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STATEWIDE AIR EMISSIONS CALCULATIONS FROM WIND AND OTHER RENEWABLES

VOLUME I

A Report to the
Texas Commission on Environmental Quality
For the Period January 2022 – December 2022

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July 2023

ENERGY SYSTEMS LABORATORY
TEXAS A&M ENGINEERING EXPERIMENT STATION

TEXAS A&M ENGINEERING EXPERIMENT STATION

ENERGY SYSTEMS LABORATORY

July 10, 2023

Ms. Lindley Anderson
Technical Specialist
Air Quality Division
Texas Commission on Environmental Quality
Austin, TX 78711-3087

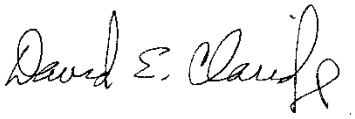
Dear Ms. Anderson,

The Energy Systems Laboratory (ESL) at the Texas Engineering Experiment Station of The Texas A&M University System is pleased to provide its 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 Commission on Environmental Quality (TCEQ).

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 January 2022 to December 2022.

Please contact me at (979) 845-9213 should you have questions concerning this report or the work presently being done to quantify emissions reductions from renewable energy measures as a result of the TERP implementation.

Sincerely,



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

Enclosure

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ACKNOWLEDGMENT

This report cannot be accomplished without the help of many people. Special thanks to Dan Mantena Planning Analyst, Resource Adequacy Department at Electric Reliability Council of Texas (ERCOT), for providing the wind farm power generation data.

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 a 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 has achieved its milestone of 10,000 MW by the end of 2010 and could reach total 41,608 MW by 2025[1] according to the information from PUCT[2]. By the end of 2022, the total installed capacity in Texas is 36,911 MW.

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

Texas Wind Summary			**SB20 Plan**	
Month-Yr	Installed-MW	Announced[3] -MW	Month-Yr	MW
Dec-2001	1,012	-		
Dec-2002	1,091	-		
Dec-2003	1,292	-		
Dec-2005	1,965	-		
Dec-2006	2,786	-	Jan-2007	2,280
Dec-2007	4,438	-		
Dec-2008	8,215	-	Jan-2009	3,272
Dec-2009	9,652	-		
Dec-2010	10,222	-	Jan-2011	4,264
Dec-2011	10,468	-		
Dec-2012	11,737	-	Jan-2013	5,256
Dec-2013	12,302	-		
Dec-2014	14,035	-	Jan-2015	5,880
Dec-2015	17,377	-		
Dec-2016	19,632	-		
Dec-2017	22,937	-		
Dec-2018	24,154	-		
Dec-2019	28,188	-		
Dec-2020	32,413	-		
Dec-2021	36,694	-		
Dec-2022	36,911	-		
Dec-2023		4,697	Jan-2025	10,000
Dec-2024	-	-		
Dec-2025	-	-		

[1] PUCT has not announced wind farms for years beyond 2023 in their 2022 announced wind farm list.

[2] The service date for announced wind farms is searched from PUCT (http://www.puc.texas.gov/industry/electric/reports/Default.aspx).

[3] TBD projects in the announced project list were not included in installed/announced capacity calculations in Table 1-1. Total announced wind power capacity including TBD projects is 5,262MW by 2025.

In this Legislation, the function of 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 TCEQ to develop and annually calculate creditable emissions reductions from wind and other renewable energy resources for the State Implementation Plan (SIP).

The ESL, in fulfillment of its responsibilities under this Legislation, submits its annual report, "Statewide Air Emissions Calculations from Wind and Other Renewables," to the TCEQ.

The report is organized in several deliverables:

1. A summary report, which details the key areas of work,
2. Volume I report, which includes main document of renewable energy projects and
3. Volume II technical Appendix that includes all information and details about renewables (i.e., wind power, non-utility scale and utility-scale solar PV, solar thermal, biomass, hydroelectric, geothermal, and landfill gas-fired)
4. Supporting data files, including weather data, and wind energy production data are available upon request.

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

- Analysis of power generation from wind farms using improved method and 2018 data,
- Analysis of emissions reductions from wind farms,
- Analysis of other renewables, including solar PV, solar thermal, biomass, hydroelectric, geothermal, and landfill gas, and
- Review of electricity generation by renewable sources and transmission planning study reported by ERCOT

1.1 Texas wind power generation (ERCOT and PUCT)

For several years now, Texas has been the largest producer of wind energy in the United States. As of January 2023, the capacity of installed wind turbine totals was 36,911 MW with another 4,697 MW announced for new projects to be completed by 2024. Figure 1-1 shows the growth pattern of the installed wind power capacity in Texas and their power generation in the ERCOT region from September 2005 to December 2022.

In the last few years, the electricity generated by wind has continually shown progressive and substantial increases. However, the wind electricity generation contains a significant seasonal response, which can be observed during the Ozone Season Period[4] when a dramatic reduction in the power generation can be observed. This reduction is mainly due to the fact that the wind speed in those periods is lower than other times during the year. On the other hand, it is also observed that the peaks of wind electricity generation occur more often during the winter periods when the wind speed also has a higher overall average value.

[4] Since 2018 the Ozone Season Period (OSP) was changed from the period of July 15 to Sep 15 to the period of May 1 to September 30.

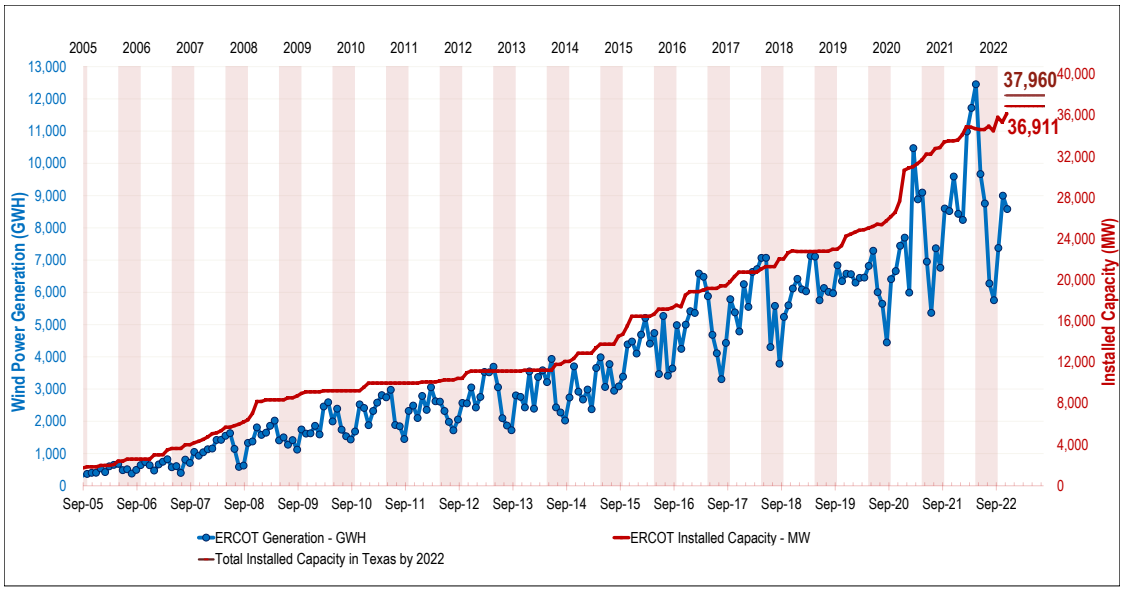


Figure 1-1: Installed Wind Power Capacity and Power Generation in the ERCOT Region from September 2005 to December 2022

1.2 Analysis of wind farms using an improved method and 2022 electricity generation 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 2022 measurement period.

In the previous Wind and Renewables reports to the TCEQ, weather normalization analysis methods were reviewed and determined to be appropriate for this report. Therefore, this report used the same analysis method as the previous reports 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 Period (OSP), from May 1 to September 30, and non-Ozone Season Period (non-OSP);
- predicting wind power generation based on 2018 baseline wind speed data, using developed coefficients from 2022 daily OSP and non-OSP models for all the wind farms; and
- the analysis of monthly capacity factors generated using the models.

This report also includes an uncertainty analysis that was performed on all the daily regression models for the entire year and OSP. The detailed analysis for each wind farm is provided in the Appendix A of Volume II of this report.

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 Competitive Load (CL) zones in ERCOT was presented. The calculation of the NOx emission reductions is based on the 2018 eGRID as modified according to ESL-TR-08-12-04 report (US EPA and ESL, 2008). As shown in Table 1-2 based on the 2022 measured ERCOT data, the total MWh savings for all the wind farms within the ERCOT region are 102,671,395 MWh/yr and 269,074 MWh/day for an average day in the OSP. The total NOx emissions reductions in 2022 across all the counties amounts are 61,972.6 tons/yr and 153.03 tons/day for the OSP. A comparison of the measured 2022 data and the modeled 2018 data is presented in Section 3.2 of this report.

Table 1-2: Electricity Generation and NOx Emission Reductions for All the Wind Farms in ERCOT Region in 2022

	Annual	**OSP**
Measured Electricity Generation in 2022	102,671,395 [MWh/yr]	269,074 [MWh/day]
NOx Emission Reduction in 2022	61,972.6 [Tons/yr]	153.03 [Tons/day]

Figure 1-2 and Figure 1-3 show the measured annual and OSP NOx emissions reductions from wind power in each county of Texas in 2022.[5]

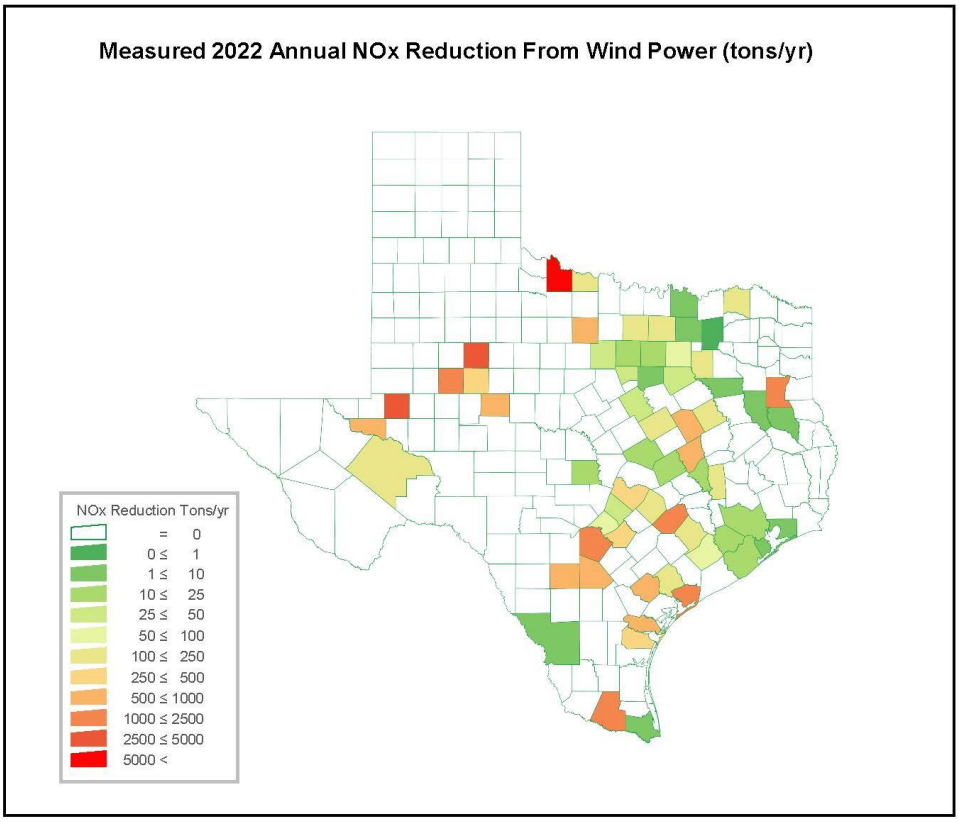


Figure 1-2: Measured 2022 Annual NOx Reductions from Wind Power in Texas

[5] The map from Figure 1-2 and Figure 1-3 are designed in simplemaps.com

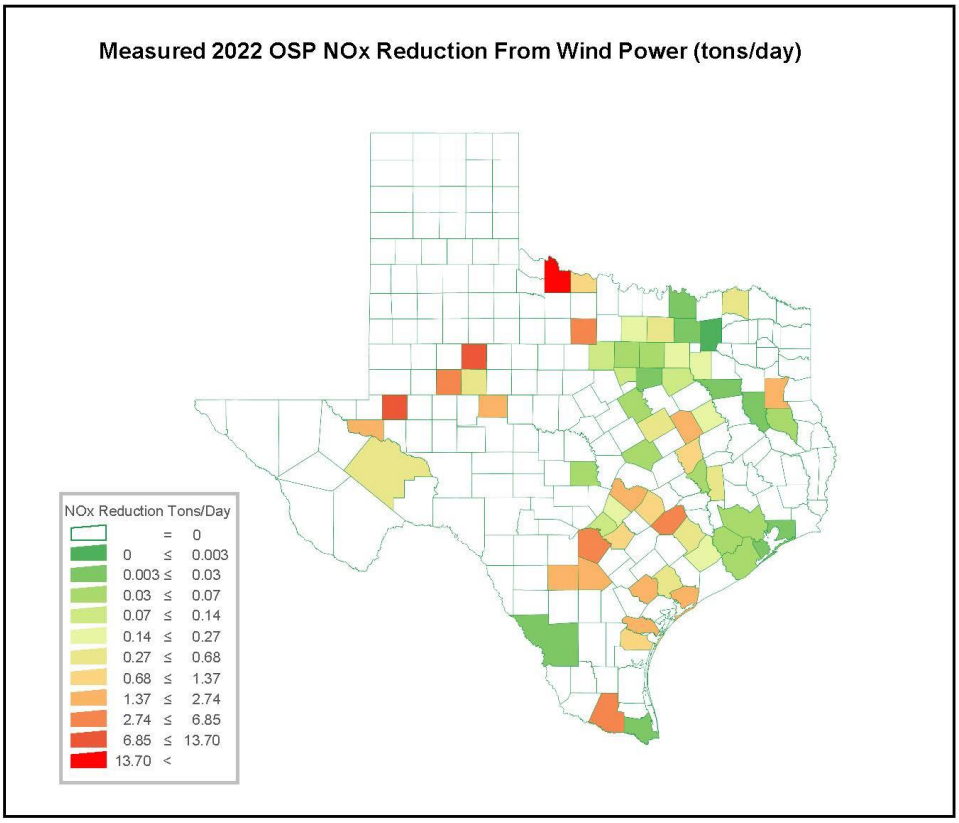


Figure 1-3: Measured 2022 OSP NOx Reductions from Wind Power in Texas

1.4 Analysis of other renewable sources

Five specific renewable sources were determined: solar, biomass, hydroelectric, geothermal, and landfill gas-fired. To generate/save energy throughout the State of Texas, six types of renewable energy projects were identified: solar photovoltaic (PV) including the non-utility scale and utility-scale solar PV, solar thermal, biomass power, hydroelectric power, geothermal HVAC, and landfill gas-fired power projects. Table 1-3 presents the number of newly located renewable energy projects and total renewable energy projects included in this report.

This report also presents county-wide annual/OSP energy savings for solar photovoltaic including solar power, solar thermal, biomass, and hydroelectric projects. The analysis of non-utility scale solar PV projects cannot be completed in the present report because the *Tracking the Sun* public database has not been updated yet for the year 2022. The power generation data for the other utility-scale renewable energy projects (solar power, biomass, and hydroelectric), which were obtained from the ERCOT and EIA, were used to evaluate the annual/OSP energy generation. The annual/OSP energy savings calculation for solar thermal was conducted based on the project data from various web sources. Then, the annual NOx emission reductions calculation was conducted with the special version of Texas 2018 eGRID.

In 2022, the total annual/OSP energy savings from each renewable projects across all the counties were:

- solar photovoltaic projects (non-utility scale): 764,231 MWh/yr and 2,363 MWh/day; in addition, solar power projects (utility-scale): 24,182,820 MWh/yr and 85,682 MWh/day,
- solar thermal projects: 255 MWh/yr and 0.7 MWh/day,
- biomass projects: 625,349 MWh/yr and 2,252 MWh/day, and
- hydroelectric projects: 444,490 MWh/yr and 1,767 MWh/day.

In 2022, the annual NOx emission reductions from renewable projects across all the counties were:

- solar photovoltaic projects (non-utility scale): 377.1 tons/yr; in addition, solar power projects (utility-scale): 13,741.7 tons/yr,
- solar thermal projects: 0.1 tons/yr,
- hydroelectric projects: 168.1 tons/yr.

Table 1-3: Number of Projects Identified for Other Renewable Sources

Renewable Energy Projects	Number of New Projects in 2022	Total Number of Projects up to 2022	Annual Measured/ Estimated Electricity Generation in 2022 [MWh/yr]	OSP Measured/ Estimated Electricity Generation in 2022 [MWh/day]	NOx Emission Reductions in 2022[6] [Tons/yr]
Solar Photovoltaic	22,971	63,671	764,231	2,363.0	377.1
Solar Power	33	150	24,182,820	85,682.0	13,741.7
Solar Thermal	0	41	255	0.7	0.1
Biomass[7]	0	12	625,349	2,252.0	-
Hydroelectric	0	33	444,490	1,767.0	168.1
Geothermal[8]	0	306	-	-	-
Landfill Gas-Fired[6,9]	1	36	-	-	-

[6] The NOx emissions reductions correspond to the electricity production from solar photovoltaic, solar power, solar thermal, and biomass for each county, based on the appropriate assigned CL zones and the 2018 eGRID.
[7] Biomass projects only reported the total number of projects and electricity generation in 2022. The NOx emission reductions from biomass is not reported.
[8] Annual or OSP electricity savings and NOx emission reductions from the geothermal and landfill gas-fired could not be estimated due to limited information.
[9] Landfill gas-fired project information from EPA have seven sub-categories for their status: operational, shutdowns, construction, planned, candidates, potential and unknown, and operational projects were considered for the number of projects.

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

In this report, the information posted on ERCOT's Renewable Energy Credit (REC) Program site (https://sa.ercot.com/rec/home) was 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 2022 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 to 2022. Figure 1-4 is included to better illustrate the annual data collected by ERCOT. Other sources present different renewable electricity generation values compared to the ERCOT source, but those are explained in general because the numbers reported in this report are focused on the ERCOT region.

Table 1-4: Annual Electricity Generation by Renewable Resources (MWh, ERCOT: 2001 - 2022)[10]

Year	Biomass (MWh)	Hydro (MWh)	Landfill gas (MWh)	Solar (MWh)*	Wind (MWh)	Total (MWh)
2001	0	30,639	0	0	565,597	596,236
2002	0	312,093	29,412	87	2,451,484	2,793,076
2003	39,496	239,684	154,206	220	2,515,482	2,949,087
2004	36,940	234,791	203,443	211	3,209,630	3,685,014
2005	58,637	310,302	213,777	227	4,221,568	4,804,512
2006	60,569	210,077	306,087	470	6,530,928	7,108,131
2007	54,101	382,882	356,339	1,844	9,351,168	10,146,333
2008	70,833	445,428	387,110	3,338	16,286,440	17,193,150
2009	73,364	507,507	412,923	4,492	20,596,105	21,594,390
2010	97,535	609,257	464,904	14,449	26,828,660	28,014,805
2011	137,004	267,113	497,645	36,580	30,769,674	31,708,016
2012	288,988	389,197	549,037	139,439	32,746,534	34,113,195
2013	200,564	294,238	550,845	178,326	36,909,385	38,133,358
2014	343,469	240,792	518,580	312,757	40,644,362	42,059,961
2015	349,600	414,289	561,915	410,318	45,165,341	46,901,462
2016	247,643	393,740	518,403	848,410	57,796,161	59,804,357
2017	216,431	444,453	446,119	2,289,394	66,076,742	69,473,139
2018	287,014	334,460	395,428	3,183,238	73,960,577	78,160,716
2019	153,531	266,718	335,361	4,492,846	81,770,300	87,018,756
2020**	140,878	222,252	270,377	8,772,250	93,507,058	102,912,813
2021**	252,321	235,170	209,019	15,778,043	101,664,605	118,139,158
2022	470,827	226,941	191,136	24,131,729	113,347,551	138,368,184

Note: The REC Program tracks renewable generation in Texas, including non-ERCOT regions of Texas. Not all renewable is eligible for REC credit.
* Solar only includes the utility-scale solar PV projects
** 2020 solar and 2021 wind, solar, hydro and biomass REC data is updated due to ERCOT's data modification this year

[10] https://sa.ercot.com/rec/public-reports

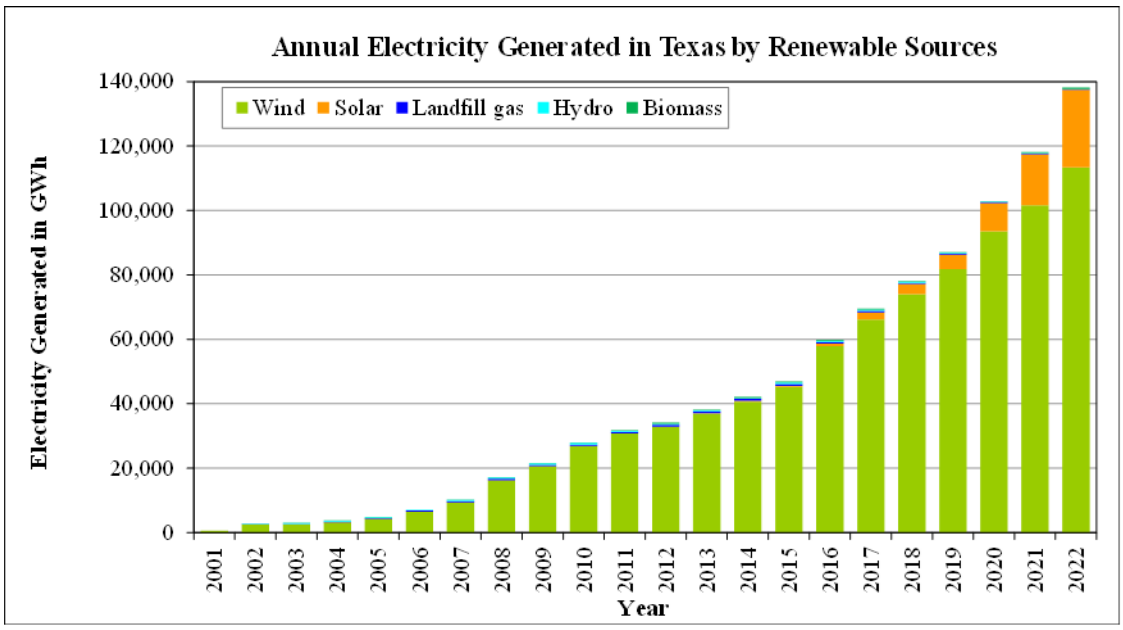


Figure 1-4: Electricity Generation by Renewable Resources (ERCOT: 2001–2022 Annual)

TABLE OF CONTENTS

1 EXECUTIVE SUMMARY 4
1.1 Texas wind power generation (ERCOT and PUCT) 5
1.2 Analysis of wind farms using an improved method and 2022 electricity generation data. 6
1.3 Analysis of emissions reduction from wind farms 7
1.4 Analysis of other renewable sources 9
1.5 Review of electricity savings and transmission planning study reported by ERCOT 10
TABLE OF CONTENTS 12
LIST OF FIGURES 13
LIST OF TABLES 16
2 INTRODUCTION 18
2.1 Statement of Work for Calculations of Emissions from Wind and Other Renewables 18
2.2 Summary of Progress 18
3 ANALYSIS ON POWER PRODUCTION FROM WIND FARMS USING 2022 DATA 20
3.1 Introduction 20
3.2 Summary of Wind Power Production for All Wind Farms in the Texas ERCOT Region 26
3.3 Comparison of Measured Wind Power in Previous Reports and Present Report 39
3.4 Uncertainty Analysis on the 2022 Daily Regression Models 50
4 DEGRADATION ANALYSIS FOR WIND FARMS 65
5 CALCULATING NO_x EMISSIONS REDUCTION FROM WIND POWER 74
5.1 Calculation of NOx Emissions from Wind Power Using 2018 eGRID 74
6 OTHER RENEWABLE SOURCES 86
6.1 Implementation 86
6.2 Renewable Energy Projects 87
6.2.1 Solar Photovoltaic 87
6.2.2 Solar Thermal 113
6.2.3 Biomass 117
6.2.4 Hydroelectric 123
6.2.5 Geothermal 130
6.2.6 Landfill Gas-Fired 131
6.3 Summary 133
7 REVIEW OF ERCOT'S RENEWABLE ENERGY CREDIT PROGRAM INFORMATION 134
7.1 Introduction 134
7.2 Summary of Renewable Projects in Texas 134
8 REFERENCES 137

LIST OF FIGURES

Figure 1-1: Installed Wind Power Capacity and Power Generation in the ERCOT Region from September 2005 to December 2022 6

Figure 1-2: Measured 2022 Annual NOx Reductions from Wind Power in Texas 7

Figure 1-3: Measured 2022 OSP NOx Reductions from Wind Power in Texas 8

Figure 1-4: Electricity Generation by Renewable Resources (ERCOT: 2001–2022 Annual) 11

Figure 3-1: Installed Wind Power Capacity and Power Generation in the ERCOT Region from September 2005 to December 2022 20

Figure 3-2: Procedure for the 2018 Annual and OSP Weather Normalized Wind Power Generation for Each Wind Farm in Operation in 2022 in Texas ERCOT Region 21

Figure 3-3: Completed Wind Projects in Texas 22

Figure 3-4: Announced and Retired Wind Projects in Texas 23

Figure 3-5: A List of Completed, Announced and Retired Wind Projects in Texas 24

Figure 3-6: Comparison of Total 2022 Measured and 2018 Modeled Power Production 32

Figure 3-7: Comparison of Total 2022 OSP Measured and 2018 OSP Modeled Power Production 32

Figure 3-8: Comparison of 2022 Measured and 2018 Modeled Wind Power Production for Each Wind Farm 33

Figure 3-9: Comparison of 2022 OSP Measured and 2018 OSP Modeled Wind Power Production for Each Wind Farm 36

Figure 3-10: Measured Annual Wind Power Comparison between 2018 and 2022 40

Figure 3-11: Measured OSP Wind Power Comparison between 2018 and 2022 43

Figure 3-12: Difference Comparison between 2018 and 2022 - Measured Annual Wind Power 46

Figure 3-13: Difference Comparison between 2018 and 2022 - Measured OSP Wind Power 48

Figure 3-14: Linear Model Presentation of the Daily Wind Power Generation on the Year 2022 for Callahan_Wind_1 Farm 50

Figure 3-15: Uncertainty of the 2022 daily wind power prediction using linear models (2018 base year) 63

Figure 4-1: Example Sliding 12-month Hourly Wind Power Generation for Anacacho Wind Farm for 2022 66

Figure 4-2: Design and Hourly Measured Maximum Capacity for 164 Wind Farms 73

Figure 5-1: 2018 Annual eGRID NOx Emissions for the CL zones: (a) Houston, (b) North, (c) West and (d) South. 75

Figure 5-2: 2018 OSP eGRID NOx Emissions for the CL zones: (a) Houston, (b) North, (c) West and (d) South. 76

Figure 5-3: Modeled 2018 and Measured 2022 Annual NOx Reductions from Wind Power in Texas Map 80

Figure 5-4: Modeled 2018 OSP and Measured 2022 OSP NOx Reductions from Wind Power in Texas Map 80

Figure 5-5: Comparisons of Modeled 2018 and Measured 2022 Annual NOx Emissions Reductions from Wind Power 81

Figure 5-6: Comparisons of Modeled 2018 and Measured 2022 OSP NOx Emissions Reductions from Wind Power 81

Figure 6-1: Chart of Workflow for Other Renewable Energy Projects 87

Figure 6-2: Map of Non-Utility Solar PV Projects Installed in Each County of Texas through 2022 91

Figure 6-3: Annual Electricity Generation per County from Solar Photovoltaic Projects through 2022 95

Figure 6-4: OSP Electricity Generation per County from Solar Photovoltaic Projects through 2022 97

Figure 6-5: NOx Emissions Reductions per County from Solar Photovoltaic Projects through 2022 100

Figure 6-6: Annual Electricity Generation by Utility-Scale Solar PV Projects in the State of Texas through 2022 107

Figure 6-7: Map of Utility-Scale Solar PV Projects Installed in Each County of Texas through 2022 108

Figure 6-8: Annual Electricity Generation per County from Utility-Scale Solar PV Projects through 2022 110

Figure 6-9: Ozone Season Period Electricity Generation per County from Utility-Scale Solar PV Projects through 2022 111

Figure 6-10: NOx Emissions Reductions per County from Utility-Scale Solar PV Projects through 2022 112

Figure 6-11: Hourly Electricity Generation Profile for Solar Photovoltaic Project ACACIA_UNIT_1 113

Figure 6-12: Daily Total Electricity Generation Profile for Solar Photovoltaic Project ACACIA_UNIT_1 113

Figure 6-13: Map of Solar Thermal Projects Installed in Each County of Texas through 2022 115

Figure 6-14: Annual Electricity Savings per County from Solar Thermal Projects through 2022 116

Figure 6-15: Ozone Season Period Electricity Savings per County from Solar Thermal Projects through 2022 116

Figure 6-16*:* NOx Emissions Reductions per County from Solar Thermal Projects through 2022 117

Figure 6-17: Annual Electricity Generation by Biomass Projects in the State of Texas through 2022 118

Figure 6-18: Map of Biomass Projects Installed in Each County of Texas 119

Figure 6-19: Annual Electricity Savings per County from Biomass Projects through 2022 120

Figure 6-20: Ozone Season Period Electricity Savings per County from Biomass Projects through 2022 121

Figure 6-21: Hourly Electricity Generation Profile for Biomass DG_HBR_2UNITS 122

Figure 6-22: Daily Total Electricity Generation Profile for Biomass Project DG_HBR_2UNITS 122

Figure 6-23: Annual Electricity Generation by Hydroelectric Projects in the State of Texas through 2022 124
Figure 6-24: Map of Hydroelectric Projects Installed in Each County of Texas 125
Figure 6-25: Annual Electricity Savings per County from Hydroelectric Projects through 2022 126
Figure 6-26: Ozone Season Period Electricity Savings per County from Hydroelectric Projects through 2022 127
Figure 6-27: NOx Emissions Reductions per County from Hydroelectric Projects through 2022 128
Figure 6-28: Hourly Electricity Generation Profile for Hydroelectric Project AMISTAD_AMISTAG1 129
Figure 6-29: Daily Total Electricity Generation Profile for Hydroelectric Project AMISTAD_AMISTAG1 129
Figure 6-30: Map of Geothermal Projects Installed in Each County of Texas by 2022 130
Figure 6-31: Map of Operational Landfill Gas-Fired Projects Installed in Each County of Texas by 2022 132
Figure 7-1: Electricity Generation by Renewable Sources (ERCOT: 2001–2022 Annually) 135
Figure 7-2: Electricity Generation by Renewable Sources Other than Wind Energy (ERCOT: 2001–2022 Annually) 136
Figure 7-3: Electricity Generation by Renewable Sources Other than Wind and Solar Energy (ERCOT: 2001–2022 Annually) 136

LIST OF TABLES

Table 1-1: Installed/Announced Wind Power Capacity and the Statutory Mandates 4
Table 1-2: Electricity Generation and NOx Emission Reductions for All the Wind Farms in ERCOT Region in 2022 7
Table 1-3: Number of Projects Identified for Other Renewable Sources 9
Table 1-4: Annual Electricity Generation by Renewable Resources (MWh, ERCOT: 2001 - 2022) 10
Table 3-1: Summary of Annual Power Production for All Wind Farms Operated for more than 6 months in 2022 27
Table 3-2: Summary of 2018 and 2022 Monthly Average Wind Speed for Five ERCOT Weather Zones 31
Table 3-3: Statistical Parameters for the 2022 Daily Wind Power Production Linear Models 52
Table 3-4: Uncertainty of the 2022 daily wind power prediction using linear models (2018 base year) 57
Table 4-1: Summary of 90th Percentile Hourly Wind Power Degradation Analysis for 164 Wind Farms in Texas 67
Table 4-2: Summary of Maximum Hourly Wind Power Analysis for 164 Wind Farms in Texas 70
Table 5-1: Texas Wind Farm Information — Updated Jan 15th, 2023 77
Table 5-2: Modeled 2018 and Measured 2022 Wind Power Production and Emission Assigned to Each CL Zone in the ERCOT Region 80
Table 5-3: Distribution of the Annual Emission Reductions per CL Zone for each County (Base Year 2018) 82
Table 5-4: Distribution of the Annual Emission Reductions per CL Zone for each County (Year 2022) 83
Table 5-5: Distribution of the OSP Emission Reductions per CL Zone for each County (Base Year 2018) 84
Table 5-6: Distribution of the OSP Emission Reductions per CL Zone for each County (Year 2022) 85
Table 6-1: Solar Photovoltaic Projects: Annual Energy and OSP Energy through 2022 89
Table 6-2: Texas Non-Utility Solar Photovoltaic Projects up to 2022 92
Table 6-3: Utility-Scale Solar PV Projects in the State of Texas through 2022 104
Table 6-4: Utility-Scale Solar PV Projects throughout Texas through 2022 109
Table 6-5: Solar Thermal Projects: Energy Reductions up to 2022 114
Table 6-6: Solar Thermal Projects throughout Texas through 2022 115
Table 6-7: Biomass Projects in the State of Texas through 2022 118
Table 6-8: Biomass Projects throughout Texas through 2022 119
Table 6-9: Hydroelectricity Power Projects in the State of Texas through 2022 124
Table 6-10: Hydroelectric Projects throughout Texas through 2022 125
Table 6-11: Geothermal Projects throughout Texas by 2022 131

Table 6-12: Operational Landfill Gas-Fired Projects Installed throughout Texas by 2022 132
Table 6-13: Comparison of the Projects Identified from Previous and Present Reports 133
Table 7-1: Annual Electricity Generation by Renewable Sources (MWh, ERCOT: 2001–2022) 135

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 January 2022 through December 2022. This work is intended to cover the basic work outline included below:

Task 1: Obtain input from public/private stakeholders

Task 2: Develop and maintain a methodology in cooperation with the Texas Commission on Environmental Quality (TCEQ) and the U.S. Environmental Protection Agency (US EPA) 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 *Texas Energy Summit* to facilitate the technical transfer

2.2 Summary of Progress

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

Task 1: Obtain input from public/private stakeholders.

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 (SIP) 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 January 2022 to December 2022, several presentations were done to report the analysis methodology and the results to interested parties.

- March 2022 – Presentation at the Texas Energy Summit about Emissions Reduction Impact of Renewables, 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 US EPA, TCEQ, and stakeholders.
- Develop acceptable methodologies for wind and renewables.
- Determine how to implement methodologies for Texas, including the 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, US EPA, and stakeholders.

- Develop acceptable methodologies for verifying installations, including documentation, EPA Quality Assurance Project Plan (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 Texas Energy Summit to facilitate the 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 of January 2022 through December 2022.

- Analysis of wind farms using 2022 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

3 ANALYSIS ON POWER PRODUCTION FROM WIND FARMS USING 2022 DATA

3.1 Introduction

Texas is the largest producer of wind energy in the United States. As of December 2022,[11] the installed wind turbine capacity totals 36,911 MW in Texas[12], and it has been announced new projects that will add another 4,697 MW of capacity by the end of 2024. The ERCOT region represents 33,521 MW, which accounts for 91% of the 2022 total capacity installed in Texas. Figure 3-1 shows the monthly electricity generation and capacity installed in the ERCOT region from September 2005 to December 2022. The total installed capacity in Texas by 2022 was 37,960 MW (in blown), and the ERCOT region installed capacity by 2022 was 36,911 MW. Figure 3-3 to Figure 3-5 shows the location and lists of the completed, announced, and retired wind farms based on the information from the PUCT.

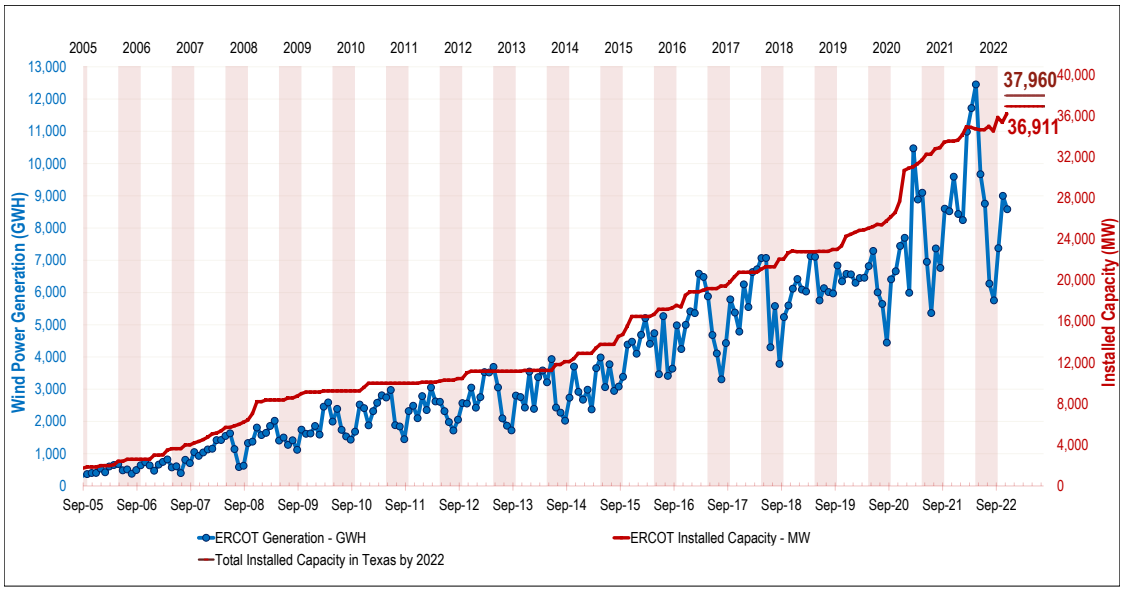


Figure 3-1: Installed Wind Power Capacity and Power Generation in the ERCOT Region from September 2005 to December 2022

In Section 3.2, a summary of wind power production for all wind farms in the Texas ERCOT region is presented. In order to weather normalize the wind power generation of the wind farms, linear regression models are developed for each wind farm that has been in operation in 2022. As shown in Figure 3-2, the model coefficients for each wind farm are obtained from these regression models using the 2022 daily power generation data of the corresponding wind farm and the 2022 daily wind speed data of the most representative ERCOT weather zone among the five ERCOT zones. The model is then used to estimate the wind power generation using the 2018 wind speed data. The weather normalized modeled power generation allows the comparison of the wind power generation of each wind farm in different years. In addition, a comparison between the annual and OSP wind power generation from the previous report and this report is presented.

[11] Wind project information obtained from the Public Utility Commission of Texas (www.puc.texas.gov) as of 1/6/2023 and the Electric Reliability Council of Texas (ERCOT) as of March 2023.

[12] The "Lone Star – Post Oak Wind" (total 200 MW) in Howard county and "Sand Bluff Wind Farm" (total 90 MW) in Glasscock county reported lower production from September 2022, and May 2022, respectively. Therefore, they are not included in the 2022 PUCT list.

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 2018. The detailed analysis for each wind farm is provided in Volume II, Appendix A.

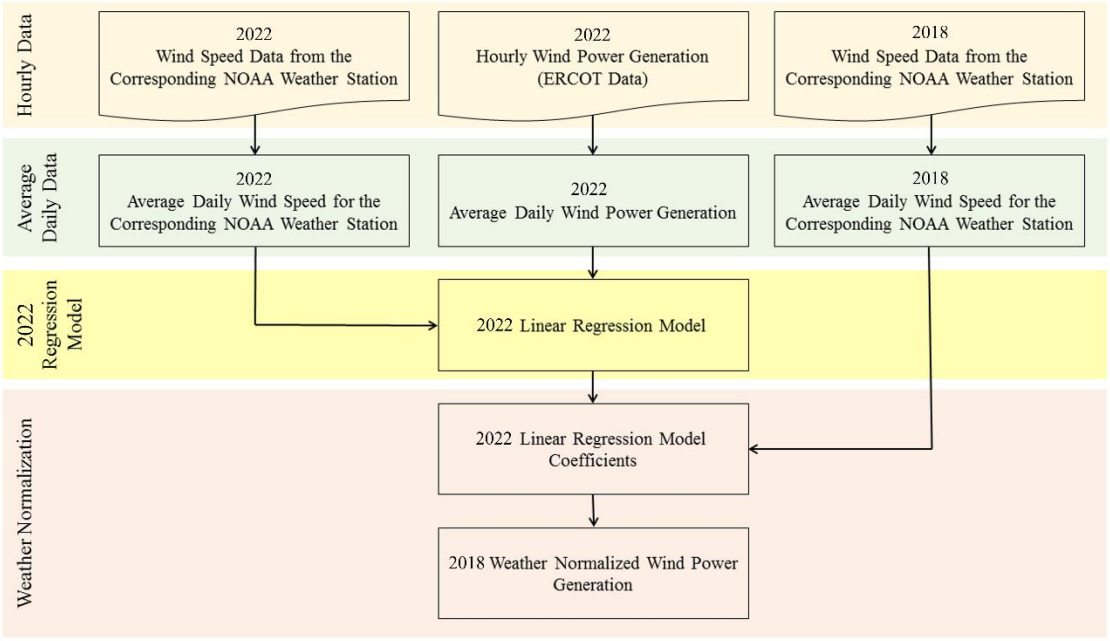


Figure 3-2: Procedure for the 2018 Annual and OSP Weather Normalized Wind Power Generation for Each Wind Farm in Operation in 2022 in Texas ERCOT Region

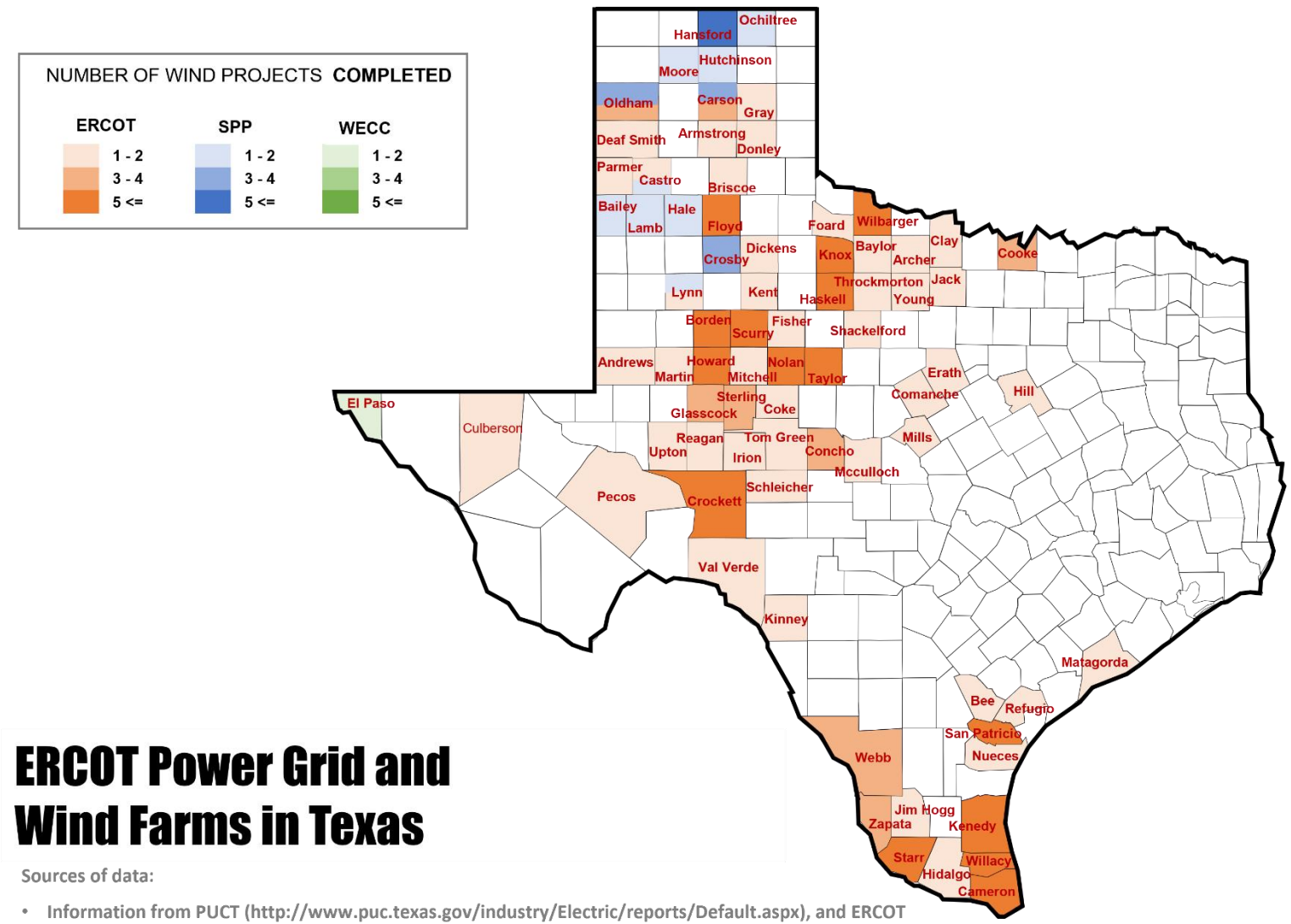


Figure 3-3: Completed Wind Projects in Texas

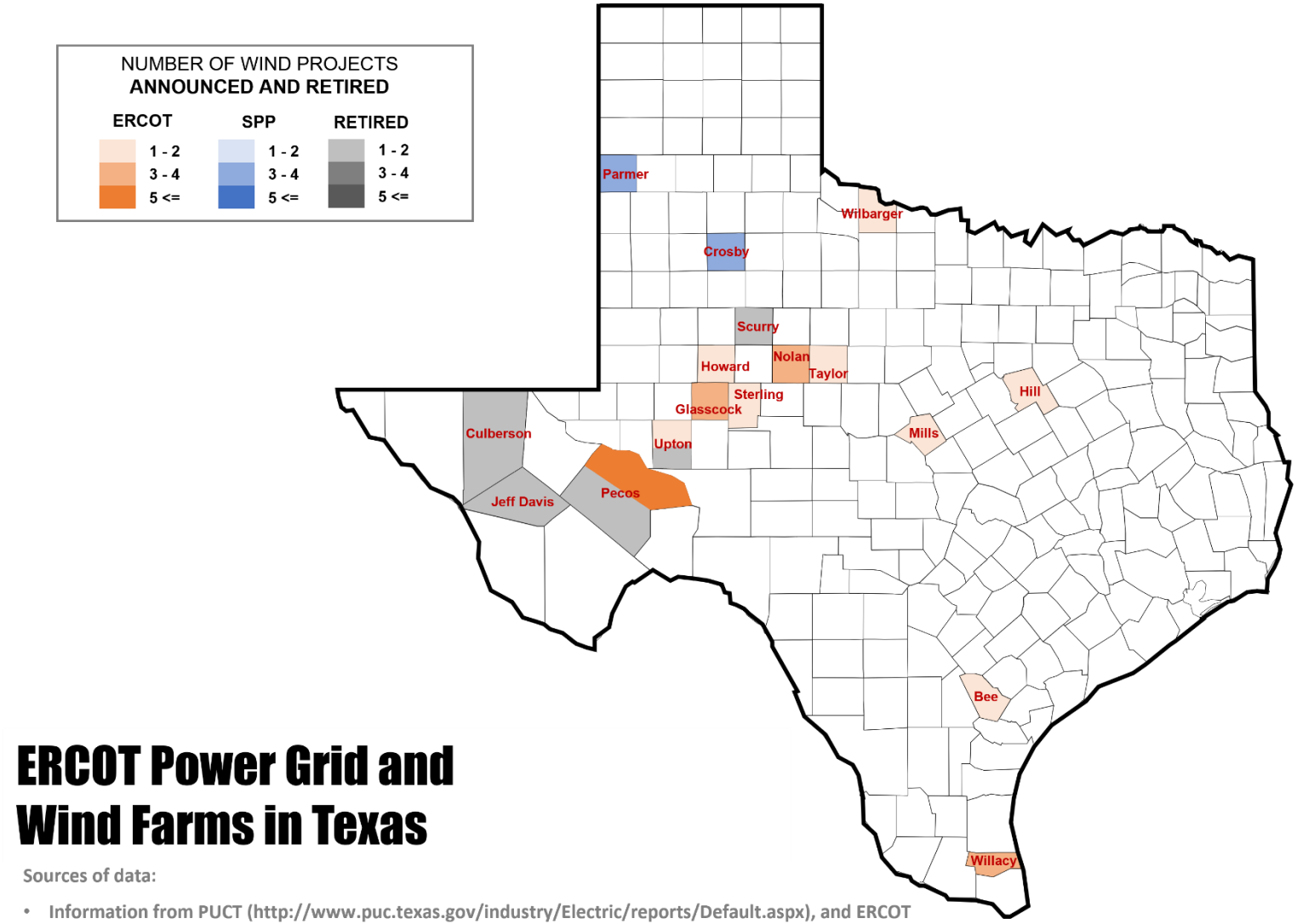
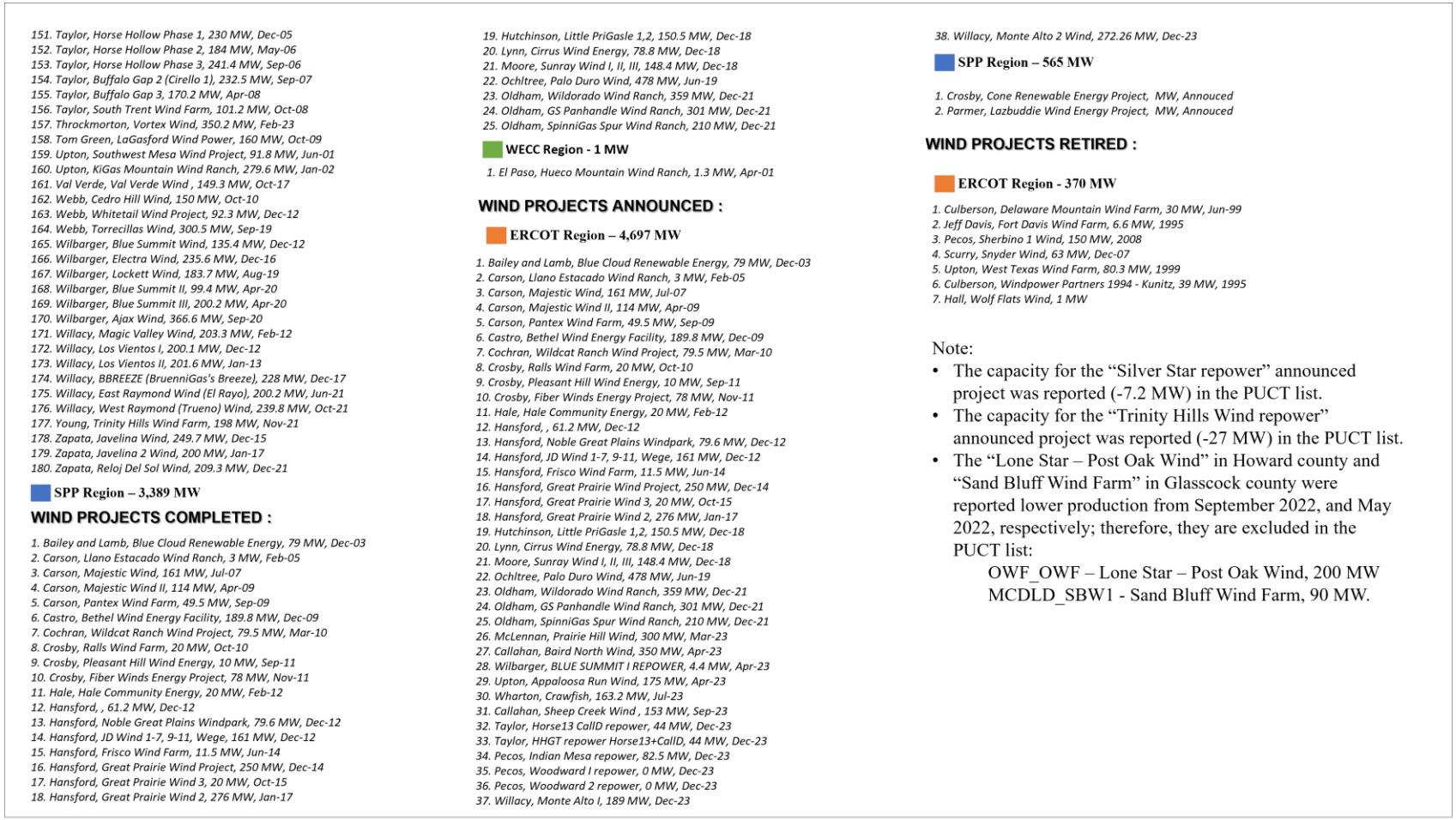


Figure 3-4: Announced and Retired Wind Projects in Texas

Figure 3-5: A List of Completed, Announced and Retired Wind Projects in Texas



151. Taylor, Horse Hollow Phase 1, 230 MW, Dec-05
152. Taylor, Horse Hollow Phase 2, 184 MW, May-06
153. Taylor, Horse Hollow Phase 3, 241.4 MW, Sep-06
154. Taylor, Buffalo Gap 2 (Cirello 1), 232.5 MW, Sep-07
155. Taylor, Buffalo Gap 3, 170.2 MW, Apr-08
156. Taylor, South Trent Wind Farm, 101.2 MW, Oct-08
157. Throckmorton, Vortex Wind, 350.2 MW, Feb-23
158. Tom Green, LaGasford Wind Power, 160 MW, Oct-09
159. Upton, Southwest Mesa Wind Project, 91.8 MW, Jun-01
160. Upton, KiGas Mountain Wind Ranch, 279.6 MW, Jan-02
161. Val Verde, Val Verde Wind , 149.3 MW, Oct-17
162. Webb, Cedro Hill Wind, 150 MW, Oct-10
163. Webb, Whitetail Wind Project, 92.3 MW, Dec-12
164. Webb, Torrecillas Wind, 300.5 MW, Sep-19
165. Wilbarger, Blue Summit Wind, 135.4 MW, Dec-12
166. Wilbarger, Electra Wind, 235.6 MW, Dec-16
167. Wilbarger, Lockett Wind, 183.7 MW, Aug-19
168. Wilbarger, Blue Summit II, 99.4 MW, Apr-20
169. Wilbarger, Blue Summit III, 200.2 MW, Apr-20
170. Wilbarger, Ajax Wind, 366.6 MW, Sep-20
171. Willacy, Magic Valley Wind, 203.3 MW, Feb-12
172. Willacy, Los Vientos I, 200.1 MW, Dec-12
173. Willacy, Los Vientos II, 201.6 MW, Jan-13
174. Willacy, BBREEZE (BruenniGas's Breeze), 228 MW, Dec-17
175. Willacy, East Raymond Wind (El Rayo), 200.2 MW, Jun-21
176. Willacy, West Raymond (Trueno) Wind, 239.8 MW, Oct-21
177. Young, Trinity Hills Wind Farm, 198 MW, Nov-21
178. Zapata, Javelina Wind, 249.7 MW, Dec-15
179. Zapata, Javelina 2 Wind, 200 MW, Jan-17
180. Zapata, Reloj Del Sol Wind, 209.3 MW, Dec-21

SPP Region – 3,389 MW

WIND PROJECTS COMPLETED :

1. Bailey and Lamb, Blue Cloud Renewable Energy, 79 MW, Dec-03
2. Carson, Llano Estacado Wind Ranch, 3 MW, Feb-05
3. Carson, Majestic Wind, 161 MW, Jul-07
4. Carson, Majestic Wind II, 114 MW, Apr-09
5. Carson, Pantex Wind Farm, 49.5 MW, Sep-09
6. Castro, Bethel Wind Energy Facility, 189.8 MW, Dec-09
7. Cochran, Wildcat Ranch Wind Project, 79.5 MW, Mar-10
8. Crosby, Ralls Wind Farm, 20 MW, Oct-10
9. Crosby, Pleasant Hill Wind Energy, 10 MW, Sep-11
10. Crosby, Fiber Winds Energy Project, 78 MW, Nov-11
11. Hale, Hale Community Energy, 20 MW, Feb-12
12. Hansford, , 61.2 MW, Dec-12
13. Hansford, Noble Great Plains Windpark, 79.6 MW, Dec-12
14. Hansford, JD Wind 1-7, 9-11, Wege, 161 MW, Dec-12
15. Hansford, Frisco Wind Farm, 11.5 MW, Jun-14
16. Hansford, Great Prairie Wind Project, 250 MW, Dec-14
17. Hansford, Great Prairie Wind 3, 20 MW, Oct-15
18. Hansford, Great Prairie Wind 2, 276 MW, Jan-17
19. Hutchinson, Little PriGasle 1,2, 150.5 MW, Dec-18
20. Lynn, Cirrus Wind Energy, 78.8 MW, Dec-18
21. Moore, Sunray Wind I, II, III, 148.4 MW, Dec-18
22. Ochltree, Palo Duro Wind, 478 MW, Jun-19
23. Oldham, Wildorado Wind Ranch, 359 MW, Dec-21
24. Oldham, GS Panhandle Wind Ranch, 301 MW, Dec-21
25. Oldham, SpinniGas Spur Wind Ranch, 210 MW, Dec-21

WECC Region - 1 MW

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

WIND PROJECTS ANNOUNCED :

ERCOT Region – 4,697 MW

1. Bailey and Lamb, Blue Cloud Renewable Energy, 79 MW, Dec-03
2. Carson, Llano Estacado Wind Ranch, 3 MW, Feb-05
3. Carson, Majestic Wind, 161 MW, Jul-07
4. Carson, Majestic Wind II, 114 MW, Apr-09
5. Carson, Pantex Wind Farm, 49.5 MW, Sep-09
6. Castro, Bethel Wind Energy Facility, 189.8 MW, Dec-09
7. Cochran, Wildcat Ranch Wind Project, 79.5 MW, Mar-10
8. Crosby, Ralls Wind Farm, 20 MW, Oct-10
9. Crosby, Pleasant Hill Wind Energy, 10 MW, Sep-11
10. Crosby, Fiber Winds Energy Project, 78 MW, Nov-11
11. Hale, Hale Community Energy, 20 MW, Feb-12
12. Hansford, , 61.2 MW, Dec-12
13. Hansford, Noble Great Plains Windpark, 79.6 MW, Dec-12
14. Hansford, JD Wind 1-7, 9-11, Wege, 161 MW, Dec-12
15. Hansford, Frisco Wind Farm, 11.5 MW, Jun-14
16. Hansford, Great Prairie Wind Project, 250 MW, Dec-14
17. Hansford, Great Prairie Wind 3, 20 MW, Oct-15
18. Hansford, Great Prairie Wind 2, 276 MW, Jan-17
19. Hutchinson, Little PriGasle 1,2, 150.5 MW, Dec-18
20. Lynn, Cirrus Wind Energy, 78.8 MW, Dec-18
21. Moore, Sunray Wind I, II, III, 148.4 MW, Dec-18
22. Ochltree, Palo Duro Wind, 478 MW, Jun-19
23. Oldham, Wildorado Wind Ranch, 359 MW, Dec-21
24. Oldham, GS Panhandle Wind Ranch, 301 MW, Dec-21
25. Oldham, SpinniGas Spur Wind Ranch, 210 MW, Dec-21
26. McLennan, Prairie Hill Wind, 300 MW, Mar-23
27. Callahan, Baird North Wind, 350 MW, Apr-23
28. Wilbarger, BLUE SUMMIT I REPOWER, 4.4 MW, Apr-23
29. Upton, Appaloosa Run Wind, 175 MW, Apr-23
30. Wharton, Crawfish, 163.2 MW, Jul-23
31. Callahan, Sheep Creek Wind , 153 MW, Sep-23
32. Taylor, Horse13 CallD repower, 44 MW, Dec-23
33. Taylor, HHGT repower Horse13+CallD, 44 MW, Dec-23
34. Pecos, Indian Mesa repower, 82.5 MW, Dec-23
35. Pecos, Woodward I repower, 0 MW, Dec-23
36. Pecos, Woodward 2 repower, 0 MW, Dec-23
37. Willacy, Monte Alto I, 189 MW, Dec-23
38. Willacy, Monte Alto 2 Wind, 272.26 MW, Dec-23

SPP Region – 565 MW

1. Crosby, Cone Renewable Energy Project, MW, Annouced
2. Parmer, Lazbuddie Wind Energy Project, MW, Annouced

WIND PROJECTS RETIRED :

ERCOT Region - 370 MW

1. Culberson, Delaware Mountain Wind Farm, 30 MW, Jun-99
2. Jeff Davis, Fort Davis Wind Farm, 6.6 MW, 1995
3. Pecos, Sherbino 1 Wind, 150 MW, 2008
4. Scurry, Snyder Wind, 63 MW, Dec-07
5. Upton, West Texas Wind Farm, 80.3 MW, 1999
6. Culberson, Windpower Partners 1994 - Kunitz, 39 MW, 1995
7. Hall, Wolf Flats Wind, 1 MW

Note:

- The capacity for the "Silver Star repower" announced project was reported (-7.2 MW) in the PUCT list.
- The capacity for the "Trinity Hills Wind repower" announced project was reported (-27 MW) in the PUCT list.
- The "Lone Star – Post Oak Wind" in Howard county and "Sand Bluff Wind Farm" in Glasscock county were reported lower production from September 2022, and May 2022, respectively; therefore, they are excluded in the PUCT list:

  OWF_OWF – Lone Star – Post Oak Wind, 200 MW
  MCDLD_SBW1 - Sand Bluff Wind Farm, 90 MW.

Figure 3-5: A List of Completed, Announced and Retired Wind Projects in Texas (Continued)

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

Table 3-1 shows the summary of the 2022 measured power production for the wind farms that were operating in the year of 2022 in the Texas ERCOT region and the modeled wind power production using daily regression models and wind speed data from 2018 (Volume II, Appendix A). This table includes annual generations, OSP generations, wind power capacity, wind zone, and CL zone for all wind farms operated for more than six months in Texas. The power generation in 2022 of Green Pastures W, Pyron, and Big Spring Wind Power have been reduced over 50% compared to last year.

Table 3-2 shows the monthly average wind speed across five ERCOT weather zones in 2018 (new base year) and 2022, which are mainly used for the wind modeling analysis. For this year, the average wind speed of ERCOT weather zones was used for data processing.

Although the daily regression models using the data of the windfarms operated for more than six months in 2022, the windfarms operated less than twelve months are excluded in the annual and OSP wind power production calculation.

As shown in Figure 3-6 and Figure 3-7, the modeled annual wind power production using 2018 wind speed data (95,245,042 MWh/yr) is lower by about 7.2% when compared to what was measured in 2022 (102,671,395 MWh/yr)[13]. For the OSP, the modeled average daily power production using 2018 wind speed data is 260,491 MWh/day, which is 3.2 % lower than that measured in 2022 (269,074 MWh/day)[13]. This is because, for the modeling analysis of this year, the average wind speed of ERCOT for the year 2022 is used for the analysis of most wind farms and more wind power was produced in the OSP. The OSP in this year's report includes the period from May 1st to September 30th.

Figure 3-8 presents the comparison of the 2022 measured annual wind power production against the modeled annual wind power production using 2018 wind speed data for each wind farm. Figure 3-9 shows the difference between the 2022 measured average daily power production and the modeled average daily wind power production using 2018 wind speed data during the OSP for each wind farm.

[13] This value reflects the total power generation for all windfarms operated for more than six months in 2022.

Table 3-1: Summary of Annual Power Production for All Wind Farms Operated for more than 6 months in 2022

Wind Unit Name	Facility Name	County	Capacity (MW)	ERCOT Wind Zone	CL Zone	Wind Power for 2018 Predicted		Wind Power for 2022 Measured	
						Annual (MWh/yr)	OSP (MWh/day)	Annual (MWh/yr)	OSP (MWh/day)
AJAXWIND_UNIT1	WKN Amadeus Wind	WILBARGER	225.6	WEST	W	686,952	1,880	807,357	2,036
AJAXWIND_UNIT2	WKN Amadeus Wind	WILBARGER	141	WEST	W	436,664	1,204	520,333	1,312
ALGODON_UNIT1	WKN Amadeus Wind	FISHER	171.6	WEST	W	504,581	1,507	541,628	1,617
AMADEUS1_UNIT1	Anacacho Windfarm	FISHER	36.7	WEST	W	90,177	271	106,423	295
AMADEUS1_UNIT2	Falvez Astra Wind	FISHER	35.8	WEST	W	89,661	253	106,782	276
AMADEUS2_UNIT3	Falvez Astra Wind	FISHER	177.7	WEST	W	484,186	1,288	540,956	1,364
ANACACHO_ANA	Falvez Astra Wind	KINNEY	99.83	SOUTH	S	354,897	1,041	332,358	985
APOGEE_UNIT1	Barrow Ranch Wind	THROCKMORTON	25	WEST	W	55,551	184	61,667	202
APOGEE_UNIT2	Barrow Ranch Wind	THROCKMORTON	14	WEST	W	44,715	143	51,399	157
APOGEE_UNIT3	BBREEZE (BruenniGas's Breeze)	THROCKMORTON	30.2	WEST	W	94,647	307	110,672	335
APOGEE_UNIT4	BBREEZE (BruenniGas's Breeze)	THROCKMORTON	115	WEST	W	216,951	741	251,356	811
APOGEE_UNIT5	Bobcat Bluff	THROCKMORTON	110	WEST	W	183,824	589	211,543	644
APOGEE_UNIT6	Blue Summit Wind	THROCKMORTON	24	WEST	W	72,125	238	84,044	260
APOGEE_UNIT7	Blue Summit Wind	THROCKMORTON	75	WEST	W	131,487	458	150,055	447
AQUILLA_U1_23	Blue Summit Wind 2	HILL	13.9	NORTH	N	50,479	138	46,155	109
AQUILLA_U1_28	Blue Summit Wind 2	HILL	135.4	NORTH	N	559,123	1,523	513,529	1,234
AQUILLA_U2_23	Blue Summit III	HILL	7	NORTH	N	26,322	73	23,844	56
AQUILLA_U2_28	Blue Summit III	HILL	143.8	NORTH	N	586,483	1,650	533,359	1,300
ASTRA_UNIT1	Javelina Wind	DEAF SMITH	163.2	PANHANDLE	W	480,729	1,319	440,673	1,154
AVIATOR_UNIT1	Javelina Wind	COKE	180.12	WEST	W	513,851	1,383	623,047	1,516
AVIATOR_UNIT2	Javelina 2 Wind	COKE	145.64	WEST	W	433,791	1,178	520,190	1,287
BAFFIN_UNIT1	Javelina 2 Wind	KENEDY	100	COASTAL	S	148,120	337	208,728	509
BAFFIN_UNIT2	Javelina 2 Wind	KENEDY	102	COASTAL	S	148,876	337	212,272	514
BAIRDWND_UNIT1	Brazos Wind Ranch	CALLAHAN	195	NORTH	W	419,520	1,097	399,680	899
BAIRDWND_UNIT2	Brazos Wind Ranch	CALLAHAN	145	NORTH	W	339,114	897	314,333	718
BARROW_UNIT1	Briscoe Wind	ANDREWS	90.2	WEST	W	300,566	830	345,219	884
BARROW_UNIT2	Barton Chapel Wind 1	ANDREWS	70.5	WEST	W	229,206	606	263,222	648
BBREEZE_UNIT1	Buckthorn Wind	WILLACY	120	COASTAL	S	227,882	514	298,297	743
BBREEZE_UNIT2	Buckthorn Wind	WILLACY	108	COASTAL	S	209,900	474	277,487	671
BCATWIND_WIND_1	Buffalo Gap 1	ARCHER	162	WEST	W	456,925	1,234	548,645	1,351
BLSUMMIT_BLSMT1_6	Buffalo Gap 2 (Cirello 1)	WILBARGER	126.4	WEST	W	318,219	878	363,806	959
BLSUMMIT_UNIT2_17	Buffalo Gap 2 (Cirello 1)	WILBARGER	6.86	WEST	W	21,566	60	22,768	65
BLSUMMIT_UNIT2_25	Buffalo Gap 3	WILBARGER	92.5	WEST	W	305,908	835	329,988	890
BLSUMIT3_UNIT_17	Bull Creek Wind Plant	WILBARGER	13.7	WEST	W	41,253	116	46,246	126
BLSUMIT3_UNIT_25	Bull Creek Wind Plant	WILBARGER	186.5	WEST	W	666,597	1,830	684,676	1,941
BORDAS_JAVEL18	Cabezon Wind	WEBB	19.69	SOUTH	S	59,930	168	56,082	160
BORDAS_JAVEL20	Cabezon Wind	WEBB	230	SOUTH	S	903,596	2,624	846,415	2,485
BORDAS2_JAVEL2_A	Callahan Divide Wind Energy Center	WEBB	96	SOUTH	S	390,903	1,119	365,495	1,059
BORDAS2_JAVEL2_B	Cameron County Wind	WEBB	74	SOUTH	S	296,684	855	277,236	809
BORDAS2_JAVEL2_C	Capricorn Ridge Wind (exp)	WEBB	30	SOUTH	S	130,640	382	122,640	363
BRISCOE_WIND	Capricorn Ridge Wind	BRISCOE	149.85	PANHANDLE	W	480,007	1,281	442,784	1,104
BRTSW_BCW1	Capricorn Ridge Wind	JACK	120	NORTH	N	257,484	704	239,629	560
BUCKTHRN_UNIT1	Capricorn Ridge Wind (exp)	ERATH	44.9	NORTH	N	162,761	477	150,730	377
BUCKTHRN_UNIT2	Cedro Hill Wind	ERATH	55.7	NORTH	N	210,643	596	197,663	485
BUFF_GAP_UNIT1	Cedro Hill Wind	TAYLOR	120.6	WEST	W	184,115	558	204,744	610
BUFF_GAP_UNIT2_1	Cactus Flats Wind	TAYLOR	115.5	WEST	W	190,884	596	212,747	654
BUFF_GAP_UNIT2_2	Chalupa Wind	TAYLOR	117	WEST	W	180,223	563	201,476	619
BUFF_GAP_UNIT3	Chalupa Wind	TAYLOR	170.2	WEST	W	253,377	772	282,166	849
BULLCRK_WND1	Champion Wind Farm	BORDEN	89	WEST	W	107,689	278	126,813	305
BULLCRK_WND2	Canadian Breaks Wind	BORDEN	91	WEST	W	113,082	296	132,195	324
CABEZON_WIND1	Cotton Plains Wind	STARR	115.2	SOUTH	S	324,020	1,048	302,384	991
CABEZON_WIND2	Old Settler Wind	STARR	122.4	SOUTH	S	340,888	1,101	319,186	1,044
CALLAHAN_WND1	Coyote Wind Farm	CALLAHAN	123.1	WEST	W	327,983	901	346,692	959
CAMWIND_UNIT1	Coyote Wind Farm	CAMERON	165	COASTAL	S	279,703	600	372,778	830
CAPRIDG4_CR4	Coyote Wind Farm	COKE	121.5	WEST	W	298,606	796	365,877	875
CAPRIDGE_CR1	Papalote Creek Phase II	STERLING	231.7	WEST	W	599,061	1,633	732,476	1,790
CAPRIDGE_CR2	Cranel Wind	STERLING	149.5	WEST	W	357,540	945	430,843	1,034
CAPRIDGE_CR3	Camp Springs I	STERLING	200.9	WEST	W	461,427	1,190	562,917	1,303
CEDROHIL_CHW1	Camp Springs II	WEBB	75	SOUTH	S	262,329	809	244,100	762
CEDROHIL_CHW2	Dermott Wind 1	WEBB	75	SOUTH	S	246,526	771	228,132	722
CFLATS_U1	Dermott Wind 1	CONCHO	148.4	WEST	W	368,530	1,033	432,481	1,121
CHALUPA_UNIT1	DEWOLF EAST	CAMERON	173.25	COASTAL	S	314,003	769	435,527	1,174
CHALUPA_UNIT2	Electra Wind	CAMERON	25.2	COASTAL	S	46,754	114	64,421	173
CHAMPION_UNIT1	Electra Wind	NOLAN	126.5	WEST	W	263,350	737	298,519	801
CN_BRKS_UNIT_1	EAST RAYMOND WIND (EL RAYO) U1	OLDHAM	210.1	PANHANDLE	W	948,314	2,479	868,041	2,138
COTPLNS_COTTONPL	EAST RAYMOND WIND (EL RAYO) U2	FLOYD	50.4	PANHANDLE	W	218,239	550	189,137	471
COTPLNS_OLDSETLR	Elbow Creek Wind	FLOYD	151.2	PANHANDLE	W	645,037	1,647	558,541	1,406
COYOTE_W_UNIT1	Sendero Wind Energy Project	SCURRY	90	WEST	W	194,227	474	232,732	519
COYOTE_W_UNIT2	Whitetail Wind Project	SCURRY	26.6	WEST	W	62,279	162	76,296	178
COYOTE_W_UNIT3	Val Verde Wind	SCURRY	126	WEST	W	273,806	657	327,978	714
COTTON_PAP2	Val Verde Wind	SAN PATRICIO	200.12	COASTAL	S	393,257	968	547,608	1,472
CRANELL_UNIT1	Silver Star Phase I	REFUGIO	220	COASTAL	S	468,068	1,047	635,351	1,546

Table 3-1: Summary of Annual Power Production for All Wind Farms Operated for more than 6 months in 2022 (Continued)

