

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

VOLUME II—TECHNICAL APPENDIX

**Annual Report to the
Texas Commission on Environmental Quality
January 2022-December 2022**



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October 2023



ENERGY SYSTEMS LABORATORY
TEXAS A&M ENGINEERING EXPERIMENT STATION



**TEXAS A&M ENGINEERING
EXPERIMENT STATION**

Energy Systems Laboratory

October 24, 2023

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

Dear Ms. Anderson:

The Energy Systems Laboratory (ESL) at the Texas A&M Engineering Experiment Station of the Texas A&M University System is pleased to provide its annual report, "Energy Efficiency/Renewable Energy Impact in the Texas Emissions Reduction Plan (TERP)," as required under Texas Health and Safety Code 386.205, 386.252, 388.006, 389.003 (e), and under Texas Utilities Code Sec. 39.9051 (g) (h), and Sec. 39.9052 (c) (d).

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 reduction from energy efficiency and renewable energy measures as a result of the TERP implementation.

Sincerely,

A handwritten signature in cursive script that reads "David E. Claridge".

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

Enclosure

Disclaimer

This report is provided by the Energy Systems Laboratory of the Texas A&M Engineering Experiment Station (TEES) as required under Sections 386.205, 386.252, 388.006, and 388.003 (e) of the Texas Health and Safety Code and Sections 39.9051 (g) (h), and 39.9052 (c) (d) of the Texas Utilities Code. The information provided in this report is intended to be the best available information at the time of publication. TEES makes no claim or warranty, express or implied, that the report or data herein is necessarily error-free. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not constitute or imply its endorsement, recommendation, or favoring by the Energy Systems Laboratory or any of its employees. The views and opinions of authors expressed herein do not necessarily state or reflect those of the Texas A&M Engineering Experiment Station or the Energy Systems Laboratory.

VOLUME II – APPENDIX

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

1 EXECUTIVE SUMMARY

The Energy Systems Laboratory (Laboratory), a division of the Texas A&M Engineering Experiment Station and a member of The Texas A&M University System, in fulfillment of its responsibilities under Sections 386.205, 386.252, 388.006, and 388.003 (e) of the Texas Health and Safety Code and Sections 39.9051 (g) (h), and 39.9052 (c) (d) of the Texas Utilities Code, submits its annual report, Energy Efficiency/Renewable Energy (EE/RE) Impact in the Texas Emissions Reduction Plan (TERP) to the Texas Commission on Environmental Quality.

The report is organized in two volumes:

Volume I – Technical Report – provides a detailed report of activities, methodologies and findings, including an executive summary and overview.

Volume II – Technical Appendix – contains detailed data from simulations for each of the counties included in the analysis.

Accomplishments are as follow:

1.1 Energy Code Amendments

The Laboratory was requested by several Council of Governments (COGs) and municipalities to analyze the stringency of several proposed residential and commercial energy code amendments, including: the 2015 IECC and the ASHRAE Standards 90.1-2013. Results of the analysis are included in the Volume I – Technical Report.

1.2 Technical Assistance

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

1.3 NO_x Emissions Reduction

Under the TERP legislation, the Laboratory must determine the energy savings from energy code adoption and, when applicable, from more stringent local codes or above-code performance ratings and must report these reductions annually to the TCEQ. Figure 1.1 shows the integrated NO_x emissions reduction through 2027 for the electricity and natural gas savings from the various EE/RE programs.

In 2022¹, the annual NOx emissions reduction from code-compliant residential and commercial construction is calculated to be 355 tons-NOx/year (1.0% of the total NOx savings), savings from the PUC's Senate Bill 7 programs will be 188 tons-NOx/year (0.6%), savings from SECO's Senate Bill 5 program will be 493 tons-NOx/year (1.4%), savings from green power purchases (wind) will be 32,816 tons-NOx/year (96.1%), and savings from residential air conditioner retrofits will be 290 tons-NOx/year (0.9%). The total annual NOx emissions reduction from all programs will be 34,142 tons-NOx/year.

By 2027, the annual NOx emissions reduction from code-compliant residential and commercial construction is calculated to be 1,080 tons-NOx/year (0.5% of the total NOx savings), savings from the PUC's Senate Bill 7 programs is 390 tons-NOx/year (0.2%), savings from SECO's Senate Bill 5 program is 1,146 tons-NOx/year (0.5%), savings from green power purchases (wind) are 208,019 tons-NOx/year (98.6%), and savings from residential air conditioner retrofits are 438 tons-NOx/year (0.2%). The total annual NOx emissions reduction from all programs is 211,074 tons-NOx/year.

In 2022, the Ozone Season Period (OSP) NOx emissions reduction from code-compliant residential and commercial construction is calculated to be 0.91 tons-NOx/day (0.6%), savings from the PUC's Senate Bill 7 programs will be 0.49 tons-NOx/day (0.3%), savings from SECO's Senate Bill 5 program will be 1.27 tons-NOx/day (0.9%), savings from green power purchases (wind) will be 141.71 tons-NOx/day (97.7%), and savings from residential air conditioner retrofits will be 0.75 tons-NOx/day (0.5%). The total OSP NOx emissions reduction from all programs will be 145.12 tons-NOx/day.

By 2027, the OSP NOx emissions reduction from code-compliant residential and commercial construction is calculated to be 2.77 tons-NOx/day (0.4%), savings from the PUC's Senate Bill 7 programs will be 1.01 tons-NOx/day (0.1%), savings from SECO's Senate Bill 5 program will be 2.99 tons-NOx/day (0.4%), savings from green power purchases (wind) will be 740.94 tons-NOx/day (98.9%), and savings from residential air conditioner retrofits will be 1.13 tons-NOx/day (0.2%). The total OSP NOx emissions reduction from all programs will be 748.48 tons-NOx/day.

