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

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

**Annual Report to the
Texas Commission on Environmental Quality
January 2018 – December 2018**

**Juan-Carlos Baltazar, Ph.D., P.E., Jeff Haberl, Ph.D.,
Bahman Yazdani, P.E., Patrick Parker, Shirley Ellis,
Gali Zilbershtein, Ph.D., David Claridge, Ph.D., P.E.**

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ENERGY SYSTEMS LABORATORY
TEXAS A&M ENGINEERING EXPERIMENT STATION

ENERGY SYSTEMS LABORATORY

October 14, 2019

Mr. Robert Gifford
Air Quality Planning Section
Air Quality Division, Office of Air
Texas Commission on Environmental Quality Austin, TX 78711-3087

Dear Mr. Robert Gifford:

The Energy Systems Laboratory (ESL) at the Texas A&M Engineering Experiment Station of the Texas A&M University System is pleased to provide this preliminary report, "Energy Efficiency/Renewable Energy Impact in the Texas Emissions Reduction Plan (TERP): Integrated NOx Emissions Savings from EE/RE Programs Statewide," as required under Texas Health and Safety Code Ann. § 388.003 (e) (Senate Bill 5, 77R as amended 78 R & 78S).

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

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

Sincerely,

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

Disclaimer

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

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

Executive Summary

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

This preliminary report shows the NOx emissions reductions from the energy-efficiency programs from multiple Texas State Agencies working under Senate Bill 5 and Senate Bill 7 in a uniform format to allow the TCEQ to consider the combined savings for Texas' State Implementation Plan (SIP) planning purposes. This required that the analysis should include the integrated savings estimation from all projects projected through 2023 for both the annual and Ozone Season Period (OSP)[1] NOx reductions. The year 2008 was used for the baseline year to estimate the emissions. The NOx emissions reductions from all these programs were calculated using estimated emissions factors for 2016 from the US Environmental Protection Agency (US EPA) eGRID database, which had been specially prepared for this purpose.

In 2018, the integrated total electricity savings from all programs are:
- Annual electricity savings is 60,622,055 MWh/year (26,010 tons-NOx/year) and
- OSP electricity savings are 176,063 MWh/day, which would be 7,336 MW average hourly load reduction during the OSP period (90 tons-NOx/day).

By 2023, the integrated total electricity savings from all programs are:
- Annual electricity savings will be 93,344,324 MWh/year (39,822 tons-NOx/year) and
- OSP electricity savings will be 269,952 MWh/day, which would be 11,248 MW average hourly load reduction during the OSP period (137 tons-NOx/day).

A summary of the savings for 2018 and 2023 is presented in the table below. (Base year 2008)

	2018	2023
Annual Electricity Savings (MWh/year)	60,622,055	93,344,324
Annual Emissions Reductions (tons NOx/year)	26,010	39,822
OSP Electricity Savings (MWh/day)	176,063	269,952
OSP Emissions Reductions (tons NOx/day)	89.79	136.77

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[1] An ozone season period (OSP) represents the daily average emissions during the period that runs from May 1 to September 30.

Legislative Background

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

The 79th Legislature expanded the scope of the SIP-eligible credits by adding savings from the State Renewable Portfolio Standards from the generation of electricity from renewable sources; specifically requiring the TCEQ to develop methods to quantify emissions reductions from renewable energy; and required the Laboratory to develop at least 3 alternative methods for achieving a 15 percent greater potential energy savings in residential, commercial and industrial construction.

In the 80th Legislature several new energy efficiency initiatives were introduced, including: requiring the Laboratory to provide written recommendations to the State Energy Conservation Office (SECO) about whether or not the energy efficiency provisions of latest published edition of the International Residential Code (IRC), or the International Energy Conservation Code (IECC), are equivalent to or better than the energy efficiency and air quality achievable under the editions adopted under the 2001 IRC/IECC; requiring the Laboratory to develop a standardized report format to be used by providers of home energy ratings; and encouraging the Laboratory to cooperate with an industry organization or trade association to develop guidelines for home energy ratings, including training.

The 81st Legislature (2009) extended the TERP to 2019 and required the TCEQ to contract with Laboratory to compute emissions reduction from wind and other renewable energy resources for the SIP.

The 82nd Legislature (2011), the Laboratory's responsibilities under TERP increased as new legislatively allocated energy efficiency initiatives were introduced.

The 83rd Legislatures (2013), the Laboratory's responsibilities under TERP were kept the same as previous years.

The 84th Legislatures (2015) changed to the Sec. 388.003. Adoption of Building Energy Efficiency Performance Standards, with the passage of HB 1736, affected the Laboratory's responsibilities under TERP.

The 85th and 86th Legislatures (2017, 2018 respectively) the Laboratory's responsibilities under TERP were kept the same as previous years.

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

In January 2005, the Laboratory was asked by the Texas Commission on Environmental Quality (TCEQ) to develop a method by which the NOx emissions reductions from the energy-efficiency programs from multiple Texas State Agencies working under Senate Bill 5 and Senate Bill 7 could be reported in a uniform format to allow the TCEQ to consider the combined savings for Texas' State Implementation Plan (SIP) planning purposes. This required that the analysis should include the integrated savings estimation from all projects projected through 2023 for both the annual and Ozone Season Period (OSP) NOx reductions. In 2018, the NOx emissions reductions from all these programs were calculated using estimated emissions factors for 2016 from the US Environmental Protection Agency (US EPA) eGRID database, which had been specially prepared for this purpose. The different programs included in this 2018 integrated analysis are:

- ESL Single-family, Multi-family, and Commercial new constructions
- PUC Senate Bill 7 Program
- SECO Senate Bill 5 Program
- Electricity generated by renewables in Texas (ERCOT)[2]
- SEER 13 upgrades to Single-family and Multi-family residences

The Laboratory's single-family and multi-family programs include the energy savings attained by constructing new residences in Texas. The baseline to estimate energy savings uses the published data on residential construction characteristics by the 2008 National Association of Home Builders (NAHB 2008) based on the 2006 IECC building code (2006 ICC). Annual electricity savings (MWh) are obtained from the Laboratory's Annual Reports to the TCEQ (Haberl et al., 2002 - 2018).

The Laboratory's commercial program includes the energy savings attained by constructing new commercial buildings in Texas, including office, apartment, healthcare, education, retail, food, and lodging as defined by Dodge building type (Dodge 2011). Energy savings were estimated from code-compliant buildings (ASHRAE Standard 90.1-2013) against pre-code buildings (ASHRAE Standard 90.1-2007) using the energy use intensity (EUI) in the USDOE report and constructed square footage in Dodge data (Dodge 2019).

The Public Utility Commission of Texas (PUC) Senate Bill 7 program includes the energy efficiency programs implemented by electric utilities under the Public Utility Regulatory Act §39.905. The PUC regulated energy efficiency program was adopted pursuant to 1999 legislation (SB 7) and subsequent legislation in 2001 (SB 5), 2007 (HB 3693), and 2011 (SB 1125). The energy efficiency measures include: high-efficiency HVAC equipment, variable speed drives, increased insulation levels, infiltration reduction, duct sealing, Energy Star Homes, etc. Annual electricity savings claimed by the utilities were reported for the different programs completed in the years 2001 through 2018.