Wind Unit Name	Facility Name	County	Capacity (MW)	ERCOT Wind Zone	CL Zone	Wind Power for 2018 Predicted		Wind Power for 2022 Measured	
						Annual (MWh/yr)	OSP (MWh/day)	Annual (MWh/yr)	OSP (MWh/day)
CSEC_CSECG1	Fluvanna Renewable 1	SCURRY	134.42	WEST	W	234,212	717	249,727	773
CSEC_CSECG2	Fluvanna Renewable 1	SCURRY	123.6	WEST	W	217,430	685	231,177	735
DERMOTT_UNIT2	Foard City Wind	SCURRY	126.5	WEST	W	399,076	1,104	470,795	1,207
DEWOLF_UNIT1	Flat Top Wind I	COKE	199.26	WEST	W	616,903	1,710	741,835	1,862
DIGBY_UNIT1	Goat Wind	WILBARGER	101.31	WEST	W	338,934	924	394,917	999
DIGBY_UNIT2	Goat Wind	WILBARGER	134.29	WEST	W	433,546	1,216	510,713	1,322
EL_RAYO_UNIT1	Colbeck's Corner	WILLACY	101.2	COASTAL	S	262,117	642	350,332	910
EL_RAYO_UNIT2	Grandview Phase 1 (Conway Windfarm)	WILLACY	99	COASTAL	S	256,430	621	345,701	891
ELB_ELBCREEK	Grandview Phase 1 (Conway Windfarm)	HOWARD	121.9	WEST	W	358,745	985	425,794	1,070
EXGNSND_WIND_1	Gunsight Mountain	JIM HOGG	78	SOUTH	S	278,183	888	261,116	845
EXGNWTL_WIND_1	Goldthwaite Wind Energy	WEBB	92.34	SOUTH	S	238,459	746	222,696	707
FERMI_WIND1	Harald (BearKat Wind B)	VAL VERDE	121.9	WEST	S	317,670	1,007	357,966	1,085
FERMI_WIND2	Horse Hollow Phase 1	VAL VERDE	27.44	WEST	S	81,278	253	89,419	269
FLTCK_SSI	Horse Hollow Phase 2	ERATH	52.8	NORTH	N	201,709	558	190,886	467
FLUVANNA_UNIT1	Horse Hollow Phase 3	SCURRY	79.8	WEST	W	257,967	684	303,163	740
FLUVANNA_UNIT2	Horse Hollow Phase 4	SCURRY	75.6	WEST	W	246,798	660	288,952	715
FOARDCTY_UNIT1	High Lonesome W	FOARD	186.48	WEST	W	516,575	1,348	603,094	1,463
FOARDCTY_UNIT2	High Lonesome W	FOARD	163.8	WEST	W	426,839	976	497,626	1,056
FTWIND_UNIT_1	High Lonesome Wind Phase II	MILLS	200	NORTH	N	848,530	2,484	788,152	2,024
GOAT_GOATWIND	High Lonesome Wind Phase II	STERLING	80	WEST	W	105,798	350	116,698	379
GOAT_GOATWIN2	HICKMAN (SANTA RITA WIND) 1	STERLING	69.6	WEST	W	105,062	367	113,465	390
GOPHER_UNIT1	HICKMAN (SANTA RITA WIND) 1	BORDEN	82	WEST	W	260,413	723	301,043	778
GOPHER_UNIT2	HICKMAN (SANTA RITA WIND) 2	BORDEN	76	WEST	W	257,162	724	296,168	778
GPASTURE_WIND_I	HICKMAN (SANTA RITA WIND) 2	BAYLOR	150	WEST	W	174,720	458	194,787	505
GRANDVW1_COLA	Horse Creek Wind	CARSON	100.24	PANHANDLE	W	465,443	1,262	430,752	1,103
GRANDVW1_COLB	Horse Creek Wind	CARSON	100.24	PANHANDLE	W	466,749	1,251	432,643	1,096
GRANDVW1_GV1A	Jumbo Road Wind (Hereford 2)	CARSON	107.4	PANHANDLE	W	496,174	1,312	461,121	1,151
GRANDVW1_GV1B	Jumbo Road Wind (Hereford 2)	CARSON	103.8	PANHANDLE	W	475,111	1,253	443,194	1,107
GRIF_TRL_UNIT1	Hereford Wind Project (Hereford 1)	KNOX	98.7	WEST	W	304,044	797	358,817	860
GRIF_TRL_UNIT2	Hereford Wind Project (Hereford 1)	KNOX	126.9	WEST	W	403,626	1,123	477,477	1,219
GUNMTN_G1	Hackberry Wind Farm	HOWARD	119.93	WEST	W	368,962	975	429,984	1,049
GWEC_GWEC_G1	Inadale	MILLS	148.6	NORTH	N	525,888	1,438	493,731	1,159
HARALD_UNIT1	Inadale	GLASSCOCK	162.1	WEST	W	413,377	1,186	486,257	1,285
H_HOLLOW_WND1	Desert Sky Wind Power Project	Kendall	230	SOUTH	S	769,498	1,757	699,751	1,628
HHOLLOW2_WIND1	Desert Sky Wind Power Project	-	184	WEST	W	478,834	1,241	569,689	1,361
HHOLLOW3_WND_1	Desert Sky Wind Power Project	TAYLOR	241.4	WEST	W	566,292	1,419	666,980	1,558
HHOLLOW4_WND1	Desert Sky Wind Power Project	TAYLOR	115	WEST	W	335,230	870	389,263	949
HI_LONE_WGR1A	Indian Mesa	CROCKETT	46	WEST	W	145,964	448	146,044	485
HI_LONE_WGR1B	Karankawa Wind	CROCKETT	51.9	WEST	W	65,199	193	69,861	215
HI_LONE_WGR1C	Karankawa Wind	CROCKETT	25.3	WEST	W	80,234	244	85,577	272
HI_LONE_WGR3	Karankawa 2 Wind	CROCKETT	127.5	WEST	W	256,763	746	288,930	798
HI_LONE_WGR4	Keechi Wind	CROCKETT	101.5	WEST	W	196,193	570	230,257	623
HI_LONE_WGR2	Sherbino Mesa Wind Farm 2	CROCKETT	122.4	WEST	W	272,833	854	276,450	920
HI_LONE_WGR2A	King Mountain Wind Ranch	CROCKETT	25.3	WEST	W	91,065	267	98,783	284
HICKMAN_G1_J01	King Mountain Wind Ranch	REAGAN	77.5	WEST	W	272,893	758	315,630	810
HICKMAN_G1_J02	King Mountain Wind Ranch	REAGAN	75	WEST	W	271,589	756	307,224	804
HICKMAN_G2_J01	King Mountain Wind Ranch	REAGAN	73.75	WEST	W	259,914	725	302,707	776
HICKMAN_G2_J02	Langford Wind Power	REAGAN	73.75	WEST	W	260,006	726	301,976	777
HORSECRK_UNIT1	Logan's Gap Wind I	HASKELL	134.81	WEST	W	412,673	1,148	489,420	1,250
HORSECRK_UNIT2	Logan's Gap Wind I	HASKELL	101.69	WEST	W	321,653	902	383,234	983
HRFDWIND_JRDWIND1	Longhorn Energy Center North	DEAF SMITH	146.15	PANHANDLE	W	534,584	1,373	489,883	1,178
HRFDWIND_JRDWIND2	Longhorn Energy Center North	DEAF SMITH	153.55	PANHANDLE	W	552,514	1,400	505,914	1,198
HRFDWIND_WIND_G	Las Majadas	DEAF SMITH	99.9	PANHANDLE	W	371,980	934	340,940	799
HRFDWIND_WIND_V	Las Majadas	DEAF SMITH	100	PANHANDLE	W	459,129	1,202	421,845	1,035
HWF_HWFG1	Las Majadas	SHACKELFORD	165.6	WEST	W	300,908	982	332,228	1,050
INDL_INADALE1	Lone Star - Mesquite Wind	NOLAN	95	WEST	W	185,213	546	215,499	601
INDL_INADALE2	Lockett Wind Farm	NOLAN	102	WEST	W	191,949	556	224,593	614
INDNNWP_INDNNWP2	Lone Star - Post Oak Wind	PECOS	91.8	WEST	W	174,143	537	203,541	578
KARAKAW1_UNIT1	Lone Star - Post Oak Wind	SAN PATRICIO	103.32	COASTAL	S	212,705	456	282,275	651
KARAKAW1_UNIT2	Loraine Windpark	SAN PATRICIO	103.32	COASTAL	S	227,673	527	308,066	771
KARAKAW2_UNIT3	Loraine Windpark	SAN PATRICIO	100.42	COASTAL	S	231,799	534	315,907	791
KEECHI_U1	Loraine Windpark	JACK	110	NORTH	N	452,764	1,333	420,286	1,058
KEO_SHRBINO2	Loraine Windpark	PECOS	132	WEST	W	467,200	1,555	558,517	1,699
KING_NE_KINGNE	Los Vientos I	UPTON	79.7	WEST	W	92,900	288	107,607	328
KING_NW_KINGNW	Los Vientos II	UPTON	79.7	WEST	W	118,368	403	125,747	459
KING_SE_KINGSE	Los Vientos III	UPTON	40.5	WEST	W	43,198	131	47,692	148
KING_SW_KINGSW	Los Vientos IV	UPTON	79.7	WEST	W	113,241	353	123,383	388
LGD_LANGFORD	Los Vientos V	TOM GREEN	159.96	WEST	W	489,137	1,363	567,136	1,483
LGW_UNIT1	Mariah Del Notre	COMANCHE	106.26	NORTH	N	351,973	1,005	327,912	803
LGW_UNIT2	Mariah Del Notre	COMANCHE	103.85	NORTH	N	332,162	963	308,046	762
LHORN_N_UNIT1	Maverick Creek I W	FLOYD	100	PANHANDLE	W	434,066	1,092	397,666	929
LHORN_N_UNIT2	Maverick Creek I W	FLOYD	100	PANHANDLE	W	440,179	1,102	395,957	913

Table 3-1: Summary of Annual Power Production for All Wind Farms Operated for more than 6 months in 2022 (Continued)

Wind Unit Name	Facility Name	County	Capacity (MW)	ERCOT Wind Zone	CL Zone	Wind Power for 2018 Predicted		Wind Power for 2022 Measured	
						Annual (MWh/yr)	OSP (MWh/day)	Annual (MWh/yr)	OSP (MWh/day)
LMAJADAS_UNIT1	Maverick Creek I W	WILLACY	110	COASTAL	S	285,408	691	375,578	978
LMAJADAS_UNIT2	Maverick Creek I W	WILLACY	24	COASTAL	S	59,148	140	78,703	201
LMAJADAS_UNIT3	Maverick Creek I W	WILLACY	138.6	COASTAL	S	354,074	848	464,988	1,206
LNCRK_G83	Maverick Creek II W	SHACKELFORD	194	WEST	W	384,744	1,027	466,614	1,139
LOCKETT_UNIT1	Maverick Creek II W	WILBARGER	183.7	WEST	W	655,480	1,861	767,629	2,014
LNCRK2_G871	Maverick Creek II W	SHACKELFORD	98	WEST	W	181,401	523	216,085	569
LNCRK2_G872	Maverick Creek II W	SHACKELFORD	100	WEST	W	185,800	517	219,408	568
LONEWOLF_G1	Maryneal Wind	MITCHELL	48	WEST	W	99,467	296	114,280	323
LONEWOLF_G2	Forest Creek Wind Farm	MITCHELL	51	WEST	W	99,999	305	115,473	334
LONEWOLF_G3	Sand Bluff Wind Farm	MITCHELL	25.5	WEST	W	57,254	173	66,137	190
LONEWOLF_G4	Mesquite Creek W	MITCHELL	24	WEST	W	51,186	154	59,274	169
LV2_LV2	Mesteno Wind	WILLACY	201.6	COASTAL	S	330,304	798	437,224	1,164
LV3_UNIT_1	Miami Wind 1 Project	STARR	200	SOUTH	S	729,533	2,076	673,460	1,939
LV4_UNIT_1	Miami Wind 1 Project	STARR	200	SOUTH	S	729,412	2,158	672,630	2,018
LV5_UNIT_1	Midway Wind	STARR	110	SOUTH	S	366,076	1,104	340,781	1,035
MARIAH_NORTE1	Hidalgo & Starr Wind	PARMER	115.2	PANHANDLE	W	499,620	1,248	462,504	1,088
MARIAH_NORTE2	Hidalgo & Starr Wind	PARMER	115.2	PANHANDLE	W	491,728	1,242	453,642	1,075
MAVCRK_E_UNIT5	HIDALGO II WIND	CONCHO	71.4	WEST	W	195,964	547	230,993	586
MAVCRK_E_UNIT6	Hidalgo & Starr Wind	CONCHO	33.3	WEST	W	98,055	281	117,268	305
MAVCRK_E_UNIT7	Mozart	CONCHO	22	WEST	W	57,594	154	68,450	165
MAVCRK_E_UNIT8	McAdoo Wind Energy	CONCHO	20	WEST	W	52,156	143	62,874	157
MAVCRK_E_UNIT9	Niels Bohr (BearKat Wind A)	CONCHO	76.8	WEST	W	188,579	527	225,431	574
MAVCRK_W_UNIT1	Notrees 1A (Vestas)	CONCHO	201.6	WEST	W	577,700	1,591	680,408	1,709
MAVCRK_W_UNIT2	Notrees 1B (GE Energy)	CONCHO	11.1	WEST	W	26,579	78	31,890	84
MAVCRK_W_UNIT3	Oveja Wind	CONCHO	33.6	WEST	W	87,757	230	104,701	248
MAVCRK_W_UNIT4	Oveja Wind	CONCHO	22.2	WEST	W	58,498	162	70,687	177
MARYNEAL_UNIT1	Ocotillo Windpower 1	NOLAN	182.4	WEST	W	479,070	1,204	534,647	1,301
MCDLD_FCW1	Palmas Altas Wind	GLASSCOCK	124.2	WEST	W	210,116	595	238,554	646
MESQCRK_WND1	Papalote Creek Wind Farm	DAWSON	105.61	WEST	W	252,539	649	288,054	698
MESQCRK_WND2	Papalote Creek Wind Farm	DAWSON	105.61	WEST	W	256,851	664	295,733	719
MESTENO_UNIT_1	Panther Creek	STARR	201.6	SOUTH	S	455,356	1,566	425,190	1,484
MIAM1_G1	Panther Creek 2	GRAY	144.3	PANHANDLE	W	575,069	1,501	532,614	1,305
MIAM1_G2	Panther Creek 3	GRAY	144.3	PANHANDLE	W	576,329	1,568	532,062	1,362
MIDWIND_UNIT1	Penascal Wind Farm	SAN PATRICIO	162.8	COASTAL	S	313,878	892	423,563	1,347
MIRASOLE_MIR11	Penascal Wind Farm	HIDALGO	52	SOUTH	S	155,311	480	146,775	454
MIRASOLE_MIR12	Penascal Wind Farm	HIDALGO	98	SOUTH	S	299,680	896	283,871	848
MIRASOLE_MIR13	Penascal Wind Farm 2	HIDALGO	50.4	SOUTH	S	143,665	427	135,388	402
MIRASOLE_MIR21	Peyton Creek Wind	HIDALGO	100	SOUTH	S	296,549	902	280,397	850
MOZART_WIND_1	Panhandle Wind 1	KENT	30	WEST	W	54,638	143	64,485	156
MWEC_G1	Panhandle Wind 1	DICKENS	150	PANHANDLE	W	475,861	1,466	437,311	1,256
NBOHR_UNIT1	Panhandle Wind 2	GLASSCOCK	196.6	WEST	W	522,572	1,531	616,793	1,660
NWF_NWF1	Panhandle Wind 2	WINKLER	92.61	WEST	W	157,326	524	185,029	575
NWF_NWF2	Prairie Hill Wind	WINKLER	60	WEST	W	97,604	327	115,449	359
OVEJA_G1	Prairie Hill Wind	IRION	151.2	WEST	W	506,452	1,461	593,492	1,574
OVEJA_G2	Pyron	IRION	151.2	WEST	W	466,784	1,293	494,942	1,392
PALMWIND_UNIT1	Pyron	CAMERON	144.9	COASTAL	S	260,422	652	361,765	959
PAP1_PAP1_J01	Ranchero	SAN PATRICIO	50.9	COASTAL	S	90,776	236	125,648	356
PAP1_PAP1_J02	Ranchero Wind	SAN PATRICIO	129	COASTAL	S	265,660	687	374,944	1,031
PC_NORTH_PANTHER1	Red Canyon 1	HOWARD	142.5	WEST	W	441,205	1,219	509,250	1,322
PC_SOUTH_PANTHER2	Magic Valley Wind	HOWARD	115.5	WEST	W	346,128	963	411,065	1,050
PC_SOUTH_PANTH31	Magic Valley Wind	HOWARD	106.92	WEST	W	292,931	795	353,933	870
PC_SOUTH_PANTH32	Reloj del Sol	HOWARD	108.54	WEST	W	306,273	850	371,544	930
PENA_UNIT1	Reloj del Sol	KENEDY	160.8	COASTAL	S	158,546	531	222,957	764
PENA_UNIT2_J01	Reloj del Sol	KENEDY	70.8	COASTAL	S	100,486	301	133,207	442
PENA_UNIT2_J02	Reloj del Sol	KENEDY	70.8	COASTAL	S	107,288	313	131,804	425
PENA3_UNIT3	Route66 Wind	KENEDY	100.8	COASTAL	S	109,460	338	149,121	486
PEY_UNIT1	RattleSnake Wind Ph 1	MATAGORDA	151.2	COASTAL	S	308,985	553	406,731	831
PH1_UNIT1	RattleSnake Wind Ph 1	CARSON	109.15	PANHANDLE	W	394,681	1,073	362,724	921
PH1_UNIT2	RTS WIND	CARSON	109.15	PANHANDLE	W	368,064	952	340,544	826
PH2_UNIT1	RTS 2 Wind	CARSON	94.19	PANHANDLE	W	391,909	1,108	362,902	971
PH2_UNIT2	RTS 2 Wind	CARSON	96.6	PANHANDLE	W	409,715	1,184	378,826	1,036
PHILLWND_UNIT1	Sage Draw Wind	LIMESTONE	153	NORTH	N	345,818	950	317,164	703
PHILLWND_UNIT2	Sage Draw Wind	LIMESTONE	147	NORTH	N	407,258	1,186	373,299	898
PRIDDY_UNIT1	Salt Fork Wind	MILLS	187.2	NORTH	N	551,012	1,576	520,346	1,314
PRIDDY_UNIT2	Salt Fork Wind	MILLS	115.2	NORTH	N	344,834	952	326,173	786
PYR_PYRON1	Willow Springs Wind	NOLAN	121.5	WEST	W	262,667	756	300,357	833
PYR_PYRON2	Willow Springs Wind	NOLAN	127.5	WEST	W	281,204	798	320,914	874
RANCHERO_UNIT1	San Roman Wind 1	CROCKETT	150	WEST	W	516,308	1,574	584,312	1,689
RANCHERO_UNIT2	Chapman Ranch Wind 1	CROCKETT	150	WEST	W	494,572	1,492	553,636	1,594
RDCANYON_RDCNY1	Chapman Ranch Wind 1	BORDEN	89.6	WEST	W	278,630	762	327,930	825
REDFISH_MV1A	Senate Wind Project	WILLACY	99.83	COASTAL	S	199,603	531	264,392	733
REDFISH_MV1B	Big Spring Wind Power	WILLACY	103.46	COASTAL	S	201,868	526	274,696	750

Table 3-1: Summary of Annual Power Production for All Wind Farms Operated for more than 6 months in 2022 (Continued)

Wind Unit Name	Facility Name	County	Capacity (MW)	ERCOT Wind Zone	CL Zone	Wind Power for 2018 Predicted		Wind Power for 2022 Measured	
						Annual (MWh/yr)	OSP (MWh/day)	Annual (MWh/yr)	OSP (MWh/day)
RELOJ_UNIT1	Big Spring Wind Power	ZAPATA	55.4	SOUTH	S	74,178	190	69,916	182
RELOJ_UNIT2	Shaffer Wind	ZAPATA	48	SOUTH	S	132,759	390	124,397	369
RELOJ_UNIT3	Shannon Wind	ZAPATA	83.1	SOUTH	S	114,963	276	104,561	256
RELOJ_UNIT4	South Plains Wind I	ZAPATA	22.8	SOUTH	S	25,747	65	21,830	63
ROUTE_66_WIND1	South Plains Wind I	CARSON	150	PANHANDLE	W	566,935	1,741	532,268	1,582
RSNAKE_G1	South Plains Wind II Phase a	GLASSCOCK	104.26	WEST	W	282,856	831	316,388	885
RSNAKE_G2	South Plains Wind II Phase b	GLASSCOCK	102.99	WEST	W	291,931	841	321,523	914
RTS_U1	Stephens Ranch Wind Phase b	MCCULLOCH	160	SOUTH	S	608,919	1,524	575,539	1,443
RTS2_U1	Stephens Ranch Wind Phase 1	MCCULLOCH	89.9	SOUTH	S	326,456	827	307,261	779
RTS2_U2	Spinning Spur Wind III	MCCULLOCH	89.9	SOUTH	S	351,606	895	331,884	846
SAGEDRAW_UNIT1	Spinning Spur Wind III	LYNN	169.2	WEST	W	535,611	1,387	629,809	1,511
SAGEDRAW_UNIT2	Spinning Spur Wind II	LYNN	169.2	WEST	W	525,665	1,362	620,329	1,488
SALTFORK_UNIT1	Stella 2 Wind	Gray	64	PANHANDLE	W	287,189	725	265,357	629
SALTFORK_UNIT2	South Trent Wind Farm	Gray	110	PANHANDLE	W	500,241	1,264	460,873	1,092
SALVTION_UNIT1	Seymour Hills Wind	HASKELL	125	WEST	W	432,669	1,206	413,731	1,282
SANROMAN_WIND_1	Sweetwater Wind 2	CAMERON	95.25	COASTAL	S	122,729	260	168,927	399
SANTACRU_UNIT1	Sweetwater Wind 2	NUECES	150.6	COASTAL	S	277,414	633	379,618	951
SANTACRU_UNIT2	Sweetwater Wind 3 (Cottonwood Creek)	NUECES	98.4	COASTAL	S	201,578	454	275,799	685
SENATEWD_UNIT1	Sweetwater Wind 3 (Cottonwood Creek)	JACK	150	NORTH	N	522,456	1,451	488,432	1,150
SGMTN_SIGNALM2	Sweetwater 4a	HOWARD	6.6	WEST	W	10,017	26	12,438	29
SHAFFER_UNIT1	Sweetwater 5	NUECES	226.05	COASTAL	S	498,839	1,139	692,469	1,717
SHANNONW_UNIT_1	Sweetwater Wind 1	CLAY	204.1	WEST	W	483,410	1,406	535,908	1,506
SPLAIN1_WIND1	Tahoka Wind	FLOYD	102	PANHANDLE	W	378,522	1,033	347,691	892
SPLAIN1_WIND2	Tahoka Wind	FLOYD	98	PANHANDLE	W	392,252	1,101	359,977	949
SPLAIN2_WIND21	Gulf Wind 1	FLOYD	148.5	PANHANDLE	W	569,624	1,440	513,737	1,221
SPLAIN2_WIND22	Gulf Wind 1	FLOYD	151.8	PANHANDLE	W	602,811	1,540	543,478	1,304
SRWE1_SRWE2	Roscoe Wind Farm 1	BORDEN	166.52	WEST	W	478,583	1,264	566,283	1,378
SRWE1_UNIT1	Roscoe Wind Farm 1	BORDEN	213.82	WEST	W	623,921	1,665	737,299	1,813
SSPURTWO_SS3WIND1	Torrecillas Wind	OLDHAM	96	PANHANDLE	W	407,474	1,084	378,162	959
SSPURTWO_SS3WIND2	Torrecillas Wind	OLDHAM	98	PANHANDLE	W	454,041	1,263	410,915	1,065
SSPURTWO_WIND_1	Torrecillas Wind	OLDHAM	160.95	PANHANDLE	W	636,210	1,694	589,803	1,492
STELLA_UNIT1	Trent Mesa Wind	KENEDY	201	COASTAL	S	473,559	1,234	630,105	1,760
STWF_T1	Trent Mesa Wind	NOLAN	101.2	WEST	W	219,103	654	259,546	716
S_HILLS_UNIT1	Trent Mesa Wind	BAYLOR	30.24	WEST	W	118,370	324	135,781	346
SWEC_G1	Trent Mesa Wind	MARTIN	123.6	WEST	W	233,102	706	257,429	754
SWEETWN2_WND2	Trent Mesa Wind	NOLAN	105.3	WEST	W	320,272	871	383,877	949
SWEETWN2_WND24	Trinity Hills Wind Farm	NOLAN	16	WEST	W	34,215	93	41,663	103
SWEETWN3_WND3A	Trinity Hills Wind Farm	NOLAN	30.78	WEST	W	94,476	250	113,003	273
SWEETWN3_WND3B	West Raymond	NOLAN	108.54	WEST	W	312,245	835	375,282	912
SWEETWN4_WND4A	West Raymond	NOLAN	119	WEST	W	231,569	615	282,992	679
SWEETWN4_WND4B	Turkey Track Energy Center	NOLAN	105.8	WEST	W	228,827	583	280,516	642
SWEETWN5_WND5	Tyler Bluff Wind (Muenster Wind)	NOLAN	80.5	WEST	W	145,888	418	167,089	461
SWEETWND_WND1	Venado Wind	NOLAN	37.5	WEST	W	116,724	327	126,514	348
TAHOKA_UNIT_1	Venado Wind	LYNN	150	WEST	W	505,819	1,348	592,005	1,464
TAHOKA_UNIT_2	Vera Wind	LYNN	150	WEST	W	506,847	1,310	587,761	1,415
TGW_T1	Vera Wind	KENEDY	141.6	COASTAL	S	269,409	795	351,769	1,121
TGW_T2	Vera Wind	KENEDY	141.6	COASTAL	S	311,790	916	405,597	1,291
TKWSW1_ROSCOE	Vera Wind	NOLAN	114	WEST	W	214,154	637	248,053	701
TKWSW1_ROSCOE2A	Vera Wind	NOLAN	95	WEST	W	173,722	498	200,200	548
TORR_UNIT1_25	Green Pastures W	WEBB	150	SOUTH	S	562,609	1,665	524,147	1,578
TORR_UNIT2_23	Wake Wind	WEBB	23	SOUTH	S	82,474	258	75,583	243
TORR_UNIT2_25	Wake Wind	WEBB	127.5	SOUTH	S	486,652	1,443	456,797	1,369
TRENT_TRENT	Wake Wind	NOLAN	38.25	WEST	W	111,305	300	134,595	328
TRENT_UNIT_1B	Wake Wind	NOLAN	15.59	WEST	W	56,327	160	64,623	171
TRENT_UNIT_2	Whirlwind	NOLAN	50.49	WEST	W	140,028	379	169,840	416
TRENT_UNIT_3A	White Mesa wind	NOLAN	38.25	WEST	W	106,799	296	128,679	323
TRENT_UNIT_3B	Whitehorse Wind	NOLAN	13.79	WEST	W	39,415	116	47,737	127
TRINITY_TH1_BUS1	Whitehorse Wind	ARCHER	103.4	WEST	W	363,270	1,010	425,956	1,090
TRINITY_TH1_BUS2	Wolf Ridge Windfarm	ARCHER	94.6	WEST	W	334,521	930	391,197	1,006
TRUENO_UNIT1	Wildcat Creek	WILLACY	116.6	COASTAL	S	287,946	689	384,881	994
TRUENO_UNIT2	Wildcat Creek	WILLACY	123.2	COASTAL	S	310,029	756	411,837	1,082
TRUSGILL_UNIT1	Wildcat Creek	KNOX	42	WEST	W	123,589	335	136,816	364
TRUSGILL_UNIT2	Wildcat Creek	KNOX	44.8	WEST	W	105,919	305	117,466	326
TRUSGILL_UNIT3	Wilson Ranch Win	KNOX	42	WEST	W	106,208	290	120,373	307
TRUSGILL_UNIT4	Windthorst 2	KNOX	207.2	WEST	W	449,107	1,419	509,858	1,529
TTWEC_G1	Woodward Mountain Ranch	NOLAN	174.6	WEST	W	298,347	895	313,598	971
TYLRWIND_UNIT1	Woodward Mountain Ranch	COOKE	125.6	NORTH	N	422,499	1,201	389,666	923
VENADO_UNIT1	VENADO WIND U1	ZAPATA	105	SOUTH	S	341,654	1,068	317,468	1,004
VENADO_UNIT2	VENADO WIND U2	ZAPATA	96.6	SOUTH	S	326,285	1,024	303,460	963
VERAWIND_UNIT1	VERA WIND 1	KNOX	12	WEST	W	35,730	98	41,870	107
VERAWIND_UNIT2	VERA WIND 2	KNOX	7.2	WEST	W	20,182	59	23,622	64
VERAWIND_UNIT3	VERA WIND 3	KNOX	100.8	WEST	W	315,182	834	371,605	907

Table 3-1: Summary of Annual Power Production for All Wind Farms Operated for more than 6 months in 2022 (Continued)

Wind Unit Name	Facility Name	County	Capacity (MW)	ERCOT Wind Zone	CL Zone	Wind Power for 2018 Predicted		Wind Power for 2022 Measured	
						Annual (MWh/yr)	OSP (MWh/day)	Annual (MWh/yr)	OSP (MWh/day)
VERAWIND_UNIT4	VERA WIND 4	KNOX	22	WEST	W	67,296	173	78,949	189
VERAWIND_UNIT5	VERA WIND 5	KNOX	100.8	WEST	W	294,126	775	344,215	839
VERTIGO_WIND_I	VERTIGO WIND (FORMERLY GREEN PASTURES WIND 2)	BAYLOR	150	WEST	W	199,706	560	240,110	613
WAKEWE_G1_J01	WAKE WIND 1	DICKENS	57.46	PANHANDLE	W	256,530	681	234,139	598
WAKEWE_G1_J02	WAKE WIND 1	DICKENS	57.45	PANHANDLE	W	242,556	644	221,384	565
WAKEWE_G2_J01	WAKE WIND 2	DICKENS	71.18	PANHANDLE	W	305,901	809	278,346	705
WAKEWE_G2_J02	WAKE WIND 2	DICKENS	71.17	PANHANDLE	W	289,238	765	263,184	667
WEC_WECG1	WHIRLWIND ENERGY	FLOYD	59.8	PANHANDLE	W	199,487	580	183,600	499
WHMESA_UNIT2_23	WHITE MESA 2 WIND U1	COKE	13.92	WEST	W	40,303	105	44,895	113
WHMESA_UNIT2_28	WHITE MESA 2 WIND U2	CROCKETT	183.3	WEST	W	571,700	1,585	673,496	1,724
WHMESA_UNIT3_23	WHITE MESA 2 WIND U3	CROCKETT	18.56	WEST	W	56,214	151	63,585	165
WHMESA_UNIT3_28	WHITE MESA 2 WIND U4	CROCKETT	132.54	WEST	W	409,793	1,149	474,957	1,245
WH_WIND_UNIT1	WHITEHORSE WIND U1	FISHER	209.4	WEST	W	511,536	1,374	617,272	1,509
WH_WIND_UNIT2	WHITEHORSE WIND U2	FISHER	209.5	WEST	W	545,571	1,456	655,785	1,586
WHTTAIL_WR1	WOLF RIDGE WIND	COOKE	112.5	NORTH	N	442,840	1,299	405,160	985
WILDWIND_UNIT1	WILDWIND U1	COOKE	18.38	NORTH	N	76,473	221	70,400	170
WILDWIND_UNIT2	WILDWIND U2	COOKE	48	NORTH	N	149,987	407	136,502	300
WILDWIND_UNIT3	WILDWIND U3	COOKE	6.3	NORTH	N	24,467	75	22,279	58
WILDWIND_UNIT4	WILDWIND U4	COOKE	54.6	NORTH	N	228,703	654	211,436	509
WILDWIND_UNIT5	WILDWIND U5	COOKE	52.8	NORTH	N	145,625	343	130,779	233
WL_RANCH_UNIT1	WILSON RANCH (INFINITY LIVE OAK WIND)	SCHLEICHER	199.5	WEST	W	653,997	1,802	772,255	1,960
WNDTHST2_UNIT1	WINDTHORST 2 WIND	ARCHER	67.62	WEST	W	192,100	521	228,637	568
WOODWRD1_WOODWRD1	PECOS WIND 1 (WOODWARD)	PECOS	91.7	WEST	W	160,809	494	189,552	534
WOODWRD2_WOODWRD2	PECOS WIND 2 (WOODWARD)	PECOS	86	WEST	W	134,609	412	157,141	442

Table 3-2: Summary of 2018 and 2022 Monthly Average Wind Speed for Five ERCOT Weather Zones

Month		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average	OSP Average
Wind Speed COASTAL (mph)	2018	11.8	12.3	11.8	12.5	12.5	13.0	10.8	11.8	9.0	11.7	10.9	11.7	11.7	11.4
	2022	12.6	14.3	16.0	17.0	16.8	12.6	15.0	13.3	9.1	11.9	12.9	12.5	13.7	13.4
Wind Speed NORTH (mph)	2018	13.2	12.0	11.3	14.0	16.5	17.6	12.6	11.0	8.5	11.1	12.9	12.9	12.8	13.2
	2022	13.2	12.2	14.2	16.3	14.8	12.2	11.4	10.0	10.1	11.9	11.0	11.6	12.4	11.7
Wind Speed PANHANDLE (mph)	2018	17.4	17.4	18.2	19.7	18.3	19.1	13.7	15.3	14.8	14.5	16.1	15.4	16.7	10.2
	2022	18.0	17.1	17.0	19.6	18.9	17.2	14.1	11.0	12.9	12.5	15.5	16.5	15.8	14.8
Wind Speed SOUTH (mph)	2018	11.6	11.9	13.6	13.8	14.8	13.5	11.8	13.7	10.4	12.4	10.9	11.6	12.5	10.2
	2022	10.3	11.9	14.2	14.1	14.8	13.1	13.8	11.6	8.7	11.1	10.9	10.3	12.1	12.4
Wind Speed WEST (mph)	2018	11.6	11.9	13.6	13.8	14.8	13.5	11.8	13.7	10.4	12.4	10.9	11.6	12.5	12.8
	2022	13.6	13.9	15.7	17.0	16.7	14.8	12.8	11.1	11.6	12.4	13.5	12.6	13.8	13.4

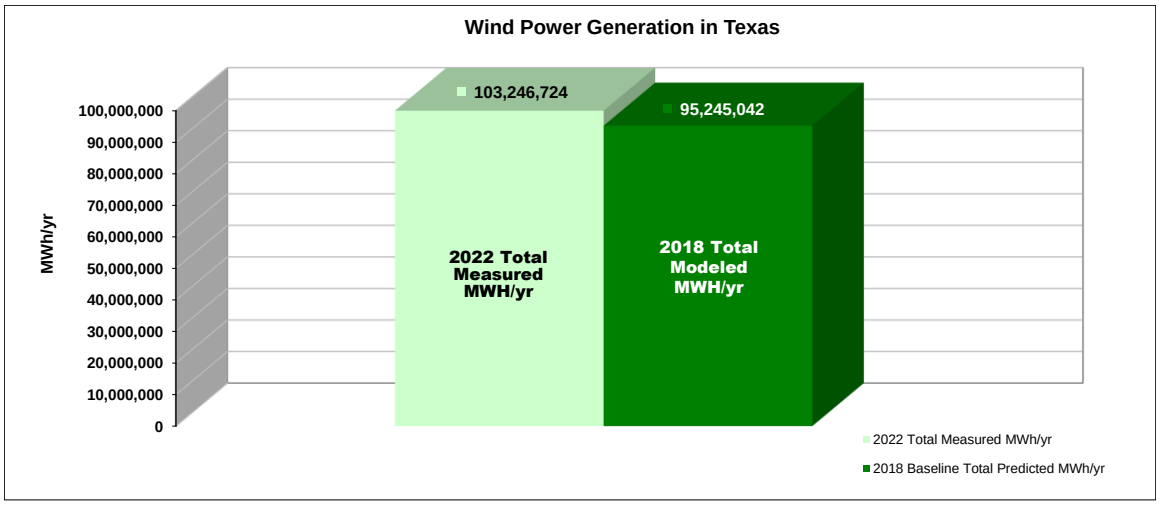


Figure 3-6: Comparison of Total 2022 Measured and 2018 Modeled Power Production

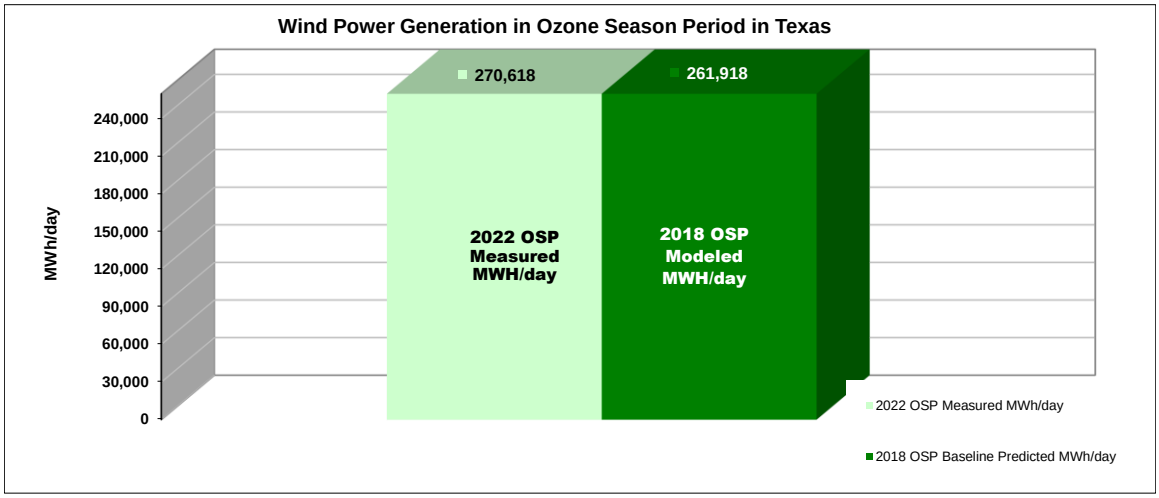


Figure 3-7: Comparison of Total 2022 OSP Measured and 2018 OSP Modeled Power Production

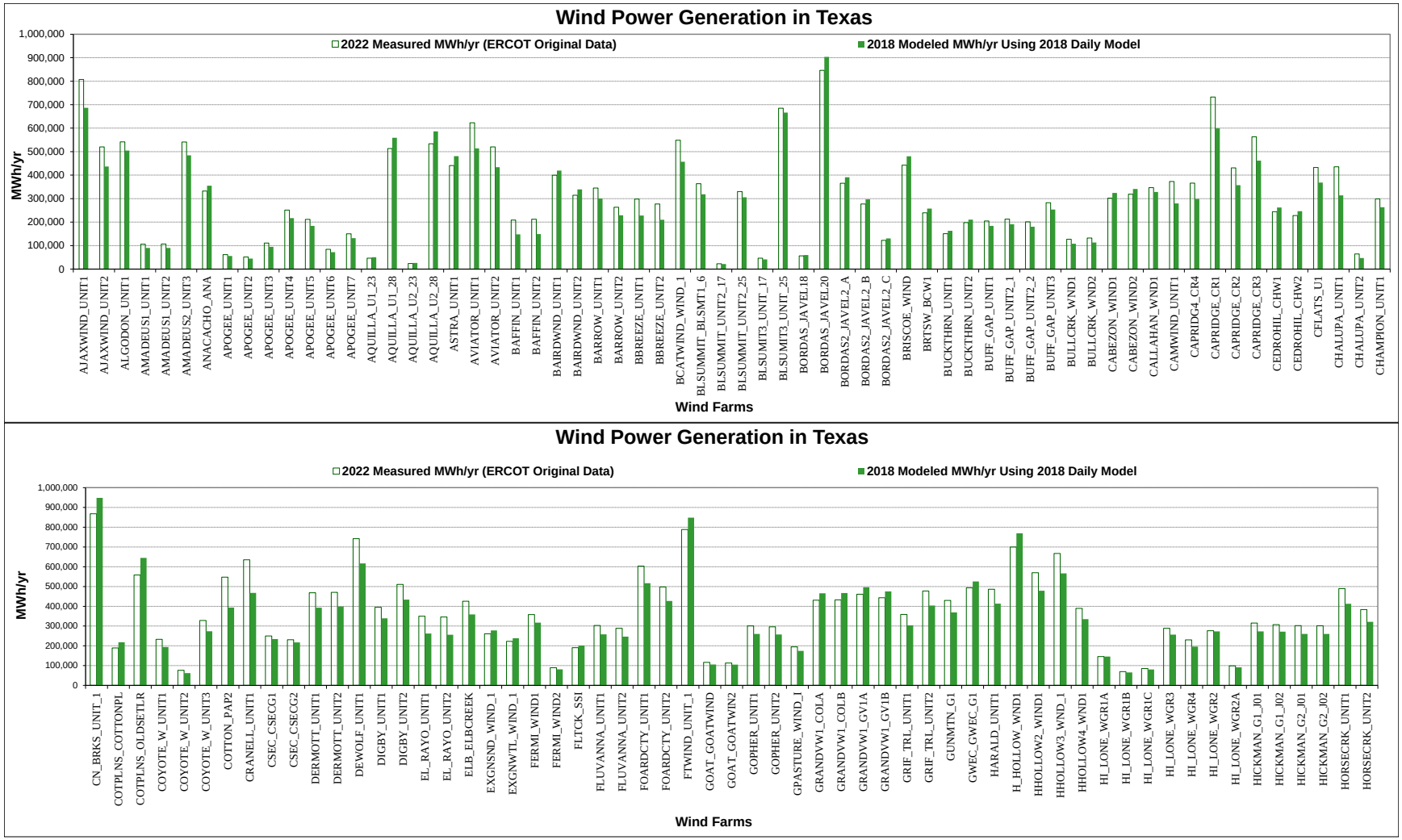


Figure 3-8: Comparison of 2022 Measured and 2018 Modeled Wind Power Production for Each Wind Farm

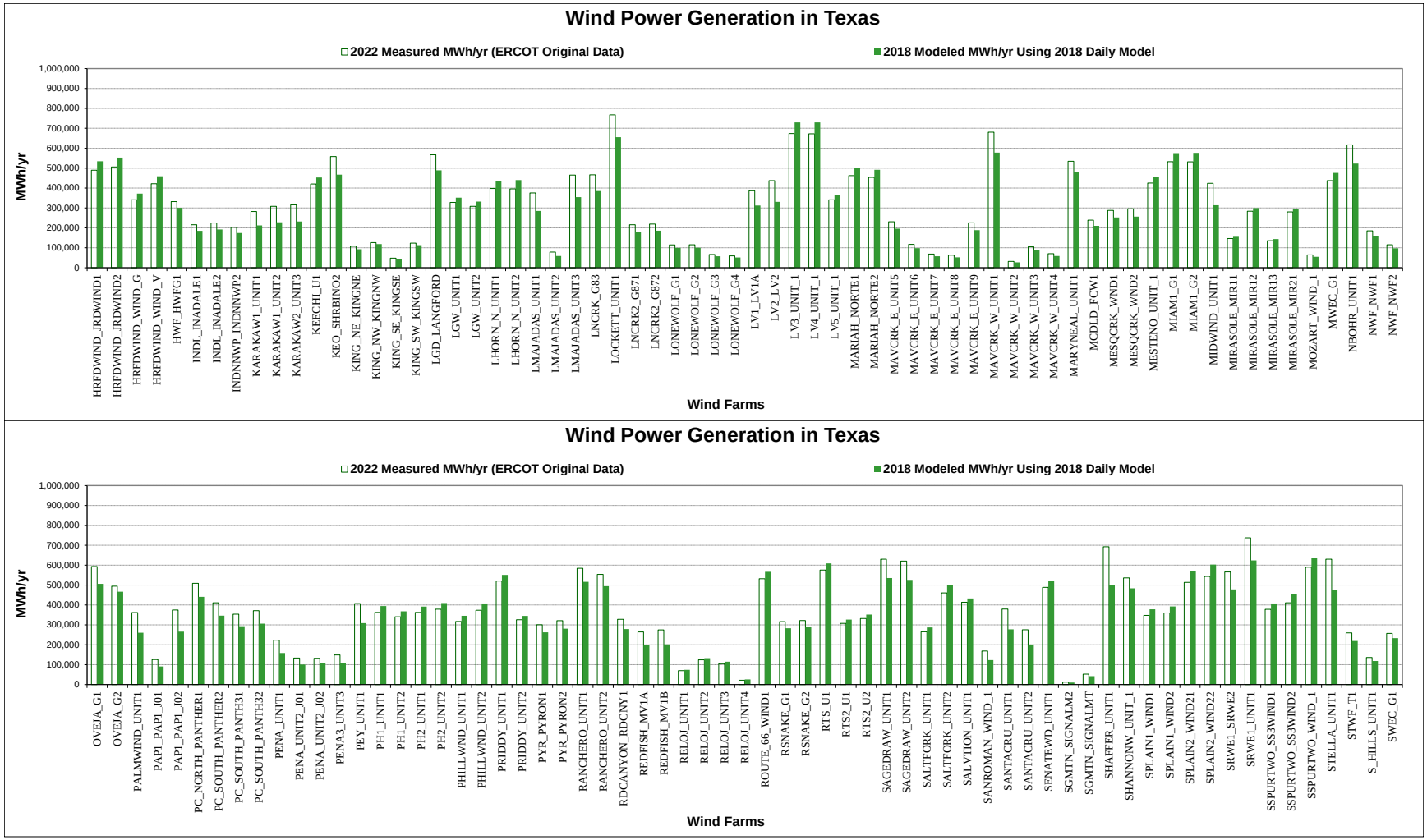


Figure 3-8: Comparison of 2022 Measured and 2018 Modeled Wind Power Production for Each Wind Farm (Continued)

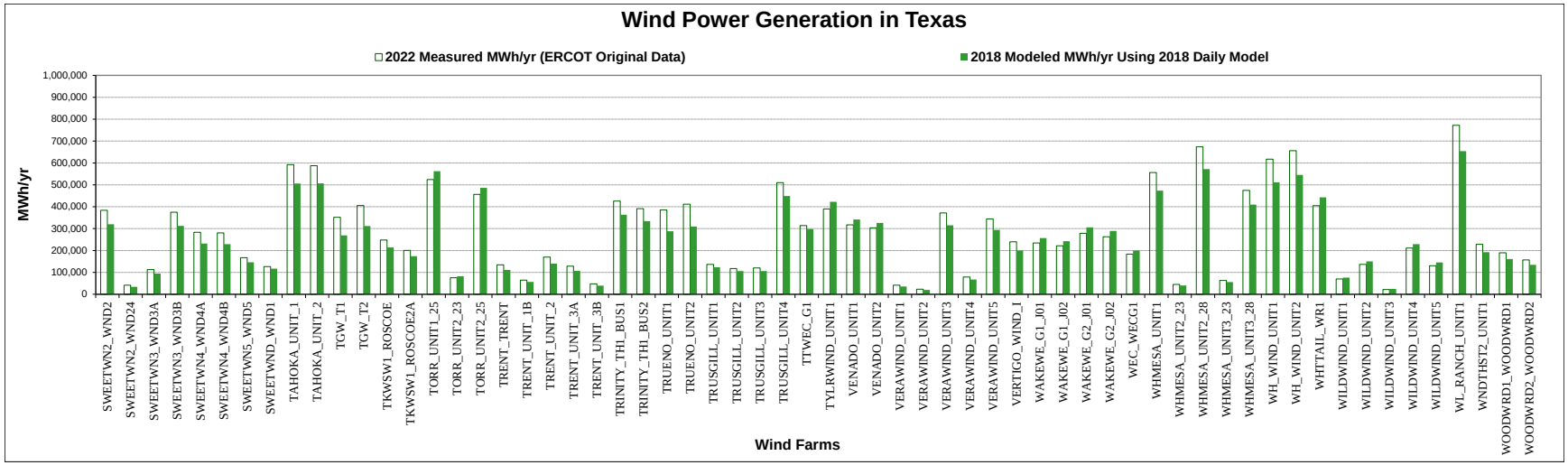


Figure 3-8: Comparison of 2022 Measured and 2018 Modeled Wind Power Production for Each Wind Farm (Continued)

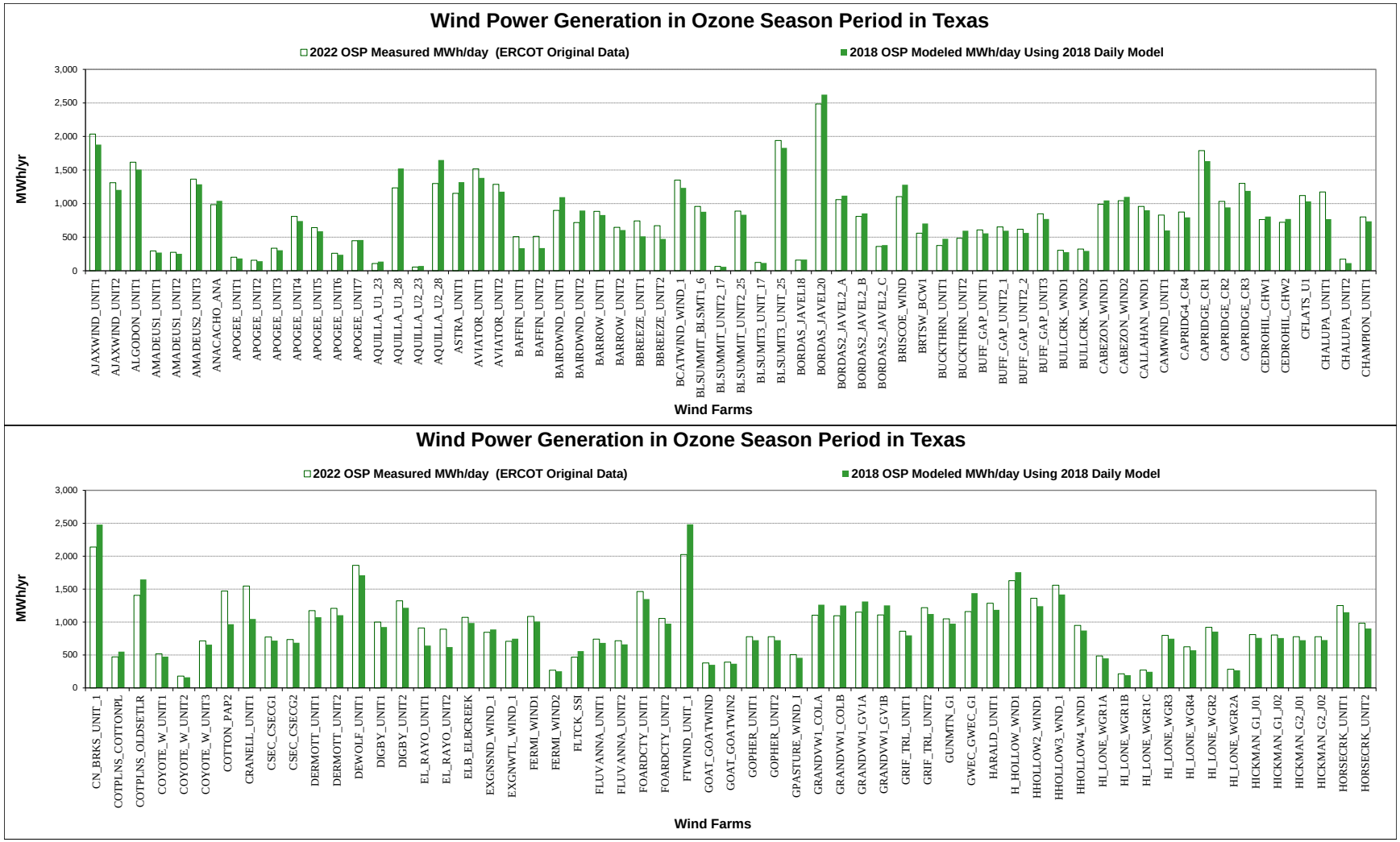


Figure 3-9: Comparison of 2022 OSP Measured and 2018 OSP Modeled Wind Power Production for Each Wind Farm

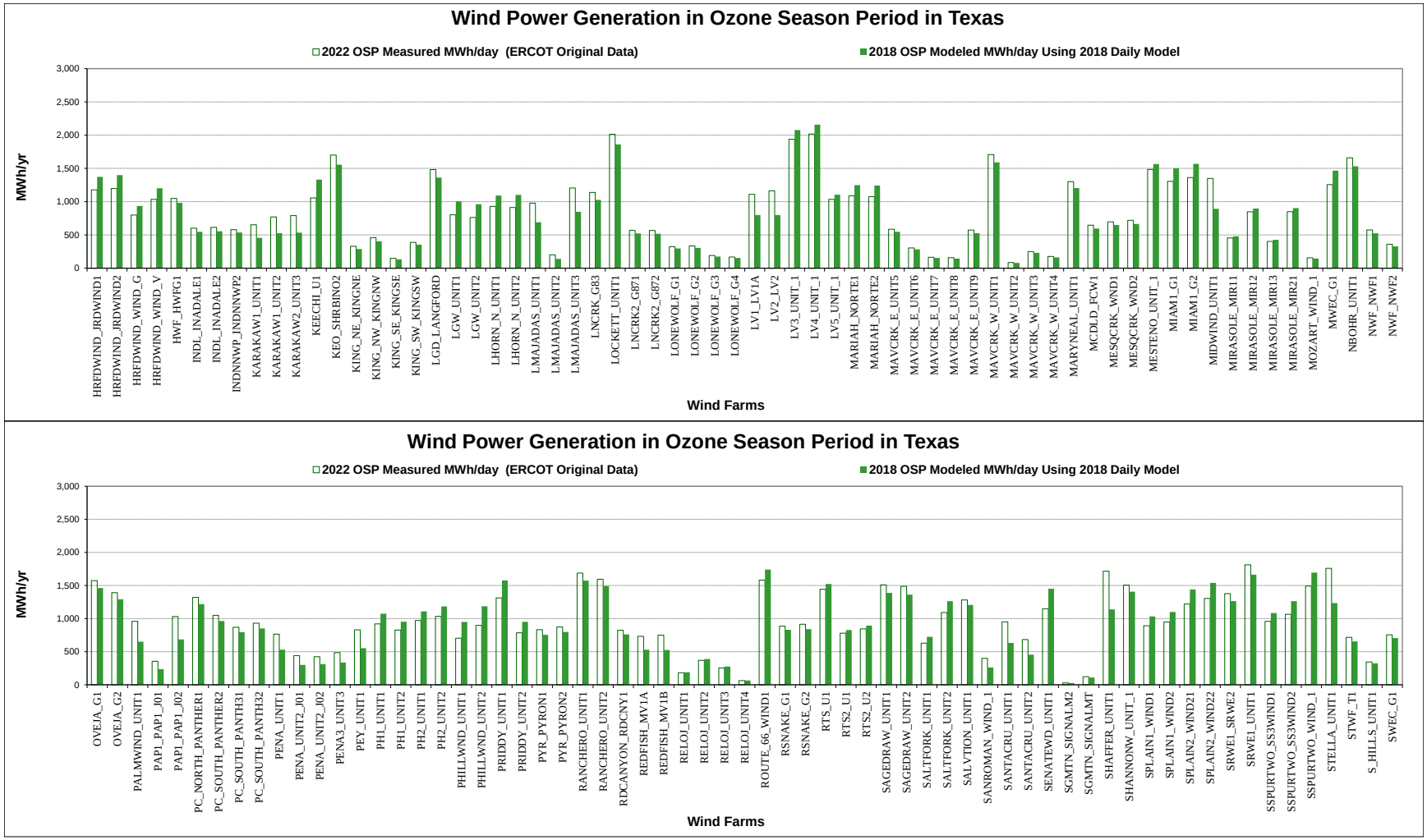


Figure 3-9: Comparison of 2022 OSP Measured and 2018 OSP Modeled Wind Power Production for Each Wind Farm (Continued)

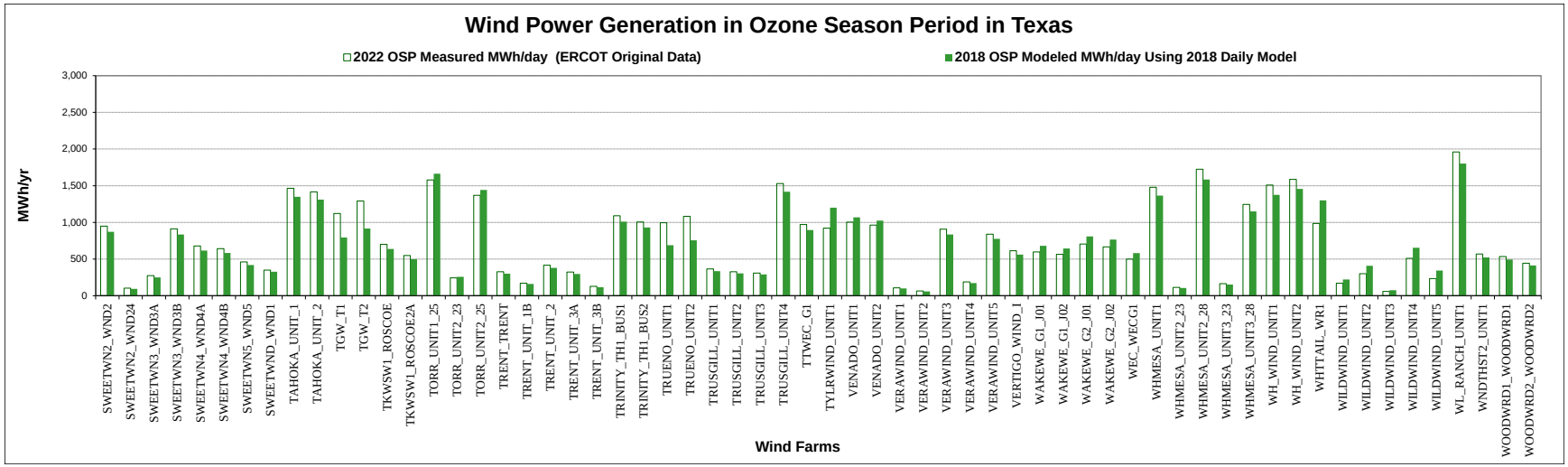


Figure 3-9: Comparison of 2022 OSP Measured and 2018 OSP Modeled Wind Power Production for Each Wind Farm (Continued)

3.3 Comparison of Measured Wind Power in Previous Reports and Present Report

The daily model is used for predicting the annual and OSP wind power productions. Due to the different base year analysis, this section only compares the ERCOT measured annual and OSP wind power productions. Compared to what was reported in the previous year's annual report, an increase of 10.9% on measured annual wind production was observed, from 95,286,230 MWh/yr in 2021 to 105,682,976 MWh/yr in 2022[14].

The average daily wind power production during the OSP showed an increase of 19.7%, from 233,740 MWh/day to 279,700 MWh/day.

Thirteen new wind farms including thirty-four new meters with over 3,468 MW capacity have started operating since the beginning of 2022. Aguayo Wind U1, Appaloosa Run Wind (U1&U2), Board Creek WP (U1&U2), Desert Sky Wind 1 (A&B), Desert Sky Wind 2 (A&B), Elbow Creek Wind, El Suaz Ranch U1, Foxrot Wind (U1, U2&U3), Inertia Wind (U1, U2&U3), Lacy Creek Wind (U1, U2, U3&U4), Priddy Wind (U1&U2), Tg East Wind (U1, U2, U3&U4), Vortex Wind (U1, U2, U3&U4), and Young Wind (U1, U2&U3) are the new wind farms in 2022. Figure 3-10 shows the measured annual wind power comparison of 2008 through 2022 for all the wind farms. Figure 3-11 shows the wind power comparison of 2008 through 2022 during the ozone season. The annual wind power difference percentages are compared for 2008 through 2022, shown in Figure 3-12. It has been observed that most of the analyzed wind farms show differences in percentage between 2018 and 2022. According to 2022 ERCOT data, Maverick Creek I W (U8), Roscoe Wind Farm 1, and Vera Wind (U3&U4) had over 50% power generation increase compared to last year. This is due to the differences in wind speed values resulted in different power generation values. In addition, Figure 3-13 shows the difference comparison of 2018 through 2022 measured data during the ozone season. Wind farms with no comparison in 2021 are excluded in these comparisons.

[14] This value reflects the total power generation for all windfarms operated ERCOT region in 2022.

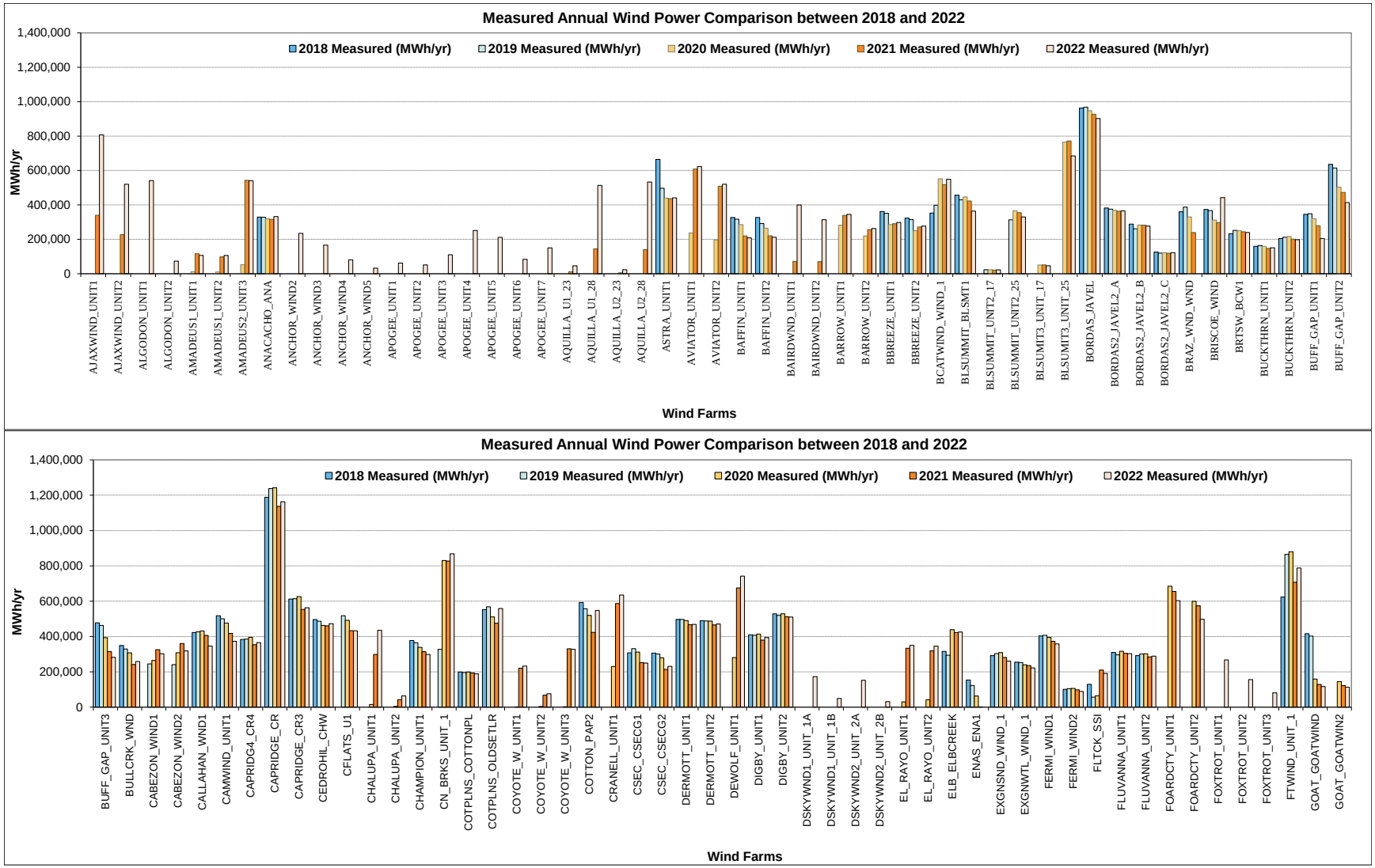


Figure 3-10: Measured Annual Wind Power Comparison between 2018 and 2022

Figure 3-10: Measured Annual Wind Power Comparison between 2018 and 2022 (Continued)

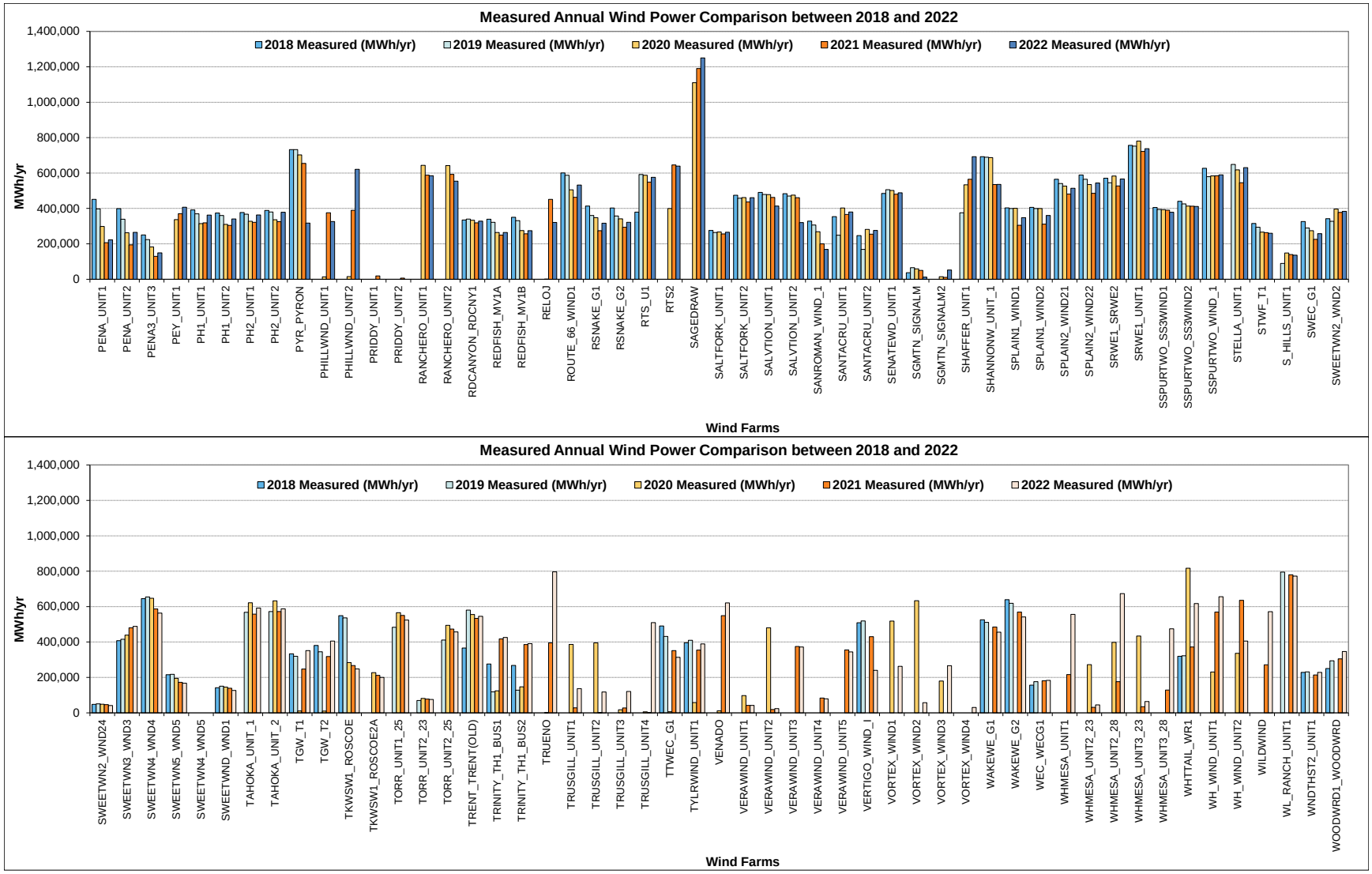


Figure 3-10: Measured Annual Wind Power Comparison between 2018 and 2022 (Continued)

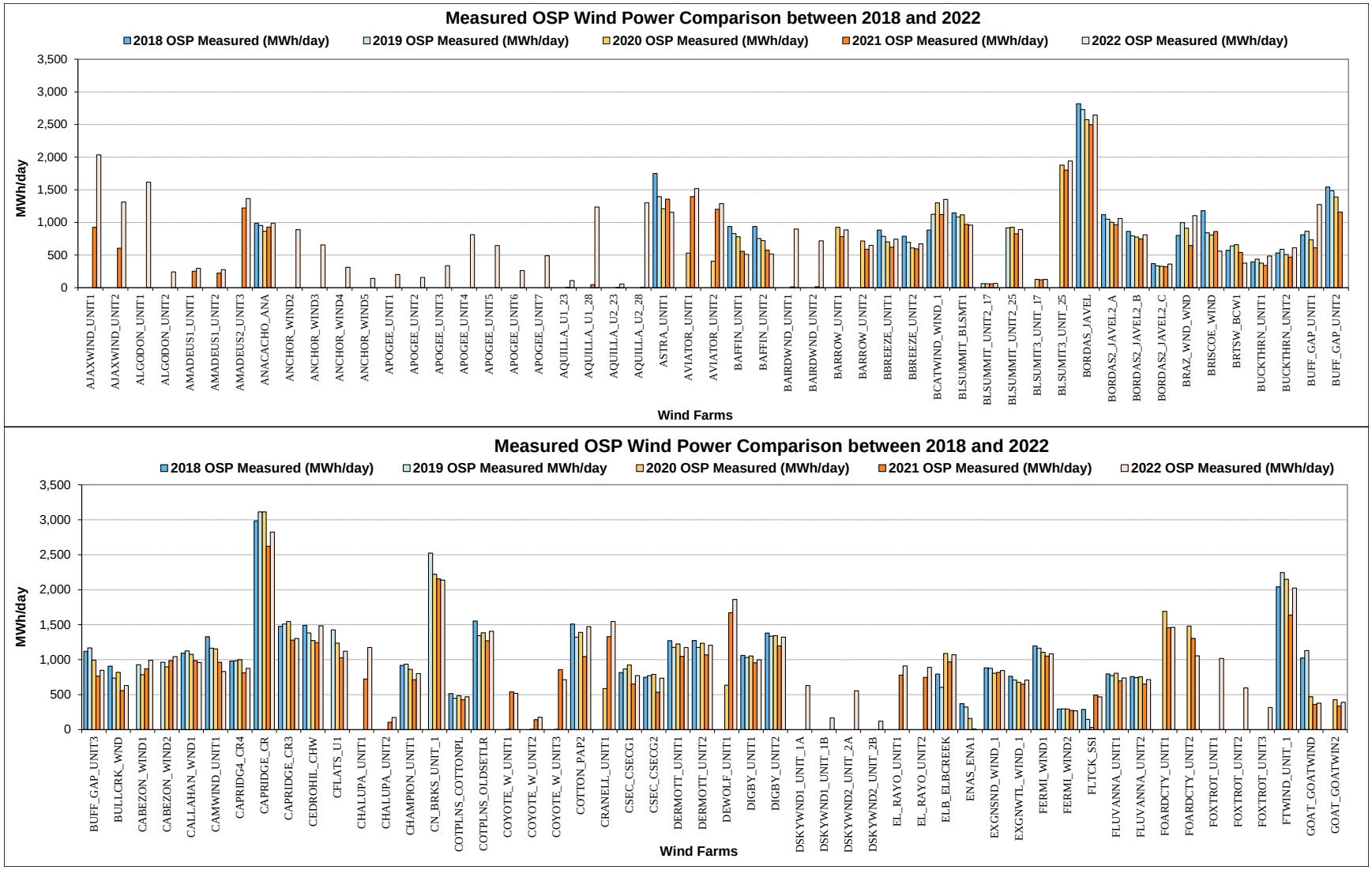


Figure 3-11: Measured OSP Wind Power Comparison between 2018 and 2022

Figure 3-11: Measured OSP Wind Power Comparison between 2018 and 2022 (Continued)

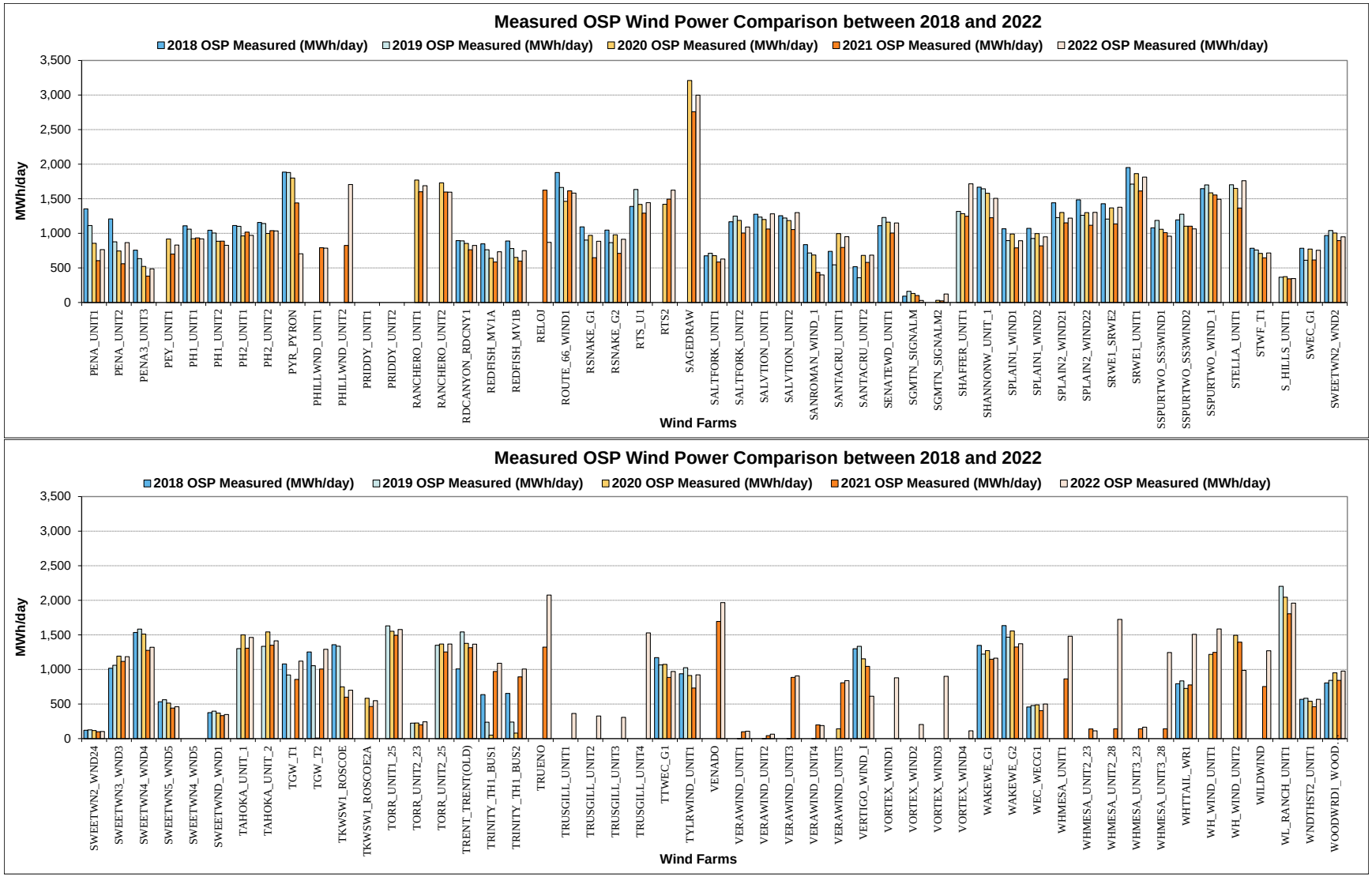


Figure 3-11: Measured OSP Wind Power Comparison between 2018 and 2022 (Continued)

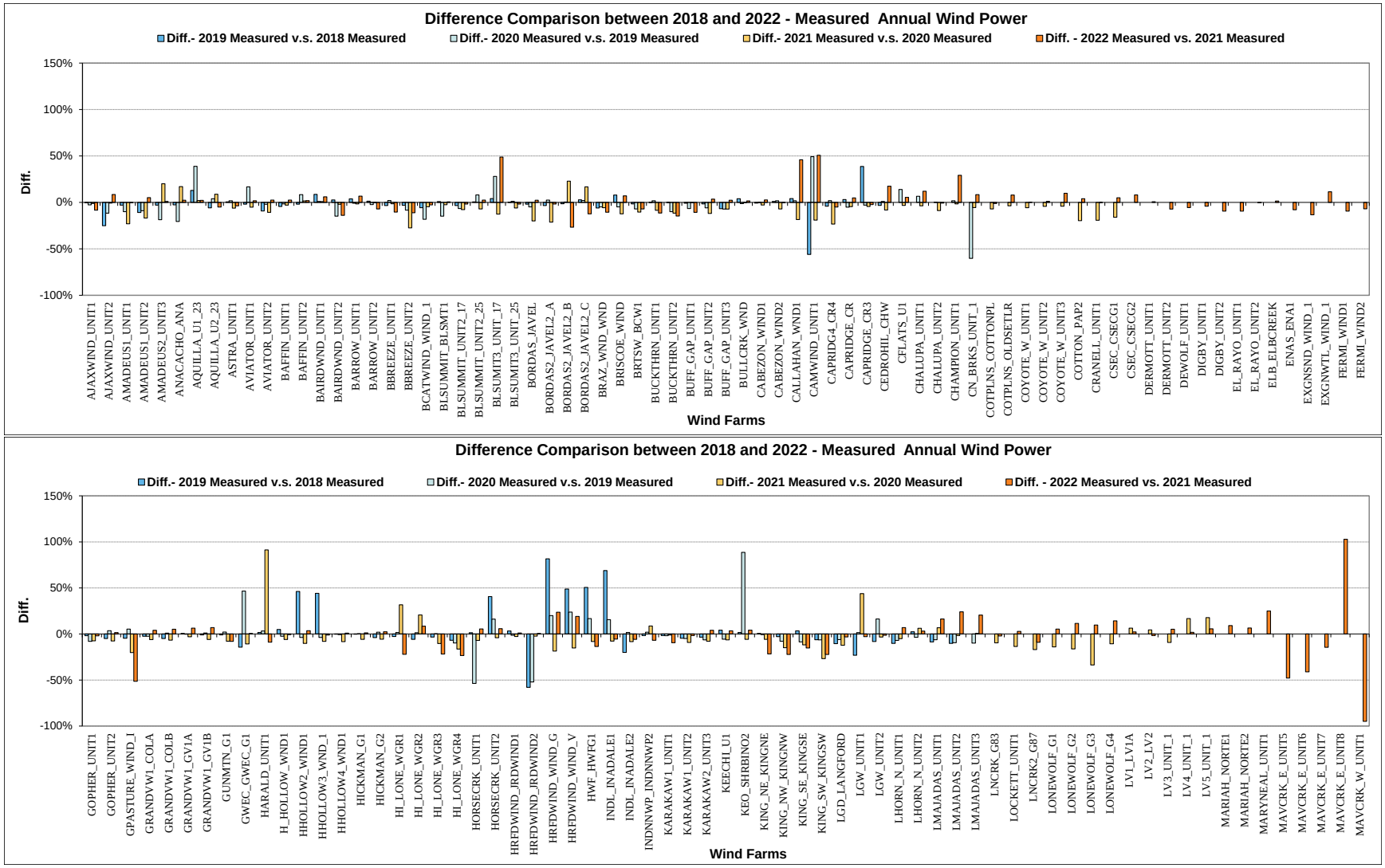


Figure 3-12: Difference Comparison between 2018 and 2022 - Measured Annual Wind Power

Figure 3-12: Difference Comparison between 2018 and 2022 - Measured Annual Wind Power (Continued)

Figure 3-13: Difference Comparison between 2018 and 2022 - Measured OSP Wind Power

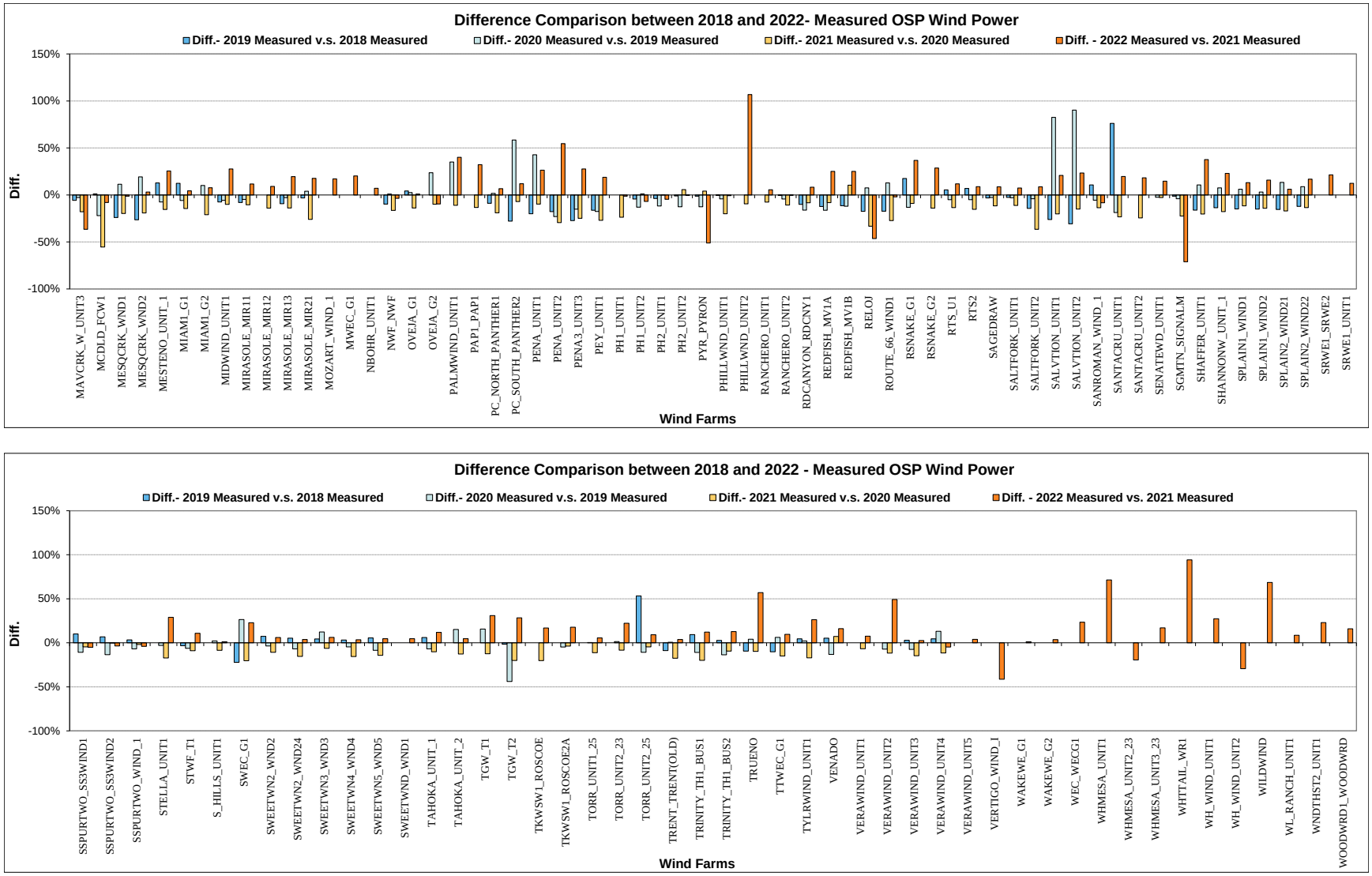


Figure 3-13: Difference Comparison between 2018 and 2022 - Measured OSP Wind Power (Continued)

3.4 Uncertainty Analysis on the 2022 Daily Regression Models

One of the advantages of using regression models is that it allows 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 2022 data.

