

EPA's Climate CHECK:

A Climate Change Education and Greenhouse Gas
Emission Inventory Kit for High Schools



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Overview

- Why Climate CHECK?
- Climate CHECK Structure
- Climate CHECK Features
- How can I get Climate CHECK?



Why Climate CHECK?

- Climate CHECK is an Excel-based kit designed to educate high school students about climate change.
- The Hamilton College Climate Change and Environment Issues Youth Poll
 - “American high school students do not understand climate change issues well.”
 - “Students who learn the most using the Internet do better than the average.”
 - “Teaching students about climate change outside typical science courses...increases student’s knowledge.”

<http://www.hamilton.edu/news/polls/Climate/index.html>

Why Climate CHECK?

- EPA's climate-change initiative includes environmental education
 - Climate change, Wildlife, and Wildlands Toolkit
 - Global-warming Wheelcard: Classroom Activity Kit
 - Climate Friendly Parks (CFP) Program
 - Climate Leadership in Parks (CLIP) Tool



Climate CHECK Structure

- Stakeholder interview (Spring 2005) design elements
 - **Educate** high-school students about climate change and climate change science.
 - Allow students to **estimate** their school's GHG emissions by performing an emission inventory.
 - Encourage students to **mitigate** their school's GHG emissions by developing and implementing an Action Plan.
- Three sections
 - Section 1: Climate Change Education Tool
 - Section 2: Emission Inventory Tool
 - Section 3: Action Planning Tool

Educate

- Section 1 provides background sheets that contain information on the greenhouse effect, the carbon cycle, and climate-change drivers, science, and impacts.
- The background information is provided as text followed by true or false and multiple-choice questions to help students gauge their understandings.

The screenshot shows a web browser window titled "EPA's Climate CHECK" with a sub-header "The Greenhouse Effect and the Carbon Cycle". A "Return" button is visible on the left. On the right, there is a "Key Words:" section with a list of terms: Greenhouse Effect, Solar Radiation, Thermal Radiation, Climate, Climate Change, and Anthropogenic, each preceded by a yellow star icon. Below this, the main content area is titled "The Greenhouse Effect". It contains a paragraph explaining the greenhouse effect as a natural phenomenon that keeps Earth warm, mentioning solar radiation, greenhouse gases (GHGs), and thermal radiation. To the right of the text is a diagram titled "The Greenhouse Effect" showing a sun, Earth, and arrows representing solar radiation, atmospheric reflection, and infrared radiation being re-emitted back to the surface. Below the text is a "True or False: The greenhouse effect is bad for the environment." question with "True" and "False" buttons. At the bottom, there is a section titled "So Why Do We Care about the Greenhouse Effect?" with a paragraph discussing the potential for climate change and its impacts.

Estimate

- Section 2 allows students to estimate GHG emissions by source using activity data and built-in calculators.
- Methodologies are based on *IPCC Guidelines for National Greenhouse Gas Inventories*, *EPA's U.S. Inventory of Greenhouse Gas Emissions and Sinks*, and *Volume VIII* of the EIP.

- Sources

- Stationary Combustion
- Purchased Elec. & Steam
- Mobile Combustion
- Landfilled Solid Waste
- Wastewater Treatment
- Refrig. and Air Conditioning
- Land Management