The Texas State Energy Conservation Office (SECO) funds energy-efficiency programs that are directed towards school districts, government agencies, city and county governments, private industries and residential energy consumers. For the 2018 reporting year SECO submitted annual energy savings values for projects funded by SECO and by Energy Service projects.

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

The *Electric Reliability Council of Texas (ERCOT) electricity production from currently installed green power generation* in Texas is reported. Actual measured electricity productions for 2001 through 2018 were included. For projections to 2023, the annual growth factor was estimated using the last six years installed power capacity.

Finally, NOx emissions reductions from *the installation of SEER 13 air conditioners in existing residences* are also reported.

Description of the Analysis Method

Annual and Ozone Season Period (OSP) NOx emissions reductions were calculated for 2018 and integrated from 2009 to 2023 using several factors to discount the potential savings. These factors include an annual degradation factor, a transmission, and distribution factor, a discount factor, and growth factors as shown in Table 1 and are described as follows:

Annual degradation factor: This factor was used to account for an assumed decrease in the performance of the measures installed as the equipment wears down and degrades. With the exception of electricity generated from renewables, an annual degradation factor of 2% was used for ESL Single-family, Multi-family, and Commercial programs and an annual degradation factor of 5% was used for all other programs[3]. The value of the 5% degradation factor was taken from a study by Kats et al. (1996).

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

Initial discount factor: This factor was used to discount the reported savings for any inaccuracies in the assumptions and methods employed in the calculation procedures. For the Laboratory's Single, Multi-family and Commercial program, the discount factor was assumed to be 20%. For PUC's Senate Bill 7 program, the discount factor was taken as 10%. For the savings in the SECO program, the discount factor was 60%. For the electricity from renewables, the discount factor was taken as 5%. In addition, the discount factor for SEER 13 single-family and SEER 13 multi-family program was 20%.

Growth factor: The growth factors shown in Table 1 were used to account for several different factors. Growth factors for single-family (4.1%), multi-family residential (6.1%), and commercial (5.3%) construction are projections based on the average growth rate for these housing types from recent U.S. Census data for Texas. The growth factor for renewable energy (8.5%) is a linear projection based on the installed renewable power generation capacity for 2009 through 2018 from the Public Utility Commission of Texas. No growth was assumed for PUC programs, SECO, and SEER 13 entries.

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

Figure 1 shows the overall information flow that was used to calculate the NOx emissions savings from the annual and OSP electricity savings (MWh) from all programs. For the Laboratory's single-family and multi-family code-implementation programs, the annual and OSP were calculated from DOE-2 hourly simulation models[4]. The base case is taken as the average characteristics of single- and multi-family residences for Texas published by the National Association of Home Builders for 2008 (NAHB 2008) and 2006 IECC. The annual electricity savings from PUC's energy efficiency programs were calculated using PUC approved demand savings calculations or tables or industry accepted measurement and verification methods (PUC 2019). The OSP consumption is the average daily consumption for the period between May 1 and September 30.

The SECO electricity savings were submitted as annual savings by project[5]. A description of the measures completed for the project was also submitted for information purposes. The electricity production from renewables in Texas was from the actual on-site metered data measured at 15-minute intervals except non-utility scale solar photovoltaic (PV) projects.

Integration of the savings from the different programs into a uniform format allowed for creditable NOx emissions to be evaluated using different criteria as shown in Table 1. These include evaluation across programs, evaluation across individual counties by program, evaluation by SIP area, and evaluation for all ERCOT counties except Houston/Galveston.

Calculation Procedure

The electricity savings in this report were estimated based on the baseline year of 2008. In addition, the emissions estimation throughout this report was updated to the 2016 eGrid database, which is applied to the four different Competitive Load (CL) zones: Houston, North, West, and South as well as other counties in Texas. For all the programs, except renewable projects, the corresponding OSP emissions reductions were calculated using an annual daily average. The OSP emissions reductions from the electricity generated by renewables except non-utility scale solar PV and biomass projects were estimated by actual measured data.

ESL Single-family and Multi-family. The calculation of the annual electricity savings reported for the years 2002 through 2018 included the savings from code-compliant new housing in all 42 non-attainment and affected counties as reported in the Laboratory's annual report submitted by the Laboratory to the Texas Commission of Environmental Quality (TCEQ). From 2009 to 2018, based on year 2008, the annual electricity savings were calculated for new residential construction in all the counties in ERCOT region as well as other counties in Texas, which includes the 42 non-attainment and affected counties. These savings were then tabulated by county and program. Using the calculated values through 2018, savings were then projected to 2023 by incorporating the different adjustment factors mentioned above.

In these calculations, it was assumed that the same amount of electricity savings from the code-compliant construction would be achieved for each year after 2018 through 2023[6]. The projected energy savings through 2023, according to county, were then divided into the CL zones in

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[4] These values are based on a performance analysis as defined by Chapter 4 of the 2006, 2009 and 2015 IECC, plus the corresponding NAHB and HIRL data.

[5] The reporting requirements to the SECO did not require energy savings by project type, although for selected sites, energy savings by project type was available.

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

ERCOT as well as other counties in Texas in the 2016 eGRID. To determine which CL zone was to be used, or in counties with multiple CL zone, the allocation to each CL zone by county was obtained from CL zone's listing published in the Laboratory's 2017 annual report[7].

For the 2018 annual NOx emissions calculations, the US EPA's 2016 eGRID was used. An example of the eGRID spreadsheet[8] is given in the Table 2. The total electricity savings for each CL zone as well as other counties in Texas were used to calculate the NOx emissions reductions for each of the different counties using the emissions factors contained in eGRID. Similar calculations were performed for each year for which the analysis was required.

ESL-Commercial Buildings. The annual electricity savings for 2004 through 2018 for commercial buildings were obtained from the annual reports for 2004 through 2018 submitted by the Laboratory to TCEQ[9]. From 2009 to 2018, based on year 2008, the annual electricity savings were also calculated for new commercial construction by county. Using the calculated savings through 2018, savings were then projected to 2023 by incorporating the different adjustment factors mentioned above[10]. In the projected annual electricity savings, it was assumed that the same 2018 amount of electricity savings would be achieved for each year through 2023. Similarly to the single-family calculations, the projected energy saving numbers through 2023, by county, were allocated into the appropriate CL zones.

PUC-Senate Bill 7. For the PUC Senate Bill 7 program savings, the annual electricity savings for 2001 through 2018 were obtained from the Public Utility Commission of Texas. Using these values savings were projected through 2023 by incorporating the different adjustment factors mentioned above. Similar savings were assumed for each year after 2018 until 2023. The 2016 annual eGRID was also used to calculate the NOx emissions savings for the PUC-Senate Bill 7 program. The total electricity savings for each CL zone were used to calculate the NOx emissions reductions for each county using the emissions factors contained in the US EPA's eGRID spreadsheet. The integrated NOx emissions reductions for each county were then calculated.

