

**ANALYSIS OF EMISSIONS CALCULATORS FOR THE  
NATIONAL CENTER OF EXCELLENCE ON DISPLACED  
EMISSION REDUCTIONS (CEDER)**

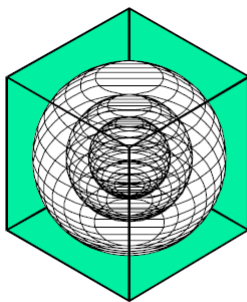
**ANNUAL REPORT**



**2009 Annual Report to the  
United States Environmental Protection Agency**

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## ANNUAL REPORT

ANALYSIS OF EMISSIONS CALCULATORS FOR NATIONAL CENTER OF EXCELLENCE ON  
DISPALCED EMISSION REDUCTIONS (CEDER)

## 1. EXECUTIVE SUMMARY

In August 2004, the USEPA issued guidance on quantifying the air emission benefits from electric sector energy efficiency and renewable energy. Because there was no clear best strategy, the EPA's guidance provided a framework and the basic requirements needed to demonstrate air quality improvements or emission reductions with adequate certainty to be incorporated into a State Implementation Plan (SIP) for achieving or maintaining National Ambient Air Quality Standards (NAAQS). The Energy Systems Laboratory, with guidance from both the US EPA and the Texas Commission on Environmental Quality (TCEQ), developed the first comprehensive engineering toolkit and database that satisfies the EPA guidelines. The value of this unique tool was demonstrated in 2005 when the Energy Systems Laboratory (ESL), at the request of the TCEQ, used it to develop integrated emissions estimates for all state agencies participating in the Texas Emissions Reduction Plan (TERP). Building on this expertise, the US EPA has established a National Center of Excellence on Displaced Emission Reductions (CEDER) at the Energy Systems Laboratory to research and gather the state-of-the-art on air pollution quantification techniques for Energy Efficiency / Renewable Energy (EE/RE) projects; provide technical support and customized analysis for state and local agencies seeking to estimate the environmental benefits from clean energy policies and programs; and to document how a user-friendly tool, based on *e2Calc*, can be used by clients to fulfill their needs to quantify emission reductions from energy efficiency and renewable energy measures.

The Energy Systems Laboratory, in fulfillment of its responsibilities, submits this annual report, "Analysis of Emissions Calculators for National Center of Excellence on Displaced Emission Reductions (CEDER)" to the United States Environmental Protection Agency.

The report is organized in several deliverables:

- A Summary Report, which details the progress of tasks;
- An Appendix, which shows the survey documentation, screenshots of emissions calculators, and screenshots for the test of each online emissions calculator.

The three main tasks that have been performed in 2009 are as follows:

- Task 1: Review existing emissions calculators from U.S. Department of Energy's EE/RE Building Energy Software Tools Directory.
- Task 2: Review and test currently available emissions calculators from the World Wide Web.
- Task 3: Assistance with the estimation of Annual Reductions of NO<sub>x</sub> Emissions in ERCOT for the HB3693 Electricity Savings Goals.

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## 2. INTRODUCTION

In August 2004, the United States Environmental Protection Agency (US EPA) issued guidance on quantifying the air emission benefits from electric sector energy efficiency and renewable energy. Because there was no clear best strategy, the EPA's guidance provided a framework and the basic requirements needed to demonstrate air quality improvements or emission reductions with adequate certainty to be incorporated into a State Implementation Plan (SIP) for achieving or maintaining the National Ambient Air Quality Standards (NAAQS). The Energy Systems Laboratory, with guidance from both the EPA and the Texas Commission on Environmental Quality (TCEQ), developed the first comprehensive engineering toolkit and database that satisfies the EPA guidance. The value of this unique tool was demonstrated in 2005 when the ESL, at the request of the TCEQ, used it to develop integrated emissions estimates for all state agencies participating in the Texas Emissions Reduction Plan (TERP). Building on this expertise, the EPA has established a National Center of Excellence on Displaced Emission Reductions (CEDER) at the Energy Systems Laboratory to research and gather the state-of-the-art on air pollution quantification techniques for EE/RE projects; provide technical support and customized analysis for state and local agencies seeking to estimate the environmental benefits from clean energy policies and programs; and to document how a user-friendly tool, based on *e2Calc*, can be used by clients to fulfill their needs to quantify emission reductions from energy efficiency and renewable energy measures.

### 2.1. Statement of Work for USEPA's Center of Excellence for Displaced Emissions Reductions (CEDER)

This summary report covers the Laboratory's work in 2009. This work is intended to cover the basic work outline included below:

- Task 1: Review existing emissions calculators from U.S. Department of Energy's EE/RE Building Energy Software Tools Directory.
- Task 2: Review and test for currently available emissions calculators from the World Wide Web.

### 2.2. Progress up to Date

#### Task 1: Review existing emissions calculators from U.S. Department of Energy's EE/RE Building Energy Software Tools Directory.

This task proposes to review existing emission calculators from U.S. Department of Energy's EE/RE Building Energy Software Tools Directory. The EE/RE Building Energy Software Tools Directory provides information on 384 building software tools for evaluating energy efficiency, renewable energy, and sustainability in buildings. The information provided for each software tool includes a short description of the tools, users, audience, input, output, computer platforms, programming language, strengths, weaknesses, technical contact, and availability.

Thirteen tools having capabilities to calculate energy-related air pollution emissions have been found and summarized. The 17 tools are categorized by the subject, and by atmospheric pollutant. The software tools are listed in the revised Appendix A of this report, along with brief information of the inputs/outputs of the 17 software tools.

## Task 2: Review and test currently available emissions calculators from the World Wide Web.

This task includes three parts: 1) check the current status of emission calculators found in the previous 2008 CEDER report, 2) search emissions calculators for update of the previous emissions calculator lists, and 3) test the newly found emissions calculators.

In the 2008 CEDER report, 40 online emissions calculators were located on the internet. Most of the calculators continue to be available. However, five calculators (AOL, The Climate Trust, The Green Office, MSN Microsoft, and SMECO) can no longer be located. Seven calculators had changes in their localization, which involve changes to the website addresses for EPA, Leonardo Academy, Texas State Energy Conservation Office, BP, Climatecrisis, ClimateCare, and Earthlab, but their emissions calculators are still available at the changed address. One calculator for the Bonneville Environmental Foundation stayed at the same web address with the input contents of the calculator are updated.

The summary table for the current availability of emissions calculators in the 2008 CEDER report is presented in the Table 1:

**Table 1. Review of Emissions Calculators in the 2008 CEDER Report**

No.	Name	Website	Institute or Company	Status (2/12/2010)
<b>Online Emission Calculators</b>				
1	Power Profiler	<a href="http://www.epa.gov/cleanenergy/energy-and-you/how-clean.html">http://www.epa.gov/cleanenergy/energy-and-you/how-clean.html</a>	EPA	Web-address changed
2	Household Emissions Calculator	<a href="http://www.epa.gov/climatechange/emissions/ind_calculator.html">http://www.epa.gov/climatechange/emissions/ind_calculator.html</a>	EPA	-
3	3.1 Emissions Calculator	<a href="http://www.cleanerandgreener.org/resources/pollutioncalculator.htm">http://www.cleanerandgreener.org/resources/pollutioncalculator.htm</a>	Leonardo Academy	-
3	3.2 Emission Reductions Calculator	<a href="http://www.cleanerandgreener.org/resources/emissions-reductions-calculator.html">http://www.cleanerandgreener.org/resources/emissions-reductions-calculator.html</a>	Leonardo Academy	Web-address changed
4	AirHead Emissions Calculator	<a href="http://airhead.cnt.org/Calculator/">http://airhead.cnt.org/Calculator/</a>	AirHead	-
5	Carbon Pollution Calculator, Electric Power Pollution Calculator	<a href="http://www.infinitepower.org/calc_carbon.htm">http://www.infinitepower.org/calc_carbon.htm</a>	Texas State Energy Conservation Office	Web-address changed
6	Non-Flash carbon footprint calculator	<a href="http://www.bp.com/iframe.do?categoryId=9027929&amp;contentId=7050956">http://www.bp.com/iframe.do?categoryId=9027929&amp;contentId=7050956</a>	BP	Web-address changed
7	NOx Calculator	<a href="http://esa21.kennesaw.edu/activities/ozonecapstone/noxcalculator.htm">http://esa21.kennesaw.edu/activities/ozonecapstone/noxcalculator.htm</a>	ESA 21	-
8	Residential Calculator & Business Calculator	<a href="http://www.10percentchallenge.org/rezcalculator.php">http://www.10percentchallenge.org/rezcalculator.php</a>	Earthlogic, Inc.	-
9	Climate Change Calculator	<a href="http://www.americanforests.org/resources/ccc/index.php">http://www.americanforests.org/resources/ccc/index.php</a>	AMERICAN FORESTS	-
10	Terrapass emissions calculator	<a href="http://www.terrapass.com/carbon-footprint-calculator/#residential">http://www.terrapass.com/carbon-footprint-calculator/#residential</a>	TerraPass Inc	-
11	Calculate your impact	<a href="http://www.climatecrisis.net/calculate-your-impact.php">http://www.climatecrisis.net/calculate-your-impact.php</a>	Climatecrisis Website	Web-address changed
12	BEF Carbon Calculator	<a href="https://www.b-e-f.org/offsets/calculator/">https://www.b-e-f.org/offsets/calculator/</a>	Bonneville Environmental Foundation	Input details changed
13	Emissions Calculator	<a href="http://www.abraxasenergy.com/emissions/">http://www.abraxasenergy.com/emissions/</a>	Abraxas Energy Consulting	-
14	Carbon Calculator	<a href="https://www.econutral.com/carboncalculator.html">https://www.econutral.com/carboncalculator.html</a>	Ecosystem Restoration Associates	-
15	15.1 eCalc (using 2007 eGrid)	<a href="http://ecalculator.tamu.edu/EmissionsWeb/">http://ecalculator.tamu.edu/EmissionsWeb/</a>	Energy Systems Laboratory	-
15	15.2 eCalc (using 1999 eGrid)	<a href="http://ecalculator.tamu.edu/EmissionsWeb/">http://ecalculator.tamu.edu/EmissionsWeb/</a>	Energy Systems Laboratory	-
16	Carbon Footprint Calculator	<a href="http://www.carbonfootprint.com/calculator.aspx">http://www.carbonfootprint.com/calculator.aspx</a>	Carbon Footprint Ltd (UK Based)	-
17	Carbon Calculator	<a href="http://www.nature.org/initiatives/climatechange/calculator/">http://www.nature.org/initiatives/climatechange/calculator/</a>	The Nature Conservancy	-
18	Calculated your personal impact	<a href="http://www.fightglobalwarming.com/carboncalculator.cfm">http://www.fightglobalwarming.com/carboncalculator.cfm</a>	Environmental Defense	-
19	America Online's Personal Impact Calculator	<a href="http://reference.aol.com/planet-earth/global-warming/calculator">http://reference.aol.com/planet-earth/global-warming/calculator</a>	AOL	Disappeared
20	ICLEI Personal CO2 Calculation	<a href="http://www3.iclei.org/co2/co2calc.htm">http://www3.iclei.org/co2/co2calc.htm</a>	ICLEI	-
21	CarbonCounter	<a href="http://www.carboncounter.org/offset-your-emissions/personal-calculator.aspx">http://www.carboncounter.org/offset-your-emissions/personal-calculator.aspx</a>	The Climate Trust	Disappeared
22	Carbon Calculators	<a href="http://www.carbonfund.org/Calculators/">http://www.carbonfund.org/Calculators/</a>	Carbonfund	-
23	Carbon dioxide emissions calculator	<a href="http://www.carbonify.com/carbon-calculator.htm">http://www.carbonify.com/carbon-calculator.htm</a>	Carbonify	-
24	Impact calculator	<a href="http://www.lowimpactliving.com/scores">http://www.lowimpactliving.com/scores</a>	Low Impact Living	-
25	CoolClimate Carbon Footprint Calculator	<a href="http://coolclimate.berkeley.edu/">http://coolclimate.berkeley.edu/</a>	The Berkeley Institute of the Environment	-
26	SafeClimate Calculator	<a href="http://www.safeclimate.net/calculator/">http://www.safeclimate.net/calculator/</a>	SafeClimate, World Resources Institute	-
27	Carbon Calculators	<a href="http://www.jpmorganclimatecare.com/us/">http://www.jpmorganclimatecare.com/us/</a>	ClimateCare	Web-address changed
28	Business CO2 Calculator	<a href="https://climatecare-uat.jpmorgan.com/business/business-co2-calculator/">https://climatecare-uat.jpmorgan.com/business/business-co2-calculator/</a>	ClimateCare	-
29	Earthlab carbon calculator	<a href="https://www.earthlab.com/createprofile/reg.aspx">https://www.earthlab.com/createprofile/reg.aspx</a>	Earthlab	Web-address changed
30	Carbon Calculators	<a href="http://www.azcentral.com/news/green/carboncalc.html">http://www.azcentral.com/news/green/carboncalc.html</a>	Azcentral.com	-
31	Carbon Calculators	<a href="http://www.comfortableresponsible.org/carboncalculator.asp">http://www.comfortableresponsible.org/carboncalculator.asp</a>	Natural Gas	-
32	Personal GHG Emission Calculators	<a href="http://www.greenregistry.org/residents_measureyouremissions_calculators.cfm">http://www.greenregistry.org/residents_measureyouremissions_calculators.cfm</a>	GreenRegistry (Canada)	-
33	GHG emissions calculation	<a href="http://www.zeroghg.com/carbon_calculators.html">http://www.zeroghg.com/carbon_calculators.html</a>	Zero GHG	-
34	Office Footprint Calculator	<a href="http://www.thegreenoffice.com/carbon/index.php">http://www.thegreenoffice.com/carbon/index.php</a>	The Green Office	Disappeared
35	Carbon Emissions Calculator	<a href="http://my.dteenergy.com/products/greenCurrents/carbonCalculator.html">http://my.dteenergy.com/products/greenCurrents/carbonCalculator.html</a>	DTE Energy	Disappeared
36	Carbon Calculator	<a href="http://green.msn.com/tools/calculator.aspx">http://green.msn.com/tools/calculator.aspx</a>	MSN Microsoft	Disappeared
37	Personal Carbon Emission Calculators	<a href="http://www.smecocoolentry.com/carboncalc/calculator.html">http://www.smecocoolentry.com/carboncalc/calculator.html</a>	SMECO	-
38	Household Carbon Dioxide Emission Calculator	<a href="http://www.co2balance.com/us/co2calculators/household/">http://www.co2balance.com/us/co2calculators/household/</a>	CarbonZero	-

In addition, twelve more online emissions calculators were found through search engines on the internet through February 2010. The summary table for the newly found emissions calculators in the 2009 CEDER report is presented in the Table 2:

**Table 2. Summary of Emissions Calculators Newly Added in the 2009 CEDER Report**

Name	Website	Institute or Company
<b>Online Emission Calculators</b>		
California Carbon Calculator	<a href="http://www.coolcalifornia.org/calculator">http://www.coolcalifornia.org/calculator</a>	California Air Resource Board
Personal Carbon Footprint Calculator	<a href="http://sustainabletravelinternational.org/documents/op_carboncalcs.html">http://sustainabletravelinternational.org/documents/op_carboncalcs.html</a>	Sustainable Travel International
Carbon Footprint Calculator	<a href="http://www.pge.com/about/environment/calculator/">http://www.pge.com/about/environment/calculator/</a>	Pacific Gas & Electric Company
Home Energy Yardstick	<a href="http://www.energystar.gov/index.cfm?fuseaction=HOME_ENERGY_YARDSTICK.showGet">http://www.energystar.gov/index.cfm?fuseaction=HOME_ENERGY_YARDSTICK.showGet</a>	Energy Star
Carbon Footprint Calculator	<a href="http://green.yahoo.com/calculator">http://green.yahoo.com/calculator</a>	Yahoo
One Minute Personal Calculator	<a href="http://calc.zerofootprint.net/one_minute/personal/">http://calc.zerofootprint.net/one_minute/personal/</a>	zerofootprint
Carbon Calculator	<a href="http://www.conservation.org/act/live_green/carboncalc/pages/default.aspx">http://www.conservation.org/act/live_green/carboncalc/pages/default.aspx</a>	CONSERVATION INTERNATIONAL
Carbon Footprint Calculator	<a href="http://www.carbonneutralcalculator.com/householdcalculator.aspx">http://www.carbonneutralcalculator.com/householdcalculator.aspx</a>	The CARBON NEUTRAL
Boston CarbonPlus Calculator	<a href="http://carboncalculator.growbostongreener.org/index.cfm?t=1">http://carboncalculator.growbostongreener.org/index.cfm?t=1</a>	Boston CarbonPlus Calculator
Carbon Neutral Calculator	<a href="http://www.goodenergy.com/store/carbon_neutral_calculator.aspx">http://www.goodenergy.com/store/carbon_neutral_calculator.aspx</a>	GoodEnergy
Greenhouse Gas Emissions Calculator	<a href="http://www.whatsyourimpact.eu.org/calculate-your-impact.php">http://www.whatsyourimpact.eu.org/calculate-your-impact.php</a>	What's Your Impact
Carbon Calculator	<a href="http://residential.directenergy.com/EN/Energy/Pages/Carbon-Calculator.aspx">http://residential.directenergy.com/EN/Energy/Pages/Carbon-Calculator.aspx</a>	Direct Energy
<b>Offline Emission Calculators</b>		
Greenhouse Gas Calculator	<a href="http://www.ratcliffarch.com/ghgcalc/">http://www.ratcliffarch.com/ghgcalc/</a>	RATCLIFF



Table 3 shows the summary of the attributes related to the currently available calculators, which include: the name of the tool, the institute or company, the energy source (Electricity, Natural Gas, Oil, Renewables), the end use (residential building, commercial building, industrial, transportation, municipal), emissions (CO<sub>2</sub>, SO<sub>x</sub>, NO<sub>x</sub> for Annual), the emissions data or rate (U.S. average, State average, or county average). In addition, screenshots of each tool were added to Appendix D of this report.

Findings from this review are summarized as follow:

- As of February 2010, 56 emissions calculators have now been found.
- 47 calculators are online tools. The remains are software tools that can be downloaded.
- Most of the online tools provide emissions calculation for electricity use (43 tools), for natural gas use (38 tools), and for heating oil use (31 tools) in residential buildings.
- Each calculator uses emissions factors to calculate emissions impact. 23 calculators use the U.S. average emission factors, 18 calculators use the state averages, and six calculators use the county or city averages.
- Some calculators provide the source of the emissions calculations. Most of them reported using emissions factors published in the EPA's eGRID (1999, 2004 and 2006 version) or the US DOE emissions data.

Table 3. Characteristics of Web-based Emissions Calculator Tools

No.	Name	Institute or Company	Energy Source				End Use				Emissions			Emission Data (Emission Rate)		
			Elec.	N.G.	Oil	Renewables (Wind, Solar, etc.)	Residential Buildings	Commercial Buildings	Industrial	Transportation	CO <sub>2</sub>	SO <sub>x</sub>	NO <sub>x</sub>	U.S. Average	State Average	County Average
											Annual	Annual	Annual			
<b>Online Emission Calculators</b>																
1	Power Profiler	EPA	x				x	x				x	x	x	x	x
2	Household Emissions Calculator	EPA	x	x	x	x	x			x		x			x	
3	3.1 Emissions Calculator	Leonardo Academy	x				x	x	x			x	x	x		x
3	3.2 Emission Reductions Calculator	Leonardo Academy	x	x			x	x	x			x	x	x		x
4	AirHead Emissions Calculator	AirHead	x	x			x			x		x	x	x		x
5	Carbon Pollution Calculator, Electric Power Pollution calculator	Texas State Energy Conservation Office	x	x	x		x			x		x	x	x		x
6	Non-Flash carbon footprint calculator	BP	x	x	x	x	x			x		x			x	
7	NOx Calculator	ESA 21	x	x			x			x				x	x	
8	Residential Calculator & Business Calculator	Earthlogic, Inc.	x	x	x	x	x	x		x		x				
9	Climate Change Calculator	AMERICAN FORESTS	x	x			x			x		x			x	
10	Terrapass emissions calculator	TerraPass Inc	x	x	x		x			x		x				x
11	Calculate your impact	Climatecrisis Website	x	x	x	x	x			x		x				x
12	BEF Carbon Calculator	Bonneville Environmental Foundation	x	x	x		x			x		x				x
13	Emissions Calculator	Abraxas Energy Consulting	x	x	x		x					x	x	x		x
14	Carbon Calculator	Ecosystem Restoration Associates	x	x	x		x			x		x				x
15	15.1 eCalc (using 2007 eGrid)	Energy Systems Laboratory	x				x					x	x	x		x
15	15.2 eCalc (using 1999 eGrid)	Energy Systems Laboratory	x				x					x	x	x		x
16	Carbon Footprint Calculator	Carbon Footprint Ltd (UK Based)	x	x	x		x			x					x	
17	Carbon Calculator	The Nature Conservancy	x				x			x		x				x
18	Calculated your personal impact	Environmental Defense	x	x			x			x		x				x
19	ICLEI Personal CO2 Calculation	ICLEI	x	x	x		x			x		x			x	
20	Carbon Calculators	Carbonfund	x	x	x		x			x		x			x	
21	Carbon dioxide emissions calculator	Carbonify	x	x	x		x			x		x			x	
22	Impact calculator	Low Impact Living	x	x	x		x			x		x				x
23	CoolClimate Carbon Footprint Calculator	The Berkeley Institute of the Environment	x	x	x		x			x		x				x
24	SafeClimate Calculator	SafeClimate, World Resources Institute	x	x	x	x	x			x		x				x
25	Carbon Calculators	ClimateCare	x	x	x		x			x		x				x
26	Business CO2 Calculator	ClimateCare	x	x	x		x			x		x				x
27	Earthlab carbon calculator	Earthlab	x	x	x	x	x			x		x				x
28	Carbon Calculators	Azcentral.com	x	x	x		x			x		x				x
29	Carbon Calculators	Natural Gas	x	x			x			x		x				x
30	Personal GHG Emission Calculators	GreenRegistry (Canada)	x	x			x			x		x				x
31	GHG emissions calculation	zero GHG	x	x	x		x			x		x				x
32	Personal Carbon Emission Calculators	SMECO	x	x	x		x			x		x				x
33	Household Carbon Dioxide Emission Calculator	CarbonZero	x	x	x		x			x		x				x
34	California Carbon Calculator	California Air Resource Board	x	x	x		x			x		x				x
35	Personal Carbon Footprint Calculator	Sustainable Travel International	x	x	x		x			x		x				x
36	Carbon Footprint Calculator	Pacific Gas & Electric Company	x	x			x			x		x				
37	Home Energy Yardstick	Energy Star	x	x	x		x			x		x				x
38	Carbon Footprint Calculator	Yahoo	x	x			x			x		x				x
39	One Minute Personal Calculator	zerofootprint	x	x			x			x		x				x
40	Carbon Calculator	CONSERVATION INTERNATIONAL					x			x		x				
41	Carbon Footprint Calculator	The CARBON NEUTRAL	x	x	x	x	x			x		x				x
42	Boston CarbonPlus Calculator	Boston CarbonPlus Calculator	x	x	x		x			x		x				x
43	Carbon Neutral Calculator	GoodEnergy	x	x	x		x			x		x				x
44	Greenhouse Gas Emissions Calculator	What's Your Impact	x	x	x		x			x		x				x
45	Carbon Calculator	Direct Energy	x	x	x		x			x		x				x
<b>Offline Emission Calculators</b>																
46	EcoCalculator	Athena Institute														
47	The Campus Carbon Calculator	Clean Air-Cool Planet														
48	Clean Air and Climate Protection Software	ICLEI	x	x	x	x	x	x	x	x	x	x	x	x		
49	MARKAL	EPA	x	x	x	x	x	x	x	x	x	x	x			x
50	CARMA (Carbon Monitoring for Action)	CARMA	x							x						x
51	HEED	UCLA	x	x			x			x						x
52	GHG Tool for Buildings in California	Energy and Environmental Economics, Inc.	x	x						x						x
53	FEDS (Cannot get the program)	Pacific Northwest National Laboratory	x	x	x		x	x		x	x	x				x
54	Greenhouse Gas Calculator	RATCLIFF	x	x	x			x		x		x				x