¹ Baltazar, J.C., Haberl, J., Yazdani, LI, Qinbo, B., Parker, P., Zilbertshtein, G., and Claridge, D. 2023. "Energy Efficiency/Renewable Energy Impact in the Texas Emissions Reduction Plan (TERP)", Summary Report: Integrated NOx Emissions Savings from EE/RE Programs Statewide, Annual Report to the Texas Commission on Environmental Quality, January 2022 – December 2022, Energy Systems Laboratory, Report [ESL-TR-23-09-01](#).

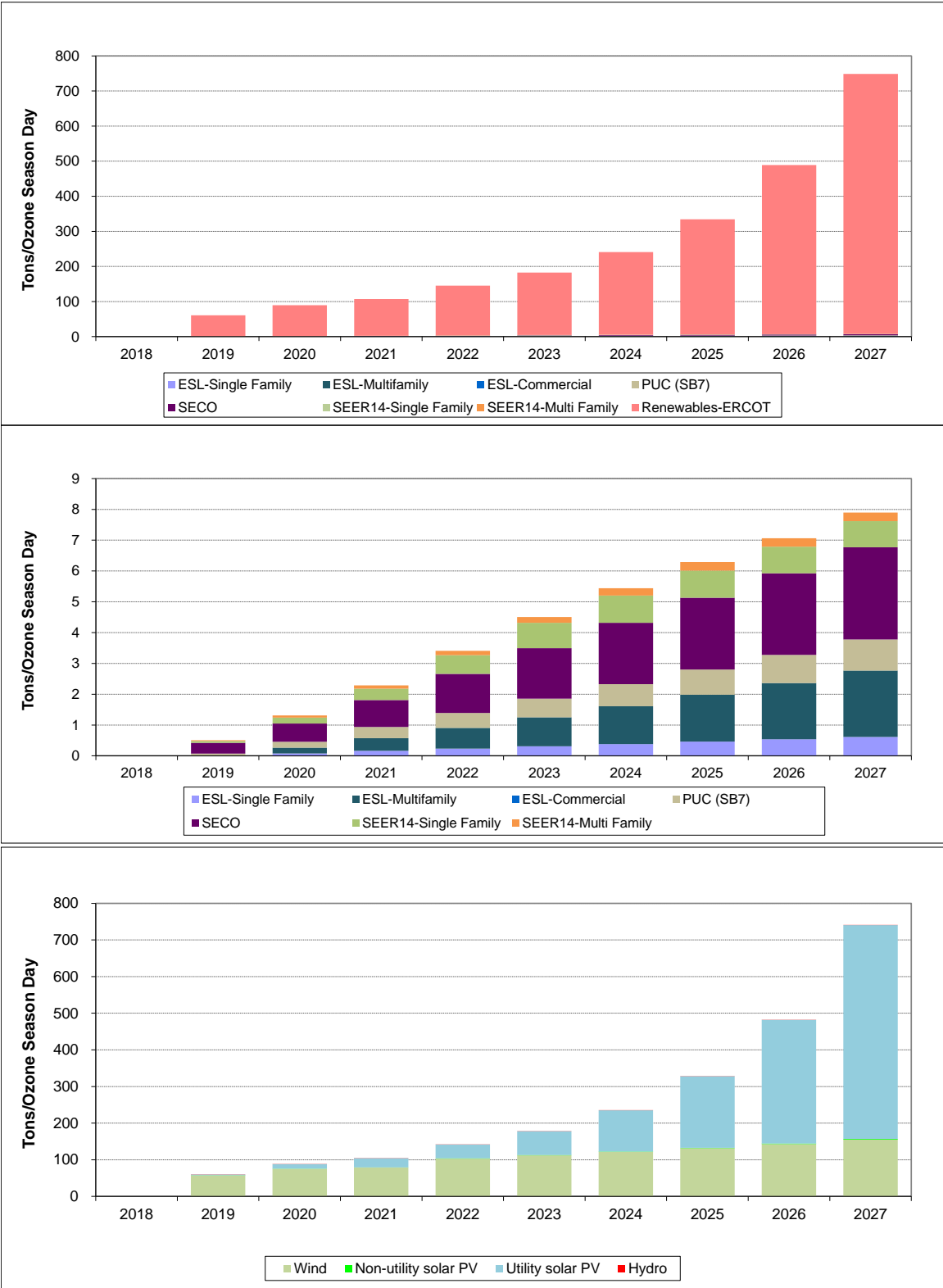


Figure 1.1: Integrated OSP NOx Emissions Reduction Projections through 2027. (Upper Plot) All Programs, (Middle Plot) All Programs Except Renewables, (Lower Plot) Renewables.

1.4 Technology Transfer

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

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

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

The Laboratory will continue to provide technical assistance to the TCEQ, counties and communities working toward obtaining full SIP credit for the energy efficiency and renewable energy projects that are lowering emissions and improving the air quality for all Texans.

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

ACKNOWLEDGEMENTS

This work has been completed as a fulfillment of Sections 386.205, 386.252, 388.006, and 388.003 (e) of the Texas Health and Safety Code and Sections 39.9051 (g) (h), and 39.9052 (c) (d) of the Texas Utilities Code, which require the Laboratory to assist TCEQ in quantifying emissions reductions credits from energy efficiency and renewable energy programs.

The authors are also grateful for the timely input provided by the following individuals, and agencies: Lindley Anderson, TCEQ, Dan Mantena, ERCOT, Therese Harris, PUCT, Eddy Trevino and Fred Yebra, SECO. Numerous additional individuals at the Energy Systems Laboratory contributed significantly to this report, including Yu Sun, Jounghwan Ahn, and Xiaodi Hou.

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2 CODE AND PRE-CODE SIMULATION RESULTS BY COUNTY

This appendix to the Laboratory's 2022 annual report contains the simulation results for single-family and multi-family residences in the 254 counties. For each county, code and pre-code simulation, and annual results for individual residence are provided (Single-family and Multi-family).