Assuming that the daily energy production of wind farm data can be related linearly with the daily average wind speed (see Figure 3-14) and expressed as

$$\hat{E}_i = c_o + c_1 V_i \qquad \text{Equation 1}$$

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 linear regression. The subscript i represents any day over the modeling period.

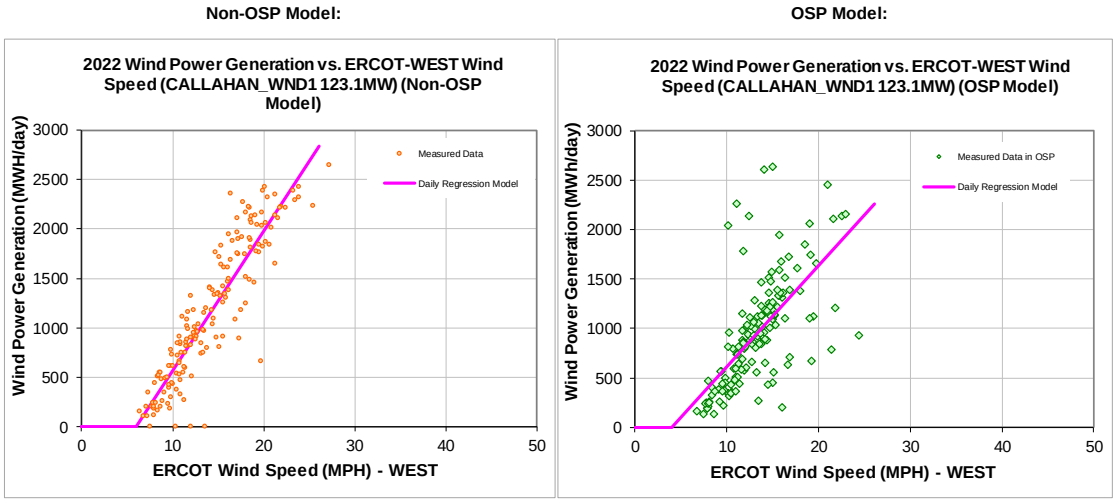


Figure 3-14: Linear Model Presentation of the Daily Wind Power Generation on the Year 2022 for Callahan_Wind_1 Farm

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 uncertainty, which is related to the prediction variance. Thus, the prediction uncertainty, $\sigma^2(\hat{E}_{pred,j})$, 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:

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

Equation 2

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

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

Equation 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 $\bar{V}_n$ is the mean value of the velocity on the modeling period.

The last term in the brackets of 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

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

Equation 4

And the total prediction variance or uncertainty is obtained through

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

Equation 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 3-3 presents all the statistical parameters for the daily linear models of all the wind farms in the ERCOT region.

Table 3-4 and Figure 3-15 show the uncertainty of applying the linear models to predict the energy generation that they would have had in the 2018 non-OSP using the non-OSP model, which considers the period of Jan 1 through April 30 and October 1 through December 31. The uncertainty of using non-OSP models for predicting wind power in the 2018 non-OSP varies from 2.19% to 18.37%. The maximum uncertainty comes from a wind farm named Ranchland Wind Project_Unit 5(ANCHOR_WIND5). One reason for this may be the meter problems suspected when measuring the data since include "0" generation values regardless of the wind speed. In the current modeling, the average wind speed provided by ERCOT is used for all the wind farms. Therefore, the average wind speed may not represent the real wind speed where the wind farms are located. The model uncertainty can come from incorrect wind speed information.

In addition, the same table and figure include the uncertainty related to the predicted wind generated for the same wind farms in the 2018 OSP using the OSP model, which considers the period of May 1 through September 31 – about 153 days. The uncertainty of using OSP models for predicting wind power in the 2018 OSP varies from 1.60% to 10.66% for all the wind farms. The maximum uncertainty of OSP models comes from a wind farm named King Mountain Wind Ranch (KING_NE_KINGNE).

Table 3-3: Statistical Parameters for the 2022 Daily Wind Power Production Linear Models

Wind Farm	Statistical Parameters of Non-OSP Daily Models						Statistical Parameters of OSP Daily Models					
	c_0	c_1	AdjR^2	RMSE	CV-RMSE	# Days	c_0	c_1	AdjR^2	RMSE	CV-RMSE	# Days
AJAXWIND_UNIT1	-1763.58	295.46	0.80	637.73	26.6%	211	-2224.78	320.42	0.83	501.40	24.6%	148
AJAXWIND_UNIT2	-1113.83	186.61	0.82	379.38	25.0%	211	-1302.89	195.79	0.83	307.32	23.4%	153
ALGODON_UNIT1	297.12	81.01	0.12	952.48	66.4%	205	-992.23	195.34	0.46	725.83	44.9%	153
ALGODON_UNIT2	39.78	14.79	0.14	158.03	63.0%	145	-190.54	32.32	0.47	116.53	48.3%	153
AMADEUS1_UNIT1	-214.88	35.87	0.60	128.17	44.1%	211	-284.47	43.40	0.86	59.30	20.1%	153
AMADEUS1_UNIT2	-236.06	38.48	0.65	124.42	40.7%	211	-284.58	41.97	0.84	63.16	22.9%	153
AMADEUS2_UNIT3	-1167.08	204.51	0.66	621.43	37.2%	203	-951.92	175.04	0.70	386.01	28.3%	148
ANACACHO_ANA	-615.11	124.74	0.64	344.01	40.0%	211	-701.33	136.14	0.78	233.33	23.7%	153
ANCHOR_WIND2	-25.90	48.26	0.11	590.49	89.7%	150	-372.46	94.37	0.70	213.51	24.0%	153
ANCHOR_WIND3	-33.57	33.59	0.10	440.22	98.6%	148	-417.37	80.25	0.77	151.56	23.2%	153
ANCHOR_WIND4	-16.67	19.83	0.14	211.06	80.8%	126	-69.95	28.60	0.57	84.55	27.1%	153
ANCHOR_WIND5	8.50	5.53	0.05	104.12	122.2%	138	-127.84	20.47	0.63	53.51	37.3%	147
APOGEE_UNIT1	-138.14	21.91	0.38	123.60	72.6%	181	-162.64	27.28	0.77	50.64	25.1%	153
APOGEE_UNIT2	-53.12	13.84	0.41	71.94	50.9%	194	-103.98	19.53	0.77	37.05	23.6%	153
APOGEE_UNIT3	-126.31	30.05	0.40	160.62	54.4%	201	-203.25	40.33	0.78	74.50	22.2%	153
APOGEE_UNIT4	-549.45	84.83	0.38	476.29	73.7%	197	-828.59	122.74	0.81	203.38	25.1%	153
APOGEE_UNIT5	-215.57	56.84	0.21	487.81	83.3%	193	-271.05	68.49	0.58	199.51	31.0%	153
APOGEE_UNIT6	-22.24	17.33	0.25	133.50	60.4%	200	-42.59	22.69	0.51	76.27	29.3%	153
APOGEE_UNIT7	-133.10	37.48	0.18	344.69	86.6%	189	-258.86	55.99	0.60	157.96	32.3%	153
AQUILLA_U1_23	-102.44	19.16	0.75	45.84	31.2%	202	-113.62	19.07	0.76	33.02	30.4%	152
AQUILLA_U1_28	-886.20	192.74	0.76	449.06	27.7%	202	-972.29	189.79	0.83	266.98	21.6%	151
AQUILLA_U2_23	-50.19	9.68	0.74	23.88	31.6%	202	-68.29	10.70	0.83	14.99	26.6%	152
AQUILLA_U2_28	-1008.72	205.43	0.76	479.54	28.9%	202	-1343.20	227.33	0.83	311.29	23.9%	152
ASTRA_UNIT1	-391.83	100.29	0.42	622.10	49.0%	208	-574.82	117.31	0.62	402.19	34.8%	153
AVIATOR_UNIT1	-1666.92	249.91	0.91	336.43	18.2%	211	-1816.28	249.53	0.93	233.56	15.4%	153
AVIATOR_UNIT2	-1226.65	195.83	0.91	262.73	17.2%	211	-1405.70	201.65	0.91	215.86	16.8%	153
BAFFIN_UNIT1	-551.99	84.62	0.68	272.98	43.8%	210	-707.25	91.02	0.78	184.16	36.2%	153
BAFFIN_UNIT2	-624.23	90.77	0.80	211.00	33.1%	210	-739.98	93.85	0.87	135.54	26.4%	153
BAIRDWND_UNIT1	-909.95	166.45	0.67	474.44	38.2%	211	-689.82	135.97	0.45	460.15	51.2%	153
BAIRDWND_UNIT2	-586.46	122.18	0.64	372.42	37.5%	211	-666.31	118.84	0.65	267.06	37.2%	146
BARROW_UNIT1	-463.80	103.55	0.71	286.49	28.8%	211	-412.50	97.10	0.65	242.71	27.4%	153
BARROW_UNIT2	-363.87	81.35	0.72	220.97	28.2%	209	-369.46	76.19	0.68	180.59	27.9%	153
BBREEZE_UNIT1	-593.35	109.38	0.65	361.21	40.1%	205	-836.52	118.26	0.84	192.38	25.9%	153
BBREEZE_UNIT2	-528.00	99.09	0.67	325.10	38.7%	208	-671.96	100.54	0.85	160.21	23.9%	153
BCATWIND_WIND_1	-1244.50	203.39	0.79	451.41	27.9%	211	-1534.73	216.09	0.82	351.85	26.0%	153
BLSUMMIT_BLSMT1_6	-619.48	120.44	0.67	367.43	34.5%	204	-1010.85	147.50	0.82	236.82	24.7%	153
BLSUMMIT_UNIT2_17	-30.84	7.22	0.69	20.11	30.0%	191	-54.01	8.91	0.75	17.54	27.0%	153
BLSUMMIT_UNIT2_25	-542.20	111.95	0.74	278.84	28.1%	197	-785.57	126.60	0.77	224.44	25.2%	151
BLSUMIT3_UNIT_17	-57.38	13.60	0.65	43.78	32.9%	203	-107.47	17.46	0.76	34.12	27.1%	153
BLSUMIT3_UNIT_25	-1110.83	237.24	0.73	603.72	28.8%	188	-1598.19	267.93	0.77	474.95	24.5%	150
BORDAS_JAVEL18	-126.80	23.39	0.84	38.10	25.4%	211	-97.84	20.78	0.85	27.97	17.5%	153
BORDAS_JAVEL20	-1640.31	325.25	0.89	426.06	19.3%	211	-1763.38	342.93	0.94	264.96	10.7%	153
BORDAS2_JAVEL2_A	-780.91	147.41	0.91	167.57	17.4%	211	-772.13	147.86	0.93	131.03	12.4%	153
BORDAS2_JAVEL2_B	-596.28	111.82	0.91	128.56	17.7%	211	-612.31	114.73	0.93	98.57	12.2%	153
BORDAS2_JAVEL2_C	-222.88	45.70	0.90	56.07	17.6%	211	-223.88	47.36	0.93	42.44	11.7%	153
BRISCOE_WIND	-217.03	91.37	0.41	586.46	45.2%	211	-708.52	123.01	0.73	325.15	29.4%	153
BRTSW_BCW1	-340.91	83.20	0.56	298.91	40.7%	211	-546.81	95.11	0.83	134.38	24.0%	151
BUCKTHRN_UNIT1	-343.74	60.92	0.82	116.03	26.1%	210	-406.28	67.04	0.85	87.82	23.3%	152
BUCKTHRN_UNIT2	-401.99	76.66	0.79	162.75	27.6%	210	-403.59	76.03	0.78	126.22	26.0%	152
BUFF_GAP_UNIT1	-42.70	40.95	0.24	316.84	59.4%	210	-648.15	94.22	0.78	172.43	28.3%	152
BUFF_GAP_UNIT2_1	-107.41	46.61	0.29	315.59	57.9%	208	-804.41	109.25	0.82	175.41	26.8%	152
BUFF_GAP_UNIT2_2	-115.63	45.18	0.29	303.07	58.7%	208	-810.91	107.09	0.83	167.65	27.1%	152
BUFF_GAP_UNIT3	-122.18	61.51	0.25	453.89	61.3%	207	-1149.43	149.69	0.83	231.71	27.3%	152
BULLCRK_WND1	-224.42	42.95	0.51	181.71	47.4%	209	-402.14	52.98	0.79	95.04	31.1%	153
BULLCRK_WND2	-206.85	42.47	0.53	172.59	44.1%	211	-382.38	52.91	0.77	100.37	31.0%	153
CABEZON_WIND1	-651.67	115.43	0.54	388.44	54.3%	211	-760.12	141.34	0.64	334.79	33.8%	153
CABEZON_WIND2	-621.99	116.41	0.53	398.80	52.8%	211	-696.49	140.47	0.63	340.35	32.6%	153
CALLAHAN_WND1	-893.22	144.55	0.85	268.34	22.9%	171	-428.25	103.85	0.43	410.27	42.8%	153
CAMWIND_UNIT1	-972.16	156.36	0.83	333.75	27.8%	211	-1016.97	141.48	0.86	206.86	24.9%	144
CAPRIDG4_CR4	-1102.55	156.32	0.91	210.52	19.1%	211	-1146.84	151.40	0.93	144.19	16.5%	153
CAPRIDGE_CR1	-2216.88	311.69	0.93	373.29	17.2%	211	-2115.22	292.40	0.93	268.09	15.0%	153
CAPRIDGE_CR2	-1132.99	172.77	0.87	288.20	22.1%	209	-1153.47	163.77	0.84	240.84	23.3%	153
CAPRIDGE_CR3	-1624.62	237.68	0.92	313.17	18.2%	211	-1473.21	207.84	0.86	290.71	22.3%	153
CEDROHIL_CHW1	-593.46	101.17	0.85	157.67	26.1%	211	-658.82	114.72	0.94	89.84	11.8%	153
CEDROHIL_CHW2	-624.92	99.87	0.88	135.88	24.4%	211	-741.95	118.22	0.95	84.40	11.7%	153
CFLATS_U1	-724.69	139.25	0.69	406.76	32.9%	211	-988.66	157.96	0.86	221.26	19.7%	153

Table 3-3: Statistical Parameters for the 2022 Daily Wind Power Production Linear Models (Continued)

Wind Farm	Statistical Parameters of Non-OSP Daily Models						Statistical Parameters of OSP Daily Models					
	c_0	c_1	AdjR^2	RMSE	CV-RMSE	# Days	c_0	c_1	AdjR^2	RMSE	CV-RMSE	# Days
CHALUPA_UNIT1	-1209.08	179.43	0.82	394.13	30.4%	200	-1586.84	205.43	0.87	300.34	25.6%	150
CHALUPA_UNIT2	-171.96	26.06	0.80	61.41	32.0%	200	-226.94	29.79	0.85	46.89	27.1%	150
CHAMPION_UNIT1	-189.08	72.62	0.35	428.08	51.3%	211	-734.10	114.95	0.83	177.02	22.1%	153
CN_BRKS_UNIT_1	-1211.60	228.95	0.78	654.79	25.3%	211	-1538.44	248.67	0.78	573.50	26.8%	151
COTPLNS_COTTONPL	-204.51	49.17	0.71	166.76	27.6%	198	-364.67	56.58	0.82	117.60	25.0%	148
COTPLNS_OLDSETLR	-590.94	143.65	0.67	538.64	30.4%	198	-1107.15	170.24	0.83	336.94	24.0%	148
COYOTE_W_UNIT1	-552.86	91.03	0.81	189.55	26.0%	211	-540.38	79.24	0.59	226.55	43.7%	152
COYOTE_W_UNIT2	-226.60	32.58	0.83	65.22	28.1%	211	-253.85	32.35	0.88	41.44	23.2%	153
COYOTE_W_UNIT3	-779.23	128.91	0.82	267.90	25.8%	211	-676.77	104.14	0.67	249.92	35.0%	153
COTTON_PAP2	-1036.17	184.56	0.64	650.46	42.6%	211	-2124.23	269.21	0.84	438.84	29.8%	153
CRANELL_UNIT1	-1148.16	218.65	0.82	481.95	25.5%	211	-1938.12	260.86	0.87	373.12	24.1%	153
CSEC_CSECG1	231.19	28.35	0.10	367.00	58.3%	210	-485.22	93.95	0.69	213.80	27.7%	152
CSEC_CSECG2	245.18	22.77	0.08	333.99	59.1%	210	-461.21	89.55	0.70	201.22	27.4%	153
DERMOTT_UNIT1	-1033.61	170.59	0.81	364.36	26.6%	211	-1328.55	187.38	0.90	208.55	17.8%	153
DERMOTT_UNIT2	-1086.66	175.31	0.86	307.95	22.5%	209	-1317.56	189.05	0.90	212.29	17.6%	153
DEWOLF_UNIT1	-1863.06	286.04	0.90	423.66	19.6%	211	-1808.32	274.77	0.88	355.87	19.1%	153
DIGBY_UNIT1	-635.20	126.89	0.71	353.08	30.6%	211	-823.95	136.60	0.78	248.94	24.9%	152
DIGBY_UNIT2	-917.32	168.88	0.71	466.15	31.9%	211	-1240.19	191.87	0.80	329.85	24.9%	153
DSKYWND1_UNIT_1A	-512.27	70.91	0.60	254.71	51.8%	156	-431.75	79.55	0.65	198.20	31.4%	153
DSKYWND1_UNIT_1B	-145.19	20.84	0.50	91.27	60.9%	156	-85.50	18.95	0.59	53.89	32.2%	153
DSKYWND2_UNIT_2A	-532.52	68.74	0.56	268.79	60.7%	155	-615.33	87.27	0.65	219.15	39.4%	151
DSKYWND2_UNIT_2B	-94.27	12.82	0.52	54.04	61.7%	155	-115.10	17.68	0.56	53.25	43.8%	150
EL_RAYO_UNIT1	-555.35	111.97	0.77	287.22	28.7%	211	-922.08	137.16	0.94	129.37	14.2%	153
EL_RAYO_UNIT2	-587.65	113.71	0.77	289.41	29.2%	211	-964.24	138.90	0.95	124.88	14.0%	153
ELB_ELBCREEK	-986.09	158.70	0.86	277.74	22.0%	208	-979.94	153.50	0.91	166.13	15.5%	153
EXGNSND_WIND_1	-226.58	72.79	0.53	253.88	40.0%	209	-402.98	100.93	0.78	172.04	20.4%	152
EXGNWTL_WIND_1	-428.06	82.30	0.59	252.43	46.1%	209	-494.72	97.02	0.82	142.74	20.2%	153
FERMI_WIND1	-251.14	83.14	0.36	481.76	52.4%	211	-842.82	144.57	0.74	295.99	27.3%	151
FERMI_WIND2	-22.84	18.16	0.32	113.03	48.7%	210	-139.79	30.68	0.66	75.13	27.9%	151
FLTCK_SSI	-211.28	60.36	0.74	143.87	25.1%	208	-256.53	61.96	0.79	98.96	21.2%	153
FLUVANNA_UNIT1	-560.00	103.67	0.79	235.20	26.1%	211	-605.69	100.75	0.85	147.69	20.0%	153
FLUVANNA_UNIT2	-496.57	95.66	0.79	215.99	25.4%	211	-606.75	98.97	0.88	127.52	17.8%	153
FOARDCTY_UNIT1	-904.76	191.86	0.66	606.44	33.7%	211	-1266.66	204.35	0.77	382.61	26.2%	153
FOARDCTY_UNIT2	-700.28	162.81	0.61	569.25	35.7%	211	-849.37	142.63	0.71	309.12	29.3%	153
FOXTROT_UNIT1	-39.05	71.99	0.13	656.70	79.1%	135	-954.08	159.16	0.86	207.40	20.4%	153
FOXTROT_UNIT2	-34.09	47.08	0.13	397.31	76.6%	126	-565.16	93.78	0.81	144.29	24.2%	153
FOXTROT_UNIT3	-131.14	34.25	0.25	193.75	72.4%	123	-436.39	60.66	0.81	94.75	30.1%	153
FTWIND_UNIT_1	-1051.01	259.17	0.75	610.10	26.5%	208	-1647.24	314.12	0.88	353.84	17.5%	153
GOAT_GOATWIND	-26.56	21.95	0.19	190.48	67.8%	209	-321.90	52.49	0.59	149.86	39.5%	153
GOAT_GOATWIN2	12.30	17.48	0.16	170.75	66.4%	209	-173.16	42.20	0.47	154.23	39.5%	153
GOPHER_UNIT1	-434.91	92.14	0.79	209.60	24.3%	211	-518.57	97.04	0.84	146.97	18.9%	153
GOPHER_UNIT2	-400.05	88.02	0.78	203.72	24.3%	211	-504.15	95.97	0.85	139.23	17.9%	153
GPASTURE_WIND_I	-676.27	94.32	0.48	427.99	63.0%	173	-743.02	93.46	0.65	234.63	46.4%	153
GRANDVW1_COLA	-315.81	93.95	0.68	341.15	27.5%	211	-548.39	112.05	0.79	253.43	23.0%	153
GRANDVW1_COLB	-323.46	95.25	0.69	340.98	27.2%	211	-508.46	108.87	0.75	274.97	25.1%	153
GRANDVW1_GV1A	-187.54	92.81	0.63	381.88	28.3%	211	-526.33	113.79	0.77	274.49	23.9%	153
GRANDVW1_GV1B	-123.12	85.70	0.61	367.08	28.3%	211	-404.55	102.57	0.74	266.51	24.1%	153
GRIF_TRL_UNIT1	-696.91	125.93	0.82	258.38	24.0%	211	-637.03	112.09	0.79	195.60	22.7%	153
GRIF_TRL_UNIT2	-952.76	165.55	0.84	320.70	23.3%	211	-1089.24	172.82	0.84	255.96	21.0%	153
GUNMTN_G1	-725.44	142.16	0.77	338.19	26.5%	211	-727.72	133.04	0.80	228.98	21.8%	153
GWEC_GWEC_G1	-606.96	162.93	0.68	457.14	30.5%	211	-1054.67	189.41	0.86	234.86	20.3%	153
HARALD_UNIT1	-1038.37	172.17	0.62	594.47	42.9%	209	-1096.67	178.30	0.74	361.97	28.2%	153
HHGT_HHOLLOW1	147.66	168.44	0.25	1065.68	49.7%	210	-1052.58	216.42	0.52	657.27	40.4%	153
HHGT_HHOLLOW2	-1252.70	211.47	0.70	610.53	35.1%	208	-1637.10	224.49	0.89	265.77	19.5%	153
HHGT_HHOLLOW3	-1356.14	243.05	0.68	729.59	35.1%	206	-1935.38	261.56	0.91	285.26	18.3%	153
HHGT_HHOLLOW4	-584.11	124.29	0.70	355.81	30.3%	208	-951.49	142.29	0.87	185.51	19.5%	153
HI_LONE_WGR1A	-235.56	48.45	0.61	167.78	35.6%	166	-252.93	54.76	0.64	146.73	30.3%	140
HI_LONE_WGR1B	-41.15	19.17	0.24	147.71	62.0%	166	-33.99	18.46	0.25	111.71	52.0%	141
HI_LONE_WGR1C	-143.25	29.45	0.66	93.04	32.5%	166	-106.34	28.08	0.59	83.03	30.5%	140
HI_LONE_WGR3	-493.95	94.27	0.61	327.57	39.5%	201	-454.71	93.78	0.65	234.47	29.4%	153
HI_LONE_WGR4	-248.10	65.77	0.53	269.60	40.0%	200	-224.07	63.44	0.49	220.24	35.3%	153
HI_LONE_WGR2	-550.61	98.40	0.58	368.76	41.7%	166	-384.02	96.73	0.58	287.95	31.3%	141
HI_LONE_WGR2A	-128.24	29.50	0.67	89.06	31.2%	195	-134.33	31.32	0.68	74.19	26.1%	152
HICKMAN_G1_J01	-506.20	100.69	0.79	225.99	24.8%	211	-459.51	95.15	0.70	214.89	26.5%	152
HICKMAN_G1_J02	-481.30	98.30	0.74	250.13	28.0%	208	-441.31	93.59	0.69	213.40	26.5%	151
HICKMAN_G2_J01	-514.37	98.40	0.79	221.89	25.5%	211	-462.40	92.76	0.70	208.21	26.8%	153

Table 3-3: Statistical Parameters for the 2022 Daily Wind Power Production Linear Models (Continued)

Wind Farm	Statistical Parameters of Non-OSP Daily Models						Statistical Parameters of OSP Daily Models					
	c_0	c_1	AdjR^2	RMSE	CV-RMSE	# Days	c_0	c_1	AdjR^2	RMSE	CV-RMSE	# Days
HICKMAN_G2_J02	-486.34	96.13	0.75	239.39	27.6%	211	-460.00	92.62	0.70	207.41	26.7%	153
HORSECRK_UNIT1	-1026.89	173.50	0.83	343.14	24.2%	210	-1214.11	184.48	0.86	260.70	20.9%	153
HORSECRK_UNIT2	-825.12	136.91	0.85	250.53	22.7%	211	-986.51	147.47	0.85	209.07	21.3%	153
HRFDWIND_JRDWIND1	-956.82	146.24	0.80	394.38	26.9%	211	-844.93	137.26	0.85	247.73	21.0%	153
HRFDWIND_JRDWIND2	-1043.98	155.19	0.79	423.07	27.7%	211	-890.01	141.70	0.85	263.00	21.9%	153
HRFDWIND_WIND_G	-642.94	101.29	0.81	265.45	25.6%	211	-601.61	95.06	0.84	182.93	22.9%	153
HRFDWIND_WIND_V	-610.04	112.13	0.80	298.36	23.9%	211	-703.94	117.99	0.82	244.53	23.6%	153
HWF_HWFG1	-100.05	65.38	0.25	495.87	60.4%	209	-587.68	122.62	0.70	275.99	26.3%	153
INDL_INADALE1	-287.96	61.99	0.42	315.50	53.9%	211	-831.72	107.30	0.86	147.76	24.6%	153
INDL_INADALE2	-325.30	67.07	0.43	339.44	54.8%	211	-922.90	115.05	0.86	161.45	26.3%	153
INDNNWP_INDNNWP2	-410.94	67.88	0.52	286.68	52.6%	211	-424.33	75.08	0.62	200.87	34.7%	153
KARAKAW1_UNIT1	-471.94	96.25	0.78	240.76	27.8%	211	-690.62	100.48	0.88	140.83	21.6%	153
KARAKAW1_UNIT2	-542.51	103.90	0.80	244.58	27.1%	211	-922.12	126.75	0.89	167.98	21.8%	153
KARAKAW2_UNIT3	-601.31	110.05	0.76	287.75	31.0%	210	-1004.98	134.46	0.88	183.16	23.2%	153
KEECHI_U1	-777.53	154.96	0.84	277.86	22.6%	210	-1107.22	185.29	0.92	166.83	15.8%	153
KEO_SHRBINO2	-27.49	103.46	0.32	654.26	45.8%	210	226.52	110.30	0.27	613.97	36.1%	152
KING_NE_KINGNE	-401.60	50.71	0.48	230.22	71.3%	185	-550.19	65.10	0.59	184.51	56.3%	146
KING_NW_KINGNW	-435.78	56.42	0.49	251.63	69.1%	175	-342.97	58.23	0.44	219.01	47.7%	135
KING_SE_KINGSE	-220.41	26.37	0.56	99.23	60.3%	158	-230.38	28.12	0.58	81.96	55.2%	146
KING_SW_KINGSW	-410.10	55.40	0.47	256.85	68.5%	174	-335.09	53.78	0.42	214.33	55.3%	150
LGD_LANGFORD	-1075.12	194.12	0.76	480.75	29.2%	207	-1416.43	217.10	0.82	348.23	23.5%	153
LGW_UNIT1	-516.17	115.31	0.68	321.44	32.9%	210	-793.77	136.61	0.85	177.65	22.1%	153
LGW_UNIT2	-494.17	108.58	0.69	299.86	32.9%	210	-807.48	134.34	0.86	168.05	22.0%	153
LHORN_N_UNIT1	-588.33	108.55	0.80	293.50	24.2%	211	-752.19	114.06	0.77	274.21	29.5%	153
LHORN_N_UNIT2	-615.45	111.45	0.81	286.22	23.2%	211	-731.63	113.50	0.73	285.97	31.3%	149
LMAJADAS_UNIT1	-443.17	108.97	0.62	398.94	37.3%	211	-978.72	146.48	0.94	137.42	14.1%	153
LMAJADAS_UNIT2	-111.83	24.48	0.66	82.25	36.0%	210	-220.39	31.56	0.93	32.40	16.1%	153
LMAJADAS_UNIT3	-514.93	132.75	0.61	497.20	37.4%	211	-1235.21	182.73	0.95	161.15	13.4%	153
LNCRK_G83	-1575.48	213.66	0.91	294.16	20.5%	211	-1285.28	180.40	0.88	231.29	20.3%	144
LOCKETT_UNIT1	-1309.55	247.55	0.72	667.35	30.6%	211	-1637.71	273.45	0.81	457.04	22.7%	153
LNCRK2_G871	-503.64	79.36	0.70	226.26	36.8%	211	-552.46	83.98	0.83	129.05	22.7%	152
LNCRK2_G872	-493.68	80.60	0.69	237.09	37.0%	211	-613.13	88.23	0.87	118.03	20.8%	148
LONEWOLF_G1	-154.71	33.12	0.52	136.31	44.0%	209	-341.47	49.78	0.90	55.52	17.2%	153
LONEWOLF_G2	-167.31	33.86	0.54	135.57	44.0%	209	-393.56	54.49	0.90	61.28	18.3%	153
LONEWOLF_G3	-99.43	19.73	0.54	78.21	44.0%	209	-213.46	30.19	0.91	33.37	17.6%	153
LONEWOLF_G4	-92.20	17.97	0.55	70.87	44.3%	209	-192.14	27.03	0.90	30.89	18.3%	153
LV1_LV1A	-41.72	79.29	0.25	623.90	59.1%	205	-1008.07	158.61	0.80	296.49	26.7%	153
LV2_LV2	-555.66	129.57	0.45	657.61	53.0%	209	-1370.78	189.74	0.87	279.60	24.0%	153
LV3_UNIT_1	-1691.61	294.67	0.85	457.87	25.4%	209	-2166.68	331.47	0.93	297.37	15.3%	153
LV4_UNIT_1	-1613.89	283.55	0.85	448.49	25.8%	209	-2198.62	340.40	0.94	281.98	14.0%	153
LV5_UNIT_1	-701.54	132.31	0.79	254.42	29.4%	211	-1051.36	168.41	0.92	156.64	15.1%	153
MARIAH_NORTE1	-594.76	120.51	0.75	372.09	26.5%	211	-576.25	112.92	0.79	252.51	23.2%	153
MARIAH_NORTE2	-638.34	121.16	0.78	343.74	25.1%	211	-652.07	117.21	0.83	234.78	21.8%	153
MAVCRK_E_UNIT5	-515.07	84.61	0.78	194.39	28.6%	208	-343.26	69.58	0.76	134.62	23.0%	153
MAVCRK_E_UNIT6	-296.54	45.03	0.80	97.42	28.7%	208	-268.48	42.95	0.84	63.27	20.7%	153
MAVCRK_E_UNIT7	-160.84	26.01	0.76	63.51	30.7%	209	-91.41	19.18	0.64	49.62	30.1%	153
MAVCRK_E_UNIT8	-182.33	26.28	0.81	55.28	29.6%	208	-190.56	26.03	0.87	34.18	21.8%	153
MAVCRK_E_UNIT9	-576.56	87.93	0.78	203.13	30.7%	208	-574.30	85.97	0.85	122.44	21.3%	153
MAVCRK_W_UNIT1	-1568.74	254.67	0.81	533.01	26.5%	208	-1085.32	209.19	0.83	328.38	19.2%	153
MAVCRK_W_UNIT2	-89.85	12.88	0.71	35.54	38.9%	208	-74.66	11.90	0.81	20.11	23.9%	153
MAVCRK_W_UNIT3	-278.00	42.55	0.81	90.72	28.3%	208	-177.49	31.88	0.79	57.24	23.1%	153
MAVCRK_W_UNIT4	-194.28	28.60	0.82	58.91	28.2%	209	-197.78	28.07	0.88	35.53	20.1%	153
MARYNEAL_UNIT1	-1332.44	220.52	0.85	398.89	23.2%	196	-1039.43	175.29	0.80	305.39	23.5%	152
MCDLD_FCW1	-189.57	60.47	0.34	364.16	55.0%	211	-588.54	92.43	0.65	234.71	36.3%	153
MESQCRK_WND1	-450.63	94.67	0.67	287.66	32.8%	207	-477.49	87.98	0.73	183.16	26.3%	153
MESQCRK_WND2	-524.17	101.42	0.69	296.10	33.0%	207	-611.76	99.66	0.77	189.21	26.3%	153
MESTENO_UNIT_1	177.23	64.95	0.16	533.65	56.5%	210	-409.78	152.85	0.51	477.20	32.2%	153
MIAM1_G1	-286.81	112.50	0.63	456.33	28.9%	211	-726.16	137.80	0.77	330.93	25.4%	153
MIAM1_G2	-422.82	118.05	0.63	479.92	31.3%	211	-775.28	145.01	0.72	395.32	29.0%	153
MIDWIND_UNIT1	-1131.36	164.98	0.64	589.01	50.7%	193	-1762.25	231.54	0.86	356.83	26.5%	148
MIRASOLE_MIR11	-84.03	38.04	0.33	196.38	53.6%	211	-335.33	63.74	0.68	140.18	30.9%	153
MIRASOLE_MIR12	-77.95	68.31	0.30	383.11	52.4%	211	-633.17	119.55	0.68	259.65	30.6%	153
MIRASOLE_MIR13	-94.72	37.60	0.36	185.38	52.9%	211	-358.09	61.33	0.70	128.12	31.9%	153
MIRASOLE_MIR21	-86.36	67.47	0.29	390.25	54.8%	211	-721.19	126.86	0.67	282.24	33.2%	153
MOZART_WIND_1	-118.39	22.05	0.60	79.19	41.2%	211	-184.58	25.53	0.82	40.52	25.9%	153
MWEC_G1	358.47	48.47	0.16	594.28	51.1%	211	-896.03	146.01	0.76	354.12	28.2%	153

Table 3-3: Statistical Parameters for the 2022 Daily Wind Power Production Linear Models (Continued)

Wind Farm	Statistical Parameters of Non-OSP Daily Models						Statistical Parameters of OSP Daily Models					
	c_0	c_1	AdjR^2	RMSE	CV-RMSE	# Days	c_0	c_1	AdjR^2	RMSE	CV-RMSE	# Days
NBOHR_UNIT1	-1394.27	222.31	0.80	489.83	28.2%	209	-1434.59	231.68	0.81	379.41	22.9%	153
NWF_NWF1	305.78	11.91	0.03	286.93	60.8%	207	23.95	41.18	0.25	242.59	42.2%	152
NWF_NWF2	219.30	5.26	0.01	180.39	61.6%	208	56.03	22.63	0.21	147.17	41.0%	152
OVEJA_G1	-1093.38	196.27	0.83	383.76	23.0%	211	-1143.01	203.46	0.82	326.88	20.8%	153
OVEJA_G2	-1017.58	184.87	0.76	437.81	28.6%	184	-980.51	177.61	0.81	295.39	21.2%	153
PALMWIND_UNIT1	-801.29	131.33	0.70	402.86	39.4%	211	-1142.12	156.94	0.87	232.17	24.2%	152
PAP1_PAP1_J01	-215.70	39.83	0.60	150.67	44.4%	210	-492.95	63.53	0.89	83.10	23.4%	153
PAP1_PAP1_J02	-880.09	137.38	0.84	276.90	26.8%	210	-1399.53	181.99	0.92	200.79	19.5%	153
PC_NORTH_PANTHER1	-1212.59	195.04	0.86	331.94	22.2%	205	-1135.04	183.94	0.89	225.08	17.0%	153
PC_SOUTH_PANTHER2	-1113.08	165.42	0.90	235.56	19.7%	209	-1060.44	158.02	0.91	169.51	16.1%	153
PC_SOUTH_PANTH31	-918.76	139.53	0.86	245.25	23.4%	211	-991.57	139.38	0.91	154.86	17.8%	153
PC_SOUTH_PANTH32	-1028.20	150.11	0.87	254.34	23.4%	211	-1044.25	147.85	0.92	146.02	15.7%	153
PENA_UNIT1	558.22	-3.69	0.00	362.89	71.6%	209	-118.86	66.13	0.29	383.56	50.2%	153
PENA_UNIT2_J01	-71.44	27.65	0.44	145.15	46.4%	210	-534.66	73.08	0.89	99.28	22.5%	153
PENA_UNIT2_J02	58.83	18.68	0.22	164.05	51.5%	210	-332.56	56.68	0.79	111.62	26.3%	153
PENA3_UNIT3	195.64	12.43	0.04	232.82	63.9%	205	-208.11	51.99	0.59	162.19	33.4%	153
PEY_UNIT1	-511.60	132.19	0.55	551.02	41.6%	211	-1131.17	146.90	0.74	328.63	39.5%	153
PH1_UNIT1	-266.31	79.49	0.52	407.34	38.7%	211	-665.30	107.61	0.80	231.75	25.2%	153
PH1_UNIT2	-233.82	75.32	0.51	392.84	38.7%	211	-483.23	88.85	0.77	212.20	25.7%	153
PH2_UNIT1	-181.24	72.22	0.52	372.57	36.7%	211	-467.10	97.56	0.71	269.86	27.8%	153
PH2_UNIT2	-188.59	74.37	0.50	399.06	38.2%	211	-515.21	105.24	0.69	306.07	29.5%	153
PHILLWND_UNIT1	-907.01	146.97	0.65	438.30	44.1%	211	-1142.79	157.97	0.82	226.08	32.1%	153
PHILLWND_UNIT2	-977.38	162.05	0.69	441.77	39.5%	211	-1287.82	187.06	0.84	254.33	28.3%	153
PRIDDY_UNIT1	-577.18	162.05	0.58	567.18	37.3%	210	-781.53	179.29	0.80	277.40	21.1%	153
PRIDDY_UNIT2	-450.49	110.51	0.57	389.33	39.7%	210	-528.52	112.53	0.81	168.77	21.5%	153
PYR_PYRON1	-249.08	76.11	0.39	412.42	50.1%	211	-990.81	136.26	0.84	202.30	24.3%	152
PYR_PYRON2	-240.90	80.10	0.38	445.50	50.2%	211	-1002.90	140.51	0.84	206.88	23.7%	153
RANCHERO_UNIT1	-634.30	156.02	0.64	512.17	32.8%	209	-1052.12	205.20	0.67	490.38	29.0%	153
RANCHERO_UNIT2	-474.22	139.64	0.60	496.10	33.3%	209	-858.71	183.71	0.69	421.12	26.4%	152
RDCANYON_RDCNY1	-641.63	113.42	0.86	197.17	20.6%	211	-689.92	113.42	0.87	150.95	18.3%	153
REDFISH_MV1A	-401.14	80.80	0.63	288.68	40.0%	211	-636.41	102.52	0.91	120.37	16.4%	153
REDFISH_MV1B	-518.59	91.90	0.64	317.64	41.9%	211	-784.48	114.84	0.93	123.41	16.5%	153
RELOJ_UNIT1	-142.26	28.84	0.43	120.91	60.7%	211	-38.42	17.82	0.49	57.40	31.5%	153
RELOJ_UNIT2	-169.40	41.49	0.52	146.31	45.5%	211	-32.22	32.42	0.43	118.36	32.0%	153
RELOJ_UNIT3	-253.41	47.62	0.36	232.62	75.0%	211	-120.16	30.33	0.48	99.61	39.0%	153
RELOJ_UNIT4	-52.96	10.31	0.23	70.52	100.3%	177	-34.75	7.83	0.50	25.09	40.1%	150
ROUTE_66_WIND1	508.63	53.14	0.16	644.64	46.4%	209	-88.41	113.31	0.47	526.37	33.3%	153
RSNAKE_G1	-273.52	81.22	0.42	418.90	47.9%	207	-405.98	96.69	0.58	283.84	32.1%	153
RSNAKE_G2	-228.54	80.48	0.40	430.21	47.4%	207	-486.96	103.76	0.59	292.17	32.0%	146
RTS_U1	-566.53	189.87	0.46	753.55	44.8%	211	-1008.32	197.91	0.62	494.42	34.3%	153
RTS2_U1	-393.92	108.55	0.52	379.86	42.6%	211	-661.43	116.31	0.63	281.95	36.2%	153
RTS2_U2	-346.63	110.34	0.48	417.82	43.5%	211	-643.32	120.23	0.63	293.38	34.7%	153
SAGEDRAW_UNIT1	-1131.30	214.44	0.80	470.82	24.9%	211	-1493.12	224.93	0.81	368.12	24.4%	153
SAGEDRAW_UNIT2	-1156.05	214.17	0.78	496.11	26.7%	211	-1589.48	230.44	0.82	374.38	25.2%	153
SALTFORK_UNIT1	-171.73	58.91	0.69	209.94	26.1%	211	-327.66	65.04	0.75	161.62	25.7%	152
SALTFORK_UNIT2	-418.01	109.53	0.74	342.47	24.5%	211	-625.12	116.78	0.76	287.63	26.3%	152
SALVTION_UNIT1	-776.05	157.49	0.80	357.45	26.1%	170	-843.05	160.18	0.63	423.24	33.0%	141
SALVTION_UNIT2	-990.53	166.52	0.82	351.25	23.4%	122	-1211.82	175.92	0.68	400.38	30.8%	105
SANROMAN_WIND_1	-307.62	58.93	0.61	217.57	42.6%	211	-598.99	74.73	0.89	98.29	24.6%	153
SANTACRU_UNIT1	-705.00	130.93	0.76	339.85	30.5%	211	-1251.31	164.49	0.92	188.00	19.8%	152
SANTACRU_UNIT2	-534.64	97.30	0.78	239.98	29.1%	208	-912.32	119.29	0.91	137.14	20.0%	152
SENATEWD_UNIT1	-929.49	186.44	0.80	375.03	25.3%	211	-1221.40	202.91	0.91	192.19	16.7%	153
SGMTN_SIGNALM2	-44.20	5.83	0.81	12.26	32.4%	211	-42.61	5.37	0.89	6.43	22.1%	153
SGMTN_SIGNALMT	-184.58	24.39	0.81	51.41	32.3%	211	-177.87	22.47	0.89	26.92	22.0%	153
SHAFFER_UNIT1	-1488.18	253.72	0.82	552.13	27.1%	211	-2359.42	305.15	0.93	322.52	18.8%	153
SHANNONW_UNIT_1	17.84	101.53	0.23	807.92	55.8%	211	-876.44	178.37	0.62	482.42	32.0%	153
SPLAIN1_WIND1	-437.26	86.74	0.55	416.05	41.6%	211	-555.95	98.27	0.73	262.01	29.4%	153
SPLAIN1_WIND2	-363.82	83.37	0.53	420.37	41.3%	211	-614.28	106.05	0.77	251.64	26.5%	153
SPLAIN2_WIND21	-976.10	154.15	0.78	437.44	27.8%	208	-1041.36	153.47	0.85	276.30	22.6%	153
SPLAIN2_WIND22	-989.12	159.89	0.78	447.97	27.1%	208	-1124.75	164.77	0.83	319.96	24.5%	153
SRWE1_SRWE2	-1118.36	198.97	0.73	531.26	31.5%	211	-1389.61	207.25	0.82	338.27	24.5%	153
SRWE1_UNIT1	-1451.86	257.81	0.74	658.55	30.2%	211	-1788.53	269.66	0.84	400.32	22.1%	153
SSPURTWO_SS3WIND1	-521.55	97.63	0.72	323.67	29.5%	211	-348.89	88.74	0.60	317.59	33.1%	153
SSPURTWO_SS3WIND2	-421.29	96.32	0.68	348.80	29.7%	211	-245.23	88.88	0.54	356.84	33.5%	153
SSPURTWO_WIND_1	-755.43	148.93	0.66	569.82	33.3%	211	-620.84	143.35	0.61	502.30	33.7%	153

Table 3-3: Statistical Parameters for the 2022 Daily Wind Power Production Linear Models (Continued)

Wind Farm	Statistical Parameters of Non-OSP Daily Models						Statistical Parameters of OSP Daily Models					
	c_0	c_1	AdjR^2	RMSE	CV-RMSE	# Days	c_0	c_1	AdjR^2	RMSE	CV-RMSE	# Days
STELLA_UNIT1	-1320.31	223.65	0.84	451.27	24.8%	198	-1835.45	269.18	0.94	266.21	15.1%	153
STWF_T1	-567.09	91.09	0.63	305.51	42.4%	208	-813.56	114.54	0.89	134.84	18.8%	153
S_HILLS_UNIT1	-166.10	39.69	0.79	88.36	22.5%	211	-175.62	39.03	0.79	69.09	20.0%	153
SWEC_G1	-36.71	50.39	0.26	370.48	55.0%	211	-400.14	86.44	0.56	260.96	34.6%	153
SWEETWN2_WND2	-926.49	146.08	0.90	217.06	19.2%	211	-947.86	142.03	0.91	154.73	16.3%	153
SWEETWN2_WND24	-134.39	18.41	0.83	36.01	29.0%	209	-144.98	18.56	0.90	20.70	20.1%	153
SWEETWN3_WND3A	-258.64	42.33	0.91	57.89	17.1%	211	-276.85	41.17	0.91	44.56	16.3%	153
SWEETWN3_WND3B	-911.65	144.03	0.90	212.63	19.0%	211	-969.85	140.92	0.91	149.54	16.4%	153
SWEETWN4_WND4A	-864.93	122.14	0.80	266.43	31.1%	211	-936.17	120.78	0.86	168.75	24.9%	151
SWEETWN4_WND4B	-904.59	126.13	0.88	207.12	23.7%	209	-929.58	117.72	0.86	161.23	25.1%	152
SWEETWN5_WND5	-165.15	44.60	0.39	243.04	52.4%	209	-675.26	85.10	0.85	122.00	26.5%	152
SWEETWND_WND1	-344.91	53.29	0.90	73.29	19.2%	196	-361.05	53.70	0.90	58.52	16.8%	149
TAHOKA_UNIT_1	-1010.26	195.57	0.81	408.53	23.4%	211	-1327.28	208.96	0.81	343.62	23.5%	153
TAHOKA_UNIT_2	-868.34	186.57	0.77	443.25	25.2%	211	-1111.74	189.18	0.79	339.12	24.0%	153
TGW_T1	-255.24	80.37	0.47	396.33	45.9%	209	-1092.37	165.67	0.88	236.13	21.1%	153
TGW_T2	-257.16	90.05	0.46	458.86	46.1%	209	-1259.75	190.97	0.87	275.12	21.3%	153
TKWSW1_ROSCOE	-302.23	68.85	0.38	381.07	57.1%	211	-895.51	119.51	0.83	186.09	26.6%	153
TKWSW1_ROSCOE2A	-201.77	53.49	0.34	324.57	58.8%	211	-694.48	93.00	0.80	158.29	28.9%	153
TORR_UNIT1_25	-1060.55	203.84	0.83	343.74	25.4%	209	-1076.61	214.27	0.88	256.88	16.3%	153
TORR_UNIT2_23	-155.86	29.10	0.79	55.44	29.6%	207	-194.18	35.36	0.86	45.07	18.5%	151
TORR_UNIT2_25	-805.26	167.08	0.81	297.67	25.4%	211	-895.71	182.79	0.88	218.05	15.9%	153
TRENT_TRENT	-354.59	53.59	0.90	76.85	19.2%	211	-363.70	51.76	0.83	80.84	24.7%	153
TRENT_UNIT_1B	-92.26	19.58	0.80	42.37	23.1%	210	-89.44	19.49	0.75	38.15	22.3%	153
TRENT_UNIT_2	-476.76	69.69	0.90	100.27	19.9%	211	-532.55	71.07	0.90	80.68	19.4%	152
TRENT_UNIT_3A	-333.40	50.33	0.88	82.39	21.9%	211	-328.17	48.77	0.90	57.19	17.7%	153
TRENT_UNIT_3B	-16.08	10.71	0.50	46.45	34.5%	210	-33.87	12.06	0.61	32.79	25.8%	153
TRINITY_TH1_BUS1	-740.64	139.79	0.81	293.79	23.9%	211	-814.56	142.59	0.79	255.31	23.4%	153
TRINITY_TH1_BUS2	-634.28	124.85	0.80	273.04	24.3%	211	-819.82	136.72	0.79	239.64	23.8%	153
TRUENO_UNIT1	-549.36	118.93	0.65	402.59	36.5%	211	-1110.91	157.61	0.93	162.11	16.3%	153
TRUENO_UNIT2	-548.37	123.47	0.63	436.94	37.4%	211	-1156.81	167.61	0.94	160.98	14.9%	153
TRUSGILL_UNIT1	-319.11	53.45	0.74	136.80	31.6%	190	-338.05	52.61	0.76	100.66	27.6%	150
TRUSGILL_UNIT2	-222.75	40.67	0.56	156.97	45.8%	200	-181.54	38.01	0.61	102.51	31.5%	150
TRUSGILL_UNIT3	-247.12	43.63	0.69	124.74	34.6%	205	-136.35	33.32	0.44	127.03	41.3%	151
TRUSGILL_UNIT4	-919.27	163.01	0.43	807.72	59.6%	206	-1300.73	212.45	0.73	440.70	28.8%	151
TTWEC_G1	397.81	29.36	0.06	487.42	60.1%	206	-711.46	125.61	0.70	280.40	28.9%	151
TYLRWIND_UNIT1	-758.15	149.73	0.71	389.54	33.1%	211	-1220.83	183.41	0.88	204.65	22.2%	153
VENADO_UNIT1	-758.76	129.69	0.85	203.83	26.3%	211	-944.50	157.32	0.94	121.87	12.1%	153
VENADO_UNIT2	-696.35	121.34	0.85	184.55	24.9%	211	-901.11	150.47	0.95	106.61	11.1%	153
VERAWIND_UNIT1	-74.33	13.89	0.73	36.95	30.3%	209	-95.73	15.17	0.68	35.66	33.4%	153
VERAWIND_UNIT2	-45.77	7.95	0.61	27.53	41.7%	210	-47.62	8.34	0.61	22.84	35.8%	153
VERAWIND_UNIT3	-692.22	127.48	0.79	286.61	26.0%	211	-839.34	130.76	0.78	240.03	26.5%	153
VERAWIND_UNIT4	-143.76	27.23	0.73	72.17	30.1%	211	-154.33	25.55	0.68	59.42	31.4%	150
VERAWIND_UNIT5	-631.81	118.07	0.77	278.70	27.0%	211	-541.08	102.86	0.66	251.07	29.9%	151
VERTIGO_WIND_I	-859.34	112.57	0.46	533.26	72.9%	200	-701.12	98.37	0.54	313.69	51.2%	153
VORTEX_WIND1	1075.71	-9.93	-0.01	872.84	91.3%	134	121.69	61.19	0.18	406.93	46.3%	153
VORTEX_WIND2	125.88	5.59	0.01	158.06	81.7%	133	-80.58	23.02	0.41	86.77	42.4%	153
VORTEX_WIND3	1373.71	-31.26	0.01	951.22	95.5%	130	284.29	49.63	0.09	499.37	55.5%	152
VORTEX_WIND4	85.68	1.56	0.00	85.53	81.9%	129	-57.61	13.72	0.40	53.59	47.7%	153
WAKEWE_G1_J01	-70.12	46.31	0.51	239.96	34.5%	205	-251.48	57.61	0.78	131.75	22.0%	153
WAKEWE_G1_J02	-66.29	43.79	0.51	226.88	34.5%	205	-237.77	54.48	0.78	124.57	22.0%	153
WAKEWE_G2_J01	-100.09	56.30	0.52	285.82	34.4%	205	-355.56	71.97	0.79	163.58	23.2%	153
WAKEWE_G2_J02	-94.63	53.24	0.52	270.25	34.4%	205	-336.17	68.05	0.79	154.67	23.2%	153
WEC_WECG1	-1.57	30.75	0.30	247.24	48.7%	211	-329.88	56.25	0.67	171.78	34.4%	153
WHMESA_UNIT1	-1025.86	183.78	0.78	431.95	27.6%	211	-1283.46	206.89	0.85	304.09	20.6%	153
WHMESA_UNIT2_23	-73.71	15.24	0.68	45.59	33.1%	200	-95.86	15.66	0.81	26.38	23.3%	153
WHMESA_UNIT2_28	-1235.21	225.57	0.77	539.69	27.8%	211	-1619.72	250.33	0.86	344.15	20.0%	153
WHMESA_UNIT3_23	-112.49	21.72	0.71	60.33	31.8%	202	-166.31	24.80	0.84	37.72	22.9%	153
WHMESA_UNIT3_28	-799.63	153.98	0.74	394.95	29.0%	209	-1066.37	173.05	0.83	267.55	21.5%	153
WH_WIND_UNIT1	-1773.62	257.94	0.87	430.38	23.2%	208	-1869.09	252.90	0.91	267.83	17.8%	153
WH_WIND_UNIT2	-1769.71	265.87	0.90	385.72	19.4%	208	-1553.23	235.05	0.91	255.31	16.1%	153
WHTTAIL_WR1	-880.23	161.32	0.79	343.26	28.5%	211	-1410.67	205.04	0.90	208.32	21.1%	153
WILDWIND_UNIT1	-125.20	25.95	0.79	53.96	25.7%	211	-220.88	33.46	0.90	34.12	20.1%	153
WILDWIND_UNIT2	-407.58	65.12	0.85	111.61	25.9%	210	-502.09	68.63	0.88	78.27	26.1%	153
WILDWIND_UNIT3	-35.88	7.74	0.71	19.81	31.0%	210	-71.44	11.07	0.88	12.56	21.7%	153
WILDWIND_UNIT4	-345.02	75.63	0.80	154.01	24.3%	211	-616.81	96.35	0.89	104.25	20.5%	153

Table 3-3: Statistical Parameters for the 2022 Daily Wind Power Production Linear Models (Continued)

Wind Farm	Statistical Parameters of Non-OSP Daily Models						Statistical Parameters of OSP Daily Models					
	c_0	c_1	AdjR^2	RMSE	CV-RMSE	# Days	c_0	c_1	AdjR^2	RMSE	CV-RMSE	# Days
WILDWIND_UNIT5	-439.69	69.70	0.79	146.60	32.0%	210	-528.42	65.31	0.74	120.72	51.8%	148
WL_RANCH_UNIT1	-1462.59	262.79	0.77	633.71	28.3%	211	-1843.55	284.75	0.88	363.93	18.6%	153
WNDTHST2_UNIT1	-467.58	80.89	0.79	179.72	26.7%	211	-554.48	84.03	0.81	140.57	24.8%	153
WOODWRD1_WOODWRD1	-404.85	65.05	0.52	270.28	52.9%	211	-434.68	72.50	0.56	218.18	40.9%	153
WOODWRD2_WOODWRD2	-306.58	51.86	0.53	214.86	50.7%	211	-278.87	54.00	0.49	188.67	42.6%	153

Table 3-4: Uncertainty of the 2022 daily wind power prediction using linear models (2018 base year)

Wind Farm	2018 Non Ozone Season Period				2018 Ozone Season Period (OSP)			
	Predicted days	Total Variance	Total Estimated	Relative Uncertainty	Predicted Days	Total Variance	Total Estimated	Relative uncertainty
AJAXWIND_UNIT1	212	18,230.56	396,619	4.60%	153	12,185.16	278,299.2	4.38%
AJAXWIND_UNIT2	212	10,845.20	250,492	4.33%	153	7,468.35	184,273.0	4.05%
ALGODON_UNIT1	212	27,228.53	274,104	9.93%	153	17,638.66	230,646.4	7.65%
ALGODON_UNIT2	212	4,520.59	46,971	9.62%	153	2,831.86	34,129.6	8.30%
AMADEUS1_UNIT1	212	3,663.96	47,985	7.64%	153	1,441.12	41,498.7	3.47%
AMADEUS1_UNIT2	212	3,556.60	50,316	7.07%	153	1,534.76	38,703.5	3.97%
AMADEUS2_UNIT3	212	17,766.92	285,784	6.22%	153	9,382.12	190,637.8	4.92%
ANACACHO_ANA	212	9,840.50	194,686	5.05%	153	5,672.27	159,241.4	3.56%
ANCHOR_WIND2	212	16,889.11	120,267	14.04%	153	5,188.46	127,784.2	4.06%
ANCHOR_WIND3	212	12,591.63	80,425	15.66%	153	3,683.23	93,259.9	3.95%
ANCHOR_WIND4	212	6,040.40	48,135	12.55%	153	2,054.79	45,285.4	4.54%
ANCHOR_WIND5	212	2,978.94	16,215	18.37%	153	1,300.40	19,720.7	6.59%
APOGEE_UNIT1	212	3,534.20	27,862	12.68%	153	1,230.66	28,528.6	4.31%
APOGEE_UNIT2	212	2,056.78	24,796	8.29%	153	900.35	22,327.3	4.03%
APOGEE_UNIT3	212	4,591.82	51,530	8.91%	153	1,810.44	47,866.2	3.78%
APOGEE_UNIT4	212	13,616.39	104,874	12.98%	153	4,942.44	113,735.2	4.35%
APOGEE_UNIT5	212	13,946.28	102,427	13.62%	153	4,848.38	92,630.9	5.23%
APOGEE_UNIT6	212	3,816.37	35,485	10.75%	153	1,853.52	36,442.7	5.09%
APOGEE_UNIT7	212	9,854.88	69,447	14.19%	153	3,838.62	70,028.4	5.48%
AQUILLA_U1_23	212	1,311.21	29,242	4.48%	153	805.74	20,968.7	3.84%
AQUILLA_U1_28	212	12,844.83	324,103	3.96%	153	6,515.27	230,604.2	2.83%
AQUILLA_U2_23	212	683.01	15,089	4.53%	153	365.87	11,100.3	3.30%
AQUILLA_U2_28	212	13,716.58	332,031	4.13%	153	7,597.73	251,607.6	3.02%
ASTRA_UNIT1	212	17,799.87	277,696	6.41%	153	9,781.73	202,481.0	4.83%
AVIATOR_UNIT1	212	9,617.36	299,033	3.22%	153	5,675.77	211,639.8	2.68%
AVIATOR_UNIT2	212	7,510.62	250,757	3.00%	153	5,245.75	180,221.2	2.91%
BAFFIN_UNIT1	212	7,799.71	95,854	8.14%	153	4,473.04	51,516.5	8.68%
BAFFIN_UNIT2	212	6,028.76	96,423	6.25%	153	3,292.13	51,631.3	6.38%
BAIRDWND_UNIT1	212	13,570.24	249,844	5.43%	153	11,227.16	168,418.5	6.67%
BAIRDWND_UNIT2	212	10,652.06	200,288	5.32%	153	6,517.75	131,403.3	4.96%
BARROW_UNIT1	212	8,189.74	171,532	4.77%	153	5,898.06	127,002.3	4.64%
BARROW_UNIT2	212	6,316.71	134,851	4.68%	153	4,388.63	92,652.4	4.74%
BBREEZE_UNIT1	212	10,322.00	148,713	6.94%	153	4,672.53	78,592.4	5.95%
BBREEZE_UNIT2	212	9,289.09	136,733	6.79%	153	3,891.26	72,508.7	5.37%
BULLCRK_WND2	212	4,933.88	66,821	7.38%	153	2,439.21	45,285.7	5.39%
BCATWIND_WIND_1	212	12,904.26	266,609	4.84%	153	8,550.53	188,923.5	4.53%
BLSUMMIT_BLSMT1_6	212	10,504.09	182,556	5.75%	153	5,755.16	134,420.5	4.28%
BLSUMMIT_UNIT2_17	212	575.08	12,264	4.69%	153	426.24	9,190.1	4.64%
BLSUMMIT_UNIT2_25	212	7,973.29	176,799	4.51%	153	5,455.70	126,089.8	4.33%
BLSUMIT3_UNIT_17	212	1,251.60	23,266	5.38%	153	829.20	17,761.3	4.67%
BLSUMIT3_UNIT_25	212	17,265.27	382,734	4.51%	153	11,545.36	274,665.3	4.20%
BORDAS_JAVEL18	212	1,089.79	34,094	3.20%	153	679.89	25,711.9	2.64%
BORDAS_JAVEL20	212	12,188.02	499,899	2.44%	153	6,441.42	401,637.2	1.60%
BORDAS2_JAVEL2_A	212	4,793.48	218,648	2.19%	153	3,185.57	171,355.0	1.86%
BORDAS2_JAVEL2_B	212	3,677.60	165,046	2.23%	153	2,396.31	130,946.3	1.83%
BORDAS2_JAVEL2_C	212	1,604.03	71,854	2.23%	153	1,031.69	58,480.0	1.76%
BRISCOE_WIND	212	16,779.97	282,683	5.94%	153	7,907.92	196,129.8	4.03%

Table 3-4: Uncertainty of the 2022 daily wind power prediction using linear models (2018 base year) (Continued)

Wind Farm	2018 Non Ozone Season Period				2018 Ozone Season Period (OSP)			
	Predicted days	Total Variance	Total Estimated	Relative Uncertainty	Predicted Days	Total Variance	Total Estimated	Relative uncertainty
BRTSW_BCW1	212	8,549.62	148,675	5.75%	153	3,279.26	106,797.6	3.07%
BUCKTHRN_UNIT1	212	3,318.88	89,226	3.72%	153	2,142.67	72,703.8	2.95%
BUCKTHRN_UNIT2	212	4,655.22	118,574	3.93%	153	3,079.56	90,884.0	3.39%
BUFF_GAP_UNIT1	212	9,057.31	97,661	9.27%	153	4,190.34	84,933.4	4.93%
BUFF_GAP_UNIT2_1	212	9,022.11	98,696	9.14%	153	4,262.73	90,721.8	4.70%
BUFF_GAP_UNIT2_2	212	8,664.45	93,216	9.30%	153	4,074.13	85,641.7	4.76%
BUFF_GAP_UNIT3	212	12,976.19	134,390	9.66%	153	5,630.93	117,397.5	4.80%
BULLCRK_WND1	212	5,194.52	64,361	8.07%	153	2,309.55	42,512.1	5.43%
CABEZON_WIND1	212	11,111.77	162,782	6.83%	153	8,139.10	160,434.6	5.07%
CABEZON_WIND2	212	11,408.02	171,556	6.65%	153	8,274.17	168,474.9	4.91%
CALLAHAN_WND1	212	7,673.30	187,657	4.09%	153	9,970.19	137,818.3	7.23%
CAMWIND_UNIT1	212	9,536.06	186,861	5.10%	153	5,025.76	86,280.1	5.82%
CAPRIDG4_CR4	212	6,018.05	174,942	3.44%	153	3,504.08	121,827.8	2.88%
CAPRIDGE_CR1	212	10,670.92	345,092	3.09%	153	6,514.83	249,944.7	2.61%
CAPRIDGE_CR2	212	8,238.76	210,706	3.91%	153	5,852.78	144,607.2	4.05%
CAPRIDGE_CR3	212	8,952.36	276,423	3.24%	153	7,064.61	182,139.2	3.88%
CEDROHIL_CHW1	212	4,510.28	137,997	3.27%	153	2,184.17	123,821.6	1.76%
CEDROHIL_CHW2	212	3,887.01	128,025	3.04%	153	2,051.72	118,022.1	1.74%
CFLATS_U1	212	11,627.84	209,301	5.56%	153	5,376.84	158,110.9	3.40%
CHALUPA_UNIT1	212	11,261.62	195,541	5.76%	153	7,295.23	115,262.7	6.33%
CHALUPA_UNIT2	212	1,754.68	29,133	6.02%	153	1,138.87	17,142.8	6.64%
CHAMPION_UNIT1	212	12,237.43	149,156	8.20%	153	4,301.84	112,854.8	3.81%
CN_BRKS_UNIT_1	212	18,734.90	566,743	3.31%	153	13,948.66	375,292.3	3.72%
COTPLNS_COTTONPL	212	4,772.22	133,509	3.57%	153	2,860.24	81,520.6	3.51%
COTPLNS_OLDSETLR	212	15,414.36	391,481	3.94%	153	8,195.01	243,841.3	3.36%
COYOTE_W_UNIT1	212	5,418.50	120,196	4.51%	153	5,505.37	72,142.4	7.63%
COYOTE_W_UNIT2	212	1,864.52	37,108	5.02%	153	1,007.04	24,745.9	4.07%
COYOTE_W_UNIT3	212	7,658.46	170,985	4.48%	153	6,073.46	100,475.5	6.04%
COTTON_PAP2	212	18,585.08	243,597	7.63%	153	10,658.81	147,893.6	7.21%
CRANELL_UNIT1	212	13,770.23	305,282	4.51%	153	9,062.45	160,101.9	5.66%
CSEC_CSECG1	212	10,491.34	122,885	8.54%	153	5,195.69	108,991.7	4.77%
CSEC_CSECG2	212	9,547.65	111,321	8.58%	153	4,889.91	104,774.3	4.67%
DERMOTT_UNIT1	212	10,415.79	225,767	4.61%	153	5,068.15	164,171.0	3.09%
DERMOTT_UNIT2	212	8,803.91	226,879	3.88%	153	5,159.02	169,002.9	3.05%
DEWOLF_UNIT1	212	12,111.06	351,453	3.45%	153	8,648.08	261,663.7	3.31%
DIGBY_UNIT1	212	10,093.19	196,024	5.15%	153	6,049.59	140,511.7	4.31%
DIGBY_UNIT2	212	13,325.50	245,755	5.42%	153	8,015.86	186,118.2	4.31%
DSKYWND1_UNIT_1A	212	7,285.60	76,931	9.47%	153	4,816.62	89,699.0	5.37%
DSKYWND1_UNIT_1B	212	2,610.51	23,672	11.03%	153	1,309.66	24,024.2	5.45%
DSKYWND2_UNIT_2A	212	7,688.21	67,471	11.39%	153	5,325.97	75,959.4	7.01%
DSKYWND2_UNIT_2B	212	1,545.64	13,568	11.39%	153	1,294.25	16,695.9	7.75%
EL_RAYO_UNIT1	212	8,206.42	163,248	5.03%	153	3,142.15	98,134.2	3.20%
EL_RAYO_UNIT2	212	8,269.19	160,754	5.14%	153	3,033.03	94,956.5	3.19%
ELB_ELBCREEK	212	7,939.98	204,877	3.88%	153	4,037.23	150,736.2	2.68%
EXGNSND_WIND_1	212	7,262.66	141,647	5.13%	153	4,182.49	135,077.0	3.10%
EXGNWTL_WIND_1	212	7,221.10	123,764	5.83%	153	3,470.02	114,261.7	3.04%
FERMI_WIND1	212	13,771.79	163,406	8.43%	153	7,193.03	152,125.4	4.73%
FERMI_WIND2	212	3,231.19	42,492	7.60%	153	1,825.65	38,166.7	4.78%
FLTCK_SSI	212	4,115.34	115,471	3.56%	153	2,414.62	85,571.8	2.82%
FLUVANNA_UNIT1	212	6,723.49	151,507	4.44%	153	3,588.99	104,628.9	3.43%
FLUVANNA_UNIT2	212	6,174.44	144,060	4.29%	153	3,098.94	100,987.1	3.07%
FOARDCTY_UNIT1	212	17,336.07	308,163	5.63%	153	9,298.02	206,413.2	4.50%
FOARDCTY_UNIT2	212	16,272.87	275,801	5.90%	153	7,512.12	149,358.9	5.03%
FOXTROT_UNIT1	212	18,814.15	179,326	10.49%	153	5,042.15	165,714.8	3.04%
FOXTROT_UNIT2	212	11,393.27	115,455	9.87%	153	3,507.81	97,180.1	3.61%
FOXTROT_UNIT3	212	5,557.59	61,456	9.04%	153	2,303.52	52,218.3	4.41%
FTWIND_UNIT_1	212	17,450.60	465,401	3.75%	153	8,633.23	381,015.7	2.27%
GOAT_GOATWIND	212	5,445.52	51,574	10.56%	153	3,641.78	53,541.3	6.80%
GOAT_GOATWIN2	212	4,881.57	48,152	10.14%	153	3,747.94	56,136.8	6.68%