Appendix B provides the list of the existing emission calculators found on the internet.

All of the working emissions calculators were tested; two input parameters (i.e., annual electricity and N.G. use) were selected and tested through the available 47 websites.

The following assumptions were used for the testing of the web tools:

- The number of occupants was set at two if a calculator has an option to enter the number of occupants.
- 2,500 ft<sup>2</sup> was used for the residential house floor area if a calculator has an option to enter it.
- Two sets of tests were run: Electricity use only and N.G. use only.
- Annual electricity consumption was 12,000 kWh (\$1,200, at a cost of 0.1\$/kWh).
- Annual N.G. consumption was 96 MCF or 984 therms (\$1,320, at a cost of 13.75\$/MCF or 1.34\$/therm).

- Carbon emission (CO<sub>2</sub>) is the most commonly assessed pollutant (41 tools), only a few calculators have the capability to calculate NO<sub>x</sub> (8 tools) and SO<sub>x</sub> (7 tools) emissions. Only 7 tools can calculate all three types of air pollution emissions impact.
- Regional emissions estimation option: some calculators have state-level calculation options; for comparison purposes, Texas (i.e., Zip 77840) should be selected. For others without this option, the U.S. should be chosen.
- Other energy use options such as bulb types, and transportation were ignored. If the emissions calculator requires other specific energy use options, these were not tested for comparison with other calculators.
- The emission calculators were tested just for only those cases that consider energy use in a single family residential building.

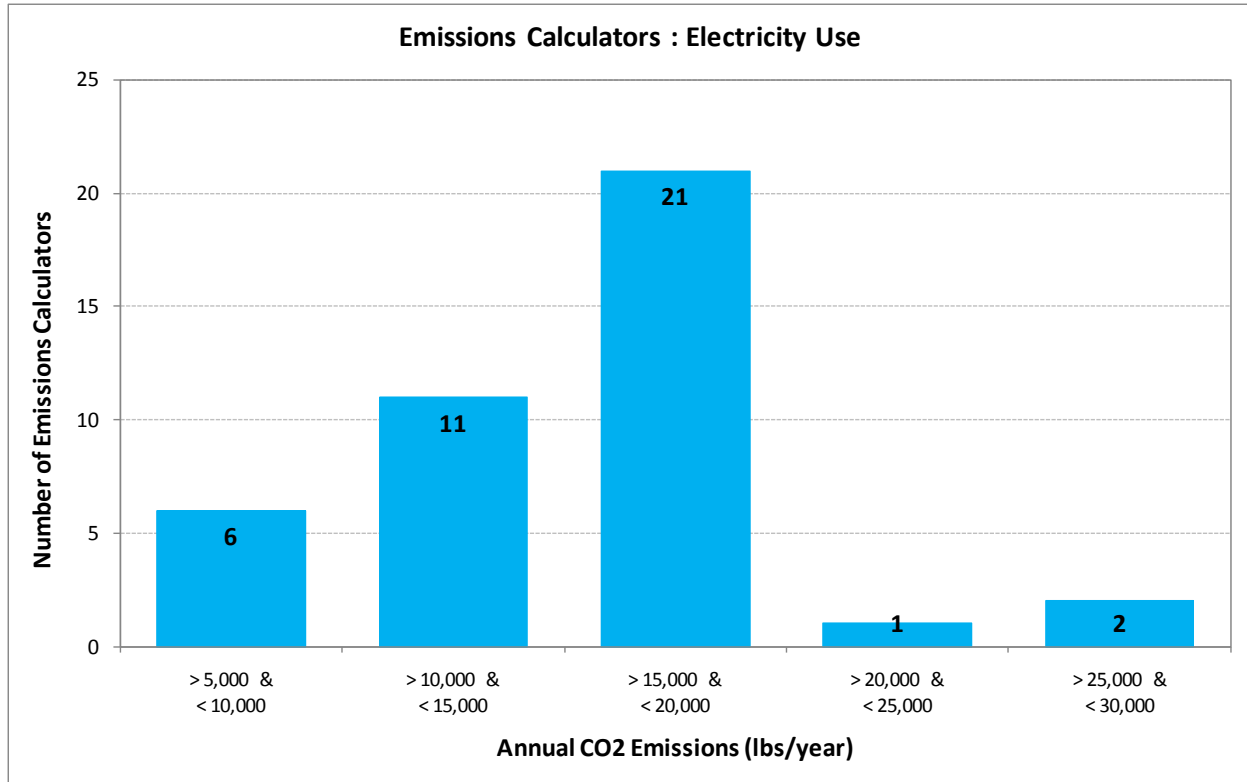
Table 4 shows the summary table that presents the results from the comparison of annual electricity use. As described earlier, most of the calculators provide CO<sub>2</sub> emission calculations, while a few can calculate NO<sub>x</sub> and SO<sub>x</sub> emissions. The summary table shows that the CO<sub>2</sub> emissions, calculated due to the electricity consumption, vary significantly from calculator to calculator in the range of 6,000 to 26,000 lbs/year. The average CO<sub>2</sub> emissions value across the emissions calculators was 15,461 lbs/year. The average NO<sub>x</sub> emissions value of the results (through 8 emissions calculators) was about 21 lbs/year, whereas the average SO<sub>x</sub> emissions value (through 7 emissions calculators) was about 25 lbs/year. Figure 1, Figure 2, and Figure 3 are bar graphs for the CO<sub>2</sub>, NO<sub>x</sub>, and SO<sub>x</sub> emissions results from annual electricity use, respectively.