SECO Savings. The annual electricity consumption reported by political subdivisions for 2018 was obtained from the State Energy Conservation Office (SECO). Using the reported consumption, the annual and OSP electricity savings resulted from energy conservation projects were then calculated. To achieve this, the annual energy use intensity (EUI) for each county was estimated and the county's energy savings for each year against the baseline year of 2008 were then calculated[11]. In addition, the savings through 2023 were projected using the different adjustment factors mentioned above. In a similar fashion to the previous programs, it was assumed that the same amount of electricity savings will be achieved for each year through 2023. The 2016 annual eGRID was also used to calculate the NOx emissions savings for the SECO program.

Electricity Generated by Renewables. The measured and estimated electricity production from renewables in Texas for 2008 through 2018 was obtained from reports of *Energy*

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[7] Haberl et al., 2018, Annual Report Volume I, pp. 49.

[8] To use this spreadsheet electricity savings for each eGRID zone is entered in the bottom row of the spreadsheet (MWh). The spreadsheet then allocates the MWh of electricity savings according to the counties (blue columns) where the CL zone owned and operated a power plant. Totals for all CL zones are then listed on the far right columns (white columns). Similar spreadsheets for the 2016 eGRID exist for SOx and CO_2.

[9] These savings include new construction in office, education, retail, food, lodging and warehouse construction as defined by Dodge building type (Dodge 2011), using energy savings from the US DOE's report (USDOE 2011), and data from CBECS (1995 - 2012) and Dodge (2018).

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

[11] In the 2018 report, EUI values were used to calculate the electricity savings. This calculation method was also applied to savings estimation for the previous years from 2009 to 2018.

Efficiency/Renewable Energy Impact in the Texas Emissions Reduction Plan (TERP) - Technical Report (2009-2010) for 2008 through 2009 data and *Statewide Air Emissions Calculations from Wind and Other Renewables (2011-2019)* for 2010 through 2018 data. Using the reported numbers for 2018, savings through 2023 were projected incorporating the different adjustment factors mentioned above. The 2010 eGRID was used for the period of 2008 through 2016 and 2016 eGRID was then used for the period of 2017 through 2023 to calculate the NOx emissions reductions for the electricity generated by renewables in Texas. The total electricity savings for each CL zone were used to calculate the NOx emissions reductions for each of the different counties.

SEER 13 Single-Family and Multi-Family. In January of 2006, Federal regulations mandated that the minimum efficiency for residential air conditioners be increased to SEER 13 from the previous SEER 10. Although the electricity savings from new construction reflected this change in values, the annual and OSP electricity savings from the replacement of the air conditioning units by air conditioners with an efficiency of SEER 13 in existing residences needed to be calculated. In this analysis, it was assumed that an equal number of existing houses had their air conditioners replaced, as reported for 2006, by the air conditioner manufacturers. This replacement rate continued until all the existing air conditioner stock was replaced with SEER 13 air conditioners.[12]

In the 2018 report to the TCEQ, the annual and OSP electricity savings for all the counties in ERCOT region as well as the 42 non-attainment and affected counties were calculated. Using the numbers for 2008, the savings after 2008 until 2023 were projected by incorporating the appropriate adjustment factors[13]. The total electricity savings for each CL zone were used to calculate the NOx emissions reductions for each of the different counties using the emissions factors contained in the 2016 eGRID. Integrated NOx emissions reductions for each county by ozone non-attainment and affected counties were also calculated.

Results

The total integrated annual and OSP electricity savings for all the different programs in the integrated format were calculated for 2009 through 2023 as shown in Table 3, using the adjustment factors shown in Table 1. Annual and OSP NOx emissions reductions from the electricity savings (presented in Table 3) for all the programs in the integrated format were shown in Table 4.

In 2018, the total integrated annual savings from all programs are 60,622,055 MWh/year. The integrated annual electricity savings from all the different programs are:
- Savings from code-compliant residential and commercial construction are 5,062,259 MWh/year (8.4% of the total electricity savings),
- Savings from the PUC's Senate Bill 7 program are 4,209,108 MWh/year (6.9%),
- Savings from SECO's Senate Bill 5 program are 1,402,040 MWh/year (2.3%),
- Electricity savings from renewable power generation are 49,700,200 MWh/year (82.0%), and

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[12] In 2011, the U.S.DOE revised the energy conservation standards for residential HVAC systems. Beginning in January 2015, split-system central air conditioners installed in Texas must be at least SEER 14. NOx emissions reductions from SEER 14 replacement air conditioners will be included in future TERP reports as statewide sales data can be evaluated.

[13] Additional details about this calculation are contained in the Laboratory's 2008 Annual Report to the TCEQ, available at the Senate Bill 5 web site "http://esl.tamu.edu/".

- Savings from residential air conditioner retrofits[14] are 248,448 MWh/year (0.4%).

In 2018, the total integrated OSP savings from all programs are 176,063 MWh/day, which would be 7,336 MW average hourly load reduction during the OSP period. The integrated OSP electricity savings from all the different programs are:
- Savings from code-compliant residential and commercial construction are 13,869 MWh/day (7.9%),
- Savings from the PUC's Senate Bill 7 programs are 11,532 MWh/day (6.5%),
- Savings from SECO's Senate Bill 5 program are 3,841 MWh/day (2.2%),
- Electricity savings from renewable power generation are 145,064 MWh/day (82.4%), and
- Savings from residential air conditioner retrofits are 1,757 MWh/day (1.0%).

By 2023, the total integrated annual savings from all programs will be 93,344,324 MWh/year. The integrated annual electricity savings from all the different programs are:
- Savings from code-compliant residential and commercial construction will be 10,788,564 MWh/year (11.6% of the total electricity savings),
- Savings from the PUC's Senate Bill 7 program will be 5,774,320 MWh/year (6.2%),
- Savings from SECO's Senate Bill 5 program will be 1,857,157 MWh/year (2.0%),
- Electricity savings from renewable power generation will be 74,732,039 MWh/year (80.1%), and
- Savings from residential air conditioner retrofits will be 192,244 MWh/year (0.2%).

By 2023, the total integrated OSP savings from all programs will be 269,952 MWh/day, which would be 11,248 MW average hourly load reduction during the OSP. The integrated OSP electricity savings from all the different programs are:
- Savings from code-compliant residential and commercial construction will be 29,558 MWh/day (10.9%),
- Savings from the PUC's Senate Bill 7 programs will be 15,820 MWh/day (5.9%),
- Savings from SECO's Senate Bill 5 program will be 5,088 MWh/day (1.9%),
- Electricity savings from renewable power generation will be 218,126 MWh/day (80.8%), and
- Savings from residential air conditioner retrofits will be 1,360 MWh/day (0.5%).