Table 3-4: Uncertainty of the 2022 daily wind power prediction using linear models (2018 base year) (Continued)

Wind Farm	2018 Non Ozone Season Period				2018 Ozone Season Period (OSP)			
	Predicted days	Total Variance	Total Estimated	Relative Uncertainty	Predicted Days	Total Variance	Total Estimated	Relative uncertainty
GOPHER_UNIT1	212	5,991.72	147,911	4.05%	153	3,571.54	110,661.6	3.23%
GOPHER_UNIT2	212	5,823.69	144,557	4.03%	153	3,383.53	110,776.3	3.05%
GPASTURE_WIND_I	212	12,239.25	103,331	11.84%	153	5,701.80	70,070.4	8.14%
GRANDVW1_COLA	212	9,761.05	271,014	3.60%	153	6,163.70	193,504.9	3.19%
GRANDVW1_COLB	212	9,756.16	274,080	3.56%	153	6,687.66	191,751.2	3.49%
GRANDVW1_GV1A	212	10,926.29	294,112	3.72%	153	6,675.82	201,174.8	3.32%
GRANDVW1_GV1B	212	10,502.94	282,199	3.72%	153	6,481.95	192,041.6	3.38%
GRIF_TRL_UNIT1	212	7,386.07	180,539	4.09%	153	4,753.30	122,008.7	3.90%
GRIF_TRL_UNIT2	212	9,167.83	229,648	3.99%	153	6,220.08	171,835.7	3.62%
GUNMTN_G1	212	9,667.54	216,716	4.46%	153	5,564.55	149,150.6	3.73%
GWEC_GWEC_G1	212	13,075.34	303,934	4.30%	153	5,730.28	220,562.7	2.60%
HARALD_UNIT1	212	16,993.97	228,868	7.43%	153	8,796.23	181,406.8	4.85%
HHGT_HHOLLOW1	212	30,485.83	498,566	6.11%	153	15,978.91	268,829.1	5.94%
HHGT_HHOLLOW2	212	17,453.27	285,860	6.11%	153	6,458.60	189,953.5	3.40%
HHGT_HHOLLOW3	212	20,856.76	346,120	6.03%	153	6,932.28	217,212.2	3.19%
HHGT_HHOLLOW4	212	10,171.53	200,052	5.08%	153	4,508.16	133,228.5	3.38%
HI_LONE_WGR1A	212	4,798.42	76,322	6.29%	153	3,565.92	62,692.0	5.69%
HI_LONE_WGR1B	212	4,224.33	35,523	11.89%	153	2,714.90	27,184.4	9.99%
HI_LONE_WGR1C	212	2,660.98	46,373	5.74%	153	2,017.92	35,420.5	5.70%
HI_LONE_WGR3	212	9,365.28	140,981	6.64%	153	5,698.01	114,036.4	5.00%
HI_LONE_WGR4	212	7,707.94	118,801	6.49%	153	5,352.20	89,930.6	5.95%
HI_LONE_WGR2	212	10,546.30	139,811	7.54%	153	6,997.95	120,383.2	5.81%
HI_LONE_WGR2A	212	2,546.44	49,695	5.12%	153	1,802.89	40,499.3	4.45%
HICKMAN_G1_J01	212	6,460.20	155,103	4.17%	153	5,222.20	115,227.3	4.53%
HICKMAN_G1_J02	212	7,150.91	154,140	4.64%	153	5,186.12	114,202.8	4.54%
HICKMAN_G2_J01	212	6,343.09	147,407	4.30%	153	5,059.75	110,865.3	4.56%
HICKMAN_G2_J02	212	6,843.19	147,427	4.64%	153	5,040.43	110,966.8	4.54%
HORSECRK_UNIT1	212	9,809.17	234,719	4.18%	153	6,335.39	175,675.3	3.61%
HORSECRK_UNIT2	212	7,161.76	182,124	3.93%	153	5,080.68	138,026.4	3.68%
HRFDWIND_JRDWIND1	212	11,283.92	323,287	3.49%	153	6,025.16	210,553.0	2.86%
HRFDWIND_JRDWIND2	212	12,104.91	337,036	3.59%	153	6,396.44	214,651.1	2.98%
HRFDWIND_WIND_G	212	7,595.14	228,090	3.33%	153	4,448.96	143,292.4	3.10%
HRFDWIND_WIND_V	212	8,536.72	274,026	3.12%	153	5,947.29	184,410.1	3.23%
HWF_HWFG1	212	14,175.23	149,164	9.50%	153	6,706.92	150,167.9	4.47%
INDL_INADALE1	212	9,019.12	93,321	9.66%	153	3,590.72	84,151.3	4.27%
INDL_INADALE2	212	9,703.53	105,824	9.17%	153	3,923.56	85,051.6	4.61%
INDNNWP_INDNNWP2	212	8,195.10	89,903	9.12%	153	4,881.51	82,087.7	5.95%
KARAKAW1_UNIT1	212	6,878.97	141,477	4.86%	153	3,420.57	69,687.7	4.91%
KARAKAW1_UNIT2	212	6,988.08	145,704	4.80%	153	4,079.98	80,555.5	5.06%
KARAKAW2_UNIT3	212	8,221.76	148,717	5.53%	153	4,448.78	81,675.9	5.45%
KEECHI_U1	212	7,947.79	246,991	3.22%	153	4,070.59	204,602.7	1.99%
KEO_SHRBINO2	212	18,703.06	227,999	8.20%	153	14,920.22	236,368.9	6.31%
KING_NE_KINGNE	212	6,582.67	48,079	13.69%	153	4,484.33	42,060.6	10.66%
KING_NW_KINGNW	212	7,195.69	55,636	12.93%	153	5,324.66	54,310.0	9.80%
KING_SE_KINGSE	212	2,838.66	22,839	12.43%	153	1,991.99	19,165.5	10.39%
KING_SW_KINGSW	212	7,344.96	58,118	12.64%	153	5,209.03	52,990.8	9.83%
LGD_LANGFORD	212	13,743.38	278,119	4.94%	153	8,462.39	208,597.8	4.06%
LGW_UNIT1	212	9,193.97	196,848	4.67%	153	4,334.51	154,184.9	2.81%
LGW_UNIT2	212	8,576.81	183,635	4.67%	153	4,100.28	147,630.7	2.78%
LHORN_N_UNIT1	212	8,397.58	265,756	3.16%	153	6,668.99	167,299.9	3.99%
LHORN_N_UNIT2	212	8,189.32	270,435	3.03%	153	6,958.46	164,629.7	4.23%
LMAJADAS_UNIT1	212	11,398.62	179,501	6.35%	153	3,337.65	105,666.6	3.16%
LMAJADAS_UNIT2	212	2,349.97	37,731	6.23%	153	787.02	21,393.2	3.68%
LMAJADAS_UNIT3	212	14,206.01	223,949	6.34%	153	3,914.02	129,753.3	3.02%
LNCRK_G83	212	8,409.02	225,394	3.73%	153	5,620.83	147,885.2	3.80%
LOCKETT_UNIT1	212	19,077.30	367,583	5.19%	153	11,106.75	284,920.6	3.90%
LNCRK2_G871	212	6,467.96	100,249	6.45%	153	3,135.99	79,488.9	3.95%
LNCRK2_G872	212	6,777.52	105,545	6.42%	153	2,868.40	76,554.4	3.75%
LONEWOLF_G1	212	3,896.82	53,498	7.28%	153	1,349.17	45,308.9	2.98%

Table 3-4: Uncertainty of the 2022 daily wind power prediction using linear models (2018 base year) (Continued)

Wind Farm	2018 Non Ozone Season Period				2018 Ozone Season Period (OSP)			
	Predicted days	Total Variance	Total Estimated	Relative Uncertainty	Predicted Days	Total Variance	Total Estimated	Relative uncertainty
LONEWOLF_G2	212	3,875.53	52,761	7.35%	153	1,489.14	46,660.9	3.19%
LONEWOLF_G3	212	2,235.99	30,352	7.37%	153	811.01	26,530.8	3.06%
LONEWOLF_G4	212	2,025.91	27,274	7.43%	153	750.71	23,613.9	3.18%
LV1_LV1A	212	17,827.12	190,122	9.38%	153	7,201.37	122,006.0	5.90%
LV2_LV2	212	18,789.76	207,325	9.06%	153	6,791.13	121,967.6	5.57%
LV3_UNIT_1	212	13,098.07	409,674	3.20%	153	7,229.32	317,881.3	2.27%
LV4_UNIT_1	212	12,829.71	397,118	3.23%	153	6,855.06	330,432.6	2.07%
LV5_UNIT_1	212	7,277.95	196,131	3.71%	153	3,808.08	168,986.0	2.25%
MARIAH_NORTE1	212	10,646.37	307,420	3.46%	153	6,141.36	191,404.9	3.21%
MARIAH_NORTE2	212	9,835.16	300,516	3.27%	153	5,710.06	190,413.6	3.00%
MAVCRK_E_UNIT5	212	5,557.26	111,474	4.99%	153	3,271.39	83,708.7	3.91%
MAVCRK_E_UNIT6	212	2,784.90	54,671	5.09%	153	1,537.44	43,039.3	3.57%
MAVCRK_E_UNIT7	212	1,815.54	33,750	5.38%	153	1,205.76	23,561.1	5.12%
MAVCRK_E_UNIT8	212	1,580.49	30,030	5.26%	153	830.56	21,919.7	3.79%
MAVCRK_E_UNIT9	212	5,806.99	107,254	5.41%	153	2,975.55	80,583.0	3.69%
MAVCRK_W_UNIT1	212	15,237.17	331,654	4.59%	153	7,979.99	243,525.3	3.28%
MAVCRK_W_UNIT2	212	1,016.05	14,604	6.96%	153	488.60	11,887.0	4.11%
MAVCRK_W_UNIT3	212	2,593.41	52,114	4.98%	153	1,391.13	35,267.4	3.94%
MAVCRK_W_UNIT4	212	1,683.94	33,500	5.03%	153	863.42	24,770.1	3.49%
MARYNEAL_UNIT1	212	11,404.53	292,610	3.90%	153	7,421.27	183,024.9	4.05%
MCDLD_FCW1	212	10,410.02	117,397	8.87%	153	5,703.82	90,998.5	6.27%
MESQCRK_WND1	212	8,223.48	151,161	5.44%	153	4,450.92	99,201.4	4.49%
MESQCRK_WND2	212	8,464.67	153,193	5.53%	153	4,598.05	101,575.8	4.53%
MESTENO_UNIT_1	212	15,266.52	206,827	7.38%	153	11,601.21	236,580.8	4.90%
MIAM1_G1	212	13,056.59	343,888	3.80%	153	8,048.61	230,052.3	3.50%
MIAM1_G2	212	13,731.48	335,009	4.10%	153	9,614.67	240,386.8	4.00%
MIDWIND_UNIT1	212	16,830.51	175,888	9.57%	153	8,667.42	131,741.0	6.58%
MIRASOLE_MIR11	212	5,617.61	81,311	6.91%	153	3,407.96	73,491.0	4.64%
MIRASOLE_MIR12	212	10,959.25	161,485	6.79%	153	6,312.27	137,192.4	4.60%
MIRASOLE_MIR13	212	5,303.03	77,906	6.81%	153	3,114.64	65,311.7	4.77%
MIRASOLE_MIR21	212	11,163.46	157,512	7.09%	153	6,861.46	138,054.8	4.97%
MOZART_WIND_1	212	2,263.75	32,370	6.99%	153	984.76	21,846.8	4.51%
MWEC_G1	212	17,003.57	250,344	6.79%	153	8,612.59	224,385.5	3.84%
NBOHR_UNIT1	212	14,002.62	284,291	4.93%	153	9,220.15	234,241.8	3.94%
NWF_NWF1	212	8,203.12	76,705	10.69%	153	5,895.26	79,666.7	7.40%
NWF_NWF2	212	5,156.99	45,533	11.33%	153	3,576.36	49,244.5	7.26%
OVEJA_G1	212	10,970.44	279,861	3.92%	153	7,943.50	223,476.2	3.55%
OVEJA_G2	212	12,519.82	266,189	4.70%	153	7,178.48	197,730.0	3.63%
PALMWIND_UNIT1	212	11,510.55	160,073	7.19%	153	5,639.16	99,046.6	5.69%
PAP1_PAP1_J01	212	4,304.99	54,237	7.94%	153	2,018.32	36,045.5	5.60%
PAP1_PAP1_J02	212	7,911.69	158,900	4.98%	153	4,876.84	105,034.5	4.64%
PC_NORTH_PANTHER1	212	9,490.36	251,658	3.77%	153	5,469.82	186,582.5	2.93%
PC_SOUTH_PANTHER2	212	6,734.60	195,942	3.44%	153	4,119.40	147,382.4	2.80%
PC_SOUTH_PANTH31	212	7,010.79	169,388	4.14%	153	3,763.35	121,612.4	3.09%
PC_SOUTH_PANTH32	212	7,270.75	174,135	4.18%	153	3,548.59	130,134.3	2.73%
PENA_UNIT1	212	10,368.76	83,118	12.47%	153	9,315.97	89,256.5	10.44%
PENA_UNIT2_J01	212	4,147.29	54,237	7.65%	153	2,411.40	46,027.1	5.24%
PENA_UNIT2_J02	212	4,687.25	59,346	7.90%	153	2,711.02	47,797.8	5.67%
PENA3_UNIT3	212	6,654.14	72,675	9.16%	153	3,939.33	58,659.7	6.72%
PEY_UNIT1	212	15,743.78	223,251	7.05%	153	7,981.98	84,562.9	9.44%
PH1_UNIT1	212	11,654.90	229,486	5.08%	153	5,636.48	164,636.8	3.42%
PH1_UNIT2	212	11,240.12	221,385	5.08%	153	5,161.01	146,032.5	3.53%
PH2_UNIT1	212	10,660.12	221,375	4.82%	153	6,563.24	170,068.3	3.86%
PH2_UNIT2	212	11,418.08	227,554	5.02%	153	7,443.88	181,715.5	4.10%
PHILLWND_UNIT1	212	12,536.52	199,386	6.29%	153	5,516.11	145,877.7	3.78%
PHILLWND_UNIT2	212	12,635.72	224,493	5.63%	153	6,205.42	182,019.7	3.41%
PRIDDY_UNIT1	212	16,222.94	307,884	5.27%	153	6,768.29	241,636.3	2.80%
PRIDDY_UNIT2	212	11,135.79	197,960	5.63%	153	4,117.77	145,843.4	2.82%
PYR_PYRON1	212	11,789.67	145,547	8.10%	153	4,916.42	114,972.2	4.28%

Table 3-4: Uncertainty of the 2022 daily wind power prediction using linear models (2018 base year) (Continued)

Wind Farm	2018 Non Ozone Season Period				2018 Ozone Season Period (OSP)			
	Predicted days	Total Variance	Total Estimated	Relative Uncertainty	Predicted Days	Total Variance	Total Estimated	Relative uncertainty
PYR_PYRON2	212	12,735.18	157,656	8.08%	153	5,027.54	122,121.1	4.12%
RANCHERO_UNIT1	212	14,641.37	272,114	5.38%	153	11,916.77	240,799.5	4.95%
RANCHERO_UNIT2	212	14,181.85	263,357	5.39%	153	10,233.82	226,821.8	4.51%
RDCANYON_RDCNY1	212	5,636.28	159,678	3.53%	153	3,668.31	116,566.0	3.15%
REDFISH_MV1A	212	8,248.08	117,711	7.01%	153	2,923.69	81,149.4	3.60%
REDFISH_MV1B	212	9,075.62	120,758	7.52%	153	2,997.49	80,365.5	3.73%
RELOJ_UNIT1	212	3,458.68	44,997	7.69%	153	1,395.35	29,018.2	4.81%
RELOJ_UNIT2	212	4,185.30	72,196	5.80%	153	2,877.43	58,553.3	4.91%
RELOJ_UNIT3	212	6,654.38	70,395	9.45%	153	2,421.72	40,992.2	5.91%
RELOJ_UNIT4	212	2,017.91	15,656	12.89%	153	609.92	9,825.8	6.21%
ROUTE_66_WIND1	212	18,444.55	307,021	6.01%	153	12,801.84	287,103.7	4.46%
RSNAKE_G1	212	11,975.13	153,677	7.79%	153	6,897.80	127,205.1	5.42%
RSNAKE_G2	212	12,298.53	161,273	7.63%	153	7,101.09	122,755.9	5.78%
RTS_U1	212	21,556.10	374,694	5.75%	153	12,019.84	233,230.5	5.15%
RTS2_U1	212	10,866.36	199,371	5.45%	153	6,854.40	126,537.4	5.42%
RTS2_U2	212	11,952.22	214,046	5.58%	153	7,132.25	136,966.2	5.21%
SAGEDRAW_UNIT1	212	13,458.98	319,067	4.22%	153	8,945.81	212,265.9	4.21%
SAGEDRAW_UNIT2	212	14,181.93	313,186	4.53%	153	9,097.97	208,485.1	4.36%
SALTFORK_UNIT1	212	6,006.75	175,493	3.42%	153	3,930.93	110,178.4	3.57%
SALTFORK_UNIT2	212	9,798.74	305,406	3.21%	153	6,995.82	192,203.0	3.64%
SALVTION_UNIT1	212	10,220.89	245,892	4.16%	153	10,287.10	170,158.3	6.05%
SALVTION_UNIT2	212	10,052.68	224,232	4.48%	153	9,743.13	109,382.3	8.91%
SANROMAN_WIND_1	212	6,216.45	82,662	7.52%	153	2,387.36	39,794.0	6.00%
SANTACRU_UNIT1	212	9,710.32	179,134	5.42%	153	4,566.29	96,203.6	4.75%
SANTACRU_UNIT2	212	6,856.91	130,853	5.24%	153	3,330.97	69,098.8	4.82%
SENATEWD_UNIT1	212	10,726.91	298,407	3.59%	153	4,689.28	222,735.8	2.11%
SGMTN_SIGNALM2	212	350.37	5,902	5.94%	153	156.35	4,031.7	3.88%
SGMTN_SIGNALMT	212	1,469.72	24,788	5.93%	153	654.19	16,955.5	3.86%
SHAFFER_UNIT1	212	15,775.48	321,621	4.90%	153	7,833.47	174,324.4	4.49%
SHANNONW_UNIT_1	212	23,095.55	268,358	8.61%	153	11,723.35	215,139.6	5.45%
SPLAIN1_WIND1	212	11,904.21	219,339	5.43%	153	6,372.28	158,239.5	4.03%
SPLAIN1_WIND2	212	12,027.65	222,761	5.40%	153	6,120.16	168,557.4	3.63%
SPLAIN2_WIND21	212	12,516.79	347,624	3.60%	153	6,719.94	220,634.3	3.05%
SPLAIN2_WIND22	212	12,818.00	365,487	3.51%	153	7,781.86	235,844.5	3.30%
SRWE1_SRWE2	212	15,186.84	281,635	5.39%	153	8,220.46	193,489.9	4.25%
SRWE1_UNIT1	212	18,825.65	364,350	5.17%	153	9,728.22	254,700.4	3.82%
SSPURTWO_SS3WIND1	212	9,260.88	240,630	3.85%	153	7,724.08	166,311.5	4.64%
SSPURTWO_SS3WIND2	212	9,979.92	257,165	3.88%	153	8,678.77	182,531.1	4.75%
SSPURTWO_WIND_1	212	16,303.87	375,596	4.34%	153	12,216.65	259,911.8	4.70%
STELLA_UNIT1	212	12,894.62	281,737	4.58%	153	6,465.73	188,833.2	3.42%
STWF_T1	212	8,733.67	117,356	7.44%	153	3,276.89	100,135.5	3.27%
S_HILLS_UNIT1	212	2,525.95	68,208	3.70%	153	1,678.95	49,538.9	3.39%
SWEC_G1	212	10,590.73	123,527	8.57%	153	6,341.61	108,023.2	5.87%
SWEETWN2_WND2	212	6,204.88	184,643	3.36%	153	3,760.21	133,275.8	2.82%
SWEETWN2_WND24	212	1,029.51	19,694	5.23%	153	502.95	14,300.1	3.52%
SWEETWN3_WND3A	212	1,654.75	55,563	2.98%	153	1,082.92	38,314.3	2.83%
SWEETWN3_WND3B	212	6,078.38	182,441	3.33%	153	3,633.93	127,811.3	2.84%
SWEETWN4_WND4A	212	7,616.43	135,981	5.60%	153	4,100.96	92,839.9	4.42%
SWEETWN4_WND4B	212	5,920.91	138,140	4.29%	153	3,918.07	88,600.9	4.42%
SWEETWN5_WND5	212	6,947.80	81,210	8.56%	153	2,964.81	63,576.2	4.66%
SWEETWND_WND1	212	2,095.73	65,936	3.18%	153	1,422.41	48,678.2	2.92%
TAHOKA_UNIT_1	212	11,678.58	295,529	3.95%	153	8,350.39	206,223.3	4.05%
TAHOKA_UNIT_2	212	12,671.10	302,102	4.19%	153	8,241.10	200,342.6	4.11%
TGW_T1	212	11,324.05	147,575	7.67%	153	5,735.26	121,622.0	4.72%
TGW_T2	212	13,110.84	171,438	7.65%	153	6,682.15	140,126.1	4.77%
TKWSW1_ROSCOE	212	10,893.44	98,625	11.05%	153	4,522.33	96,634.0	4.68%
TKWSW1_ROSCOE2A	212	9,278.23	87,970	10.55%	153	3,846.77	76,635.0	5.02%
TORR_UNIT1_25	212	9,833.15	306,447	3.21%	153	6,244.86	254,814.8	2.45%
TORR_UNIT2_23	212	1,585.81	42,797	3.71%	153	1,095.68	39,005.0	2.81%

Table 3-4: Uncertainty of the 2022 daily wind power prediction using linear models (2018 base year) (Continued)

Wind Farm	2018 Non Ozone Season Period				2018 Ozone Season Period (OSP)			
	Predicted days	Total Variance	Total Estimated	Relative Uncertainty	Predicted Days	Total Variance	Total Estimated	Relative uncertainty
TORR_UNIT2_25	212	8,515.29	264,686	3.22%	153	5,300.95	220,841.8	2.40%
TRENT_TRENT	212	2,196.95	64,719	3.39%	153	1,964.61	45,837.4	4.29%
TRENT_UNIT_1B	212	1,211.11	31,457	3.85%	153	927.19	24,474.2	3.79%
TRENT_UNIT_2	212	2,866.27	80,970	3.54%	153	1,960.74	57,667.2	3.40%
TRENT_UNIT_3A	212	2,355.24	60,689	3.88%	153	1,389.89	45,353.1	3.06%
TRENT_UNIT_3B	212	1,327.98	24,495	5.42%	153	796.83	18,436.9	4.32%
TRINITY_TH1_BUS1	212	8,398.38	207,343	4.05%	153	6,204.47	154,568.3	4.01%
TRINITY_TH1_BUS2	212	7,805.36	190,924	4.09%	153	5,823.56	142,311.0	4.09%
TRUENO_UNIT1	212	11,502.84	181,973	6.32%	153	3,937.32	105,310.0	3.74%
TRUENO_UNIT2	212	12,484.44	193,587	6.45%	153	3,909.93	115,564.9	3.38%
TRUSGILL_UNIT1	212	3,911.52	71,740	5.45%	153	2,446.37	50,322.2	4.86%
TRUSGILL_UNIT2	212	4,487.83	58,784	7.63%	153	2,491.33	45,726.9	5.45%
TRUSGILL_UNIT3	212	3,566.31	61,358	5.81%	153	3,087.21	43,800.6	7.05%
TRUSGILL_UNIT4	212	23,091.92	230,092	10.04%	153	10,710.08	214,218.9	5.00%
TTWEC_G1	212	13,934.15	160,857	8.66%	153	6,814.23	135,296.1	5.04%
TYLRWIND_UNIT1	212	11,141.97	237,230	4.70%	153	4,993.32	184,410.5	2.71%
VENADO_UNIT1	212	5,830.71	177,299	3.29%	153	2,962.75	163,565.1	1.81%
VENADO_UNIT2	212	5,279.16	168,742	3.13%	153	2,591.70	156,799.3	1.65%
VERAWIND_UNIT1	212	1,056.25	20,453	5.16%	153	866.51	15,060.5	5.75%
VERAWIND_UNIT2	212	786.97	11,026	7.14%	153	555.14	9,048.0	6.14%
VERAWIND_UNIT3	212	8,193.24	185,555	4.42%	153	5,833.01	127,716.0	4.57%
VERAWIND_UNIT4	212	2,063.19	40,494	5.10%	153	1,444.03	25,901.5	5.58%
VERAWIND_UNIT5	212	7,967.15	173,803	4.58%	153	6,101.63	117,059.1	5.21%
VERTIGO_WIND_I	212	15,244.85	112,966	13.50%	153	7,623.16	85,637.3	8.90%
VORTEX_WIND1	212	25,009.97	212,253	11.78%	153	9,892.74	145,238.7	6.81%
VORTEX_WIND2	212	4,529.02	42,969	10.54%	153	2,109.38	33,772.6	6.25%
VORTEX_WIND3	212	27,256.82	221,717	12.29%	153	12,140.25	147,149.5	8.25%
VORTEX_WIND4	212	2,450.93	25,785	9.51%	153	1,302.91	19,926.4	6.54%
WAKEWE_G1_J01	212	6,866.22	151,726	4.53%	153	3,204.33	104,163.0	3.08%
WAKEWE_G1_J02	212	6,492.09	143,461	4.53%	153	3,029.77	98,488.9	3.08%
WAKEWE_G2_J01	212	8,178.36	181,327	4.51%	153	3,978.45	123,784.8	3.21%
WAKEWE_G2_J02	212	7,732.82	171,450	4.51%	153	3,761.69	117,042.1	3.21%
WEC_WECG1	212	7,074.16	110,283	6.41%	153	4,177.98	88,793.9	4.71%
WHMESA_UNIT1	212	12,348.00	261,620	4.72%	153	7,389.78	208,824.0	3.54%
WHMESA_UNIT2_23	212	1,303.40	24,081	5.41%	153	641.02	16,003.4	4.01%
WHMESA_UNIT2_28	212	15,427.81	326,144	4.73%	153	8,363.27	242,566.8	3.45%
WHMESA_UNIT3_23	212	1,724.64	32,764	5.26%	153	916.68	23,146.0	3.96%
WHMESA_UNIT3_28	212	11,290.54	231,800	4.87%	153	6,501.72	175,749.2	3.70%
WH_WIND_UNIT1	212	12,303.23	297,862	4.13%	153	6,508.57	210,356.3	3.09%
WH_WIND_UNIT2	212	11,026.68	318,886	3.46%	153	6,204.34	222,877.9	2.78%
WHTTAIL_WR1	212	9,818.22	242,483	4.05%	153	5,082.72	199,652.5	2.55%
WILDWIND_UNIT1	212	1,543.27	42,395	3.64%	153	832.56	33,908.2	2.46%
WILDWIND_UNIT2	212	3,192.37	87,183	3.66%	153	1,909.67	62,584.6	3.05%
WILDWIND_UNIT3	212	566.53	12,965	4.37%	153	306.39	11,448.6	2.68%
WILDWIND_UNIT4	212	4,405.02	127,747	3.45%	153	2,543.69	100,396.5	2.53%
WILDWIND_UNIT5	212	4,193.34	92,628	4.53%	153	2,945.84	50,961.5	5.78%
WL_RANCH_UNIT1	212	18,115.68	375,017	4.83%	153	8,843.92	275,767.8	3.21%
WNDTHST2_UNIT1	212	5,137.44	111,798	4.60%	153	3,416.11	79,791.8	4.28%
WOODWRD1_WOODWRD1	212	7,726.48	83,832	9.22%	153	5,301.97	75,476.1	7.02%
WOODWRD2_WOODWRD2	212	6,142.19	70,244	8.74%	153	4,584.84	63,070.4	7.27%

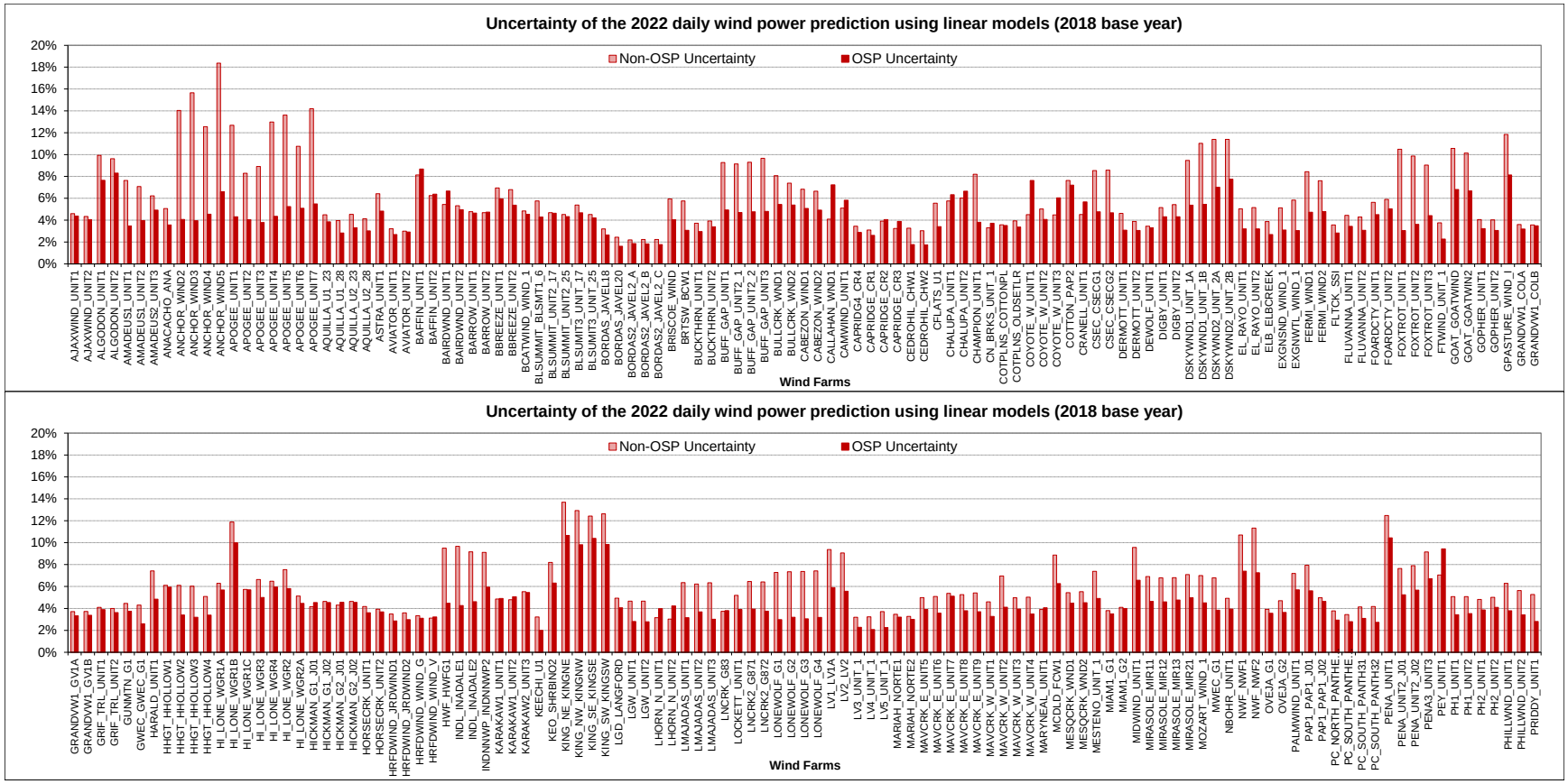


Figure 3-15: Uncertainty of the 2022 daily wind power prediction using linear models (2018 base year)

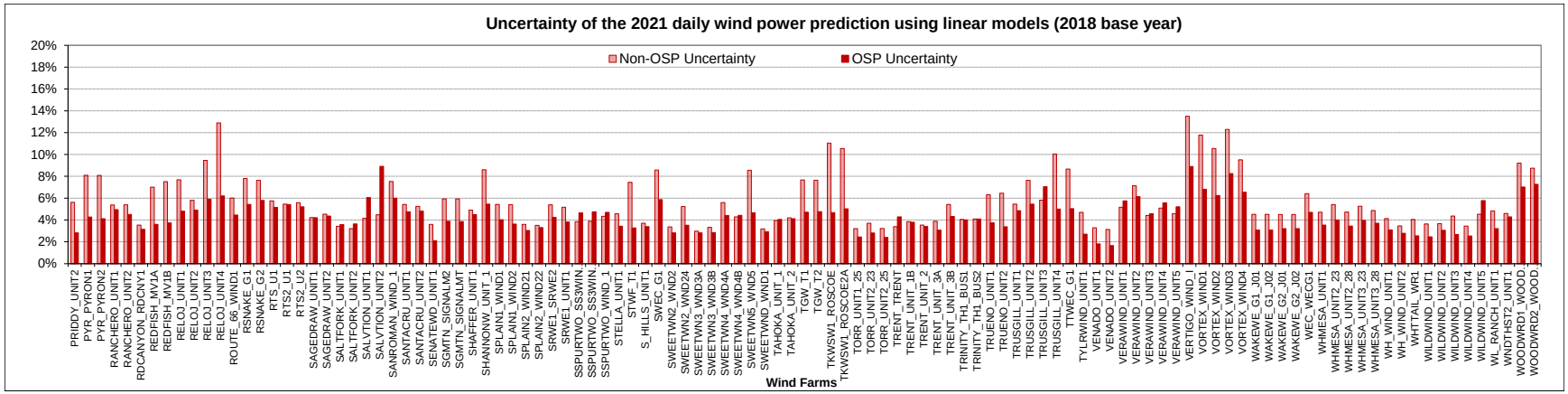


Figure 3-15: Uncertainty of the 2022 daily wind power prediction using linear models (2018 base year) (Continued)

4 DEGRADATION ANALYSIS FOR WIND FARMS

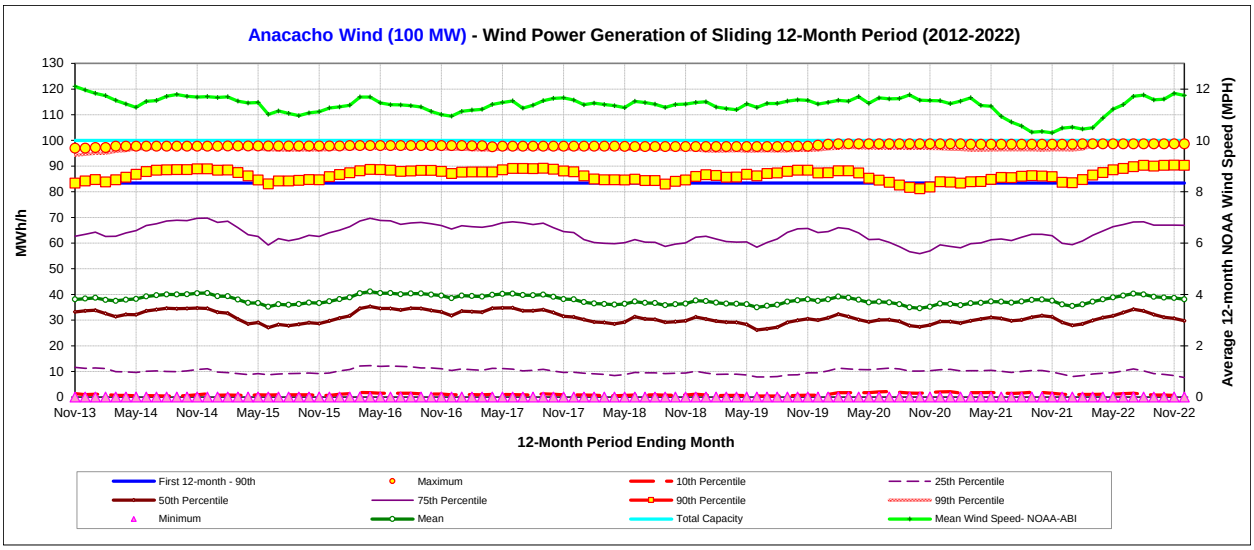
This report contains an updated analysis to determine any degradation that could be observed in the measured power generation from Texas wind farms. By request of the TCEQ, the ESL has been evaluating any observed degradation from the measured data for Texas wind farms. To accomplish this, in this report one hundred and sixty-four sites[15] built from 2002 to 2019, which have been in operation for more than three years, were evaluated with a total capacity of 20,857.7 MW (see Table 4-1).

In this analysis, a sliding statistical index was established for each site that used the 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 were 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.

Table 4-1 presents a summary of the degradation analysis for the one hundred and sixty-four sites. For each of the wind farms that are included in the degradation analysis, Table 4-1 includes the first year, average, maximum, and minimum 12-month sliding 90th percentile as well as the number of months of data and the capacity. The first year 12-month sliding 90th percentile reports the 90th percentile for the generation in MW for the first 12-months that the wind farm has been in operation. Similarly, the 90th percentile for the generation in each 12-month is calculated by sliding one month at-a-time toward the current date. Then the maximum and minimum of the calculated 12-month 90th percentiles are reported for each wind farm. Furthermore, the difference between the first 12-month 90th percentile and each of the average, maximum, and minimum 12-month 90th percentiles are reported.
Of the one hundred and sixty-four sites analyzed, eighty-six sites showed an increase when one compares the 90th percentile of the whole period to the 90th percentile of the first 12-month period, ranging from 0.1% to 55.1%, the remaining seventy-eight sites showed a decrease from -0.1% to -45.2%. The weighted average of this increase across all wind farms studied is 2.5% (positive), which indicates that no degradation was observed from the aggregated energy production from these wind farms over the studied operation period. Based on the observations, special attention needs to be paid to sites Big Spring Wind Farm (-22.0%), Briscoe Wind 19 (-11.0%), Cedro Hill Wind (-10%), Gulf Wind 1 (-12.7%), Harbor Wind (-45.2%), Magic Valley Wind (Redfish) 1B (-10.1%), Ocotillo Windpower (-13.1%), Papalote Creek Wind Farm (-11.4%), Penascal Wind 1 (-15.5%), Penascal Wind 3 (-21.1%), Roscoe Wind Farm(-11%), San Roman Wind(-14.0%), Sand Bluff Wind (-18.4%), Sherbino 2 Wind(-29.3%) and Sweetwater Wind 5(-10.1%). Those wind farms have comparison percentages larger than 10%, which may be caused by wind farm operation issues, meter problems or other similar issues.

Table 4-2 and Figure 4-2 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 in most cases the observed maximum hourly wind power generation is equal to, or slightly lower than the design/announced capacity for all the sites. Figure B-1 to Figure B-164 (in Volume II, Appendix B) also present sliding 12-months wind power generations for degradation analysis. An example of the degradation analysis figures shown in Appendix B is illustrated in Figure 4-1.

[15] The one hundred and sixty-four wind farm sites presented in the degradation analysis section include one hundred and eighty-two individual wind farm units.



Note: The wind speed dropping from approximate 11.5 MPH to 10.5 MPH from June through December is unusual for 2021 since the wind power production remained relatively constant during these months. It is possible that the NOAA wind speed sensor is out of calibration.

Figure 4-1: Example Sliding 12-month Hourly Wind Power Generation for Anacacho Wind Farm for 2022

Table 4-1: Summary of 90th Percentile Hourly Wind Power Degradation Analysis for 164 Wind Farms in Texas

Wind Farm	12-Month Sliding 90th Percentile Hourly Wind Report								No. of Months of Data	Capacity (MW)
	First Year		Average		Minimum		Maximum			
	First 12-mo Ending Mo.	MW	MW	% Diff. vs. First 12-mo	MW	% Diff. vs. First 12-mo	MW	% Diff. vs. First 12-mo		
Anacacho Wind	Nov-13	83.4	86.5	*3.7%*	81.2	-2.7%	90.4	8.4%	110	100
Baffin Wind 1	Dec-16	80.5	77.8	*-3.4%*	61.2	-24.0%	86.3	7.2%	73	100
Baffin Wind 2	Dec-16	73.3	75.8	*3.3%*	62.4	-14.9%	83.3	13.6%	73	102
Barton Chapel Wind 1	Dec-09	74.9	73.4	*-2.0%*	61.2	-18.2%	89.1	19.0%	157	120
Big Spring Wind Farm	Dec-02	27.2	21.2	*-22.0%*	11.1	-59.2%	27.2	0.0%	241	41
Blue Summit Wind	Oct-13	121.9	116.7	*-4.3%*	102.4	-16.0%	128.5	5.4%	111	135
Bobcat Bluff Wind	Nov-13	115.0	114.3	*-0.6%*	92.8	-19.4%	131.7	14.5%	110	150
Brazos Wind Ranch	Dec-04	127.5	116.1	*-9.0%*	6.8	-94.7%	139.4	9.3%	217	160
Briscoe Wind_19	Jun-16	123.4	109.8	*-11.0%*	79.1	-35.9%	128.3	4.0%	79	149.8
Buckthorn Wind 1 A	May-18	36.9	39.3	*6.3%*	36.9	0.0%	41.1	11.2%	56	44.9
Buckthorn Wind 1 B	May-18	47.7	50.0	*4.9%*	47.6	-0.1%	52.5	10.1%	56	55.7
Buffalo Gap 1	Nov-06	100.9	94.9	*-6.0%*	62.2	-38.3%	105.7	4.8%	194	120
Buffalo Gap 2	Apr-08	183.4	172.7	*-5.8%*	104.9	-42.8%	207.6	13.2%	177	233
Buffalo Gap 3	Apr-10	122.4	131.7	*7.6%*	84.3	-31.1%	152.1	24.2%	153	170
Bull Creek Wind Plant	Dec-09	93.9	92.5	*-1.4%*	41.5	-55.8%	130.4	38.9%	157	180
Cabezon Wind 1 A	Dec-19	79.2	81.0	*2.3%*	68.6	-13.4%	88.2	11.4%	37	115.2
Cabezon Wind 1 B	Dec-19	81.0	88.8	*9.6%*	79.6	-1.8%	96.2	18.7%	37	122.4
Callahan Divide Wind	Feb-06	93.3	95.0	*1.9%*	83.9	-10.0%	101.5	8.8%	203	114
Cameron County Wind (Camwind_Unit1)	Dec-16	128.0	126.0	*-1.5%*	103.7	-19.0%	142.5	11.4%	73	165
Camp Springs Wind 2	Jan-09	94.0	91.9	*-2.2%*	59.9	-36.2%	107.9	14.8%	168	120
Camp Springs Wind Energy Center	Apr-08	111.3	101.2	*-9.1%*	68.2	-38.8%	120.9	8.6%	177	130
Capricorn Ridge Wind 1&2	Aug-08	258.0	266.1	*3.1%*	174.5	-32.4%	309.3	19.9%	173	364
Capricorn Ridge Wind 4	May-09	83.5	88.8	*6.4%*	67.6	-19.0%	100.2	20.0%	164	112.5
Cedro Hill Wind	Dec-11	136.3	122.7	*-10.0%*	101.9	-25.2%	136.9	0.4%	133	150
Champion Wind Farm	Jan-09	89.4	99.6	*11.4%*	82.3	-8.0%	113.2	26.6%	168	126.5
Chapman Ranch Wind IA (Santa Cruz)	Mar-18	104.4	96.8	*-7.3%*	54.6	-47.7%	122.0	16.8%	58	150.6
Chapman Ranch Wind IB (Santa Cruz)	Mar-18	71.1	66.3	*-6.7%*	41.5	-41.7%	78.9	11.0%	58	98.4
Desert Sky Wind Farm	Dec-02	89.0	114.2	*28.3%*	11.5	-87.1%	134.4	50.9%	241	160.5
Doug Colbeck's Corner (Conway) B	Jan-17	90.1	92.7	*3.0%*	85.7	-4.8%	94.7	5.2%	72	100.2
Doug Colbeck's Corner (Conway) A	Jan-17	92.6	92.9	*0.3%*	91.2	-1.5%	95.2	2.8%	72	100.2
Elbow Creek Wind	Dec-09	94.5	95.9	*1.5%*	70.2	-25.7%	109.6	16.0%	157	121.9
Falvez Astra Wind	Jan-18	149.3	135.8	*-9.0%*	112.8	-24.5%	155.6	4.2%	60	163.2
Foard City Wind 1 A	Dec-19	108.6	165.9	*52.8%*	108.6	0.0%	173.9	60.2%	37	186.48
Foard City Wind 1 B	Dec-19	97.5	144.9	*48.7%*	97.5	0.0%	152.2	56.1%	37	163.8
Forest Creek Wind	Dec-07	105.2	99.8	*-5.2%*	69.3	-34.1%	111.2	5.7%	181	124.2
Goat Wind	Apr-09	67.0	100.5	*50.1%*	61.8	-7.8%	122.6	83.0%	165	150
Goldthwaite Wind 1	Dec-14	122.8	125.8	*2.4%*	115.8	-5.7%	134.4	9.4%	97	149
Grandview Wind 1 (Conway) GV1A	Nov-15	99.3	97.8	*-1.5%*	91.0	-8.3%	101.4	2.2%	86	107
Grandview Wind 1 (Conway) GV1B	Nov-15	94.0	93.4	*-0.7%*	89.5	-4.8%	98.0	4.2%	86	104
Green Mountain Wind 1 (Brazos)	Aug-18	92.7	92.4	*-0.3%*	82.7	-10.8%	103.3	11.4%	53	120
Green Mountain Wind 2 (Brazos)	Aug-18	82.8	82.7	*-0.1%*	75.3	-9.0%	90.0	8.8%	53	108
Green Pastures Wind I_19	Feb-16	125.2	124.6	*-0.5%*	66.9	-46.5%	139.2	11.2%	83	150
Gulf Wind 1	Jun-10	108.6	94.8	*-12.7%*	0.7	-99.4%	119.4	9.9%	151	141.6
Gulf Wind 2	Jun-10	116.5	105.0	*-9.9%*	3.1	-97.3%	126.3	8.4%	151	141.6
Gunsight Mountain Wind	Jan-17	109.5	111.5	*1.8%*	100.5	-8.2%	115.2	5.2%	72	119.9
Hackberry Wind	Dec-09	138.0	124.4	*-9.9%*	100.4	-27.2%	140.6	1.9%	157	165.5
Harbor Wind	Jan-13	6.1	3.3	*-45.2%*	0.0	-100.0%	7.1	15.9%	120	9
Hereford Wind G_19	Dec-15	80.9	82.7	*2.3%*	75.3	-6.9%	86.9	7.5%	85	99.9
Hereford Wind V_19	Dec-15	90.4	93.8	*3.8%*	90.4	0.0%	95.7	5.8%	85	100
Hidalgo & Starr Wind 11	Jul-17	45.1	43.2	*-4.0%*	37.1	-17.8%	47.3	5.1%	66	52
Hidalgo & Starr Wind 12	Jul-17	85.8	82.9	*-3.4%*	71.5	-16.7%	91.2	6.3%	66	98
Hidalgo & Starr Wind 21	Jul-17	85.0	81.6	*-4.0%*	68.1	-19.9%	89.2	4.9%	66	100
Horse Creek Wind 1	Dec-17	121.6	121.4	*-0.2%*	117.5	-3.3%	123.6	1.7%	61	131.1
Horse Creek Wind 2	Dec-17	92.3	92.2	*-0.1%*	90.5	-1.9%	93.8	1.6%	61	98.9
Horse Hollow Phase 1	Jun-06	157.0	169.0	*7.7%*	141.3	-10.0%	185.1	17.9%	199	213
Horse Hollow Phase 2	Aug-07	145.7	142.8	*-2.0%*	99.0	-32.1%	164.9	13.2%	185	184
Horse Hollow Phase 3	May-07	169.2	170.6	*0.8%*	123.9	-26.8%	187.7	11.0%	188	223.5
Horse Hollow Phase 4	Jun-07	88.6	91.5	*3.3%*	80.9	-8.7%	103.1	16.3%	187	115
Inadale Wind	Sep-10	117.9	139.6	*18.4%*	99.0	-16.0%	166.3	41.1%	148	197
Indian Mesa Wind Farm	Dec-02	48.0	55.5	*15.8%*	36.0	-24.9%	72.2	50.5%	241	82.5
Javelina II Wind 1	Dec-17	86.2	86.3	*0.0%*	83.2	-3.5%	89.1	3.3%	61	96

Table 4-1: Summary of 90th Percentile Hourly Wind Power Degradation Analysis for 164 Wind Farms in Texas (Continued)

Wind Farm	12-Month Sliding 90th Percentile Hourly Wind Report								No. of Months of Data	Capacity (MW)
	First Year		Average		Minimum		Maximum			
	First 12-mo Ending Mo.	MW	MW	% Diff. vs. First 12-mo	MW	% Diff. vs. First 12-mo	MW	% Diff. vs. First 12-mo		
Javelina II Wind 2	Dec-17	64.9	65.9	*1.6%*	63.4	-2.3%	68.0	4.7%	61	74
Javelina II Wind 3	Dec-17	27.5	27.5	*0.1%*	26.4	-3.9%	28.5	3.8%	61	30
Javelina Wind 18&20_19	Sep-16	211.0	218.8	*3.7%*	209.6	-0.7%	229.3	8.7%	76	249.7
Jumbo Road Wind 1_19	Mar-16	117.3	124.3	*6.0%*	117.3	0.0%	129.1	10.1%	82	146.2
Jumbo Road Wind 2_19	Mar-16	119.7	128.7	*7.5%*	119.7	0.0%	134.7	12.5%	82	153.6
Karankawa Wind 1a	Dec-19	4.9	82.2	*N/A*	4.9	0.0%	90.9	1741.9%	37	103.32
Karankawa Wind 1b	Dec-19	1.3	82.8	*N/A*	1.3	0.0%	90.2	6846.7%	37	103.32
Karankawa Wind 2	Dec-19	8.3	80.4	*N/A*	8.3	0.0%	86.6	938.5%	37	100.42
Keechi Wind 138 Kv Joplin_19	Dec-15	99.7	102.5	*2.9%*	99.5	-0.2%	104.0	4.3%	85	110
King Mountain-NE Wind Farm	Dec-02	41.8	43.2	*3.2%*	20.8	-50.3%	56.4	34.8%	241	79.3
King Mountain-NW Wind Farm	Dec-02	44.7	51.2	*14.5%*	27.7	-37.9%	65.3	46.1%	241	79.3
King Mountain-SE Wind Farm	Dec-02	21.6	21.5	*-0.4%*	11.8	-45.7%	28.1	29.8%	241	40.3
King Mountain-SW Wind Farm	Dec-02	41.6	44.4	*6.8%*	22.9	-44.9%	53.7	29.1%	241	79.3
Langford Wind	Dec-10	115.7	125.9	*8.8%*	107.8	-6.9%	141.3	22.1%	145	150
Lockett Wind Farm	Dec-19	153.8	175.6	*14.2%*	153.8	0.0%	180.1	17.1%	37	183.7
Logans Gap Wind I U1_19	Apr-16	88.5	86.5	*-2.3%*	80.6	-9.0%	90.6	2.3%	81	103.8
Logans Gap Wind I U2_19	Apr-16	83.8	83.1	*-0.8%*	77.5	-7.6%	86.6	3.3%	81	106.3
Lone Star-Mesquite Wind	Sep-08	140.4	143.8	*2.4%*	121.0	-13.9%	168.1	19.7%	172	200
Lone Star-Post Oak Wind	Mar-09	149.1	148.1	*-0.7%*	119.5	-19.8%	170.5	14.4%	166	200
Longhorn Wind North U1_19	Mar-16	91.0	92.6	*1.7%*	90.8	-0.3%	94.0	3.3%	82	100
Longhorn Wind North U2_19	Dec-15	88.9	93.2	*4.8%*	88.9	0.0%	95.0	6.9%	85	100
Loraine Windpark I	Dec-10	30.4	35.3	*16.1%*	25.9	-14.8%	42.3	39.2%	145	126
Loraine Windpark II	Dec-10	27.8	35.8	*28.7%*	25.7	-7.6%	43.3	55.7%	145	124.5
Loraine Windpark III	Jan-12	16.2	20.1	*23.9%*	16.2	0.0%	22.6	39.4%	132	26
Loraine Windpark IV	Dec-12	17.4	17.2	*-1.6%*	5.0	-71.5%	20.8	19.1%	121	24
Los Vientos I Wind	Oct-13	148.5	155.4	*4.6%*	94.5	-36.4%	175.1	17.9%	111	200.1
Los Vientos II Wind	Nov-13	153.3	145.0	*-5.4%*	121.1	-21.0%	164.3	7.2%	110	201.6
Los Vientos III Wind_19	Feb-16	154.0	167.6	*8.9%*	154.0	0.0%	175.9	14.3%	83	200
Los Vientos IV Wind	Apr-17	167.7	172.4	*2.8%*	160.1	-4.5%	180.0	7.3%	69	200
Los Vientos V Wind	Dec-16	92.1	90.7	*-1.5%*	80.7	-12.4%	96.9	5.2%	73	110
Magic Valley Wind (Redfish) 1A	Apr-13	88.6	81.0	*-8.5%*	61.9	-30.1%	90.7	2.4%	117	99.8
Magic Valley Wind (Redfish) 1B	Jul-13	94.2	84.7	*-10.1%*	64.7	-31.3%	94.6	0.4%	114	103.5
Mariah Del Norte 1	Dec-17	103.7	103.6	*-0.2%*	97.2	-6.3%	107.0	3.2%	61	115.2
Mariah Del Norte 2	Dec-17	105.6	103.7	*-1.8%*	95.5	-9.6%	107.9	2.2%	61	115.2
McAdoo Wind	Dec-09	111.7	133.0	*19.1%*	111.7	0.0%	143.6	28.5%	157	150
Mesquite Creek Wind 1_19	Dec-15	93.3	89.3	*-4.3%*	73.2	-21.5%	97.7	4.7%	85	105.6
Mesquite Creek Wind 2_19	Dec-15	90.5	88.7	*-2.0%*	77.3	-14.7%	96.2	6.2%	85	105.6
Miami Wind G1	Aug-15	125.8	127.7	*1.5%*	119.5	-5.0%	132.6	5.4%	89	144
Miami Wind G2	Aug-15	126.0	128.0	*1.6%*	120.9	-4.0%	133.4	5.9%	89	144
Midway Wind	Dec-19	122.8	128.1	*4.2%*	119.2	-3.0%	132.3	7.7%	37	162.8
Notrees Windpower	Feb-10	103.7	110.1	*6.3%*	90.6	-12.6%	122.9	18.6%	155	153
Ocotillo Windpower	Dec-09	39.1	34.0	*-13.1%*	2.6	-93.4%	47.2	20.7%	157	58.8
Panhandle Wind 1 U1	May-15	94.5	93.7	*-0.8%*	81.6	-13.6%	101.3	7.2%	92	109
Panhandle Wind 1 U2	May-15	90.6	89.5	*-1.2%*	76.6	-15.4%	98.0	8.2%	92	109
Panhandle Wind 2 U1	Oct-15	88.2	86.2	*-2.3%*	79.7	-9.6%	90.0	2.0%	87	94
Panhandle Wind 2 U2	Sep-15	90.2	89.0	*-1.3%*	83.2	-7.7%	93.4	3.6%	88	97
Panther Creek	Dec-09	114.4	123.5	*7.9%*	107.8	-5.8%	134.3	17.4%	157	142.5
Panther Creek 2	Dec-09	91.8	98.3	*7.1%*	83.5	-9.0%	108.4	18.1%	157	115.5
Panther Creek 3	Aug-10	128.5	140.8	*9.6%*	0.0	-100.0%	177.1	37.8%	149	199.5
Papalote Creek Phase II	Dec-11	174.2	159.9	*-8.2%*	120.7	-30.7%	176.3	1.2%	133	200.1
Papalote Creek Wind Farm	Dec-10	150.1	133.1	*-11.4%*	39.6	-73.6%	157.9	5.2%	145	180
Penascal Wind 1	Feb-11	133.2	112.5	*-15.5%*	55.8	-58.1%	141.5	6.2%	143	161
Penascal Wind 2	Dec-09	83.3	99.9	*19.9%*	57.7	-30.8%	125.4	50.5%	157	142
Penascal Wind 3	May-11	87.1	68.8	*-21.1%*	38.2	-56.2%	88.8	2.0%	140	101
Pyron	Dec-09	157.2	191.4	*21.8%*	151.4	-3.7%	220.1	40.0%	157	249
Rattlesnake Den Wind Phase 1 G1_19	Mar-16	97.0	88.2	*-9.1%*	70.3	-27.5%	99.7	2.8%	82	104.3
Rattlesnake Den Wind Phase 1 G2_19	Mar-16	93.5	87.1	*-6.9%*	76.2	-18.5%	97.3	4.0%	82	103
Red Canyon1	Aug-07	76.4	76.2	*-0.3%*	71.0	-7.0%	79.6	4.2%	185	84
Roscoe Wind Farm	Dec-08	169.4	150.7	*-11.0%*	108.1	-36.2%	179.8	6.2%	169	209
Route 66 Wind_19	Mar-16	139.0	135.8	*-2.3%*	120.7	-13.2%	142.6	2.5%	82	150

Table 4-1: Summary of 90th Percentile Hourly Wind Power Degradation Analysis for 164 Wind Farms in Texas (Continued)

Wind Farm	12-Month Sliding 90th Percentile Hourly Wind Report								No. of Months of Data	Capacity (MW)
	First Year		Average		Minimum		Maximum			
	First 12-mo Ending Mo.	MW	MW	% Diff. vs. First 12-mo	MW	% Diff. vs. First 12-mo	MW	% Diff. vs. First 12-mo		
Saltfork_Unit1	Aug-17	58.1	60.7	*4.5%*	58.1	0.0%	61.7	6.2%	65	64
Saltfork_Unit2	Aug-17	100.9	104.1	*3.1%*	100.9	0.0%	105.4	4.4%	65	110
San Roman Wind	Dec-17	82.1	70.6	*-14.0%*	46.3	-43.6%	82.9	1.0%	61	95.2
Sand Bluff Wind	Nov-08	69.4	56.6	*-18.4%*	1.4	-98.0%	75.4	8.6%	170	90
Senate Wind	Sep-13	127.1	125.7	*-1.1%*	119.0	-6.4%	132.2	4.0%	112	150
Sendero Wind Energy_19	Aug-16	67.2	69.7	*3.7%*	64.7	-3.7%	72.6	8.1%	77	76
Shannon Wind_19	Oct-16	175.3	172.9	*-1.3%*	148.4	-15.3%	183.9	4.9%	75	204.1
Sherbino 2 Wind	Dec-12	125.7	88.8	*-29.3%*	13.3	-89.5%	125.7	0.0%	121	150
Silver Star Wind	Apr-09	40.6	40.9	*0.8%*	6.1	-85.0%	50.5	24.4%	165	60
South Plains Wind 2_19	Jul-16	89.2	89.6	*0.5%*	86.0	-3.6%	92.5	3.7%	78	98
South Plains Wind I_19	Jul-16	94.8	92.4	*-2.6%*	86.3	-9.0%	95.5	0.8%	78	102
South Plains Wind II A	Dec-16	120.2	134.9	*12.3%*	120.2	0.0%	141.3	17.5%	73	148.5
South Plains Wind II B	Dec-16	128.1	139.1	*8.5%*	128.1	0.0%	145.1	13.2%	73	151.8
Spinning Spur 3 (Wind 1)_19	Apr-16	87.5	90.4	*3.3%*	87.5	0.0%	91.6	4.7%	81	96
Spinning Spur 3 (Wind 2)_19	Apr-16	88.4	92.3	*4.5%*	88.4	0.0%	93.9	6.2%	81	98
Spinning Spur Wind Two	May-15	140.9	144.7	*2.8%*	139.0	-1.3%	149.4	6.1%	92	161
Stephens Ranch Wind 2_19	Mar-16	144.3	148.1	*2.7%*	144.3	0.0%	151.9	5.3%	82	164.7
Stephens Ranch Wind Phase 1	Nov-15	182.9	189.0	*3.3%*	182.9	0.0%	193.1	5.6%	86	211
Sweetwater Wind 1	Dec-04	34.1	33.4	*-1.9%*	28.8	-15.4%	36.2	6.2%	217	37.5
Sweetwater Wind 2	Jan-06	71.4	83.2	*16.6%*	71.4	0.0%	89.6	25.6%	204	97.5
Sweetwater Wind 3	Dec-06	99.6	103.7	*4.1%*	67.1	-32.7%	125.9	26.3%	193	135
Sweetwater Wind 4	Mar-08	161.0	170.8	*6.0%*	153.2	-4.9%	182.2	13.2%	178	240.8
Sweetwater Wind 5	Dec-08	66.5	59.8	*-10.1%*	43.9	-33.9%	69.3	4.3%	169	80.5
Sweetwater Wind24	Mar-08	13.1	13.5	*3.4%*	11.9	-9.1%	14.8	13.3%	178	16
Tahoka Wind 1	Dec-19	139.2	140.2	*0.7%*	139.2	0.0%	141.2	1.5%	37	150
Tahoka Wind 2	Dec-19	138.8	140.2	*1.0%*	138.8	0.0%	141.3	1.8%	37	150
Torrecillas Wind_23+25	Dec-19	130.6	131.0	*0.3%*	129.6	-0.7%	133.4	2.2%	37	150.5
Trent Mesa Wind Farm	Dec-02	108.8	101.4	*-6.8%*	33.3	-69.4%	132.8	22.0%	241	150
Trinity Hills Wind Farm 1	Dec-12	78.8	76.1	*-3.4%*	12.5	-84.2%	99.0	25.6%	121	118
Trinity Hills Wind Farm 2	Dec-12	74.8	74.0	*-1.1%*	23.9	-68.0%	89.9	20.3%	121	108
Turkey Track Wind Energy Center	Dec-09	77.4	120.0	*55.1%*	76.5	-1.1%	143.1	85.0%	157	169.5
Tyler Bluff Wind	Aug-17	104.0	107.1	*3.0%*	102.6	-1.4%	110.7	6.5%	65	125.6
Vertigo Wind (Formerly Green Pastures Wind 2	Nov-16	123.5	123.1	*-0.3%*	84.0	-32.0%	133.4	8.0%	74	150
Wake Wind 1	Apr-17	109.3	107.1	*-2.0%*	98.9	-9.5%	110.2	0.8%	69	114.9
Wake Wind 2	Apr-17	136.0	131.7	*-3.2%*	118.9	-12.6%	137.0	0.7%	69	142.3
Whirlwind	Dec-08	54.0	52.2	*-3.4%*	39.8	-26.3%	56.9	5.4%	169	60
Whitetail Wind	Oct-13	72.9	66.6	*-8.6%*	60.2	-17.4%	73.1	0.3%	111	92
Willow Springs Wind A	Jul-18	118.1	118.7	*0.5%*	116.8	-1.2%	121.0	2.4%	54	125
Willow Springs Wind B	Jul-18	117.7	118.2	*0.5%*	116.0	-1.4%	119.3	1.4%	54	125
Windthorst 2	Oct-15	50.3	56.6	*12.4%*	50.3	0.0%	59.4	18.1%	87	68
WKN Mozart Wind	Oct-13	22.4	21.1	*-5.9%*	16.8	-24.9%	25.8	15.0%	111	30
Wolf Ridge Wind	Dec-09	105.9	100.0	*-5.6%*	81.2	-23.4%	108.8	2.7%	157	112.5
Woodward Wind Farm	Dec-02	85.3	93.9	*10.2%*	65.2	-23.5%	112.4	31.8%	241	159.7
Weighted Average:				**2.5%**		**-21.3%**		**61.3%**	**Total:**	**20857.74**

Table 4-2: Summary of Maximum Hourly Wind Power Analysis for 164 Wind Farms in Texas

Wind Farm	Design Capacity (A)	12-Month Slididng Maximum MW - Measured		Maximum MW in Last 12-mo - Measured (D)	Difference (A-B)	Difference (B-D)
		Maximum (B)	Minimum (C)			
Anacacho Wind	100	98.7	97.0	98.7	1.3	0.0
Baffin Wind 1	100	98.6	89.9	90.0	1.4	8.6
Baffin Wind 2	102	99.9	90.5	90.5	2.1	9.4
Barton Chapel Wind 1	120	114.1	99.4	104.1	5.9	10.0
Big Spring Wind Farm	41	37.0	17.1	27.4	4.0	9.6
Blue Summit Wind	135	135.0	132.7	134.8	0.0	0.2
Bobcat Bluff Wind	150	150.0	145.2	150.0	0.0	0.0
Brazos Wind Ranch	160	160.0	80.2	80.2	0.0	79.7
Briscoe Wind_19	150	147.9	141.1	144.4	1.9	3.5
Buckthorn Wind 1 A	45	44.2	43.9	44.0	0.7	0.2
Buckthorn Wind 1 B	56	54.6	54.3	54.5	1.1	0.2
Buffalo Gap 1	120	120.0	96.4	96.4	0.0	23.6
Buffalo Gap 2	233	232.7	203.9	205.0	0.3	27.7
Buffalo Gap 3	170	167.9	146.6	152.0	2.1	15.9
Bull Creek Wind Plant	180	177.6	73.6	169.1	2.4	8.5
Cabezon Wind 1 A	115	112.6	110.2	112.6	2.6	0.0
Cabezon Wind 1 B	122	119.5	118.8	119.4	2.9	0.1
Callahan Divide Wind	114	114.0	103.7	114.0	0.0	0.0
Cameron County Wind (Camwind_Unit1)	165	163.9	156.4	158.0	1.1	5.9
Camp Springs Wind 2	120	120.0	100.0	108.2	0.0	11.8
Camp Springs Wind Energy Center	130	130.0	112.7	124.7	0.0	5.3
Capricorn Ridge Wind 1&2	364	359.7	335.8	359.7	4.3	0.0
Capricorn Ridge Wind 4	113	112.5	110.1	112.5	0.0	0.0
Cedro Hill Wind	150	150.0	144.5	146.2	0.0	3.8
Champion Wind Farm	127	124.5	116.4	123.8	2.0	0.6
Chapman Ranch Wind IA (Santa Cruz)	151	148.3	76.1	137.5	2.3	10.8
Chapman Ranch Wind IB (Santa Cruz)	98	97.3	51.3	97.0	1.1	0.2
Desert Sky Wind Farm	161	160.3	105.8	123.8	0.3	36.4
Doug Colbeck's Corner (Conway) B	100	99.5	97.5	98.5	0.7	1.0
Doug Colbeck's Corner (Conway) A	100	100.1	97.9	98.2	0.1	1.9
Elbow Creek Wind	122	118.7	88.9	118.3	3.2	0.4
Falvez Astra Wind	163	162.8	162.0	162.7	0.4	0.1
Foard City Wind 1 A	186	184.6	183.7	184.6	1.9	0.0
Foard City Wind 1 B	164	163.3	161.8	162.0	0.5	1.3
Forest Creek Wind	124	123.9	109.2	113.2	0.3	10.8
Goat Wind	150	149.9	80.9	137.7	0.1	12.2
Goldthwaite Wind 1	149	148.7	141.7	145.8	0.3	2.9
Grandview Wind 1 (Conway) GV1A	107	106.9	103.5	104.3	0.1	2.7
Grandview Wind 1 (Conway) GV1B	104	103.8	99.3	101.8	0.2	2.0
Green Mountain Wind 1 (Brazos)	120	120.0	113.3	120.0	0.0	0.0
Green Mountain Wind 2 (Brazos)	108	108.0	107.2	108.0	0.0	0.0
Green Pastures Wind I_19	150	149.9	110.0	110.0	0.1	39.9
Gulf Wind 1	142	140.7	20.2	134.9	0.9	5.8
Gulf Wind 2	142	140.9	30.0	136.3	0.7	4.6
Gunsight Mountain Wind	120	118.6	115.9	115.9	1.3	2.7
Hackberry Wind	166	162.8	160.6	160.6	2.7	2.2
Harbor Wind	9	9.0	0.0	0.0	0.0	9.0
Hereford Wind G_19	100	99.0	96.6	98.2	0.9	0.8
Hereford Wind V_19	100	99.2	98.0	98.6	0.8	0.6
Hidalgo & Starr Wind 11	52	51.9	51.1	51.9	0.1	0.0
Hidalgo & Starr Wind 12	98	97.9	96.1	97.9	0.1	0.0
Hidalgo & Starr Wind 21	100	99.4	97.2	99.4	0.6	0.0
Horse Creek Wind 1	131	130.9	126.9	128.1	0.2	2.8
Horse Creek Wind 2	99	98.6	98.1	98.3	0.3	0.2
Horse Hollow Phase 1	213	212.5	196.7	212.5	0.5	0.0
Horse Hollow Phase 2	184	183.4	156.7	179.4	0.6	4.0
Horse Hollow Phase 3	224	223.0	178.7	220.8	0.5	2.2
Horse Hollow Phase 4	115	114.0	105.3	112.2	1.0	1.8
Inadale Wind	197	197.0	188.5	196.6	0.0	0.4
Indian Mesa Wind Farm	83	82.5	49.4	72.8	0.0	9.6
Javelina II Wind 1	96	95.8	94.8	95.3	0.2	0.6

Table 4-2: Summary of Maximum Hourly Wind Power Analysis for 164 Wind Farms in Tex (Continued)

Wind Farm	Design Capacity (A)	12-Month Slididng Maximum MW- Measured		Maximum MW in Last 12-mo - Measured (D)	Difference (A-B)	Difference (B-D)
		Maximum (B)	Minimum (C)			
Javelina II Wind 2	74	73.8	73.3	73.8	0.2	0.0
Javelina II Wind 3	30	30.0	29.8	30.0	0.0	0.0
Javelina Wind 18&20_19	250	247.9	241.8	244.8	1.8	3.1
Jumbo Road Wind 1_19	146	145.6	143.3	145.6	0.6	0.0
Jumbo Road Wind 2_19	154	153.2	151.0	153.1	0.4	0.1
Karankawa Wind 1a	103	102.6	101.1	101.1	0.7	1.6
Karankawa Wind 1b	103	102.1	101.0	102.1	1.3	0.0
Karankawa Wind 2	100	100.1	99.2	100.1	0.3	0.0
Keechi Wind 138 Kv Joplin_19	110	107.5	106.7	107.3	2.5	0.2
King Mountain-NE Wind Farm	79	77.0	47.2	65.0	2.3	12.0
King Mountain-NW Wind Farm	79	77.6	52.1	72.5	1.7	5.1
King Mountain-SE Wind Farm	40	40.0	27.8	39.6	0.3	0.5
King Mountain-SW Wind Farm	79	78.8	45.6	78.8	0.5	0.0
Langford Wind	150	150.0	147.2	150.0	0.0	0.0
Lockett Wind Farm	184	183.7	183.5	183.7	0.0	0.0
Logans Gap Wind I U1_19	104	103.3	95.6	103.0	0.5	0.3
Logans Gap Wind I U2_19	106	102.1	98.2	99.9	4.2	2.3
Lone Star-Mesquite Wind	200	195.0	171.0	180.5	5.0	14.4
Lone Star-Post Oak Wind	200	192.1	169.5	169.5	7.9	22.6
Longhorn Wind North U1_19	100	99.3	97.6	97.9	0.7	1.4
Longhorn Wind North U2_19	100	99.8	97.7	99.8	0.2	0.0
Loraine Windpark I	126	95.2	47.4	47.4	30.8	47.8
Loraine Windpark II	125	85.0	48.7	49.2	39.5	35.8
Loraine Windpark III	26	26.0	23.6	25.2	0.0	0.8
Loraine Windpark IV	24	24.0	17.5	23.6	0.0	0.4
Los Vientos I Wind	200	199.2	190.7	198.8	0.9	0.5
Los Vientos II Wind	202	201.4	191.7	191.7	0.2	9.7
Los Vientos III Wind_19	200	195.5	188.0	194.0	4.5	1.5
Los Vientos IV Wind	200	195.6	192.0	193.1	4.4	2.5
Los Vientos V Wind	110	107.8	103.6	103.6	2.2	4.2
Magic Valley Wind (Redfish) 1A	100	98.7	73.7	95.3	1.1	3.4
Magic Valley Wind (Redfish) 1B	104	103.4	78.7	100.7	0.1	2.8
Mariah Del Norte 1	115	113.7	112.9	113.4	1.5	0.3
Mariah Del Norte 2	115	114.4	113.7	114.4	0.8	0.0
McAdoo Wind	150	150.0	149.6	149.9	0.0	0.1
Mesquite Creek Wind 1_19	106	104.1	97.2	97.2	1.5	6.9
Mesquite Creek Wind 2_19	106	104.3	96.0	96.0	1.3	8.3
Miami Wind G1	144	141.3	134.5	134.5	2.7	6.7
Miami Wind G2	144	141.5	138.9	139.5	2.5	2.0
Midway Wind	163	156.8	152.8	155.9	6.0	0.9
Notrees Windpower	153	151.7	137.3	141.2	1.3	10.5
Ocotillo Windpower	59	57.5	12.3	12.3	1.3	45.2
Panhandle Wind 1 U1	109	109.0	106.1	108.7	0.0	0.3
Panhandle Wind 1 U2	109	108.3	103.7	104.3	0.7	4.1
Panhandle Wind 2 U1	94	93.8	91.3	92.2	0.2	1.6
Panhandle Wind 2 U2	97	96.9	94.7	94.9	0.1	2.0
Panther Creek	143	142.5	139.0	142.5	0.0	0.0
Panther Creek 2	116	115.5	112.2	115.5	0.0	0.0
Panther Creek 3	200	199.5	0.0	0.0	0.0	199.5
Papalote Creek Phase II	200	195.6	191.6	193.9	4.5	1.7
Papalote Creek Wind Farm	180	180.0	49.2	174.1	0.0	5.9
Penascal Wind 1	161	161.0	115.3	146.5	0.0	14.5
Penascal Wind 2	142	142.0	103.6	130.5	0.0	11.5
Penascal Wind 3	101	100.9	82.5	95.8	0.1	5.0
Pyron	249	249.0	242.1	242.1	0.0	6.9
Rattlesnake Den Wind Phase 1 G1_19	104	103.8	89.2	103.8	0.5	0.0
Rattlesnake Den Wind Phase 1 G2_19	103	102.8	95.9	102.8	0.2	0.0
Red Canyon1	84	84.0	82.1	82.6	0.0	1.4
Roscoe Wind Farm	209	209.0	199.5	208.3	0.0	0.7
Route 66 Wind_19	150	147.1	143.6	145.2	2.9	1.9

Table 4-2: Summary of Maximum Hourly Wind Power Analysis for 164 Wind Farms in Tex (Continued)

Wind Farm	Design Capacity (A)	12-Month Slididng Maximum MW- Measured		Maximum MW in Last 12-mo - Measured (D)	Difference (A-B)	Difference (B-D)
		Maximum (B)	Minimum (C)			
Saltfork_Unit1	64	64.0	62.8	63.0	0.0	1.0
Saltfork_Unit2	110	108.7	108.3	108.4	1.3	0.3
San Roman Wind	95	94.4	83.2	83.2	0.8	11.3
Sand Bluff Wind	90	89.3	25.0	25.0	0.7	64.3
Senate Wind	150	146.1	141.8	144.8	3.9	1.3
Sendero Wind Energy_19	76	76.0	75.4	75.4	0.0	0.6
Shannon Wind_19	204	204.1	198.8	204.1	0.0	0.0
Sherbino 2 Wind	150	146.8	44.4	127.5	3.2	19.2
Silver Star Wind	60	60.0	14.1	51.5	0.0	8.5
South Plains Wind 2_19	98	97.3	95.5	95.7	0.7	1.6
South Plains Wind I_19	102	100.7	95.6	95.6	1.3	5.1
South Plains Wind II A	149	146.5	145.5	146.5	2.0	0.0
South Plains Wind II B	152	150.2	148.2	149.1	1.6	1.1
Spinning Spur 3 (Wind 1)_19	96	95.4	93.6	93.6	0.6	1.9
Spinning Spur 3 (Wind 2)_19	98	98.0	95.1	96.3	0.0	1.7
Spinning Spur Wind Two	161	157.9	155.0	155.0	3.1	2.8
Stephens Ranch Wind 2_19	165	164.5	160.5	164.5	0.2	0.0
Stephens Ranch Wind Phase 1	211	207.6	204.8	205.4	3.4	2.2
Sweetwater Wind 1	38	37.5	36.0	37.5	0.0	0.0
Sweetwater Wind 2	98	97.5	91.8	97.5	0.0	0.0
Sweetwater Wind 3	135	134.6	121.5	134.6	0.4	0.0
Sweetwater Wind 4	241	240.6	216.7	220.7	0.2	19.9
Sweetwater Wind 5	81	80.5	76.9	79.0	0.0	1.5
Sweetwater Wind24	16	16.0	15.9	16.0	0.0	0.0
Tahoka Wind 1	150	149.9	149.3	149.3	0.1	0.6
Tahoka Wind 2	150	148.9	148.2	148.2	1.1	0.7
Torrecillas Wind_23+25	151	150.3	148.7	150.3	0.2	0.0
Trent Mesa Wind Farm	150	147.6	37.2	38.3	2.4	109.2
Trinity Hills Wind Farm 1	118	117.7	29.4	101.3	0.3	16.4
Trinity Hills Wind Farm 2	108	107.6	45.5	106.0	0.4	1.5
Turkey Track Wind Energy Center	170	169.5	164.8	168.8	0.0	0.7
Tyler Bluff Wind	126	123.2	117.5	122.3	2.4	0.9
Vertigo Wind (Formerly Green Pastures Win	150	148.6	128.1	128.1	1.4	20.5
Wake Wind 1	115	114.5	109.4	109.9	0.4	4.6
Wake Wind 2	142	140.4	133.0	133.1	1.9	7.4
Whirlwind	60	59.3	57.0	58.3	0.7	1.0
Whitetail Wind	92	90.7	88.5	89.6	1.3	1.0
Willow Springs Wind A	125	125.0	124.5	125.0	0.0	0.0
Willow Springs Wind B	125	124.5	124.0	124.0	0.5	0.5
Windthorst 2	68	66.7	64.5	64.8	1.3	1.9
WKN Mozart Wind	30	30.0	29.8	29.8	0.0	0.2
Wolf Ridge Wind	113	112.5	109.2	111.7	0.0	0.8
Woodward Wind Farm	160	148.7	104.1	136.9	11.0	11.8
Total:	**20,857.7**	**20,606.9**	**17,813.2**	**19,377.6**	**250.8**	**1,229.3**

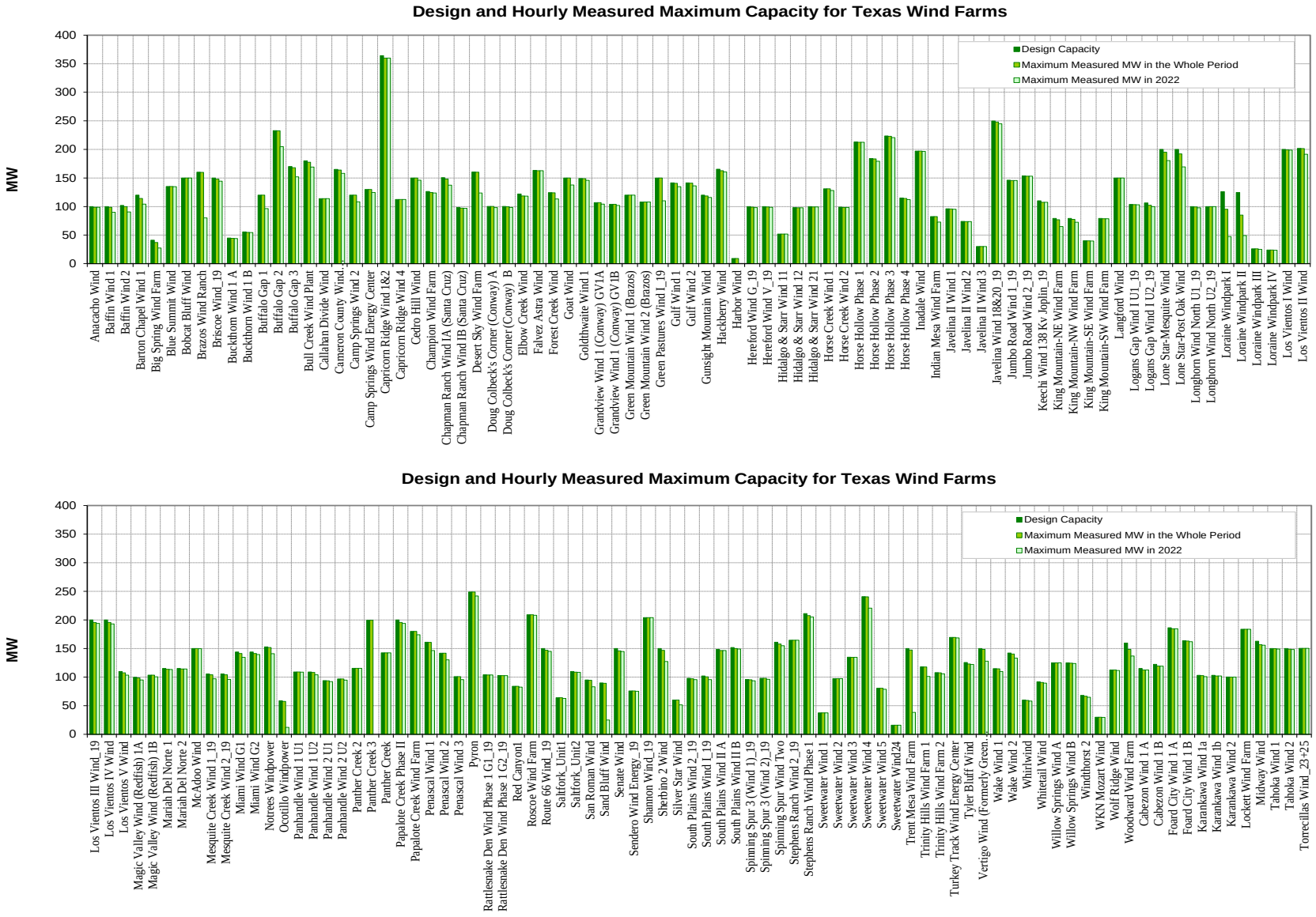


Figure 4-2: Design and Hourly Measured Maximum Capacity for 164 Wind Farms

5 CALCULATING NO_x EMISSIONS REDUCTION FROM WIND POWER

5.1 Calculation of NOx Emissions from Wind Power Using 2018 eGRID

The Energy Systems Laboratory has worked closely with the TCEQ and EPA to develop credible procedures for calculating NOx reductions from electricity savings using the 2018 EPA's Emissions and Generation Resource Integrated Database (eGRID[16]). The calculation uses a simplified dispatch approach of the ERCOT grid to estimate NOx emission reductions across the ERCOT region in Texas. ERCOT is currently divided into four CL zones: Houston (H), North (N), South (S), and West (W). The 2018 eGrid table, which describes the distribution of the NOx emission reductions per Competitive Load (CL) zone for each county in Texas, has four developed steps (EPA and ESL: 2008):

1. assign energy savings to CL Zones
2. assign generation reductions within each CL Zone to individual plants
3. determine plant-specific NOx emission rates
4. assemble all CL Zones for total savings

The procedure presented in this section calculates annual and peak-day, county-wide NOx reductions from electricity generations from wind projects implemented in the ERCOT CL Zones listed in the EPA's eGRID. For this purpose, a special version of eGRID[17] was developed that reflects the 2018 electricity and pollution from electric utilities in ERCOT. The NOx production for each power plant is provided from the 2018 eGRID database for four CL zones: Houston, North, West, and South. This eGRID matrix was utilized to assign the power plant used by CL zones, once a CL zone 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 CL zones, which was derived from the 2018 Annual eGRID table. For example, the counties marked in red show higher NOx emissions of above 0.1 lbs/MWh. The counties marked in dark green were least impacted by the NOx emissions (less than 0.0005 lbs/MWh), Figure 5-1 and Figure 5-2 shows county-wide NOx emissions distribution for all the CL zones: Houston, North, West, and South.