Table 5 shows the summary that presents the emissions numbers from the annual N.G. use. As in the case of the emissions from electricity use, the CO<sub>2</sub> emissions calculations, due to the on-site N.G. consumption, vary greatly in the results across the emissions calculators (between 1,000 to 13,646,440 lbs/year). Specifically, 3 emissions calculators (calculator numbers 14, 19, and 31) gave unusual results; a problem in the unit denomination seems to be the cause of the difference. The average result of annual CO<sub>2</sub> emissions values, excluding the three unusual results, was 13,515 lbs/year. Whereas, the average values of the NO<sub>x</sub> and SO<sub>x</sub> emissions values across the calculators were 11 lbs/year and 0.3 lbs/year, respectively. Only two calculators reported SO<sub>x</sub> emissions and three calculators reported NO<sub>x</sub> emissions. Only two calculators provide a CO<sub>2</sub>, SO<sub>x</sub>, and NO<sub>x</sub> emissions calculations. Figure 4, Figure 5, and Figure 6 show bar graphs for the CO<sub>2</sub>, NO<sub>x</sub>, and SO<sub>x</sub> emissions results from annual N.G. use, respectively.

Appendix C provides the online calculators list which shows which existing emissions calculators were tested. Appendix D shows the screenshots for the existing emissions calculators and for the tests of each calculator.

Table 4. Emissions estimates from the Web based tools: Electricity Use Only

	Emissions Calculator	Institute or Company	Region	Annual Elec. Consumption:	Number of Occupants	Nox (lbs)	SOx (lbs)	CO2 (lbs)	Notes
1	Power Profiler	EPA	Texas (77840)	12000 kWh (Monthly 1000 kWh)	N/A	11	41	16,870	Elec. Only
2	Household Emissions Calculator	EPA	Texas (77840)	12000 kWh (Monthly 1000 kWh)	2	N/A	N/A	19,089	
3.1.3.1	Emissions Calculator	Leonardo Academy	Texas	\$100/month	N/A	13	37	17,325	Elec. Only (Annual 10,979 kWh)
3.2.3.2	Emission Reductions Calculator	Leonardo Academy	Texas	12000 kWh/Year	N/A	10	10	17,208	The value in SOx section represents SO2
4	AirHead Emissions Calculator	AirHead							Result is aggregate emissions
5	Carbon Pollution Calculator, Electric Power Pollution Calculator	Texas State Energy Conservation Office	Texas	12000 kWh (Monthly 1000 kWh)	N/A	13.68	0.072	15,360	Elec. Only, The value in SOx section represents SO2
6	Non-Flash carbon footprint calculator	BP	United States	N/A	2	N/A	N/A	25,800	Small apartment(1-2bed)
7	NOx Calculator	ESA 21	United States	12000 kWh/Year	2	23.04	N/A	N/A	Nox Only
8	Residential Calculator & Business Calculator	Earthlogic, Inc.	United States	\$1200/Year	2	N/A	N/A	14,700	
9	Climate Change Calculator	AMERICAN FORESTS	United States	12000 kWh/Year	N/A	N/A	N/A	18,000	
10	TerraPass emissions calculator	TerraPass Inc	Texas (77840)	\$100/month	N/A	N/A	N/A	13,140	
11	Calculate your impact	Climatecrisis Website	Texas (77840)	1005 - \$150/month	2	N/A	N/A	10,300	
12	BEF Carbon Calculator	Bonneville Environmental Foundation	Texas (77840)	12000 kWh (Monthly 1000 kWh)	N/A	N/A	N/A	18,587	
13	Emissions Calculator	Abraxas Energy Consulting	Texas	12000 kWh/Year	N/A	46.8	56.4	18,600	The value in SOx section represents SO2.
14	Carbon Calculator	EcoNeutral	Texas	\$100/month	2	N/A	N/A	10,620	
15.1	15.1 eCalc ( 2007 eGrid)	Energy Systems Laboratory	Texas (77840)	12000 kWh/Year	N/A	17.04	10.93	14,305	Using 2007 eGrid
15.2	15.2 eCalc ( 1999 eGrid)	Energy Systems Laboratory	Texas (77840)	12000 kWh/Year	N/A	32.25	19.52	15,907	Using 1999 eGrid
16	Carbon Footprint Calculator	Carbon Footprint Ltd (UK Based)	Texas	12000 kWh/Year	2	N/A	N/A	15,920	
17	Carbon Calculator	The Nature Conservancy	Texas	N/A	2	N/A	N/A	22,000	By number of people
18	Calculated your personal impact	Environmental Defense Fund	Texas	N/A	2	N/A	N/A	19,000	By number of people, Single Family, 2 Bed rooms
19	ICLEI Personal CO2 Calculation	ICLEI	College Station	12000 kWh/Year	2	N/A	N/A	13,596	Household Income(\$50,000 or more), Age(25-44)
20	Carbon Calculators	Carbonfund	United States	12000 kWh/Year	2	N/A	N/A	14,120	1 ton=2000 lbs
21	Carbon dioxide emissions calculator	Carbonify	United States	12000 kWh (Monthly 1000 kWh)	2	N/A	N/A	26,000	
22	Impact calculator	Low Impact Living							Conditions are different
23	CoolClimate Carbon Footprint Calculator	The Berkeley Institute of the Environment	Texas	\$100/month	2	N/A	N/A	18,000	
24	SafeClimate Calculator	SafeClimate, World Resources Institute	Texas	12000 kWh (Monthly 1000 kWh)	2	N/A	N/A	17,520	
25	Carbon Calculators	ClimateCare	Texas	12000 kWh/Year	N/A	N/A	N/A	16,020	1 ton=2000 lbs
26	Business CO2 Calculator	ClimateCare							For commercial bldgs
27	Earthlab carbon calculator	Earthlab	Texas (77840)	\$100/month	2	N/A	N/A	6,000	Single Family, 2 Bed rooms
28	Carbon Calculators	Azcentral.com	United States	\$100/month	2	N/A	N/A	18,476	
29	Carbon Calculators	Natural Gas							Conditions are different
30	Personal GHG Emission Calculators	GreenRegistry (Canada)							Conditions are different
31	GHG emissions calculation	Zero GHG	Texas	12000 kWh/Year	N/A	N/A	N/A	16,940	
32	Personal Carbon Emission Calculators	SMECO	United States	\$100/month	2	N/A	N/A	18,476	
33	Household Carbon Dioxide Emission Calculator	CarbonZero	United States	12000 kWh/Year	N/A	N/A	N/A	14,540	
34	California Carbon Calculator	California Air Resource Board	United States	12000 kWh/Year	N/A	N/A	N/A	17,000	Sqar feet in a living space(2,500 ft <sup>2</sup> ), 1 ton=2000 lbs
35	Personal Carbon Footprint Calculator	Sustainable Travel International	United States	N/A	2	N/A	N/A	6,454	Living Area (large, more than 1300 sq ft), 1 ton=2000 lbs
36	Carbon Footprint Calculator	Pacific Gas & Electric Company	United States	12000 kWh (Monthly 1000 kWh)	N/A	N/A	N/A	6,288	
37	Home Energy Yardstick	Energy Star	Texas (77840)	12000 kWh/Year	2	N/A	N/A	19,680	Sqar feet in a living space(2,500 ft <sup>2</sup> ), 1 ton=2000 lbs
38	Carbon Footprint Calculator	Yahoo	Texas	N/A	2	N/A	N/A	19,000	By number of people, Single Family, 2 Bed rooms
39	One Minute Personal Calculator	zerofootprint	Canada	N/A	2	N/A	N/A	6,260	2 Bed rooms, Air Conditioning
40	Carbon Calculator	CONSERVATION INTERNATIONAL	United States	N/A	2	N/A	N/A	12,600	Single Family, 2 Bed rooms, Omnivorous Diet
41	Carbon Footprint Calculator	The CARBON NEUTRAL	United States	12000 kWh/Year	N/A	N/A	N/A	13,400	
42	Boston CarbonPlus Calculator	Boston CarbonPlus Calculator	Boston	\$100/month	2	N/A	N/A	9,871	
43	Carbon Neutral Calculator	GoodEnergy	United States	\$100/month	2	N/A	N/A	18,476	This calculator shows wrong decimal points.
44	Greenhouse Gas Emissions Calculator	What's Your Impact	Houston, Texas	12000 kWh (Monthly 1000 kWh)	2	N/A	N/A	7,700	Mixed Fossil Fuel(American national average), 1 ton=2000 lbs
45	Carbon Calculator	Direct Energy	Texas	12000 kWh/Year	N/A	N/A	N/A	14,760	1 ton=2000 lbs
46	EcoCalculator	Athena Institute							Offline emissions calculator
47	Campus Carbon Calculator	Clean Air-Cool Planet							Offline emissions calculator
48	Clean Air and Climate Protection Software	ICLEI							Offline emissions calculator
49	MARKAL	EPA							Offline emissions calculator
50	CARMA (Carbon Monitoring for Action)	CARMA							Offline emissions calculator
51	HEED	UCLA							Offline emissions calculator
52	GHG Tool for Buildings in California	Energy and Environmental Economics, Inc.							Offline emissions calculator
53	FEDS (Cannot get the program)	Pacific Northwest National Laboratory							Offline emissions calculator
54	Greenhouse Gas Calculator	RATCLIFF							Offline emissions calculator