In 2018 (Table 4), the total integrated annual NOx emissions reductions from all programs are 26,010 tons-NOx/year. The integrated annual NOx emissions reductions from all the different programs are:
- NOx emissions reductions from code-compliant residential and commercial construction are 1,662 tons-NOx/year (6.4% of the total NOx savings),
- NOx emissions reductions from the PUC's Senate Bill 7 programs are 1,410 tons-NOx/year (5.4%),
- NOx emissions reductions from SECO's Senate Bill 5 program are 447 tons-NOx/year (1.7%),
- NOx emissions reductions from renewable power generation are 22,408 tons-NOx/year (86.1%), and
- NOx emissions reductions from residential air conditioner retrofits are 83 tons-NOx/year (0.3%).

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

In 2018, the total integrated OSP NOx emissions reductions from all programs are 89.79 tons-NOx/day. The integrated OSP NOx emissions reductions from all the different programs are:

- NOx emissions reductions from code-compliant residential and commercial construction are 4.85 tons-NOx/day (5.4%),
- NOx emissions reductions from the PUC's Senate Bill 7 programs are 4.21 tons-NOx/day (4.7 %),
- NOx emissions reductions from SECO's Senate Bill 5 program are 1.30 tons-NOx/day (1.4%),
- NOx emissions reductions from renewable power generation are 78.80 tons-NOx/day (87.8%), and
- NOx emissions reductions from residential air conditioner retrofits are 0.64 tons-NOx/day (0.7%).

By 2023, the total integrated annual NOx emissions reductions from all programs will be 39,822 tons-NOx/year. The integrated annual NOx emissions reductions from all the different programs are:

- NOx emissions reductions from code-compliant residential and commercial construction will be 3,525 tons-NOx/year (8.9% of the total NOx savings),
- NOx emissions reductions from the PUC's Senate Bill 7 programs will be 1,935 tons-NOx/year (4.9%),
- NOx emissions reductions from SECO's Senate Bill 5 program will be 605 tons-NOx/year (1.5%),
- NOx emissions reductions from renewable power generation will be 33,693 tons-NOx/year (84.6%), and
- NOx emissions reductions from residential air conditioner retrofits will be 64 tons-NOx/year (0.2%).

By 2023, the total integrated OSP NOx emissions reductions from all programs will be 136.77 tons-NOx/day. The integrated OSP NOx emissions reductions from all the different programs are:

- NOx emissions reductions from code-compliant residential and commercial construction will be 10.25 tons-NOx/day (7.5%),
- NOx emissions reductions from the PUC's Senate Bill 7 programs will be 5.78 tons-NOx/day (4.2%),
- NOx emissions reductions from SECO's Senate Bill 5 program will be 1.75 tons-NOx/day (1.3%),
- NOx emissions reductions from renewable power generation will be 118.49 tons-NOx/day (86.6%), and
- NOx emissions reductions from residential air conditioner retrofits will be 0.49 tons-NOx/day (0.4%).

Summary

This preliminary report presents the NOx emissions reductions from the energy-efficiency programs from multiple Texas State Agencies working under Senate Bill 5 and Senate Bill 7 in a uniform format to allow the TCEQ to consider the combined savings for Texas' State Implementation Plan (SIP) planning purposes. This required that the analysis should include the integrated savings estimation from all projects projected through 2023 for both the annual and

OSP NOx reductions. The NOx emissions reductions from all these programs were calculated using estimated emissions factors for 2016 from the US Environmental Protection Agency (US EPA) eGRID database, which had been specially prepared for this purpose.

In 2018, the integrated total electricity savings from all programs are:
- Annual electricity savings is 60,622,055 MWh/year (26,010 tons-NOx/year) and
- OSP electricity savings are 176,063 MWh/day, which would be 7,336 MW average hourly load reduction during the OSP period (90 tons-NOx/day).

By 2023, the integrated total electricity savings from all programs are:
- Annual electricity savings will be 93,344,324 MWh/year (39,822 tons-NOx/year) and
- OSP electricity savings will be 269,952 MWh/day, which would be 11,248 MW average hourly load reduction during the OSP period (137 tons-NOx/day).

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

If any questions arise, please contact us by phone at 979-845-9213.

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

	ESL-Single Family	ESL-Multifamily	ESL-Commercial	PUC (SB7)	SECO	Renewables-ERCOT	SEER13 Single Family	SEER13 Multi Family
Annual Degradation Factor	2.0%	2.0%	2.0%	5.0%	5.0%	0.0%	5.0%	5.0%
T&D Loss	7.0%	7.0%	7.0%	7.0%	7.0%	0.0%	7.0%	7.0%
Initial Discount Factor	20.0%	20.0%	20.0%	10.0%	60.0%	5.0%	20.0%	20.0%
Growth Factor	4.1%	6.1%	5.3%	0.0%	0.0%	8.5%	N.A.	N.A.
Weather Normalized	Yes	Yes	Yes	No	No	No	Yes	Yes

Note: For Renewables-ERCOT, the OSP energy consumption is the average daily consumption of the measured data from mid-July to mid-September.
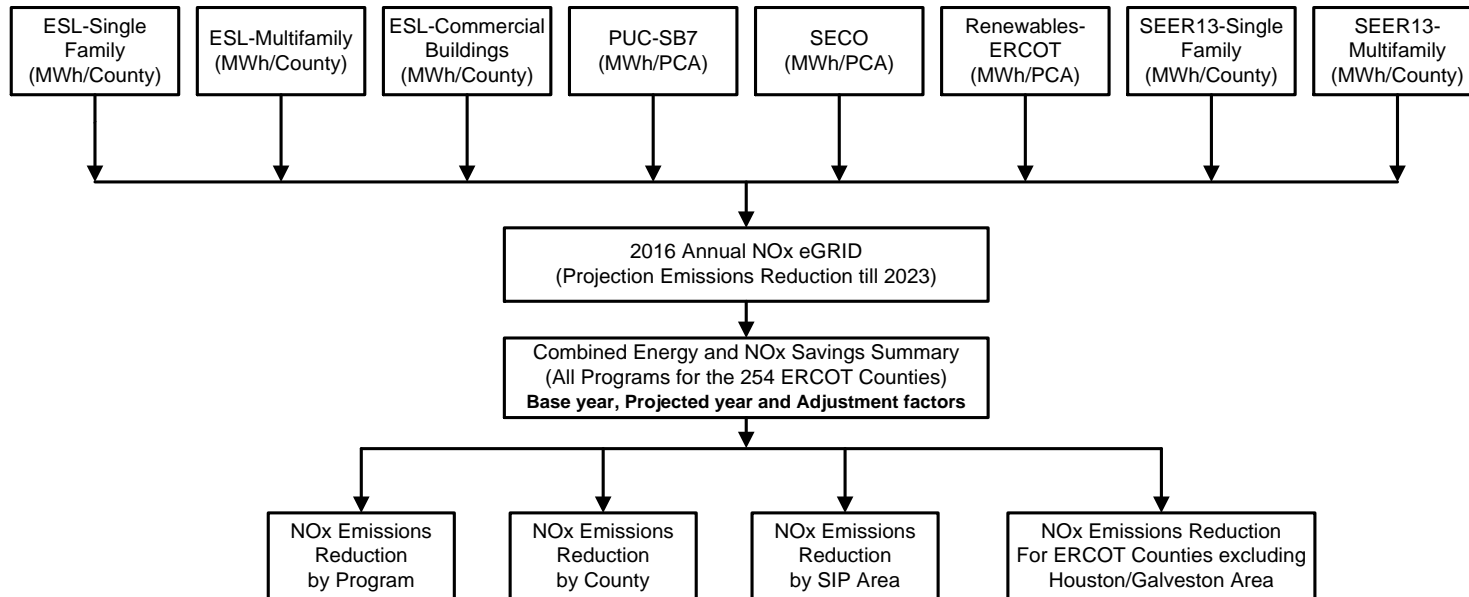

