56,572	57,580	-1.78%	25%	25%

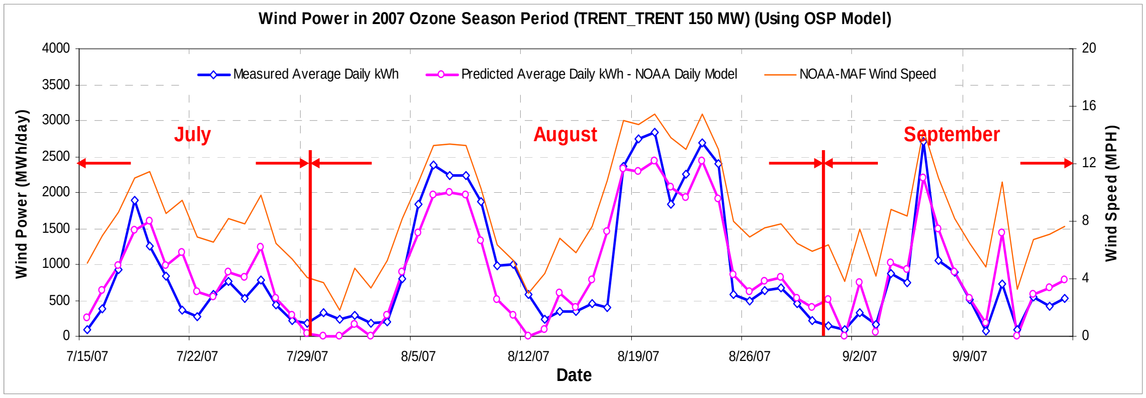


Figure 11-75: TRENT_TRENT – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

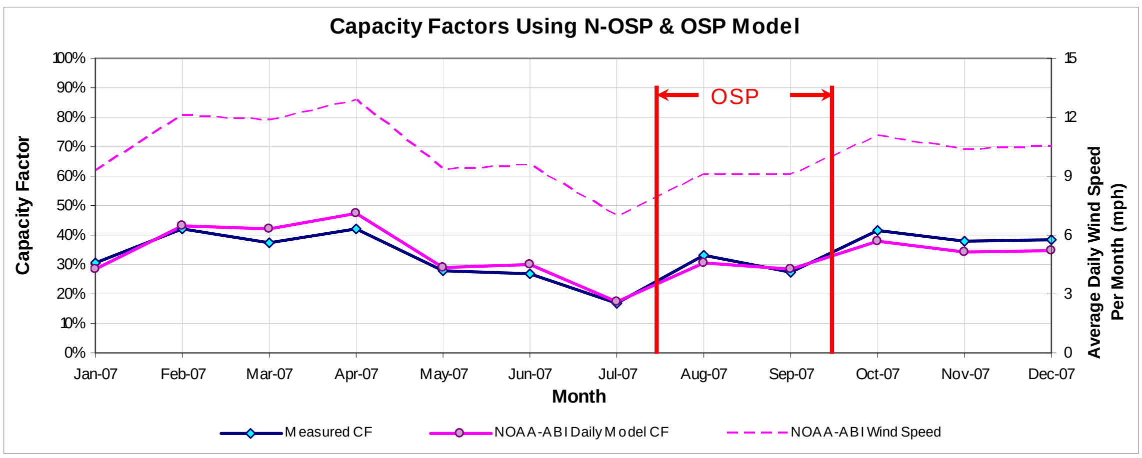


Figure 11-76: TRENT_TRENT – Predicted Capacity Factors Using Daily Models (2007)

Table 11-75: TRENT_TRENT – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr for Modeling
522,564	439,271

OSD

1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day for Modeling
1,216	898

Note: The 2007 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 365 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.18 Delaware Mountain Wind Farm

Table 11-76: Site Information for Delaware Mountain Wind Farm

GENSITECODE _ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Intercon-nection	Weather Station
DELAWARE	WIND		CULBERSON	Jun-99	30	American National Wind Power	Delaware Mountain Wind Farm	Zond (40)	ERCOT	TXU	TXU	GDP

SUBGENCODE _ERCOT	GENSITECODE _ERCOT	Capacity (MW)
DELAWARE_WIND_NWP	DELAWARE	30

11.18.1 Delaware Mountain – DELAWARE_WIND_NWP

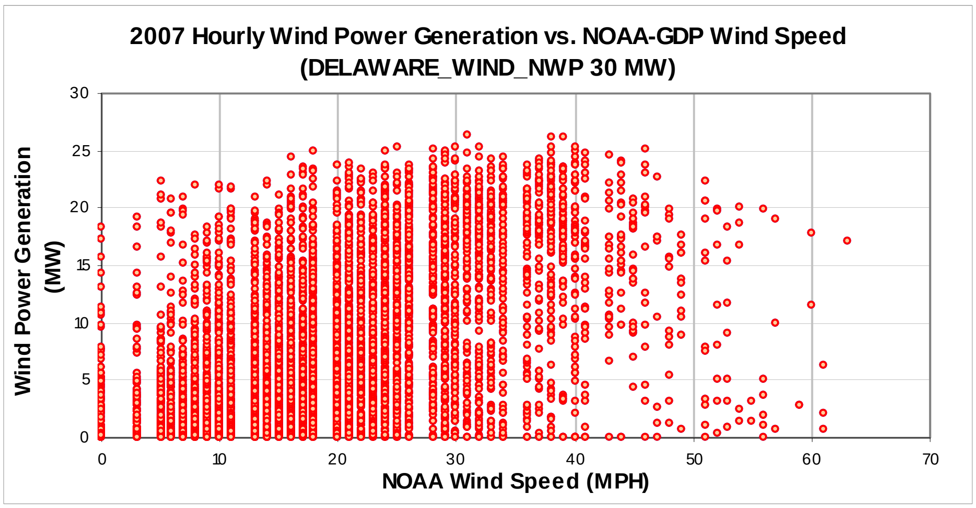


Figure 11-77: DELAWARE_WIND_NWP – Hourly Wind Power vs. NOAA Wind Speed (2007)

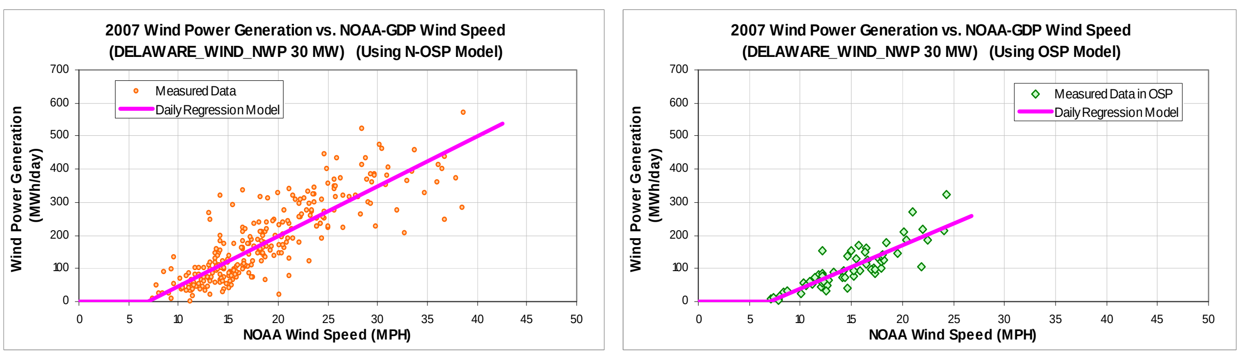


Figure 11-78: DELAWARE_WIND_NWP – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-77: DELAWARE_WIND_NWP – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-104.1174
Left Slope (MWh/mph-day)	15.0940
RMSE (MWh/day)	62.9801
R2	0.7211
CV-RMSE	35.0%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-92.7621
Left Slope (MWh/mph-day)	13.1860
RMSE (MWh/day)	33.2960
R2	0.7415
CV-RMSE	32.5%

Table 11-78: DELAWARE_WIND_NWP – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07	23	22.38	5,694	5,374	5.63%	34%	32%
Feb-07	23	21.93	5,725	5,220	8.83%	35%	32%
Mar-07	31	16.77	4,766	4,617	3.12%	21%	21%
Apr-07	27	21.96	6,092	6,138	-0.76%	31%	32%
May-07	30	18.57	5,019	5,285	-5.29%	23%	24%
Jun-07	25	17.05	3,265	3,833	-17.40%	18%	21%
Jul-07	31	15.06	3,268	3,517	-7.62%	15%	16%
Aug-07	29	14.22	2,777	2,746	1.13%	13%	13%
Sep-07	30	13.81	2,810	2,855	-1.58%	13%	13%
Oct-07	31	17.59	4,703	5,001	-6.35%	21%	22%
Nov-07	23	17.98	3,265	3,848	-17.86%	20%	23%
Dec-07	30	21.84	7,813	6,764	13.42%	36%	31%
Total	333	18.08	55,197	55,197	0.00%	23%	23%
Total in OSP (07/15-09/15)	61	14.81	6,253	6,253	0.00%	14%	14%

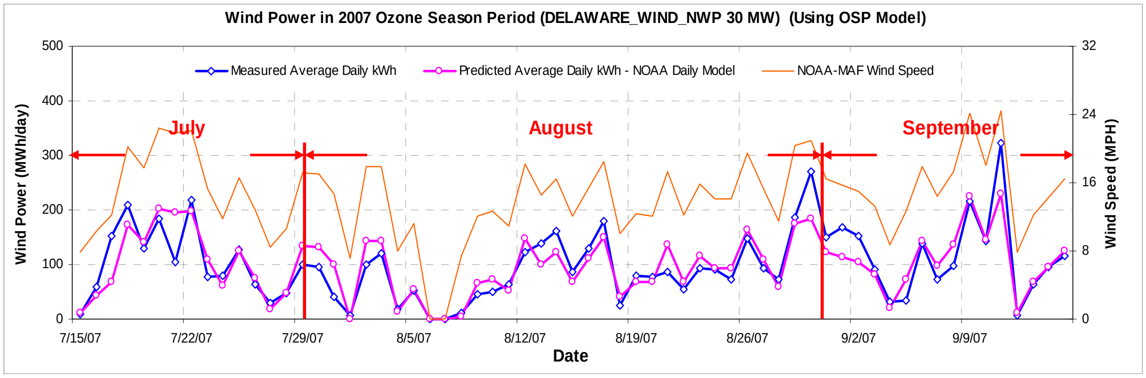


Figure 11-79: DELAWARE_WIND_NWP – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

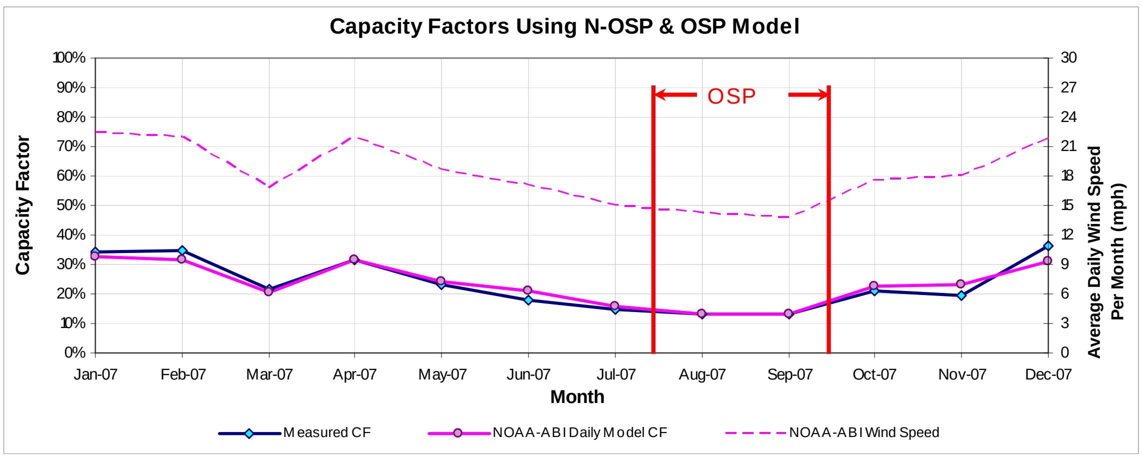


Figure 11-80: DELAWARE_WIND_NWP – Predicted Capacity Factors Using Daily Models (2007)

Table 11-79: DELAWARE_WIND_NWP – Predicted Power Production in 1999

Annual		OSD	
1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr for Modeling	1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day for Modeling
62,053	60,501	90	103

Note: The 2007 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 365 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.19 Indian Mesa

Table 11-80: Site Information for Indian Mesa

GENSITECODE _ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Intercon-nection	Weather Station
INDNNWP	WIND	Iraan	PECOS	Jun-01	82.5	Orion Energy/American National Wind Power	Indian Mesa I	Vestas V-47 (125)	ERCOT	AEP-West	WTU	FST

SUBGENCODE _ERCOT	GENSITECODE_ERCOT	Capacity (MW)
INDNNWP_INDNNWP_J01	INDNNWP	50.3
INDNNWP_INDNNWP_J02	INDNNWP	32.2

11.19.1 Indian Mesa – INDNNWP_INDNNWP

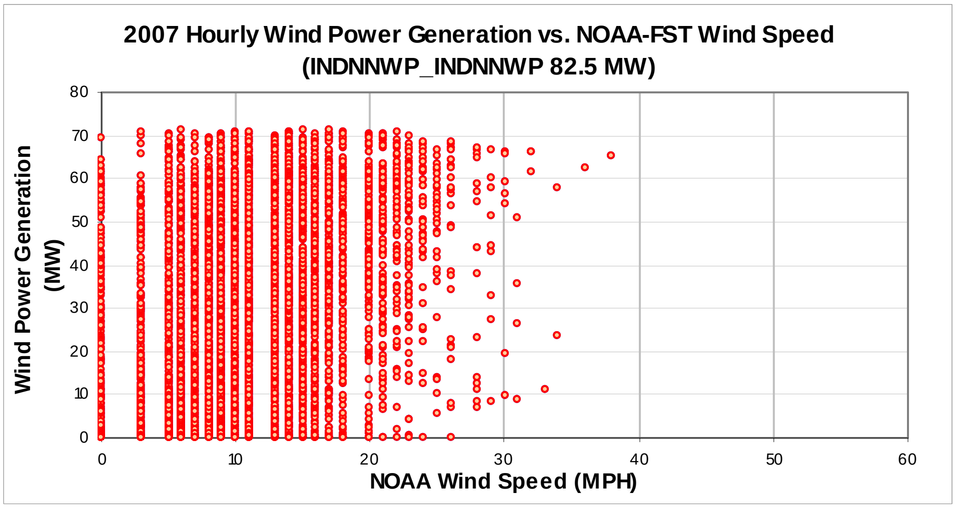


Figure 11-81: INDNNWP_INDNNWP- Hourly Wind Power vs. NOAA Wind Speed (2007)

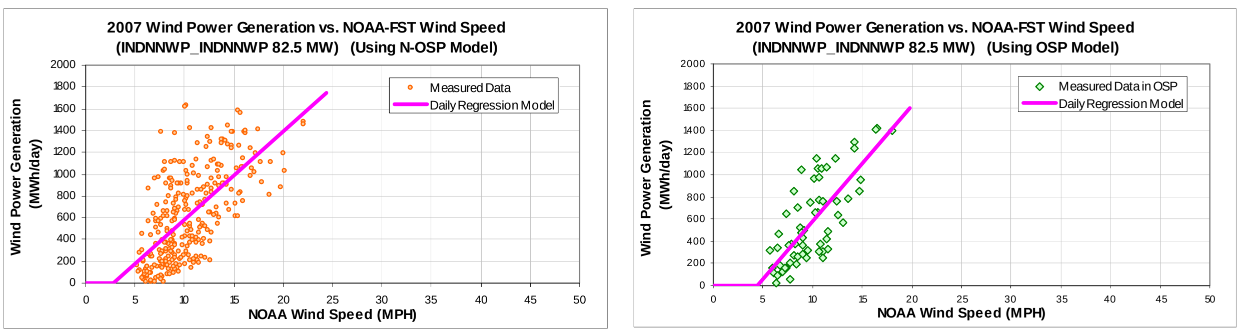


Figure 11-82: INDNNWP_INDNNWP – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-81: INDNNWP_INDNNWP – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-233.3429
Left Slope (MWh/mph-day)	81.3796
RMSE (MWh/day)	314.1551
R2	0.4244
CV-RMSE	51.0%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-460.1109
Left Slope (MWh/mph-day)	104.0352
RMSE (MWh/day)	249.0883
R2	0.5781
CV-RMSE	43.3%

Table 11-82: INDNNWP_INDNNWP – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07	29	9.07	12,836	14,649	-14.12%	22%	26%
Feb-07	27	11.21	17,688	18,334	-3.65%	33%	34%
Mar-07	30	11.82	22,472	21,849	2.77%	38%	37%
Apr-07	30	12.99	21,754	24,706	-13.57%	37%	42%
May-07	28	10.00	15,305	16,259	-6.24%	28%	29%
Jun-07	30	10.19	17,718	17,871	-0.86%	30%	30%
Jul-07	30	9.51	12,484	16,171	-29.53%	21%	27%
Aug-07	31	10.51	22,081	19,641	11.05%	36%	32%
Sep-07	29	9.95	18,771	16,310	13.11%	33%	28%
Oct-07	31	10.27	21,206	18,682	11.90%	35%	30%
Nov-07	27	8.88	15,467	13,207	14.61%	29%	25%
Dec-07	31	9.67	17,061	17,162	-0.59%	28%	28%
Total	353	10.35	214,843	214,843	0.00%	31%	31%
Total in OSP (07/15-09/15)	63	9.95	36,254	36,254	0.00%	29%	29%

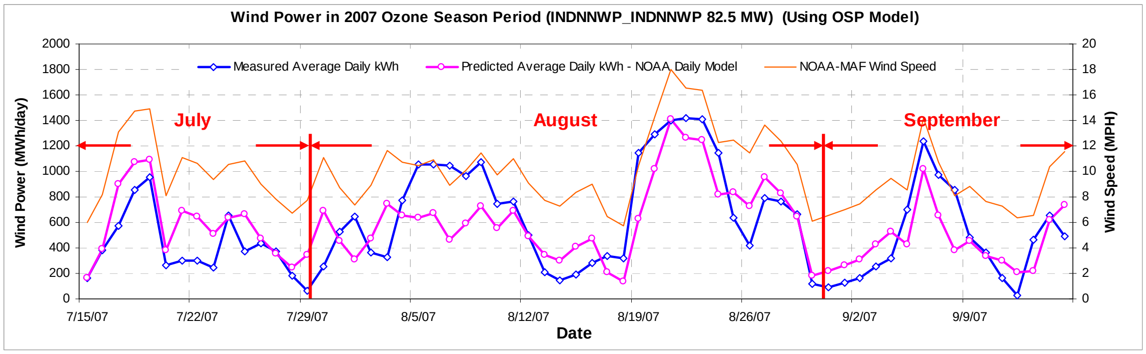


Figure 11-83: INDNNWP_INDNNWP – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