Table 5-1 shows the latest wind farm information from PUCT, updated in Jan 2023. To calculate the NOx emissions reduction from the wind projects within the ERCOT region, the total MWh wind power for each CL zone is summarized in Table 5-2 for modeled 2018 baseline and 2022 measured data. Both annual wind power and OSP wind power are presented. Only the completed projects are shown in the ERCOT, WSCC and SPP regions, with a total generation capacity of 36,694 MW by wind resource. The total MWh production in each CL zone was input in the corresponding cells in the eGRID table to calculate the total annual and OSP emissions reductions for the entire ERCOT region in 2018 model (using 2018 wind speed data) and 2021 (using measured data), as shown from Table 5-3 to Table 5-6.

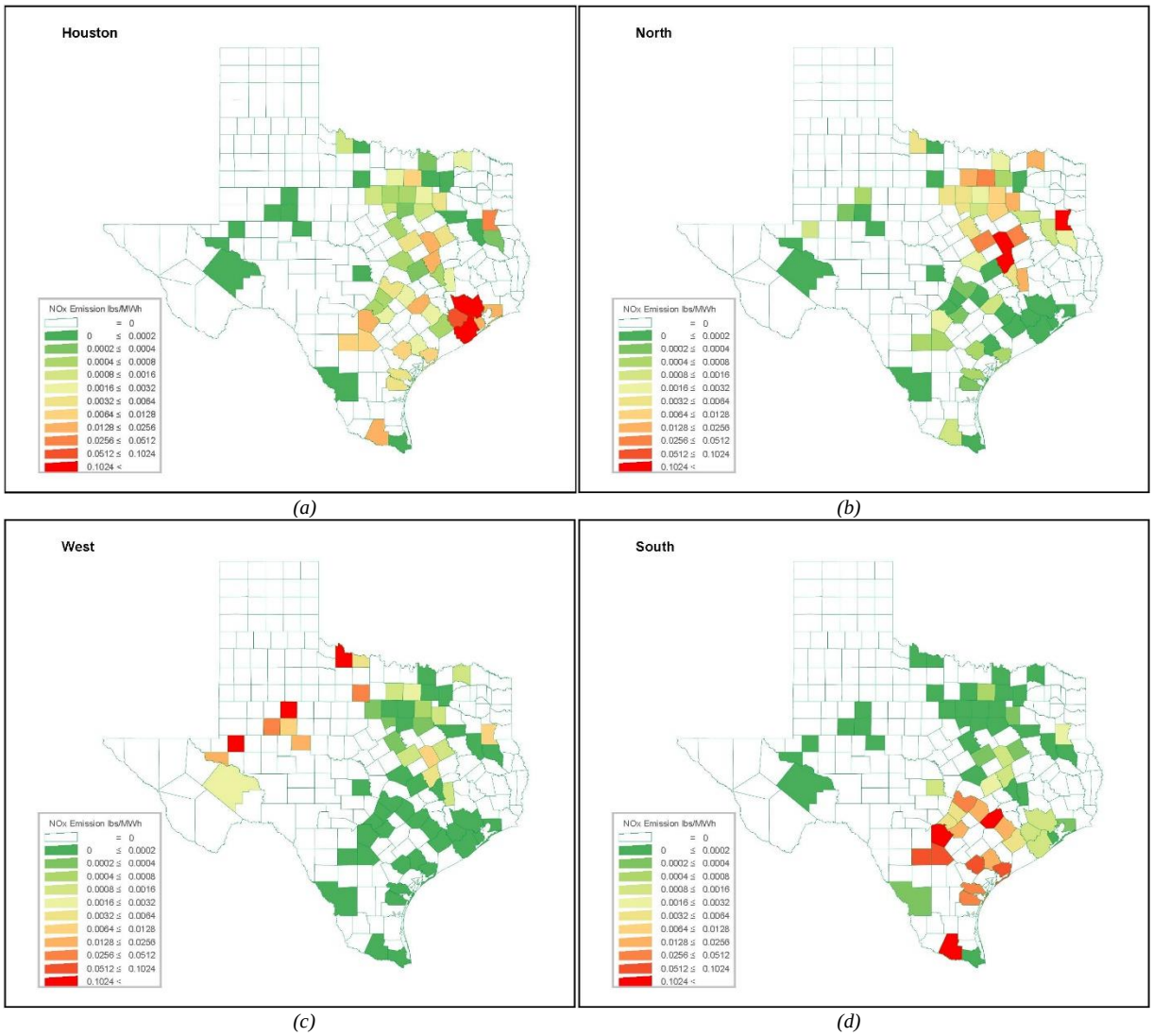
According to the developed models, the total MWh savings in the base year 2018 for the wind farms within the ERCOT region are 94,757,524 MWh/yr and 260,491 MWh/day in the OSP, compared with total 102,671,395 MWh/yr savings and 269,074 MWh/day in the OSP in 2022 within ERCOT. The total NOx emissions reductions for modeled 2018 across all the counties amount to 56,950.4 tons/yr and 147.6 tons/day for the OSP. Compared to the modeled 2018, the total NOx emissions reductions in 2022 is higher by 8.8 %, from 56,950.4 tons/yr to 61,972.6 tons/yr. For the OSP, the total NOx emissions reductions in 2022 is higher by 3.7 %, from 147.6 tons/day to 153.0 tons/day. The distribution of the NOx emissions reduction in the counties within the ERCOT region is shown in Figure 5-3 through Figure 5-6. The EPA finalized, on July 25th, 2018, that the nonattainment county designations are: Brazoria, Chambers, Fort Bend, Galveston, Harris, Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Tarrant, Wise, Bexar, Freestone, Howard, Rusk, Anderson, El Paso, Hutchinson, Liberty, Montgomery, Navarro, Panola, Rockwall, Titus, and Waller [18]. The non-attainment county Montgomery, Anderson, Liberty, Navarro, Rockwall, Titus, and Waller did not reduce NOx emissions this year. Hutchinson and Panola are within SPP, El

[16] This report used the non-attainment areas established by TCEQ information at https://www.tceq.texas.gov/assets/public/comm_exec/pubs/rg/rg388/rg-388.pdf

[17] 2018 eGRID table for Texas was retrieved by the US EPA at https://www.epa.gov/egrid

[18] The EPA finalized nonattainment county designations were retrieved at https://www.tceq.texas.gov/airquality/sip/texas-sip

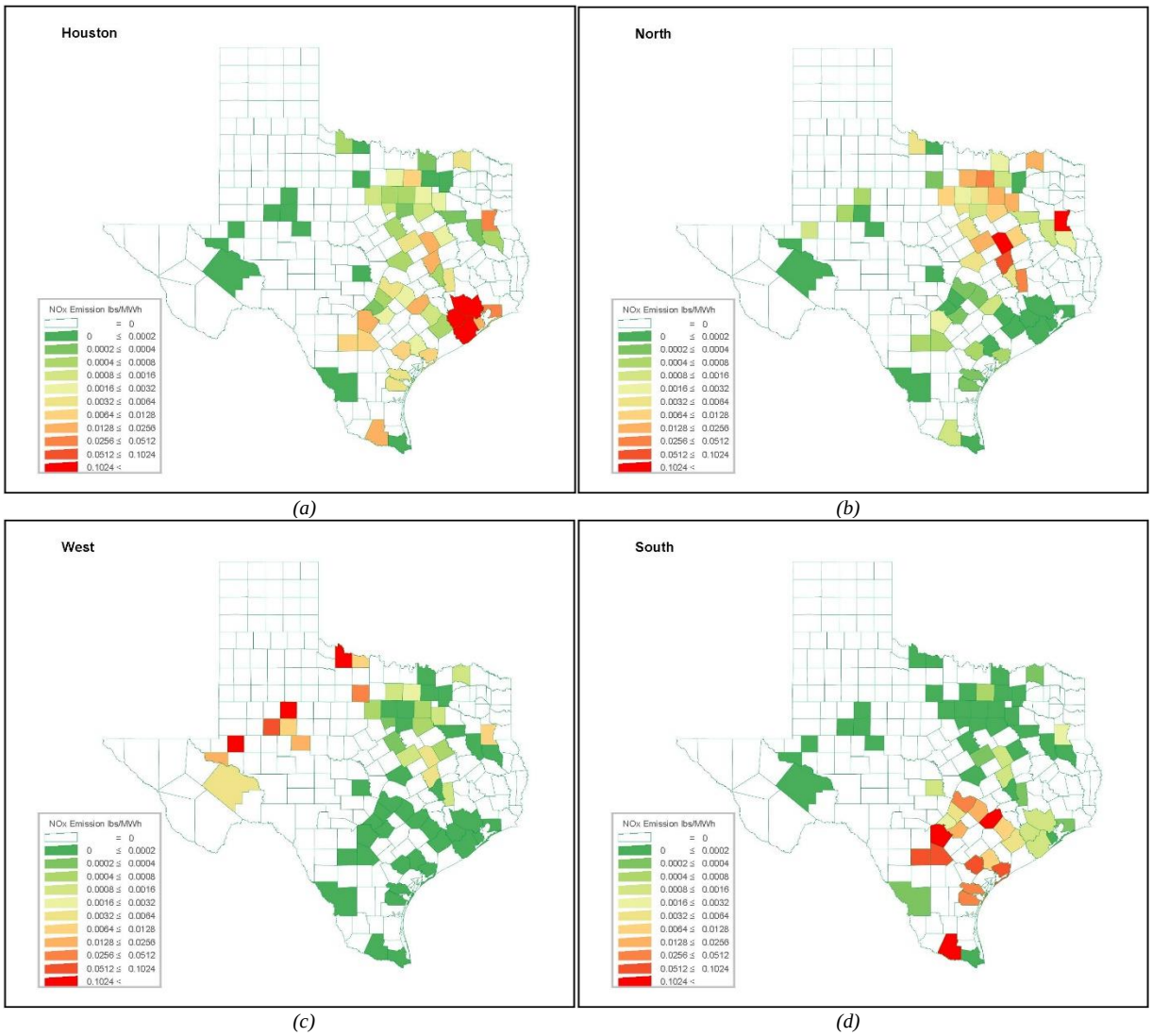
Paso is within WECC. The 2018 eGRID shows that the counties Scurry, Ector and Wilbarger got the most emissions benefit from the wind farms.



(a) *(b)*

(c) *(d)*

Figure 5-1: 2018 Annual eGRID NOx Emissions for the CL zones: (a) Houston, (b) North, (c) West and (d) South.



(a) *(b)*

(c) *(d)*

Figure 5-2: 2018 OSP eGRID NOx Emissions for the CL zones: (a) Houston, (b) North, (c) West and (d) South.

Table 5-1: Texas Wind Farm Information — Updated Jan 15th, 2023

Facility	County	Resource	Capacity (MW)	In Service	Region*
Texas Wind Power Project	Culberson	Wind	35	Oct-95	ERCOT
Big SpriGas Wind Power	Howard	Wind	27.7	Feb-99	ERCOT
Big SpriGas Wind Power	Howard	Wind	6.6	Jun-99	ERCOT
Delaware Mountain Wind Farm	Culberson	Wind	30	Apr-01	ERCOT
Southwest Mesa Wind Project	Upton	Wind	91.8	Jun-01	ERCOT
Hueco Mountain Wind Ranch	El Paso	Wind	1.30	Jul-01	WSCC
Woodward Mountain Ranch	Pecos	Wind	177.7	Nov-01	ERCOT
Trent Mesa	Nolan	Wind	156.4	Dec-01	ERCOT
KiGas Mountain Wind Ranch	Upton	Wind	279.6	Jan-02	ERCOT
Llano Estacado Wind Ranch	Carson	Wind	79.00	Dec-03	SPP
Sweetwater Wind 1	Nolan	Wind	37.5	Dec-03	ERCOT
	Hansford	Wind	3.00	Feb-05	SPP
Callahan Divide Wind Energy Center	Taylor	Wind	123.1	Feb-05	ERCOT
Sweetwater Wind 2	Nolan	Wind	121.3	Sep-05	ERCOT
Buffalo Gap 1	Taylor	Wind	120.6	Oct-05	ERCOT
Horse Hollow Phase 1	Taylor	Wind	230	Dec-05	ERCOT
Sweetwater Wind 3 (Cottonwood Creek)	Nolan	Wind	139.3	May-06	ERCOT
Horse Hollow Phase 2	Taylor	Wind	184	May-06	ERCOT
Horse Hollow Phase 3	Taylor	Wind	241.4	Sep-06	ERCOT
Forest Creek Wind Farm	Glasscock	Wind	182.4	Dec-06	ERCOT
Wildorado Wind Ranch	Oldham	Wind	161.00	Apr-07	SPP
Sweetwater Wind 4 (Cottonwood Creek)	Nolan	Wind	224.8	Jul-07	ERCOT
Camp SpriGass I	Scurry	Wind	130.5	Aug-07	ERCOT
Buffalo Gap 2 (Cirello 1)	Taylor	Wind	232.5	Sep-07	ERCOT
Capricorn Ridge Wind	Sterling	Wind	381.2	May-08	ERCOT
Lone Star - Mesquite Wind	Shackleford	Wind	194	Dec-07	ERCOT
Snyder Wind Project	Scurry	Wind	120	Dec-07	ERCOT
Sweetwater Wind 5	Nolan	Wind	80.5	Dec-07	ERCOT
Whirlwind	Floyd	Wind	59.8	Jan-08	ERCOT
Champion Wind Farm	Scurry		126.5	Jan-08	ERCOT
Roscoe Wind Farm 1	Scurry	Wind	209	Jan-08	ERCOT
Stanton Wind Energy	Martin	Wind	123.6	Jan-08	ERCOT
Silver Star Phase I	Erath	Wind	52.8	Apr-08	ERCOT
Buffalo Gap 3	Taylor	Wind	170.2	Apr-08	ERCOT
Goat Wind	Sterling	Wind	80	May-08	ERCOT
Capricorn Ridge Wind (exp)	Sterling	Wind	198	May-08	ERCOT
McAdoo Wind Energy	Dickens	Wind	150	Jun-08	ERCOT
Camp SpriGass II	Scurry	Wind	123.6	Jul-08	ERCOT
Panther Creek	Howard	Wind	142.5	Oct-08	ERCOT
South Trent Wind Farm	Taylor	Wind	101.2	Oct-08	ERCOT
Wolf Ridge Windfarm	Cooke	Wind	112.5	Nov-08	ERCOT
Bull Creek Wind Plant	Borden	Wind	180	Nov-08	ERCOT
Elbow Creek Wind	Howard	Wind	121.9	May-21	ERCOT
Gulf Wind 1	Kenedy	Wind	283.2	Nov-08	ERCOT
Hackberry Wind Farm	Shackleford	Wind	165.6	Nov-08	ERCOT
Inadale	Nolan	Wind	325	Nov-08	ERCOT
Panther Creek 2	Howard	Wind	115.5	Nov-08	ERCOT
Penascal Wind Farm	Kenedy	Wind	160.8	Nov-08	ERCOT
Pyron	Scurry	Wind	249	Nov-08	ERCOT
Turkey Track Energy Center	Nolan	Wind	174.6	Jan-09	ERCOT
Noble Great Plains Windpark	Hansford	Wind	114.00	Feb-09	SPP
Goat Wind Phase 2	Sterling	Wind	69.6	Apr-09	ERCOT
Sunray Wind I, II, III	Moore	Wind	49.50	Feb-09	SPP
Papalote Creek Wind Farm	San Patricio	Wind	179.9	Sep-09	ERCOT
LaGasford Wind Power	Tom Green	Wind	160	Oct-09	ERCOT
Loraine Windpark	Mitchell	Wind	148.5	Oct-09	ERCOT
JD Wind 1-7, 9-11, Wege	Hansford	Wind	189.80	Dec-09	SPP
Majestic Wind	Carson	Wind	79.50	Dec-09	SPP
Penascal Wind Farm 2	Kenedy	Wind	141.6	Mar-10	ERCOT
Papalote Creek Phase II	San Patricio	Wind	200.1	Jun-10	ERCOT
Little PriGasle 1,2	Hutchinson	Wind	20.00	Sep-10	SPP
Cedro Hill Wind	Webb	Wind	150	Oct-10	ERCOT
Ralls Wind Farm	Crosby	Wind	10.00	Jul-11	SPP
GS Panhandle Wind Ranch	Oldham	Wind	78.00	Sep-11	SPP
Sherbino Mesa Wind Farm 2	Pecos	Wind	132	Nov-11	ERCOT
Trinity Hills Wind Farm	YouGas	Wind	198	Nov-21	ERCOT
Frisco Wind Farm	Hansford		20.00	Jan-12	SPP
Magic Valley Wind	Willacy	Wind	203.3	Feb-12	ERCOT
Anacacho Windfarm	Kinney	Wind	99.8	Apr-12	ERCOT

Note: * Texas Wind Farm Information from ERCOT and PUCT

Table 5-1: Texas Wind Farm Information — Updated Jan 15th, 2023 (Continued)

Facility	County	Resource	Capacity (MW)	In Service	Region
Blue Summit Wind	Wilbarger	Wind	135.4	Dec-12	ERCOT
Cirrus Wind Energy	Lynn	Wind	61.20	Dec-12	SPP
Majestic Wind II	Carson	Wind	80.00	Dec-12	SPP
Mozart	Kent	Wind	30	Dec-12	ERCOT
Senate Wind Project	Jack	Wind	150	Dec-12	ERCOT
SpinniGas Spur Wind Ranch	Oldham	Wind	161.00	Dec-12	SPP
Whitetail Wind Project	Webb	Wind	92.3	Dec-12	ERCOT
Los Vientos I	Willacy	Wind	200.1	Dec-12	ERCOT
Los Vientos II	Willacy	Wind	201.6	Jan-13	ERCOT
Bobcat Bluff	Clay	Wind	162	Jan-13	ERCOT
Goldthwaite Wind Energy	Mills	Wind	148.6	Mar-13	ERCOT
Pantex Wind Farm	Carson	Wind	11.50	Jun-14	SPP
SpinniGas Spur Wind II	Oldham	Wind	161	Jun-14	ERCOT
Panhandle Wind 1	Carson	Wind	218.4	Jun-14	ERCOT
Panhandle Wind 2	Carson	Wind	190.8	Jul-14	ERCOT
Grandview Phase 1 (Conway Windfarm)	Carson	Wind	211.2	Nov-14	ERCOT
Miami Wind 1 Project	Gray	Wind	288.6	Dec-14	ERCOT
Palo Duro Wind	Ochltree	Wind	250.00	Dec-14	SPP
Stephens Ranch Wind Phase 1	Borden	Wind	213.8	Dec-14	ERCOT
Windthorst 2	Archer	Wind	67.6	Dec-14	ERCOT
Keechi Wind	Jack	Wind	110	Dec-14	ERCOT
Jumbo Road Wind (Hereford 2)	Castro	Wind	299.8	Jan-15	ERCOT
Mesquite Creek W	Borden	Wind	211.2	Apr-15	ERCOT
Hereford Wind Project (Hereford 1)	Deaf Smith	Wind	199.9	Apr-15	ERCOT
Stephens Ranch Wind Phase b	Borden	Wind	166.5	May-15	ERCOT
Route66 Wind	ArmstroGas	Wind	150	May-15	ERCOT
Logan's Gap Wind I	Comanche	Wind	213.2	Aug-15	ERCOT
LoGashorn Energy Center North	Briscoe	Wind	200	Sep-15	ERCOT
RattleSnake Wind Ph 1	Glasscock	Wind	207.3	Sep-15	ERCOT
Pleasant Hill Wind Energy	Crosby	Wind	20.00	Sep-15	SPP
SpinniGas Spur Wind III	Oldham	Wind	194	Oct-15	ERCOT
Briscoe Wind	Briscoe	Wind	149.9	Oct-15	ERCOT
Green Pastures W	Knox	Wind	300	Nov-15	ERCOT
South Plains Wind I	Floyd	Wind	200	Nov-15	ERCOT
Shannon Wind	Clay	Wind	204.1	Nov-15	ERCOT
Los Vientos III	Starr	Wind	200	Dec-15	ERCOT
Sendero Wind Energy Project	Jim Hogg	Wind	78	Dec-15	ERCOT
Javelina Wind	Zapata	Wind	249.7	Dec-15	ERCOT
Cameron County Wind	Cameron	Wind	165	Dec-15	ERCOT
Colbeck's Corner	Carson	Wind	200.4	Jan-16	ERCOT
South Plains Wind II Phase a	Floyd	Wind	148.5	May-16	ERCOT
South Plains Wind II Phase b	Floyd	Wind	151.8	Jun-16	ERCOT
Baffin Wind Farm (Penascal 3)	Kenedy	Wind	202	Jun-16	ERCOT
Los Vientos IV	Starr	Wind	200	Jun-16	ERCOT
Gunsight Mountain	Howard	Wind	119.9	Jun-16	ERCOT
Los Vientos V	Starr	Wind	110	Sep-16	ERCOT
Wake Wind	Dickens	Wind	257.3	Sep-16	ERCOT
Salt Fork Wind	Donley and Gray	Wind	174	Oct-16	ERCOT
Tyler Bluff Wind (Muenster Wind)	Cooke	Wind	125.6	Dec-16	ERCOT
Hidalgo & Starr Wind	Hidalgo	Wind	300.4	Dec-16	ERCOT
Electra Wind	Wilbarger	Wind	235.6	Dec-16	ERCOT
Horse Creek Wind	Haskell	Wind	236.5	Jan-17	ERCOT
Bethel Wind Energy Facility	Castro	Wind	276.00	Jan-17	SPP
Javelina 2 Wind	Zapata	Wind	200	Jan-17	ERCOT
San Roman Wind 1	Cameron	Wind	95.3	Feb-17	ERCOT
Mariah Del Notre	Parmer	Wind	230.4	Feb-17	ERCOT
Cotton Plains Wind	Floyd	Wind	50.4	Mar-17	ERCOT
Old Settler Wind	Floyd	Wind	151.2	Apr-17	ERCOT
Cotton Plains Wind	Floyd	Wind	50.4	Mar-17	ERCOT
Falvez Astra Wind	Deaf Smith	Wind	163.2	Apr-17	ERCOT
Dermott Wind 1	Scurry	Wind	253	May-17	ERCOT
Chapman Ranch Wind 1	Nueces	Wind	249	Aug-17	ERCOT
Val Verde Wind	Val Verde	Wind	149.3	Oct-17	ERCOT
Fluvanna Renewable 1	Scurry	Wind	155.4	Oct-17	ERCOT
Willow SpriGass Wind (SALVTION)	Haskell	Wind	250	Nov-17	ERCOT
SALVTION (Willow SpriGass Wind)	Haskell	Wind	250	Dec-17	ERCOT
BUCKTHORN WIND	Erath	Wind	100.6	Dec-17	ERCOT
BBREEZE (BruenniGas's Breeze)	Willacy	Wind	228	Dec-17	ERCOT
Niels Bohr (BearKat Wind A)	Glasscock	Wind	196.6	Dec-17	ERCOT
HICKMAN	Reagan	Wind	300	Feb-18	ERCOT
Flat Top Wind I	Comanche	Wind	200	May-18	ERCOT

Table 5-1: Texas Wind Farm Information — Updated Jan 15th, 2023 (Continued)

Facility	County	Resource	Capacity (MW)	In Service	Region
RTS Wind Project	McCulloch	Wind	160	Sep-18	ERCOT
Stella 1 Wind	Kenedy	Wind	201	Sep-18	ERCOT
Wildcat Ranch Wind Project	Cochran	Wind	150.50	Dec-18	SPP
Fiber Winds Energy Project	Crosby	Wind	78.80	Dec-18	SPP
Blue Cloud Renewable Energy	Bailey and Lamb	Wind	148.40	Dec-18	SPP
Tahoka Wind	Lynn	Wind	300	Dec-18	ERCOT
Hale Community Energy	Hale	Wind	478.00	Mar-19	SPP
Midway Wind	San Patricio	Wind	162.8	Jun-19	ERCOT
S_Hills Wind	Baylor	Wind	30.2	Jun-19	ERCOT
Lockett Wind	Wilbarger	Wind	183.7	Aug-19	ERCOT
Torrecillas Wind	Webb	Wind	300.5	Sep-19	ERCOT
Foard City Wind	Foard	Wind	350.3	Nov-19	ERCOT
Cabezon Wind	Starr	Wind	237.6	Nov-19	ERCOT
Canadian Breaks Wind	Oldham	Wind	210.1	Dec-19	ERCOT
Karankawa Wind	San Patricio	Wind	206.6	Dec-19	ERCOT
Karankawa 2 Wind	San Patricio	Wind	100.4	Dec-19	ERCOT
Gopher Creek Wind	Borden	Wind	158	Dec-19	ERCOT
Wilson Ranch	Schleicher	Wind	199.5	Mar-20	ERCOT
Blue Summit II	Wilbarger	Wind	99.4	Apr-20	ERCOT
Blue Summit III	Wilbarger	Wind	200.2	Apr-20	ERCOT
Ranchero Wind	Crockett	Wind	300	May-20	ERCOT
Peyton Creek Wind	Matagorda	Wind	151.2	May-20	ERCOT
Palmas Altas Wind	Cameron	Wind	144.9	Jun-20	ERCOT
WKN Amadeus Wind	Fisher	Wind	250.2	Nov-20	ERCOT
Vera Wind V110	Knox	Wind	34	Apr-21	ERCOT
Gulf Wind 1 Repower	Kenedy	Wind	0	May-21	ERCOT
RTS 2 Wind	McCulloch	Wind	15.96	May-21	ERCOT
Vera Wind	Knox	Wind	208.8	May-21	ERCOT
Aviator Wind	Coke	Wind	525	Jun-21	ERCOT
Espiritu Wind	Cameron	Wind	25.2	Jun-21	ERCOT
Chalupa Wind	Cameron	Wind	173.3	Jun-21	ERCOT
Shaffer Wind	Nueces	Wind	226.1	Jun-21	ERCOT
East Raymond Wind (El Rayo)	Willacy	Wind	200.2	Jun-21	ERCOT
High Lonesome Wind	Crockett	Wind	449.3	Jul-21	ERCOT
High Lonesome Wind Phase II	Crockett	Wind	50.6	Jul-21	ERCOT
Hidalgo II Wind	Hidalgo	Wind	50.4	Jul-21	ERCOT
Barrow Ranch Wind	Andrews	Wind	160.7	Sep-21	ERCOT
West Raymond (Trueno) Wind	Willacy	Wind	239.8	Oct-21	ERCOT
Oveja Wind	Irion	Wind	302.4	Oct-21	ERCOT
Griffin Trail Wind	Knox	Wind	225.6	Oct-21	ERCOT
Venado Wind	Starr	Wind	201.6	Dec-21	ERCOT
Ajax Wind	Wilbarger	Wind	366.6	Sep-20	ERCOT
Cranel Wind	Refugio	Wind	220	Mar-22	ERCOT
Panther Creek III Repower	Howard	Wind	15.96	Jan-22	ERCOT
Maverick Creek I Wind	Concho	Wind	223.5	Mar-22	ERCOT
Maverick Creek II Wind	Concho	Wind	268.5	Dec-20	ERCOT
Sage Draw Wind	Lynn	Wind	338.4	Mar-08	ERCOT
El Algodon Alto W	San Patricio	Wind	200.2	Nov-21	ERCOT
Cactus Flats Wind	Concho	Wind	148.4	Nov-21	ERCOT
Reloj Del Sol Wind	Zapata	Wind	209.3	Dec-21	ERCOT
White Mesa Wind	Crockett	Wind	152.3	Dec-21	ERCOT
White Mesa 2 Wind	Crockett	Wind	348.3	Dec-21	ERCOT
Great Prairie Wind Project	Hansford	Wind	359.00	Dec-21	SPP
Great Prairie Wind 3	Hansford	Wind	301.00	Dec-21	SPP
Great Prairie Wind 2	Hansford	Wind	210.00	Dec-21	SPP
TG East Wind	Knox	Wind	336	Jan-22	ERCOT
Apogee Wind	Haskell	Wind	393.2	Sep-22	ERCOT
Foxtrot Wind	Bee	Wind	268.2	Jan-23	ERCOT
Aquilla Lake Wind	Hill	Wind	300.1	Dec-22	ERCOT
Coyote Wind	Scurry	Wind	242.6	Oct-22	ERCOT
Mesteno Wind	Starr	Wind	201.6	Dec-22	ERCOT
Priddy Wind	Mills	WIN	302.4	Feb-23	ERCOT
Vortex Wind	Throckmorton	WIN	350.2	Feb-23	ERCOT
WILDWIND	Cooke	WIN	180.1	Mar-23	ERCOT
Whitehorse Wind	Fisher	WIN	418.9	Apr-23	ERCOT
Inertia Wind	Haskell	WIN	640.1	Apr-23	ERCOT
Total			36911.7		

Table 5-2: Modeled 2018 and Measured 2022 Wind Power Production and Emission Assigned to Each CL Zone in the ERCOT Region

	Modeled 2018				Measured 2022			
CL Zones	**Annual Wind Power**		**OSP Wind Power**		**Annual Wind Power**		**OSP Wind Power**	
	Generation (MWh/yr)	NOx Emission Reduction (Tons/yr)	Generation (MWh/yr)	NOx Emission Reduction (Tons/yr)	Generation (MWh/yr)	NOx Emission Reduction (Tons/yr)	Generation (MWh/yr)	NOx Emission Reduction (Tons/yr)
Houston	0	0	0	0	0	0	0	0
North	8,228,291	2863.6	23,256	7.5	7,625,561	2,653.9	18,424	5.9
West	65,284,764	43,584.4	179,788	113.4	71,182,027	47,521.4	184,181	116.1
South	21,244,469	10,502.4	57,447	26.8	23,863,807	11,797.3	66,469	31.0
Total	94,757,524	56,950.4	260,491	147.6	102,671,395	61,972.6	269,074	153.0

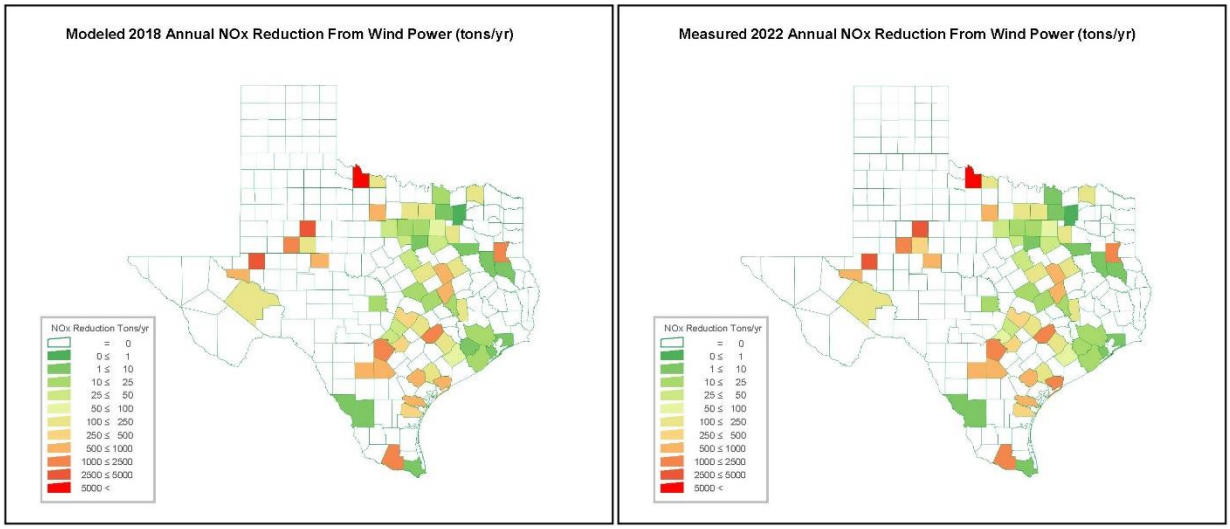


Figure 5-3: Modeled 2018 and Measured 2022 Annual NOx Reductions from Wind Power in Texas Map

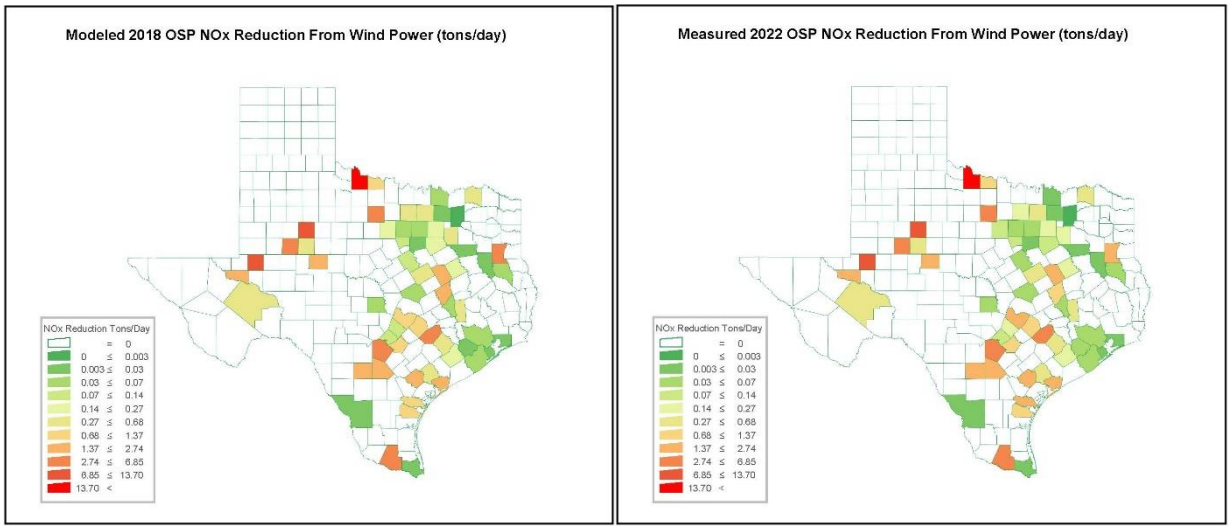


Figure 5-4: Modeled 2018 OSP and Measured 2022 OSP NOx Reductions from Wind Power in Texas Map

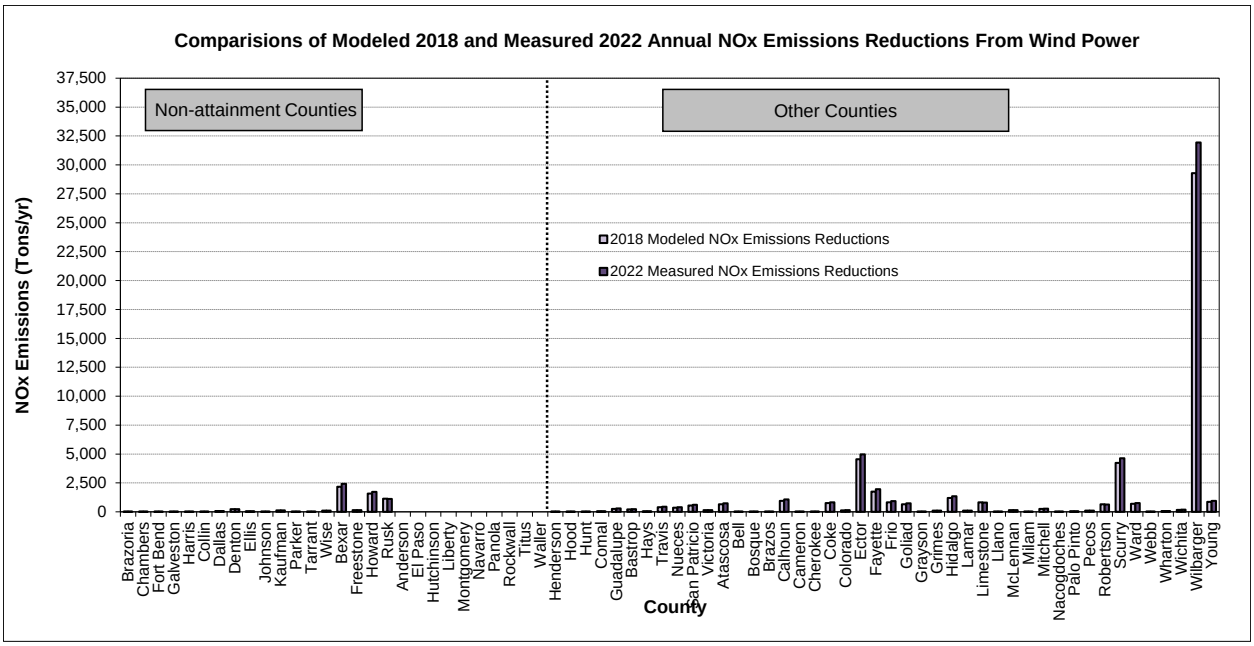


Figure 5-5: Comparisons of Modeled 2018 and Measured 2022 Annual NOx Emissions Reductions from Wind Power

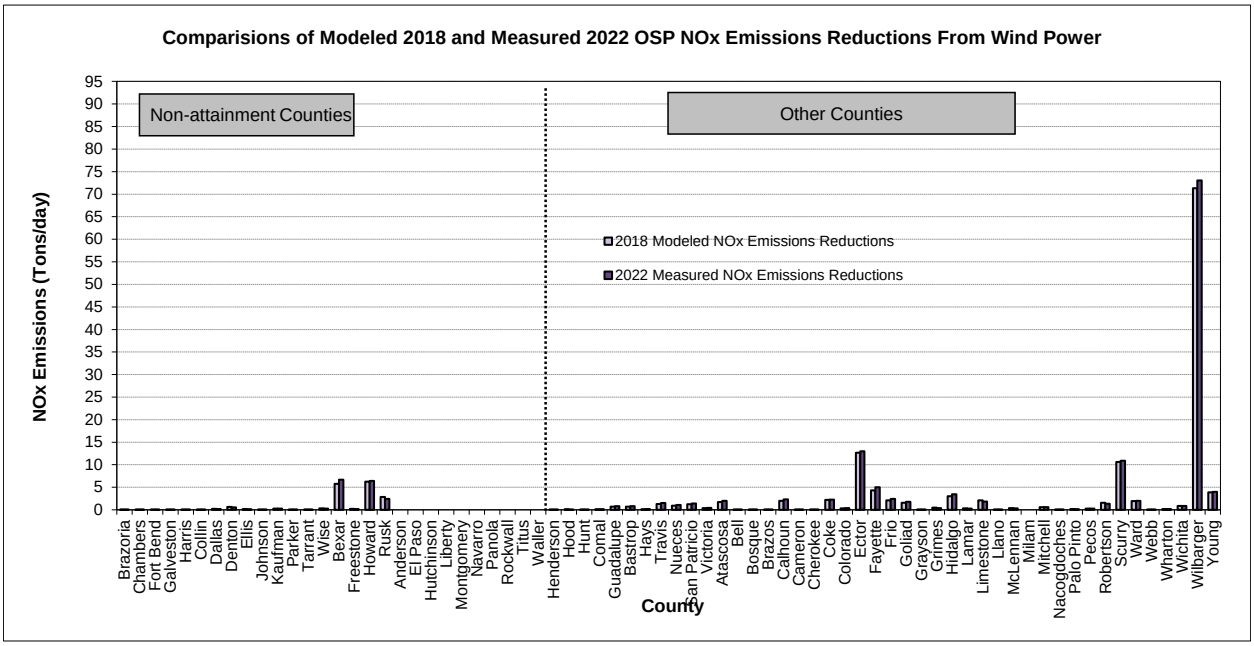


Figure 5-6: Comparisons of Modeled 2018 and Measured 2022 OSP NOx Emissions Reductions from Wind Power

Table 5-3: Distribution of the Annual Emission Reductions per CL Zone for each County (Base Year 2018)

Area	County	CL Zones								Total Nox Reductions (lbs)	Total Nox Reductions (Tons)
		H		N		W		S			
Houston-Galveston Area	Brazoria	0.1445243	0	0.0000183	151	0.0000009	58	0.0013540	28,765	28,973	14.4867
	Chambers	0.0232302	0	0.0000029	24	0.0000001	9	0.0002176	4,623	4,657	2.33
	Fort Bend	0.0925360	0	0.0000117	97	0.0000006	37	0.0008669	18,417	18,551	9.28
	Galveston	0.0189140	0	0.0000024	20	0.0000001	8	0.0001772	3,764	3,792	1.90
	Harris	0.1374166	0	0.0000174	143	0.0000008	55	0.0012874	27,350	27,548	13.77
	Liberty*	-	-	-	-	-	-	-	-	-	-
	Montgomery	-	-	-	-	-	-	-	-	-	-
	Waller*	-	-	-	-	-	-	-	-	-	-
Beaumont/ Port Arthur Area	Hardin*	-	-	-	-	-	-	-	-	-	-
	Jefferson*	-	-	-	-	-	-	-	-	-	-
	Orange*	-	-	-	-	-	-	-	-	-	-
Dallas/ Fort Worth Area	Collin	0.0000743	0	0.0004556	3,749	0.0000220	1,437	0.0000046	99	5,284	2.64
	Dallas	0.0019090	0	0.0117105	96,357	0.0005656	36,927	0.0001195	2,538	135,822	67.91
	Denton	0.0066429	0	0.0407509	335,310	0.0019683	128,502	0.0004158	8,833	472,645	236.32
	Henderson	0.0001509	0	0.0009255	7,616	0.0000447	2,919	0.0000094	201	10,735	5.37
	Hood	0.0008451	0	0.0051842	42,657	0.0002504	16,348	0.0000529	1,124	60,128	30.06
	Hunt	0.0000043	0	0.0000263	216	0.0000013	83	0.0000003	6	305	0.15
	Tarrant	0.0004188	0	0.0025693	21,141	0.0001241	8,102	0.0000262	557	29,800	14.90
	Ellis	0.0013349	0	0.0081890	67,381	0.0003955	25,823	0.0000835	1,775	94,979	47.49
	Johnson	0.0002010	0	0.0012332	10,148	0.0000596	3,889	0.0000126	267	14,304	7.15
	Kaufman	0.0034596	0	0.0212228	174,627	0.0010251	66,923	0.0002165	4,600	246,150	123.08
	Parker	0.0005940	0	0.0036438	29,982	0.0001760	11,490	0.0000372	790	42,262	21.13
	Rockwall*	-	-	-	-	-	-	-	-	-	-
	Wise	0.0031300	0	0.0192012	157,993	0.0009275	60,548	0.0001959	4,162	222,704	111.35
El Paso Area	El Paso*	-	-	-	-	-	-	-	-	-	-
San Antonio Area	Bexar	0.0253670	0	0.0017108	14,077	0.0000826	5,395	0.2025905	4,303,927	4,323,399	2161.70
	Comal	0.0005285	0	0.0000356	293	0.0000017	112	0.0042210	89,672	90,078	45.04
	Guadalupe	0.0030546	0	0.0002060	1,695	0.0000100	650	0.0243949	518,256	520,601	260.30
	Wilson	-	-	-	-	-	-	-	-	-	-
Austin Area	Austin	-	-	-	-	-	-	-	-	-	-
	Bastrop	0.0024800	0	0.0001673	1,376	0.0000081	527	0.0198060	420,769	422,672	211.34
	Caldwell*	-	-	-	-	-	-	-	-	-	-
	Hays	0.0004731	0	0.0000319	263	0.0000015	101	0.0037782	80,266	80,629	40.31
	Travis	0.0046184	0	0.0003115	2,563	0.0000150	982	0.0368846	783,595	787,140	393.57
	Williamson	-	-	-	-	-	-	-	-	-	-
North East Texas Area	Gregg*	-	-	-	-	-	-	-	-	-	-
	Harrison*	-	-	-	-	-	-	-	-	-	-
	Rusk	0.0322708	0	0.1979648	1,628,912	0.0095620	624,255	0.0020197	42,908	2,296,075	1148.04
	Smith*	-	-	-	-	-	-	-	-	-	-
	Upshur*	-	-	-	-	-	-	-	-	-	-
Corpus Christi Area	Nueces	0.0042426	0	0.0002861	2,354	0.0000138	902	0.0338828	719,822	723,078	361.54
	San Patricio	0.0063692	0	0.0004296	3,534	0.0000207	1,355	0.0508668	1,080,638	1,085,527	542.76
Victoria Area	Victoria	0.0016730	0	0.0001128	928	0.0000054	356	0.0133614	283,855	285,140	142.57
Other ERCOT counties	Anderson	-	-	-	-	-	-	-	-	-	-
	Andrews*	-	-	-	-	-	-	-	-	-	-
	Angelina	-	-	-	-	-	-	-	-	-	-
	Atascosa	0.0077084	0	0.0005199	4,278	0.0000251	1,639	0.0615620	1,307,853	1,313,770	656.88
	Bell	0.0004444	0	0.0027262	22,432	0.0001317	8,597	0.0000278	591	31,620	15.81
	Bosque	0.0007214	0	0.0044257	36,416	0.0002138	13,956	0.0000452	959	51,331	25.67
	Brazos	0.0005654	0	0.0034687	28,542	0.0001675	10,938	0.0000354	752	40,231	20.12
	Calhoun	0.0111852	0	0.0007544	6,207	0.0000364	2,379	0.0893292	1,897,751	1,906,337	953.17
	Cameron	0.0000231	0	0.0000016	13	0.0000001	5	0.0001843	3,916	3,934	1.97
	Cherokee	0.0001844	0	0.0011310	9,306	0.0000546	3,566	0.0000115	245	13,118	6.56
	Coke	0.0000223	0	0.0001365	1,123	0.0231815	1,513,401	0.0000014	30	1,514,554	757.28
	Coleman*	-	-	-	-	-	-	-	-	-	-
	Colorado	0.0016158	0	0.0001090	897	0.0000053	344	0.0129041	274,140	275,380	137.69
	Crockett*	-	-	-	-	-	-	-	-	-	-
	Ector	0.0001338	0	0.0008206	6,752	0.1393442	9,097,053	0.0000084	178	9,103,983	4551.99
	Fannin*	-	-	-	-	-	-	-	-	-	-
	Fayette	0.0204274	0	0.0013777	11,336	0.0000665	4,344	0.1631405	3,465,834	3,481,514	1740.76
	Freestone	0.0042261	0	0.0259247	213,316	0.0012522	81,750	0.0002645	5,619	300,685	150.34
	Frio	0.0097614	0	0.0006583	5,417	0.0000318	2,076	0.0779581	1,656,179	1,663,672	831.84
	Goliad	0.0077047	0	0.0005196	4,276	0.0000251	1,639	0.0615328	1,307,232	1,313,146	656.57
	Grayson	0.0002857	0	0.0017525	14,420	0.0000846	5,526	0.0000179	380	20,326	10.16
	Grimes	0.0029942	0	0.0183678	151,136	0.0008872	57,920	0.0001874	3,981	213,037	106.52
	Hardeman*	-	-	-	-	-	-	-	-	-	-
	Haskell*	-	-	-	-	-	-	-	-	-	-
	Hidalgo	0.0140830	0	0.0009498	7,815	0.0000459	2,995	0.1124720	2,389,408	2,400,219	1200.11
	Hill	-	-	-	-	-	-	-	-	-	-
	Howard	0.0000467	0	0.0002865	2,358	0.0486558	3,176,485	0.0000029	62	3,178,904	1589.45
	Jack*	-	-	-	-	-	-	-	-	-	-
	Jones*	-	-	-	-	-	-	-	-	-	-
	Lamar	0.0031379	0	0.0192492	158,388	0.0009298	60,700	0.0001964	4,172	223,260	111.63
	Limestone	0.0231674	0	0.1421203	1,169,407	0.0068646	448,157	0.0014500	30,804	1,648,368	824.18
	Llano	0.0001855	0	0.0000125	103	0.0000006	39	0.0014818	31,479	31,622	15.81
	McLennan	0.0043688	0	0.0268006	220,523	0.0012945	84,512	0.0002734	5,809	310,844	155.42
	Milam	0.0002486	0	0.0000168	138	0.0000008	53	0.0019850	42,171	42,362	21.18
	Mitchell	0.0000072	0	0.0000443	365	0.0075244	491,226	0.0000005	10	491,600	245.80
	Nacogdoches	0.0002714	0	0.0016647	13,698	0.0000804	5,249	0.0000170	361	19,308	9.65
	Nolan	-	-	-	-	-	-	-	-	-	-
	Palo Pinto	0.0010391	0	0.0063745	52,451	0.0003079	20,101	0.0000650	1,382	73,933	36.97
	Pecos	0.0000029	0	0.0000180	148	0.0030637	200,016	0.0000002	4	200,168	100.08
	Potter	-	-	-	-	-	-	-	-	-	-
	Presidio*	-	-	-	-	-	-	-	-	-	-
	Reagan	-	-	-	-	-	-	-	-	-	-
	Red River	-	-	-	-	-	-	-	-	-	-
	Robertson	0.0184177	0	0.1129830	929,657	0.0054573	356,276	0.0011527	24,488	1,310,421	655.21
	Scurry	0.0001246	0	0.0007646	6,291	0.1298311	8,475,992	0.0000078	166	8,482,449	4241.22
	Taylor*	-	-	-	-	-	-	-	-	-	-
	Titus	-	-	-	-	-	-	-	-	-	-
	Tom Green*	-	-	-	-	-	-	-	-	-	-
	Upton	-	-	-	-	-	-	-	-	-	-
	Ward	0.0000206	0	0.0001265	1,041	0.0214790	1,402,250	0.0000013	27	1,403,318	701.66
	Webb	0.0000253	0	0.0000017	14	0.0000001	5	0.0002020	4,291	4,310	2.16
	Wharton	0.0006585	0	0.0000444	365	0.0000021	140	0.0052594	111,733	112,239	56.12
	Wichita	0.0000051	0	0.0000315	259	0.0053432	348,832	0.0000003	7	349,098	174.55
	Wilbarger	0.0008609	0	0.0052810	43,454	0.8967472	58,543,930	0.0000539	1,145	58,588,528	29294.26
	Wood	-	-	-	-	-	-	-	-	-	-
	Young	0.0000257	0	0.0001578	1,298	0.0267892	1,748,927	0.0000016	34	1,750,260	875.13
	Total	**0.6511636**	**0**	**0.6960434**	**5,727,248**	**1.3352091**	**87,168,813**	**0.9887171**	**21,004,770**	**113,900,830**	**56950.41**
Energy Savings (MWh)		**0**		**8,228,291**		**65,284,764**		**21,244,469**			

Note *: These counties are not quantified because they are not in the ERCOT region.

Table 5-4: Distribution of the Annual Emission Reductions per CL Zone for each County (Year 2022)

Area	County	CL Zones								Total Nox Reductions (lbs)	Total Nox Reductions (Tons)
		H		N		W		S			
Houston-Galveston Area	Brazoria	0.1445243	0	0.0000183	140	0.0000009	63	0.0013540	32,311	32,514	16.2570
	Chambers	0.0232302	0	0.0000029	22	0.0000001	10	0.0002176	5,194	5,226	2.61
	Fort Bend	0.0925360	0	0.0000117	90	0.0000006	40	0.0008669	20,688	20,818	10.41
	Galveston	0.0189140	0	0.0000024	18	0.0000001	8	0.0001772	4,229	4,255	2.13
	Harris	0.1374166	0	0.0000174	133	0.0000008	60	0.0012874	30,722	30,915	15.46
	Liberty*	-	-	-	-	-	-	-	-	-	-
	Montgomery	-	-	-	-	-	-	-	-	-	-
	Waller*	-	-	-	-	-	-	-	-	-	-
Beaumont/ Port Arthur Area	Hardin*	-	-	-	-	-	-	-	-	-	-
	Jefferson*	-	-	-	-	-	-	-	-	-	-
	Orange*	-	-	-	-	-	-	-	-	-	-
Dallas/ Fort Worth Area	Collin	0.0000743	0	0.0004556	3,474	0.0000220	1,567	0.0000046	111	5,152	2.58
	Dallas	0.0019090	0	0.0117105	89,299	0.0005656	40,263	0.0001195	2,851	132,413	66.21
	Denton	0.0066429	0	0.0407509	310,748	0.0019683	140,110	0.0004158	9,922	460,780	230.39
	Henderson	0.0001509	0	0.0009255	7,058	0.0000447	3,182	0.0000094	225	10,465	5.23
	Hood	0.0008451	0	0.0051842	39,532	0.0002504	17,824	0.0000529	1,262	58,619	29.31
	Hunt	0.0000043	0	0.0000263	201	0.0000013	90	0.0000003	6	297	0.15
	Tarrant	0.0004188	0	0.0025693	19,592	0.0001241	8,834	0.0000262	626	29,052	14.53
	Ellis	0.0013349	0	0.0081890	62,446	0.0003955	28,155	0.0000835	1,994	92,595	46.30
	Johnson	0.0002010	0	0.0012332	9,404	0.0000596	4,240	0.0000126	300	13,945	6.97
	Kaufman	0.0034596	0	0.0212228	161,836	0.0010251	72,968	0.0002165	5,167	239,971	119.99
	Parker	0.0005940	0	0.0036438	27,786	0.0001760	12,528	0.0000372	887	41,201	20.60
	Rockwall*	-	-	-	-	-	-	-	-	-	-
	Wise	0.0031300	0	0.0192012	146,420	0.0009275	66,018	0.0001959	4,675	217,113	108.56
El Paso Area	El Paso*	-	-	-	-	-	-	-	-	-	-
San Antonio Area	Bexar	0.0253670	0	0.0017108	13,046	0.0000826	5,882	0.2025905	4,834,580	4,853,508	2426.75
	Comal	0.0005285	0	0.0000356	272	0.0000017	123	0.0042210	100,728	101,123	50.56
	Guadalupe	0.0030546	0	0.0002060	1,571	0.0000100	708	0.0243949	582,154	584,434	292.22
	Wilson	-	-	-	-	-	-	-	-	-	-
Austin Area	Austin	-	-	-	-	-	-	-	-	-	-
	Bastrop	0.0024800	0	0.0001673	1,275	0.0000081	575	0.0198060	472,647	474,498	237.25
	Caldwell*	-	-	-	-	-	-	-	-	-	-
	Hays	0.0004731	0	0.0000319	243	0.0000015	110	0.0037782	90,162	90,515	45.26
	Travis	0.0046184	0	0.0003115	2,375	0.0000150	1,071	0.0368846	880,208	883,654	441.83
	Williamson	-	-	-	-	-	-	-	-	-	-
North East Texas Area	Gregg*	-	-	-	-	-	-	-	-	-	-
	Harrison*	-	-	-	-	-	-	-	-	-	-
	Rusk	0.0322708	0	0.1979648	1,509,593	0.0095620	680,645	0.0020197	48,198	2,238,436	1119.22
	Smith*	-	-	-	-	-	-	-	-	-	-
	Upshur*	-	-	-	-	-	-	-	-	-	-
Corpus Christi Area	Nueces	0.0042426	0	0.0002861	2,182	0.0000138	984	0.0338828	808,572	811,738	405.87
	San Patricio	0.0063692	0	0.0004296	3,276	0.0000207	1,477	0.0508668	1,213,875	1,218,627	609.31
Victoria Area	Victoria	0.0016730	0	0.0001128	860	0.0000054	388	0.0133614	318,853	320,102	160.05
Other ERCOT counties	Anderson	-	-	-	-	-	-	-	-	-	-
	Andrews*	-	-	-	-	-	-	-	-	-	-
	Angelina	-	-	-	-	-	-	-	-	-	-
	Atascosa	0.0077084	0	0.0005199	3,964	0.0000251	1,787	0.0615620	1,469,105	1,474,856	737.43
	Bell	0.0004444	0	0.0027262	20,789	0.0001317	9,373	0.0000278	664	30,826	15.41
	Bosque	0.0007214	0	0.0044257	33,748	0.0002138	15,216	0.0000452	1,078	50,042	25.02
	Brazos	0.0005654	0	0.0034687	26,451	0.0001675	11,926	0.0000354	845	39,221	19.61
	Calhoun	0.0111852	0	0.0007544	5,752	0.0000364	2,594	0.0893292	2,131,734	2,140,080	1070.04
	Cameron	0.0000231	0	0.0000016	12	0.0000001	5	0.0001843	4,399	4,416	2.21
	Cherokee	0.0001844	0	0.0011310	8,625	0.0000546	3,889	0.0000115	275	12,789	6.39
	Coke	0.0000223	0	0.0001365	1,041	0.0231815	1,650,109	0.0000014	33	1,651,183	825.59
	Coleman*	-	-	-	-	-	-	-	-	-	-
	Colorado	0.0016158	0	0.0001090	831	0.0000053	375	0.0129041	307,940	309,146	154.57
	Crockett*	-	-	-	-	-	-	-	-	-	-
	Ector	0.0001338	0	0.0008206	6,258	0.1393442	9,918,803	0.0000084	200	9,925,260	4962.63
	Fannin*	-	-	-	-	-	-	-	-	-	-
	Fayette	0.0204274	0	0.0013777	10,505	0.0000665	4,737	0.1631405	3,893,154	3,908,396	1954.20
	Freestone	0.0042261	0	0.0259247	197,691	0.0012522	89,135	0.0002645	6,312	293,137	146.57
	Frio	0.0097614	0	0.0006583	5,020	0.0000318	2,263	0.0779581	1,860,378	1,867,661	933.83
	Goliad	0.0077047	0	0.0005196	3,962	0.0000251	1,787	0.0615328	1,468,407	1,474,157	737.08
	Grayson	0.0002857	0	0.0017525	13,364	0.0000846	6,025	0.0000179	427	19,816	9.91
	Grimes	0.0029942	0	0.0183678	140,065	0.0008872	63,153	0.0001874	4,472	207,690	103.84
	Hardeman*	-	-	-	-	-	-	-	-	-	-
	Haskell*	-	-	-	-	-	-	-	-	-	-
	Hidalgo	0.0140830	0	0.0009498	7,243	0.0000459	3,266	0.1124720	2,684,011	2,694,519	1347.26
	Hill	-	-	-	-	-	-	-	-	-	-
	Howard	0.0000467	0	0.0002865	2,185	0.0486558	3,463,421	0.0000029	70	3,465,676	1732.84
	Jack*	-	-	-	-	-	-	-	-	-	-
	Jones*	-	-	-	-	-	-	-	-	-	-
	Lamar	0.0031379	0	0.0192492	146,786	0.0009298	66,183	0.0001964	4,687	217,656	108.83
	Limestone	0.0231674	0	0.1421203	1,083,747	0.0068646	488,640	0.0014500	34,602	1,606,988	803.49
	Llano	0.0001855	0	0.0000125	95	0.0000006	43	0.0014818	35,360	35,499	17.75
	McLennan	0.0043688	0	0.0268006	204,369	0.0012945	92,146	0.0002734	6,525	303,040	151.52
	Milam	0.0002486	0	0.0000168	128	0.0000008	58	0.0019850	47,370	47,556	23.78
	Mitchell	0.0000072	0	0.0000443	338	0.0075244	535,599	0.0000005	11	535,948	267.97
	Nacogdoches	0.0002714	0	0.0016647	12,694	0.0000804	5,724	0.0000170	405	18,823	9.41
	Nolan	-	-	-	-	-	-	-	-	-	-
	Palo Pinto	0.0010391	0	0.0063745	48,609	0.0003079	21,917	0.0000650	1,552	72,077	36.04
	Pecos	0.0000029	0	0.0000180	138	0.0030637	218,083	0.0000002	4	218,225	109.11
	Potter	-	-	-	-	-	-	-	-	-	-
	Presidio*	-	-	-	-	-	-	-	-	-	-
	Reagan	-	-	-	-	-	-	-	-	-	-
	Red River	-	-	-	-	-	-	-	-	-	-
	Robertson	0.0184177	0	0.1129830	861,558	0.0054573	388,459	0.0011527	27,508	1,277,525	638.76
	Scurry	0.0001246	0	0.0007646	5,830	0.1298311	9,241,641	0.0000078	186	9,247,657	4623.83
	Taylor*	-	-	-	-	-	-	-	-	-	-
	Titus	-	-	-	-	-	-	-	-	-	-
	Tom Green*	-	-	-	-	-	-	-	-	-	-
	Upton	-	-	-	-	-	-	-	-	-	-
	Ward	0.0000206	0	0.0001265	965	0.0214790	1,528,917	0.0000013	31	1,529,912	764.96
	Webb	0.0000253	0	0.0000017	13	0.0000001	6	0.0002020	4,820	4,839	2.42
	Wharton	0.0006585	0	0.0000444	339	0.0000021	153	0.0052594	125,509	126,001	63.00
	Wichita	0.0000051	0	0.0000315	240	0.0053432	380,343	0.0000003	8	380,590	190.30
	Wilbarger	0.0008609	0	0.0052810	40,271	0.8967472	63,832,285	0.0000539	1,286	63,873,841	31936.92
	Wood	-	-	-	-	-	-	-	-	-	-
	Young	0.0000257	0	0.0001578	1,203	0.0267892	1,906,910	0.0000016	38	1,908,152	954.08
	Total	**0.6511636**	**0**	**0.6960434**	**5,307,721**	**1.3352091**	**95,042,893**	**0.9887171**	**23,594,554**	**123,945,168**	**61972.58**
Energy Savings (MWh)		**0**		**7,625,561**		**71,182,027**		**23,863,807**			

Note *: These counties are not quantified because they are not in the ERCOT region.