Figure 1: Process Flow Diagram of the NOx Emissions Reduction Calculations

Table 2: Example of NOx Emissions Reduction Calculations using 2016 eGRID

Area	County	ERCOT-H	NOx Reductions (lbs)	ERCOT-N	NOx Reductions (lbs)	ERCOT-W	NOx Reductions (lbs/year)	ERCOT-S	NOx Reductions (lbs)	SPP	NOx Reductions (lbs)	SERC	NOx Reductions (lbs)	WECC	NOx Reductions (lbs)	Total Nox Reductions (lbs)	Total Nox Reductions (Tons)
Houston-Galveston Area	Brazoria	0.0615737	16537.50	0.0000078	2.94	0.0000004	0.01	0.0005769	158.42	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	16698.87	8.35
	Chambers	0.0196226	5270.25	0.0000025	0.94	0.0000001	0.00	0.0001838	50.49	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	5321.68	2.66
	Fort Bend	0.0751386	20180.75	0.0000095	3.59	0.0000005	0.02	0.0007039	193.32	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	20377.68	10.19
	Galveston	0.0135834	3648.23	0.0000017	0.65	0.0000001	0.00	0.0001273	34.95	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	3683.83	1.84
	Harris	0.1216150	32663.39	0.0000154	5.81	0.0000007	0.03	0.0011394	312.90	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	32982.13	16.49
	Liberty	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.00	0.00
	Montgomery	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.00	0.00
	Waller	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.00	0.00
Beaumont/ Port Arthur Area	Hardin	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0007374	2.99	0.0000000	0.00	2.99	0.00
	Jefferson	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.1794027	728.32	0.0000000	0.00	728.32	0.36
	Orange	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.2428943	986.07	0.0000000	0.00	986.07	0.49
Dallas/ Fort Worth Area	Collin	0.0001044	28.05	0.0006407	241.37	0.0000309	1.07	0.0000065	1.80	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	272.29	0.14
	Dallas	0.0020857	560.19	0.0127949	4819.93	0.0006180	21.33	0.0001305	35.85	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	5437.29	2.72
	Denton	0.0015278	410.34	0.0093723	3530.59	0.0004527	15.62	0.0000956	26.26	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	3982.81	1.99
	Henderson	0.0002013	54.06	0.0012348	465.18	0.0000596	2.06	0.0000126	3.46	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	524.76	0.26
	Hood	0.0011288	303.17	0.0069245	2608.49	0.0003345	11.54	0.0000706	19.40	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	2942.60	1.47
	Hunt	0.0000342	9.19	0.0002100	79.11	0.0000101	0.35	0.0000021	0.59	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	89.24	0.04
	Tarrant	0.0007507	201.61	0.0046049	1734.71	0.0002224	7.68	0.0000470	12.90	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	1956.91	0.98
	Ellis	0.0009845	264.42	0.0060395	2275.13	0.0002917	10.07	0.0000616	16.92	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	2566.54	1.28
	Johnson	0.0001392	37.39	0.0008539	321.67	0.0000412	1.42	0.0000087	2.39	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	362.87	0.18
	Kaufman	0.0027857	748.20	0.0170891	6437.59	0.0008254	28.49	0.0001743	47.88	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	7262.15	3.63
	Parker	0.0006351	170.57	0.0038958	1467.59	0.0001882	6.49	0.0000397	10.92	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	1655.57	0.83
	Rockwall	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.00	0.00
	Wise	0.0028208	757.60	0.0173039	6518.51	0.0008358	28.84	0.0001765	48.48	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	7353.43	3.68
El Paso Area	El Paso	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	1.2223686	5069.07	5069.07	2.53
San Antonio Area	Bexar	0.0156585	4205.56	0.0010560	397.82	0.0000510	1.76	0.1250544	34343.45	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	38948.59	19.47
	Comal	0.0004238	113.83	0.0000286	10.77	0.0000014	0.05	0.0033848	929.55	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	1054.20	0.53
	Guadalupe	0.0025537	685.86	0.0001722	64.88	0.0000083	0.29	0.0203945	5600.90	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	6351.93	3.18
	Wilson	0.0001742	46.78	0.0000117	4.43	0.0000006	0.02	0.0013911	382.03	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	433.25	0.22
Austin Area	Bastrop	0.0020209	542.78	0.0001363	51.34	0.0000066	0.23	0.0161398	4432.45	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	5026.80	2.51
	Caldwell	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.00	0.00
	Hays	0.0004570	122.73	0.0000308	11.61	0.0000015	0.05	0.0036495	1002.25	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	1136.64	0.57
	Travis	0.0037244	1000.30	0.0002512	94.62	0.0000121	0.42	0.0297443	8168.61	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	9263.95	4.63
	Williamson	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.00	0.00
North East Texas Area	Gregg	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0066563	29.14	0.0000000	0.00	0.0000000	0.00	29.14	0.01
	Harrison	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.2657716	1163.57	0.0000000	0.00	0.0000000	0.00	1163.57	0.58
	Rusk	0.0230990	6203.94	0.1417007	53379.60	0.0068444	236.20	0.0014457	397.05	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	60216.76	30.11
	Smith	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.00	0.00
	Upshur	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.00	0.00
Corpus Christi Area	Nueces	0.0394446	1059.45	0.0002660	100.22	0.0000128	0.44	0.0315033	8651.68	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	9811.79	4.91
	San Patricio	0.0065901	1769.96	0.0004444	167.43	0.0000215	0.74	0.0526306	14453.85	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	16391.98	8.20
Victoria Area	Victoria	0.0013565	364.34	0.0000915	34.46	0.0000044	0.15	0.0108338	2975.26	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	3374.22	1.69
Other ERCOT Counties	Anderson	0.0000993	26.67	0.0006091	229.45	0.0000294	1.02	0.0000062	1.71	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	258.83	0.13
	Angelina	0.0023609	634.10	0.0144832	5455.92	0.0006996	24.14	0.0001478	40.58	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	6154.74	3.08
	Atascosa	0.0056178	1508.84	0.0003789	142.73	0.0000183	0.63	0.0448662	12321.52	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	13973.72	6.99
	Bell	0.0003169	85.10	0.0019438	732.24	0.0000939	3.24	0.0000198	5.45	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	826.03	0.41
	Bosque	0.0005586	150.03	0.0034268	1290.90	0.0001655	5.71	0.0000350	9.60	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	1456.25	0.73
	Brazos	0.0006309	169.44	0.0038702	1457.92	0.0001869	6.45	0.0000395	10.84	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	1644.66	0.82
	Calhoun	0.0089052	2391.76	0.0006006	226.24	0.0000290	1.00	0.0711201	19531.57	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	22150.58	11.08
	Cameron	0.0003829	102.83	0.0000258	9.73	0.0000012	0.04	0.0030576	839.70	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	952.30	0.48
	Cherokee	0.0003163	84.95	0.0019403	730.91	0.0000937	3.23	0.0000198	5.44	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	824.53	0.41