**Figure 1. Number of Emissions Calculators According to Annual CO2 Emissions from Electricity Use**

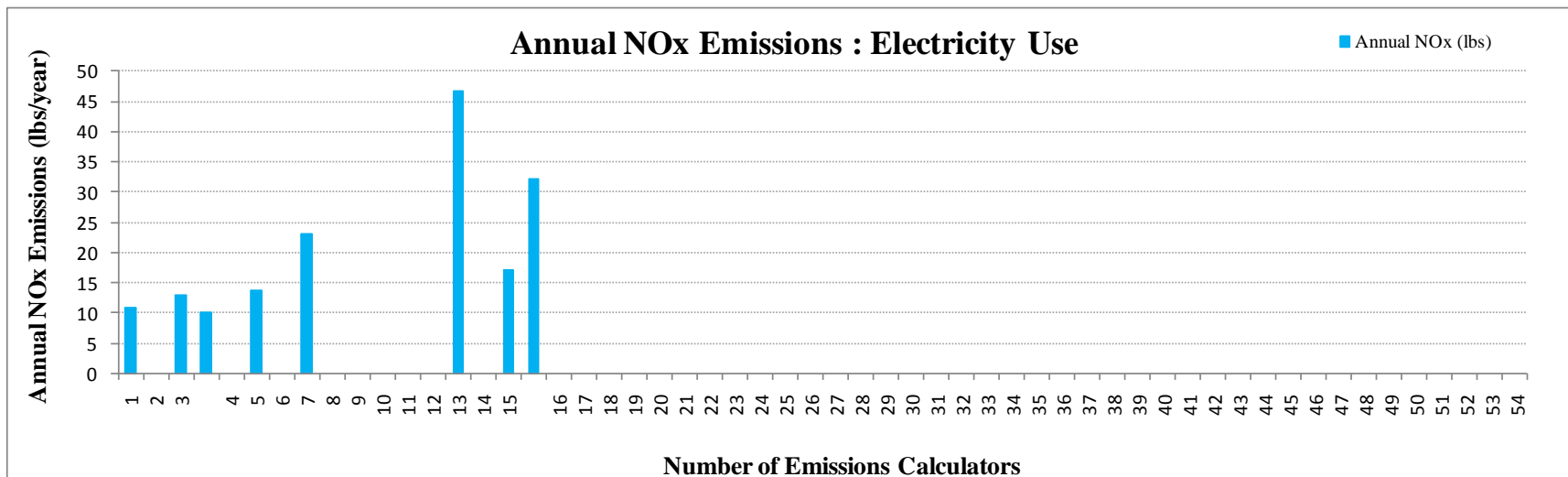


Figure 2. Annual NOx Emissions from the Electricity Use of a Residential Building

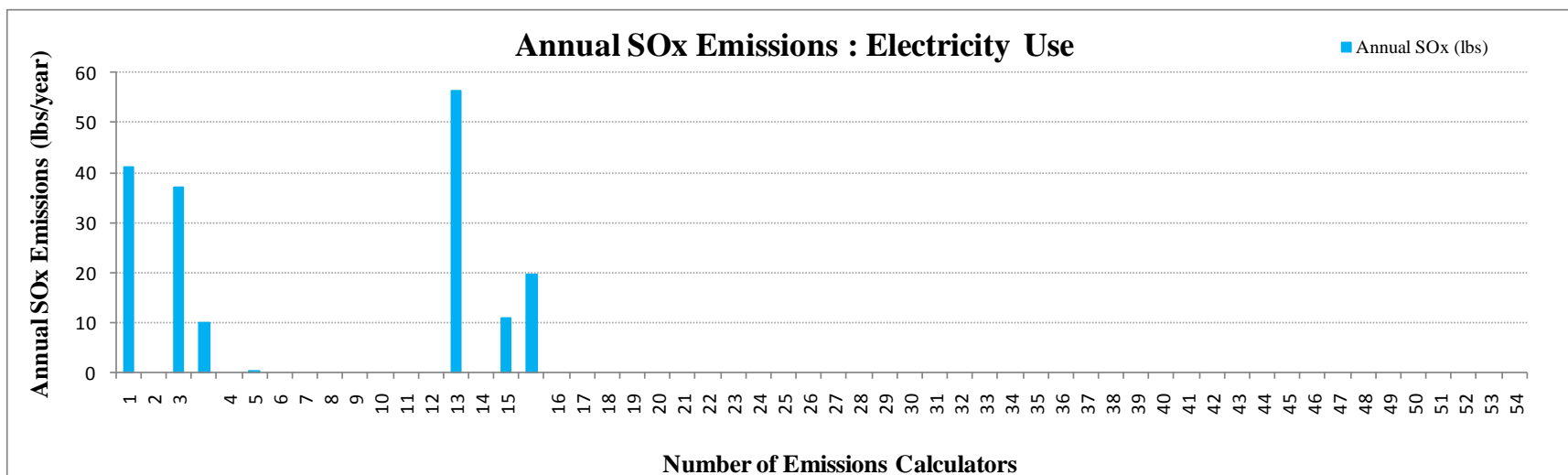
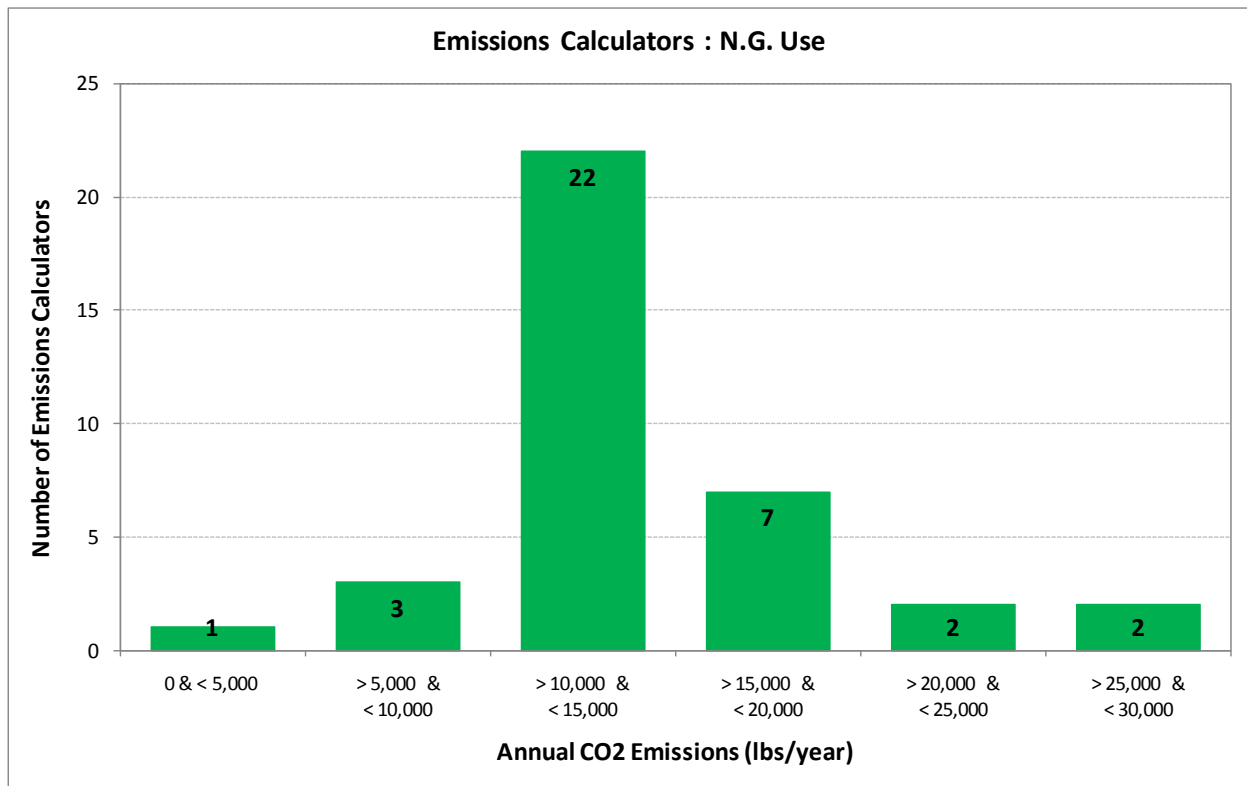