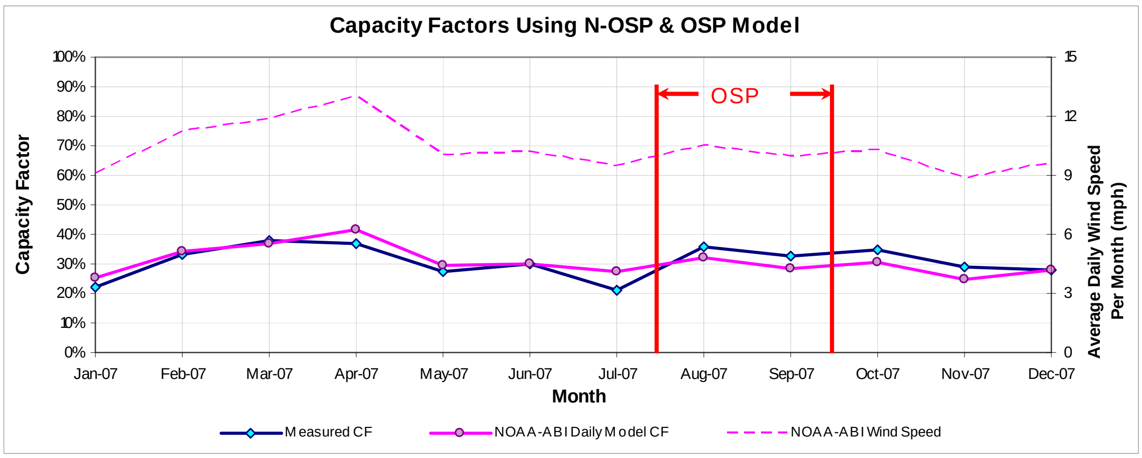


Figure 11-84: INDNNWP_INDNNWP – Predicted Capacity Factors Using Daily Models (2007)

Table 11-83: INDNNWP_INDNNWP – Predicted Power Production in 1999

Annual		OSD	
1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr for Modeling	1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day for Modeling
246,998	222,146	576	575

Note: The 2007 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 365 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.20 Texas Wind Power Project

Table 11-84: Site Information for Texas Wind Power Project

GENSITECODE _ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Intercon-nection	Weather Station
KUNITZ	WIND		CULBERSON	Jan-95	35	LG&E	Texas Wind Power Project	Kenetech (112)	ERCOT	Colorado River Authority		GDP

SUBGENCODE_ ERCOT	GENSITECOD E_ERCOT	Capacity (MW)
KUNITZ_WIND_ LGE_J01	KUNITZ	24.9
KUNITZ_WIND_ LGE_J02	KUNITZ	10.1

11.20.1 Texas Wind Power Project – KUNITZ_WIND_LGE

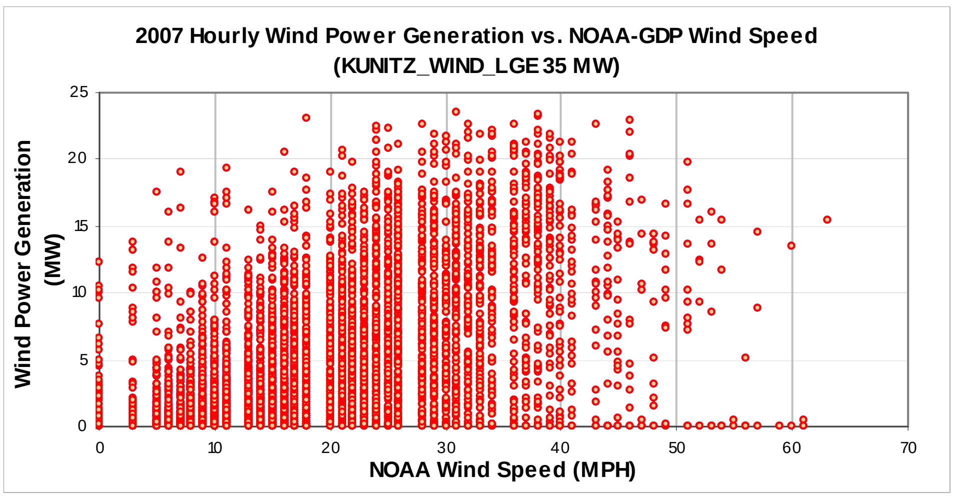
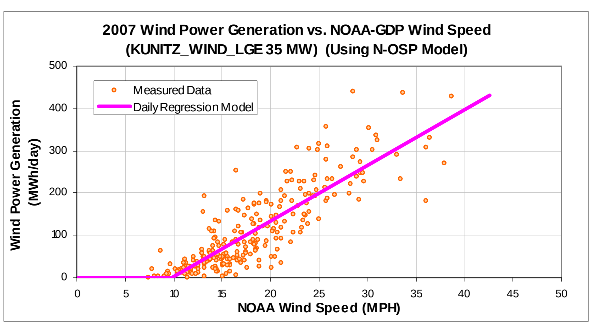


Figure 11-85: KUNITZ_WIND_LGE – Hourly Wind Power vs. NOAA Wind Speed (2007)



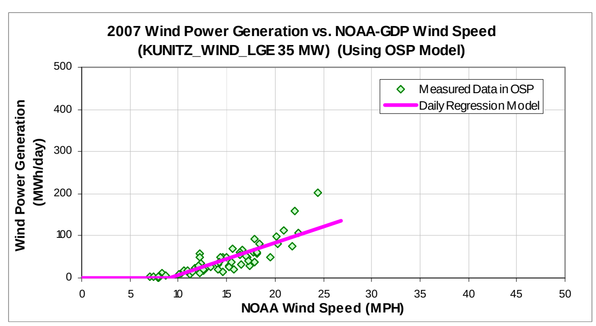


Figure 11-86: KUNITZ_WIND_LGE – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-85: KUNITZ_WIND_LGE – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-129.0796
Left Slope (MWh/mph-day)	13.1786
RMSE (MWh/day)	50.0871
R2	0.7270
CV-RMSE	45.3%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-68.7809
Left Slope (MWh/mph-day)	7.6301
RMSE (MWh/day)	21.0327
R2	0.6921
CV-RMSE	48.9%

Table 11-86: KUNITZ_WIND_LGE – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07	17	22.00	3,594	2,735	23.91%	25%	19%
Feb-07	21	21.20	3,157	3,162	-0.15%	18%	18%
Mar-07	31	16.77	3,288	2,926	11.03%	13%	11%
Apr-07	24	20.63	3,211	3,427	-6.74%	16%	17%
May-07	29	18.34	2,350	3,267	-39.04%	10%	13%
Jun-07	22	15.17	770	1,568	-103.54%	4%	8%
Jul-07	31	15.06	1,534	1,753	-14.22%	6%	7%
Aug-07	29	14.22	985	1,186	-20.34%	4%	5%
Sep-07	29	13.45	1,179	1,100	6.75%	5%	5%
Oct-07	31	17.59	2,915	3,206	-9.97%	11%	12%
Nov-07	22	18.22	2,596	2,450	5.62%	14%	13%
Dec-07	27	20.89	4,962	3,964	20.11%	22%	17%
Total	313	17.50	30,543	30,743	-0.65%	12%	12%
Total in OSP (07/15-09/15)	60	14.65	2,581	2,641	-2.32%	5%	5%

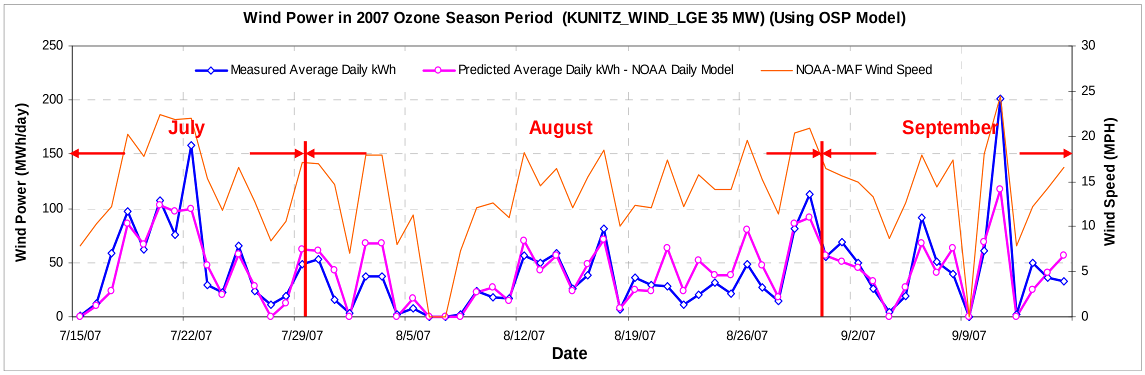


Figure 11-87: KUNITZ_WIND_LGE – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

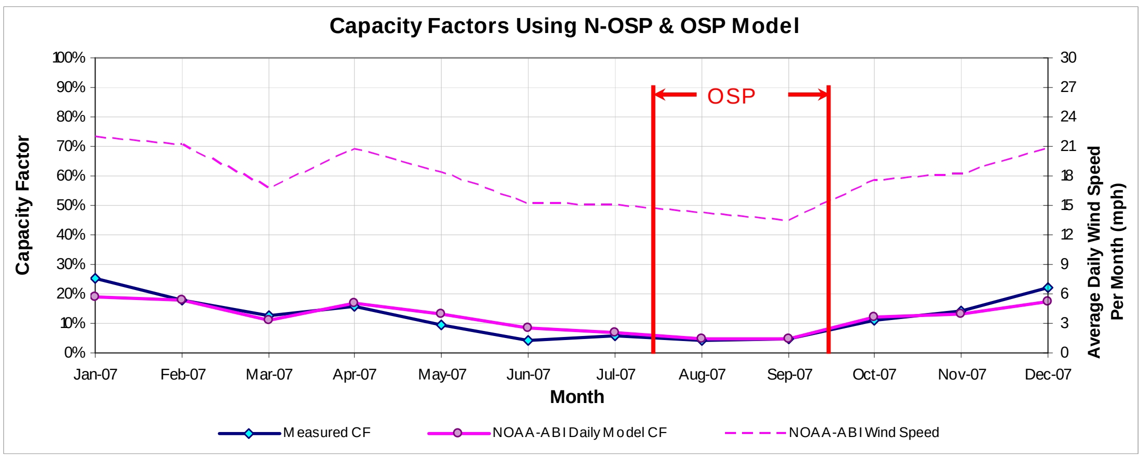


Figure 11-88: KUNITZ_WIND_LGE – Predicted Capacity Factors Using Daily Models (2007)

Table 11-87: KUNITZ_WIND_LGE – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr for Modeling
40,305	35,617

OSD

1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day for Modeling
38	43

Note: The 2007 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 365 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.21 Big Spring Wind Power

Table 11-88: Site Information for Big Spring Wind Power

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Intercon-nection	Weather Station
SGMTN	WIND	Big Spring	HOWARD	Feb-99	41	York Research	Big Spring Wind Power	Vestas V-47 (42) Vestas (4)	ERCOT	TXU	TXU	MAF

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
SGMTN_SIGNALMT	SGMTN	41

11.21.1 Big Spring Wind Power – SGMTN_SIGNALMT

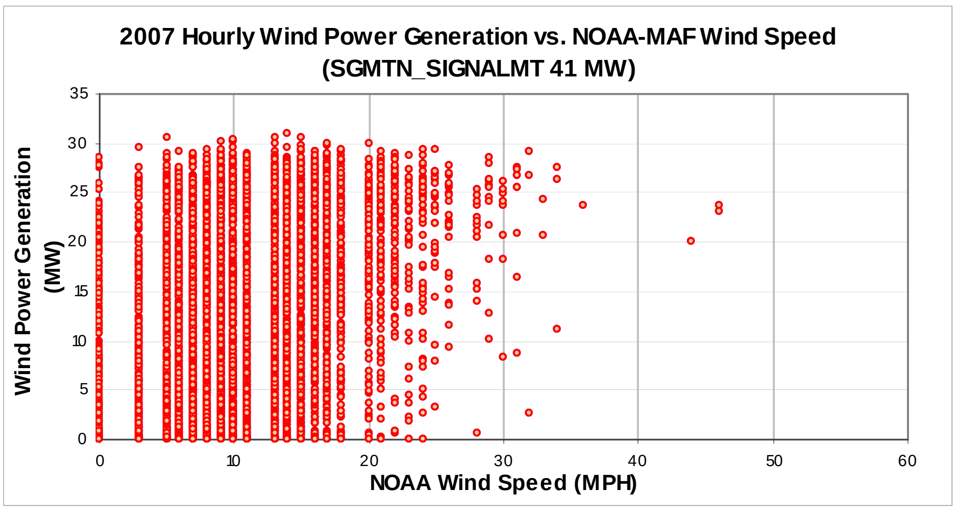


Figure 11-89: SGMTN_SIGNALMT – Hourly Wind Power vs. NOAA Wind Speed (2007)

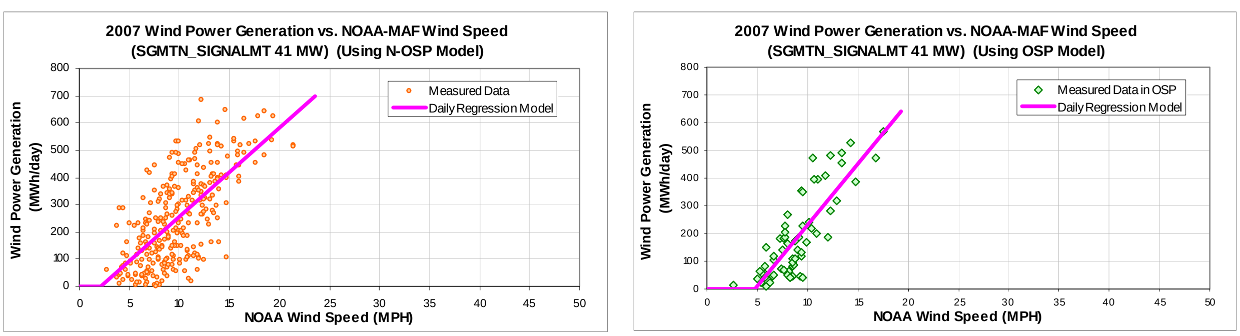


Figure 11-90: SGMTN_SIGNALMT – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-89: SGMTN_SIGNALMT – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-71.8245
Left Slope (MWh/mph-day)	32.6551
RMSE (MWh/day)	121.9463
R2	0.4534
CV-RMSE	48.5%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-208.3962
Left Slope (MWh/mph-day)	43.9936
RMSE (MWh/day)	86.3661
R2	0.6832
CV-RMSE	46.4%

Table 11-90: SGMTN_SIGNALMT – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07	25	9.60	5,973	6,041	-1.15%	24%	25%
Feb-07	27	10.76	8,153	7,546	7.45%	31%	28%
Mar-07	30	9.86	7,798	7,504	3.77%	26%	25%
Apr-07	30	12.32	8,454	9,912	-17.24%	29%	34%
May-07	31	9.65	5,541	7,547	-36.19%	18%	25%
Jun-07	29	9.98	5,837	7,370	-26.27%	20%	26%
Jul-07	31	8.01	3,446	5,110	-48.26%	11%	17%
Aug-07	31	9.98	8,095	7,155	11.61%	27%	23%
Sep-07	30	8.89	6,359	5,954	6.37%	22%	20%
Oct-07	31	10.21	9,418	8,112	13.86%	31%	27%
Nov-07	30	8.90	7,776	6,564	15.58%	26%	22%
Dec-07	31	8.80	8,550	6,679	21.88%	28%	22%
Total	356	9.73	85,401	85,494	-0.11%	24%	24%
Total in OSP (07/15-09/15)	63	8.97	11,723	11,816	-0.79%	19%	19%

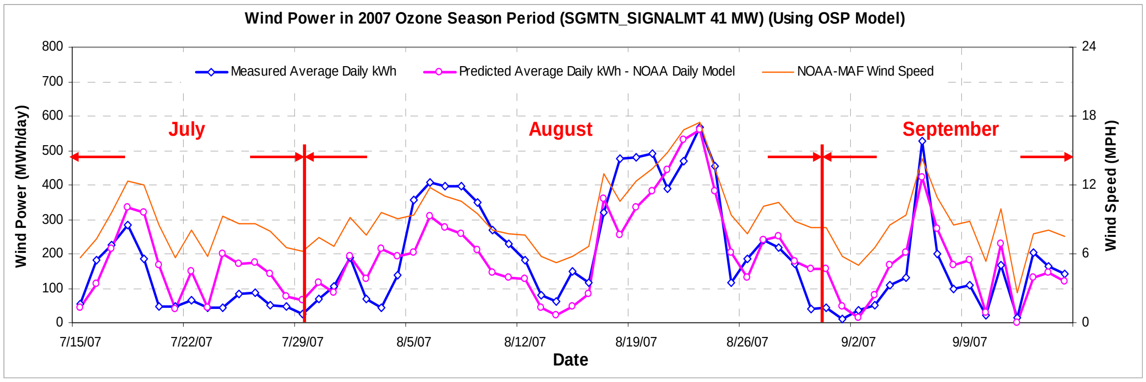


Figure 11-91: SGMTN_SIGNALMT – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