	Coke	0.0000186	4.99	0.0001140	42.94	0.0193554	667.95	0.0000012	0.32	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	716.20	0.36
	Colorado	0.0014238	382.39	0.0000960	36.17	0.0000046	0.16	0.0113706	3122.69	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	3541.41	1.77
	Ector	0.0000875	23.51	0.0005370	202.31	0.0911920	3146.99	0.0000055	1.50	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	3374.31	1.69
	Fayette	0.0145746	3914.46	0.0009829	370.28	0.0000475	1.64	0.1163983	31966.25	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	36252.62	18.13
	Freestone	0.0119927	3221.00	0.0735691	27713.96	0.0035535	122.63	0.0007506	206.13	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	31263.72	15.63
	Frio	0.0070493	1893.31	0.0004754	179.09	0.0000230	0.79	0.0562984	15461.12	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	17534.31	8.77
	Goliad	0.0048705	1308.11	0.0003285	123.74	0.0000159	0.55	0.0388972	10682.27	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	12114.67	6.06
	Grayson	0.0003526	94.70	0.0021631	814.85	0.0001045	3.61	0.0000221	6.06	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	919.22	0.46
	Grimes	0.0040259	1081.28	0.0246970	9303.51	0.0011929	41.17	0.0002520	69.20	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	10495.16	5.25
	Hidalgo	0.0019966	536.25	0.0001347	50.73	0.0000065	0.22	0.0159456	4379.10	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	4966.29	2.48
	Hill	0.0002855	76.69	0.0017516	659.85	0.0000846	2.92	0.0000179	4.91	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	744.37	0.37
	Howard	0.0000144	3.86	0.0000882	33.21	0.0149685	516.56	0.0000009	0.25	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	553.87	0.28
	Lamar	0.0021320	572.62	0.0130790	4926.93	0.0006317	21.80	0.0001334	36.65	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	5558.00	2.78
	Limestone	0.0204136	5482.70	0.1252272	47173.94	0.0060487	208.74	0.0012776	350.87	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	53216.24	26.61
	Llano	0.0001824	48.99	0.0000123	4.63	0.0000006	0.02	0.0014569	400.10	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	453.75	0.23
	McLennan	0.0030116	808.86	0.0184748	6959.59	0.0008924	30.80	0.0001885	51.76	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	7851.01	3.93
	Milam	0.0070728	1899.62	0.0004770	179.69	0.0000230	0.80	0.0564861	15512.66	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	17592.76	8.80
	Mitchell	0.0000271	7.28	0.0001662	62.62	0.0282258	974.06	0.0000017	0.47	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	1044.42	0.52
	Nacogdoches	0.0001434	38.51	0.0008796	331.34	0.0000425	1.47	0.0000090	2.46	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	373.77	0.19
	Nolan	0.0000118	3.17	0.0000723	27.24	0.0122792	423.75	0.0000007	0.20	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	454.36	0.23
	Palo Pinto	0.0004872	130.85	0.0029887	1125.87	0.0001444	4.98	0.0000305	8.37	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	1270.08	0.64
	Pecos	0.0000027	0.71	0.0000163	6.15	0.0027724	95.68	0.0000002	0.05	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	102.59	0.05
	Reagan	0.0000002	0.06	0.0000013	0.48	0.0002145	7.40	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	7.94	0.00
	Red River	0.0000370	9.92	0.0002267	85.39	0.0000109	0.38	0.0000023	0.64	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	96.33	0.05
	Robertson	0.0132076	3547.31	0.0810220	30521.54	0.0039135	135.05	0.0008266	227.01	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	34430.91	17.22
	Scurry	0.0001368	36.73	0.0008389	316.02	0.1424505	4915.90	0.0000086	2.35	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	5271.00	2.64
	Titus	0.0137878	3703.13	0.0845810	31862.24	0.0040854	140.99	0.0008629	236.98	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	35943.34	17.97
	Upton	0.0000002	0.05	0.0000011	0.41	0.0001866	6.44	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	6.91	0.00
	Ward	0.0000029	0.79	0.0000180	6.78	0.0030571	105.50	0.0000002	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	113.12	0.06
	Webb	0.0000284	7.63	0.0000019	0.72	0.0000001	0.00	0.0002269	62.33	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	70.68	0.04
	Wharton	0.0008837	237.35	0.0000596	22.45	0.0000029	0.10	0.0070577	1938.26	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	2198.16	1.10
	Wichita	0.0000018	0.48	0.0000109	4.12	0.0018585	64.13	0.0000001	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	68.77	0.03
	Wilbarger	0.0005643	151.55	0.0034614	1303.94	0.5877706	20283.68	0.0000353	9.70	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	21748.87	10.87
	Wood	0.0000059	1.57	0.0000359	13.54	0.0000017	0.00	0.0000004	0.10	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	15.27	0.01
	Young	0.0000208	5.58	0.0001274	48.00	0.0216376	746.70	0.0000013	0.36	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	800.64	0.40
Other SPP Counties	Cass	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0117610	51.49	0.0000000	0.00	0.0000000	0.00	51.49	0.03
	Gaines	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0017993	7.88	0.0000000	0.00	0.0000000	0.00	7.88	0.00
	Gray	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.00	0.00
	Hale	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0137110	60.03	0.0000000	0.00	0.0000000	0.00	60.03	0.03
	Hemphill	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0229912	100.66	0.0000000	0.00	0.0000000	0.00	100.66	0.05
	Hutchinson	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.1043705	456.94	0.0000000	0.00	0.0000000	0.00	456.94	0.23
	Lamb	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.2602463	1139.38	0.0000000	0.00	0.0000000	0.00	1139.38	0.57
	Lubbock	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0446470	195.47	0.0000000	0.00	0.0000000	0.00	195.47	0.10
	Marion	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0255208	111.73	0.0000000	0.00	0.0000000	0.00	111.73	0.06
	Moore	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0004443	1.95	0.0000000	0.00	0.0000000	0.00	1.95	0.00
	Morris	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0003403	1.49	0.0000000	0.00	0.0000000	0.00	1.49	0.00
	Potter	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.00	0.00
	Titus	0.0137878	3703.13	0.0845810	31862.24	0.0040854	140.99	0.0008629	236.98	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	35943.34	17.97
	Yoakum	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0358423	156.92	0.0000000	0.00	0.0000000	0.00	156.92	0.08
Other SERC Counties	Jasper	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0130217	52.86	0.0000000	0.00	52.86	0.03
	Newton	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0148427	60.26	0.0000000	0.00	60.26	0.03
	San Jacinto	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0026310	10.68	0.0000000	0.00	10.68	0.01
	Tyler	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0000000	0.00	0.0006796	2.76	0.0000000	0.00	2.76	0.00
	Total	**0.4927768**	**132350.18**	**0.6891868**	**259621.27**	**0.9589944**	**33094.42**	**0.7276081**	**199821.60**	**1.3340545**	**5840.62**	**0.4990937**	**2026.16**	**1.2223686**	**5069.07**	**637823.31**	**318.91**