The screenshot shows the 'Stationary Combustion' module of EPA's Climate CHECK software. It features a navigation bar with 'Previous Sheet', 'Next Sheet', and 'Return to Control' buttons. A 'Key Words' section lists terms like Fossil Fuel, Carbon Content, Oxidation Factor, Incomplete Combustion, Global Warming Potential, Carbon Dioxide Equivalent, and Boiler. Below this is a table titled 'Table 1: Fuel Consumption in Stationary Sources (e.g., boilers, furnaces, etc.)' with columns for Device Name, Device Type, Fuel Type, Quantity of Fuel Used, Units, Carbon Content Value, Unit, and Oxidation Factor (%). The table contains one entry: 'Basement Boiler', 'Boiler', 'Fuel Oil', '5,000', 'Liters', '0.85', 'kg C/liter', and '99.0%'. Below the table, instructions guide the user through two steps: 'Step 1) Calculate Total Carbon' and 'Step 2) Calculate Amount of Carbon Oxidized into CO₂'. Step 1 shows a calculation: 5,000 Liters of Fuel Oil x 0.85 kg C/liter = 4,250 kg of Carbon in Fuel. Step 2 shows: 4,250 kg of Carbon x 99.0% Oxidation Factor = Oxidized Carbon (kg of C). The final results are: 'Total oxidized carbon from stationary combustion at your school is: [] kg of C' and 'Oxidizing this carbon produces: [] kg of CO₂'. A cartoon character asks 'Why does carbon dioxide seem heavier than carbon?' and a box says 'Thinking like a scientist...'. The bottom of the screen shows 'CH₄ and N₂O Emissions'.

Device Name	Device Type	Fuel Type	Quantity of Fuel Used	Units	Carbon Content Value	Unit	Oxidation Factor (%)
Basement Boiler	Boiler	Fuel Oil	5,000	Liters	0.85	kg C/liter	99.0%

To calculate CO₂ emissions, follow the steps below.

Step 1) Calculate Total Carbon

Device Name	Fuel Consumed	X	Carbon Content	=	Carbon in Fuel (kg)
Basement Boiler	5,000 Liters of Fuel Oil	x	0.85 kg C/liter	=	4,250

Step 2) Calculate Amount of Carbon Oxidized into CO₂

Device Name	Carbon in Fuel (kg)	X	Oxidation Factor (%)	=	Oxidized Carbon (kg of C)
Basement Boiler	4,250	x	99.0%	=	[]

Total oxidized carbon from stationary combustion at your school is: [] kg of C
Oxidizing this carbon produces: [] kg of CO₂

Why does carbon dioxide seem heavier than carbon?

Thinking like a scientist...

CH₄ and N₂O Emissions

Mitigate

- Section 3 provides resources to help students apply critical-thinking and problem-solving skills to design ways to reduce emissions.
- Students quantify and record emission-mitigation actions they, and the greater school community, can take.
- These “mitigation actions” are summarized in an “Action Plan” that can be printed, signed, and displayed at their school.

The screenshot displays the EPA's Climate CHECK software interface. The title bar reads "EPA's Climate CHECK" and the menu bar includes "File", "Edit", and "Module Options". The main heading is "Energy Mitigation: Reducing Emissions from Stationary Sources and Purchased Electricity and Steam". Navigation buttons for "Previous Sheet", "Next Sheet", and "Return to Control" are visible.

Action Items
What are some actions your school can take to reduce energy used for cooling? You can write these actions in the cells below.

☀️ Replace inefficient boiler with more energy-efficient model.
☀️

If your school takes these actions, by how much do you estimate your school can reduce energy used for cooling? 15% percent
These actions would prevent the release of 15,986 kg CO₂E
If your school achieves the energy reduction goals established by these actions, your school's cooling-related emissions will be 90,588 kg CO₂E

Lighting Emissions 77,981 kg CO₂E

Ways to Reduce Emissions from Lighting

- Turn off lights when not in use
- Use natural lighting
- Install automatic lighting controls

Action Items
What are some actions your school can take to reduce energy used for lighting? You can write these actions in the cells below.

☀️
☀️

Additional Features

- Guidance and Units Discussion
- National Science Content Standards
- Inventory Snapshot and Data Needs
- Glossary
- Web Links
- Thinking Like a Scientist
- How'd They Do That?
- School District Compiler



How'd they do that?
How'd they do that?