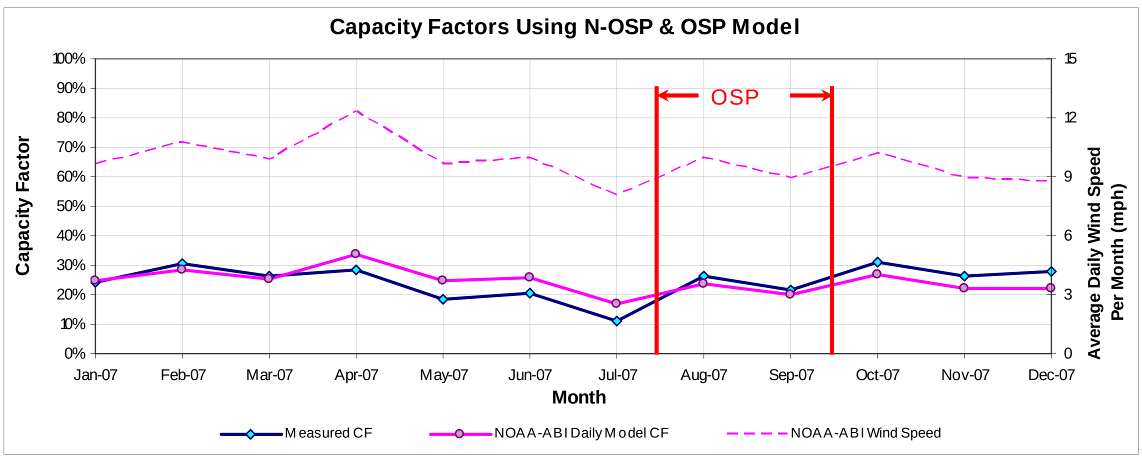


Figure 11-92: SGMTN_SIGNALMT – Predicted Capacity Factors Using Daily Models (2007)

Table 11-91: SGMTN_SIGNALMT – Predicted Power Production in 1999

Annual		OSD	
1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr for Modeling	1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day for Modeling
101,909	87,560	208	186

Note: The 2007 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 365 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.22 Southwest Mesa Wind Project

Table 11-92: Site Information for Southwest Mesa

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Intercon-nection	Weather Station
SW_MESA	WIND	McCamey	UPTON	Jun-99	75	FPL Energy	Southwest Mesa Wind Project	NEG Micon (107)	ERCOT	AEP-West	WTU	MAF

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
SW_MESA_SW_MESA	SW_MESA	75

11.22.1 Southwest Mesa Wind Project – SW_MESA_SW_MESA

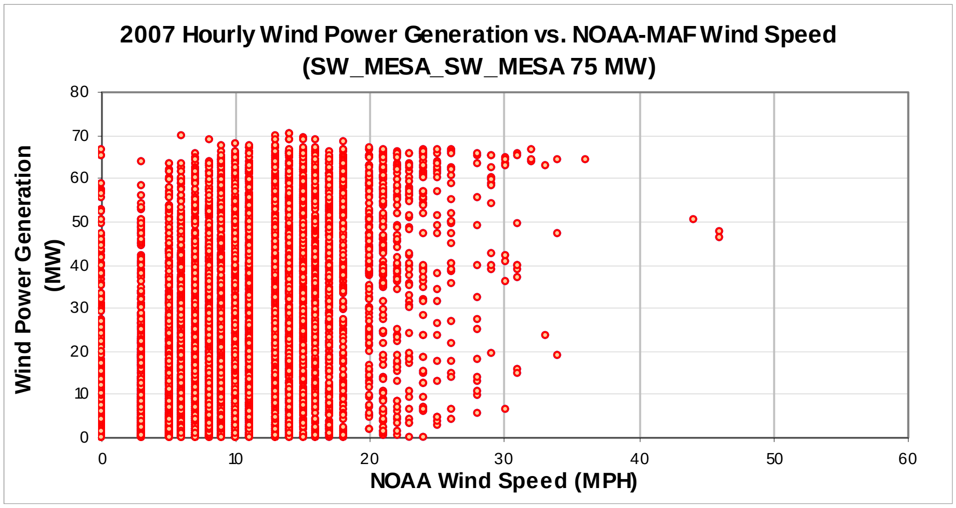
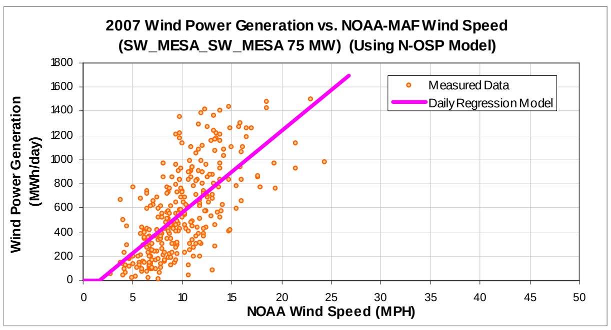


Figure 11-93: SW_MESA_SW_MESA - Hourly Wind Power vs. NOAA Wind Speed (2007)



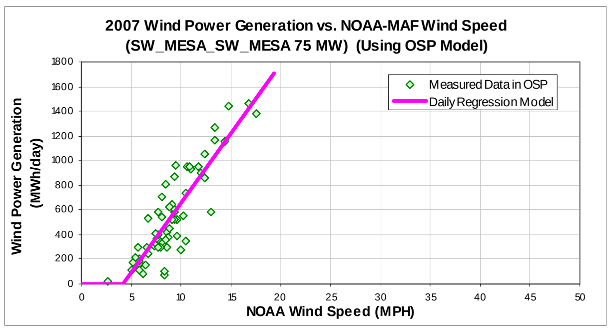


Figure 11-94: SW_MESA_SW_MESA – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-93: SW_MESA_SW_MESA – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-110.7568
Left Slope (MWh/mph-day)	67.4901
RMSE (MWh/day)	267.7022
R2	0.4452
CV-RMSE	47.6%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-470.8379
Left Slope (MWh/mph-day)	112.6634
RMSE (MWh/day)	173.2956
R2	0.7784
CV-RMSE	32.1%

Table 11-94: SW_MESA_SW_MESA – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07	31	9.46	12,588	16,352	-29.90%	23%	29%
Feb-07	28	11.24	16,276	18,147	-11.50%	32%	36%
Mar-07	31	10.28	20,371	18,076	11.26%	37%	32%
Apr-07	30	12.32	20,523	21,615	-5.32%	38%	40%
May-07	31	9.65	15,976	16,766	-4.94%	29%	30%
Jun-07	29	9.98	16,039	16,325	-1.78%	31%	31%
Jul-07	31	8.01	11,755	13,368	-13.72%	21%	24%
Aug-07	31	9.98	20,785	20,273	2.46%	37%	36%
Sep-07	30	8.89	17,310	14,841	14.26%	32%	27%
Oct-07	31	10.21	19,744	17,934	9.16%	35%	32%
Nov-07	30	8.90	15,192	14,697	3.25%	28%	27%
Dec-07	31	8.80	16,633	14,973	9.98%	30%	27%
Total	364	9.80	203,192	203,367	-0.09%	31%	31%
Total in OSP (07/15-09/15)	63	8.97	33,981	34,156	-0.52%	30%	30%

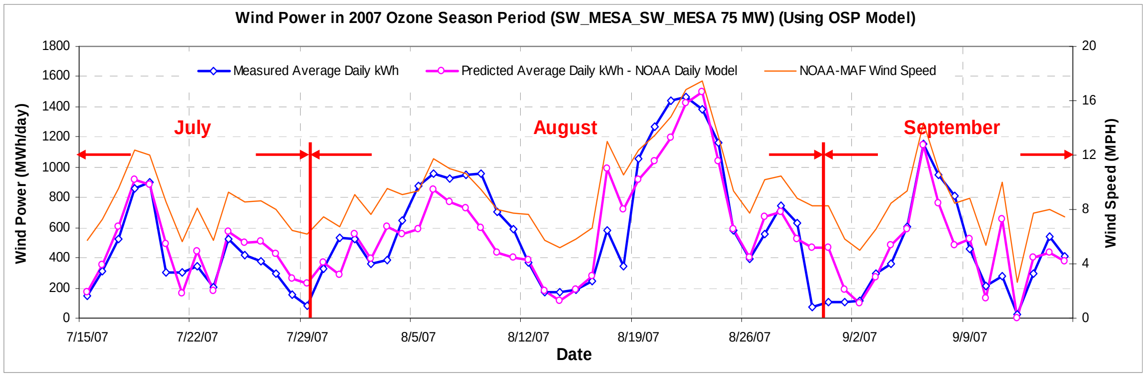


Figure 11-95: SW_MESA_SW_MESA – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

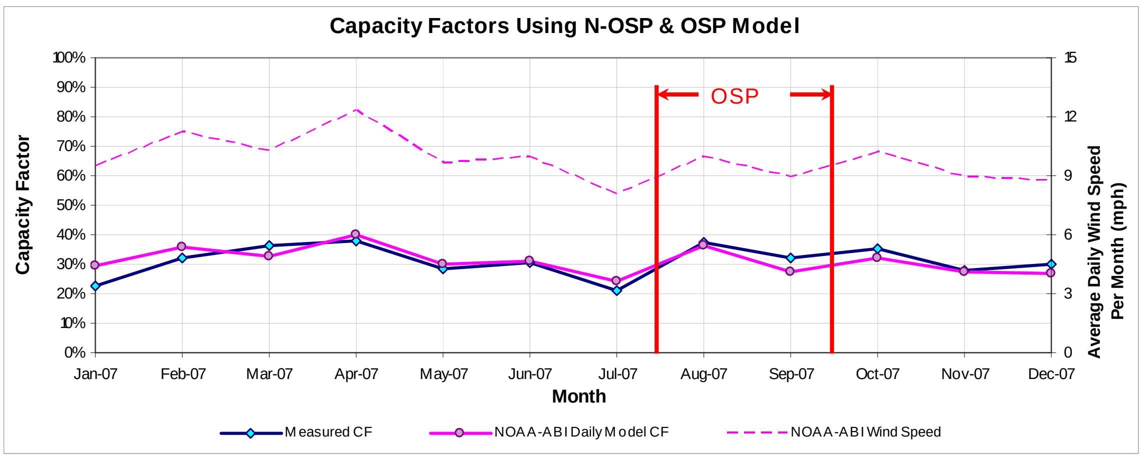


Figure 11-96: SW_MESA_SW_MESA – Predicted Capacity Factors Using Daily Models (2007)

Table 11-95: SW_MESA_SW_MESA – Predicted Power Production in 1999

Annual		OSD	
1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr for Modeling	1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day for Modeling
232,435	203,750	596	539

Note: The 2007 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 365 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.23 Woodward Mountain Ranch (WOODWRD1)

Table 11-96: Site Information for Woodward Mountain Ranch (WOODWRD1)

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Intercon-nection	Weather Station
WOODWRD1	WIND	McCamey	PECOS	Jul-01	80	FPL/Cielo/TXU	Woodward Mountain Ranch	Vestas V-47 (121)	ERCOT	AEP-West	WTU	FST

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
WOODWRD1_WOODWRD1	WOODWRD1	80

11.23.1 Woodward Mountain Ranch (WOODWRD1_WOODWRD1)

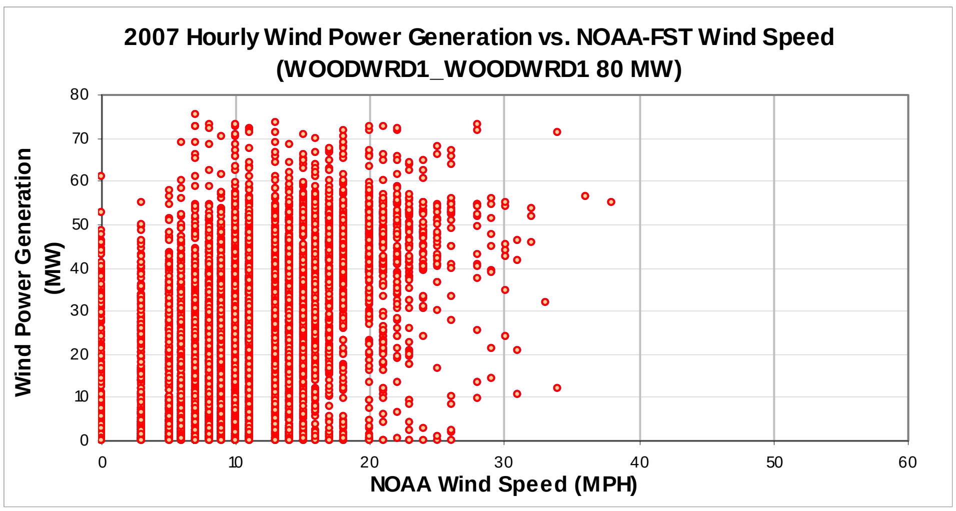


Figure 11-97: WOODWRD1_WOODWRD1 – Hourly Wind Power vs. NOAA Wind Speed (2007)

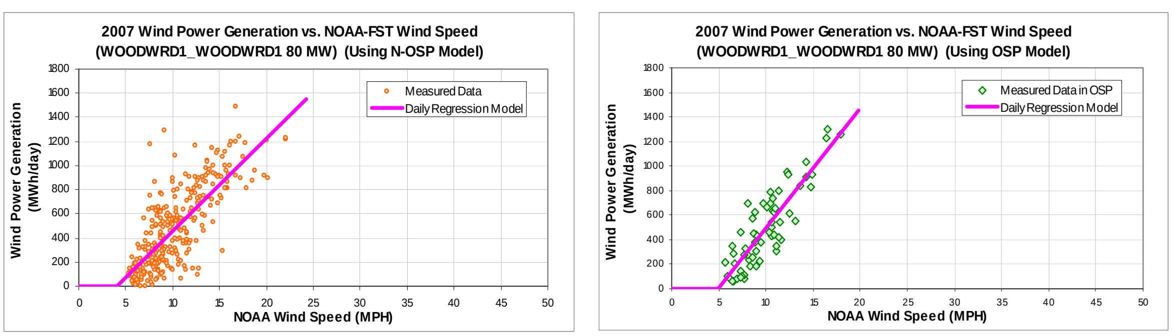


Figure 11-98: WOODWRD1_WOODWRD1 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-97: WOODWRD1_WOODWRD1 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-307.6020
Left Slope (MWh/mph-day)	76.5842
RMSE (MWh/day)	213.9926
R2	0.5846
CV-RMSE	43.6%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-487.4650
Left Slope (MWh/mph-day)	97.9257
RMSE (MWh/day)	154.8833
R2	0.7585
CV-RMSE	31.8%

Table 11-98: WOODWRD1_WOODWRD1 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07	29	9.07	9,975	11,234	-0.13	18%	20%
Feb-07	27	11.21	12,634	14,877	-0.18	24%	29%
Mar-07	31	11.67	17,558	18,162	-0.03	29%	31%
Apr-07	30	12.99	18,108	20,610	-0.14	31%	36%
May-07	28	10.00	11,646	12,837	-0.10	22%	24%
Jun-07	30	10.19	13,559	14,177	-0.05	24%	25%
Jul-07	30	9.51	11,522	13,153	-0.14	20%	23%
Aug-07	31	10.51	18,202	16,806	0.08	31%	28%
Sep-07	29	9.95	15,623	13,304	0.15	28%	24%
Oct-07	31	10.27	17,553	14,853	0.15	29%	25%
Nov-07	27	8.88	10,934	10,053	0.08	21%	19%
Dec-07	31	9.67	16,177	13,423	0.17	27%	23%
Total	354	10.34	173,490	173,490	0.00	26%	26%
Total in OSP (07/15-09/15)	63	9.95	30,706	30,706	0.00	25%	25%

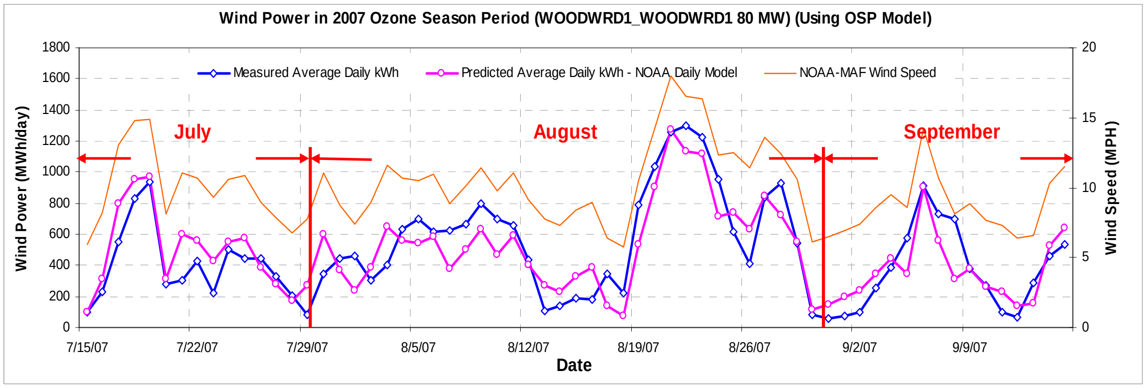


Figure 11-99: WOODWRD1_WOODWRD1 – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

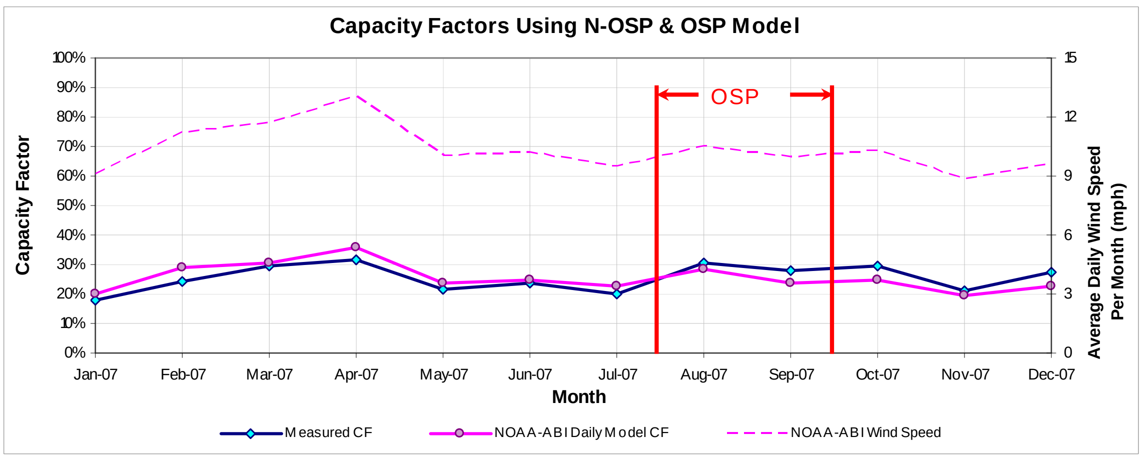


Figure 11-100: WOODWRD1_WOODWRD1 – Predicted Capacity Factors Using Daily Models (2007)