| Energy Savings (MWh) | | 268,580 | | 376,707 | | 34,510 | | 274,628 | | 4,378 | | 4,060 | | 4,147 | | | |

Table 3: Annual and OSP Electricity Savings for the Different Programs (Base Year 2008)

PROGRAM	ANNUAL (MWh)															
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
ESL-Single Family	0	25,031	47,000	74,109	153,562	215,164	275,535	360,010	533,473	722,595	967,082	1,217,296	1,473,558	1,736,200	2,005,565	2,282,010
ESL-Multifamily	0	50,784	108,018	200,414	332,835	527,292	774,578	1,225,617	1,856,682	2,472,527	3,151,036	3,860,381	4,602,654	5,380,069	6,194,973	7,049,853
ESL-Commercial*	0	0	24,066	83,255	119,422	247,952	400,015	559,947	696,924	850,020	944,141	1,037,981	1,135,918	1,238,187	1,345,025	1,456,701
PUC (SB7)	0	538,841	976,984	1,437,883	1,831,318	2,267,414	2,675,295	3,079,759	3,498,867	3,844,949	4,209,108	4,555,058	4,883,711	5,195,932	5,492,541	5,774,320
SECO**	0	74,198	157,524	349,845	512,539	713,477	1,015,815	1,019,507	1,117,717	1,296,153	1,402,040	1,502,632	1,598,195	1,688,979	1,775,224	1,857,157
Renewables-ERCOT	0	3,454,992	8,351,369	12,158,649	13,392,752	17,028,343	18,753,002	20,883,590	34,193,486	47,055,032	49,700,200	53,924,717	58,508,318	63,481,525	68,877,455	74,732,039
SEER13-Single Family**	0	363,440	345,268	328,005	311,605	296,024	281,223	267,162	253,804	241,114	229,058	217,605	206,725	196,389	186,569	177,241
SEER13-Multi Family**	0	30,765	29,227	27,766	26,377	25,059	23,806	22,615	21,485	20,410	19,390	18,420	17,499	16,624	15,793	15,003
Total Annual (MWh)	**0**	**4,538,051**	**10,039,456**	**14,659,925**	**16,680,410**	**21,320,725**	**24,199,269**	**27,418,208**	**42,172,438**	**56,502,800**	**60,622,055**	**66,334,092**	**72,426,578**	**78,933,905**	**85,893,146**	**93,344,324**

PROGRAM	OZONE SEASON PERIOD - OSP (MWh/day)															
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
ESL-Single Family	0	69	129	203	421	589	755	986	1,462	1,980	2,650	3,335	4,037	4,757	5,495	6,252
ESL-Multifamily	0	139	296	549	912	1,445	2,122	3,358	5,087	6,774	8,633	10,576	12,610	14,740	16,973	19,315
ESL-Commercial*	0	0	66	228	327	679	1,096	1,534	1,909	2,329	2,587	2,844	3,112	3,392	3,685	3,991
PUC (SB7)	0	1,476	2,677	3,939	5,017	6,212	7,330	8,438	9,586	10,534	11,532	12,480	13,380	14,235	15,048	15,820
SECO**	0	203	432	958	1,404	1,955	2,783	2,793	3,062	3,551	3,841	4,117	4,379	4,627	4,864	5,088
Renewables-ERCOT***	0	15,037	26,234	30,736	32,528	31,695	46,338	63,604	86,957	96,446	145,064	157,394	170,773	185,288	201,038	218,126
SEER13-Single Family**	0	2,582	2,453	2,330	2,214	2,103	1,998	1,898	1,803	1,713	1,627	1,546	1,468	1,395	1,325	1,259
SEER13-Multi Family**	0	207	196	187	177	168	160	152	144	137	130	124	118	112	106	101
Total OSP (MWh)	**0**	**19,713**	**32,482**	**39,130**	**43,000**	**44,846**	**62,581**	**82,763**	**110,011**	**123,464**	**176,063**	**192,415**	**209,877**	**228,547**	**248,533**	**269,952**

* ESL commercial for 2017 recalculated based on Dodge data (2019)
** Eight counties added to the base year in SECO and SEER 13-Single/Multi-Family to calculate whole Texas energy savings
*** Ozone Season Period (OSP) for Renewable-ERCOT changed from July 15-September 15 to May 1-September 30.

Table 4: Annual and OSP NOx Emissions Reduction Values for the Different Programs (Base Year 2008)

PROGRAM	ANNUAL (in tons NOx)															
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
ESL-Single Family	0	3	8	15	34	50	65	86	129	224	315	395	477	562	648	737
ESL-Multifamily	0	4	19	43	77	127	190	305	468	810	1,060	1,297	1,544	1,803	2,074	2,359
ESL-Commercial*	0	0	5	16	22	47	79	114	141	229	287	313	340	368	398	429
PUC (SB7)	0	135	246	362	460	567	669	770	874	1,326	1,410	1,526	1,636	1,741	1,840	1,935
SECO**	0	20	44	92	134	185	267	269	298	407	447	482	515	546	576	605
Renewables-ERCOT***	0	951	2,645	3,258	3,561	4,693	5,116	5,683	9,359	24,054	22,408	24,312	26,379	28,621	31,054	33,693
SEER13-Single Family **	0	86	81	77	73	70	66	63	60	72	77	73	69	66	63	60
SEER13-Multi Family **	0	7	7	7	6	6	6	5	5	6	6	6	6	5	5	5
Total Annual (Tons NOx)	**0**	**1,205**	**3,054**	**3,870**	**4,369**	**5,744**	**6,457**	**7,294**	**11,335**	**27,127**	**26,010**	**28,404**	**30,967**	**33,713**	**36,659**	**39,822**