Additional Features

- Guidance and Units Discussion
 - Timeline for using Climate CHECK
 - Global Warming Potentials, Physical Units
- National Science Content Standards
 - Unifying Concepts
 - Science as Inquiry
 - Physical Science
 - Life Science
 - Earth and Space
 - Science and Technology
 - Social Perspectives
 - Nature of Science

Additional Features

- Inventory Snapshot
- Data Needs
 - Printable sheet
- Glossary
 - 50 terms (Aerobic to Weather)
- Web Links
 - Mitigation strategies, educator resources, climate change information

The screenshot shows the EPA's Climate CHECK software interface. The title bar reads "EPA's Climate CHECK" and the menu bar includes "File", "Edit", and "Module Options". The main window title is "Climate CHECK - GHG Emission Inventory Snapshot". A "Getting Started" button is visible in the top right corner. The content area is titled "Stationary Combustion and Purchased Electricity" and contains instructions for estimating emissions. It provides two options for entering school square footage: Option 1 (total square footage) and Option 2 (classroom size and number of classrooms). The form shows input fields with values: 50,000 sq ft for Option 1, 1,000 sq ft for Option 2, and 40 classrooms. A summary line at the bottom states "Your school's total size is 50,000 square feet."

Stationary Combustion and Purchased Electricity

Devices that consume fossil fuels for heating, generating electricity or other non-mobile purposes are considered Stationary Sources. Later in the kit, emissions resulting from Purchased Electricity will be estimated separately from Stationary Source emissions; however, both sources are reported together here to accommodate the methods used to estimate emissions.

To estimate emissions from Stationary Combustion and Purchased Electricity, please follow the steps below.

Step 1 Either enter your school's total square footage in the pale yellow cell below (Option 1) or estimate this amount using the steps in Option 2 below.

Option 1)	Please enter your school's total square footage.	<input type="text" value="50,000"/>	sq ft
Option 2)	Enter the approximate size of your classroom. <i>If your classroom does not represent the size of an average classroom, please enter an average classroom size.</i>	<input type="text" value="1,000"/>	sq ft
	How many classrooms are in your school?	<input type="text" value="40"/>	classrooms
	Please enter any additional non-classroom square footage you would like to include in your estimate.	<input type="text" value="10,000"/>	sq ft

Your school's total size is 50,000 square feet.

Thinking Like a Scientist...

[Return](#)

Carbon (C) vs. Carbon Dioxide (CO₂)

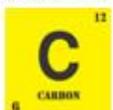
In 2003, U.S. emissions of CO₂ equaled 5,842 million metric tons. These CO₂ emissions occurred when carbon contained in fossil fuels, wood, and other carbon-based materials oxidized (underwent a chemical reaction with oxygen) usually because the fossil fuel, wood, or carbon-based material was combusted. During the oxidation process, each carbon atom picked up two oxygen atoms to become CO₂.

This same process happens at your school when fuels containing carbon such as natural gas, propane, or gasoline are combusted in stationary sources (e.g., boilers, heaters, generators) or mobile sources (e.g., cars, trucks, tractors).

? Carbon dioxide must have more mass than carbon because it contains two additional oxygen atoms, but how much more?

Using a periodic table of the elements in your classroom, on the web, or in this kit, enter the atomic mass of a carbon atom and an oxygen atom in the yellow cells below.

Periodic Table

Atomic mass of a **carbon** atom: (mean relative) Correct!Atomic mass of an **oxygen** atom: (mean relative) Correct!

The mass of a molecule of CO₂ is equal to:

The mass of **one** carbon atom: plus the mass of **two** oxygen atoms: + =

The mass of a molecule of CO₂ is: + =

The percent of carbon in CO₂ is equal to the mass of carbon: mass of a carbon atom Correct!

... divided by the mass of CO₂: mass of a CO₂ molecule Correct!

percent of carbon in carbon dioxide

Carbon has 27.27 percent as much mass as carbon dioxide.

How'd they do that? *Calculation Explanations*

Return

Methane (CH₄) and Nitrous Oxide (N₂O) from Stationary Combustion

Background Information:

Methane and nitrous oxide emissions from stationary combustion are determined by multiplying the amount of fuel combusted by the amount of heat generated through that combustion (heat content). The resulting value reports the heat generated by combusting the fuel in Million British Thermal Units (MMBTU). The heat generated in MMBtu is then converted to Giga Joules (another energy unit) and multiplied by that fuel's CH₄ or N₂O emission factor.