Table 5-5: Distribution of the OSP Emission Reductions per CL Zone for each County (Base Year 2018)

Area	County	CL Zones								Total Nox Reductions (lbs)	Total Nox Reductions (Tons)
		H		N		W		S			
Houston-Galveston Area	Brazoria	0.1338985	0	0.0000170	0	0.0000008	0	0.0012544	72	73	0.0363
	Chambers	0.0326319	0	0.0000041	0	0.0000002	0	0.0003057	18	18	0.01
	Fort Bend	0.1028262	0	0.0000130	0	0.0000006	0	0.0009633	55	56	0.03
	Galveston	0.0163861	0	0.0000021	0	0.0000001	0	0.0001535	9	9	0.00
	Harris	0.1329895	0	0.0000169	0	0.0000008	0	0.0012459	72	72	0.04
	Liberty*	-	-	-	-	-	-	-	-	-	-
	Montgomery	-	-	-	-	-	-	-	-	-	-
	Waller*	-	-	-	-	-	-	-	-	-	-
Beaumont/ Port Arthur Area	Hardin*	-	-	-	-	-	-	-	-	-	-
	Jefferson*	-	-	-	-	-	-	-	-	-	-
	Orange*	-	-	-	-	-	-	-	-	-	-
Dallas/ Fort Worth Area	Collin	0.0001333	0	0.0008179	19	0.0000395	7	0.0000083	0	27	0.01
	Dallas	0.0020916	0	0.0128308	298	0.0006198	111	0.0001309	8	417	0.21
	Denton	0.0066363	0	0.0407106	947	0.0019664	354	0.0004153	24	1,324	0.66
	Henderson	0.0002303	0	0.0014128	33	0.0000682	12	0.0000144	1	46	0.02
	Hood	0.0009171	0	0.0056259	131	0.0002717	49	0.0000574	3	183	0.09
	Hunt	0.0000072	0	0.0000443	1	0.0000021	0	0.0000005	0	1	0.00
	Tarrant	0.0006459	0	0.0039625	92	0.0001914	34	0.0000404	2	129	0.06
	Ellis	0.0015545	0	0.0095358	222	0.0004606	83	0.0000973	6	310	0.16
	Johnson	0.0002466	0	0.0015125	35	0.0000731	13	0.0000154	1	49	0.02
	Kaufman	0.0029234	0	0.0179336	417	0.0008662	156	0.0001830	11	583	0.29
	Parker	0.0004755	0	0.0029172	68	0.0001409	25	0.0000298	2	95	0.05
	Rockwall*	-	-	-	-	-	-	-	-	-	-
	Wise	0.0031354	0	0.0192341	447	0.0009290	167	0.0001962	11	626	0.31
El Paso Area	El Paso*	-	-	-	-	-	-	-	-	-	-
San Antonio Area	Bexar	0.0251261	0	0.0016946	39	0.0000819	15	0.2006666	11,528	11,582	5.79
	Comal	0.0003940	0	0.0000266	1	0.0000013	0	0.0031468	181	182	0.09
	Guadalupe	0.0031600	0	0.0002131	5	0.0000103	2	0.0252373	1,450	1,457	0.73
	Wilson	-	-	-	-	-	-	-	-	-	-
Austin Area	Austin	-	-	-	-	-	-	-	-	-	-
	Bastrop	0.0030802	0	0.0002077	5	0.0000100	2	0.0245997	1,413	1,420	0.71
	Caldwell*	-	-	-	-	-	-	-	-	-	-
	Hays	0.0005948	0	0.0000401	1	0.0000019	0	0.0047504	273	274	0.14
	Travis	0.0055911	0	0.0003771	9	0.0000182	3	0.0446524	2,565	2,577	1.29
	Williamson	-	-	-	-	-	-	-	-	-	-
North East Texas Area	Gregg*	-	-	-	-	-	-	-	-	-	-
	Harrison*	-	-	-	-	-	-	-	-	-	-
	Rusk	0.0284443	0	0.1744911	4,058	0.0084282	1,515	0.0017802	102	5,675	2.84
	Smith*	-	-	-	-	-	-	-	-	-	-
	Upshur*	-	-	-	-	-	-	-	-	-	-
Corpus Christi Area	Nueces	0.0041146	0	0.0002775	6	0.0000134	2	0.0328606	1,888	1,897	0.95
	San Patricio	0.0052899	0	0.0003568	8	0.0000172	3	0.0422468	2,427	2,438	1.22
Victoria Area	Victoria	0.0016002	0	0.0001079	3	0.0000052	1	0.0127795	734	738	0.37
Other ERCOT counties	Anderson	-	-	-	-	-	-	-	-	-	-
	Andrews*	-	-	-	-	-	-	-	-	-	-
	Angelina	-	-	-	-	-	-	-	-	-	-
	Atascosa	0.0075430	0	0.0005087	12	0.0000246	4	0.0602409	3,461	3,477	1.74
	Bell	0.0005412	0	0.0033200	77	0.0001604	29	0.0000339	2	108	0.05
	Bosque	0.0007335	0	0.0044996	105	0.0002173	39	0.0000459	3	146	0.07
	Brazos	0.0005896	0	0.0036168	84	0.0001747	31	0.0000369	2	118	0.06
	Calhoun	0.0087907	0	0.0005929	14	0.0000286	5	0.0702058	4,033	4,052	2.03
	Cameron	0.0000245	0	0.0000016	0	0.0000001	0	0.0001954	11	11	0.01
	Cherokee	0.0002513	0	0.0015416	36	0.0000745	13	0.0000157	1	50	0.03
	Coke	0.0000237	0	0.0001452	3	0.0246578	4,433	0.0000015	0	4,437	2.22
	Coleman*	-	-	-	-	-	-	-	-	-	-
	Colorado	0.0015097	0	0.0001018	2	0.0000049	1	0.0120568	693	696	0.35
	Crockett*	-	-	-	-	-	-	-	-	-	-
	Ector	0.0001352	0	0.0008292	19	0.1408089	25,316	0.0000085	0	25,335	12.67
	Fannin*	-	-	-	-	-	-	-	-	-	-
	Fayette	0.0187428	0	0.0012641	29	0.0000611	11	0.1496873	8,599	8,640	4.32
	Freestone	0.0019968	0	0.0122492	285	0.0005917	106	0.0001250	7	398	0.20
	Frio	0.0091204	0	0.0006151	14	0.0000297	5	0.0728387	4,184	4,204	2.10
	Goliad	0.0067193	0	0.0004532	11	0.0000219	4	0.0536627	3,083	3,097	1.55
	Grayson	0.0003257	0	0.0019979	46	0.0000965	17	0.0000204	1	65	0.03
	Grimes	0.0046998	0	0.0288309	670	0.0013926	250	0.0002941	17	938	0.47
	Hardeman*	-	-	-	-	-	-	-	-	-	-
	Haskell*	-	-	-	-	-	-	-	-	-	-
	Hidalgo	0.0130513	0	0.0008802	20	0.0000425	8	0.1042321	5,988	6,016	3.01
	Hill	-	-	-	-	-	-	-	-	-	-
	Howard	0.0000670	0	0.0004110	10	0.0697893	12,547	0.0000042	0	12,557	6.28
	Jack*	-	-	-	-	-	-	-	-	-	-
	Jones*	-	-	-	-	-	-	-	-	-	-
	Lamar	0.0032049	0	0.0196606	457	0.0009496	171	0.0002006	12	639	0.32
	Limestone	0.0211793	0	0.1299244	3,021	0.0062756	1,128	0.0013255	76	4,226	2.11
	Llano	0.0001481	0	0.0000100	0	0.0000005	0	0.0011830	68	68	0.03
	McLennan	0.0040079	0	0.0245863	572	0.0011876	214	0.0002508	14	800	0.40
	Milam	0.0000000	0	0.0000000	0	0.0000000	0	0.0000000	0	0	0.00
	Mitchell	0.0000065	0	0.0000398	1	0.0067613	1,216	0.0000004	0	1,217	0.61
	Nacogdoches	0.0004206	0	0.0025801	60	0.0001246	22	0.0000263	2	84	0.04
	Nolan	-	-	-	-	-	-	-	-	-	-
	Palo Pinto	0.0015001	0	0.0092024	214	0.0004445	80	0.0000939	5	299	0.15
	Pecos	0.0000031	0	0.0000192	0	0.0032590	586	0.0000002	0	586	0.29
	Potter	-	-	-	-	-	-	-	-	-	-
	Presidio*	-	-	-	-	-	-	-	-	-	-
	Reagan	-	-	-	-	-	-	-	-	-	-
	Red River	-	-	-	-	-	-	-	-	-	-
	Robertson	0.0156406	0	0.0959474	2,231	0.0046344	833	0.0009789	56	3,121	1.56
	Scurry	0.0001133	0	0.0006948	16	0.1179741	21,210	0.0000071	0	21,227	10.61
	Taylor*	-	-	-	-	-	-	-	-	-	-
	Titus	-	-	-	-	-	-	-	-	-	-
	Tom Green*	-	-	-	-	-	-	-	-	-	-
	Upton	-	-	-	-	-	-	-	-	-	-
	Ward	0.0000207	0	0.0001271	3	0.0215799	3,880	0.0000013	0	3,883	1.94
	Webb	0.0000313	0	0.0000021	0	0.0000001	0	0.0002498	14	14	0.01
	Wharton	0.0007265	0	0.0000490	1	0.0000024	0	0.0058023	333	335	0.17
	Wichita	0.0000093	0	0.0000571	1	0.0096992	1,744	0.0000006	0	1,745	0.87
	Wilbarger	0.0007609	0	0.0046675	109	0.7925755	142,495	0.0000476	3	142,606	71.30
	Wood	-	-	-	-	-	-	-	-	-	-
	Young	0.0000415	0	0.0002543	6	0.0431818	7,764	0.0000026	0	7,770	3.88
	Total	**0.6378044**	**0**	**0.6440648**	**14,978**	**1.2610464**	**226,720**	**0.9317090**	**53,524**	**295,223**	**147.61**
Energy Savings (MWh)		**0**		**23,256**		**179,788**		**57,447**			

Note *: These counties are not quantified because they are not in the ERCOT region.

Table 5-6: Distribution of the OSP Emission Reductions per CL Zone for each County (Year 2022)

Area	County	CL Zones								Total Nox Reductions (lbs)	Total Nox Reductions (Tons)
		H		N		W		S			
Houston-Galveston Area	Brazoria	0.1338985	0	0.0000170	0	0.0000008	0	0.0012544	83	84	0.0419
	Chambers	0.0326319	0	0.0000041	0	0.0000002	0	0.0003057	20	20	0.01
	Fort Bend	0.1028262	0	0.0000130	0	0.0000006	0	0.0009633	64	64	0.03
	Galveston	0.0163861	0	0.0000021	0	0.0000001	0	0.0001535	10	10	0.01
	Harris	0.1329895	0	0.0000169	0	0.0000008	0	0.0012459	83	83	0.04
	Liberty*	-	-	-	-	-	-	-	-	-	-
	Montgomery	-	-	-	-	-	-	-	-	-	-
	Waller*	-	-	-	-	-	-	-	-	-	-
Beaumont/ Port Arthur Area	Hardin*	-	-	-	-	-	-	-	-	-	-
	Jefferson*	-	-	-	-	-	-	-	-	-	-
	Orange*	-	-	-	-	-	-	-	-	-	-
Dallas/ Fort Worth Area	Collin	0.0001333	0	0.0008179	15	0.0000395	7	0.0000083	1	23	0.01
	Dallas	0.0020916	0	0.0128308	236	0.0006198	114	0.0001309	9	359	0.18
	Denton	0.0066363	0	0.0407106	750	0.0019664	362	0.0004153	28	1,140	0.57
	Henderson	0.0002303	0	0.0014128	26	0.0000682	13	0.0000144	1	40	0.02
	Hood	0.0009171	0	0.0056259	104	0.0002717	50	0.0000574	4	158	0.08
	Hunt	0.0000072	0	0.0000443	1	0.0000021	0	0.0000005	0	1	0.00
	Tarrant	0.0006459	0	0.0039625	73	0.0001914	35	0.0000404	3	111	0.06
	Ellis	0.0015545	0	0.0095358	176	0.0004606	85	0.0000973	6	267	0.13
	Johnson	0.0002466	0	0.0015125	28	0.0000731	13	0.0000154	1	42	0.02
	Kaufman	0.0029234	0	0.0179336	330	0.0008662	160	0.0001830	12	502	0.25
	Parker	0.0004755	0	0.0029172	54	0.0001409	26	0.0000298	2	82	0.04
	Rockwall*	-	-	-	-	-	-	-	-	-	-
	Wise	0.0031354	0	0.0192341	354	0.0009290	171	0.0001962	13	539	0.27
El Paso Area	El Paso*	-	-	-	-	-	-	-	-	-	-
San Antonio Area	Bexar	0.0251261	0	0.0016946	31	0.0000819	15	0.2006666	13,338	13,384	6.69
	Comal	0.0003940	0	0.0000266	0	0.0000013	0	0.0031468	209	210	0.10
	Guadalupe	0.0031600	0	0.0002131	4	0.0000103	2	0.0252373	1,677	1,683	0.84
	Wilson	-	-	-	-	-	-	-	-	-	-
Austin Area	Austin	-	-	-	-	-	-	-	-	-	-
	Bastrop	0.0030802	0	0.0002077	4	0.0000100	2	0.0245997	1,635	1,641	0.82
	Caldwell*	-	-	-	-	-	-	-	-	-	-
	Hays	0.0005948	0	0.0000401	1	0.0000019	0	0.0047504	316	317	0.16
	Travis	0.0055911	0	0.0003771	7	0.0000182	3	0.0446524	2,968	2,978	1.49
	Williamson	-	-	-	-	-	-	-	-	-	-
North East Texas Area	Gregg*	-	-	-	-	-	-	-	-	-	-
	Harrison*	-	-	-	-	-	-	-	-	-	-
	Rusk	0.0284443	0	0.1744911	3,215	0.0084282	1,552	0.0017802	118	4,886	2.44
	Smith*	-	-	-	-	-	-	-	-	-	-
	Upshur*	-	-	-	-	-	-	-	-	-	-
Corpus Christi Area	Nueces	0.0041146	0	0.0002775	5	0.0000134	2	0.0328606	2,184	2,192	1.10
	San Patricio	0.0052899	0	0.0003568	7	0.0000172	3	0.0422468	2,808	2,818	1.41
Victoria Area	Victoria	0.0016002	0	0.0001079	2	0.0000052	1	0.0127795	849	852	0.43
Other ERCOT counties	Anderson	-	-	-	-	-	-	-	-	-	-
	Andrews*	-	-	-	-	-	-	-	-	-	-
	Angelina	-	-	-	-	-	-	-	-	-	-
	Atascosa	0.0075430	0	0.0005087	9	0.0000246	5	0.0602409	4,004	4,018	2.01
	Bell	0.0005412	0	0.0033200	61	0.0001604	30	0.0000339	2	93	0.05
	Bosque	0.0007335	0	0.0044996	83	0.0002173	40	0.0000459	3	126	0.06
	Brazos	0.0005896	0	0.0036168	67	0.0001747	32	0.0000369	2	101	0.05
	Calhoun	0.0087907	0	0.0005929	11	0.0000286	5	0.0702058	4,667	4,683	2.34
	Cameron	0.0000245	0	0.0000016	0	0.0000001	0	0.0001954	13	13	0.01
	Cherokee	0.0002513	0	0.0015416	28	0.0000745	14	0.0000157	1	43	0.02
	Coke	0.0000237	0	0.0001452	3	0.0246578	4,542	0.0000015	0	4,544	2.27
	Coleman*	-	-	-	-	-	-	-	-	-	-
	Colorado	0.0015097	0	0.0001018	2	0.0000049	1	0.0120568	801	804	0.40
	Crockett*	-	-	-	-	-	-	-	-	-	-
	Ector	0.0001352	0	0.0008292	15	0.1408089	25,934	0.0000085	1	25,950	12.98
	Fannin*	-	-	-	-	-	-	-	-	-	-
	Fayette	0.0187428	0	0.0012641	23	0.0000611	11	0.1496873	9,950	9,984	4.99
	Freestone	0.0019968	0	0.0122492	226	0.0005917	109	0.0001250	8	343	0.17
	Frio	0.0091204	0	0.0006151	11	0.0000297	5	0.0728387	4,842	4,858	2.43
	Goliad	0.0067193	0	0.0004532	8	0.0000219	4	0.0536627	3,567	3,579	1.79
	Grayson	0.0003257	0	0.0019979	37	0.0000965	18	0.0000204	1	56	0.03
	Grimes	0.0046998	0	0.0288309	531	0.0013926	256	0.0002941	20	807	0.40
	Hardeman*	-	-	-	-	-	-	-	-	-	-
	Haskell*	-	-	-	-	-	-	-	-	-	-
	Hidalgo	0.0130513	0	0.0008802	16	0.0000425	8	0.1042321	6,928	6,952	3.48
	Hill	-	-	-	-	-	-	-	-	-	-
	Howard	0.0000670	0	0.0004110	8	0.0697893	12,854	0.0000042	0	12,862	6.43
	Jack*	-	-	-	-	-	-	-	-	-	-
	Jones*	-	-	-	-	-	-	-	-	-	-
	Lamar	0.0032049	0	0.0196606	362	0.0009496	175	0.0002006	13	550	0.28
	Limestone	0.0211793	0	0.1299244	2,394	0.0062756	1,156	0.0013255	88	3,638	1.82
	Llano	0.0001481	0	0.0000100	0	0.0000005	0	0.0011830	79	79	0.04
	McLennan	0.0040079	0	0.0245863	453	0.0011876	219	0.0002508	17	688	0.34
	Milam	0.0000000	0	0.0000000	0	0.0000000	0	0.0000000	0	0	0.00
	Mitchell	0.0000065	0	0.0000398	1	0.0067613	1,245	0.0000004	0	1,246	0.62
	Nacogdoches	0.0004206	0	0.0025801	48	0.0001246	23	0.0000263	2	72	0.04
	Nolan	-	-	-	-	-	-	-	-	-	-
	Palo Pinto	0.0015001	0	0.0092024	170	0.0004445	82	0.0000939	6	258	0.13
	Pecos	0.0000031	0	0.0000192	0	0.0032590	600	0.0000002	0	601	0.30
	Potter	-	-	-	-	-	-	-	-	-	-
	Presidio*	-	-	-	-	-	-	-	-	-	-
	Reagan	-	-	-	-	-	-	-	-	-	-
	Red River	-	-	-	-	-	-	-	-	-	-
	Robertson	0.0156406	0	0.0959474	1,768	0.0046344	854	0.0009789	65	2,686	1.34
	Scurry	0.0001133	0	0.0006948	13	0.1179741	21,729	0.0000071	0	21,742	10.87
	Taylor*	-	-	-	-	-	-	-	-	-	-
	Titus	-	-	-	-	-	-	-	-	-	-
	Tom Green*	-	-	-	-	-	-	-	-	-	-
	Upton	-	-	-	-	-	-	-	-	-	-
	Ward	0.0000207	0	0.0001271	2	0.0215799	3,975	0.0000013	0	3,977	1.99
	Webb	0.0000313	0	0.0000021	0	0.0000001	0	0.0002498	17	17	0.01
	Wharton	0.0007265	0	0.0000490	1	0.0000024	0	0.0058023	386	387	0.19
	Wichita	0.0000093	0	0.0000571	1	0.0096992	1,786	0.0000006	0	1,788	0.89
	Wilbarger	0.0007609	0	0.0046675	86	0.7925755	145,978	0.0000476	3	146,067	73.03
	Wood	-	-	-	-	-	-	-	-	-	-
	Young	0.0000415	0	0.0002543	5	0.0431818	7,953	0.0000026	0	7,958	3.98
	Total	**0.6378044**	**0**	**0.6440648**	**11,866**	**1.2610464**	**232,261**	**0.9317090**	**61,930**	**306,057**	**153.03**
Energy Savings (MWh)		**0**		**18,424**		**184,181**		**66,469**			

Note *: These counties are not quantified because they are not in the ERCOT region.

6 OTHER RENEWABLE SOURCES

Five specific renewable sources were determined: solar, biomass, hydroelectric, geothermal, and landfill gas-fired, to generate energy throughout the State of Texas, six types of renewable energy projects were identified: solar photovoltaic (PV), including the non-utility scale and utility-scale solar PV, solar thermal, biomass power, hydroelectric power, geothermal HVAC, and landfill gas-fired power projects. The generated, avoided, and used energy from renewable energy projects impacts emissions reductions throughout the State of Texas. To determine the amount of NOx emission reductions using 2018 eGRID, this report collected installation and/or generation data of renewable energy projects. The majority of the collected data were after the year 2000. However, projects before the year 2000 were also included in order to provide a complete record.

6.1 Implementation

This report included a lot of newly located renewable energy projects in the six renewable energy projects categories, as already discussed. The information was collected using the following modes:

- information from the internet websites of manufacturers, distributors, and consultants related to renewable energy products;
- some information was collected by personally emailing individuals, who were either manufacturers, distributors or consultants; and
- information published from environmental agencies like the Electric Reliability Council of Texas (ERCOT), the Environmental Protection Agency (EPA), U.S. Energy Information Administration (EIA), and Lawrence Berkeley National Laboratory (LBNL) which are available to the general public.

It was mainly the same methodology/protocol followed for data collection used in the previous report. Most of the information collected from websites was very limited since the information did not include detailed project information such as system specifications data. To obtain more information, we emailed manufacturers, consultants, distributors, or officers in environmental agencies. Unfortunately, we were not able to take many responses back from the people whom we contacted. Therefore, most of the updated information in the present report was obtained from environmental agencies like ERCOT, EPA, EIA, and LBNL.

The present report data for non-utility scale solar PV projects throughout the State of Texas were identified from the *Tracking the Sun* public database of the Lawrence Berkeley National Laboratory (LBNL 2023). The three other utility-scale renewable resources (i.e., solar power, biomass, and hydroelectricity) were obtained from the Electric Reliability Council of Texas (ERCOT) and the U.S. Energy Information Administration (EIA). The solar thermal projects and geothermal projects throughout the State of Texas were identified from various web sources. The information for the landfill gas-fired power plant section was provided by the Environmental Protection Agency's (EPA's) project database for Landfill Methane Outreach Program (LMOP).

To determine energy savings from solar photovoltaic, solar thermal, biomass, and hydroelectric, the generated energy was calculated in electricity and electricity equivalent. Then, NOx emission reductions throughout the State of Texas were evaluated based on the generated energy. To determine NOx emission reductions, the 2018 eGRID version was used. Figure 6-1 presents the work process to implement the analysis of other renewable resources, including steps: project classification, data collection, data preparation, NOx emission reductions calculation, and result production.

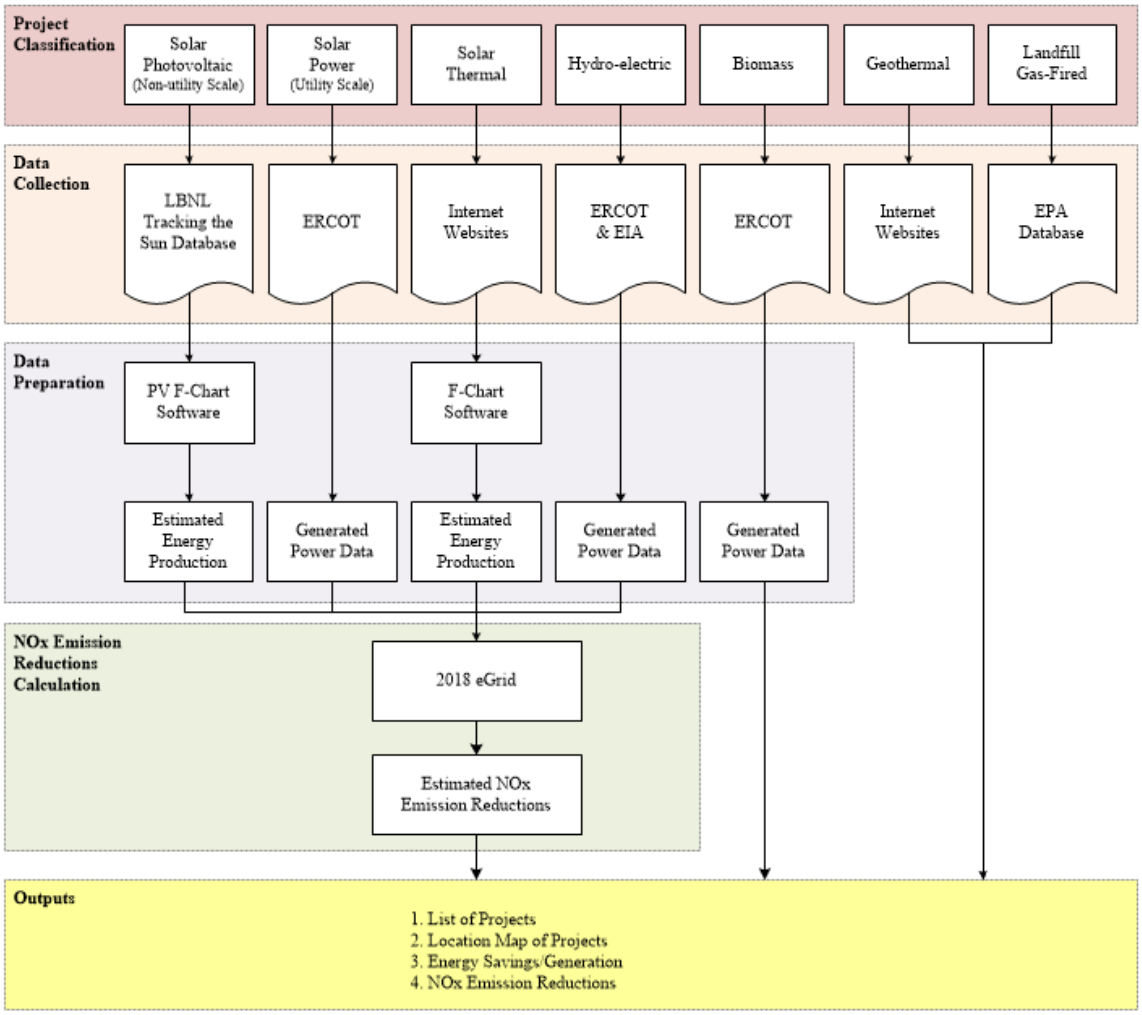


Figure 6-1: Chart of Workflow for Other Renewable Energy Projects

6.2 Renewable Energy Projects

6.2.1 Solar Photovoltaic

The section of 6.2.1 Solar Photovoltaic included two different scales of solar PV projects in Texas, including: the non-utility scale solar PV projects and the utility-scale solar PV projects. The non-utility scale solar PV projects included the residential PV systems and non-residential PV systems in Texas (i.e., roof-mounted systems of any size and ground-mounted systems up to 5 MW_{AC}). On the other hand, the utility-scale solar PV projects only included solar power farm projects in Texas.

6.2.1.1 Non-Utility Scale Solar Photovoltaic

As of the end of 2022, a total of 63,671 projects (non-utility scale) were found. These data were collected from the *Tracking the Sun* public database of the Lawrence Berkeley National Laboratory (LBNL). The new database from Tracking the Sun provides information about solar PV projects that have been implemented since 2004. The database includes individual solar PV projects (non-utility scale) of residential and non-residential in Texas. Also, it provides detailed information, such as zip code, system size (kW DC), system efficiency, total installed cost, installed date and location. All of the solar PV projects identified in this report can be found in Table F-1 (Vol II, Appendix F).

The generated energy from all the solar PV projects, that have information on which county they were installed in, is presented in Table 6-1. Table 6-1 shows the annual and OSP energy savings from non-utility scale solar PV projects were 764,231 MWh/yr and 2,363 MWh/day, respectively. Figure 6-2 shows the map of the solar PV projects installed in each county of Texas. In addition, Table 6-2 provides detailed information about Figure 6-2, including: county name, FIPS code, number of solar PV projects and total installed capacity for each county. Table 6-2 also shows that the total number and total installed capacity of non-utility scale solar PV projects, that can be identified in which county they were installed, were 48,147 and 480,523 kW, respectively. The annual electric generations per county and the OSP electric generations per county, which were estimated from these projects, are presented in Figure 6-3 and in Figure 6-4. Please note that Figure 6-3 is presented using a logarithmic scale for the electricity generation because of the large variation in the amounts shown. Lastly, the corresponding annual NOx emission reductions are shown in Figure 6-5, which is also presented using a logarithmic scale for the annual NOx emission reductions because of the large variation in the amounts shown.

To improve the accuracy of the current calculation methods, this report recalculated the weighted solar PV efficiencies based on *2022 Tracking the Sun* data. Using the PV F-Chart software, the annual solar generation coefficients and OSP solar generation coefficients were recomputed using forty TMY3 weather stations to estimate annual and OSP solar PV generations by county. Also, the target counties were expanded from the previous 41 counties to 254 counties to treat entire regions across Texas.

Table 6-1: Solar Photovoltaic Projects: Annual Energy and OSP Energy through 2022

County	Annual Elec. Generation (MWh/year)	OSP Elec. Generation (MWh/Day)	County	Annual Elec. Generation (MWh/year)	OSP Elec. Generation (MWh/Day)
Anderson	31.8	0.10	Crockett	-	-
Andrews	-	-	Crosby	-	-
Angelina	92.1	0.28	Culberson	-	-
Aransas	93.6	0.33	Dallam	-	-
Archer	243.9	0.72	Dallas	5,265.9	15.76
Armstrong	-	-	Dawson	-	-
Atascosa	2,080.1	6.33	Deaf Smith	-	-
Austin	-	-	Delta	-	-
Bailey	-	-	Denton	740.9	2.22
Bandera	-	-	De Witt	-	-
Bastrop	-	-	Dickens	-	-
Baylor	-	-	Dimmit	-	-
Bee	4.5	0.01	Donley	-	-
Bell	452.9	1.41	Duval	25.7	0.09
Bexar	549,432.3	1,673.20	Eastland	33.6	0.10
Blanco	303.4	1.00	Ector	70.5	0.20
Borden	-	-	Edwards	-	-
Bosque	41.3	0.13	Ellis	459.5	1.38
Bowie	195.3	0.63	El Paso	5,997.9	16.85
Brazoria	17.0	0.06	Erath	17.0	0.05
Brazos	-	-	Falls	10.2	0.03
Brewster	432.7	1.24	Fannin	15.7	0.05
Briscoe	-	-	Fayette	-	-
Brooks	-	-	Fisher	-	-
Brown	100.5	0.29	Floyd	-	-
Burleson	-	-	Foard	-	-
Burnet	17.2	0.06	Fort Bend	-	-
Caldwell	13.6	0.04	Franklin	6.2	0.02
Calhoun	-	-	Freestone	-	-
Callahan	237.0	0.69	Frio	7.5	0.02
Cameron	1,695.4	5.36	Gaines	-	-
Camp	-	-	Galveston	108.0	0.35
Carson	-	-	Garza	-	-
Cass	48.4	0.16	Gillespie	-	-
Castro	-	-	Glasscock	-	-
Chambers	-	-	Goliad	42.4	0.13
Cherokee	104.3	0.31	Gonzales	-	-
Childress	-	-	Gray	-	-
Clay	53.3	0.16	Grayson	130.4	0.42
Cochran	-	-	Gregg	329.9	1.06
Coke	-	-	Grimes	19.9	0.06
Coleman	18.7	0.05	Guadalupe	11,967.5	36.45
Collin	1,053.1	3.38	Hale	23.8	0.07
Collingsworth	-	-	Hall	-	-
Colorado	37.9	0.12	Hamilton	20.1	0.06
Comal	8,540.3	26.01	Hansford	-	-
Comanche	-	-	Hardeman	-	-
Concho	-	-	Hardin	30.1	0.09
Cooke	136.6	0.41	Harris	34.7	0.10
Coryell	15.6	0.05	Harrison	23.4	0.08
Cottle	-	-	Hartley	-	-
Crane	-	-	Haskell	18.6	0.05

Table 6-1: Solar Photovoltaic Projects: Annual Energy and OSP Energy through 2022 (Continued)

County	Annual Elec. Generation (MWh/year)	OSP Elec. Generation (MWh/Day)
Hays	-	-
Hemphill	-	-
Henderson	67.6	0.20
Hidalgo	3,875.1	12.42
Hill	4.0	0.01
Hockley	-	-
Hood	20.5	0.06
Hopkins	407.2	1.31
Houston	-	-
Howard	363.6	1.03
Hudspeth	-	-
Hunt	64.6	0.21
Hutchinson	-	-
Irion	-	-
Jack	-	-
Jackson	14.8	0.05
Jasper	-	-
Jeff Davis	132.0	0.38
Jefferson	42.7	0.13
Jim Hogg	5.9	0.02
Jim Wells	588.4	1.99
Johnson	143.9	0.43
Jones	74.4	0.22
Karnes	13.6	0.04
Kaufman	41.8	0.13
Kendall	9,651.5	29.39
Kenedy	-	-
Kent	-	-
Kerr	-	-
Kimble	83.8	0.24
King	-	-
Kinney	-	-
Kleberg	44.3	0.15
Knox	78.0	0.24
Lamar	208.3	0.70
Lamb	-	-
Lampasas	-	-
La Salle	10.2	0.03
Lavaca	-	-
Lee	-	-
Leon	27.5	0.08
Liberty	-	-
Limestone	16.4	0.05
Lipscomb	-	-
Live Oak	-	-
Llano	-	-
Loving	-	-
Lubbock	-	-
Lynn	-	-
McCulloch	-	-
McLennan	1,009.6	3.08
McMullen	-	-
Madison	-	-
Marion	-	-
Martin	-	-
Mason	-	-
Matagorda	62.2	0.18
Maverick	109.1	0.33
Medina	2,899.8	9.68
Menard	-	-
Midland	174.9	0.50
Milam	-	-
Mills	-	-
Mitchell	-	-
Montague	6.6	0.02
Montgomery	261.8	0.78
Moore	-	-
Morris	23.4	0.08
Motley	-	-
Nacogdoches	-	-
Navarro	31.0	0.09
Newton	-	-
Nolan	18.1	0.05
Nueces	948.9	3.00
Ochiltree	-	-
Oldham	-	-
Orange	124.9	0.38
Palo Pinto	8.6	0.02
Panola	32.0	0.11
Parker	80.7	0.23
Parmer	-	-
Pecos	43.5	0.12
Polk	-	-
Potter	-	-
Presidio	563.2	1.62
Rains	-	-
Randall	-	-
Reagan	-	-
Real	34.4	0.12
Red River	61.3	0.18
Reeves	101.4	0.29
Refugio	-	-
Roberts	-	-
Robertson	6.8	0.02
Rockwall	91.7	0.29
Runnels	16.9	0.05
Rusk	40.7	0.13
Sabine	-	-
San Augustine	-	-
San Jacinto	-	-
San Patricio	36.6	0.12
San Saba	-	-
Schleicher	34.9	0.10
Scurry	-	-
Shackelford	63.1	0.18
Shelby	-	-
Sherman	-	-
Smith	266.2	0.80
Somervell	-	-
Starr	115.1	0.37
Stephens	-	-
Sterling	-	-
Stonewall	-	-
Sutton	-	-
Swisher	-	-
Tarrant	3,536.6	10.59
Taylor	432.4	1.26
Terrell	-	-
Terry	-	-
Throckmorton	-	-
Titus	-	-
Tom Green	950.1	2.75
Travis	141,332.7	465.62
Trinity	15.1	0.05
Tyler	24.6	0.08
Upshur	9.0	0.03
Upton	-	-
Uvalde	11.7	0.04
Val Verde	22.0	0.07
Van Zandt	39.6	0.13
Victoria	8.8	0.03
Walker	32.0	0.10
Waller	13.8	0.04
Ward	-	-
Washington	-	-
Webb	2,106.4	6.47
Wharton	10.5	0.03
Wheeler	-	-
Wichita	410.7	1.22
Wilbarger	134.3	0.40
Willacy	38.6	0.12
Williamson	876.4	2.90
Wilson	51.7	0.16
Winkler	2.3	0.01
Wise	-	-
Wood	15.4	0.05
Yoakum	-	-
Young	16.0	0.05
Zapata	-	-
Zavala	-	-
Total	**764,231**	**2,363**

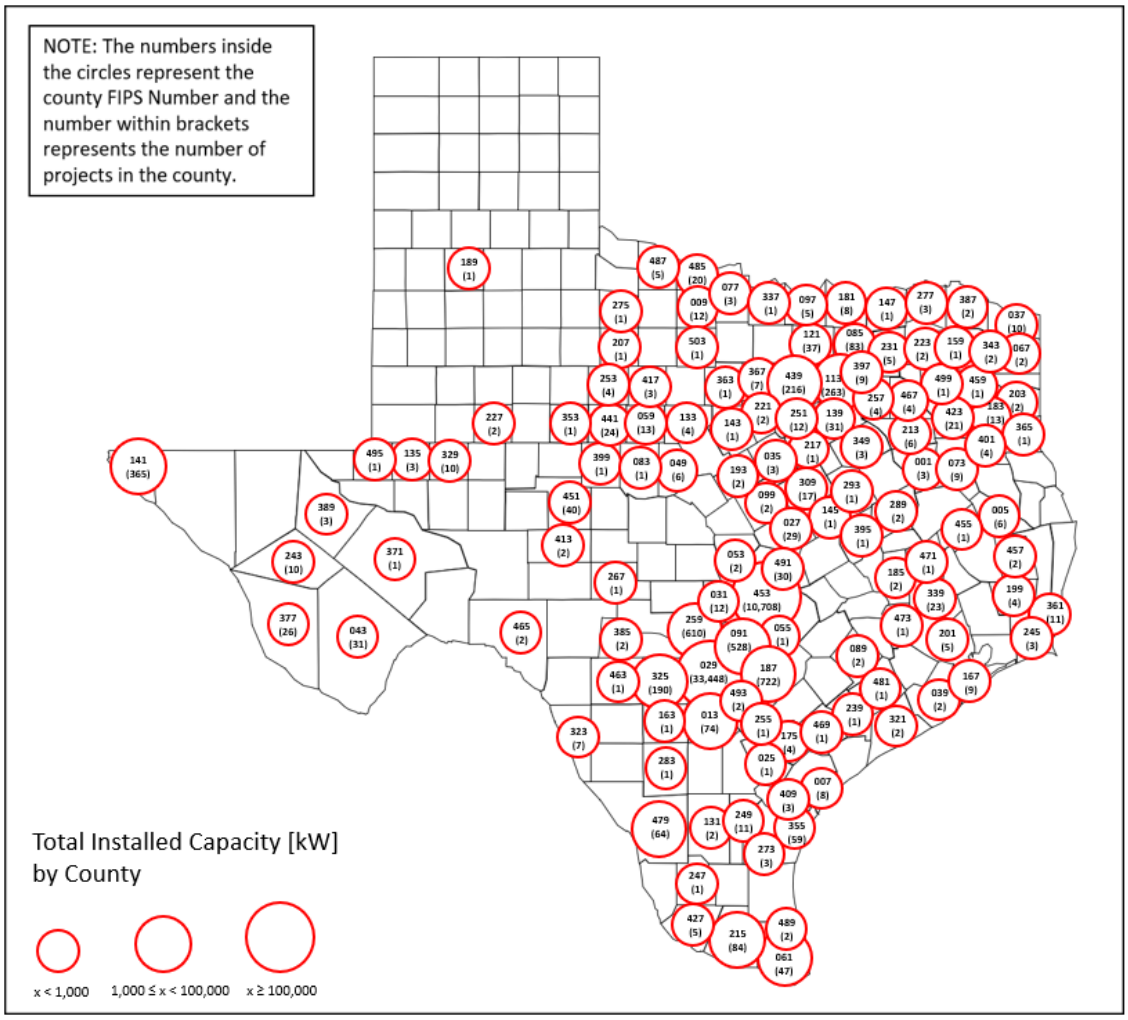


Figure 6-2: Map of Non-Utility Solar PV Projects Installed in Each County of Texas through 2022

Table 6-2: Texas Non-Utility Solar Photovoltaic Projects up to 2022

County	FIPS Code	No. of Projects	Total Installed Capacity (kW)
Anderson	001	3	21
Andrews	003	0	0
Angelina	005	6	62
Aransas	007	8	64
Archer	009	12	142
Armstrong	011	0	0
Atascosa	013	74	1,267
Austin	015	0	0
Bailey	017	0	0
Bandera	019	0	0
Bastrop	021	0	0
Baylor	023	0	0
Bee	025	1	3
Bell	027	29	282
Bexar	029	33,451	333,368
Blanco	031	12	211
Borden	033	0	0
Bosque	035	3	25
Bowie	037	10	130
Brazoria	039	2	12
Brazos	041	0	0
Brewster	043	31	207
Briscoe	045	0	0
Brooks	047	0	0
Brown	049	6	56
Burleson	051	0	0
Burnet	053	2	11
Caldwell	055	1	9
Calhoun	057	0	0
Callahan	059	13	133
Cameron	061	47	1,181
Camp	063	0	0
Carson	065	0	0
Cass	067	2	32
Castro	069	0	0
Chambers	071	0	0
Cherokee	073	9	69
Childress	075	0	0
Clay	077	3	31
Cochran	079	0	0
Coke	081	0	0
Coleman	083	1	11
Collin	085	83	714
Collingsworth	087	0	0
Colorado	089	2	26
Comal	091	528	5,165
Comanche	093	0	0
Concho	095	0	0
Cooke	097	5	82
Coryell	099	2	10

County	FIPS Code	No. of Projects	Total Installed Capacity (kW)
Cottle	101	0	0
Crane	103	0	0
Crockett	105	0	0
Crosby	107	0	0
Culberson	109	0	0
Dallam	111	0	0
Dallas	113	263	3,161
Dawson	115	0	0
Deaf Smith	117	0	0
Delta	119	0	0
Denton	121	37	445
De Witt	123	0	0
Dickens	125	0	0
Dimmit	127	0	0
Donley	129	0	0
Duval	131	2	18
Eastland	133	4	21
Ector	135	3	38
Edwards	137	0	0
Ellis	139	31	2,909
El Paso	141	365	2,909
Erath	143	1	11
Falls	145	1	6
Fannin	147	1	10
Fayette	149	0	0
Fisher	151	0	0
Floyd	153	0	0
Foard	155	0	0
Fort Bend	157	0	0
Franklin	159	1	4
Freestone	161	0	0
Frio	163	1	5
Gaines	165	0	0
Galveston	167	9	77
Garza	169	0	0
Gillespie	171	0	0
Glasscock	173	0	0
Goliad	175	4	29
Gonzales	177	0	0
Gray	179	0	0
Grayson	181	8	88
Gregg	183	13	219
Grimes	185	2	14
Guadalupe	187	722	7,303
Hale	189	1	13
Hall	191	0	0
Hamilton	193	2	13
Hansford	195	0	0
Hardeman	197	0	0
Hardin	199	4	21

Table 6-2: Texas Non-Utility Solar Photovoltaic Projects up to 2022 (Continued)

County	FIPS Code	No. of Projects	Total Installed Capacity (kW)
Harris	201	5	24
Harrison	203	2	16
Hartley	205	0	0
Haskell	207	1	10
Hays	209	0	0
Hemphill	211	0	0
Henderson	213	6	45
Hidalgo	215	84	2,648
Hill	217	1	2
Hockley	219	0	0
Hood	221	2	13
Hopkins	223	2	276
Houston	225	0	0
Howard	227	2	194
Hudspeth	229	0	0
Hunt	231	5	44
Hutchinson	233	0	0
Irion	235	0	0
Jack	237	0	0
Jackson	239	1	10
Jasper	241	0	0
Jeff Davis	243	10	63
Jefferson	245	3	30
Jim Hogg	247	1	4
Jim Wells	249	11	412
Johnson	251	12	86
Jones	253	4	42
Karnes	255	1	8
Kaufman	257	4	28
Kendall	259	610	5,855
Kenedy	261	0	0
Kent	263	0	0
Kerr	265	0	0
Kimble	267	1	47
King	269	0	0
Kinney	271	0	0
Kleberg	273	3	31
Knox	275	1	46
Lamar	277	3	135
Lamb	279	0	0
Lampasas	281	0	0
La Salle	283	1	46
Lavaca	285	0	0
Lee	287	0	0
Leon	289	2	20
Liberty	291	0	0
Limestone	293	1	10
Lipscomb	295	0	0
Live Oak	297	0	0
Llano	299	0	0
Loving	301	0	0
Lubbock	303	0	0
Lynn	305	0	0
McCulloch	307	0	70
McLennan	309	17	70
McMullen	311	0	70
Madison	313	0	0
Marion	315	0	0
Martin	317	0	0
Mason	319	0	0
Matagorda	321	2	45
Maverick	323	7	70
Medina	325	190	1,989
Menard	327	0	0
Midland	329	10	93
Milam	331	0	0
Mills	333	0	0
Mitchell	335	0	0
Montague	337	1	4
Montgomery	339	23	184
Moore	341	0	0
Morris	343	2	16
Motley	345	0	0
Nacogdoches	347	0	0
Navarro	349	3	19
Newton	351	0	0
Nolan	353	1	10
Nueces	355	59	672
Ochiltree	357	0	0
Oldham	359	0	0
Orange	361	11	86
Palo Pinto	363	1	5
Panola	365	1	22
Parker	367	7	51
Parmer	369	0	0
Pecos	371	1	23
Polk	373	0	0
Potter	375	0	0
Presidio	377	26	269
Rains	379	0	0
Randall	381	0	0
Reagan	383	0	0
Real	385	2	24
Red River	387	2	45
Reeves	389	3	55
Refugio	391	0	0
Roberts	393	0	0
Robertson	395	1	5
Rockwall	397	9	62
Runnels	399	1	9

Table 6-2: Texas Non-Utility Solar Photovoltaic Projects up to 2022 (Continued)

County	FIPS Code	No. of Projects	Total Installed Capacity (kW)
Rusk	401	4	27
Sabine	403	0	0
San Augustine	405	0	0
San Jacinto	407	0	0
San Patricio	409	3	26
San Saba	411	0	0
Schleicher	413	2	20
Scurry	415	0	0
Shackelford	417	3	35
Shelby	419	0	0
Sherman	421	0	0
Smith	423	21	175
Somervell	425	0	0
Starr	427	5	79
Stephens	429	0	0
Sterling	431	0	0
Stonewall	433	0	0
Sutton	435	0	0
Swisher	437	0	0
Tarrant	439	216	2,123
Taylor	441	24	242
Terrell	443	0	0
Terry	445	0	0
Throckmorton	447	0	0
Titus	449	0	0
Tom Green	451	40	531
Travis	453	10,708	100,097
Trinity	455	1	10
Tyler	457	2	16
Upshur	459	1	6
Upton	461	0	0
Uvalde	463	1	8
Val Verde	465	2	15
Van Zandt	467	4	27
Victoria	469	1	6
Walker	471	1	23
Waller	473	1	10
Ward	475	0	0
Washington	477	0	0
Webb	479	64	1,345
Wharton	481	1	8
Wheeler	483	0	0
Wichita	485	20	239
Wilbarger	487	5	78
Willacy	489	2	27
Williamson	491	30	547
Wilson	493	2	32
Winkler	495	1	1
Wise	497	0	0
Wood	499	1	10
Yoakum	501	0	0
Young	503	1	10
Zapata	505	0	0
Zavala	507	0	0
Total		**48,147**	**480,523**

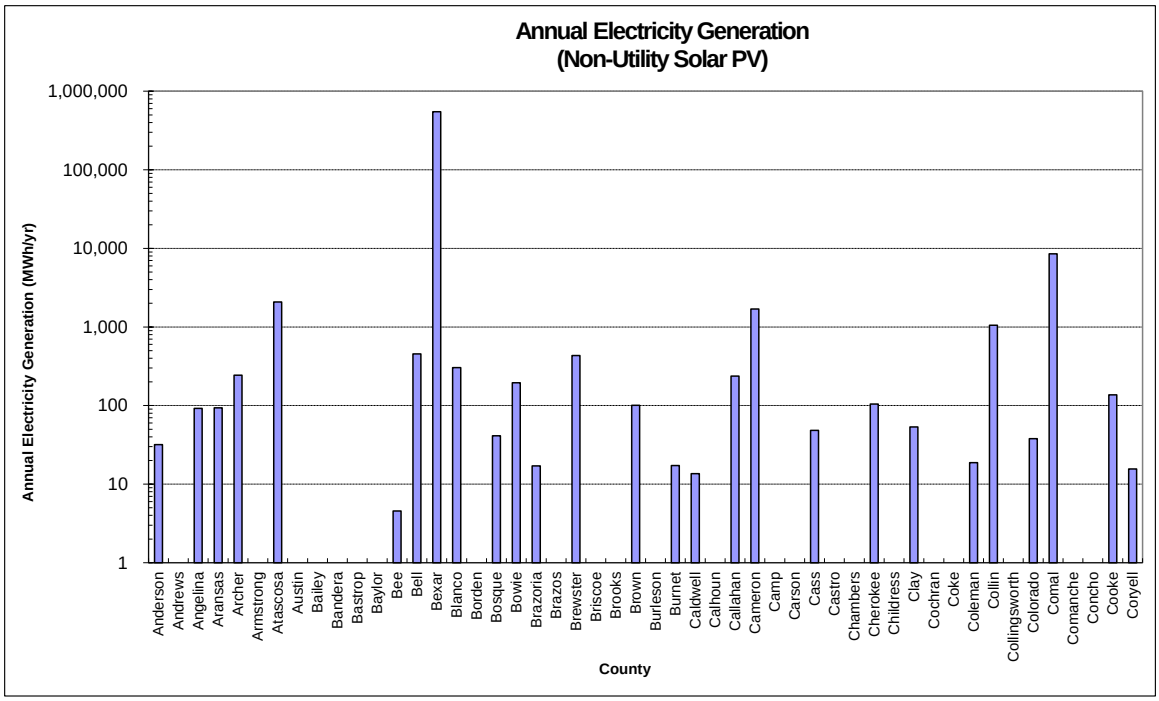


Figure 6-3: Annual Electricity Generation per County from Solar Photovoltaic Projects through 2022

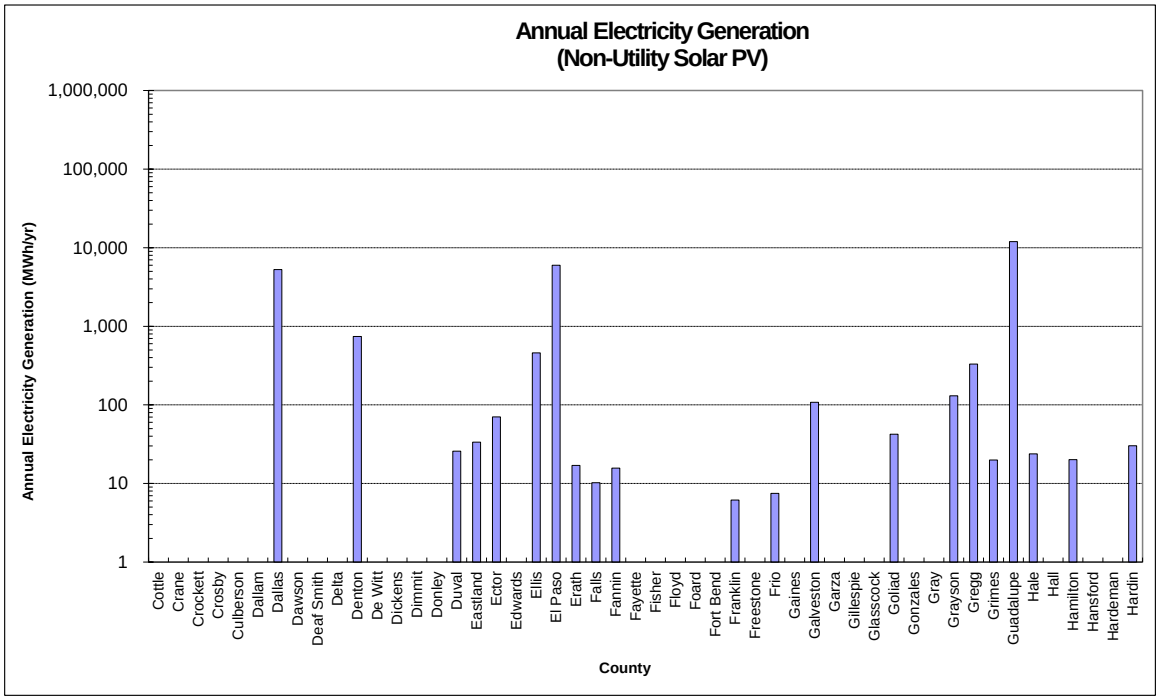


Figure 6-3: Annual Electricity Generation per County from Solar Photovoltaic Projects through 202 (Continued)

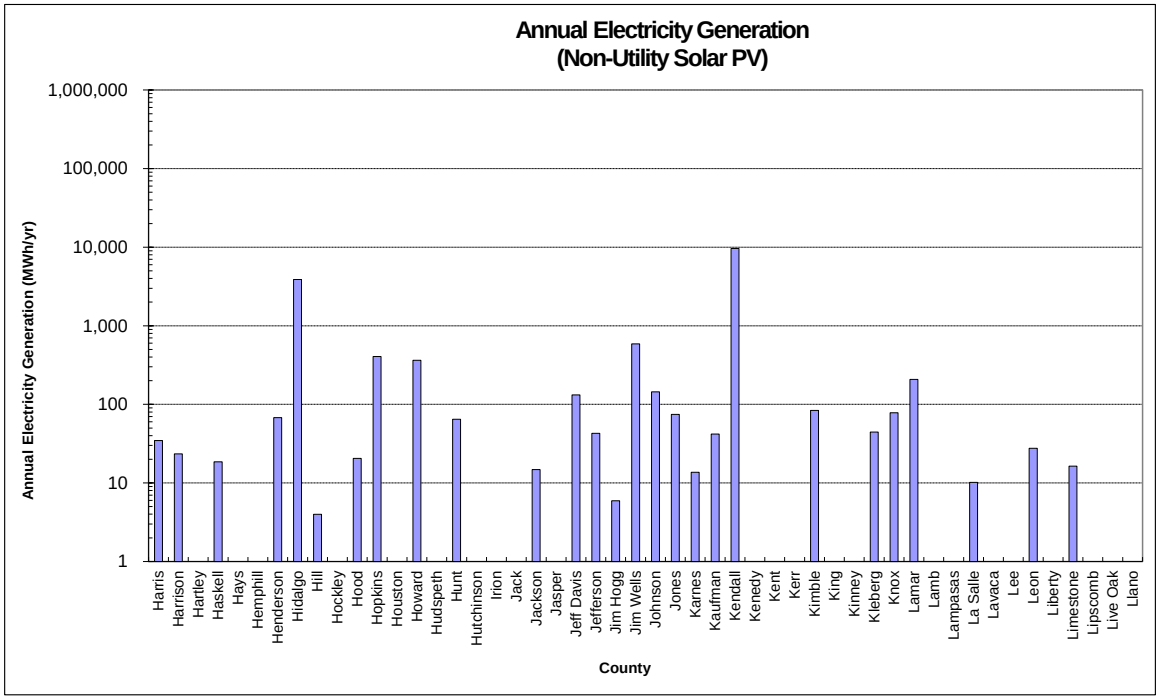


Figure 6-3: Annual Electricity Generation per County from Solar Photovoltaic Projects through 202 (Continued)

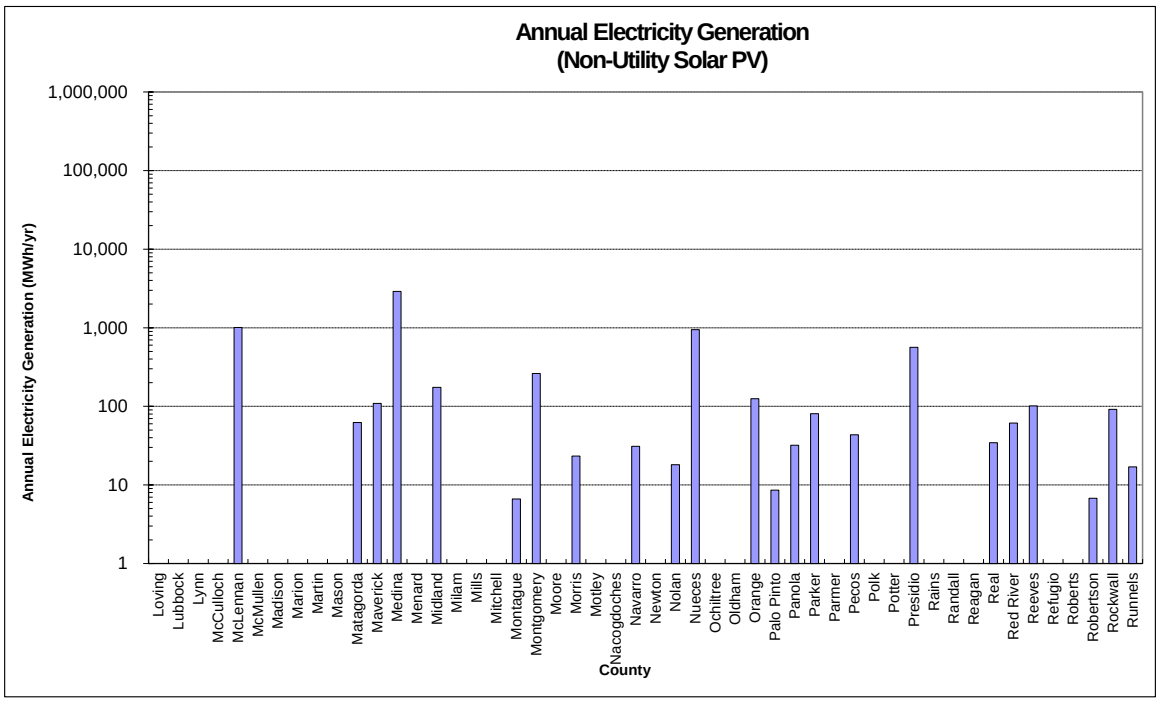


Figure 6-3: Annual Electricity Generation per County from Solar Photovoltaic Projects through 202 (Continued)

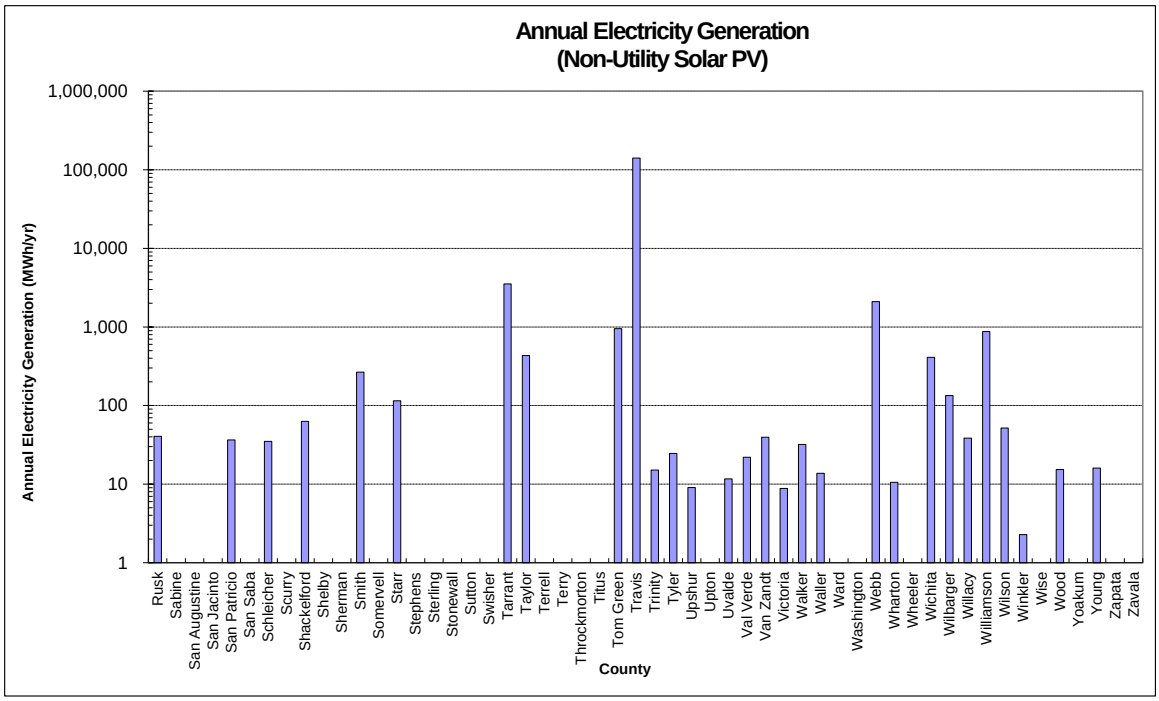
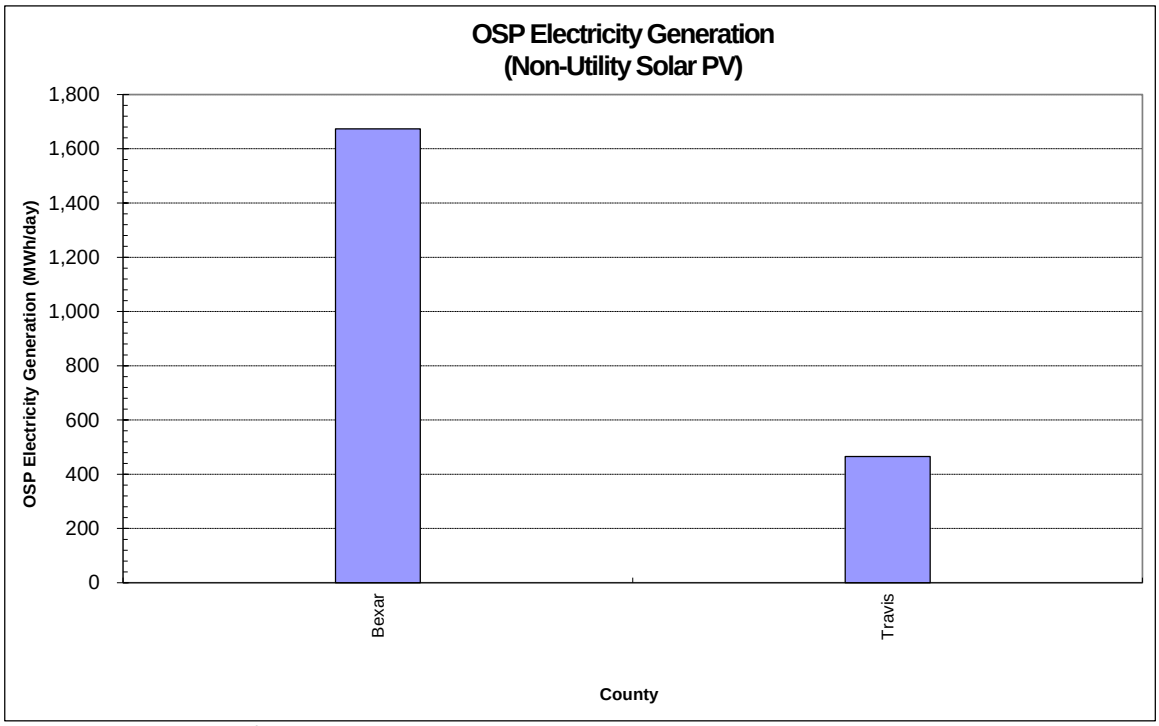


Figure 6-3: Annual Electricity Generation per County from Solar Photovoltaic Projects through 202 (Continued)



Note: OSP electricity generation for Bexar and Travis counties are shown separately in Figure 6-4 due to the generation scale.

Figure 6-4: OSP Electricity Generation per County from Solar Photovoltaic Projects through 2022

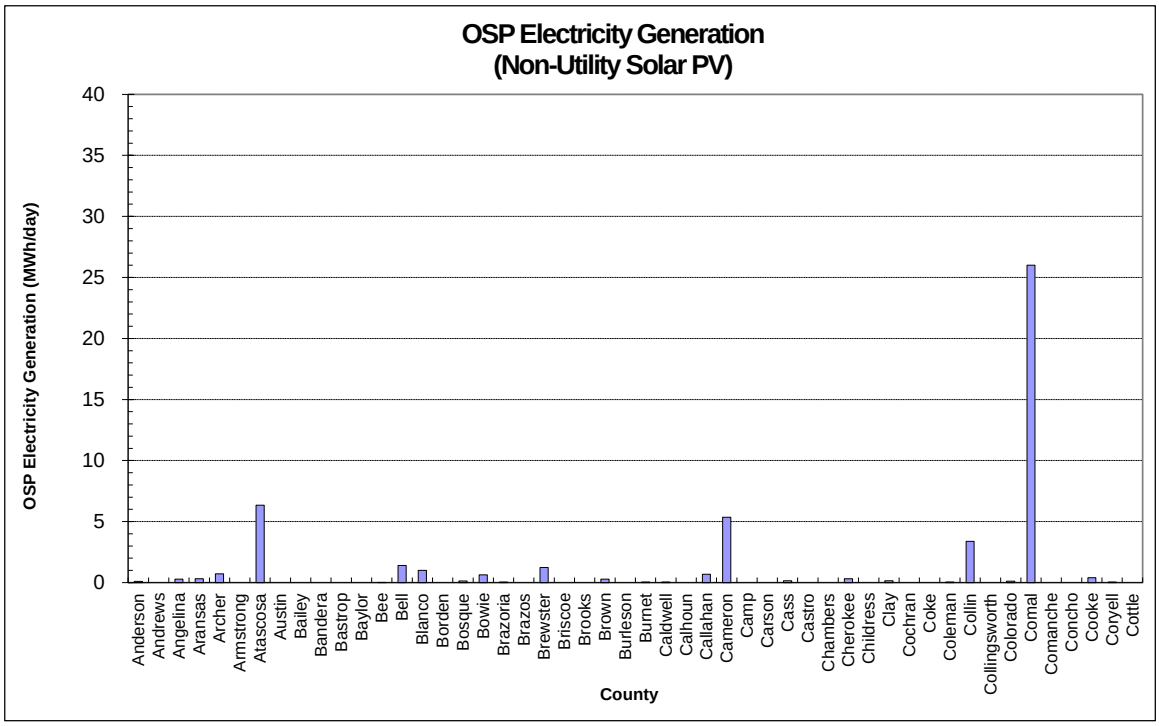


Figure 6-4: OSP Electricity Generation per County from Solar Photovoltaic Projects through 202 (Continued)

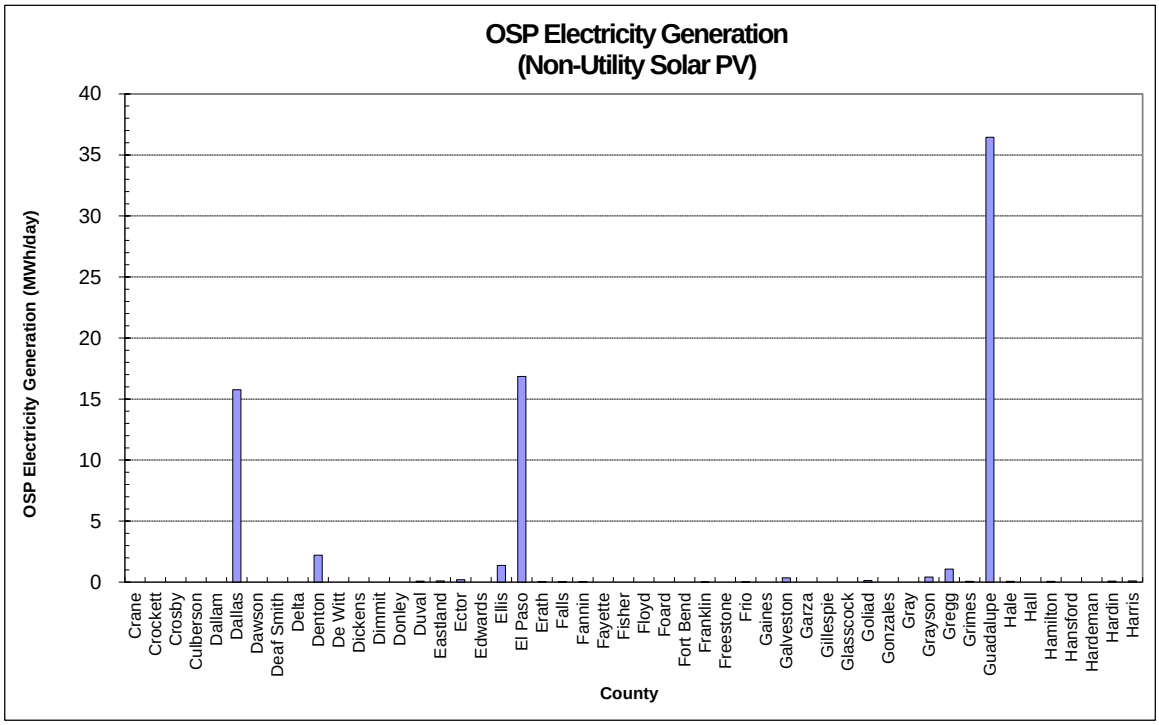


Figure 6-4: OSP Electricity Generation per County from Solar Photovoltaic Projects through 202 (Continued)

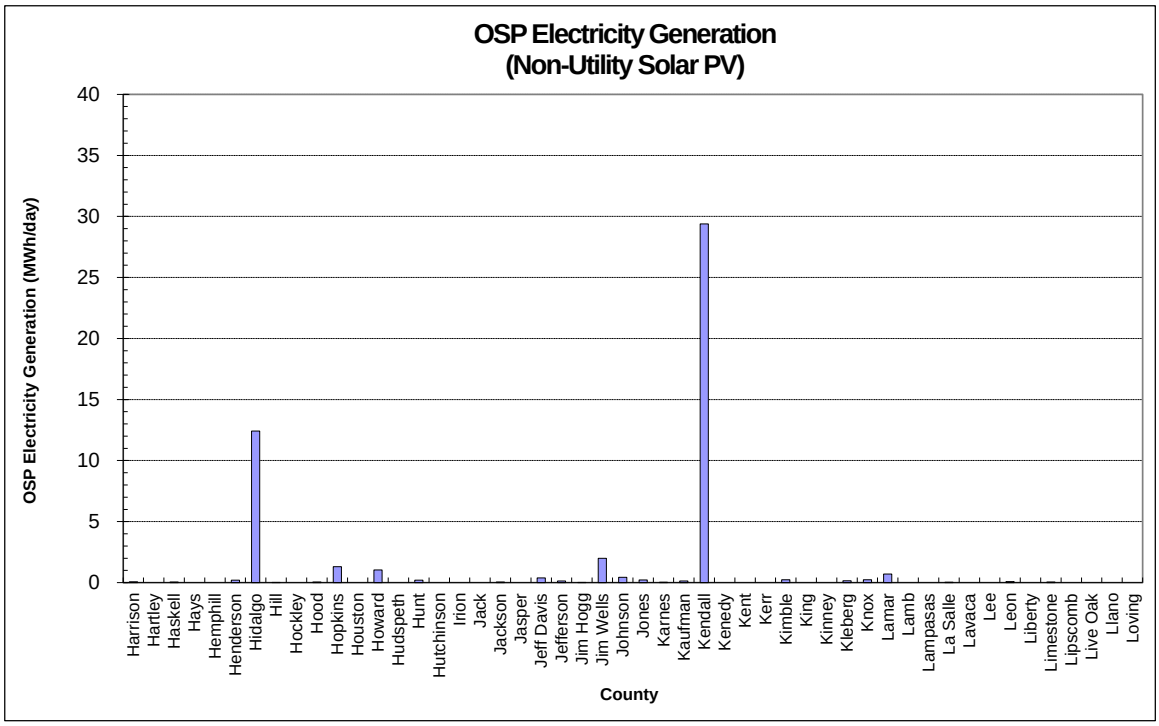


Figure 6-4: OSP Electricity Generation per County from Solar Photovoltaic Projects through 202 (Continued)

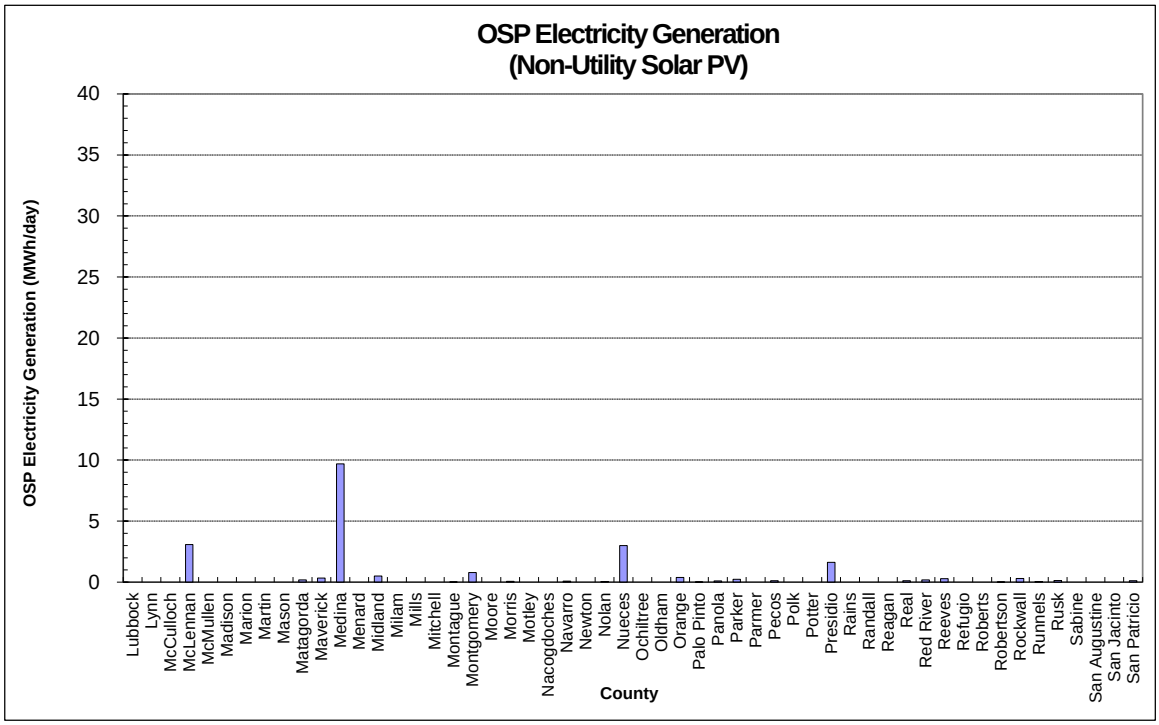


Figure 6-4: OSP Electricity Generation per County from Solar Photovoltaic Projects through 202 (Continued)

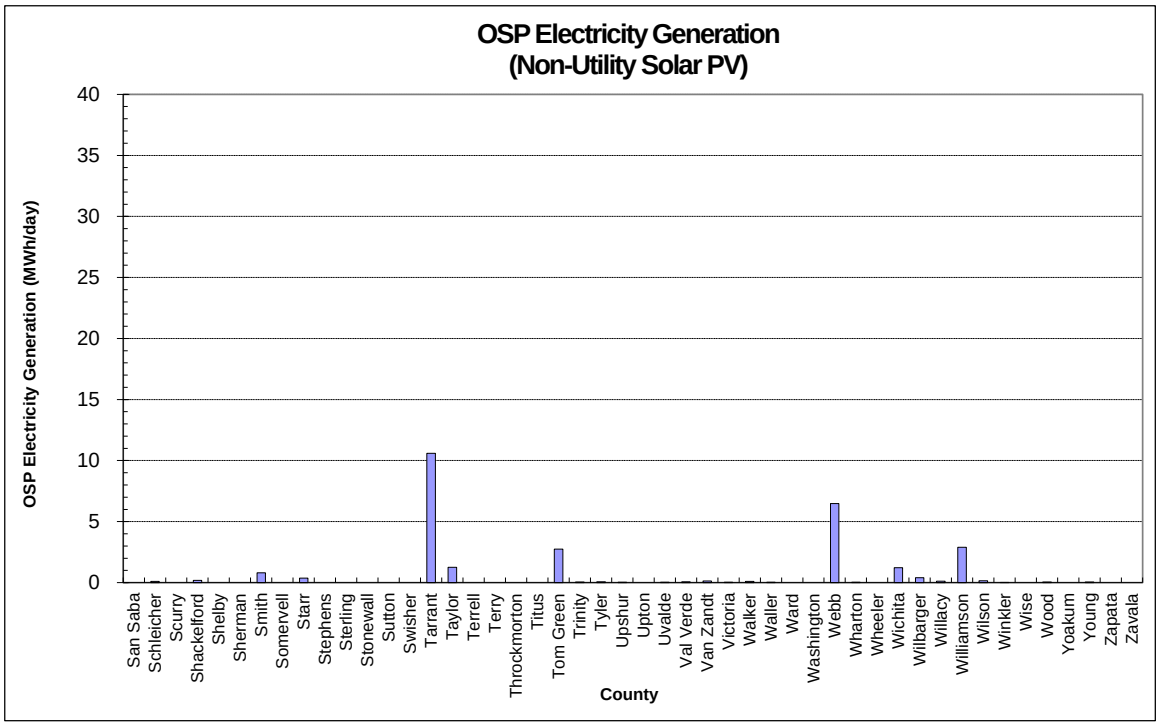


Figure 6-4: OSP Electricity Generation per County from Solar Photovoltaic Projects through 202 (Continued)

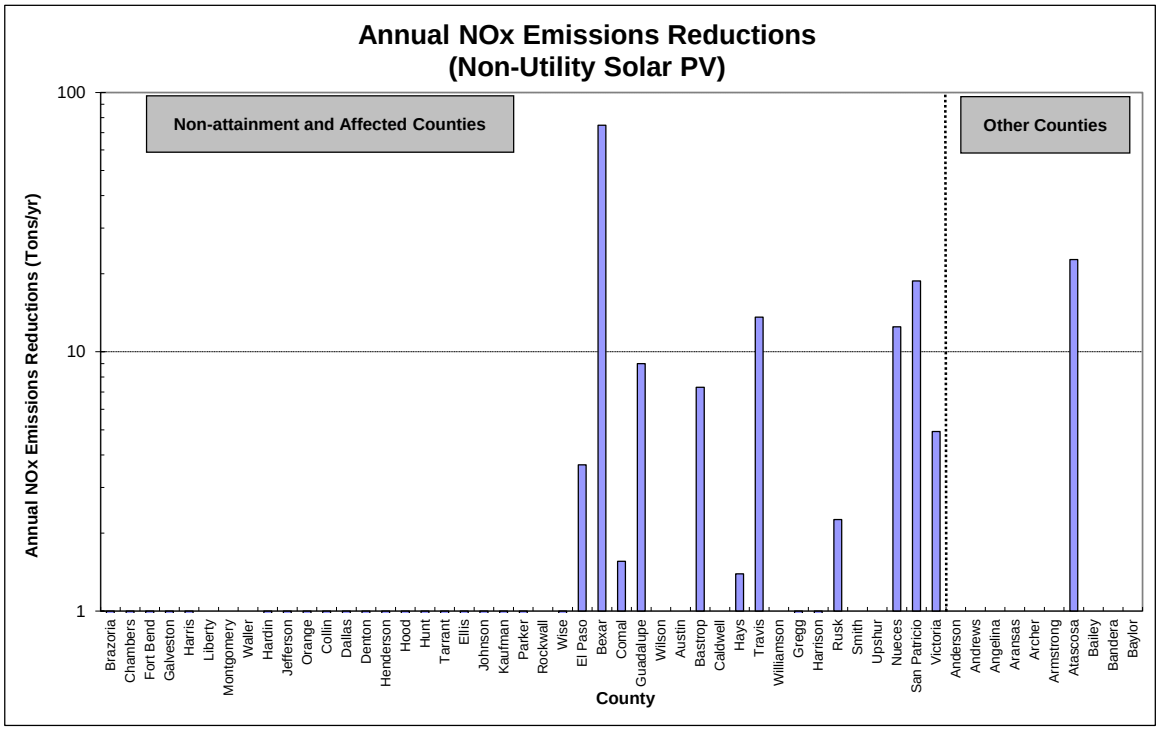


Figure 6-5: NOx Emissions Reductions per County from Solar Photovoltaic Projects through 2022