For each county, pre-code and code simulation, and annual results, for 2018 base year, for individual Single-family and Multi-family residences can be viewed using the links provided in Table 1. Some simulations were performed with one representative county in the same climate zone. The annual savings for each county were calculated using the simulation results for the representative county for the same climate zone and number of houses.

The files included in Table 1 can be obtained upon request, please contact the Energy Systems Laboratory. An example of the files that can be provided are shown in Figure 2.1 that presents the simulation results of Annual and OSP energy usages of Bastrop County; Figure 2.2 shows annual and OSP energy savings of the single-family for Bastrop County in 2022. Figure 2.3 shows annual and OSP energy savings of the multi-family for Bastrop County in 2022.

Table 1: Simulation Results for Individual Single Family and Multi Family Residences for All Counties.²

Non-attainment Counties (*Representative counties)		2022		
*	BEXAR	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
**	FREESTONE	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
	NAVARRO		<u>Single Family</u>	<u>Multifamily</u>
**	HUTCHINSON	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
**	HOWARD	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
	PANOLA	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
*	RUSK		<u>Single Family</u>	<u>Multifamily</u>
	ANDERSON		<u>Single Family</u>	<u>Multifamily</u>
*	TITUS	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
*	BRAZORIA	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
*	CHAMBERS	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
*	COLLIN	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
	WISE		<u>Single Family</u>	<u>Multifamily</u>
*	DALLAS	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
*	DENTON	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
*	EL PASO	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
*	ELLIS	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
*	FORT BEND	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
*	GALVESTON	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
*	HARRIS	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
*	JOHNSON	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
*	KAUFMAN	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
*	LIBERTY	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
*	MONTGOMERY	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
*	PARKER	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
*	ROCKWALL	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
*	TARRANT	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
*	WALLER	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
Other Texas Counties (*Representative counties)				
*	HAYS	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
*	NUECES	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
*	SAN PATRICIO	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
*	SMITH	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
*	TRAVIS	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
*	UPSHUR	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
*	VICTORIA	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
*	WILLIAMSON	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>
*	WILSON	<u>Summary</u>	<u>Single Family</u>	<u>Multifamily</u>

Note: **The representative county for Freestone and Navarro is Bell, for Hutchinson is Briscoe, and for Howard is Ector.

² Table 1 contains the list of simulation results that are compiled by the Laboratory each year for the TERP report. These include over 70 megabytes of files of results that contain the results of the simulations. These files are available upon request.

Table 1: Simulation Results for Individual Single Family and Multi Family Residences for All Counties (Continues)

Other Texas Counties (*Representative counties)		2022	
* COLEMAN	Summary	Single Family	Multifamily
CALLAHAN	Summary	Single Family	Multifamily
EASTLAND		Single Family	Multifamily
ERATH		Single Family	Multifamily
FISHER		Single Family	Multifamily
HASKELL		Single Family	Multifamily
JACK		Single Family	Multifamily
JONES		Single Family	Multifamily
MITCHELL		Single Family	Multifamily
NOLAN		Single Family	Multifamily
PALO PINTO		Single Family	Multifamily
SHACKELFORD		Single Family	Multifamily
STEPHENS		Single Family	Multifamily
* TAYLOR		Single Family	Multifamily
THROCKMORTON		Single Family	Multifamily
YOUNG	Single Family	Multifamily	
* LEON	Summary	Single Family	Multifamily
TRINITY	Single Family	Multifamily	
* CALDWELL	Summary	Single Family	Multifamily
* BELL	Summary	Single Family	Multifamily
BOSQUE		Single Family	Multifamily
BROWN		Single Family	Multifamily
COMANCHE		Single Family	Multifamily
CORYELL		Single Family	Multifamily
FALLS		Single Family	Multifamily
HAMILTON		Single Family	Multifamily
HILL		Single Family	Multifamily
LAMPASAS		Single Family	Multifamily
LIMESTONE		Single Family	Multifamily
MCLENNAN		Single Family	Multifamily
MILLS	Single Family	Multifamily	
* GUADALUPE	Summary	Single Family	Multifamily
ARMSTRONG	Summary	Single Family	Multifamily
BAILEY		Single Family	Multifamily
* BRISCOE		Single Family	Multifamily
CARSON		Single Family	Multifamily
CASTRO		Single Family	Multifamily
COCHRAN		Single Family	Multifamily
DALLAM		Single Family	Multifamily
DEAF SMITH		Single Family	Multifamily
DONLEY		Single Family	Multifamily
FLOYD		Single Family	Multifamily

Table 1: Simulation Results for Individual Single Family and Multi Family Residences for All Counties (Continues)

Other Texas Counties (*Representative counties)	2022		
GRAY		Single Family	Multifamily
HALE		Single Family	Multifamily
HANSFORD		Single Family	Multifamily
HARTLEY		Single Family	Multifamily
HOCKLEY		Single Family	Multifamily
LAMB		Single Family	Multifamily
LIPSCOMB		Single Family	Multifamily
MOORE		Single Family	Multifamily
OCHILTREE		Single Family	Multifamily
OLDHAM		Single Family	Multifamily
PARMER		Single Family	Multifamily
RANDALL		Single Family	Multifamily
ROBERTS		Single Family	Multifamily
SHERMAN		Single Family	Multifamily
SWISHER		Single Family	Multifamily
YOAKUM		Single Family	Multifamily
* GREGG	Summary	Single Family	Multifamily
COLLINGSWORTH		Single Family	Multifamily
* HALL	Summary	Single Family	Multifamily
HEMPHILL		Single Family	Multifamily
WHEELER		Single Family	Multifamily
* BASTROP	Summary	Single Family	Multifamily
CALDWELL		Single Family	Multifamily
LEE		Single Family	Multifamily
BLANCO		Single Family	Multifamily
BURNET		Single Family	Multifamily
GILLESPIE		Single Family	Multifamily
KERR		Single Family	Multifamily
REAL		Single Family	Multifamily
HAYS	Summary	Single Family	Multifamily
LLANO		Single Family	Multifamily
MASON		Single Family	Multifamily
SAN SABA		Single Family	Multifamily
* TRAVIS		Single Family	Multifamily
WILLIAMSON		Single Family	Multifamily
* CHAMBERS	Summary	Single Family	Multifamily
BROOKS		Single Family	Multifamily
CAMERON		Single Family	Multifamily
* HIDALGO	Summary	Single Family	Multifamily
KENEDY		Single Family	Multifamily
STARR		Single Family	Multifamily
WILLACY		Single Family	Multifamily