Table 11-99: WOODWRD1_WOODWRD1 – Predicted Power Production in 1999

Annual		OSD	
1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr for Modeling	1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day for Modeling
202,553	178,881	488	487

Note: The 2007 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 365 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.24 Woodward Mountain Ranch (WOODWRD2)

Table 11-100: Site Information for Woodward Mountain Ranch (WOODWRD2)

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Intercon-nection	Weather Station
WOODWRD2	WIND	McCamey	PECOS	Jul-01	80	FPL/Cielo/TXU	Woodward Mountain Ranch	Vestas V-47 (121)	ERCOT	AEP-West	WTU	FST

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
WOODWRD2_WOODWRD2	WOODWRD2	80

11.24.1 Woodward Mountain Ranch (WOODWRD2_WOODWRD2)

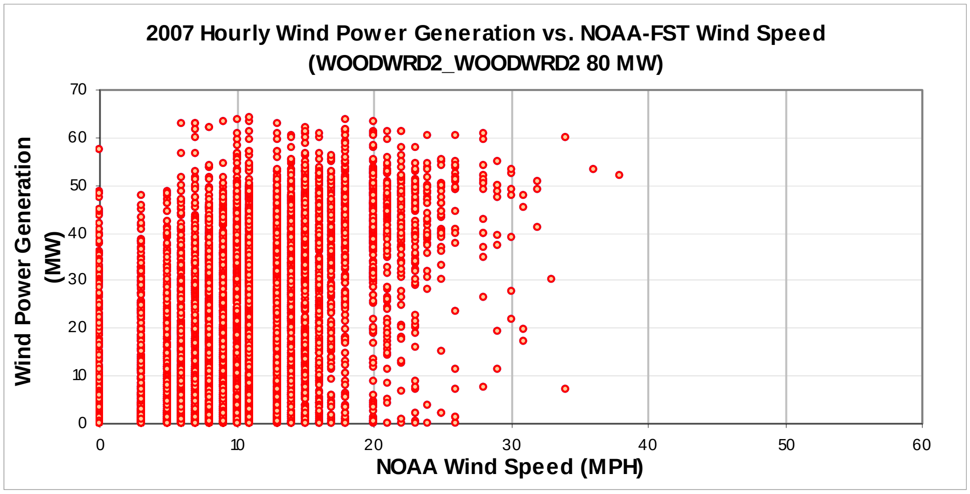
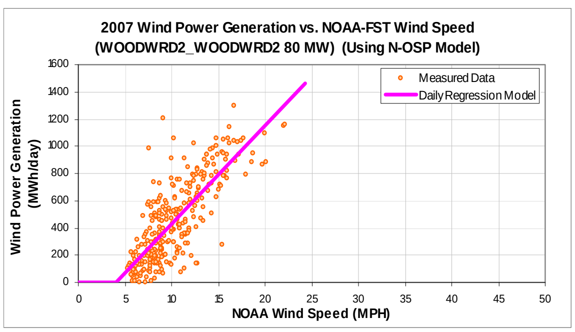


Figure 11-101: WOODWRD2_WOODWRD2 – Hourly Wind Power vs. NOAA Wind Speed (2007)



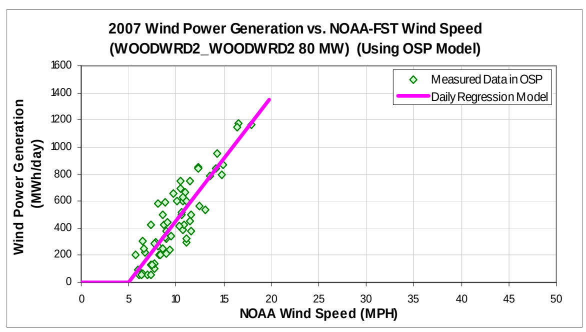


Figure 11-102: WOODWRD2_WOODWRD2 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-101: WOODWRD2_WOODWRD2 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-295.3532
Left Slope (MWh/mph-day)	72.3576
RMSE (MWh/day)	189.0851
R2	0.6167
CV-RMSE	41.2%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-446.4468
Left Slope (MWh/mph-day)	90.8552
RMSE (MWh/day)	134.9829
R2	0.7806
CV-RMSE	29.5%

Table 11-102: WOODWRD2_WOODWRD2 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07	29	9.07	9,465	10,477	-10.69%	17%	19%
Feb-07	27	11.21	12,170	13,929	-14.45%	23%	27%
Mar-07	31	11.67	16,245	17,013	-4.73%	27%	29%
Apr-07	30	12.99	17,518	19,331	-10.35%	30%	34%
May-07	28	10.00	11,145	11,996	-7.63%	21%	22%
Jun-07	30	10.19	13,024	13,253	-1.76%	23%	23%
Jul-07	30	9.51	10,938	12,323	-12.67%	19%	21%
Aug-07	31	10.51	17,262	15,770	8.65%	29%	26%
Sep-07	29	9.95	14,014	12,493	10.85%	25%	22%
Oct-07	31	10.27	16,186	13,887	14.21%	27%	23%
Nov-07	27	8.88	10,035	9,370	6.63%	19%	18%
Dec-07	31	9.67	14,376	12,535	12.80%	24%	21%
Total	354	10.34	162,378	162,378	0.00%	24%	24%
Total in OSP (07/15-09/15)	63	9.95	28,850	28,850	0.00%	24%	24%

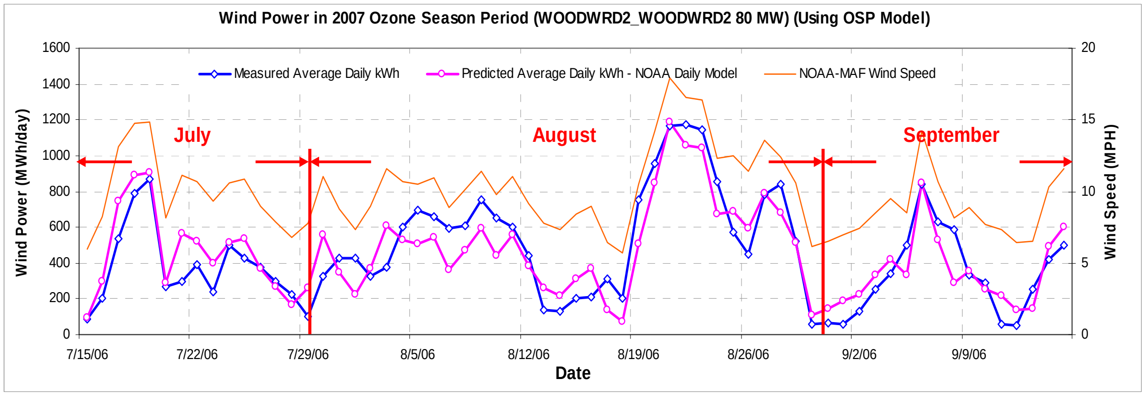


Figure 11-103: WOODWRD2_WOODWRD2 – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

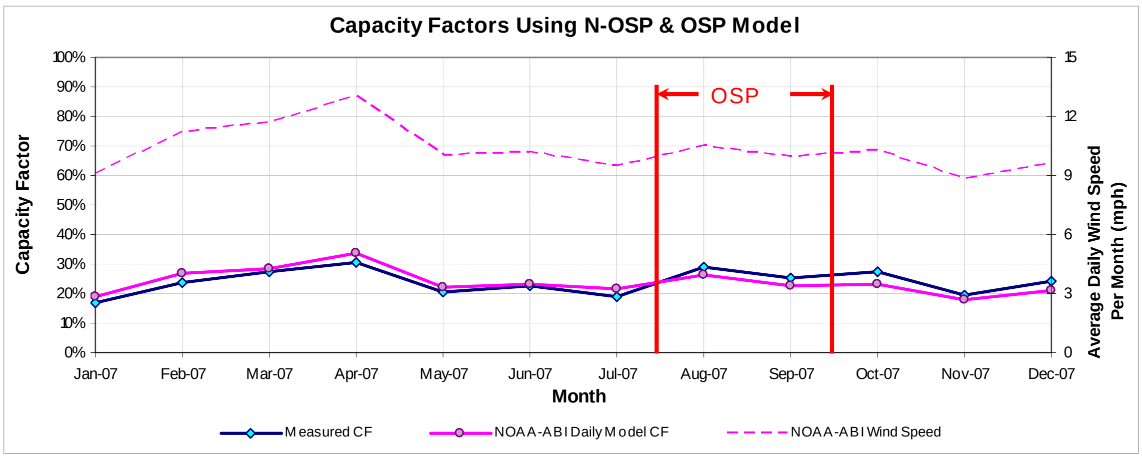


Figure 11-104: WOODWRD2_WOODWRD2 – Predicted Capacity Factors Using Daily Models (2007)

Table 11-103: WOODWRD2_WOODWRD2 – Predicted Power Production in 1999

Annual		OSD	
1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr for Modeling	1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day for Modeling
189,790	167,424	458	458

Note: The 2007 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 365 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.25 Buffalo Gap2 (BUFF_GAP_UNIT2)

Table 11-104: Site Information for Buffalo Gap (BUFF_GAP_UNIT2)

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
BUFF_CAP	WIND	Abilene	TAYLOR	May-07	233	AES Corporation	Buffalo Gap2	Vestas 1.8 MW (67)	ERCOT	AEP-West	AEP-TNC	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
BUFF_GAP_UNIT2	BUFF_CAP	233

11.26 Buffalo Gap2 (BUFF_GAP_UNIT2)

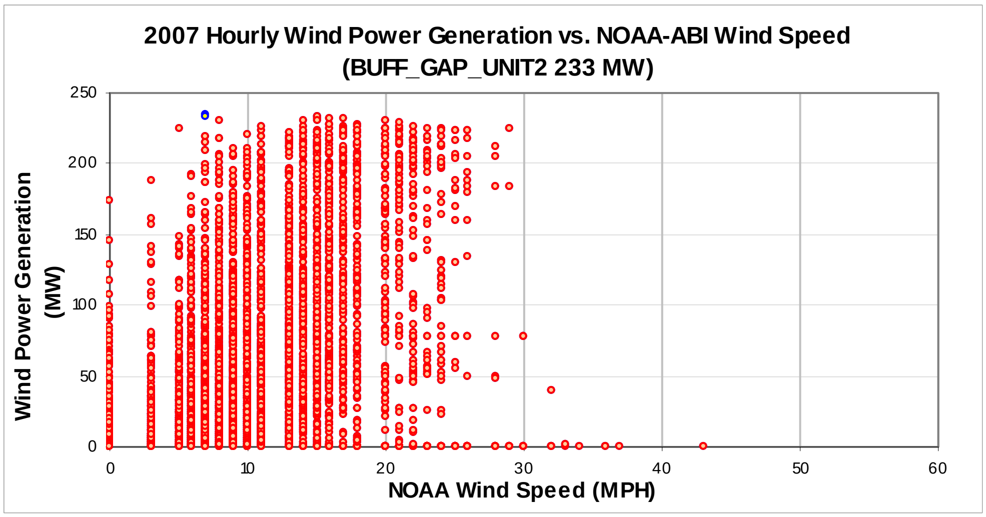
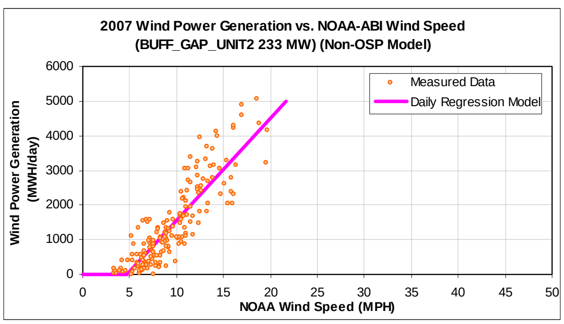


Figure 11-105: BUFF_GAP_UNIT2 – Hourly Wind Power vs. NOAA Wind Speed (2007)



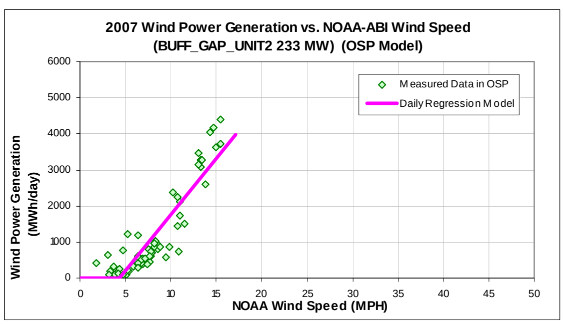


Figure 11-106: BUFF_GAP_UNIT2 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-105: BUFF_GAP_UNIT2 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-1378.88
Left Slope (MWh/mph-day)	294.72
RMSE (MWh/day)	582.9618
R2	0.7619
CV-RMSE	40.4%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-1369.732
Left Slope (MWh/mph-day)	312.5814
RMSE (MWh/day)	530.11
R2	0.809
CV-RMSE	44.4%

Table 11-106: BUFF_GAP_UNIT2 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07							
Feb-07							
Mar-07							
Apr-07							
May-07	27	8.25	16,789	29,674	-76.75%	11%	20%
Jun-07	28	9.05	22,802	36,426	-59.75%	15%	23%
Jul-07	31	6.95	19,973	24,624	-23.28%	12%	14%
Aug-07	31	9.10	50,595	46,448	8.20%	29%	27%
Sep-07	30	9.04	40,246	41,322	-2.67%	24%	25%
Oct-07	30	10.77	59,416	54,262	8.67%	35%	32%
Nov-07	29	10.16	57,006	46,958	17.63%	35%	29%
Dec-07	30	10.36	58,126	50,220	13.60%	35%	30%
Total	236	9.21	324,954	329,933	-1.53%	25%	25%
Total in OSP (07/15-09/15)	63	8.20	75,246	77,676	-3.23%	21%	22%

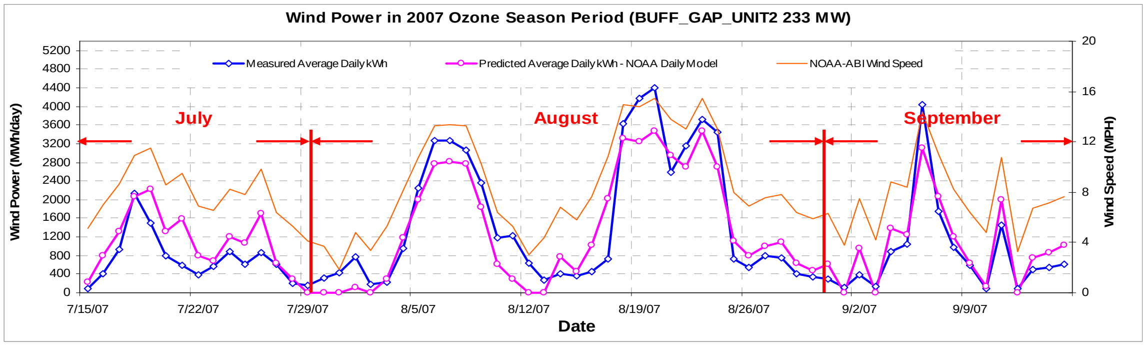


Figure 11-107: BUFF_GAP_UNIT2 – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

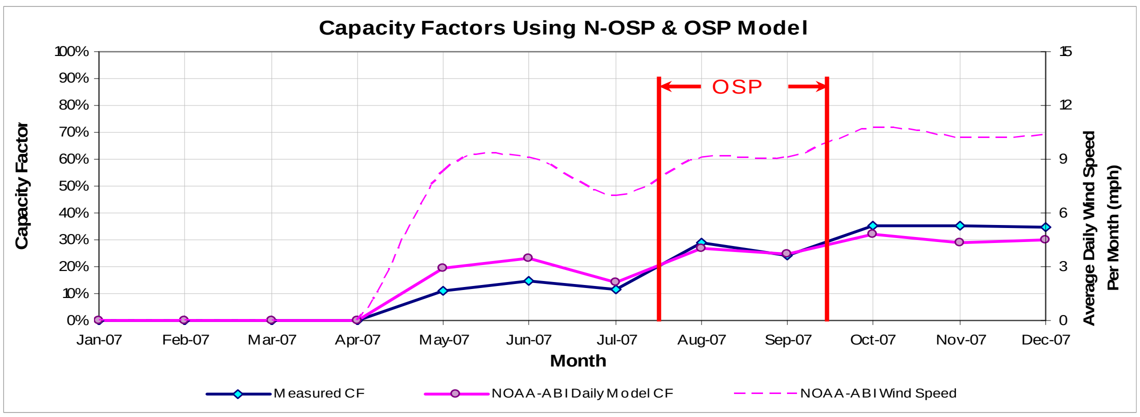


Figure 11-108: BUFF_GAP_UNIT2 – Predicted Capacity Factors Using Daily Models (2007)

Table 11-107: BUFF_GAP_UNIT2 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr
724,458	502,577

OSD

1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day
1,665	1,194

1999 (May-Dec) Estimated MWh/yr (2007 Daily Model)	2007 (May-Dec) Measured MWh/yr
451,147	337,346

Note: The 2007 (May-Dec) Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 245 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.27 Capricorn Ridge Wind (CAPRIDGE_CR1)

Table 11-108: Site Information for Capricorn Ridge Wind (CAPRIDGE_CR1)

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
CAPRIDGE_CR1	WIND	ABILENE	Sterling	Sep-07	214.5	FPL Energy	Capricorn Ridge Wind	FPL Energy	ERCOT		LCRA	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
CAPRIDGE_CR1	CAPRIDGE_CR1	214.5