Figure 3. Annual SOx Emissions from the Electricity Use of a Residential Building

Table 5. Summary Table for Test of Emissions Calculators: Natural Gas Use Only

	Emissions Calculator	Institute or Company	Region	Annual N.G. Consumption:	Number of Occupants	Nox (lbs)	Sox (lbs)	CO2 (lbs)	Notes
1	Power Profiler	EPA							No N.G. Option
2	Household Emissions Calculator	EPA	Texas (77840)	984 therm (82 therms Monthly)	2	N/A	N/A	13,555	
3.1	Emissions Calculator	Leonardo Academy							No N.G. Option
3.2	Emission Reductions Calculator	Leonardo Academy	Texas	984 therm/Year	N/A	15	0	11,521	The value in SOx section represents SO2
4	AirHead Emissions Calculator	AirHead							Result is aggregate emissions
5	Carbon Pollution Calculator, Electric Power Pollution Calculator	Texas State Energy Conservation Office	Texas	984 therm (82 therms Monthly)	N/A	N/A	N/A	11,799	
6	Non-Flash carbon footprint calculator	BP	United States	N/A	2	N/A	N/A	16,000	Small apartment(1-2bed)
7	N0x Calculator	ESA 21	United States	984 therm/Year	2	4.53	N/A	N/A	Nox Only
8	Residential Calculator & Business Calculator	Earthlogic, Inc.	United States	\$1320/Year	2	N/A	N/A	21,600	
9	Climate Change Calculator	AMERICAN FORESTS	United States	984 therm/Year	N/A	N/A	N/A	11,554	
10	Terrapass emissions calculator	TerraPass Inc	Texas (77840)	\$110/Month	N/A	N/A	N/A	12,500	
11	BEF Carbon Calculator	Climatecrisis Website	Texas (77840)	\$110/Month	2	N/A	N/A	8,600	With Elec = 05-255/Month
12	Carbon Calculator	Bonneville Environmental Foundation	Texas (77840)	984 therm (82 therms Monthly)	N/A	N/A	N/A	11,521	
13	Emissions Calculator	Abraxas Energy Consulting	Texas	984 therm/Year	N/A	14.8	0.6	11,600	The value in SOx section represents SO2
14	Carbon Calculator	EcoNeutral	Texas	96 MCF (8 MCF Monthly)	2	N/A	N/A	13,646,440	Unit Problem ! (1 ft3=28.3168 liter)
15.1	15.1 eCalc (Year 2007)	Energy Systems Laboratory							No N.G. Option
15.2	15.2 eCalc (Year 1999)	Energy Systems Laboratory							No N.G. Option
16	Carbon Footprint Calculator	Carbon Footprint Ltd (UK Based)	Texas	984 therm/Year	2	N/A	N/A	10,680	
17	Carbon Footprint Calculator	The Nature Conservancy	Texas	N/A	2	N/A	N/A	22,000	By number of people
18	Calculated your personal impact	Environmental Defense Fund	Texas	N/A	2	N/A	N/A	19,000	By number of people, Single Family, 2 Bed rooms
19	ICLEI Personal CO2 Calculation	ICLEI	College Station	96 MCF/Year	2	N/A	N/A	232,320	Unit Problem ! (1 MCF = 1000 ft3)
20	Carbon Calculators	Carbonfund	United States	984 therm/Year	2	N/A	N/A	11,640	
21	Carbon dioxide emissions calculator	Carbonify	United States	96 MCF (8 MCF Monthly)	2	N/A	N/A	11,149	
22	Impact calculator	Low Impact Living							Conditions are different
23	CoolClimate Carbon Footprint Calculator	The Berkeley Institute of the Environment	Texas	\$110/Month	2	N/A	N/A	18,000	
24	SafeClimate Calculator	SafeClimate, World Resources Institute	Texas	984 therm (82 therms Monthly)	2	N/A	N/A	12,828	With Elec = 1 kwh/yr
25	Carbon Calculators	ClimateCare	Texas	984 therm/Year	N/A	N/A	N/A	10,520	1 ton=2000 lbs
26	Business CO2 Calculator	ClimateCare							
27	Earthlab carbon calculator	Earthlab	Texas (77840)	\$100/Month (No option for \$110)	2	N/A	N/A	14,000	With Elec - Use regional average
28	Carbon Calculators	Azcentral.com	United States	\$110/Month	2	N/A	N/A	13,548	
29	Carbon Calculators	Natural Gas							Conditions are different
30	Personal GHG Emission Calculators	GreenRegistry (Canada)							Conditions are different
31	GHG emissions calculation	Zero GHG	Texas	96 MCF/Year	N/A	N/A	N/A	1,000	
32	Personal Carbon Emission Calculators	SMECO	United States	\$110/Month	2	N/A	N/A	13,548	
33	Household Carbon Dioxide Emission Calculator	CarbonZero	United States	\$1320/Year	N/A	N/A	N/A	17,920	
34	California Carbon Calculator	California Air Resource Board	United States	984 therm/Year	N/A	N/A	N/A	19,400	Sqar feet in a living space(2,500 ft <sup>2</sup> ), 1 ton=2000 lbs
35	Personal Carbon Footprint Calculator	Sustainable Travel International	United States	N/A	2	N/A	N/A	6,454	Living Area (large, more than 1300 sq ft)
36	Carbon Footprint Calculator	Pacific Gas & Electric Company	United States	984 therm (82 therms Monthly)	N/A	N/A	N/A	13,230	
37	Home Energy Yardstick	Energy Star	Texas (77840)	984 therm/Year	2	N/A	N/A	11,483	Sqar feet in a living space(2,500 ft <sup>2</sup> ), 1 ton=2000 lbs
38	Carbon Footprint Calculator	Yahoo	Texas	N/A	2	N/A	N/A	19,000	By number of people, Single Family, 2 Bed rooms
39	One Minute Personal Calculator	zerofootprint	CANADA	N/A	2	N/A	N/A	6,260	2 Bed rooms, Air Conditioning
40	Carbon Calculator	CONSERVATION INTERNATIONAL	United States	N/A	2	N/A	N/A	12,600	Single Family, 2 Bed rooms, Omnivorous Diet
41	Carbon Footprint Calculator	The CARBON NEUTRAL	United States	984 therm/Year	N/A	N/A	N/A	12,200	
42	Boston CarbonPlus Calculator	Boston CarbonPlus Calculator	Boston	\$110/Month	2	N/A	N/A	17,862	
43	Carbon Neutral Calculator	GoodEnergy	United States	\$110/Month	2	N/A	N/A	13,548	This calculator shows wrong decimal points.
44	Greenhouse Gas Emissions Calculator	What's Your Impact	Houston, Texas	\$110/Month	2	N/A	N/A	11,920	Mixed Fossil Fuel % (American national average)
45	Carbon Calculator	Direct Energy	Texas	984 therm/Year	N/A	N/A	N/A	10,460	1 ton=2000 lbs
46	EcoCalculator	Athena Institute							Offline emissions calculator
47	Campus Carbon Calculator	Clean Air-Cool Planet							Offline emissions calculator
48	Clean Air and Climate Protection Software	ICLEI							Offline emissions calculator
49	MARKAL	EPA							Offline emissions calculator
50	CARMA (Carbon Monitoring for Action)	CARMA							Offline emissions calculator
51	HEED	UCLA							Offline emissions calculator
52	GHG Tool for Buildings in California	Energy and Environmental Economics, Inc.							Offline emissions calculator
53	FEDS (Cannot get the program)	Pacific Northwest National Laboratory							Offline emissions calculator
54	Greenhouse Gas Calculator	RATCLIFF							Offline emissions calculator