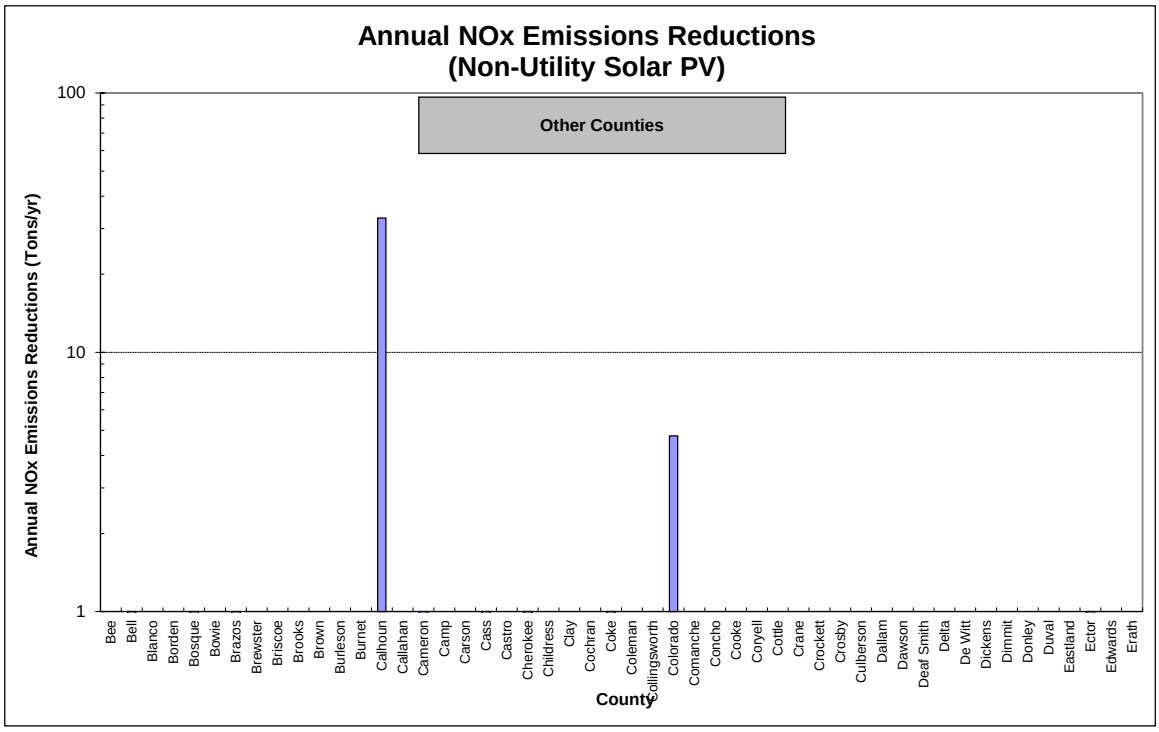


Figure 6-5: NOx Emissions Reductions per County from Solar Photovoltaic Projects through 202 (Continued)

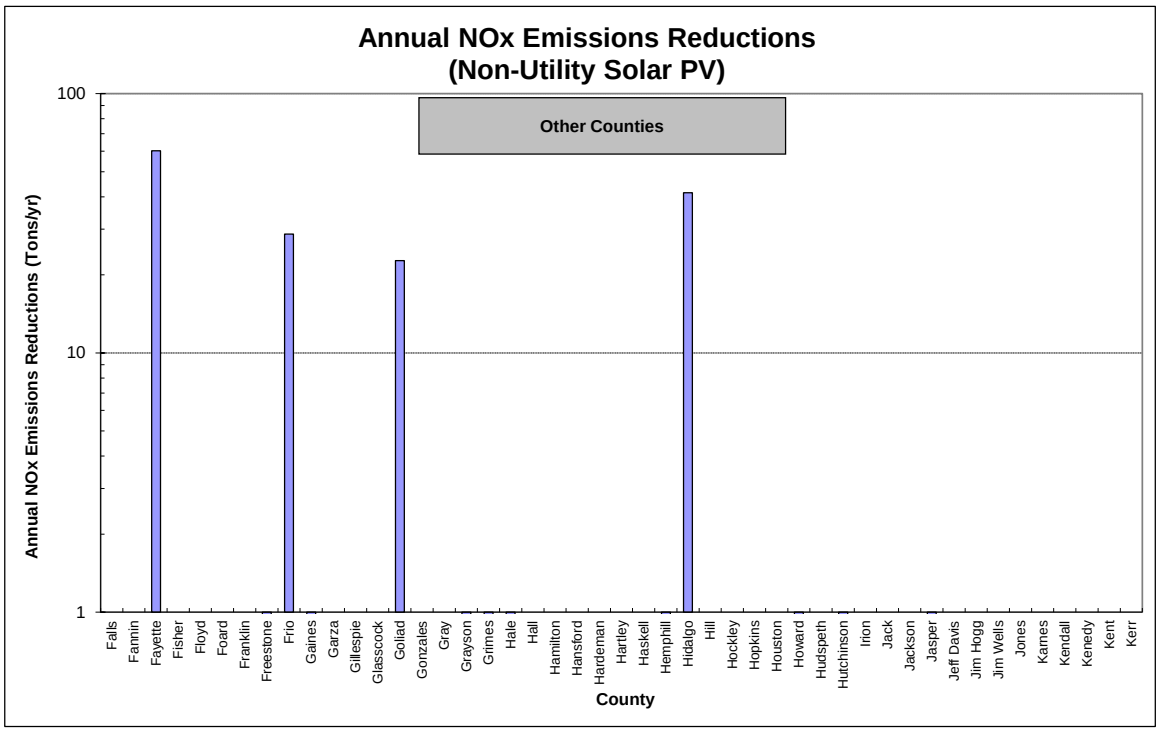


Figure 6-5: NOx Emissions Reductions per County from Solar Photovoltaic Projects through 202 (Continued)

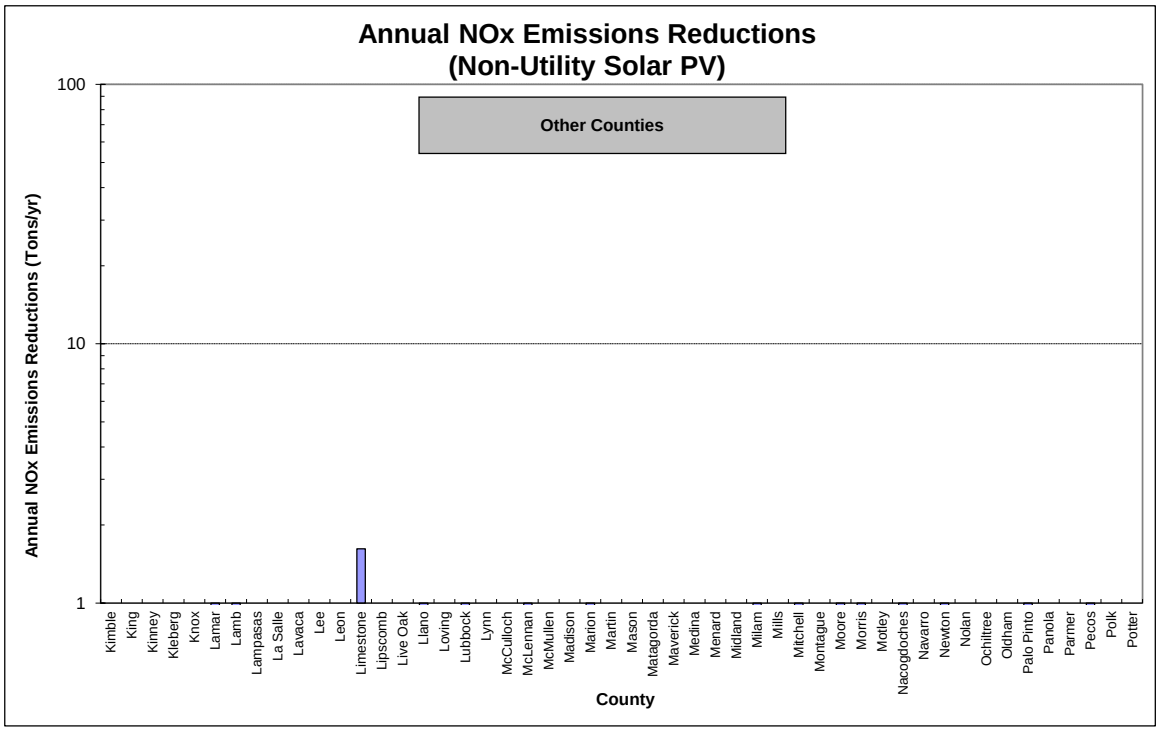


Figure 6-5: NOx Emissions Reductions per County from Solar Photovoltaic Projects through 202 (Continued)

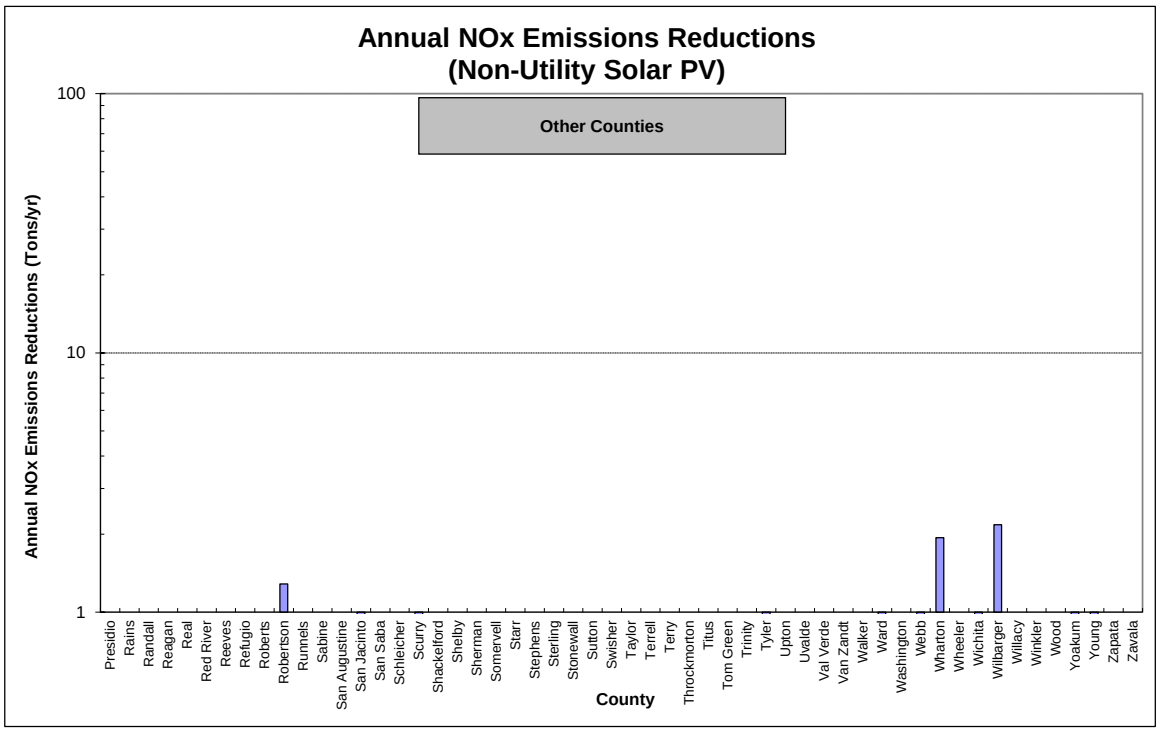


Figure 6-5: NOx Emissions Reductions per County from Solar Photovoltaic Projects through 202 (Continued)

6.2.1.2 Utility-Scale Solar Photovoltaic

This section includes only solar power plant projects (i.e., utility-scale) in Texas. The data from one-hundred fifty solar power plants identified in the State of Texas were obtained. Table 6-3 shows the list of solar power plant projects with their names, respective county, year commissioned, the forecast zone they serve, installed capacity and electricity produced for the year 2022. In Table 6-3, the annual and OSP electricity generated for the year 2022 from all the projects were 24,182,820 MWh/year and 85,682 MWh/day, respectively. In addition, the total installed capacity from all the projects was 13,492 MW. Figure 6-6 shows the annual electricity generation of solar power plant projects. Figure 6-7 shows the map of the number of solar power plants for each county. In addition, Table 6-4 provides detailed information about Figure 6-7, including: county name, FIPS code, number of solar power plants and total installed capacity for each county.

The annual electric savings per county, which were estimated from these projects, are presented in Figure 6-8. In addition, the OSP electric savings per county, which were estimated from these projects, are presented in Figure 6-9. The corresponding annual NOx emission reductions are shown in Figure 6-10.

The hourly and daily total electricity generation profiles of different solar power projects are shown in Volume II, Appendix C. Figure 6-11shows an example of the hourly electricity generation profile for ACACIA_UNIT_1, meanwhile Figure 6-12 shows an example of the daily total generation profile for the same unit.

Table 6-3: Utility-Scale Solar PV Projects in the State of Texas through 2022

No	Name of the Project	County	Year Commissioned	ERCOT Zone	Installed Capacity (MW_{AC})*	Annual Power Generation in 2022 (MWh/year)**	Daily Average Power Generation in 2022 OSP (MWh/day)**
1	ACACIA_UNIT_1	Presidio	2012	West	10	24,436	73
2	ALEXIS_ALEXIS	Brooks	2019	South	10	20,289	78
3	ANSON1_UNIT1	Jones	2021	West	100	244,108	858
4	ANSON1_UNIT2	Jones	2021	West	100	232,145	804
5	ARAGORN_UNIT1	Culberson	2021	West	185	405,290	1,477
6	AZURE_SOLAR1	Haskell	2021	West	75	180,583	601
7	AZURE_SOLAR2	Haskell	2021	West	154	403,393	1,332
8	BCK_UNIT1	Fort Bend	2022	Houston	218	271,991	1,224
9	BCK_UNIT2	Fort Bend	2022	Houston	221	219,288	892
10	BLUEJAY_UNIT1***	Grimes	2023	North	69	161,656	561
11	BLUEJAY_UNIT2***	Grimes	2023	North	141	91,534	274
12	BOOTLEG_UNIT1	Pecos	2017	West	121	275,541	912
13	BOVINE2_BOVINE2	Austin	2018	South	5	9,095	32
14	BOVINE_BOVINE	Austin	2018	South	5	9,932	36
15	BRIGHTSD_UNIT1	Bee	2021	South	50	97,176	343
16	BRNSN2_BRNSN2	Fort Bend	2018	Houston	5	6,207	22
17	BRNSN_BRNSN	Fort Bend	2018	Houston	5	6,427	24
18	CAPRIDG4_BB2_PV1	Sterling	2021	West	100	241,064	859
19	CAPRIDG4_BB2_PV2	Sterling	2021	West	15	33,690	128
20	CAPRIDG4_BB_PV	Sterling	2019	West	30	72,914	257
21	CASCADE2_CASCADE2	Wharton	2018	South	5	10,791	37
22	CASCADE_CASCADE	Wharton	2018	South	5	10,112	35
23	CASL_GAP_UNIT1	Upton	2018	West	180	458,407	1,526
24	CECSOLAR_DG_BECK1	Bexar	2016	South	1	2,099	7
25	CHISUM_CHISUM	Lamar	2018	North	10	20,308	73
26	CONIGLIO_UNIT1	Fannin	2021	North	126	247,636	819
27	CORAZON_UNIT1	Webb	2021	South	203	350,704	1,285
28	COSERVSS_CSS1	Denton	2015	North	2	1,570	3
29	CS10_CATAN	Karnes	2020	South	10	23,499	80
30	DAG_UNIT1	Brazoria	2022	Houston	101	69,069	194
31	DAG_UNIT2	Brazoria	2022	Houston	101	26,050	0
32	DG_BROOK_1UNIT	Bexar	2010	South	8	10,468	33
33	DG_ELMEN_1UNIT	Bexar	2010	South	7	11,863	38
34	DG_SOME1_1UNIT	Bexar	2012	South	6	6,764	22
35	DG_SOME2_1UNIT	Bexar	2012	South	5	5,769	19
36	DG_STHWG_UNIT1	Bexar	2014	South	4	5,864	10
37	DG_VALL1_1UNIT	Bexar	2012	South	10	12,704	42
38	DG_VALL2_1UNIT	Bexar	2012	South	10	10,904	34
39	DG_WALZM_UNIT1	Bexar	2014	South	6	11,479	38
40	DG_WHITNEY_SOLAR1	Bosque	2017	North	10	18,430	57
41	ECLIPSE_UNIT1	Kinney	2014	South	38	74,856	273
42	EDDYII_EDDYII	McLennan	2018	North	10	17,307	62
43	EGROVESL_UNIT1	Crane	2022	West	110	259,783	983
44	ELARA_SL_UNIT1	Frio	2021	South	132	333,382	1,149
45	ERATH_ERATH21	Erath	2021	North	10	10,265	38
46	EUNICE_PV1	Andrews	2021	West	190	414,590	1,494
47	EUNICE_PV2	Andrews	2021	West	237	523,865	1,891
48	E_BLACK_UNIT_1	Travis	2021	South	144	320,095	1,124
49	FIFTHGS1_FGSOLAR1	Travis	2016	South	2	3,690	7
50	FWLR_SLR_UNIT1	Crane	2020	West	150	433,399	1,415

* Capacity, Demand and Reserves Report-May 2023.xlsx from the webpage of the ERCOT (http://www.ercot.com/gridinfo/resource/index.html)

** 2022 ERCOT utility-scale solar PV 15-min generation data

*** Although the year commissioned is 2023, the utility-scale solar PV project is included since the project has electricity generation in 2022

Table 6-3: Utility-Scale Solar PV Projects in the State of Texas through 2022 (Continued)

No	Name of the Project	County	Year Commissioned	ERCOT Zone	Installed Capacity (MW_{AC})*	Annual Power Generation in 2022 (MWh/year)**	Daily Average Power Generation in 2022 OSP (MWh/day)**
51	GALLOWAY_SOLAR1	Concho	2021	West	257	559,389	2,121
52	GREASWOD_UNIT1	Pecos	2021	West	125	266,020	755
53	GREASWOD_UNIT2	Pecos	2021	West	130	140,003	96
54	GRIFFIN_GRIFFIN	McLennan	2019	North	5	10,754	41
55	HELIOS_UNIT1	Uvalde	2015	South	100	207,031	678
56	HOLSTEIN_SOLAR1	Nolan	2020	West	102	217,957	816
57	HOLSTEIN_SOLAR2	Nolan	2020	West	102	212,212	780
58	HOVEY_UNIT1	Pecos	2015	West	22	49,169	145
59	HOVEY_UNIT2	Pecos	2020	West	7	9,936	29
60	HWY56_HWY56	Grayson	2017	North	5	7,628	28
61	IMPACT_UNIT1	Lamar	2021	North	199	450,950	1,624
62	JAY_UNIT1***	Fort Bend	2023	Houston	180	146,896	656
63	JAY_UNIT2***	Fort Bend	2023	Houston	172	218,837	1,043
64	JUNO_UNIT1	Borden	2021	West	162	426,989	1,418
65	JUNO_UNIT2	Borden	2021	West	144	383,946	1,275
66	KELAM_SL_UNIT1	Van Zandt	2020	North	60	135,631	482
67	LAMPWICK_LAMPWICK	Menard	2019	West	8	19,292	64
68	LAPETUS_UNIT_1	Andrews	2020	West	101	223,065	793
69	LASSO_UNIT1	Brewster	2018	West	50	131,636	411
70	LEON_LEON	Hunt	2017	North	10	21,562	77
71	LGDRAW_S_UNIT1_1	Borden	2021	West	99	234,451	806
72	LGDRAW_S_UNIT1_2	Borden	2021	West	128	305,065	1,059
73	LILY_SOLAR1	Kaufman	2021	North	148	368,960	1,288
74	LMESASLR_IVORY	Dawson	2018	West	50	107,257	345
75	LMESASLR_UNIT1	Dawson	2018	West	102	207,550	736
76	LON_SOLAR1	Brazoria	2022	Houston	78	40,347	85
77	MARLIN_MARLIN	Falls	2017	North	5	10,610	37
78	MARS_MARS	Webb	2019	South	10	20,265	71
79	MCLNSLR_UNIT1	Dimmit	2022	South	207	123,760	343
80	MISAE_UNIT1	Childress	2021	North	121	266,434	994
81	MISAE_UNIT2	Childress	2021	North	119	255,822	942
82	NEBULA_UNIT1	Cameron	2022	Houston	138	171,852	767
83	NGNSVL_NGAINESV	Cooke	2017	North	5	9,416	33
84	NOBLESLR_SOLAR1	Denton	2022	North	149	233,456	1,126
85	NOBLESLR_SOLAR2	Denton	2022	North	130	182,855	866
86	OBERON_UNIT_1_J01	Ector	2020	West	180	330,240	1,215
87	OBERON_UNIT_1_J02	Ector	N/A	West	N/A	64,394	238
88	OCI_ALM1_UNIT1	Bexar	2013	South	39	92,464	311
89	OXYSOLAR_SOLAR_1	Ector	N/A	West	17	9,240	34
90	PCOMM_1UNIT	N/A	N/A	N/A	N/A	1,947	8
91	PFK_PFKPV	Travis	2017	South	3	4,179	13
92	PHOEBE_UNIT1	Winkler	2019	West	125	273,178	999
93	PHOEBE_UNIT2	Winkler	2019	West	128	276,158	1,010
94	PHOENIX_UNIT1	Fannin	2021	North	84	194,931	697
95	PISGAH_SOLAR1	Navarro	2022	North	189	10,710	0
96	PISGAH_SOLAR2	Navarro	2022	North	64	3,873	0
97	PLN_UNIT1***	Wharton	2023	South	270	584,855	2,061
98	PROSPERO_UNIT1	Andrews	2020	West	154	283,798	911
99	PROSPERO_UNIT2	Andrews	2020	West	150	348,606	1,220
100	PRSPERO2_UNIT1	Andrews	2021	West	127	263,904	838

* Capacity, Demand and Reserves Report-May 2023.xlsx from the webpage of the ERCOT (http://www.ercot.com/gridinfo/resource/index.html)
** 2022 ERCOT utility-scale solar PV 15-min generation data
*** Although the year commissioned is 2023, the utility-scale solar PV project is included since the project has electricity generation in 2022

Table 6-3: Utility-Scale Solar PV Projects in the State of Texas through 2022 (Continued)

No	Name of the Project	County	Year Commissioned	ERCOT Zone	Installed Capacity (MW_{AC})*	Annual Power Generation in 2022 (MWh/year)**	Daily Average Power Generation in 2022 OSP (MWh/day)**
101	PRSPERO2_UNIT2	Andrews	2021	West	126	294,605	964
102	QUEEN_SL_SOLAR1	Upton	2020	West	103	255,225	924
103	QUEEN_SL_SOLAR2	Upton	2020	West	103	250,155	906
104	QUEEN_SL_SOLAR3	Upton	2020	West	98	241,703	870
105	QUEEN_SL_SOLAR4	Upton	2020	West	108	263,843	952
106	RADN_SLR_UNIT1***	Brown	2023	North	161	36,586	14
107	RADN_SLR_UNIT2***	Brown	2023	North	166	13,789	0
108	RAMBLER_UNIT1	Tom Green	2020	West	200	411,645	1,485
109	RATLIFF_SOLAR1	Tom Green	2022	West	162	128,391	479
110	REDBARN_UNIT_1	Pecos	2021	West	222	504,426	1,867
111	REDBARN_UNIT_2	Pecos	2021	West	28	57,535	195
112	REROCK_UNIT1	Pecos	2016	West	79	185,445	614
113	REROCK_UNIT2	Pecos	2016	West	79	183,174	615
114	RIGGINS_UNIT1	Pecos	2018	West	150	334,049	1,213
115	RIPPEY_UNIT1	Cooke	2020	North	60	142,241	493
116	ROSELAND_SOLAR1***	Falls	2023	North	254	6,705	0
117	ROSELAND_SOLAR2***	Falls	2023	North	168	1,443	0
118	ROW_UNIT1	Fort Bend	2022	Houston	102	69,791	290
119	SAMSON_1_G1	Lamar	2022	North	128	258,687	979
120	SAMSON_1_G2	Lamar	2022	North	128	251,800	960
121	SAMSON_3_G1	Lamar	2022	North	128	131,462	672
122	SAMSON_3_G2	Lamar	2022	North	128	174,555	859
123	SEALY_1UNIT	Austin	2015	South	2	1,662	6
124	SIRIUS_UNIT1	Pecos	2017	West	110	260,798	867
125	SIRIUS_UNIT2	Pecos	2017	West	49	105,227	380
126	SOLARA_UNIT1	Haskell	2016	West	112	256,495	840
127	SPTX12B_UNIT1	Upton	2017	West	158	359,878	1,316
128	STRATEGC_UNIT1	Ellis	2021	North	137	308,918	1,116
129	STRLING_STRLING	Hunt	2018	North	10	13,528	45
130	SUNVASLR_UNIT1	Hill	2022	North	166	25,911	0
131	SUNVASLR_UNIT2	Hill	2022	North	86	15,037	0
132	TAYGETE_UNIT1	Pecos	2021	West	126	289,718	1,022
133	TAYGETE_UNIT2	Pecos	2021	West	129	296,724	1,024
134	TI_SOLAR_UNIT1	Culberson	2021	West	137	369,407	1,189
135	TI_SOLAR_UNIT2	Culberson	2021	West	131	349,573	1,113
136	VANCOURT_UNIT1	Cameron	2022	Houston	46	18,997	23
137	VISION_UNIT1	Navarro	2021	North	129	297,189	1,080
138	WAYMARK_UNIT1	Upton	2018	West	182	280,862	960
139	WBOROII_WHBOROII	Grayson	2017	North	5	10,428	37
140	WBORO_WHTSBORO	Grayson	2017	North	5	11,167	39
141	WEBBER_S_WSP1	Travis	2011	South	27	62,767	213
142	WES_UNIT1	Brazoria	2022	Houston	102	130,189	585
143	WES_UNIT2	Brazoria	2022	Houston	102	135,775	615
144	WGU_UNIT1	Brazoria	2021	Houston	120	238,851	821
145	WHTRT_WHTRGHT	Fannin	2017	North	10	19,694	66
146	WLNTSPRG_1UNIT	Bosque	2016	North	10	11,142	39
147	WMOOREII_WMOOREII	Grayson	2018	North	5	7,319	27
148	W_PECOS_UNIT1	Reeves	2019	West	100	258,652	882
149	X443PV1_SWRI_PV1	Bexar	2019	South	5	6,757	31
150	YLWJACKET_YLWJACKET	Bosque	2018	North	5	10,946	38
Total					**13,492**	**24,182,820**	**85,682**

* Capacity, Demand and Reserves Report-May 2023.xlsx from the webpage of the ERCOT (http://www.ercot.com/gridinfo/resource/index.html)

** 2022 ERCOT utility-scale solar PV 15-min generation data

*** Although the year commissioned is 2023, the utility-scale solar PV project is included since the project has electricity generation in 2022

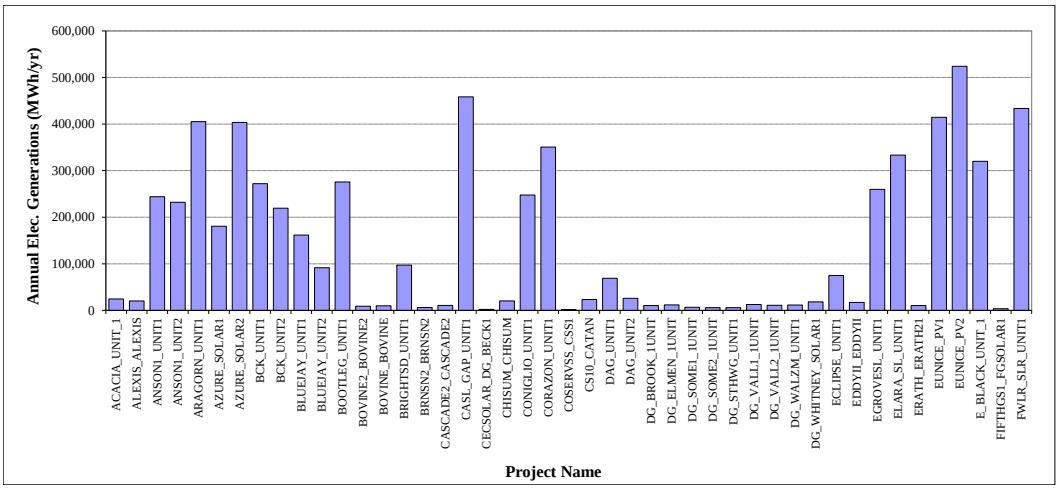


Figure 6-6: Annual Electricity Generation by Utility-Scale Solar PV Projects in the State of Texas through 2022

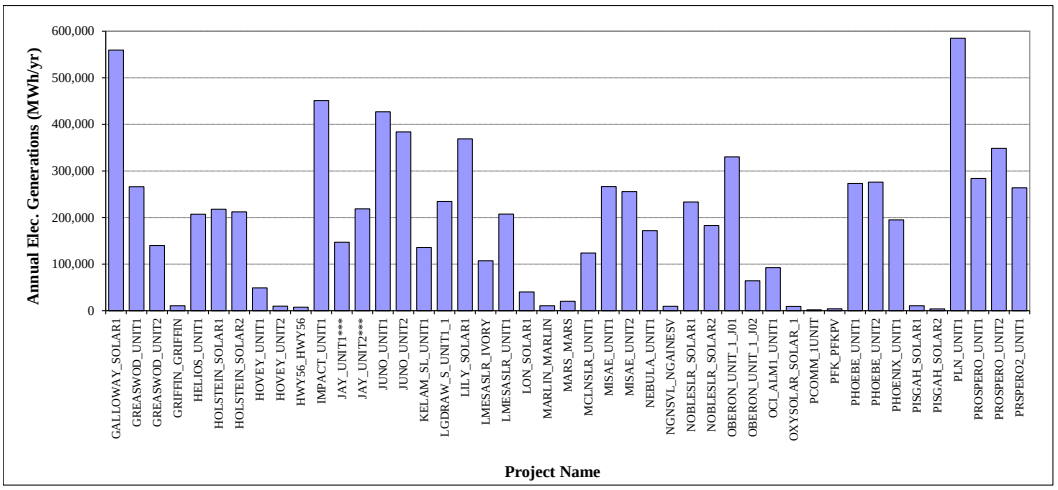


Figure 6-6: Annual Electricity Generation by Utility-Scale Solar PV Projects in the State of Texas through 2022 (Continued)

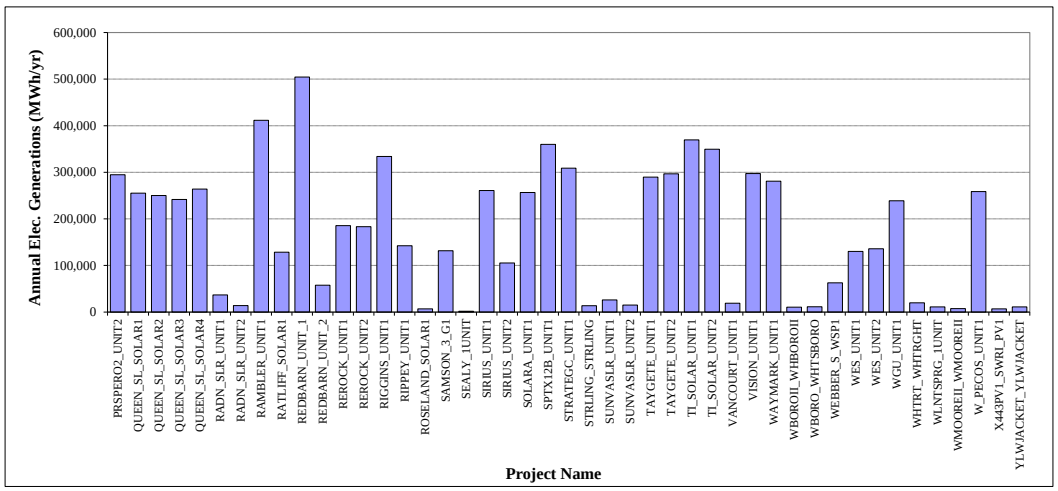


Figure 6-6: Annual Electricity Generation by Utility-Scale Solar PV Projects in the State of Texas through 2022 (Continued)

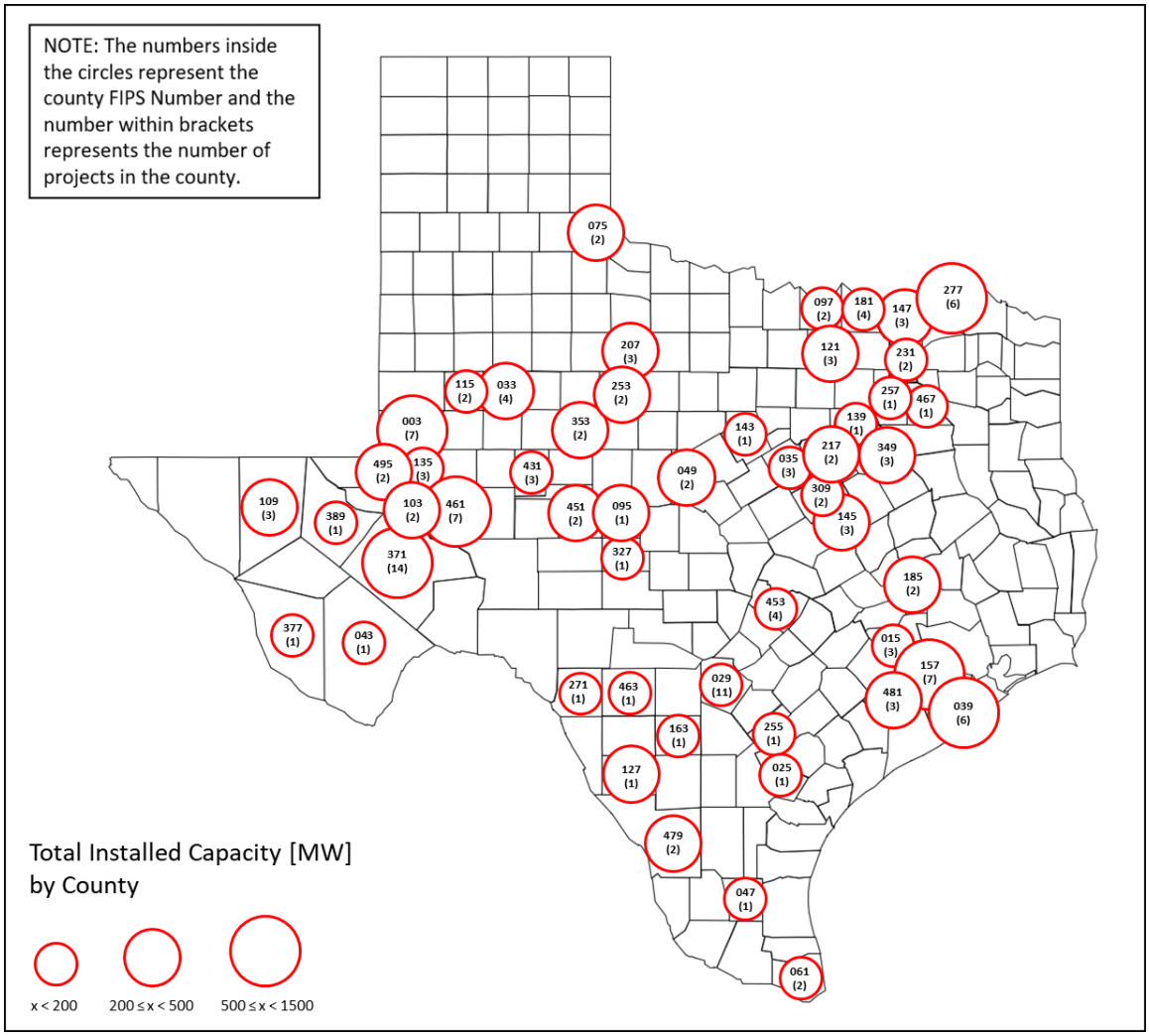


Figure 6-7: Map of Utility-Scale Solar PV Projects Installed in Each County of Texas through 2022

Table 6-4: Utility-Scale Solar PV Projects throughout Texas through 2022

County	FIPS Code	No. of Projects	Total Installed Capacity (MW_{AC})	County	FIPS Code	No. of Projects	Total Installed Capacity (MW_{AC})
Andrews	003	7	1,084	Grimes	185	2	210
Austin	015	3	12	Haskell	207	3	340
Bee	025	1	50	Hill	217	2	252
Bexar	029	11	100	Hunt	231	2	20
Borden	033	4	532	Jones	253	2	200
Bosque	035	3	25	Karnes	255	1	10
Brazoria	039	6	604	Kaufman	257	1	148
Brewster	043	1	50	Kinney	271	1	38
Brooks	047	1	10	Lamar	277	6	722
Brown	049	2	327	McLennan	309	2	15
Cameron	061	2	183	Menard	327	1	8
Childress	075	2	240	Navarro	349	3	383
Concho	095	1	257	Nolan	353	2	205
Cooke	097	2	65	Pecos	371	14	1,377
Crane	103	2	260	Presidio	377	1	10
Culberson	109	3	453	Reeves	389	1	100
Dawson	115	2	152	Sterling	431	3	145
Denton	121	3	281	Tom Green	451	2	362
Dimmit	127	1	207	Travis	453	4	175
Ector	135	3	197	Upton	461	7	930
Ellis	139	1	137	Uvalde	463	1	100
Erath	143	1	10	Van Zandt	467	1	60
Falls	145	3	427	Webb	479	2	213
Fannin	147	3	220	Wharton	481	3	280
Fort Bend	157	7	902	Winkler	495	2	253
Frio	163	1	132	N/A	N/A	1	0
Grayson	181	4	20	**Total**		**150**	**13,492**

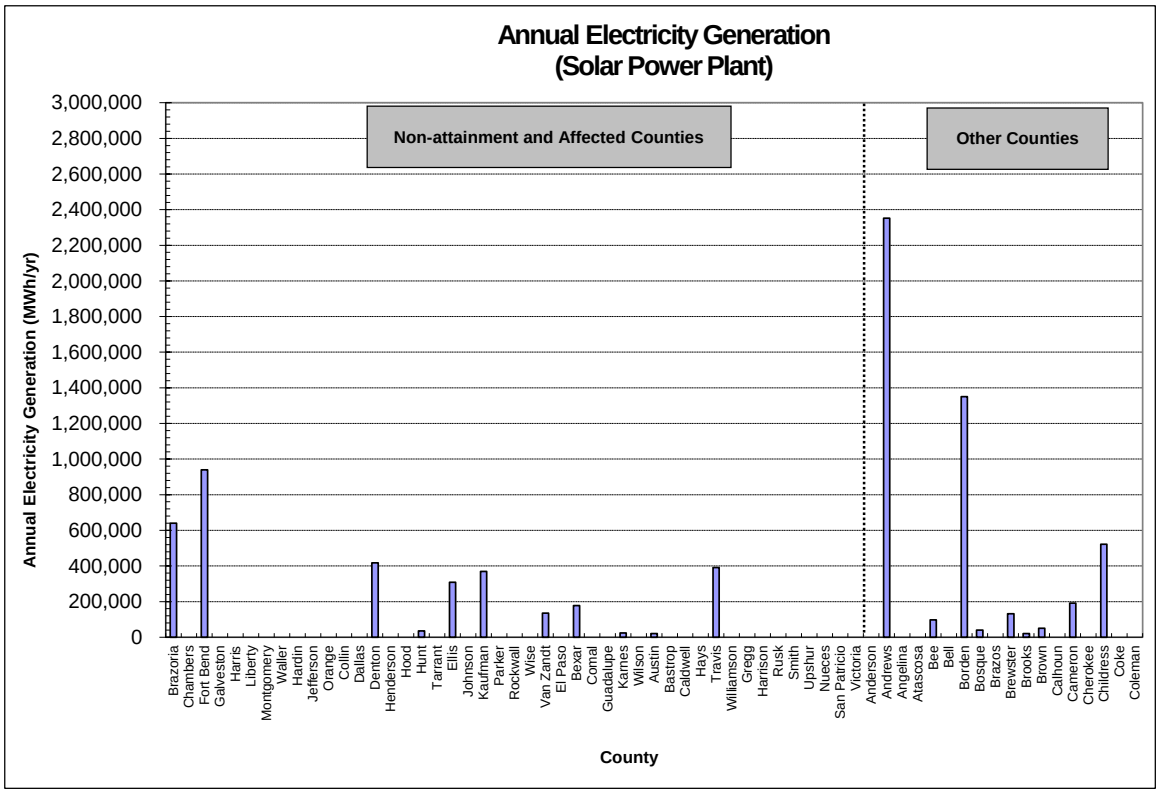


Figure 6-8: Annual Electricity Generation per County from Utility-Scale Solar PV Projects through 2022

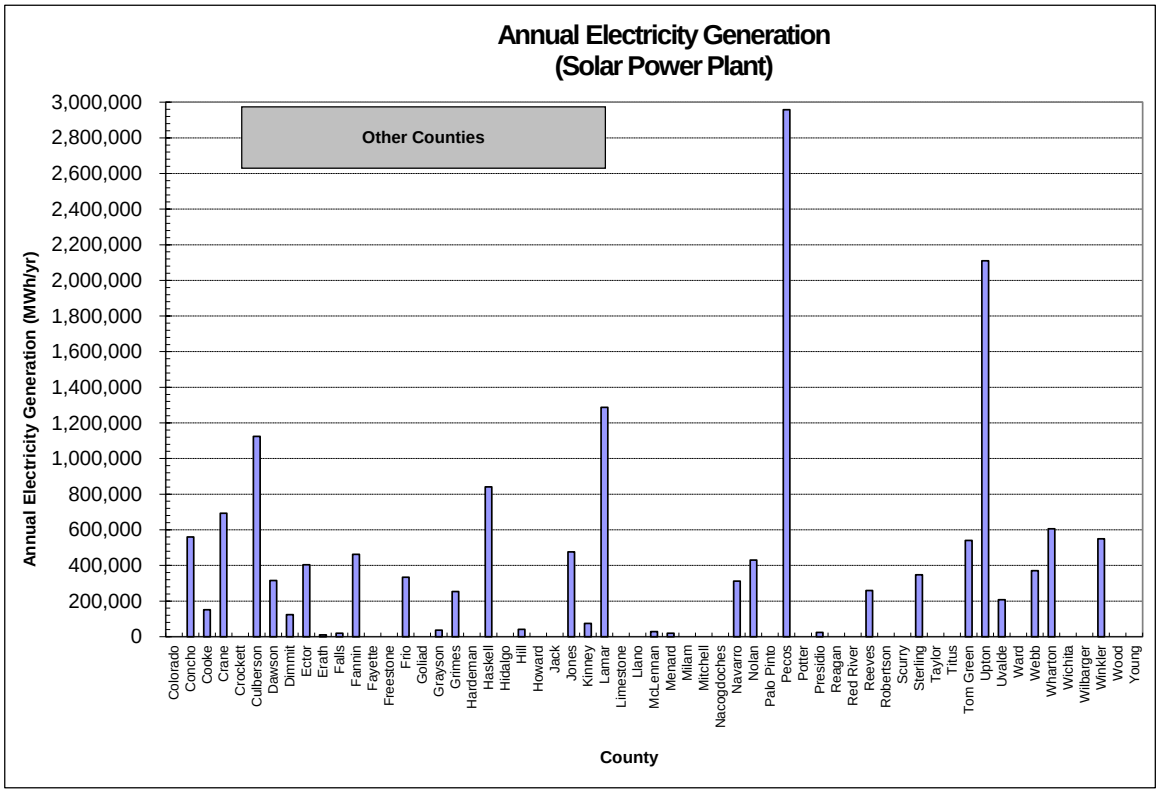


Figure 6-8: Annual Electricity Generation per County from Utility-Scale Solar PV Projects through 2022 (Continued)

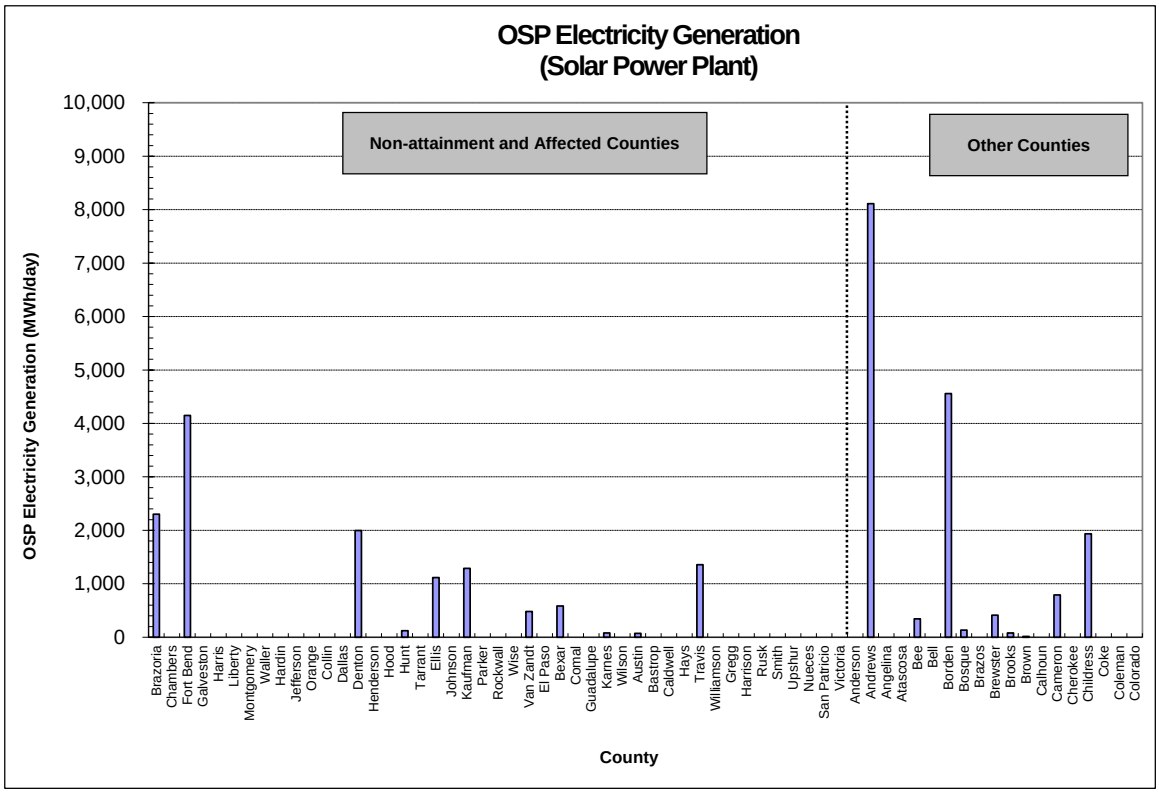


Figure 6-9: Ozone Season Period Electricity Generation per County from Utility-Scale Solar PV Projects through 2022

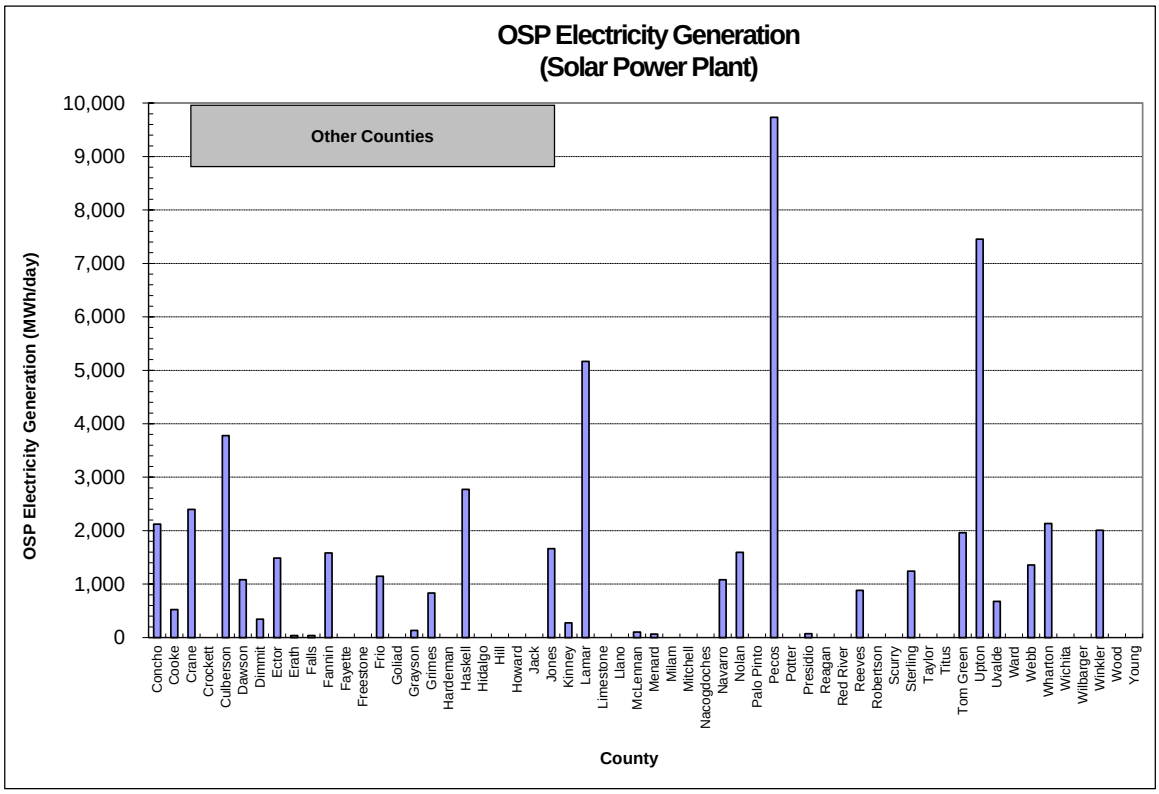


Figure 6-9: Ozone Season Period Electricity Generation per County from Utility-Scale Solar PV Projects through 2022 (Continued)

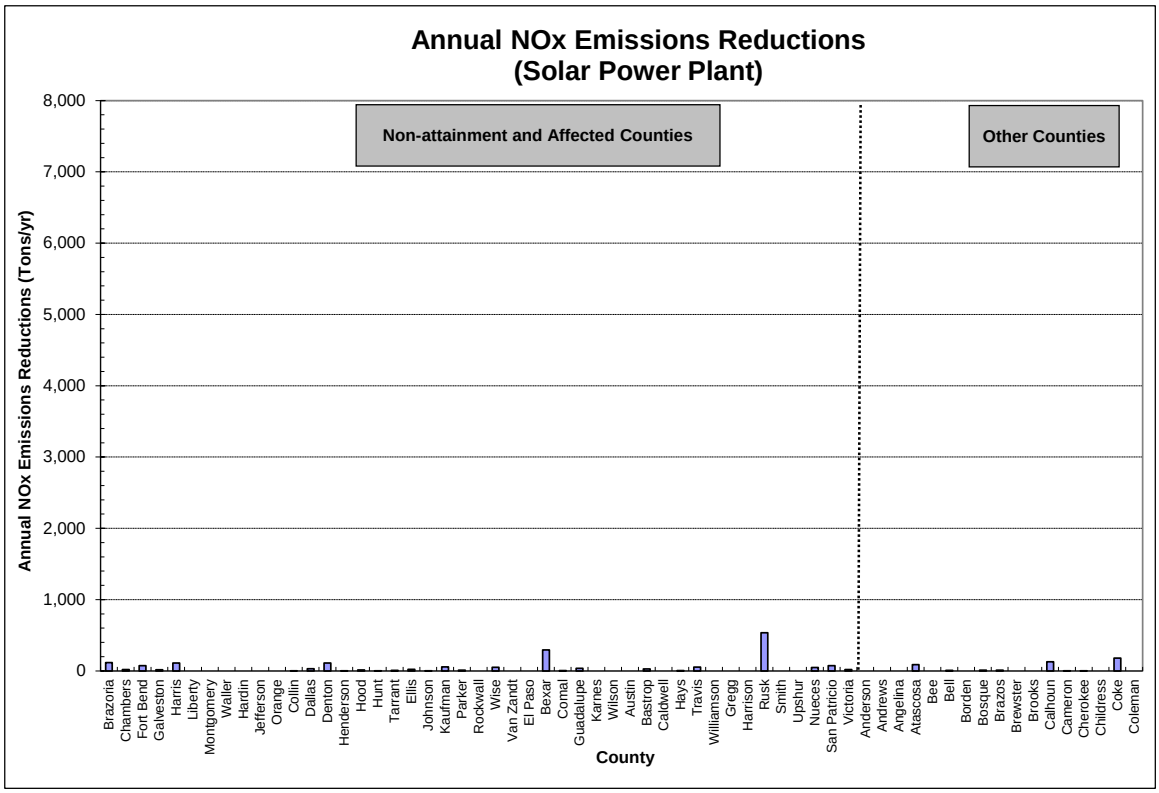


Figure 6-10: NOx Emissions Reductions per County from Utility-Scale Solar PV Projects through 2022

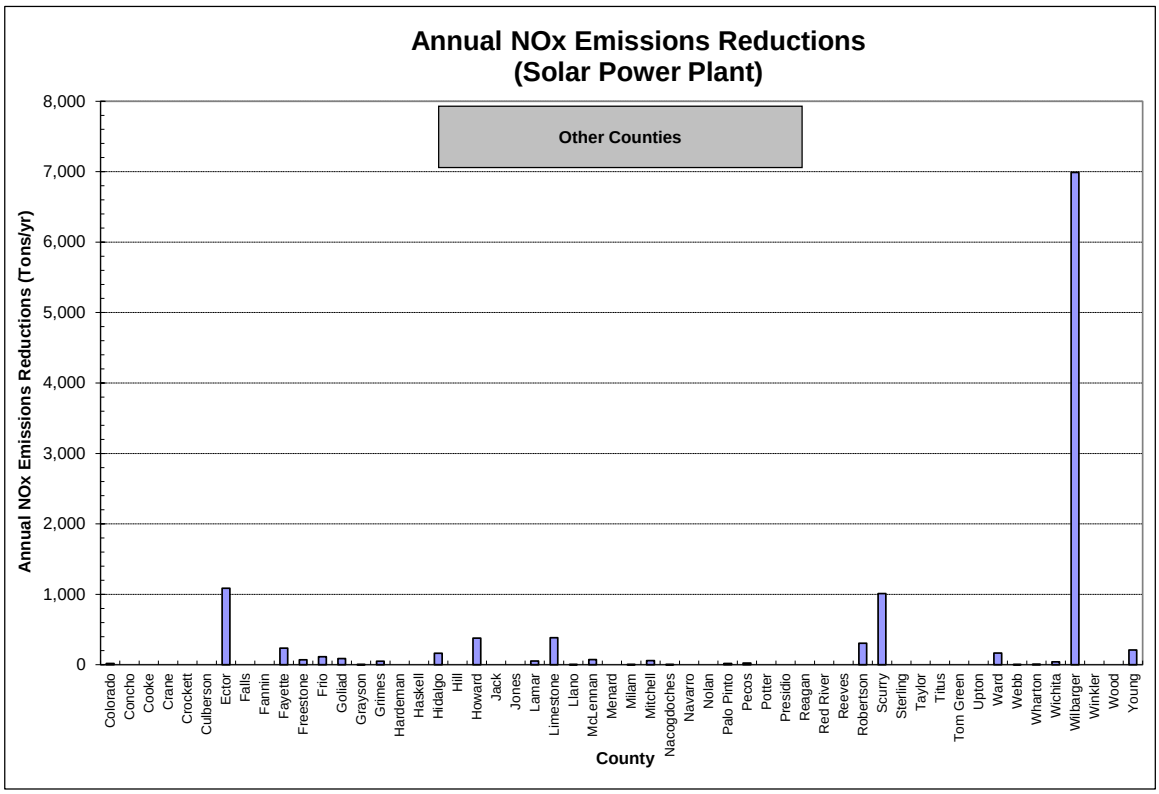


Figure 6-10: NOx Emissions Reductions per County from Utility-Scale Solar PV Projects through 2022 (Continued)

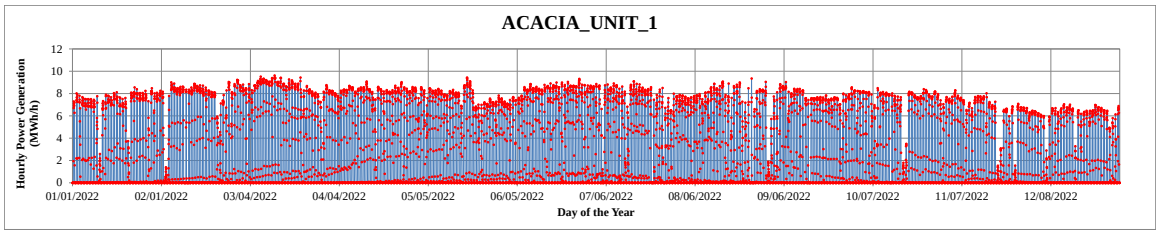


Figure 6-11: Hourly Electricity Generation Profile for Solar Photovoltaic Project ACACIA_UNIT_1

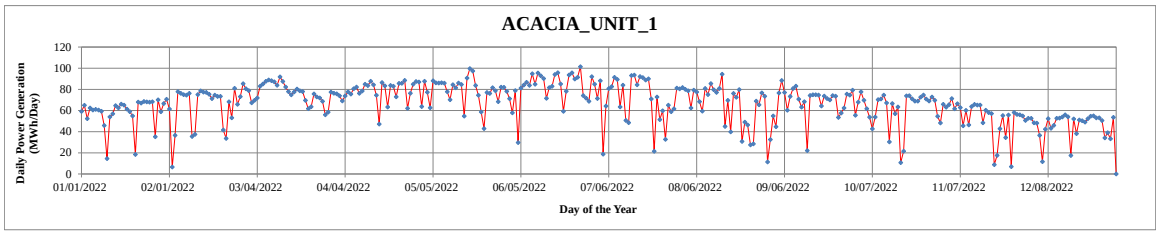


Figure 6-12: Daily Total Electricity Generation Profile for Solar Photovoltaic Project ACACIA_UNIT_1

6.2.2 Solar Thermal

Solar thermal projects are to generate thermal energy so that buildings utilize thermal energy to heat water or air for their use. Many of the solar thermal projects throughout the State of Texas were identified from various web sources. In the present report for the year 2022, unfortunately, no new solar thermal projects were found. As a result, the total number of solar thermal projects for the present report was 41. In 2022, it was estimated that solar thermal projects in nine Texas counties produced 254,511 kWh/yr through 2022 and 689 kWh/day in the 2022 OSP.

The equivalent energy in electricity from all the solar thermal projects are presented in Table 6-5. The equivalent energy in electricity was estimated how much electricity can be saved by the amount of hot water produced by solar thermal water heater systems. eCalc (f-Chart method) was used in designing liquid solar heating system to calculate the hot water produced. Due to the limited availability of solar thermal project information, the estimation was based on the collector areas and project locations. The list of all the projects is shown in Table F-2 (Vol. II, APPENDIX F).

Figure 6-13 shows the map of the solar thermal projects identified in each county of Texas. In addition, Table 6-6 provides detailed information about Figure 6-13, including: county name, FIPS code and number of solar thermal projects for each county. The annual electric savings per county and the OSP electric savings per county, which were estimated from these projects, are presented in Figure 6-14 and in Figure 6-15, respectively. Lastly, the corresponding annual NOx emission reductions are shown in Figure 6-16.

Table 6-5: Solar Thermal Projects: Energy Reductions up to 2022

County	Annual Energy Savings (for Base Year Conditions)	OSP Energy Savings (for Base Year Conditions)
	Annual Elec. Equivalent (kWh/year)	OSP Elec. Equivalent (kWh/day)
Bexar	60,388	161
El Paso	141,850	390
Fort Bend	16,318	44
Hays	276	1
Nueces	12,250	34
Parker	9,806	27
Travis	1,768	1
Victoria	336	1
Williamson	11,519	31
Total	**254,511**	**689**

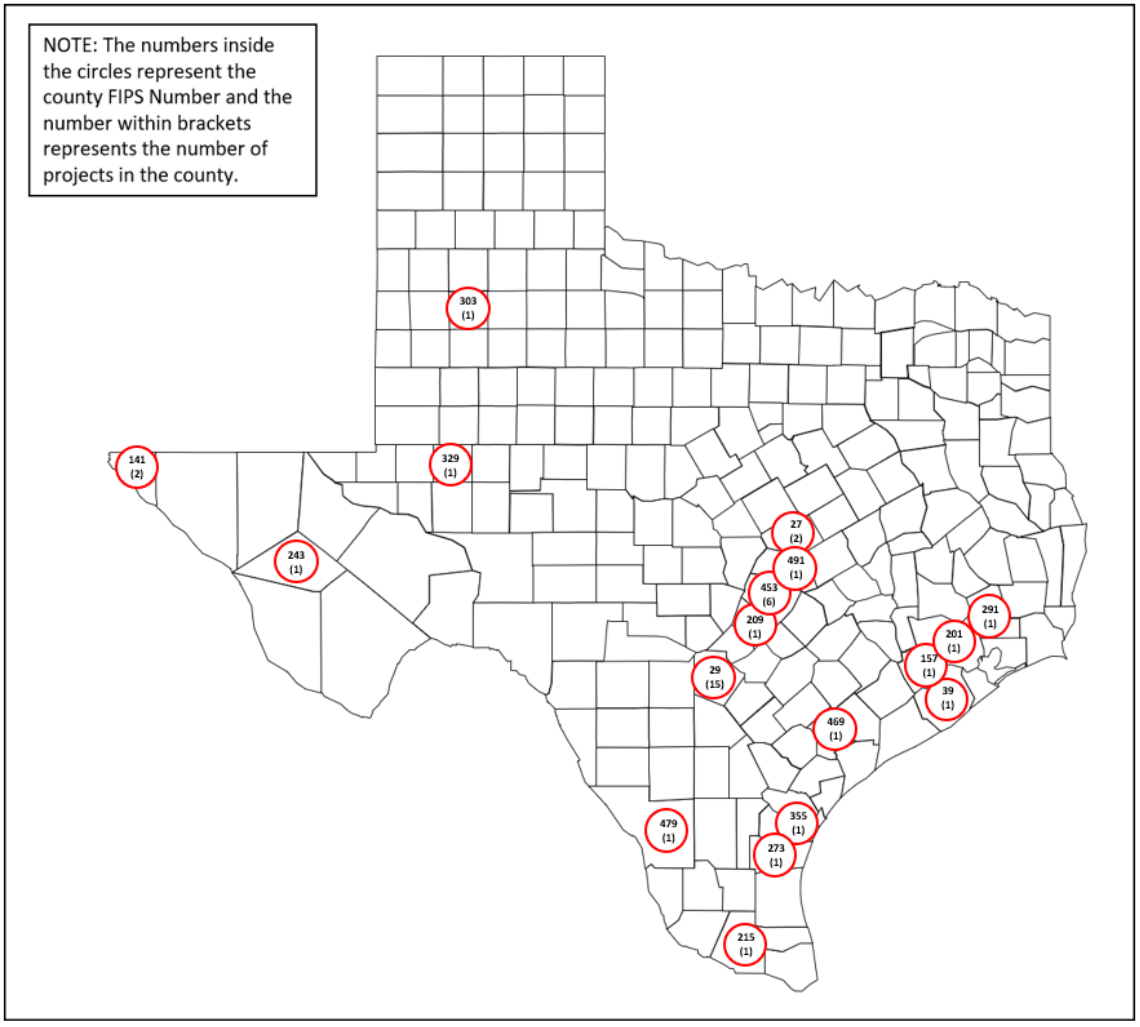


Figure 6-13: Map of Solar Thermal Projects Installed in Each County of Texas through 2022

Table 6-6: Solar Thermal Projects throughout Texas through 2022

County	FIPS Code	No. of Projects
Bell	27	2
Bexar	29	15
Brazoria	39	1
El Paso	141	2
Fort Bend	157	1
Harris	201	1
Hays	209	1
Hidalgo	215	1
Jeff Davis	243	1
Kleberg	273	1
Liberty	291	1
Lubbock	303	1
Midland	329	1
Nueces	355	1
Travis	453	6
Victoria	469	1
Webb	479	1
Williamson	491	1
N/A	-	2
Total		**41**

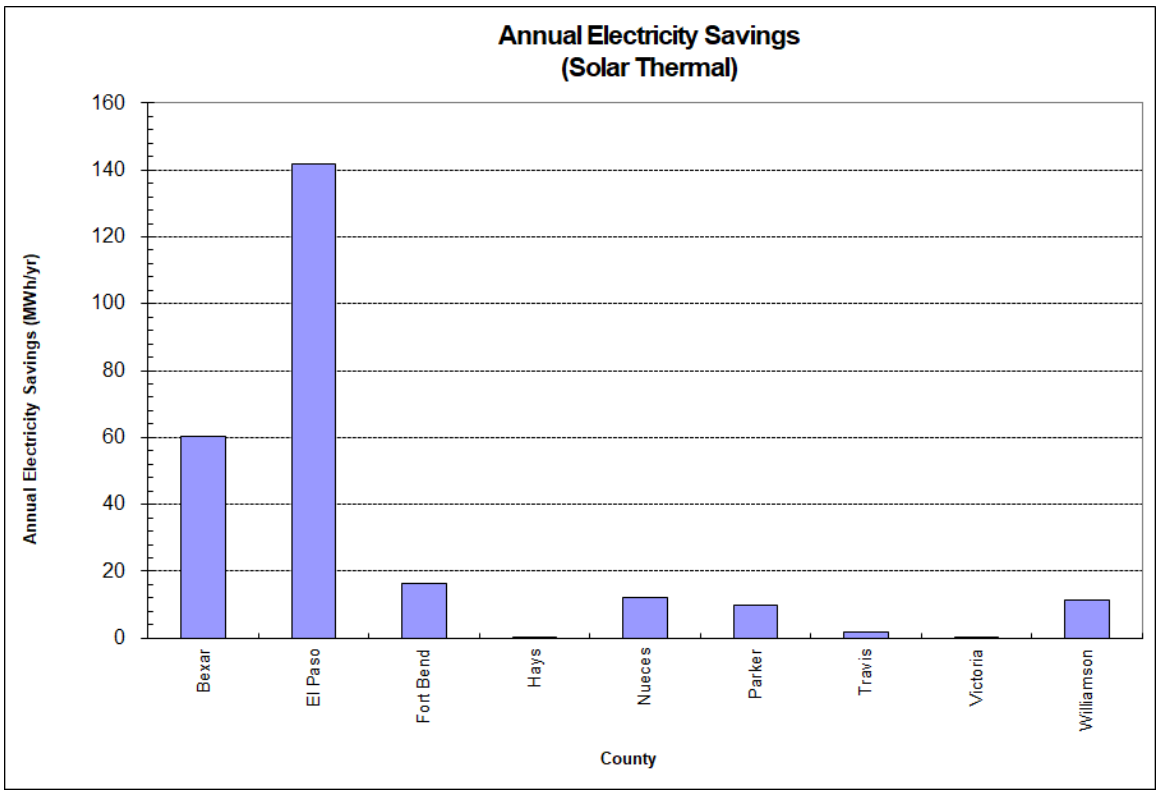


Figure 6-14: Annual Electricity Savings per County from Solar Thermal Projects through 2022

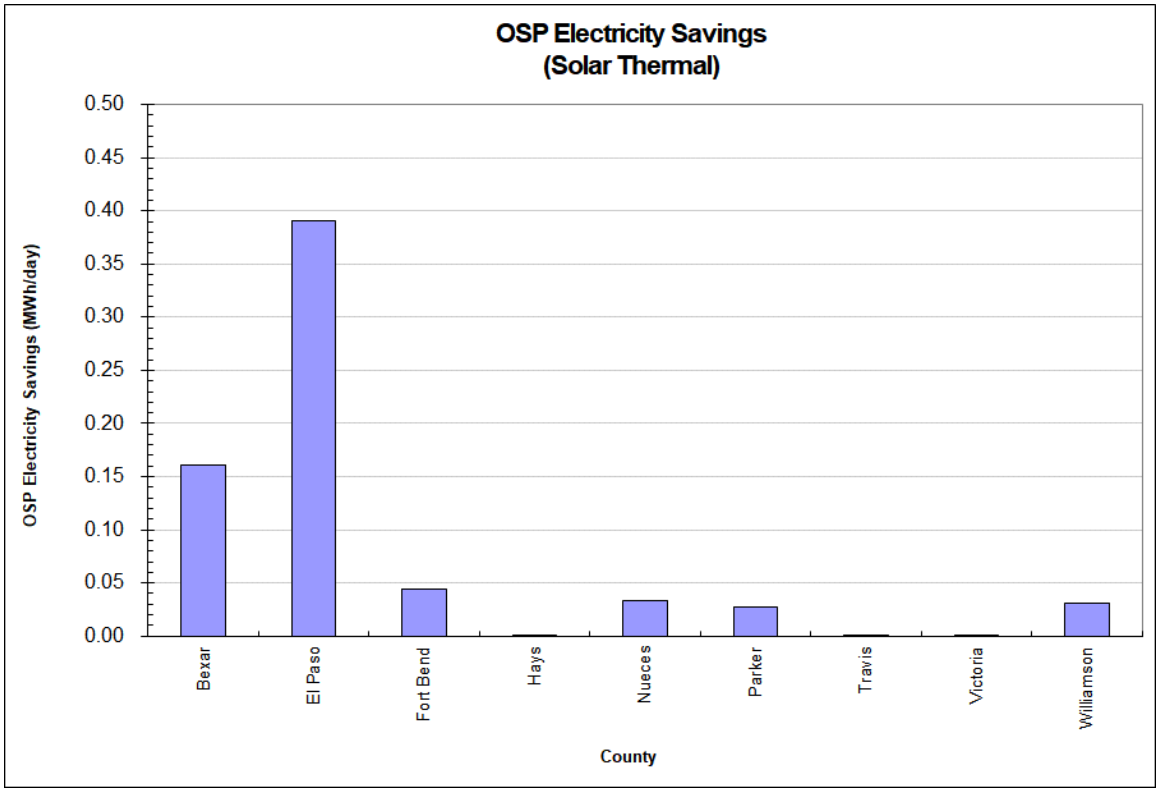


Figure 6-15: Ozone Season Period Electricity Savings per County from Solar Thermal Projects through 2022

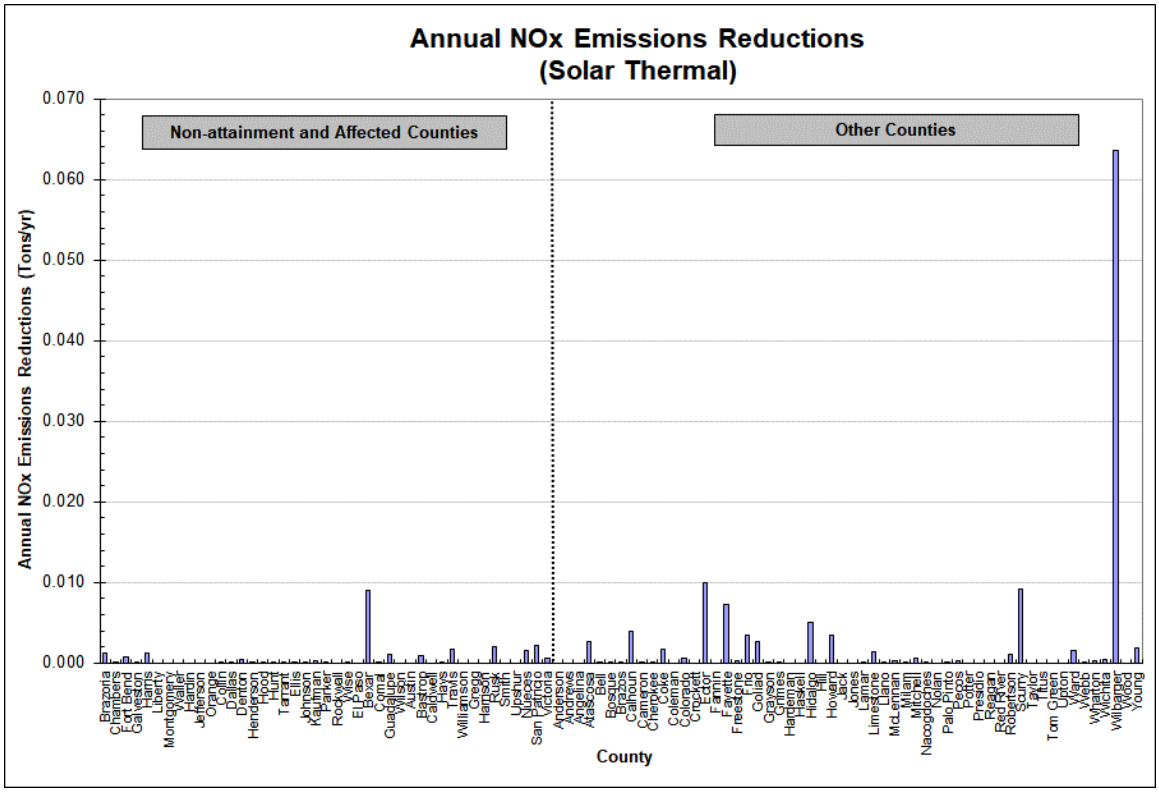


Figure 6-16*:* NOx Emissions Reductions per County from Solar Thermal Projects through 2022

6.2.3 Biomass

The data from 12 biomass power plants in the State of Texas were obtained from ERCOT. Table 6-7 shows the list of the biomass projects with their names, respective county, year commissioned, the forecast zone they serve, installed capacity and total electricity produced for the year 2022. Figure 6-17 shows the annual electricity generation of the identified biomass projects in the State of Texas. Figure 6-18 shows the map of the number of biomass projects for each county. In addition, Table 6-8 provides detailed information about Figure 6-18, including: county name, FIPS code, number of biomass plants and total installed capacity for each county. The total power generation capacity from all biomass projects in 2022 is 179 MW. Compared to what was reported last year, an increase of 44% on measured annual electricity generation by biomass was observed, from 434,278 MWh/yr in 2021 to 625,349 MWh/yr in 2022.