11.27.1 Capricorn Ridge Wind (CAPRIDGE_CR1)

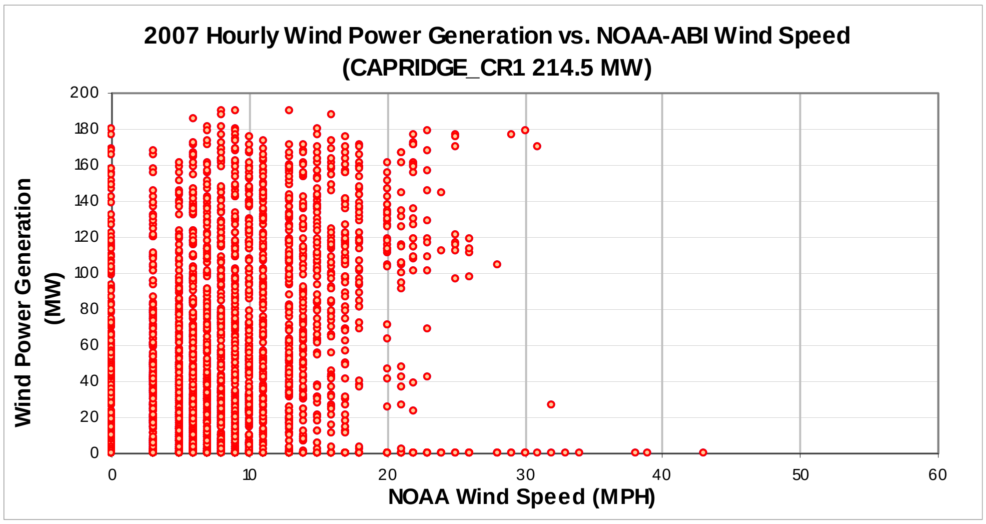
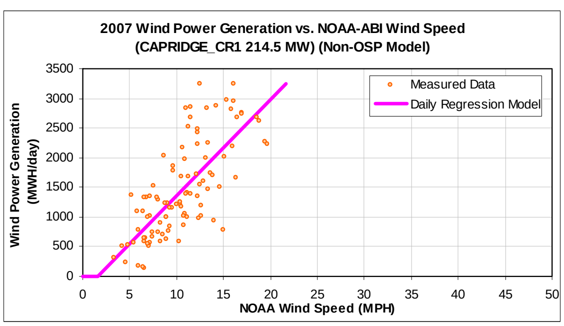


Figure 11-109: CAPRIDGE_CR1 – Hourly Wind Power vs. NOAA Wind Speed (2007)



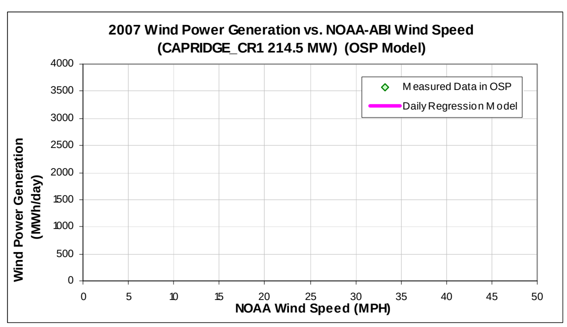


Figure 11-110: CAPRIDGE_CR1 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-109: CAPRIDGE_CR1 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-250.3573
Left Slope (MWh/mph-day)	161.4228
RMSE (MWh/day)	546.4666
R2	0.5433
CV-RMSE	37.5%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	
Left Slope (MWh/mph-day)	
RMSE (MWh/day)	
R2	
CV-RMSE	

Table 11-110: CAPRIDGE_CR1 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07							
Feb-07							
Mar-07							
Apr-07							
May-07							
Jun-07							
Jul-07							
Aug-07							
Sep-07	15	10.56	13,908	21,810	-56.81%	18%	28%
Oct-07	29	11.26	38,992	45,436	-16.53%	26%	30%
Nov-07	28	10.57	46,090	40,759	11.57%	32%	28%
Dec-07	28	9.92	46,859	37,845	19.24%	33%	26%
Total	100	10.59	145,850	145,850	0.00%	28%	28%
Total in OSP (07/15-09/15)							

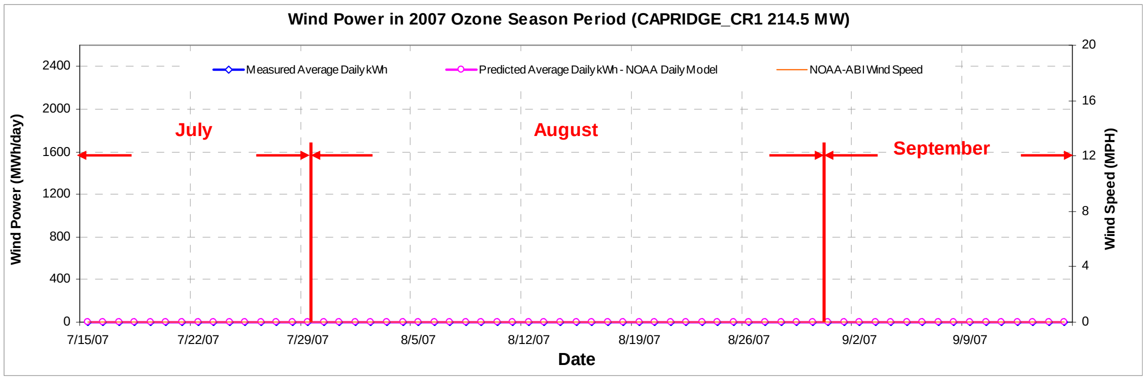


Figure 11-111: CAPRIDGE_CR1 – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

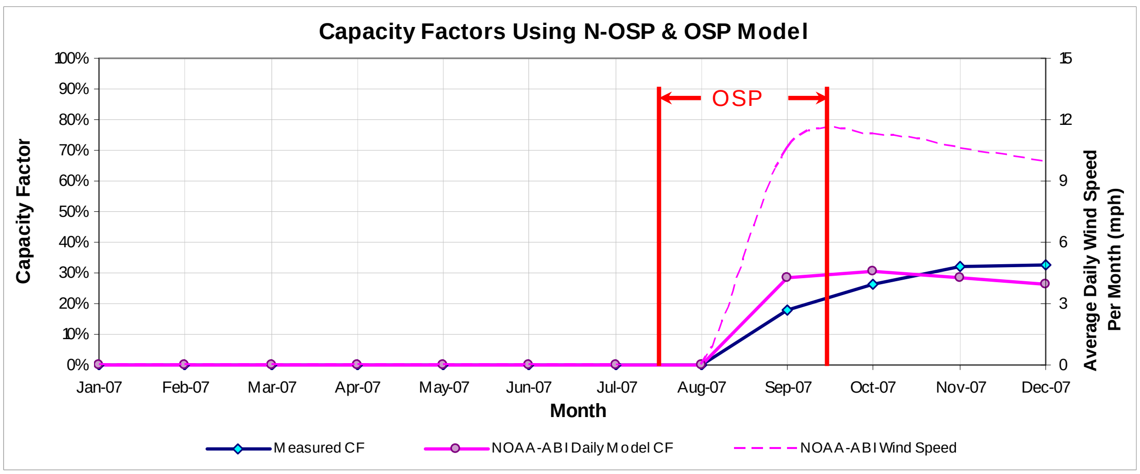


Figure 11-112: CAPRIDGE_CR1 – Predicted Capacity Factors Using Daily Models (2007)

Table 11-111: CAPRIDGE_CR1 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr
490,972	532,351

OSD

1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day

1999 (Sep-Dec) Estimated MWh/yr (2007 Daily Model)	2007 (Sep-Dec) Measured MWh/yr
150,290	177,936

Note: The 2007 (Sep-Dec) Measured MWh/yr presented in the above table includes only validated data and it was adjusted to 122 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.28 Capricorn Ridge Wind (CAPRIDGE_CR2)

Table 11-112: Site Information for Capricorn Ridge Wind (CAPRIDGE_CR2)

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
CAPRIDGE_CR2	WIND	ABILENE	Sterling	Sep-07	149.5	FPL Energy	Capricorn Ridge Wind	GE Energy	ERCOT		LCRA	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
CAPRIDGE_CR2	CAPRIDGE_CR2	149.5

11.28.1 Capricorn Ridge Wind (CAPRIDGE_CR2)

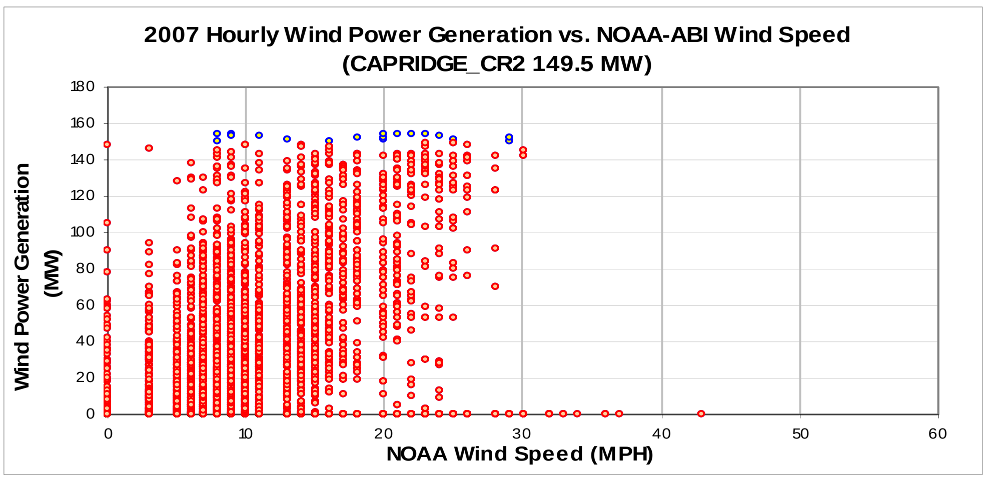


Figure 11-113: CAPRIDGE_CR2 – Hourly Wind Power vs. NOAA Wind Speed (2007)

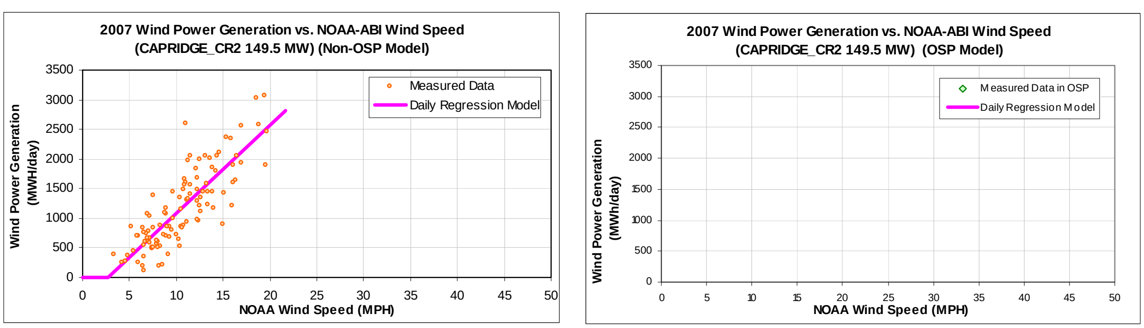


Figure 11-114: CAPRIDGE_CR2 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-113: CAPRIDGE_CR2 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-399.4675
Left Slope (MWh/mph-day)	148.4157
RMSE (MWh/day)	374.5225
R2	0.6879
CV-RMSE	31.8%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	
Left Slope (MWh/mph-day)	
RMSE (MWh/day)	
R2	
CV-RMSE	

Table 11-114: CAPRIDGE_CR2 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07							
Feb-07							
Mar-07							
Apr-07							
May-07							
Jun-07							
Jul-07							
Aug-07							
Sep-07	15	10.56	14,560	17,513	-20.28%	27%	33%
Oct-07	31	11.05	41,416	38,453	7.15%	37%	35%
Nov-07	30	10.37	32,421	34,175	-5.41%	30%	32%
Dec-07	31	10.51	37,700	35,956	4.62%	34%	32%
Total	107	10.63	126,098	126,098	0.00%	33%	33%
Total in OSP (07/15-09/15)							

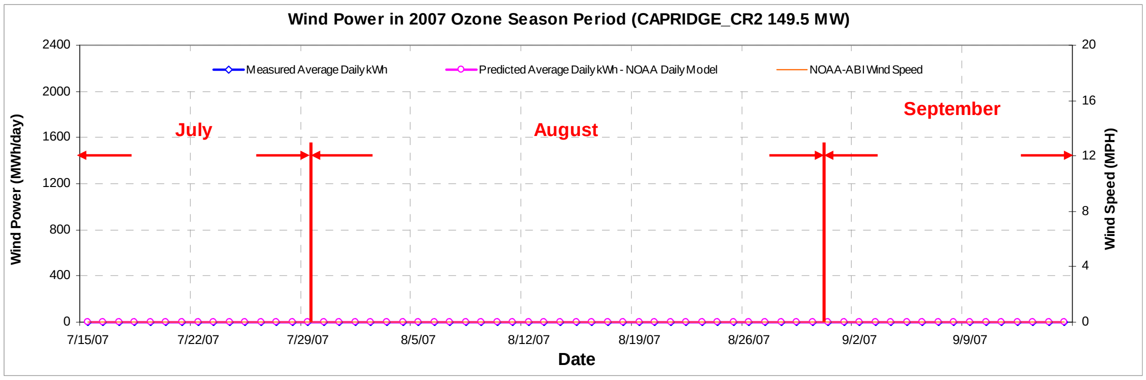


Figure 11-115: CAPRIDGE_CR2 – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

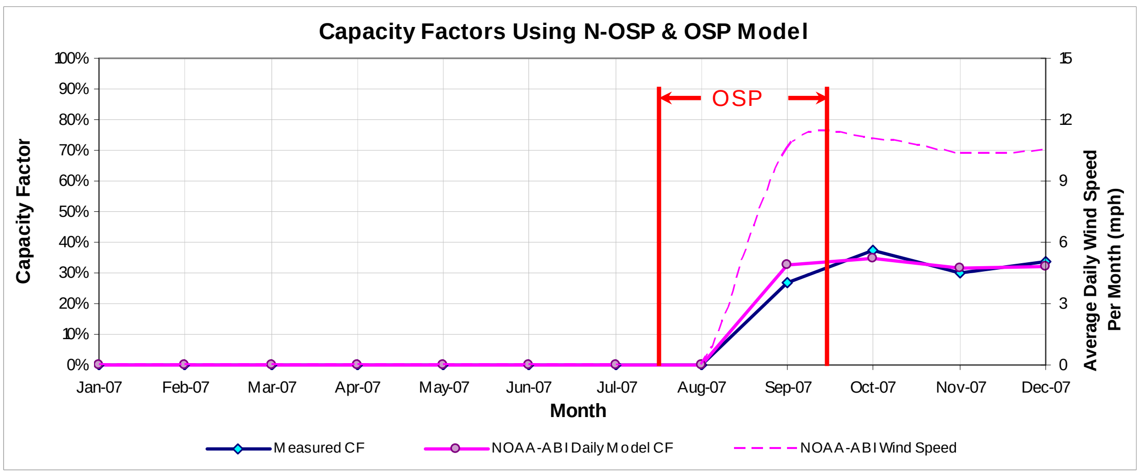


Figure 11-116: CAPRIDGE_CR2 – Predicted Capacity Factors Using Daily Models (2007)

Table 11-115: CAPRIDGE_CR2 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr
400,311	430,146

OSD

1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day

1999 (Sep-Dec) Estimated MWh/yr (2007 Daily Model)	2007 (Sep-Dec) Measured MWh/yr
120,091	143,775

Note: The 2007 (Sep-Dec) Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 122 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.29 Camp Springs Wind Energy Center (CSEC_CSECG1)

Table 11-116: Site Information for Camp Springs Wind Energy Center (CSEC_CSECG1)

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
CSEC_CSECG1	WIND	Lubbock	Scurry	Jun-07	135	FPL ENERGY	Camp Springs Wind Energy Center	GE Energy	ERCOT		Oncor	LBB	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
CSEC_CSECG1	CSEC_CSEC	135

11.29.1 Camp Springs Wind Energy Center (CSEC_CSECG1)

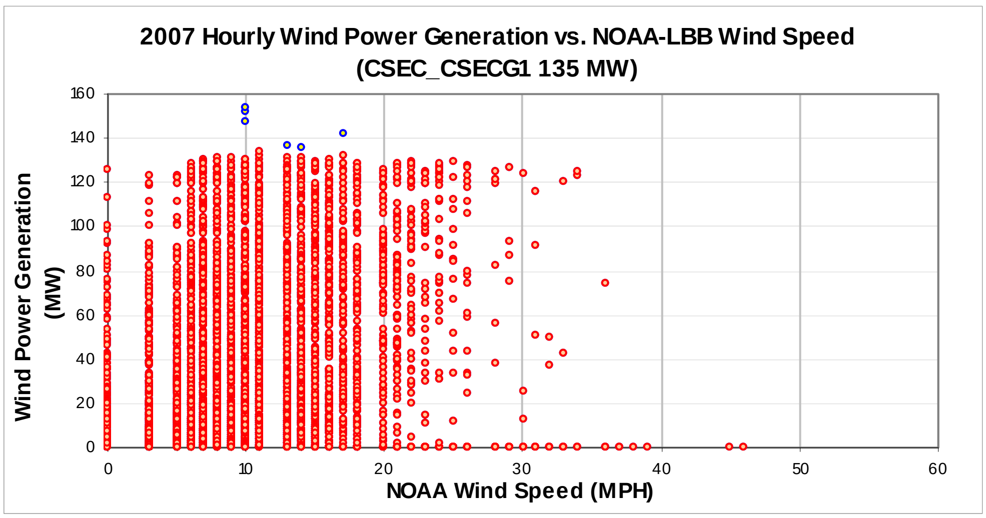


Figure 11-117: CSEC_CSECG1– Hourly Wind Power vs. NOAA Wind Speed (2007)

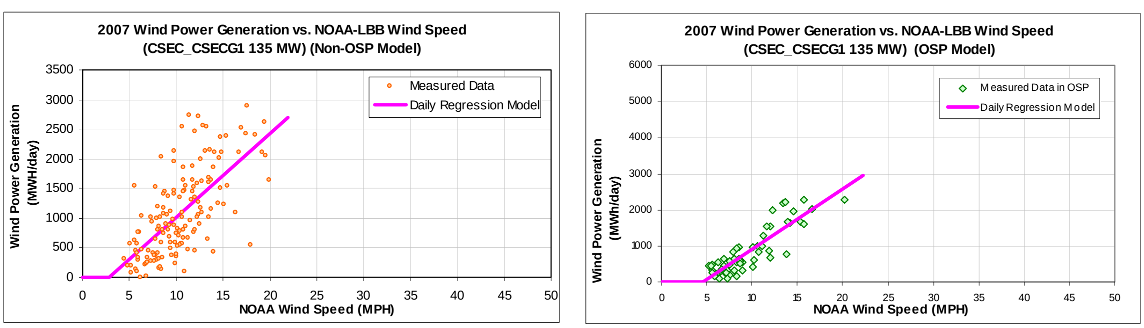


Figure 11-118: CSEC_CSECG1– Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-117: CSEC_CSECG1 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-397.1139
Left Slope (MWh/mph-day)	141.4519
RMSE (MWh/day)	539.0513
R2	0.4421
CV-RMSE	49.7%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-768.8942
Left Slope (MWh/mph-day)	166.2396
RMSE (MWh/day)	294.4827
R2	0.7789
CV-RMSE	36.6%