PROGRAM	OZONE SEASON PERIOD - OSP (in tons NOx/day)															
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
ESL-Single Family	0.00	0.01	0.02	0.04	0.09	0.14	0.18	0.24	0.35	0.62	0.92	1.15	1.39	1.64	1.89	2.15
ESL-Multifamily	0.00	0.01	0.05	0.12	0.21	0.35	0.52	0.83	1.28	2.24	3.08	3.77	4.48	5.23	6.02	6.85
ESL-Commercial*	0.00	0.00	0.01	0.04	0.06	0.13	0.22	0.31	0.39	0.64	0.84	0.92	1.00	1.08	1.17	1.26
PUC (SB7)	0.00	0.37	0.67	0.99	1.26	1.55	1.83	2.11	2.39	3.75	4.21	4.56	4.89	5.20	5.50	5.78
SECO**	0.00	0.05	0.12	0.25	0.37	0.51	0.73	0.74	0.82	1.14	1.30	1.40	1.49	1.58	1.67	1.75
Renewables-ERCOT***	0.00	4.15	7.53	8.42	8.91	9.03	12.87	17.55	24.11	50.25	78.80	85.50	92.77	100.65	109.21	118.49
SEER13-Single Family **	0.00	0.60	0.57	0.54	0.52	0.49	0.47	0.44	0.42	0.52	0.59	0.56	0.53	0.50	0.48	0.45
SEER13-Multi Family **	0.00	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.03	0.04	0.05	0.04	0.04	0.04	0.04	0.04
Total OSP (Tons NOx)	**0.00**	**5.24**	**9.03**	**10.45**	**11.46**	**12.23**	**16.85**	**22.26**	**29.80**	**59.21**	**89.79**	**97.90**	**106.60**	**115.94**	**125.98**	**136.77**

* ESL commercial for 2017 recalculated based on Dodge data (2019)

** Eight counties added to the base year in SECO and SEER 13-Single/Multi-Family to calculate whole Texas energy savings

*** Ozone Season Period (OSP) for Renewable-ERCOT changed from July 15-September 15 to May 1-September 30.

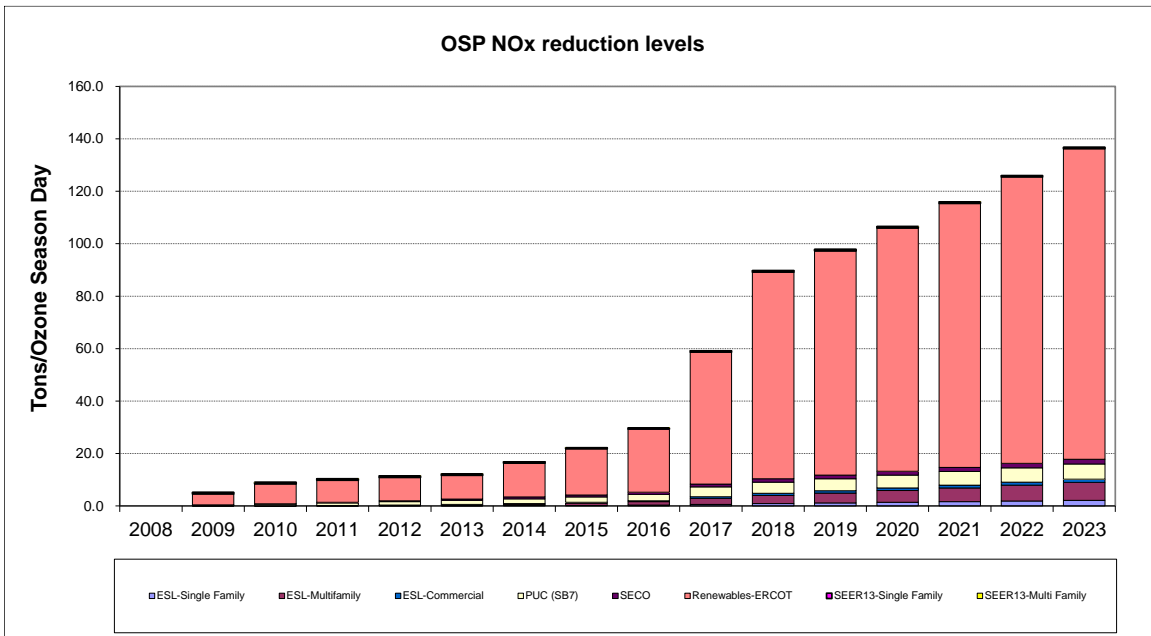**** NOx calculations for 2018-2023 updated based on 2016 eGRID for all 254 Texas counties

Figure 2: Integrated OSP NOx Emissions Reduction Projections through 2023 (Base Year 2008)
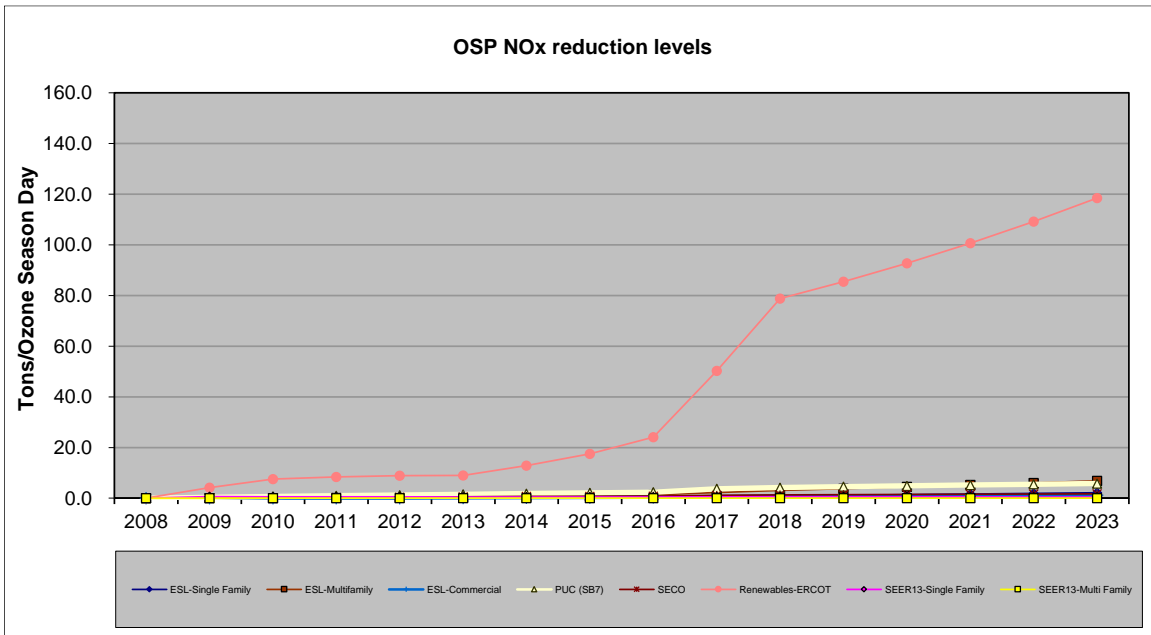

Figure 3: Integrated OSP Individual Programs NOx Emissions Reduction Projections through 2023 (Base Year 2008)

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