**Figure 4. Number of Emissions Calculators According to Annual CO2 Emissions from N.G. Use**



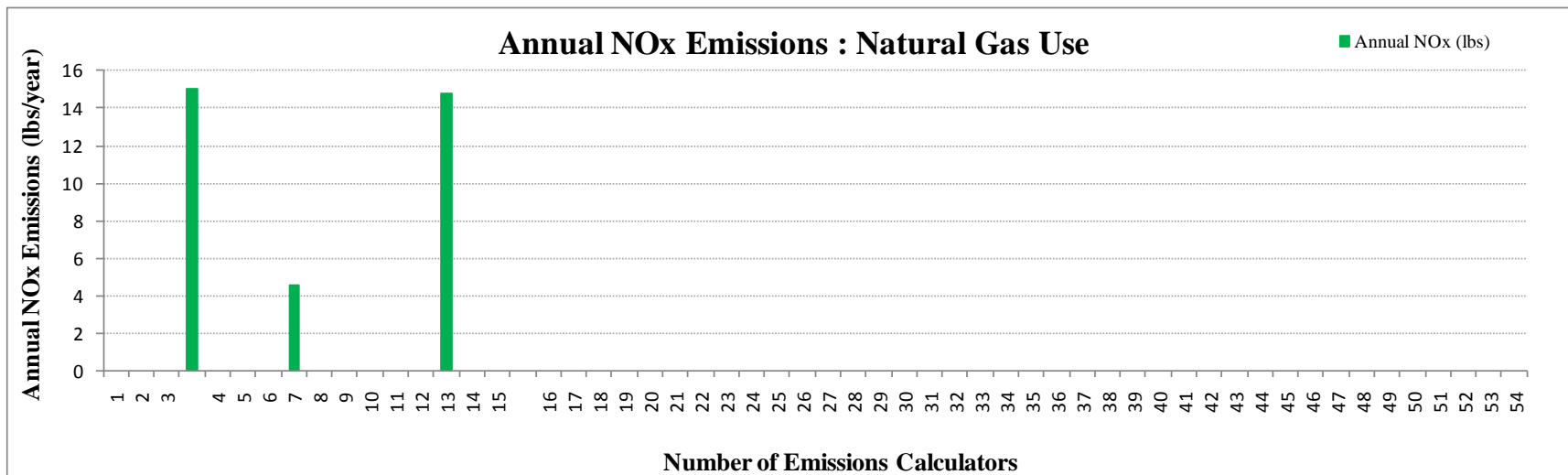


Figure 5. Annual NOx Emissions from the N.G. Use of a Residential Building

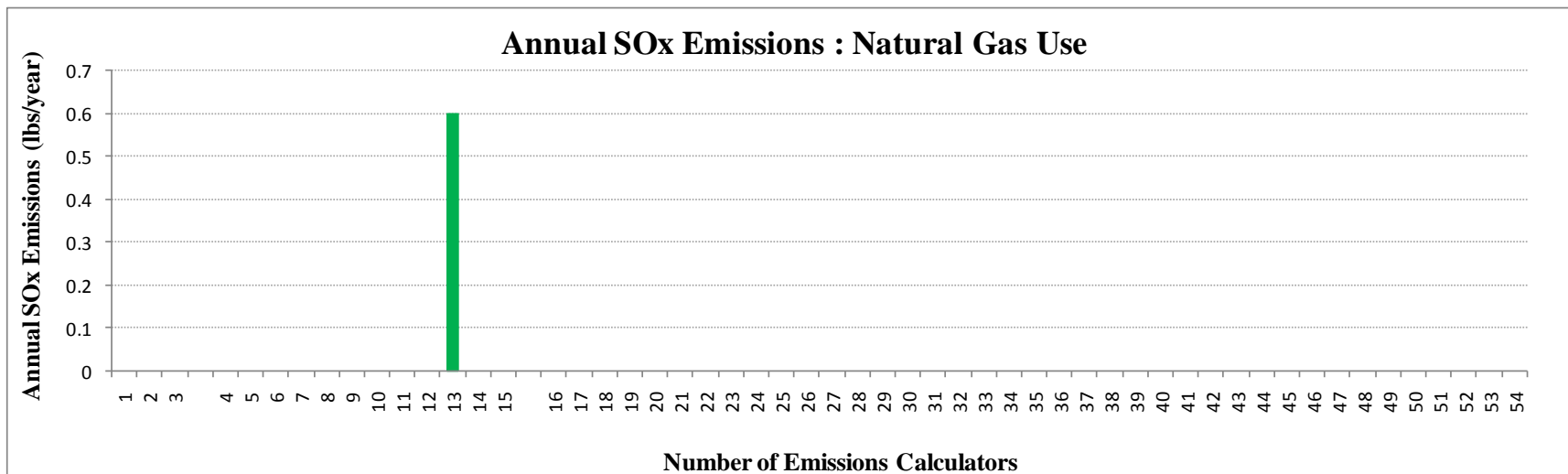


Figure 6. Annual SOx Emissions from the N.G. Use of a Residential Building