Table 1: Simulation Results for Individual Single Family and Multi Family Residences for All Counties (Continues)

Other Texas Counties (*Representative counties)		2022	
JIM HOGG	Summary	Single Family	Multifamily
* ZAPATA		Single Family	Multifamily
* KLEBERG	Summary	Single Family	Multifamily
ARANSAS	Summary	Single Family	Multifamily
* NUECES		Single Family	Multifamily
DUVAL		Single Family	Multifamily
JIM WELLS		Single Family	Multifamily
LIVE OAK		Single Family	Multifamily
SAN PATRICIO		Single Family	Multifamily
DIMMIT		Summary	Single Family
LA SALLE	Single Family		Multifamily
MAVERICK	Single Family		Multifamily
MCMULLEN	Single Family		Multifamily
* WEBB	Single Family		Multifamily
ZAVALA	Single Family		Multifamily
HENDERSON	Summary	Single Family	Multifamily
* SMITH		Single Family	Multifamily
* DALLAS	Summary	Single Family	Multifamily
ELLIS		Single Family	Multifamily
HOOD		Single Family	Multifamily
JOHNSON		Single Family	Multifamily
SOMERVELL		Single Family	Multifamily
TARRANT		Single Family	Multifamily
BOWIE		Summary	Single Family
CAMP	Single Family		Multifamily
CASS	Single Family		Multifamily
LAMAR	Single Family		Multifamily
MORRIS	Single Family		Multifamily
RED RIVER	Single Family		Multifamily
The simulation results of this group of counties are based on Titus County.			
* COLLIN	Summary	Single Family	Multifamily
DELTA		Single Family	Multifamily
DENTON		Single Family	Multifamily
FRANKLIN		Single Family	Multifamily
HOPKINS		Single Family	Multifamily
KAUFMAN		Single Family	Multifamily
PARKER		Single Family	Multifamily
RAINS		Single Family	Multifamily
ROCKWALL		Single Family	Multifamily
VAN ZANDT		Single Family	Multifamily
WISE		Single Family	Multifamily
* CULBERSON	Summary	Single Family	Multifamily

Table 1: Simulation Results for Individual Single Family and Multi Family Residences for All Counties (Continues)

Other Texas Counties (*Representative counties)		2022		
*	HUDSPETH		Single Family Multifamily	
*	BASTROP	Summary	Single Family Multifamily	
	ANGELINA	Summary	Single Family Multifamily	
	CHEROKEE		Single Family Multifamily	
	HOUSTON		Single Family Multifamily	
	NACOGDOCHES		Single Family Multifamily	
	SABINE		Single Family Multifamily	
	SAN AUGUSTINE		Single Family Multifamily	
	SHELBY		Single Family Multifamily	
	The simulation results of this group of counties are based on Rusk County.			
*	HARRISON		Summary	Single Family Multifamily
	BRAZORIA	Summary	Single Family Multifamily	
*	GALVESTON		Single Family Multifamily	
	AUSTIN	Summary	Single Family Multifamily	
	BRAZOS		Single Family Multifamily	
	BURLESON		Single Family Multifamily	
	COLORADO		Single Family Multifamily	
	FAYETTE		Single Family Multifamily	
	FORT BEND		Single Family Multifamily	
	GRIMES		Single Family Multifamily	
*	HARRIS		Single Family Multifamily	
	MADISON		Single Family Multifamily	
	MONTGOMERY		Single Family Multifamily	
	ROBERTSON		Single Family Multifamily	
	WALKER		Single Family Multifamily	
	WALLER		Single Family Multifamily	
	WASHINGTON		Single Family Multifamily	
*	MILAM		Summary	Single Family Multifamily
	BORDEN		Summary	Single Family Multifamily
	CHILDRESS	Single Family Multifamily		
	CROSBY	Single Family Multifamily		
	DAWSON	Single Family Multifamily		
	DICKENS	Single Family Multifamily		
	GARZA	Single Family Multifamily		
	KENT	Single Family Multifamily		
	KING	Single Family Multifamily		
	LUBBOCK	Single Family Multifamily		
	LYNN	Single Family Multifamily		
	MOTLEY	Single Family Multifamily		
*	SCURRY	Single Family Multifamily		
	STONEWALL	Single Family Multifamily		
	TERRY	Single Family Multifamily		

Table 1: Simulation Results for Individual Single Family and Multi Family Residences for All Counties (Continues)

Other Texas Counties (*Representative counties)		2022		
* CRANE	Summary	Single Family	Multifamily	
REAGAN		Single Family	Multifamily	
UPTON		Single Family	Multifamily	
COMAL	Summary	Single Family	Multifamily	
ANDREWS	Summary	Single Family	Multifamily	
* ECTOR		Single Family	Multifamily	
GAINES		Single Family	Multifamily	
GLASSCOCK		Single Family	Multifamily	
JEFF DAVIS		Single Family	Multifamily	
LOVING		Single Family	Multifamily	
MARTIN		Single Family	Multifamily	
MIDLAND		Single Family	Multifamily	
REEVES		Single Family	Multifamily	
WARD		Single Family	Multifamily	
WINKLER		Single Family	Multifamily	
* ATASCOSA		Summary	Single Family	Multifamily
FRIO			Single Family	Multifamily
* BEXAR	Summary	Single Family	Multifamily	
COMAL		Single Family	Multifamily	
GONZALES		Single Family	Multifamily	
GUADALUPE		Single Family	Multifamily	
KINNEY		Single Family	Multifamily	
MEDINA		Single Family	Multifamily	
UVALDE		Single Family	Multifamily	
VAL VERDE		Single Family	Multifamily	
WILSON		Single Family	Multifamily	
BANDERA	Summary	Single Family	Multifamily	
* KENDALL	Summary	Single Family	Multifamily	
BREWSTER		Single Family	Multifamily	
EDWARDS		Single Family	Multifamily	
KIMBLE		Single Family	Multifamily	
PECOS		Single Family	Multifamily	
PRESIDIO		Single Family	Multifamily	
SUTTON		Single Family	Multifamily	
TERRELL		Single Family	Multifamily	
CONCHO		Single Family	Multifamily	
CROCKETT		Single Family	Multifamily	
IRION		Single Family	Multifamily	
MCCULLOCH		Single Family	Multifamily	
MENARD		Single Family	Multifamily	
RUNNELS		Single Family	Multifamily	
SCHLEICHER		Single Family	Multifamily	