Table 11-118: CSEC_CSECG1 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07							
Feb-07							
Mar-07							
Apr-07							
May-07							
Jun-07	30	10.57	19,958	32,950	-65.10%	21%	34%
Jul-07	31	8.07	14,849	20,247	-36.36%	15%	20%
Aug-07	31	10.56	33,252	30,559	8.10%	33%	30%
Sep-07	30	9.67	28,150	26,740	5.01%	29%	28%
Oct-07	31	11.50	41,498	38,099	8.19%	41%	38%
Nov-07	30	10.20	35,323	31,377	11.17%	36%	32%
Dec-07	31	10.67	41,441	34,498	16.75%	41%	34%
Total	214	10.18	214,472	214,472	0.00%	31%	31%
Total in OSP (07/15-09/15)	63	9.47	50,735	50,735	0.00%	25%	25%

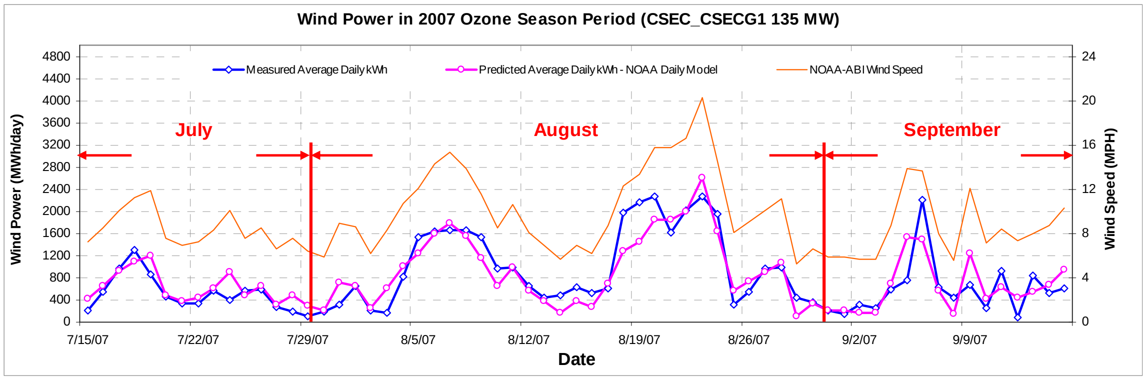


Figure 11-119: CSEC_CSECG1 – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

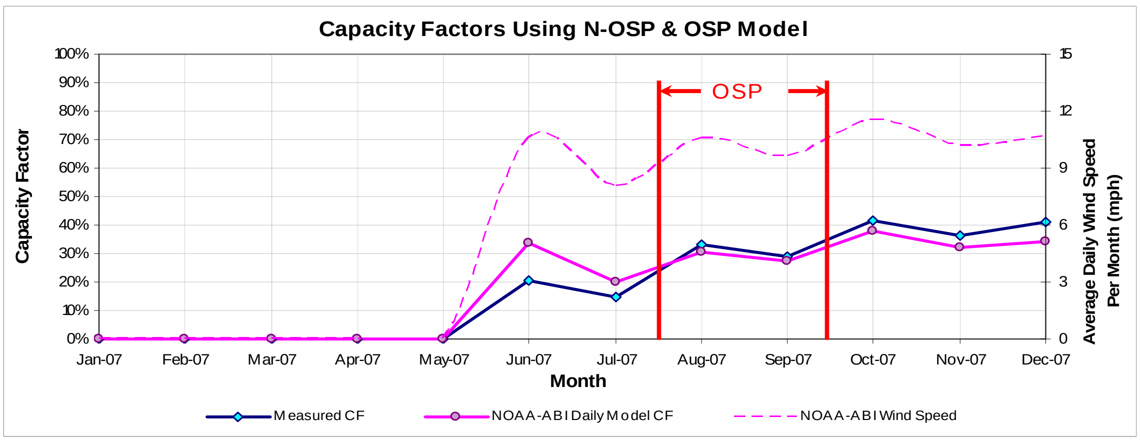


Figure 11-120: CSEC_CSECG1 – Predicted Capacity Factors Using Daily Models (2007)

Table 11-119: CSEC_CSECG1 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr
468,181	365,804

OSD

1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day
868	805

1999 (Jun-Dec) Estimated MWh/yr (2007 Daily Model)	2007 (Jun-Dec) Measured MWh/yr
236,787	214,472

Note: The 2007 (Jun-Dec) Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 214 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.30 Lone Star – Mesquite Wind (LNCRK_G83)

Table 11-120: Site Information for Lone Star – Mesquite Wind (LNCRK_G83)

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
LNCRK_G83	WIND	Abilene	Shackleford	Mar-07	200	Horizon Wind Energy	LNCRK_G83	Vestas 1.8 MW (67)	ERCOT		Oncor	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
LNCRK_G83	LNCRK_G83	200

11.30.1 Lone Star – Mesquite Wind (LNCRK_G83)

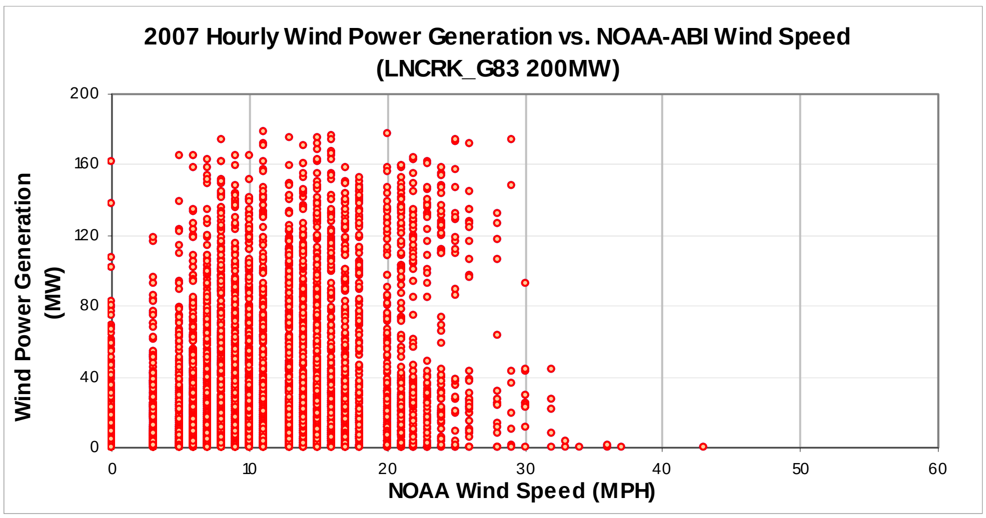


Figure 11-121: LNCRK_G83– Hourly Wind Power vs. NOAA Wind Speed (2007)

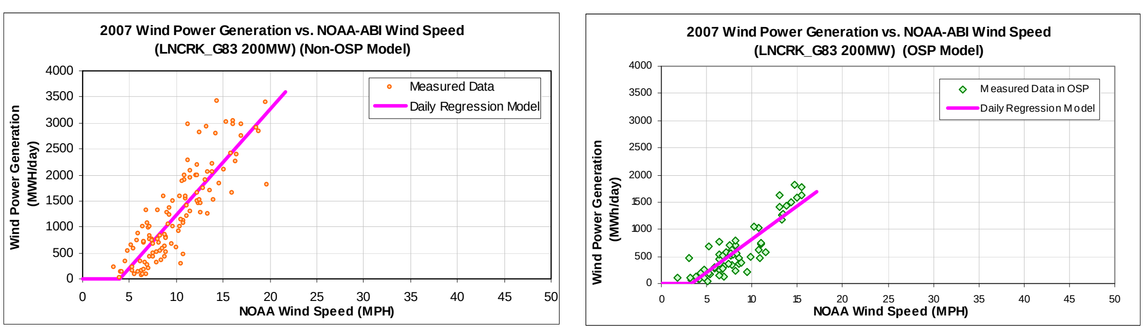


Figure 11-122: LNCRK_G83– Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-121: LNCRK_G83 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-794.5221
Left Slope (MWh/mph-day)	203.2856
RMSE (MWh/day)	453.1796
R2	0.7340
CV-RMSE	36.2%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-413.2860
Left Slope (MWh/mph-day)	123.3985
RMSE (MWh/day)	225.3374
R2	0.7856
CV-RMSE	37.6%

Table 11-122: LNCRK_G83 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07							
Feb-07							
Mar-07							
Apr-07							
May-07							
Jun-07							
Jul-07	31	6.95	8,415	16,127	-91.64%	6%	11%
Aug-07	31	9.10	25,294	22,032	12.90%	17%	15%
Sep-07	30	9.04	23,730	28,019	-18.07%	16%	19%
Oct-07	30	10.77	40,497	41,957	-3.60%	28%	29%
Nov-07	30	10.37	41,313	39,388	4.66%	29%	27%
Dec-07	30	10.36	47,261	39,337	16.77%	33%	27%
Total	182	9.42	186,511	186,859	-0.19%	21%	21%
Total in OSP (07/15-09/15)	63	8.20	37,734	37,974	-0.63%	12%	13%

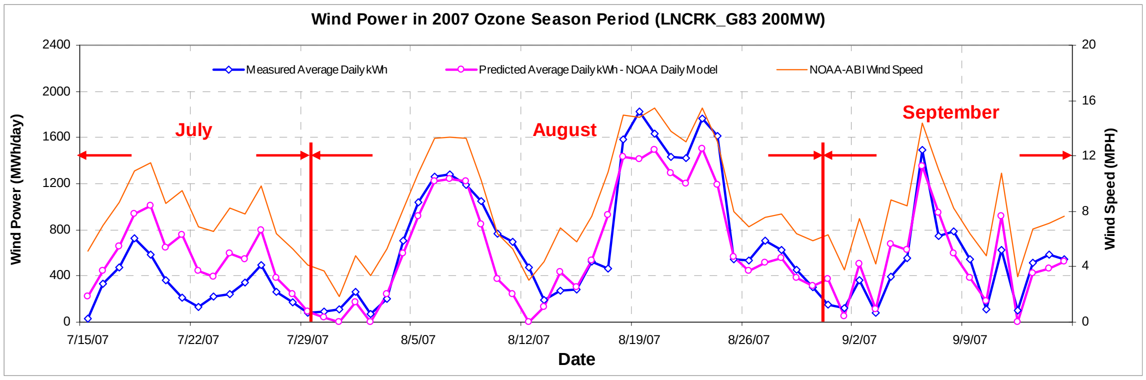


Figure 11-123: LNCRK_G83 – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

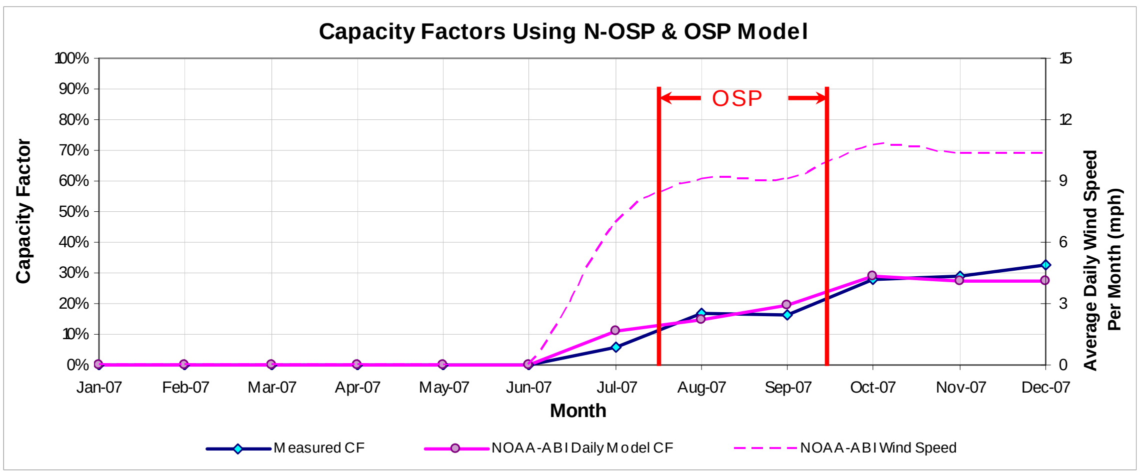


Figure 11-124: LNCRK_G83 – Predicted Capacity Factors Using Daily Models (2007)

Table 11-123: LNCRK_G83 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr
523,340	374,047

OSD

1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day
785	599

1999 (Jul-Dec) Estimated MWh/yr (2007 Daily Model)	2007 (Jul-Dec) Measured MWh/yr
208,662	188,561

Note: The 2007 (Mar-Dec) Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 306 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.31 Forest Creek Wind Farm (MCDLD_FCW1)

Table 11-124: Site Information for Forest Creek Wind Farm (MCDLD_FCW1)

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
MDCDLD_FCW1	WIND	ABILENE	STERLING	Jan-07	125	Airtricity	Forest Creek Wind Farm	Siemens	ERCOT		TXU-ED	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
MCDLD_FCW1	MCDLD_FCW1	125

11.31.1 Forest Creek Wind Farm (MCDLD_FCW1)

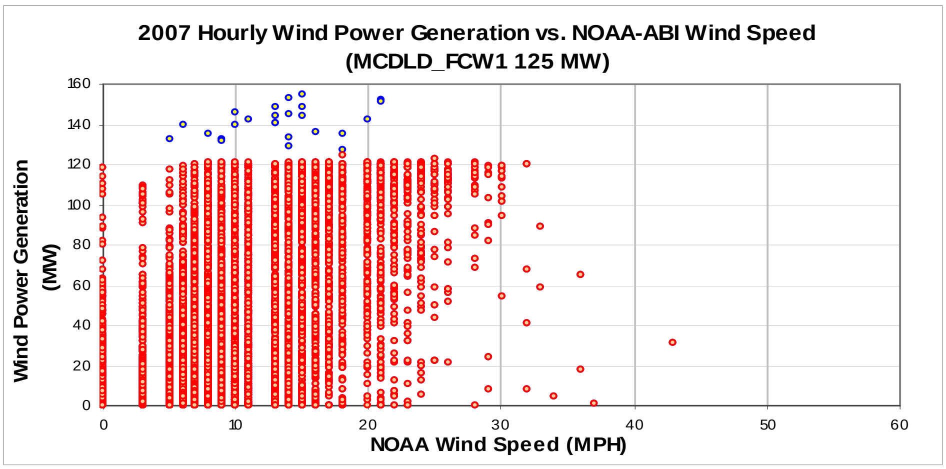


Figure 11-125: MCDLD_FCW1 – Hourly Wind Power vs. NOAA Wind Speed (2007)

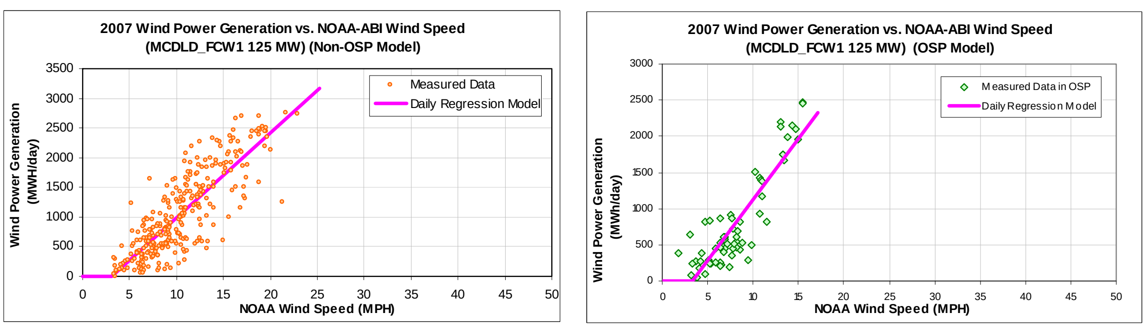


Figure 11-126: MCDLD_FCW1 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-125: MCDLD_FCW1 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-443.894
Left Slope (MWh/mph-day)	142.9576
RMSE (MWh/day)	386.7189
R2	0.6902
CV-RMSE	36.4%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-574.7724
Left Slope (MWh/mph-day)	169.8109
RMSE (MWh/day)	315.6254
R2	0.7796
CV-RMSE	38.6%

Table 11-126: MCDLD_FCW1 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07	27	9.17	12,567	23,423	-86.38%	16%	29%
Feb-07	28	12.04	31,982	35,772	-11.85%	38%	43%
Mar-07	31	11.82	36,123	38,603	-6.87%	39%	42%
Apr-07	30	12.85	40,746	41,805	-2.60%	45%	46%
May-07	31	9.32	26,136	27,524	-5.31%	28%	30%
Jun-07	30	9.53	27,826	27,533	1.05%	31%	31%
Jul-07	31	6.95	15,560	18,370	-18.06%	17%	20%
Aug-07	31	9.10	34,332	30,143	12.20%	37%	32%
Sep-07	30	9.04	27,183	26,551	2.33%	30%	30%
Oct-07	31	11.05	41,152	35,207	14.45%	44%	38%
Nov-07	29	10.17	34,153	29,295	14.22%	39%	34%
Dec-07	31	10.51	38,914	32,801	15.71%	42%	35%
Total	360	10.12	366,674	367,027	-0.10%	34%	34%
Total in OSP (07/15-09/15)	63	8.20	51,546	51,900	-0.69%	27%	27%