The annual electricity savings per county and the OSP electricity savings per county, which were estimated from these projects, are presented in Figure 6-19 and in Figure 6-20, respectively. In addition, the hourly and daily total electricity generation profiles of different biomass projects are shown in Volume II, Appendix D. Figure 6-21 shows an example of the hourly electricity generation profile for DG_HBR_2UNITS, meanwhile Figure 6-22 shows an example of the daily total generation profile for the same unit.

Table 6-7: Biomass Projects in the State of Texas through 2022

No	Name of the Project	County	Year Commissioned	ERCOT Zone	Installed Capacity (MW_{AC})*	Annual Power Generated in 2022 (MWh/year)**	Daily Average Power Generated in 2022 OSP (MWh/day) **
1	DG_78252_4UNITS	Bexar	2013	South	4.2	9,381	30
2	DG_BIO2_4UNITS	Denton	2009	North	6.4	29,007	84
3	DG_BIOE_2UNITS	Denton	1988	North	6.2	34,626	103
4	DG_FREIH_2UNITS	Comal	2011	South	3.2	19,856	49
5	DG_HBR_2UNITS	Denton	2011	North	3.2	22,466	60
6	DG_MEDIN_1UNIT	Bexar	2005	South	9.6	35,436	92
7	DG_S_SNR_UNIT1	Cameron	1973	South	4.5	357	0
8	DG_SPRIN_4UNITS	Travis	2007	South	6.4	28,287	68
9	DG_WALZE_4UNITS***	Bexar	2002	South	9.8	0	0
10	DG_WSTHL_3UNITS	Parker	2010	North	4.8	15,066	60
11	NACPW_UNIT1	Nacogdoches	2012	North	116.5	430,865	1,705
12	TRIRA_1UNIT	Dallas	2015	North	4.0	4	0
Total					**179**	**625,349**	**2,252**

* Capacity, Demand and Reserves Report-May 2023.xlsx from the webpage of the ERCOT (https://www.ercot.com/gridinfo/resource/index.html)
** 2022 ERCOT biomass 15-min generation data
*** In 2022 ERCOT data, DG_WALZE_4UNITS had no generation

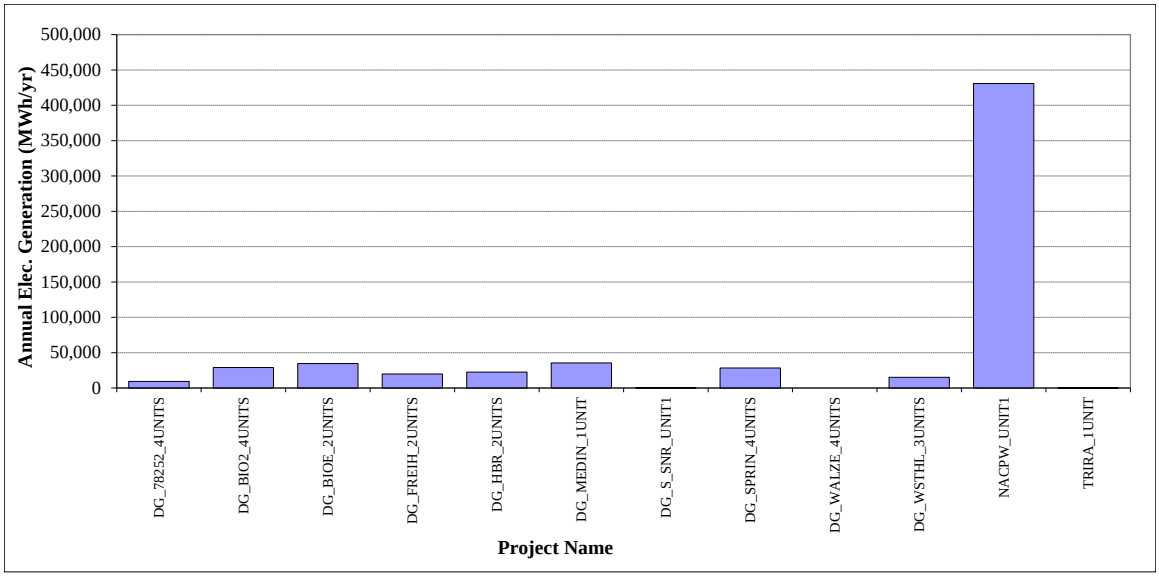


Figure 6-17: Annual Electricity Generation by Biomass Projects in the State of Texas through 2022

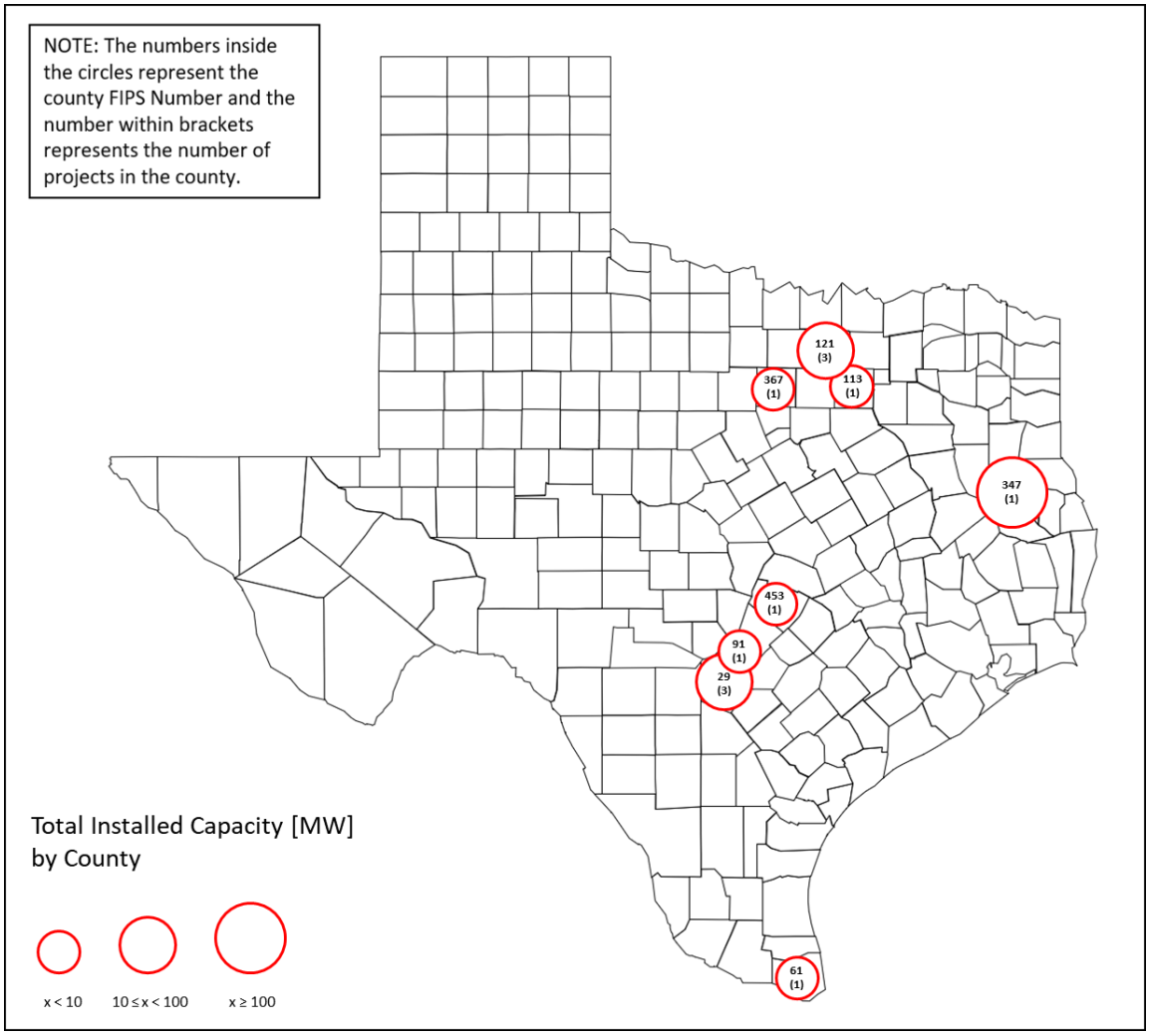


Figure 6-18: Map of Biomass Projects Installed in Each County of Texas

Table 6-8: Biomass Projects throughout Texas through 2022

County	FIPS Code	No. of Projects	Total Installed Capacity (MW)
Bexar	29	3	23.6
Cameron	61	1	4.5
Comal	91	1	3.2
Dallas	113	1	4
Denton	121	3	15.8
Nacogdoches	347	1	116.5
Parker	367	1	4.8
Travis	453	1	6.4
Total		**12**	**179**

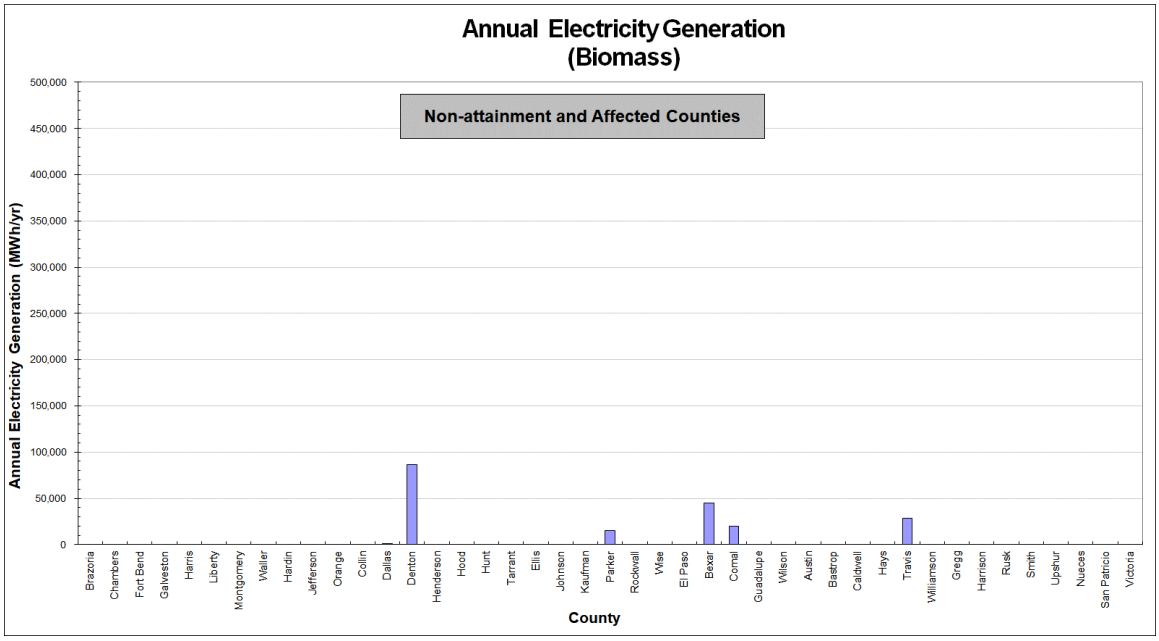


Figure 6-19: Annual Electricity Savings per County from Biomass Projects through 2022

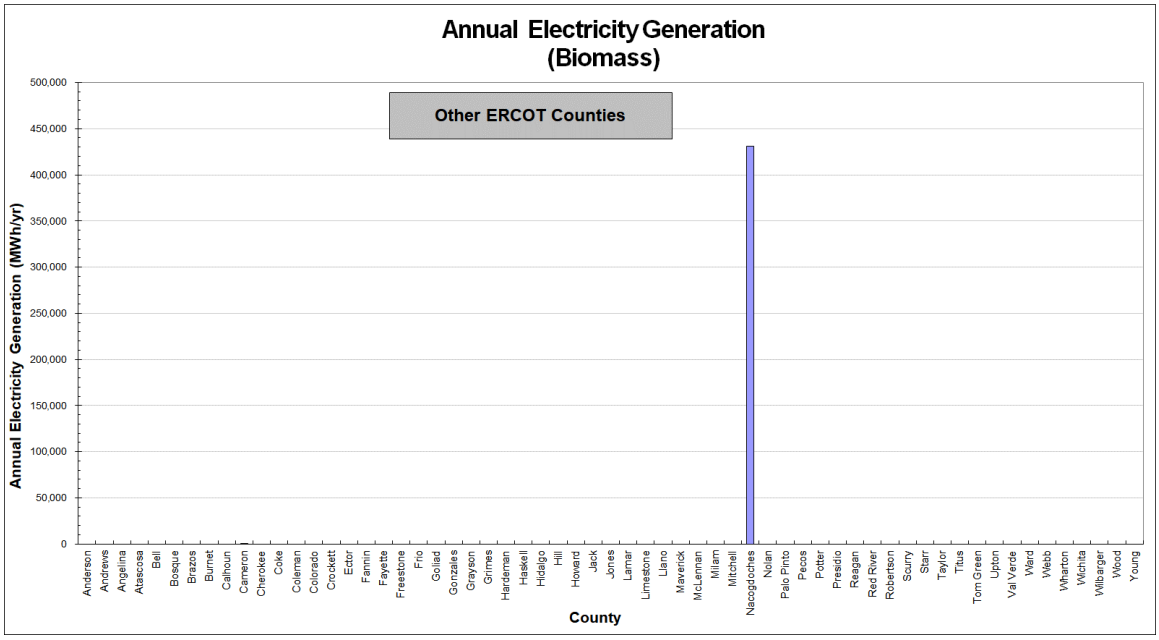


Figure 6-19: Annual Electricity Savings per County from Biomass Projects through 2022 (Continued)

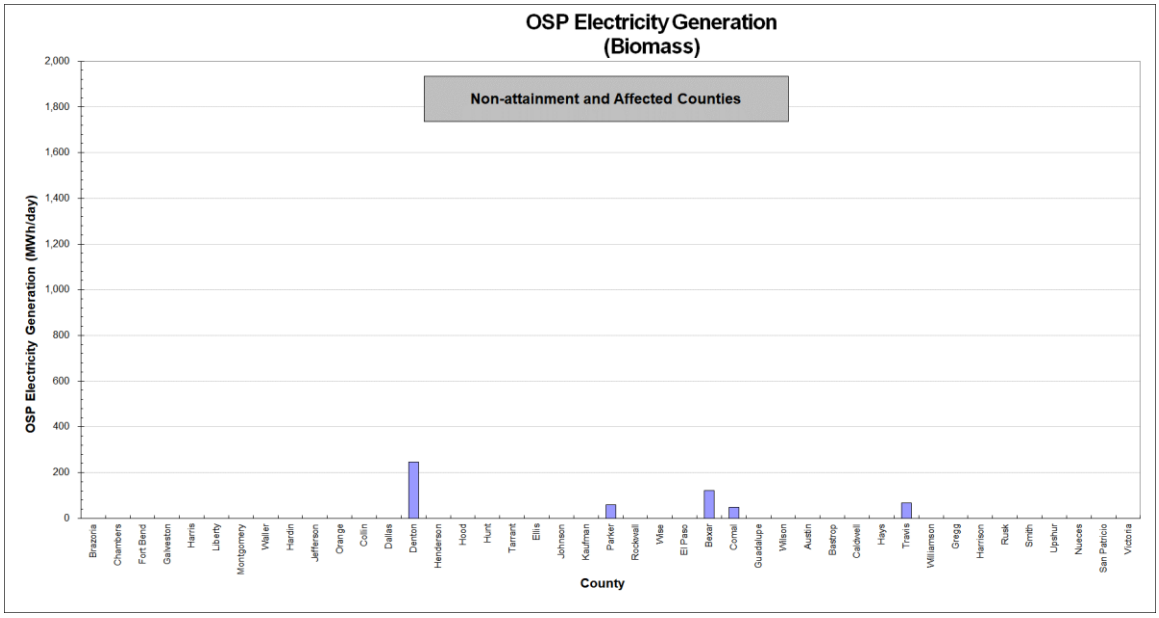


Figure 6-20: Ozone Season Period Electricity Savings per County from Biomass Projects through 2022

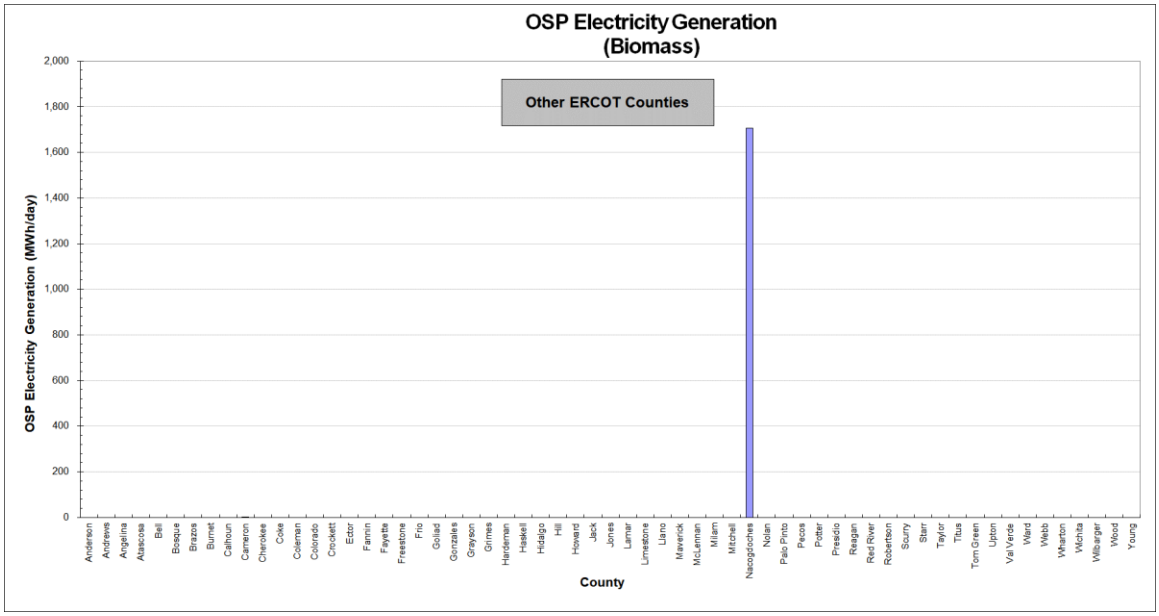


Figure 6-20: Ozone Season Period Electricity Savings per County from Biomass Projects through 2022 (Continued)

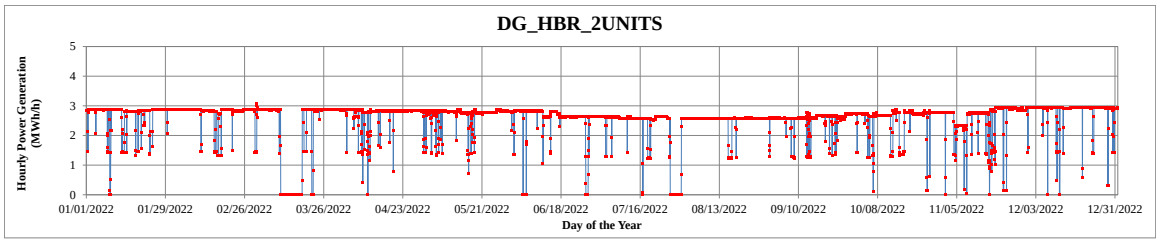


Figure 6-21: Hourly Electricity Generation Profile for Biomass DG_HBR_2UNITS

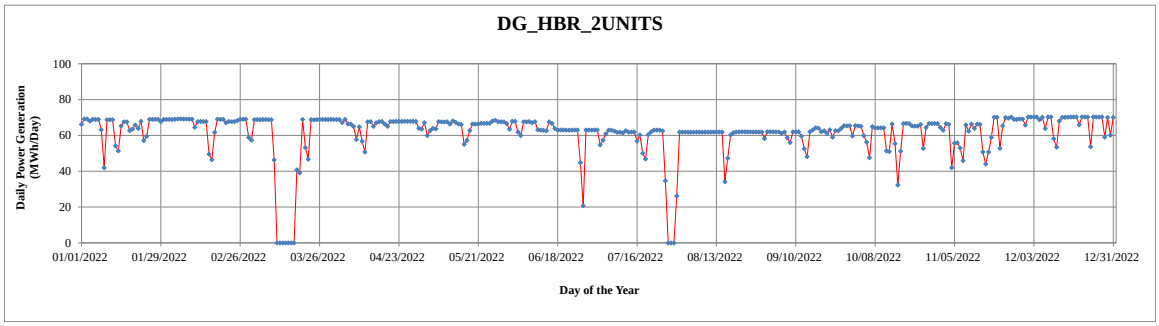


Figure 6-22: Daily Total Electricity Generation Profile for Biomass Project DG_HBR_2UNITS

6.2.4 Hydroelectric

The data from thirty-three hydroelectric power plants in the State of Texas were obtained. Table 6-9 shows the list of hydroelectric projects with their names, respective county, year commissioned, the forecast zone they serve, installed capacity and total electricity produced for the whole-year as well as Ozone Season Period (OSP) of 2022. Table 6-9 includes four hydroelectric power plants (i.e., RC THOMAS, ROBERT D WILLIS, SAM RAYBURN and TOLEDO BEND) that were installed outside ERCOT regions. These four hydroelectric power plants were identified from U.S. DOE Energy Information Administration (EIA) data (USEIA 2023a).

Figure 6-23 shows the annual electricity generation of the identified hydroelectric projects in the State of Texas. Figure 6-24 shows the map of the number of hydroelectric projects for each county. In addition, Table 6-10 provides detailed information about Figure 6-24, including: county name, FIPS code, number of hydroelectric power plants and total installed capacity for each county. The total power generation capacity from all hydroelectric projects in 2022 is 737 MW. The total annual and OSP electricity generation from all the hydroelectric plants for the year 2022 were 444,490 MWh/year and 1,767 MWh/day, respectively.

The annual electricity savings per county, which were estimated from these projects, are presented in Figure 6-25. The OSP electricity savings per county, which were estimated from these projects, are presented in Figure 6-26. In addition, the corresponding annual NOx emission reductions are shown in Figure 6-27.

The hourly and daily total electricity generation profiles of different hydroelectric projects are shown in Volume II, Appendix E. Figure 6-28 shows an example of the hourly electricity generation profile for AMISTAD_AMISTAG1, meanwhile Figure 6-29 shows an example of the daily total generation profile for the same unit. Based on the power generation data from the hydroelectric power plants, one significant pattern was observed. Most of the hydroelectric plants were intermittently operated for a few hours of the day.

Table 6-9: Hydroelectricity Power Projects in the State of Texas through 2022

No	Name of the Project	County	Year Commissioned	ERCOT Zone	Installed Capacity (MW_{AC})*	Annual Power Generated in 2022 (MWh/year)**	Daily Average Power Generated in 2022 OSP (MWh/day)**
1	AMISTAD_AMISTAG1	Val Verde	1983	West	34.7	45,106	124
2	AMISTAD_AMISTAG2	Val Verde	1983	West	34.7	18,621	61
3	AUSTPL_AUSTING1	Travis	1940	South	9.0	6,333	35
4	AUSTPL_AUSTING2	Travis	1940	South	9.0	6,823	36
5	BUCHAN_BUCHANG1	Llano	1938	South	18.3	3,478	16
6	BUCHAN_BUCHANG2	Llano	1938	South	18.3	11,614	68
7	BUCHAN_BUCHANG3	Llano	1950	South	18.3	8,510	55
8	CANYHY_CANYHYG1	Comal	1989	South	6.0	383	2
9	DG_LKWDT_2UNITS	Gonzales	1931	South	4.8	34	0
10	DG_LWSVL_1UNIT***	Denton	1991	North	2.2	0	0
11	DG_MCQUE_5UNITS	Guadalupe	1928	South	7.7	5,696	10
12	DG_OAKHL_1UNIT	Tarrant	2014	North	1.4	7	0
13	DG_SCHUM_2UNITS	Guadalupe	1928	South	3.6	73	0
14	DNDAM_DENISOG1	Grayson	1944	North	50.8	41,485	163
15	DNDAM_DENISOG2	Grayson	1948	North	50.8	39,698	161
16	EAGLE_HY_EAGLE_HY1	Maverick	2005	South	9.6	39,476	110
17	FALCON_FALCONG1	Starr	1954	South	10.5	9,841	36
18	FALCON_FALCONG2	Starr	1954	South	10.5	899	2
19	FALCON_FALCONG3	Starr	1954	South	10.5	10,010	40
20	INKSDA_INKS_G1	Llano	1938	South	15.0	11,957	70
21	MARBFA_MARBFAG1	Burnet	1951	South	19.8	3,953	25
22	MARBFA_MARBFAG2	Burnet	1951	South	19.8	6,104	38
23	MARSFO_MARSFOG1	Travis	1941	South	36.0	13,427	56
24	MARSFO_MARSFOG2	Travis	1941	South	36.0	23,619	120
25	MARSFO_MARSFOG3	Travis	1941	South	36.0	12,997	62
26	RC THOMAS	Polk	2020	N/A	26.7	100,732	351
27	ROBERT D WILLIS****	Jasper	1989	N/A	8.0	N/A	N/A
28	SAM RAYBURN****	Jasper	1965	N/A	52.0	N/A	N/A
29	TOLEDO BEND****	Newton	1969	N/A	81.0	N/A	N/A
30	WIRTZ_WIRTZ_G1	Burnet	1951	South	27.0	8,648	47
31	WIRTZ_WIRTZ_G2	Burnet	1951	South	27.0	8,335	44
32	WND_WHITNEY1	Bosque	1953	North	21.0	3,812	17
33	WND_WHITNEY2	Bosque	1953	North	21.0	2,818	17
Total					**737**	**444,490**	**1,767**

* Capacity, Demand and Reserves Report-May 2023.xlsx from the webpage of the ERCOT (https://www.ercot.com/gridinfo/resource/index.html) and EIA annual power generation data
** 2022 ERCOT hydroelectric 15-min generation data and EIA annual power generation data
*** In 2022 ERCOT data, DG_LWSVL_1UNIT had no generation
**** 2023 EIA data did not include annual power generation of the hydro project for the year 2022

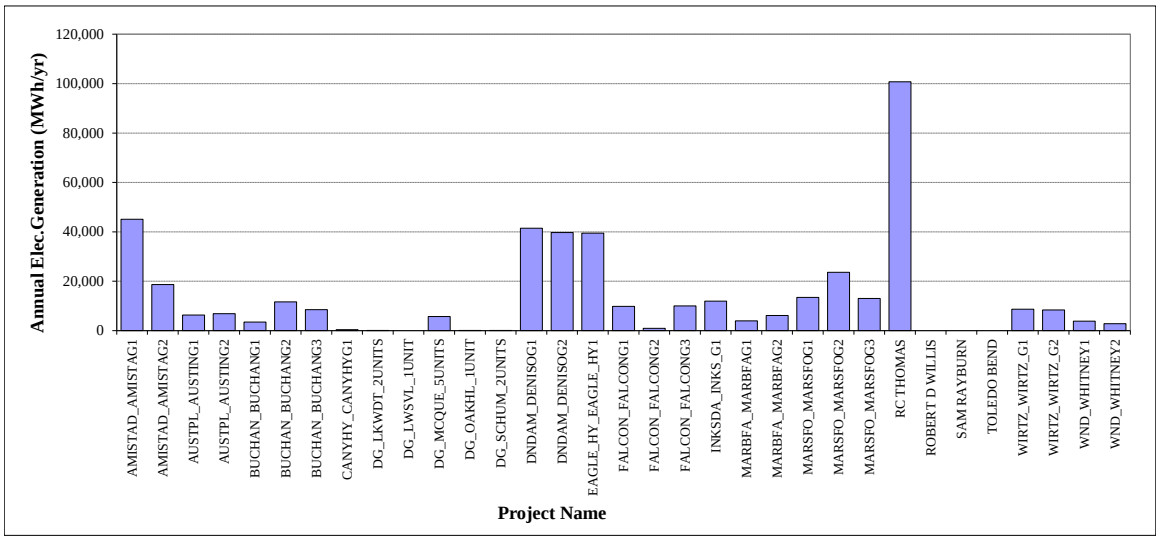


Figure 6-23: Annual Electricity Generation by Hydroelectric Projects in the State of Texas through 2022

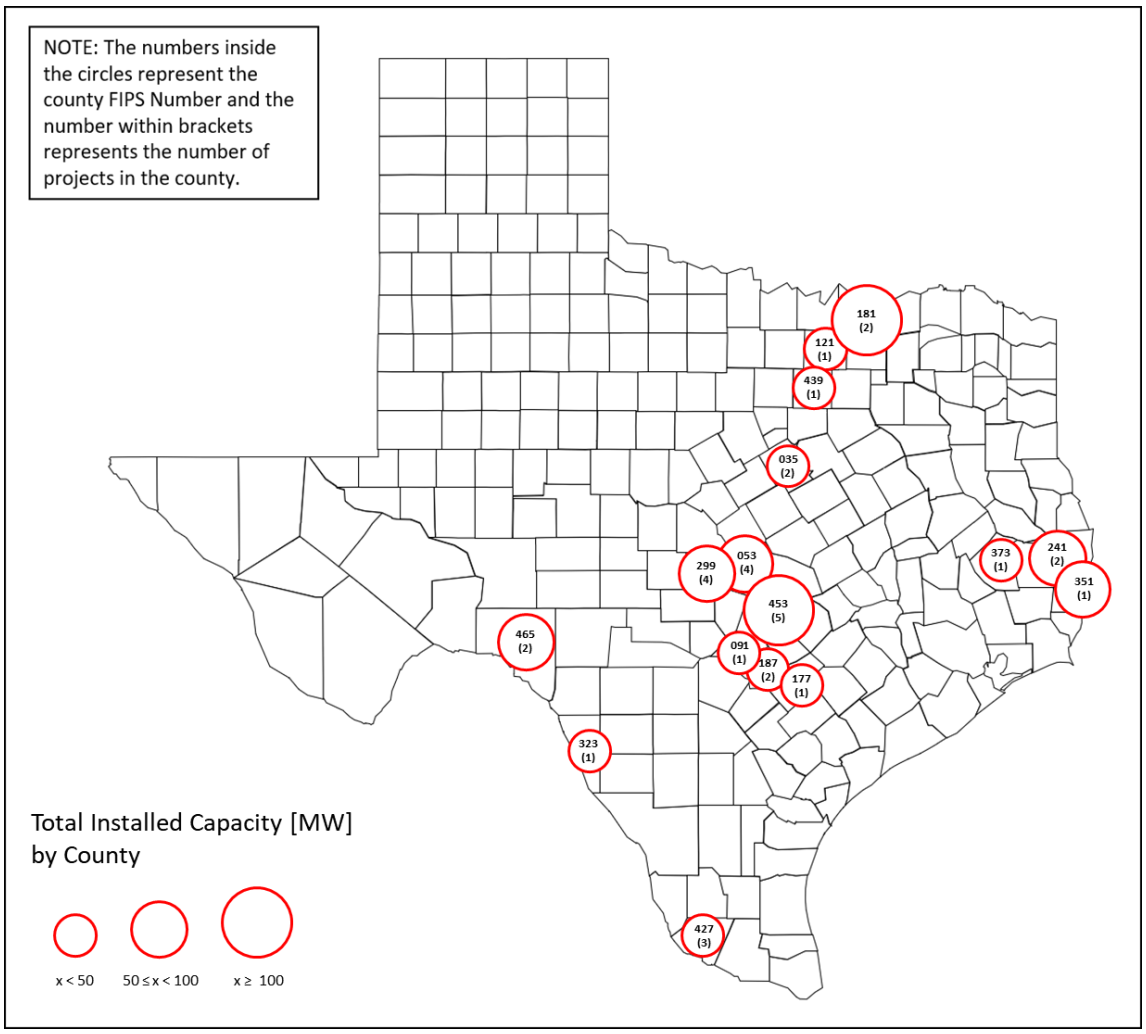


Figure 6-24: Map of Hydroelectric Projects Installed in Each County of Texas

Table 6-10: Hydroelectric Projects throughout Texas through 2022

County	FIPS Code	No. of Projects	Total Installed Capacity (MW)
Bosque	35	2	42
Burnet	53	4	94
Comal	91	1	6
Denton	121	1	2
Gonzales	177	1	5
Grayson	181	2	102
Guadalupe	187	2	11
Jasper	241	2	60
Llano	299	4	70
Maverick	323	1	10
Newton	351	1	81
Polk	373	1	27
Starr	427	3	32
Tarrant	439	1	1
Travis	453	5	126
Val Verde	465	2	69
Total		**33**	**737**

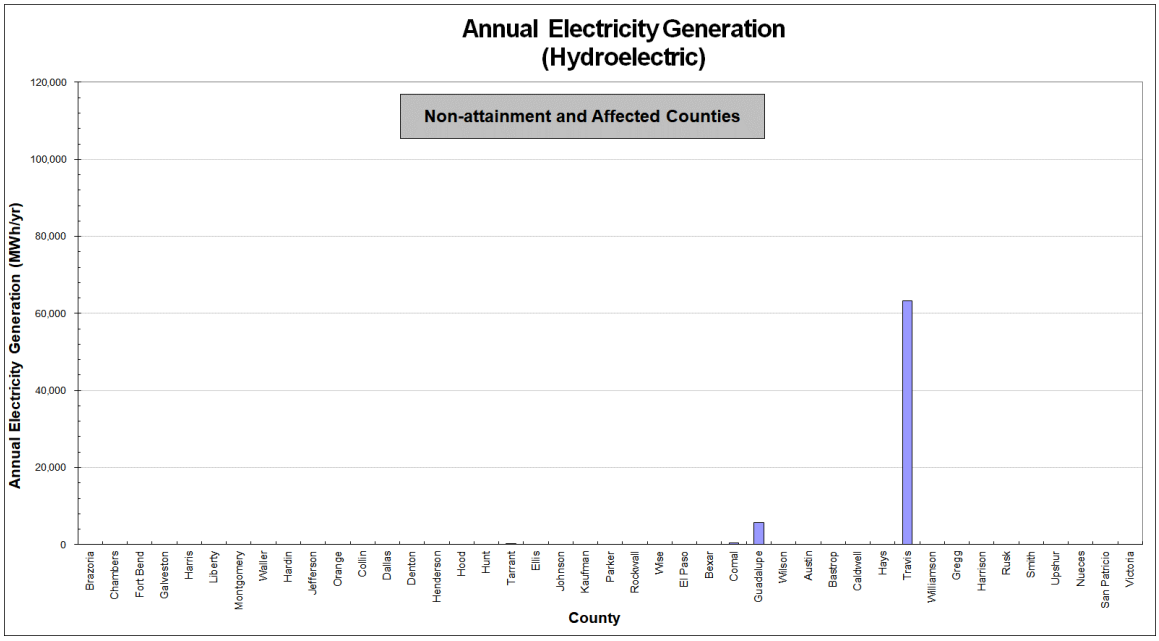


Figure 6-25: Annual Electricity Savings per County from Hydroelectric Projects through 2022

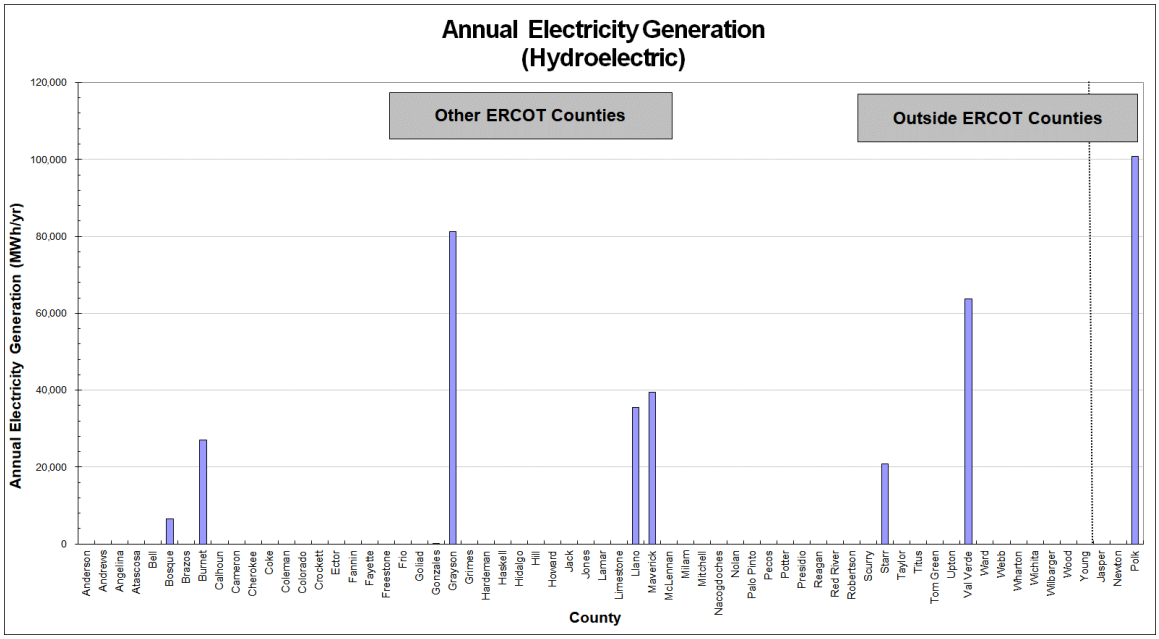


Figure 6-25: Annual Electricity Savings per County from Hydroelectric Projects through 2022 (Continued)

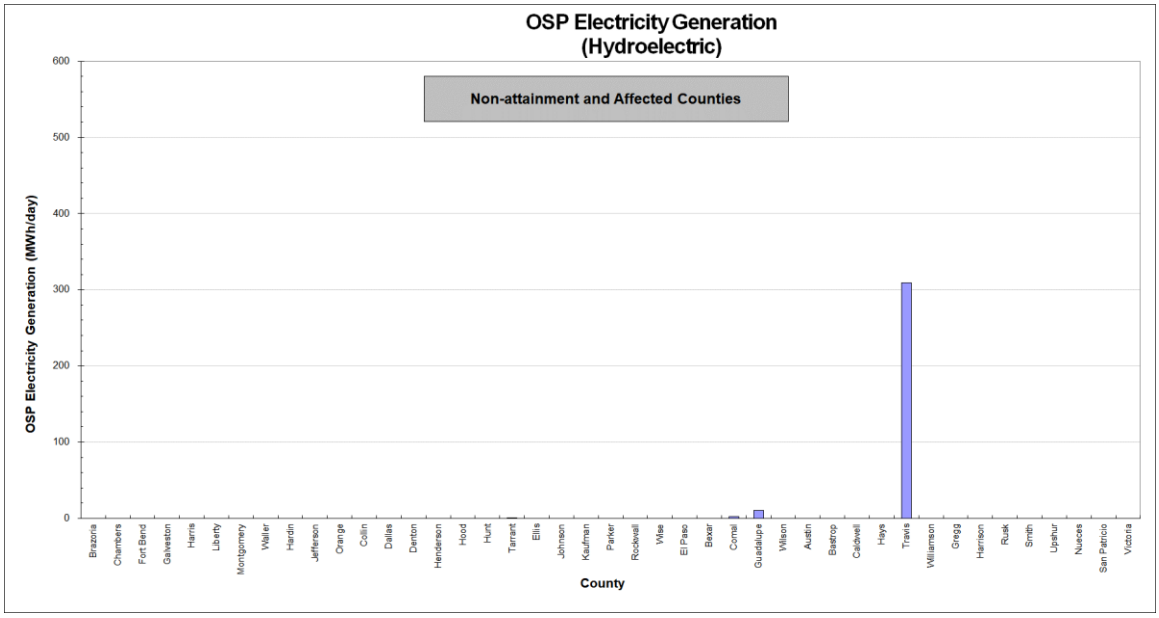


Figure 6-26: Ozone Season Period Electricity Savings per County from Hydroelectric Projects through 2022

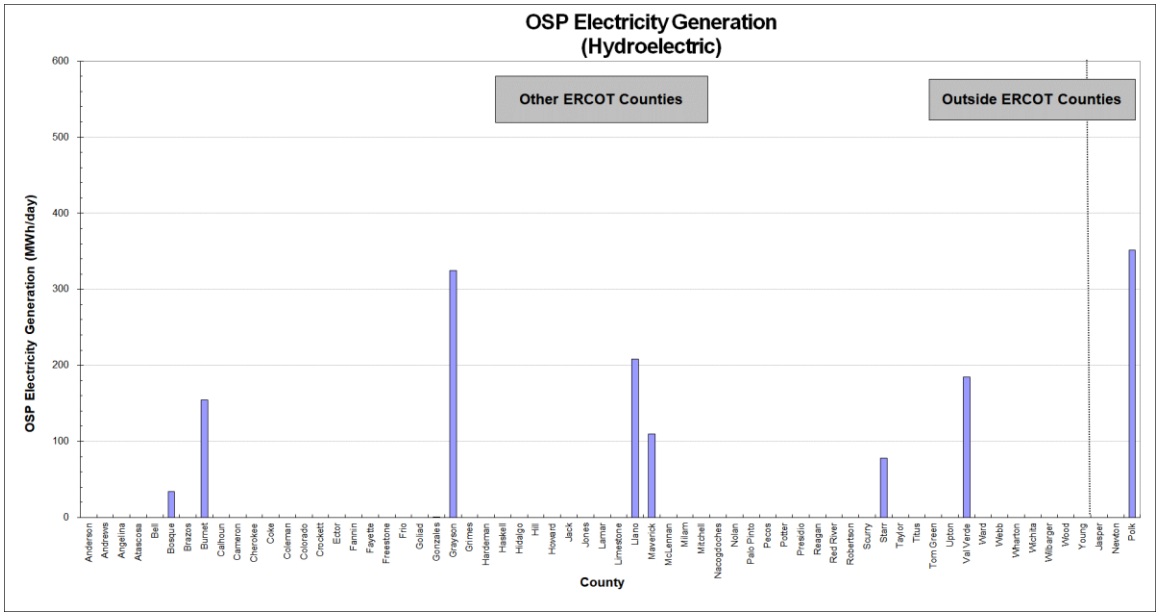


Figure 6-26: Ozone Season Period Electricity Savings per County from Hydroelectric Projects through 2022 (Continued)

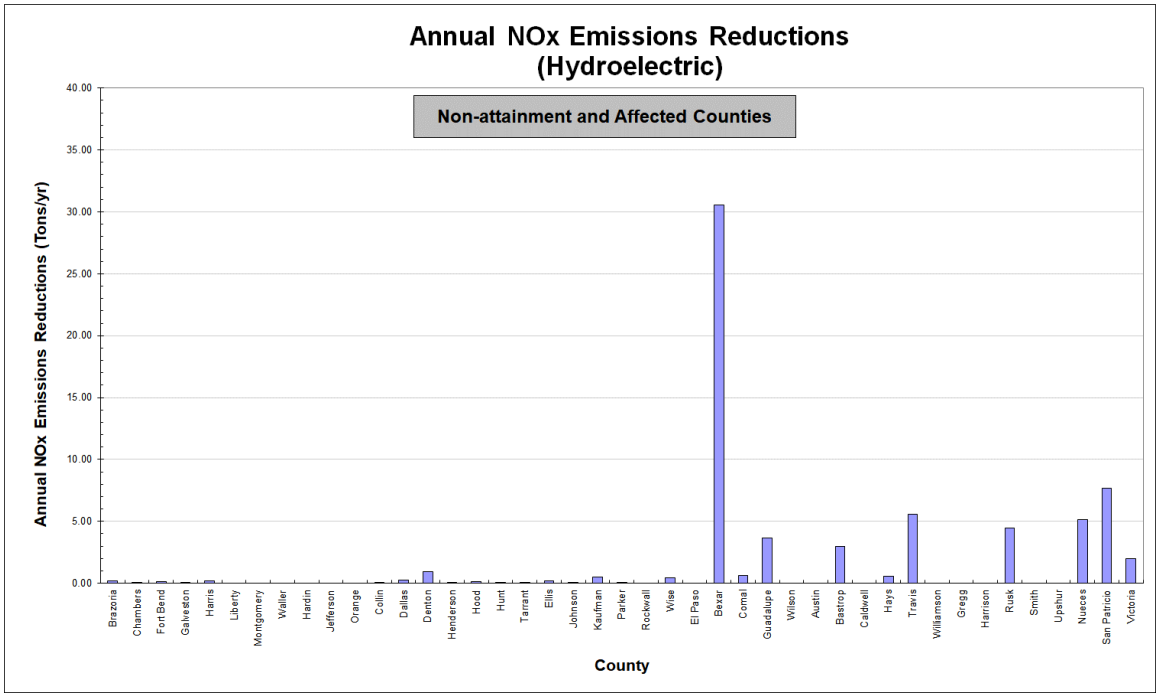


Figure 6-27: NOx Emissions Reductions per County from Hydroelectric Projects through 2022

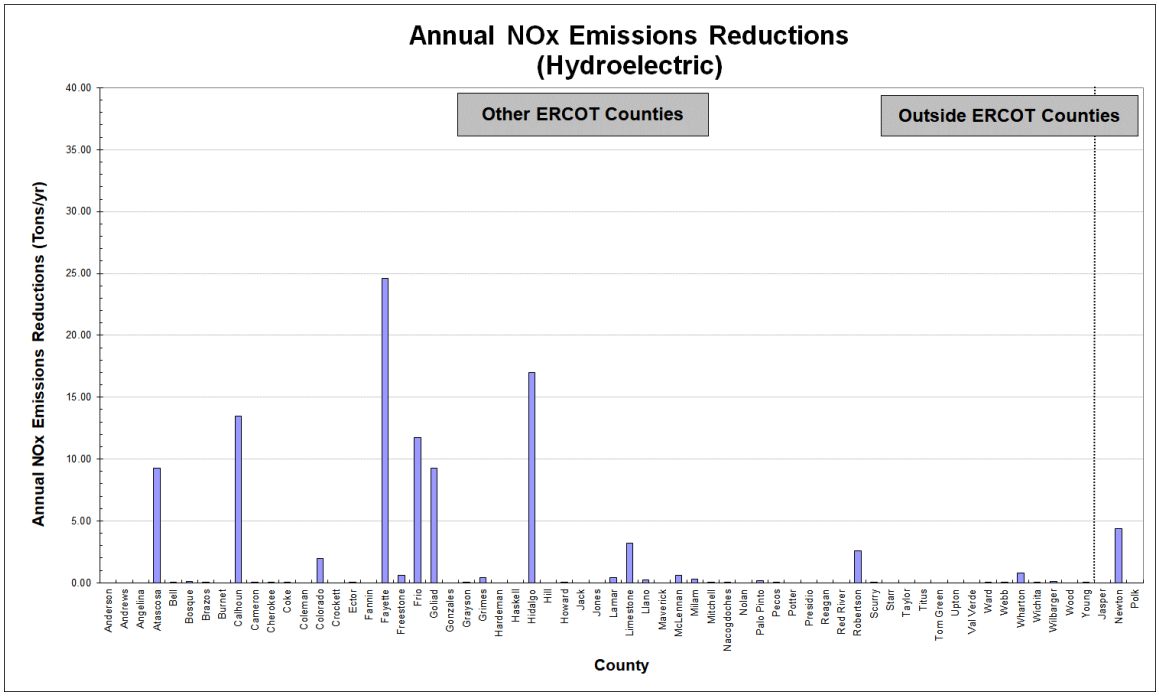


Figure 6-27: NOx Emissions Reductions per County from Hydroelectric Projects through 2022 (Continued)

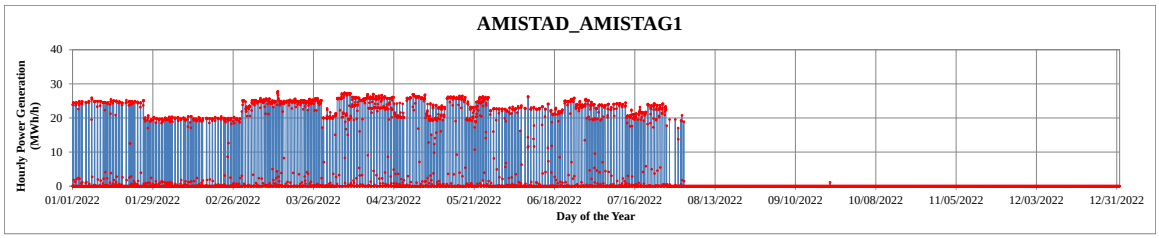


Figure 6-28: Hourly Electricity Generation Profile for Hydroelectric Project AMISTAD_AMISTAG1

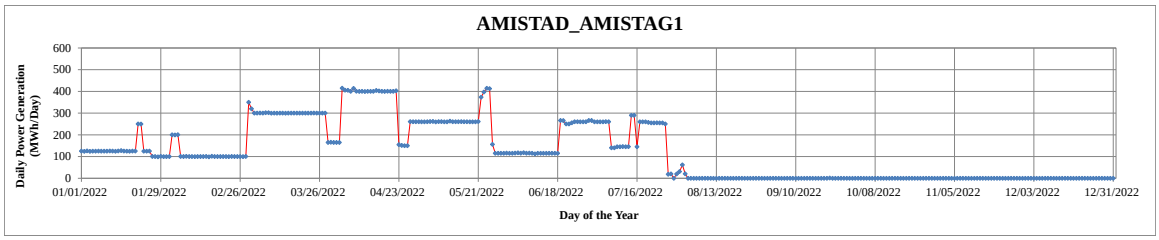


Figure 6-29: Daily Total Electricity Generation Profile for Hydroelectric Project AMISTAD_AMISTAG1

6.2.5 Geothermal

The total number of the identified geothermal projects for the present report was 306. Most of the geothermal projects throughout the State of Texas were identified from various web sources. In the present report for the year 2022, unfortunately, no new geothermal projects were found.

Figure 6-30 shows the map of the number of geothermal projects for each county. In addition, Table 6-11 provides detailed information about Figure 6-30, including: county name, FIPS code, number of geothermal projects and total installed capacity for each county. In Table 6-11, the total number and total installed capacity of geothermal projects were 306 and 35,792 tons, respectively. This report did not include either annual or OSP electricity savings and the NOx emission reductions per county from the geothermal projects, which were not possible to be estimated. Table F-3 (in Volume II, Appendix F) shows the list of the geothermal projects with their names, respective county, implementation year, installed capacity and service area.

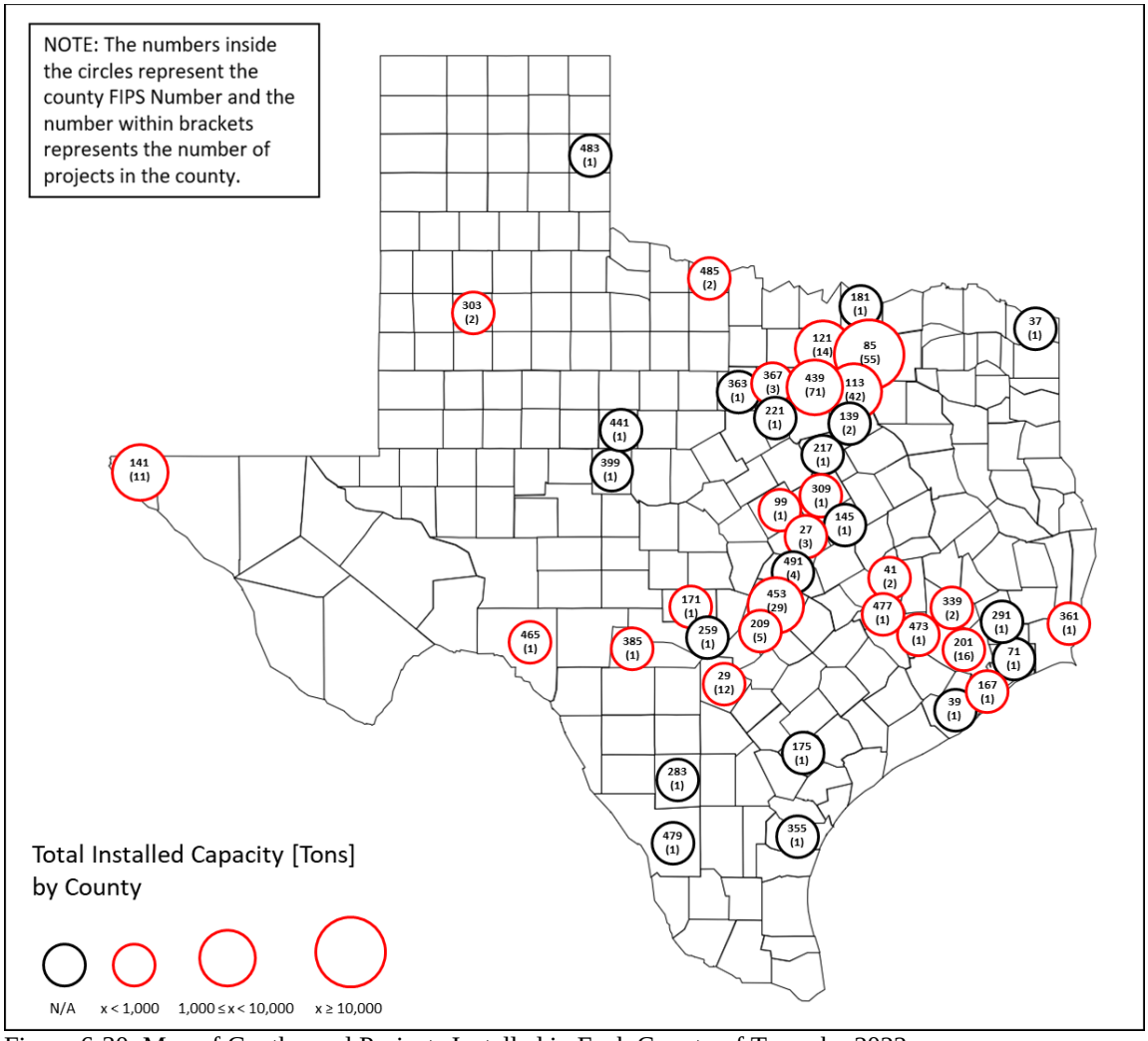


Figure 6-30: Map of Geothermal Projects Installed in Each County of Texas by 2022

Table 6-11: Geothermal Projects throughout Texas by 2022

County	FIPS Code	No. of Projects	Total Installed Capacity (Tons)	County	FIPS Code	No. of Projects	Total Installed Capacity (Tons)
Bell	27	3	208	La Salle	283	1	N/A
Bexar	29	12	80	Liberty	291	1	N/A
Bowie	37	1	N/A	Lubbock	303	2	800
Brazoria	39	1	N/A	McLennan	309	1	14
Brazos	41	2	90	Montgomery	339	2	70
Chambers	71	1	N/A	Nueces	355	1	N/A
Collin	85	55	13,144	Orange	361	1	50
Coryell	99	1	4	Palo pinto	363	1	N/A
Dallas	113	42	4,292	Parker	367	3	367
Denton	121	14	2,609	Real	385	1	120
Ellis	139	2	N/A	Runnels	399	1	N/A
El Paso	141	11	2,600	Tarrant	439	71	5,025
Falls	145	1	N/A	Taylor	441	1	N/A
Galveston	167	1	100	Travis	453	29	3,224
Gillespie	171	1	120	Val Verde	465	1	150
Goliad	175	1	N/A	Waller	473	1	70
Grayson	181	1	N/A	Washington	477	1	3
Harris	201	16	786	Webb	479	1	N/A
Hays	209	5	430	Wheeler	483	1	N/A
Hill	217	1	N/A	Wichita	485	2	1
Hood	221	1	N/A	Williamson	491	4	N/A
Kendall	259	1	N/A	N/A	-	5	1,437
				Total		**306**	**35,792**

6.2.6 Landfill Gas-Fired

The information for the landfill gas-fired power plants in Texas was found in the Environmental Protection Agency (EPA) project database for Landfill Methane Outreach Program (LMOP) (USEPA 2023). In the EPA database, the current status of landfill gas-fired power plants is categorized by operational, shutdown, construction, planned, candidate, potential and unknown.

In the EPA project database that was released in March 2023, 36 operational, 35 shutdowns, 2 construction, 4 planned, 47 candidates, 37 potential and 3 unknown landfill gas-fired projects were identified. Table F-4 (Volume II, Appendix F) shows the 36 operational landfill gas-fired power plants up to 2022. Figure 6-31 shows the map of the number of operational landfill gas-fired power plants for each county. In addition, Table 6-12 provides detailed information about Figure 6-33, including: county name, FIPS code, number of operational landfill gas-fired power plants and total installed capacity for each county. In Table 6-12, the total number and total installed capacity of landfill gas-fired projects were 36 and 45.8 MW, respectively. This report did not include either annual or OSP electricity savings and NOx emission reductions per county from the landfill gas-fired projects, which were not possible to be estimated.

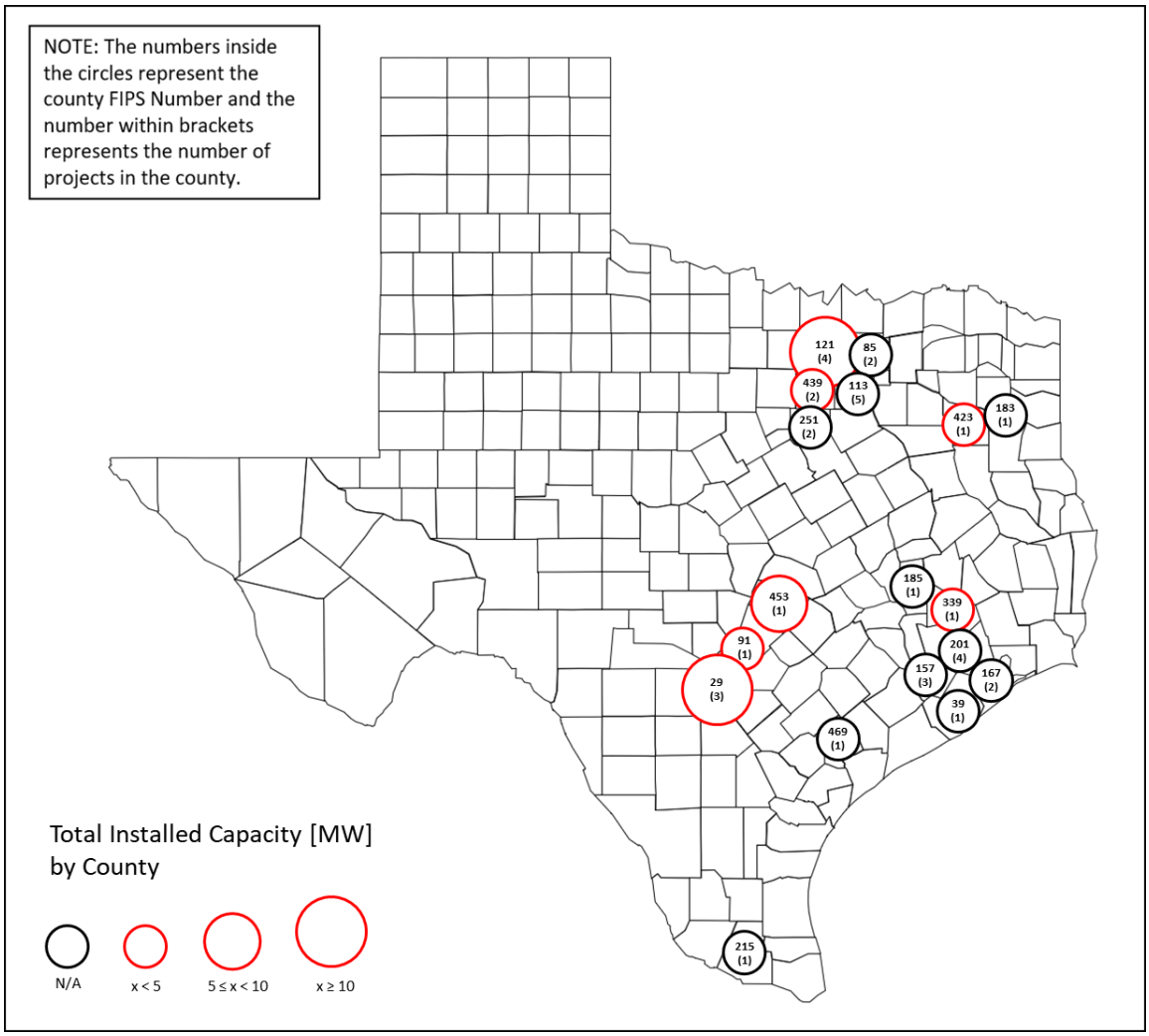


Figure 6-31: Map of Operational Landfill Gas-Fired Projects Installed in Each County of Texas by 2022

Table 6-12: Operational Landfill Gas-Fired Projects Installed throughout Texas by 2022

County	FIPS Code	No. of Projects	Total Installed Capacity (MW)
Bexar	29	3	13.8
Brazoria	39	1	N/A
Collin	85	2	N/A
Comal	91	1	3.2
Dallas	113	5	N/A
Denton	121	4	15.8
Fort Bend	157	3	N/A
Galveston	167	2	N/A
Gregg	183	1	N/A
Grimes	185	1	N/A
Harris	201	4	N/A
Hidalgo	215	1	N/A
Johnson	251	2	N/A
Montgomery	339	1	3.33
Smith	423	1	N/A
Tarrant	439	2	3.2
Travis	453	1	6.4
Victoria	469	1	N/A
Total		**36**	**45.8**

6.3 Summary

The State of Texas leads the renewable energy development in the U.S. In June 2023, 23,005 new renewable energy projects in Texas, which were not part of the previous report published, were identified, located and included in the present report. The details of the new project can be found in Table 6-13.

Table 6-13: Comparison of the Projects Identified from Previous and Present Reports

Renewable Energy Source	Total Number of Projects up to 2021	Number of New Projects in 2022	Total Number of Projects up to 2022	Total Capacity Installed up to 2022
Non-Utility Solar PV	40,700	22,971	63,671	481 MW
Utility Solar PV	117	33	150	13,492 MW
Solar Thermal	41	0	41	N/A
Biomass	12	0	12	179 MW
Hydroelectric	33	0	33	737 MW
Geothermal	306	0	306	35,792 tons
Landfill Gas-Fired[1]	35	1	36	46 MW

Note:
[1] Landfill gas-fired project information from EPA have seven sub-categories for their status: operational, shutdowns, construction, planned, candidates, potential and unknown, and operational projects were considered for the number of projects.

This report also presents county-wide annual/OSP energy savings for solar photovoltaic including solar power, solar thermal, biomass, and hydroelectric projects. The power generation data for the other utility-scale renewable energy projects (solar power, biomass, and hydroelectric), which were obtained from the ERCOT and EIA, were used to evaluate the annual/OSP energy generation. The annual/OSP energy savings calculation for solar thermal was conducted based on the project data from various web sources. Then, the annual NOx emission reductions calculation was conducted with the special version of Texas 2018 eGRID, based on their energy savings/generation.

In 2022, the total annual/OSP energy savings from each renewable projects across all the counties were:

- solar photovoltaic projects (non-utility scale): 764,231 MWh/yr and 2,363 MWh/day;
  in addition, solar power projects (utility-scale): 24,182,820 MWh/yr and 85,682 MWh/day,
- solar thermal projects: 255 MWh/yr and 0.7 MWh/day,
- biomass projects: 625,349 MWh/yr and 2,252 MWh/day, and
- hydroelectric projects: 444,490 MWh/yr and 1,767 MWh/day.

In 2022, the annual NOx emission reductions from renewable projects across all the counties were:

- solar photovoltaic projects (non-utility scale): 377.1 tons/yr;
  in addition, solar power projects (utility-scale): 13,741.7 tons/yr,
- solar thermal projects: 0.1 tons/yr,
- hydroelectric projects: 168.1 tons/yr.

These savings and reductions do not represent all of the solar thermal projects in the State of Texas. They only reflect the projects based on the investigated resources.

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 (REC) Program site (https://sa.ercot.com/rec/home) was reviewed for use in the Laboratory's report to the TCEQ. 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 2022 reports to the Legislature, which were converted into a tabular format for analysis and insertion into this report (in Volume II, Appendix G). Similarly, information from ERCOT's listing of REC generators was inspected to determine how it compared with other sources of information the Laboratory has assembled.

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 it to the Legislature. Table 7-1 shows a summary of annual electricity generation by renewable sources from 2001 to 2022 from ERCOT report (https://sa.ercot.com/rec/tech-generator).

Figure 7-1, Figure 7-2 and Figure 7-3 have been included to better illustrate the annual data collected by ERCOT. In Figure 7-1, the annual total electricity generation of all the renewable sources is shown. In Figure 7-2, the annual electricity generation of renewable sources excluding wind is shown. Similarly, in Figure 7-3, the annual electricity generation of renewable sources excluding wind and solar is shown. This was done to understand the contribution of individual energy sources to the total electricity generated.

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. The renewable energy in Texas has grown from 596,236 MWh in 2001 to 138,368,184 MWh in 2022. This is followed by:

- Wind energy has grown from 565,597 MWh in 2001 to 113,347,551 MWh in 2022;
- Solar energy has grown from 87 MWh in 2002 to 24,131,729 MWh in 2022;
- Biomass energy has grown from 39,496 MWh in 2003 to 470,827 MWh in 2022;
- Hydroelectric energy has grown from 30,639 MWh in 2001 to 226,941 MWh in 2022; and
- Landfill gas energy has grown from 29,412 MWh in 2002 to 191,136 MWh in 2022.

Other sources of information present some differences in the values of the renewable electricity generated in Texas. It has been found some discrepancies between U.S. DOE Energy Information Administration (EIA) and ERCOT sources on electricity generation from wind, but it has been a small difference. In 2022, the wind electricity generation data from the ERCOT REC program is similar to the generation data from the EIA. The EIA wind electricity generation for 2022 (USEIA 2023b) was 113,880,000 MWh in a net generation, and the wind electricity generation of EIA are 0.47% higher than that of ERCOT.

Table 7-1: Annual Electricity Generation by Renewable Sources (MWh, ERCOT: 2001–2022)

Year	Biomass (MWh)	Hydro (MWh)	Landfill gas (MWh)	Solar (MWh)	Wind (MWh)	Total (MWh)
2001	0	30,639	0	0	565,597	596,236
2002	0	312,093	29,412	87	2,451,484	2,793,076
2003	39,496	239,684	154,206	220	2,515,482	2,949,087
2004	36,940	234,791	203,443	211	3,209,630	3,685,014
2005	58,637	310,302	213,777	227	4,221,568	4,804,512
2006	60,569	210,077	306,087	470	6,530,928	7,108,131
2007	54,101	382,882	356,339	1,844	9,351,168	10,146,333
2008	70,833	445,428	387,110	3,338	16,286,440	17,193,150
2009	73,364	507,507	412,923	4,492	20,596,105	21,594,390
2010	97,535	609,257	464,904	14,449	26,828,660	28,014,805
2011	137,004	267,113	497,645	36,580	30,769,674	31,708,016
2012	288,988	389,197	549,037	139,439	32,746,534	34,113,195
2013	200,564	294,238	550,845	178,326	36,909,385	38,133,358
2014	343,469	240,792	518,580	312,757	40,644,362	42,059,961
2015	349,600	414,289	561,915	410,318	45,165,341	46,901,462
2016	247,643	393,740	518,403	848,410	57,796,161	59,804,357
2017	216,431	444,453	446,119	2,289,394	66,076,742	69,473,139
2018	287,014	334,460	395,428	3,183,238	73,960,577	78,160,716
2019	153,531	266,718	335,361	4,492,846	81,770,300	87,018,756
2020	140,878	222,252	270,377	8,772,250	93,507,058	102,912,813
2021	252,321	235,170	209,019	15,778,043	101,664,605	118,139,158
2022	470,827	226,941	191,136	24,131,729	113,347,551	138,368,184

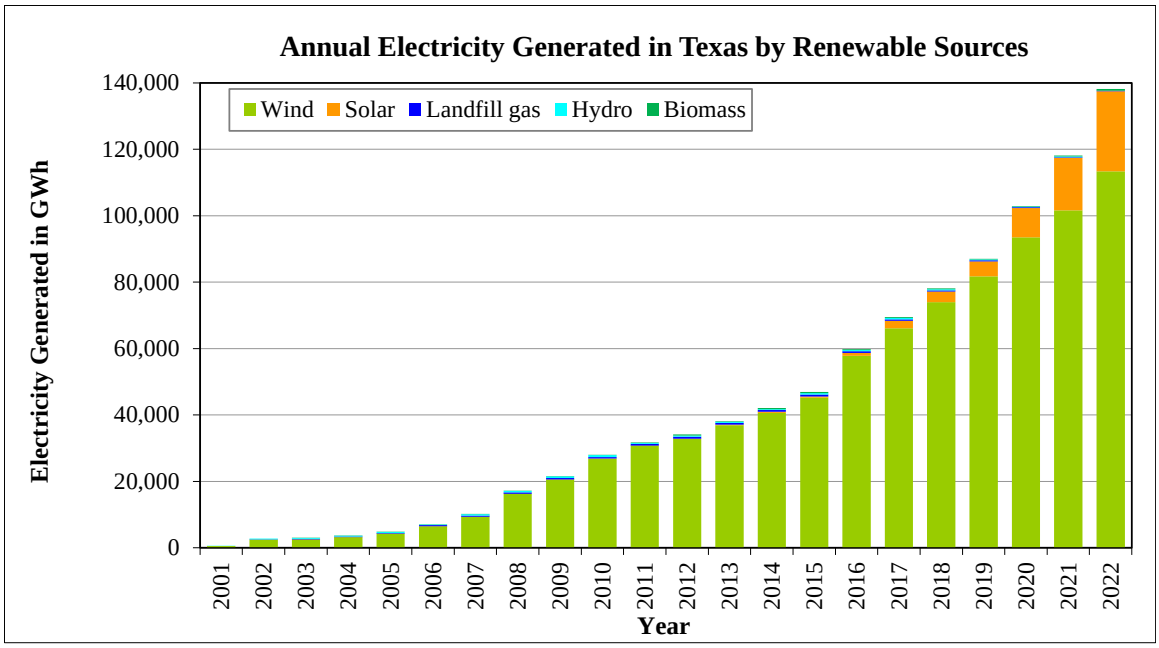


Figure 7-1: Electricity Generation by Renewable Sources (ERCOT: 2001–2022 Annually)

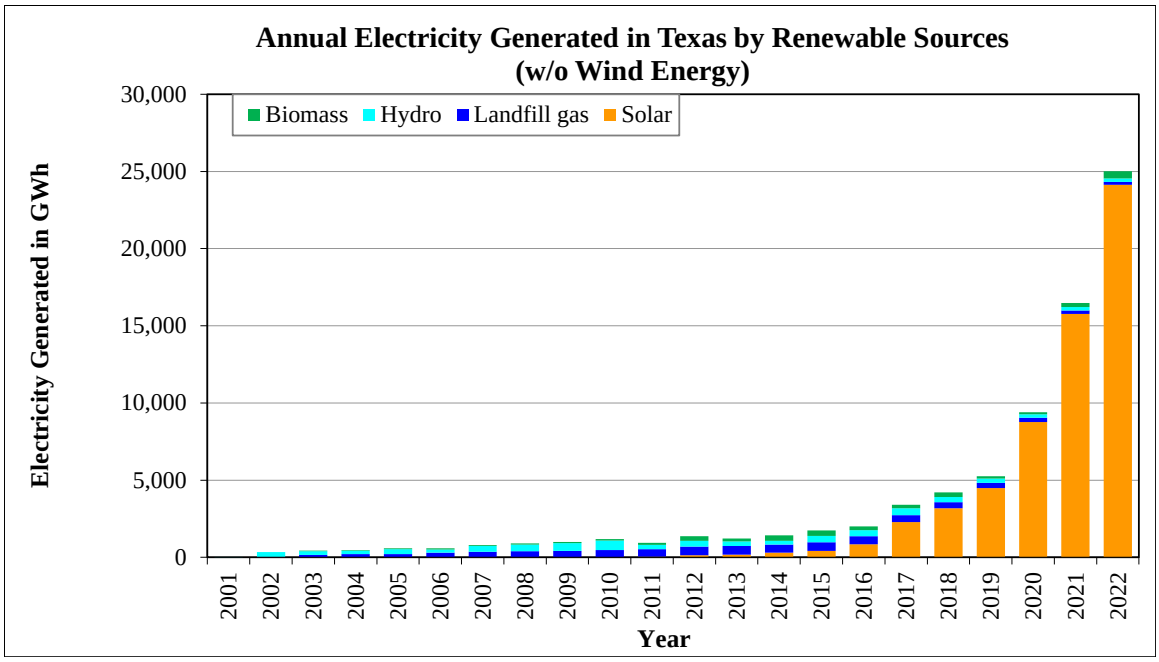


Figure 7-2: Electricity Generation by Renewable Sources Other than Wind Energy (ERCOT: 2001–2022 Annually)

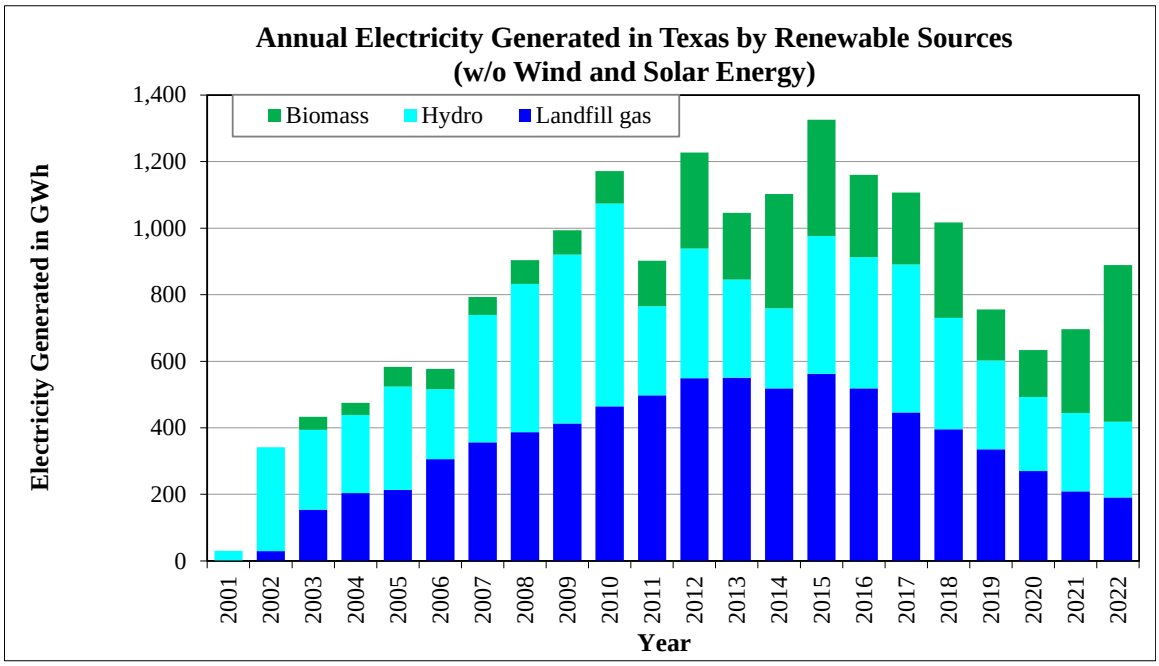


Figure 7-3: Electricity Generation by Renewable Sources Other than Wind and Solar Energy (ERCOT: 2001–2022 Annually)

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Useful information was obtained from the following websites:

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- http://www.energyhomes.org/projects.html
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