Table 1: Simulation Results for Individual Single Family and Multi Family Residences for All Counties (Continues)

Other Texas Counties (*Representative counties)		2022		
*	TOM GREEN		Single Family	Multifamily
*	COKE	Summary	Single Family	Multifamily
	STERLING		Single Family	Multifamily
	COOKE	Summary	Single Family	Multifamily
	FANNIN		Single Family	Multifamily
	GRAYSON		Single Family	Multifamily
*	HUNT		Single Family	Multifamily
	MONTAGUE		Single Family	Multifamily
	ARCHER	Summary	Single Family	Multifamily
	BAYLOR		Single Family	Multifamily
	CLAY		Single Family	Multifamily
	COTTLE		Single Family	Multifamily
	FOARD		Single Family	Multifamily
	HARDEMAN		Single Family	Multifamily
	KNOX		Single Family	Multifamily
*	WICHITA		Single Family	Multifamily
	WILBARGER		Single Family	Multifamily
	BEE		Summary	Single Family
	CALHOUN	Single Family		Multifamily
	GOLIAD	Single Family		Multifamily
	JACKSON	Single Family		Multifamily
	MATAGORDA	Single Family		Multifamily
	REFUGIO	Single Family		Multifamily
*	VICTORIA	Single Family		Multifamily
	WHARTON	Single Family		Multifamily
	DE WITT	Single Family	Multifamily	
*	KARNES	Summary	Single Family	Multifamily
*	LAVACA	Summary	Single Family	Multifamily
*	HARRISON	Summary	Single Family	Multifamily
	MARION		Single Family	Multifamily
	JASPER	Summary	Single Family	Multifamily
*	ORANGE		Single Family	Multifamily
	NEWTON		Single Family	Multifamily
*	HARDIN	Summary	Single Family	Multifamily
	POLK		Single Family	Multifamily
	TYLER		Single Family	Multifamily
*	LIBERTY	Summary	Single Family	Multifamily
	SAN JACINTO		Single Family	Multifamily

County	SF or MF	Precode or Code-compliant	Options	Simulation #	Annual Elec. (kWh/yr)	Annual NG (Therms/yr)	Avg. OSD Elec. (kWh/day)	Avg. OSD NG (Therm/day)	Annual Elec.Savings (kWh/yr)	Annual NG Savings (Therms/yr)	Avg. OSD Elec. Savings (kWh/day)	Avg. OSD NG Savings (Therm/day)		
Bastrop	SF	Precode	Slab-on-grade	Fuel Option 1	1-story	1	13888	393	38	1				
				2-story	2	13413	376	37	1					
				Fuel Option 2	1-story	3	21653	0	59	0				
				2-story	4	20787	0	57	0					
				Fuel Option 3	1-story	5	18369	0	50	0				
				2-story	6	17788	0	49	0					
			Crawl Space	Fuel Option 1	1-story	7	14780	407	40	1				
				2-story	8	13964	368	38	1					
				Fuel Option 2	1-story	9	22895	0	63	0				
				2-story	10	21152	0	58	0					
				Fuel Option 3	1-story	11	19362	0	53	0				
				2-story	12	18296	0	50	0					
		Code - Compliant	Slab-on-grade	Fuel Option 1	1-story	13	13441	382	37	1	447	11	1.22	0.03
				2-story	14	12958	367	36	1	455	9	1.25	0.02	
				Fuel Option 2	1-story	15	21170	0	58	0	483	0	1.32	0.00
				2-story	16	20306	0	56	0	481	0	1.32	0.00	
				Fuel Option 3	1-story	17	17822	0	49	0	547	0	1.50	0.00
				2-story	18	17242	0	47	0	546	0	1.50	0.00	
			Crawl Space	Fuel Option 1	1-story	19	14210	395	39	1	570	12	1.56	0.03
				2-story	20	13436	357	37	1	528	11	1.45	0.03	
				Fuel Option 2	1-story	21	22247	0	61	0	648	0	1.78	0.00
				2-story	22	20569	0	56	0	583	0	1.60	0.00	
				Fuel Option 3	1-story	23	18675	0	51	0	687	0	1.88	0.00
				2-story	24	17673	0	48	0	623	0	1.71	0.00	
	MF	Precode	Slab-on-grade	Fuel Option 1	1-story	1	49386	752	135	2				
				2-story	2	98037	1378	269	4					
				3-story	3	146585	2021	402	6					
				Fuel Option 2	1-story	4	63270	0	173	0				
				2-story	5	122835	0	337	0					
				3-story	6	182701	0	501	0					
			Crawl Space	Fuel Option 3	1-story	7	60060	0	165	0				
				2-story	8	118592	0	325	0					
				3-story	9	177117	0	485	0					
				Fuel Option 1	1-story	10	47763	736	131	2	1,623	16	4.45	0.04
				2-story	11	95262	1357	261	4	2,775	21	7.60	0.06	
				3-story	12	142718	1990	391	5	3,867	31	10.59	0.08	
		Code - Compliant	Slab-on-grade	Fuel Option 1	1-story	13	61278	0	168	0	1,992	0	5.46	0.00
				2-story	14	119533	0	327	0	3,302	0	9.05	0.00	
				Fuel Option 2	1-story	15	178135	0	488	0	4,566	0	12.51	0.00
				2-story	16	58250	0	160	0	1,810	0	4.96	0.00	
				Fuel Option 3	1-story	17	115533	0	317	0	3,059	0	8.38	0.00
				2-story	18	172863	0	474	0	4,254	0	11.65	0.00	