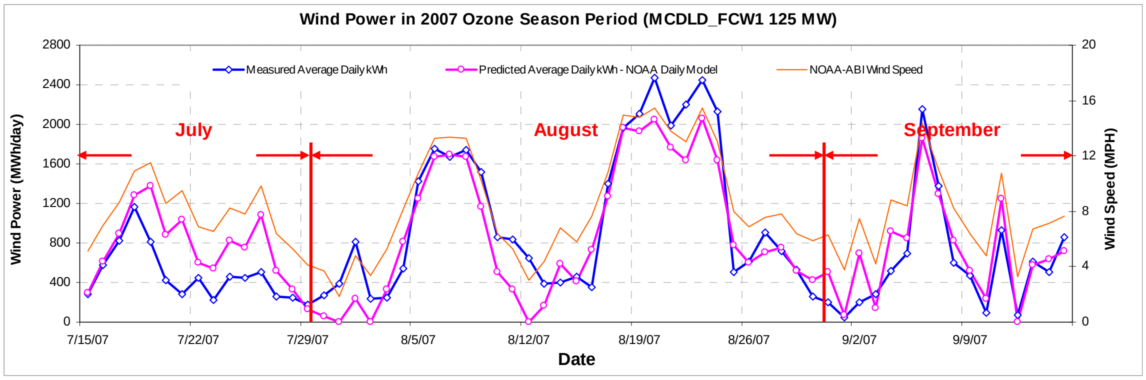


Figure 11-127: MCDLD_FCW1 – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

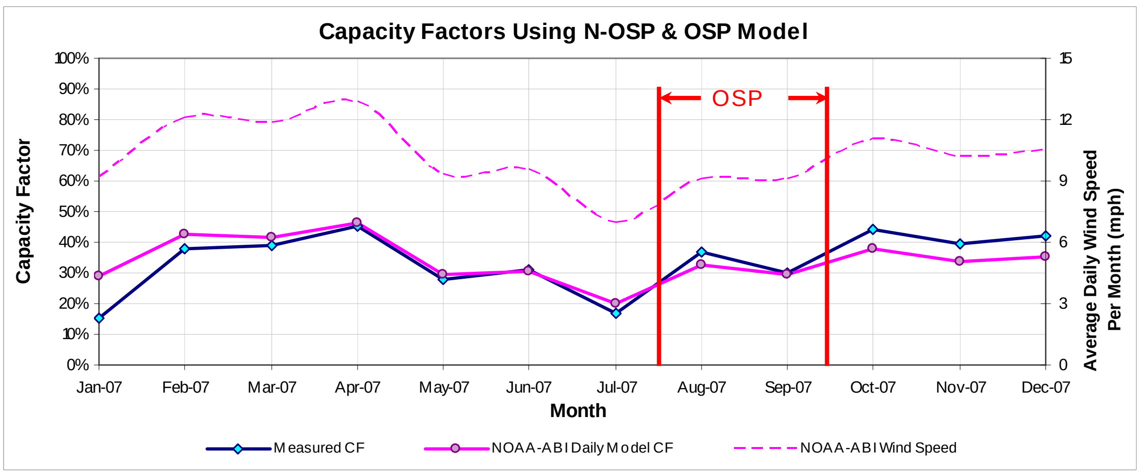


Figure 11-128: MCDLD_FCW1 – Predicted Capacity Factors Using Daily Models (2007)

Table 11-127: MCDLD_FCW1 – Predicted Power Production in 1999

Annual		OSD	
1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr	1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day
435,455	371,766	1,074	818

Note: The 2007 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 365 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.32 Sand Bluff Wind Farm (MCDLD_SBW1)

Table 11-128: Site Information for Sand Bluff Wind Farm (MCDLD_SBW1)

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
MDCDLD_SBW1	WIND	ABILENE	STERLING	Jan-07	90	Airtricity	Sand Bluff Wind Farm	Siemens	ERCOT		TXU-ED	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
MCDLD_SBW1	MCDLD_SBW2	90

11.32.1 Sand Bluff Wind Farm (MCDLD_SBW1)

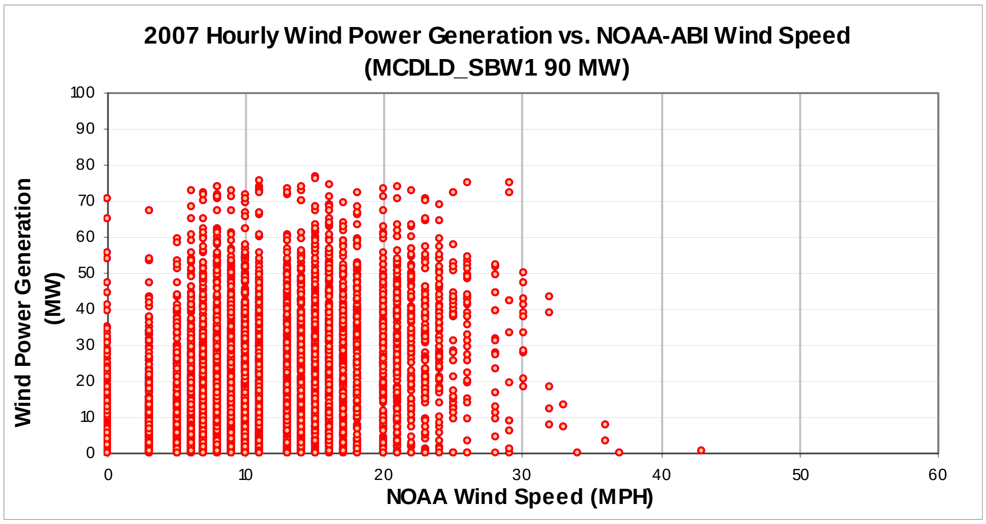


Figure 11-129: MCDLD_SBW1 – Hourly Wind Power vs. NOAA Wind Speed (2007)

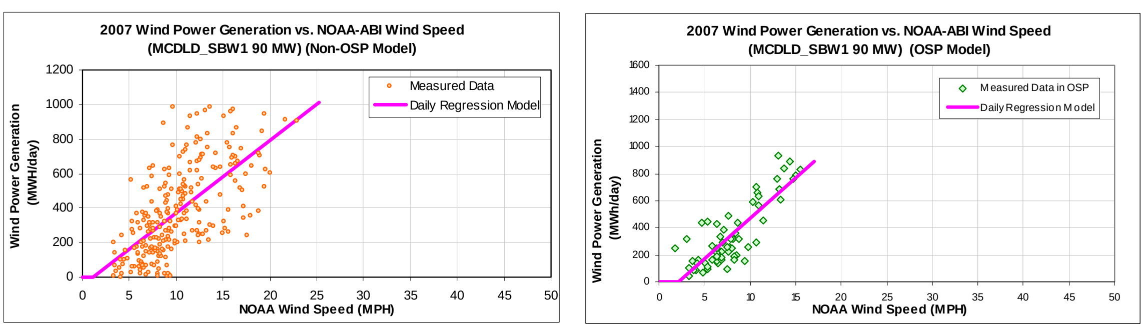


Figure 11-130: MCDLD_SBW1 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-129: MCDLD_SBW1 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-30.3215
Left Slope (MWh/mph-day)	41.0793
RMSE (MWh/day)	194.4011
R2	0.4151
CV-RMSE	49.6%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-133.7765
Left Slope (MWh/mph-day)	60.3486
RMSE (MWh/day)	132.4880
R2	0.7050
CV-RMSE	37.4%

Table 11-130: MCDLD_SBW1 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07							
Feb-07	17	10.99	2,566	7,160	-179.03%	7%	19%
Mar-07	27	12.00	9,208	12,486	-35.60%	16%	21%
Apr-07	29	12.92	11,831	14,517	-22.70%	19%	23%
May-07	31	9.32	8,394	10,923	-30.13%	13%	16%
Jun-07	30	9.53	9,343	10,829	-15.90%	14%	17%
Jul-07	31	6.95	7,765	8,529	-9.84%	12%	13%
Aug-07	30	8.88	13,374	12,072	9.73%	21%	19%
Sep-07	29	8.85	12,442	10,286	17.32%	20%	16%
Oct-07	25	9.75	13,001	9,258	28.79%	24%	17%
Nov-07	30	10.37	16,043	11,866	26.03%	25%	18%
Dec-07	22	9.23	11,609	7,670	33.93%	24%	16%
Total	301	9.82	115,574	115,597	-0.02%	18%	18%
Total in OSP (07/15-09/15)	62	8.09	21,958	21,981	-0.11%	16%	16%

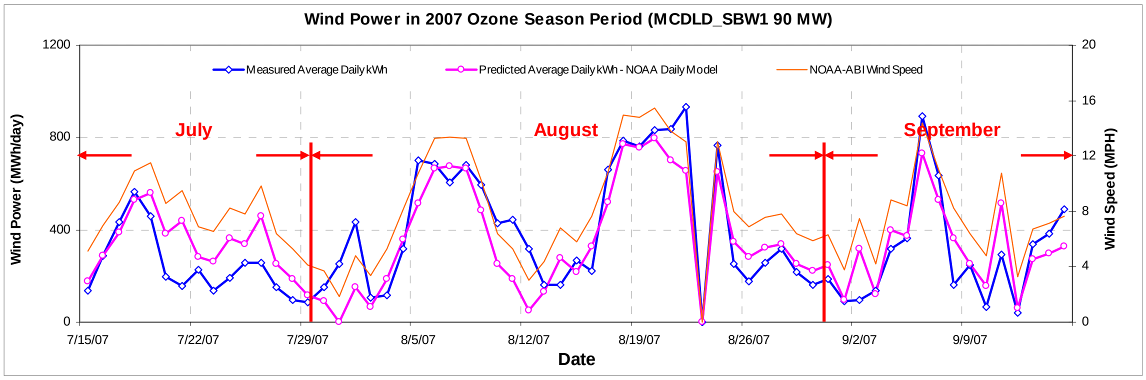


Figure 11-131: MCDLD_SBW1 – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

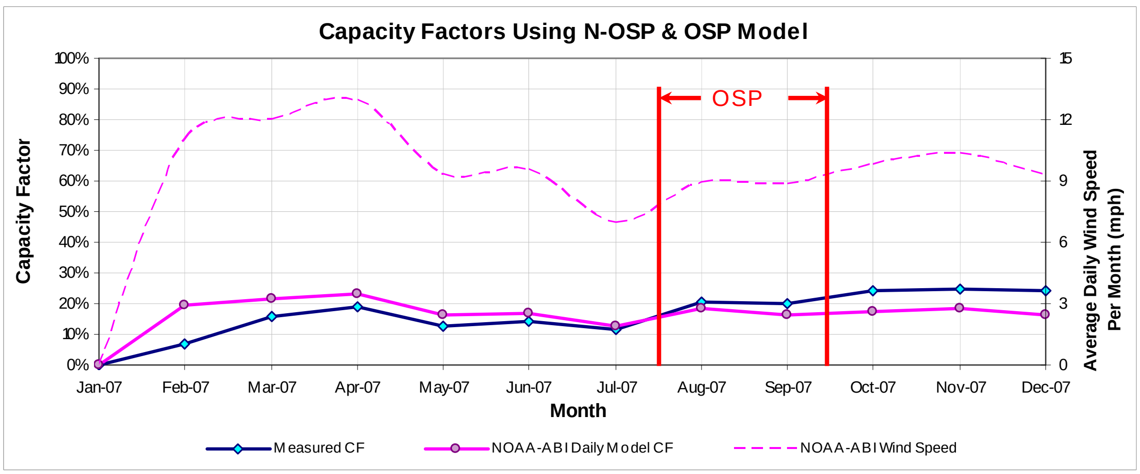


Figure 11-132: MCDLD_SBW1 – Predicted Capacity Factors Using Daily Models (2007)

Table 11-131: MCDLD_SBW1 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr
163,514	140,148

OSD

1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day
452	354

1999 (Feb-Dec) Estimated MWh/yr (2007 Daily Model)	2007 (Feb-Dec) Measured MWh/yr
149,417	128,245

Note: The 2007 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 365 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.33 Sweetwater (SWEETWN2_WND24 18 MW)

Table 11-132: Site Information for Sweetwater (SWEETWN2_WND24)

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
SWEETWN2_WND24	WIND	Abilene	NOLAN	Apr-07	18	DKRW Development	SWEET WIND 24		ERCOT		LCRA	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
SWEETWN2_WND24	SWEETWN2_WND24	18

11.33.1 Sweetwater (SWEETWN2_WND24)

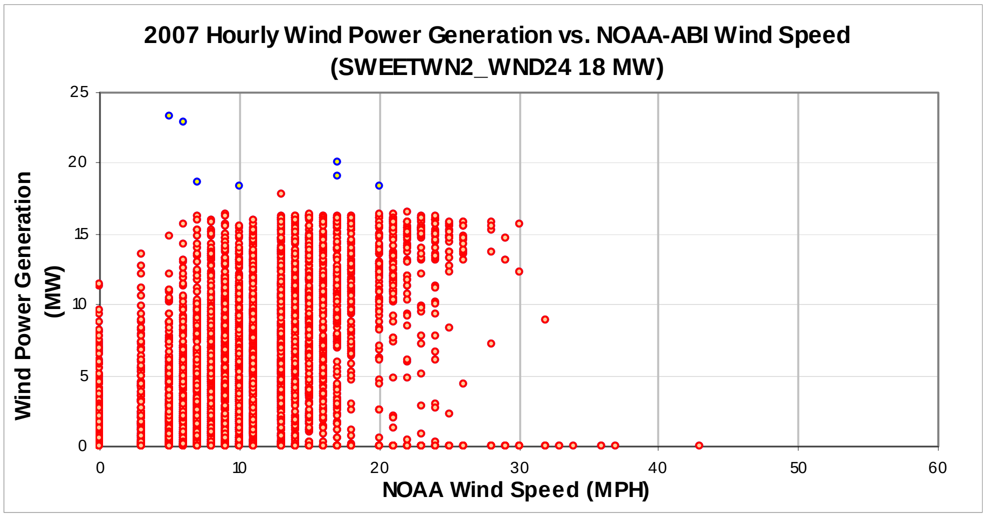


Figure 11-133: SWEETWN2_WND24 – Hourly Wind Power vs. NOAA Wind Speed (2007)

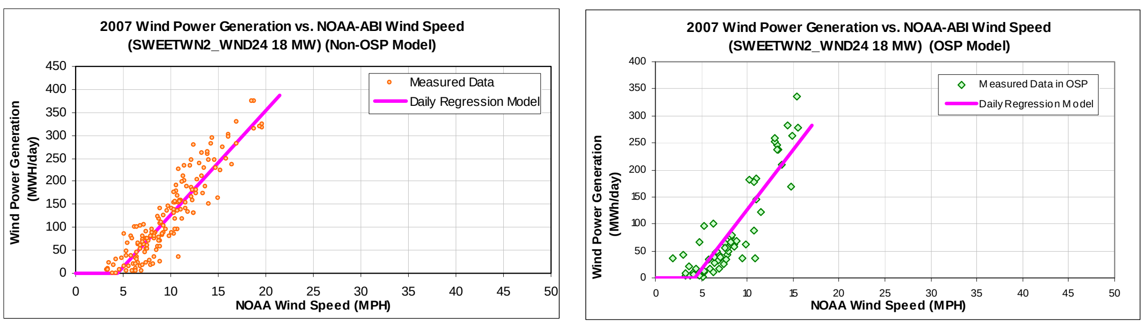


Figure 11-134: SWEETWN2_WND24 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-133: SWEETWN2_WND24 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-101.8787
Left Slope (MWh/mph-day)	23.2669
RMSE (MWh/day)	34.0359
R2	0.8608
CV-RMSE	26.2%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-96.6399
Left Slope (MWh/mph-day)	22.4031
RMSE (MWh/day)	41.7246
R2	0.7789
CV-RMSE	47.9%

Table 11-134: SWEETWN2_WND24 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07							
Feb-07							
Mar-07							
Apr-07							
May-07							
Jun-07	30	9.53	3,270	3,615	-10.55%	25%	28%
Jul-07	31	6.95	1,650	1,933	-17.16%	12%	14%
Aug-07	31	9.10	3,671	3,373	8.12%	27%	25%
Sep-07	29	9.12	3,014	3,220	-6.81%	24%	26%
Oct-07	30	10.87	4,572	4,556	0.36%	35%	35%
Nov-07	30	10.37	4,249	4,184	1.55%	33%	32%
Dec-07	29	10.16	4,127	3,904	5.42%	33%	31%
Total	210	9.43	24,554	24,783	-0.94%	27%	27%
Total in OSP (07/15-09/15)	63	8.20	5,489	5,651	-2.95%	20%	21%

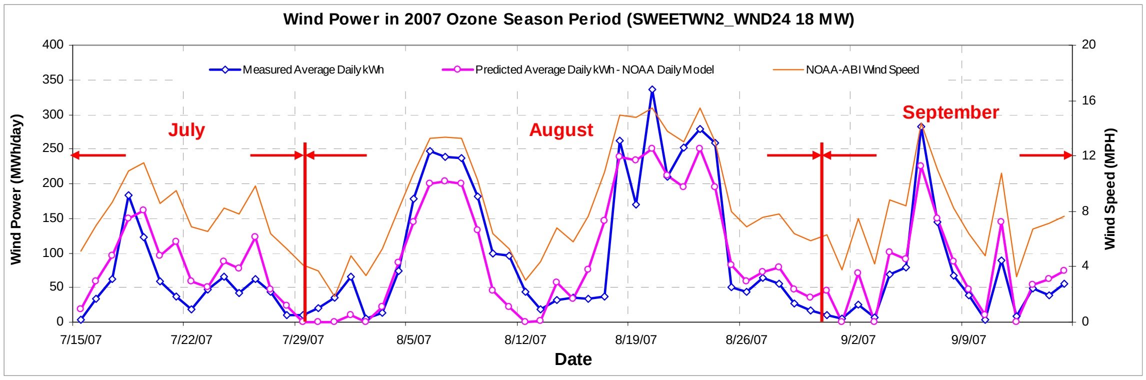


Figure 11-135: SWEETWN2_WND24 – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

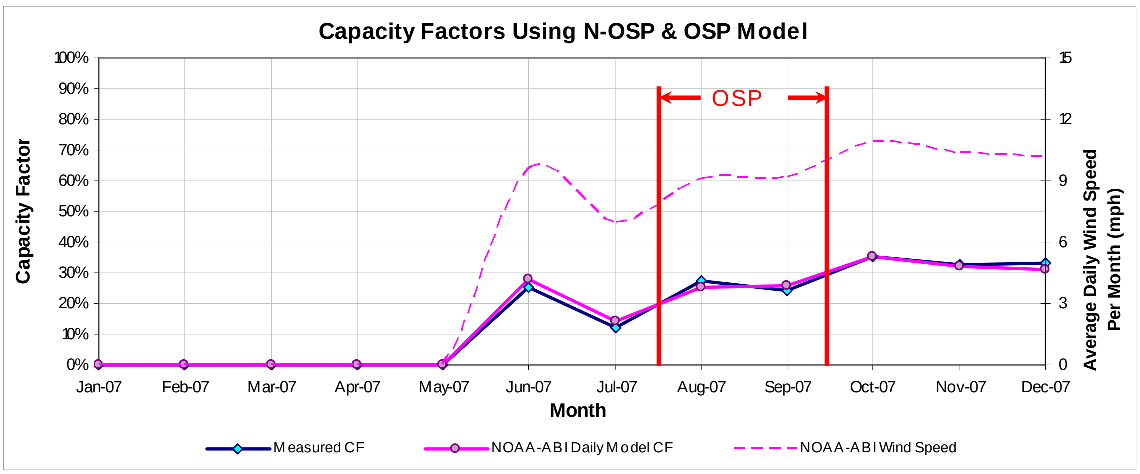


Figure 11-136: SWEETWN2_WND24 – Predicted Capacity Factors Using Daily Models (2007)