Figure 2.1: The Summary Simulation Results of Annual and OSP Energy Usages of Bastrop County

County Name	Bastrop
Division (East or West Texas)	East Texas
Number of new building permits for SFD	1,853

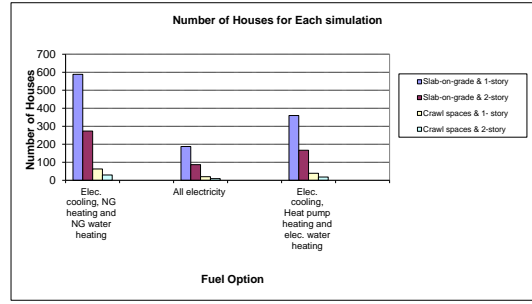
		Fuel Option			Total	
		1 Elec. cooling, NG heating and NG water heating	2 All electricity	3 Elec. cooling, Heat pump heating and elec. water heating		
	90.30%	68.30%	51.5%	16.4%	31.5%	61.30%
	31.70%	14.74%	31.76%	10.11%	19.33%	28.45%
	9.70%	68.30%	3.41%	1.09%	2.09%	6.59%
	31.70%	1.58%	51.50%	16.40%	31.50%	99.40%
Total						

Number of Houses for each simulation						
		Fuel Option			Total	
		1 Elec. cooling, NG heating and NG water heating	2 All electricity	3 Elec. cooling, Heat pump heating and elec. water heating		
	90.30%	68.30%	51.5%	16.4%	31.5%	369
	31.70%	273	187	87	167	527
	9.70%	63	20	39	39	122
	31.70%	29	9	18	57	184
Total		594	304	594	594	1,942

Precode Energy Use for each option (per house)							
		Fuel Option			Total		
		1 Elec. cooling, NG heating and NG water heating	2 All electricity	3 Elec. cooling, Heat pump heating and elec. water heating			
		Elec. Use (kWh)	NG Use (Therm)	Elec. Use (kWh)	NG Use (Therm)	Elec. Use (kWh)	NG Use (Therm)
Slab-on-grade	1-Story	13,888	393	21,663	0	18,369	0
	2-Story	13,413	376	20,787	0	17,788	0
Crawl spaces	1-Story	14,793	407	22,865	0	19,362	0
	2-Story	13,964	368	21,152	0	18,295	0
Total		56,045	1,544	86,487	0	73,815	0

Precode Total Energy Use (For total houses in a County)							
		Fuel Option			Total		
		1 Elec. cooling, NG heating and NG water heating	2 All electricity	3 Elec. cooling, Heat pump heating and elec. water heating			
		Elec. Use (MWh)	NG Use (Therm)	Elec. Use (MWh)	NG Use (Therm)	Elec. Use (MWh)	NG Use (Therm)
Slab-on-grade	1-Story	6,174	231,304	4,058	0	6,513	0
	2-Story	3,664	102,711	1,808	0	2,972	0
Crawl spaces	1-Story	934	25,732	461	0	749	0
	2-Story	410	10,756	198	0	268	0
Total		13,156	370,546	6,525	0	10,563	0

Total Energy Savings Due to the Code Adoption							
		Fuel Option			Total		
		1 Elec. cooling, NG heating and NG water heating	2 All electricity	3 Elec. cooling, Heat pump heating and elec. water heating			
		Elec. Savings (MWh)	NG Savings (Therm)	Elec. Savings (MWh)	NG Savings (Therm)	Elec. Savings (MWh)	NG Savings (Therm)
Slab-on-grade	1-Story	263	6,474	91	0	197	0
	2-Story	128	2,458	42	0	257	2,458
Crawl spaces	1-Story	36	759	13	0	27	0
	2-Story	15	323	5	0	11	0
Total		439	10,014	151	0	328	2,458



Code compliant Energy Use for each option (per house)							
		Fuel Option			Total		
		1 Elec. cooling, NG heating and NG water heating	2 All electricity	3 Elec. cooling, Heat pump heating and elec. water heating			
		Elec. Use (kWh)	NG Use (Therm)	Elec. Use (kWh)	NG Use (Therm)	Elec. Use (kWh)	NG Use (Therm)
Slab-on-grade	1-Story	13,441	382	21,170	0	17,822	0
	2-Story	12,958	367	20,306	0	17,242	0
Crawl spaces	1-Story	14,210	385	22,247	0	18,675	0
	2-Story	13,438	357	20,569	0	17,673	0
Total		54,045	1,501	84,292	0	71,412	0

Code compliant Total Energy Use (For total houses in a County)							
		Fuel Option			Total		
		1 Elec. cooling, NG heating and NG water heating	2 All electricity	3 Elec. cooling, Heat pump heating and elec. water heating			
		Elec. Use (MWh)	NG Use (Therm)	Elec. Use (MWh)	NG Use (Therm)	Elec. Use (MWh)	NG Use (Therm)
Slab-on-grade	1-Story	7,911	224,830	3,368	0	6,410	0
	2-Story	3,540	100,253	1,768	0	2,881	0
Crawl spaces	1-Story	898	24,973	448	0	722	0
	2-Story	394	10,476	192	0	317	0
Total		12,743	360,531	6,374	0	10,330	0

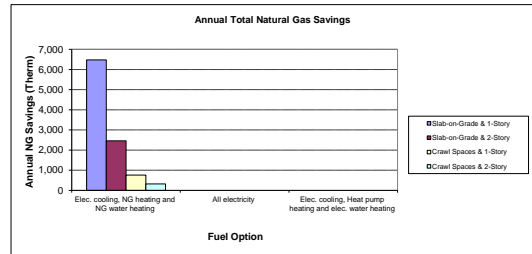
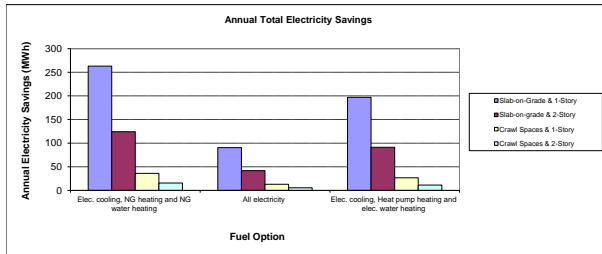


Figure 2.2: Annual and OSP Energy Savings of the Single-Family for Bastrop County in 2022

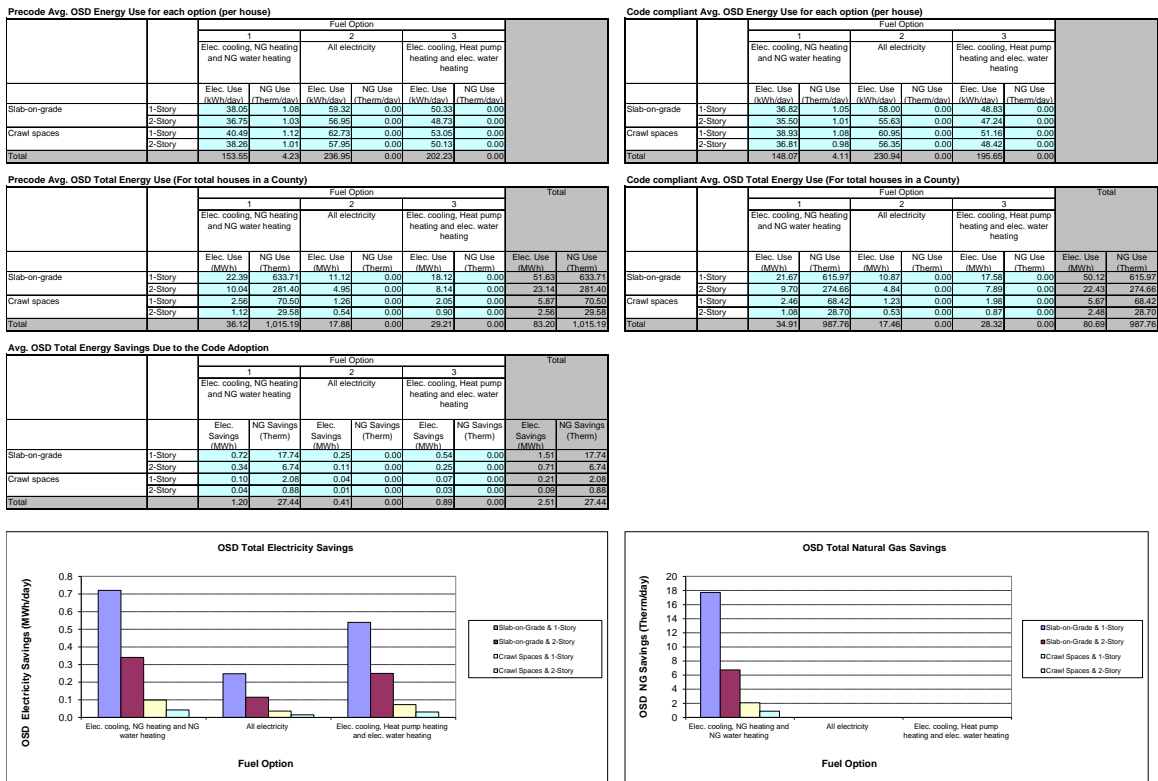


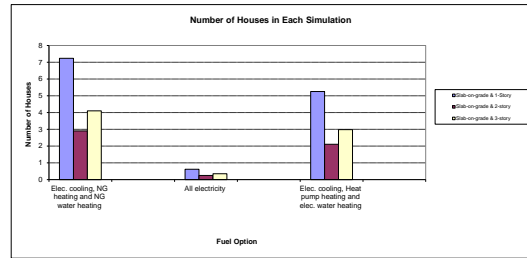
Figure 2.2: Annual and OSP Energy Savings of the Single-Family for Bastrop County in 2022 (Continued)

County Name	Bastrop
NABD Division	West South Central
Number of new building permits for MF	26

	Fuel Option				Total
	1	2	3		
	Elec. cooling, NG heating and NG water heating	All electricity	Elec. cooling, Heat pump heating and elec. water heating		
Slab-on-grade (100%)	54.8%	4.7%	39.8%		
	50.80%	27.84%	2.39%	20.22%	50.44%
	20.40%	11.83%	0.96%	8.12%	20.20%
	28.80%	15.78%	1.35%	11.46%	28.80%
Total	54.80%	4.70%	39.80%		99.30%

Number of Houses for each simulation

	Fuel Option				Total
	1	2	3		
	Elec. cooling, NG heating and NG water heating	All electricity	Elec. cooling, Heat pump heating and elec. water heating		
Slab-on-grade (100%)	54.8%	4.7%	39.8%		
	50.80%	7	1	0	13
	20.40%	3	0	2	5
	28.80%	4	0	3	7
Total	14	1	10		25



Precode Energy Use for each option (per house)

	Fuel Option					
	1		2		3	
	Elec. Use (kWh)	NG Use (Therm)	Elec. Use (kWh)	NG Use (Therm)	Elec. Use (kWh)	NG Use (Therm)
Slab-on-grade						
1-Story	49,398	752	63,270	0	60,050	0
2-Story	98,031	1,379	122,833	0	118,052	0
3-Story	146,585	2,021	182,701	0	177,117	0
Total	294,009	4,151	368,806	0	355,769	0