Table 11-135: SWEETWN2_WND24 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr
58,591	42,677

OSD

1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day
121	87

1999 (Jun-Dec) Estimated MWh/yr (2007 Daily Model)	2007 (Jun-Dec) Measured MWh/yr
30,361	25,021

Note: The 2007 (Apr-Dec) Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 275 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.34 Sweetwater (SWEETWN4_WIND4A)

Table 11-136: Site Information for Sweetwater (SWEETWN4_WIND4A)

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
SWEETWN4_WND4A	WIND	Abilene	NOLAN	Apr-07	120	DKRW/ Babcock Brown	SWEET WIND 4A	Mitsubishi	ERCOT		LCRA	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ ERCOT	Capacity (MW)
SWEETWN4_WND4A	SWEETWN4_WND4 A	120

11.34.1 Sweetwater (SWEETWN4_WIND4A)

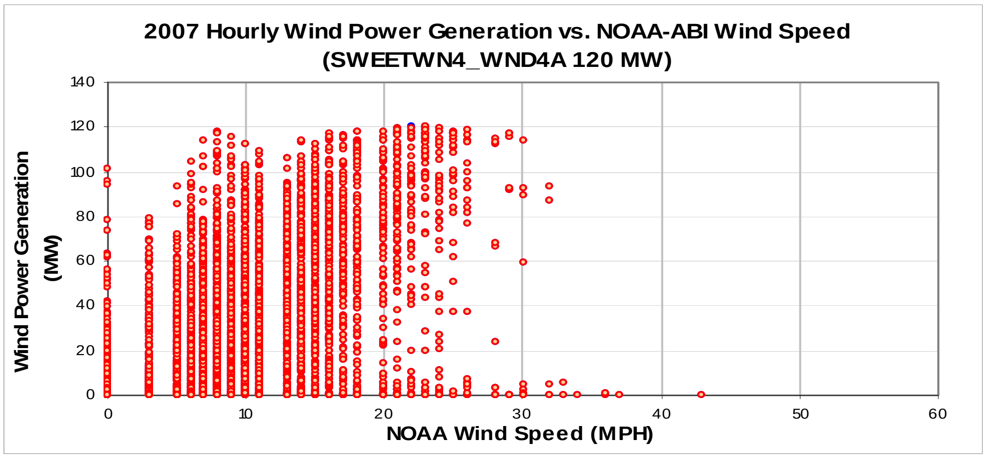


Figure 11-137: SWEETWN4_WIND4A – Hourly Wind Power vs. NOAA Wind Speed (2007)

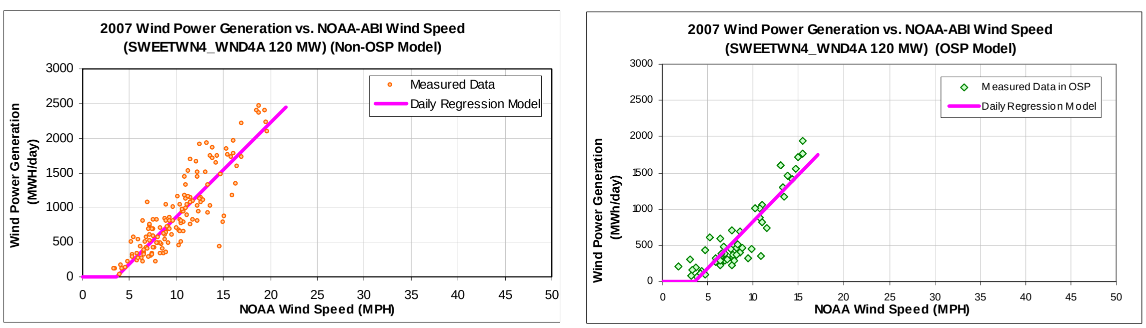


Figure 11-138: SWEETWN4_WIND4A – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-137: SWEETWN4_WIND4A – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-480.5448
Left Slope (MWh/mph-day)	135.6657
RMSE (MWh/day)	272.0618
R2	0.7712
CV-RMSE	30.1%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-457.1491
Left Slope (MWh/mph-day)	128.6757
RMSE (MWh/day)	222.1949
R2	0.8121
CV-RMSE	35.4%

Table 11-138: SWEETWN4_WIND4A – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07							
Feb-07							
Mar-07							
Apr-07							
May-07							
Jun-07	27	9.92	20,063	23,395	-16.61%	26%	30%
Jul-07	26	7.17	10,792	12,590	-16.66%	14%	17%
Aug-07	28	9.43	23,002	21,264	7.56%	29%	26%
Sep-07	28	8.92	17,772	20,062	-12.89%	22%	25%
Oct-07	30	11.15	34,215	30,974	9.47%	40%	36%
Nov-07	30	10.37	26,671	27,777	-4.15%	31%	32%
Dec-07	31	10.51	32,443	29,290	9.72%	36%	33%
Total	200	9.70	164,958	165,352	-0.24%	29%	29%
Total in OSP (07/15-09/15)	57	8.44	35,814	36,168	-0.99%	22%	22%

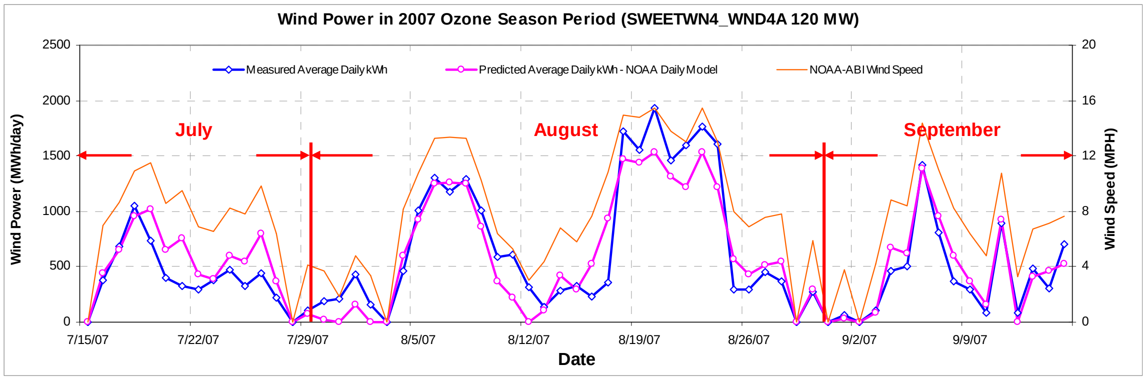


Figure 11-139: SWEETWN4_WIND4A – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

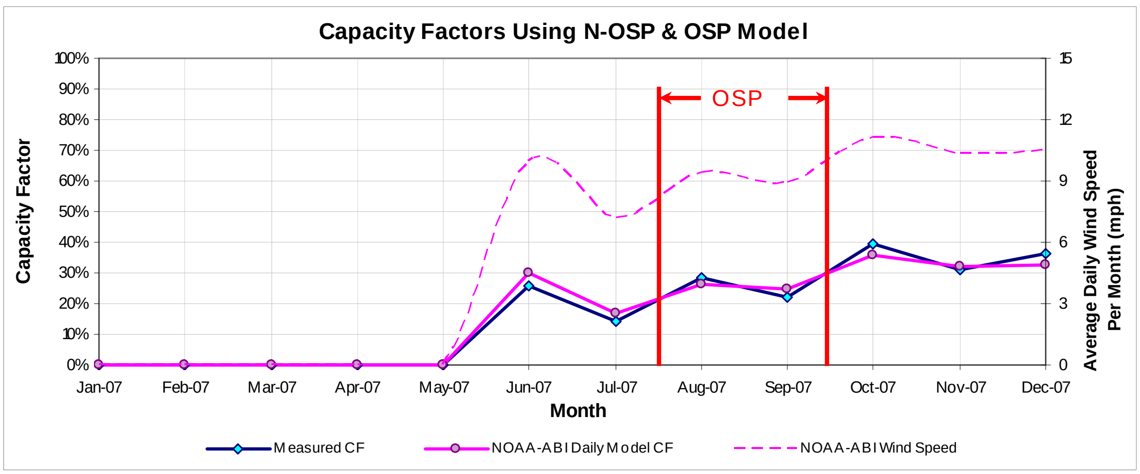


Figure 11-140: SWEETWN4_WIND4A – Predicted Capacity Factors Using Daily Models (2007)

Table 11-139: SWEETWN4_WIND4A – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr
381,096	301,049

OSD

1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day
792	628

1999 (Jun-Dec) Estimated MWh/yr (2007 Daily Model)	2007 (Jun-Dec) Measured MWh/yr
199,353	176,505

Note: The 2007 (Apr-Dec) Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 275 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7.

11.35 Sweetwater (SWEETWN4_WIND4B)

Table 11-140: Site Information for Sweetwater (SWEETWN4_WIND4B)

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
SWEETWN4_WND4B	WIND	Abilene	NOLAN	Apr-07	105	DKRW/ Babcock Brown	SWEET WIND 4B	Siemens	ERCOT		LCRA	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ ERCOT	Capacity (MW)
SWEETWN4_WND4B	SWEETWN4_WND4 B	105

11.35.1 Sweetwater (SWEETWN4_WIND4B)

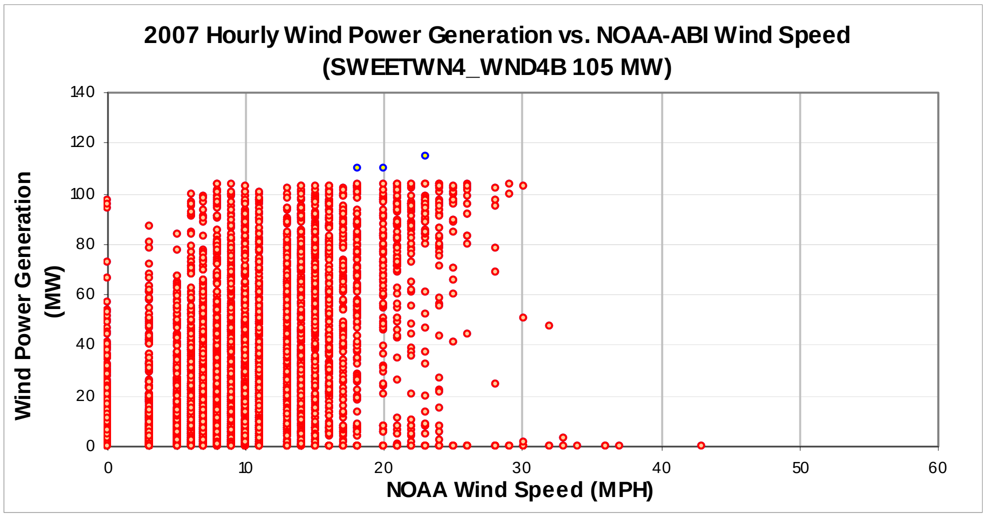
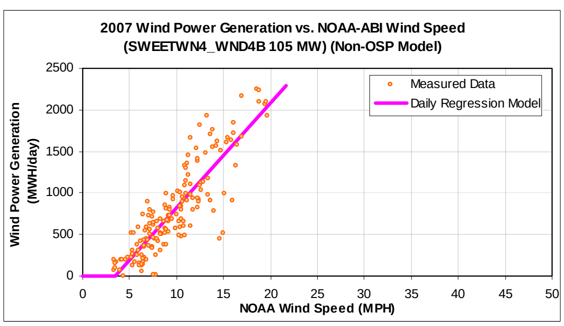


Figure 11-141: SWEETWN4_WIND4B – Hourly Wind Power vs. NOAA Wind Speed (2007)



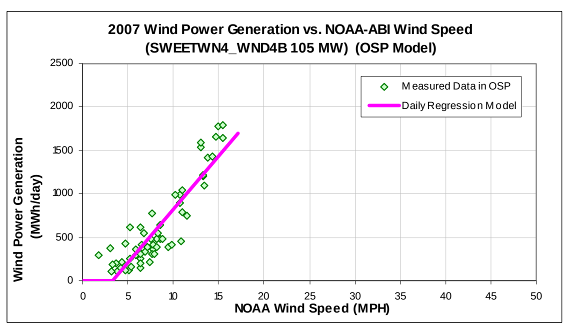


Figure 11-142: SWEETWN4_WIND4B – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-141: SWEETWN4_WIND4B – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-443.9256
Left Slope (MWh/mph-day)	126.2999
RMSE (MWh/day)	261.5789
R2	0.7649
CV-RMSE	33.2%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-408.8710
Left Slope (MWh/mph-day)	123.0498
RMSE (MWh/day)	207.5254
R2	0.8112
CV-RMSE	34.6%

Table 11-142: SWEETWN4_WIND4B – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-07							
Feb-07							
Mar-07							
Apr-07							
May-07							
Jun-07	30	9.53	19,718	22,785	-15.55%	26%	30%
Jul-07	31	6.95	11,906	13,850	-16.33%	15%	18%
Aug-07	31	9.10	23,729	22,065	7.01%	30%	28%
Sep-07	29	8.87	18,357	19,785	-7.78%	25%	27%
Oct-07	30	11.15	33,236	28,935	12.94%	44%	38%
Nov-07	29	10.43	26,033	25,323	2.73%	36%	35%
Dec-07	31	10.51	30,402	27,375	9.96%	39%	35%
Total	211	9.49	163,380	160,116	2.00%	31%	30%
Total in OSP (07/15-09/15)	63	8.20	37,832	38,059	-0.60%	24%	24%

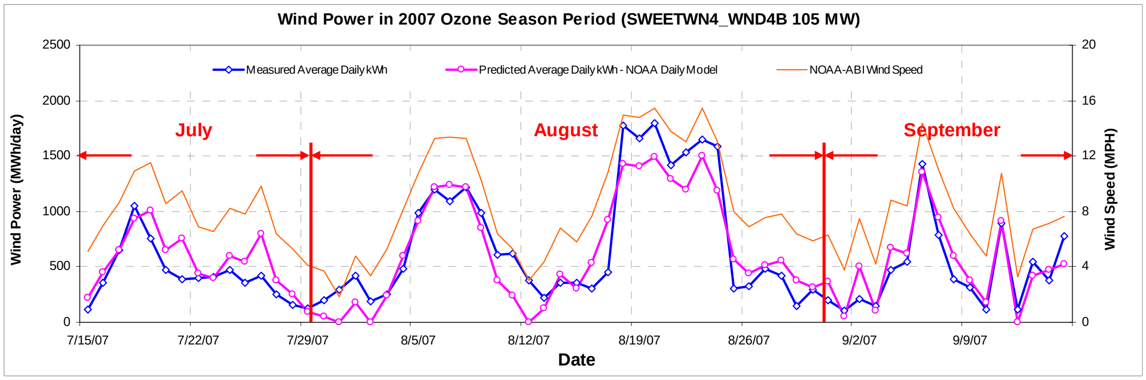


Figure 11-143: SWEETWN4_WIND4B – Predicted Wind Power in OSP Using NOAA Wind Speed (2007)

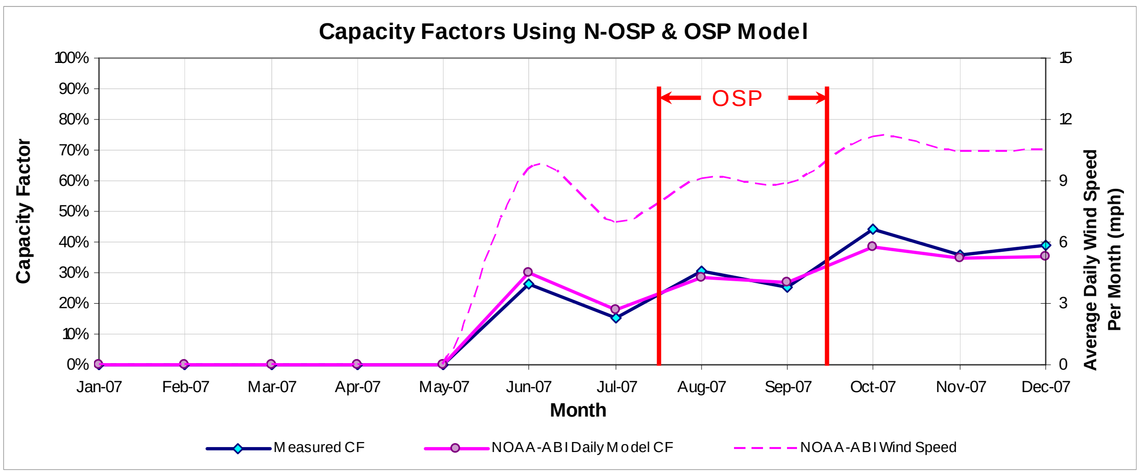


Figure 11-144: SWEETWN4_WIND4B – Predicted Capacity Factors Using Daily Models (2007)

Table 11-143: SWEETWN4_WIND4B – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2007 Daily Model)	2007 Measured MWh/yr
358,870	282,625

OSD

1999 OSD Estimated MWh/day (2007 Daily Model)	2007 OSD Measured MWh/day
786	601

1999 (Jun-Dec) Estimated MWh/yr (2007 Daily Model)	2007 (Jun-Dec) Measured MWh/yr
189,153	165,703

Note: The 2007 (Apr-Dec) Measured MWh/yr presented in the above table included only validated data and it was also adjusted to 275 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-7

12 APPENDIX C

12.1 Data Files for Wind Energy Production and Weather Files for the Modeling

WT-2009 HARC DATA.xls

12.2 Papers Presented

Liu, Z., Haberl, J. S., Baltazar, J. C., Culp, C., Yazdani, B., Chandrasekaran, V., 2008. "Calculating Emissions Reduction from Renewable Energy Programs and Its Application to the Wind Farms in the Texas ERCOT Region," *16th Symposium on Improving Building Systems in Hot and Humid Climates, Dallas TX, December 16-17, 2008*