Code compliant Energy Use for each option (per house)

	Fuel Option					
	1		2		3	
	Elec. Use (kWh)	NG Use (Therm)	Elec. Use (kWh)	NG Use (Therm)	Elec. Use (kWh)	NG Use (Therm)
Slab-on-grade						
1-Story	47,763	736	61,276	0	58,250	0
2-Story	95,262	1,351	119,533	0	116,533	0
3-Story	142,719	1,990	178,135	0	172,863	0
Total	285,743	4,083	358,944	0	347,646	0

Precode Total Energy Use (For total houses in a County)

	Fuel Option						Total
	1		2		3		
	Elec. Use (MWh)	NG Use (Therm)	Elec. Use (MWh)	NG Use (Therm)	Elec. Use (MWh)	NG Use (Therm)	
Slab-on-grade							
1-Story	357	5,443	39	0	316	0	
2-Story	255	4,055	31	0	250	0	
3-Story	602	8,203	64	0	528	0	
Total	1,244	17,741	134	0	1,094	0	

Code compliant Total Energy Use (For total houses in a County)

	Fuel Option						Total
	1		2		3		
	Elec. Use (MWh)	NG Use (Therm)	Elec. Use (MWh)	NG Use (Therm)	Elec. Use (MWh)	NG Use (Therm)	
Slab-on-grade							
1-Story	346	5,327	38	0	308	0	
2-Story	277	3,844	29	0	248	0	
3-Story	509	8,166	63	0	512	0	
Total	1,208	17,437	131	0	1,068	0	

Total Energy Savings Due to the Code Adoption

	Fuel Option						Total
	1		2		3		
	Elec. Use (MWh)	NG Use (Therm)	Elec. Use (MWh)	NG Use (Therm)	Elec. Use (MWh)	NG Use (Therm)	
Slab-on-grade							
1-Story	12	116	1	0	10	0	
2-Story	8	61	1	0	6	0	
3-Story	16	127	2	0	13	0	
Total	36	304	4	0	29	0	

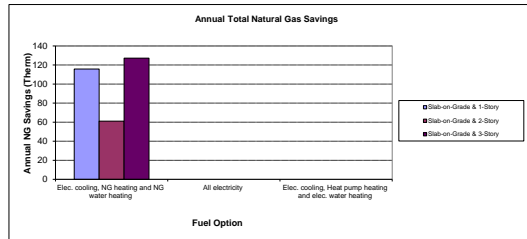
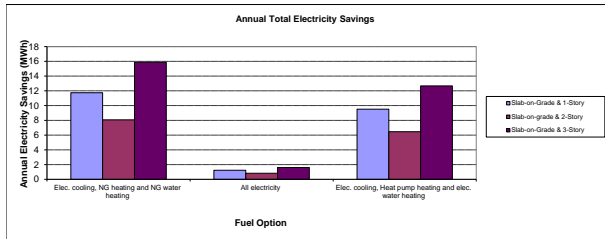


Figure 2.3: Annual and OSP Energy Savings of the Multi-Family for Bastrop County in 2022

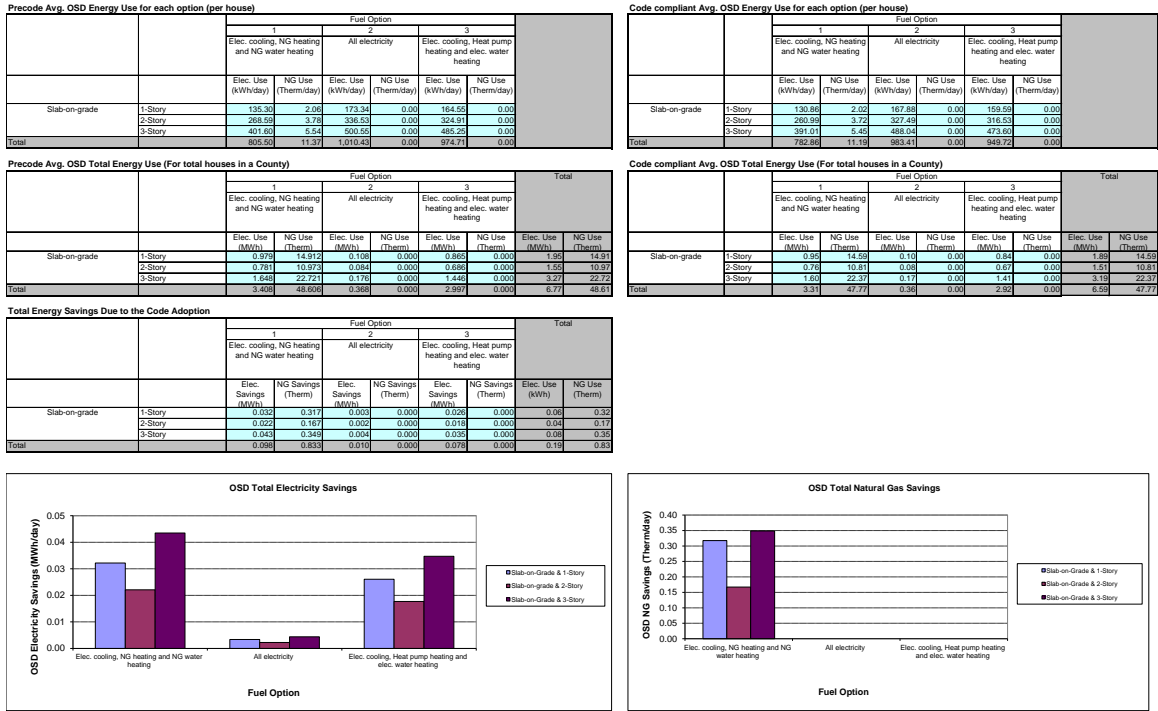


Figure 2.3: Annual and OSP Energy Savings of the Multi-Family for Bastrop County in 2022 (Continued)