Factors:

Heat Content	
Value	Unit
Coal	23.38 MMBtu/ mt
Natural Gas	0.036 MMBtu/ l
Propane	0.031 MMBtu/ l
Gasoline	0.044 MMBtu/ l
Diesel Fuel	0.049 MMBtu/ l
Fuel Oil	0.053 MMBtu/ l
Kerosene	0.048 MMBtu/ l

CH ₄ and N ₂ O Emissions Factors			
CH ₄	Unit	N ₂ O	Unit
10	g/GJ	1.4	g/GJ
5	g/GJ	0.1	g/GJ
10	g/GJ	0.6	g/GJ
10	g/GJ	0.6	g/GJ
10	g/GJ	0.6	g/GJ
10	g/GJ	0.6	g/GJ
10	g/GJ	0.6	g/GJ

Conversion Factors

Value	Unit
1.055	MMBtu/ GJ ²

Example Equation:

Templeton Heights High School combusts 5,000,000 liters of natural gas in a natural gas boiler each year.

How many **kilograms** of CH₄ does the school produce through this combustion?

How many **kilograms** of N₂O does the school produce through this combustion?

	kg
	kg

round to the nearest whole number

round to the nearest whole number

Hide Answers

Methane from Natural Gas

$$5,000,000 \text{ liters} \times \frac{0.036 \text{ MMBtu}}{1 \text{ liter}} \times \frac{1 \text{ GJ}}{1,055 \text{ MMBtu}} \times \frac{5 \text{ grams CH}_4}{1 \text{ GJ}} \times \frac{1 \text{ kg}}{1,000 \text{ grams}} = 853 \text{ kg CH}_4$$

Nitrous Oxide from Natural Gas

$$5,000,000 \text{ liters} \times \frac{0.036 \text{ MMBtu}}{1 \text{ liter}} \times \frac{1 \text{ GJ}}{1,055 \text{ MMBtu}} \times \frac{0.1 \text{ grams N}_2\text{O}}{1 \text{ GJ}} \times \frac{1 \text{ kg}}{1,000 \text{ grams}} = 17 \text{ kg N}_2\text{O}$$

Sources:

EPA's Climate CHECK: Emissions Factors Tool (EPA.gov)

School District Sheet

[Return](#)

1 Import data from schools

Individual method

Press the button below and follow instructions to load the data from one school

Batch method

Place all data files in a single directory first.

Then press the button below and follow instructions to load data from more than one school

2 Calculate Totals

When you have imported all of the data from the schools, press the button below to calculate total emissions

3 Set up the results viewer

Click the button below to prepare the viewer

4 View the results

Pick different schools or total

School Information

School	0
Year	0



How can I get Climate CHECK?

- EPA's global warming website
 - <http://www.epa.gov/climatechange/wycd/school.html>
- ClimateCHECK@icfi.com
- Special thanks to Karen Scott of EPA

Scott.Karen@epa.gov



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The screenshot shows the EPA website page for "Climate Change - What You Can Do". The page features a navigation menu on the left with options like "Climate Change Home", "What You Can Do", "At Home", "On the Road", "At the Office", "At School", "State and Local Governments", "Businesses", "Waste", and "Agriculture and Forest Land". The main content area is titled "At School" and includes a search bar, a "Students" section with two numbered items, and a "Related Links" section. The "Students" section lists "Bring science to life" and "High school students check your school's climate impact". The "Related Links" section includes "Greenhouse Gas Emissions", "Newsroom", "Climate Change ListServs", and "Related Educators Links". A "Did You Know?" section at the bottom right provides a fact about electricity consumption in homes.

U.S. Environmental Protection Agency
Climate Change - What You Can Do

Contact Us Search: All EPA This Area
You are here: [EPA Home](#) » [Climate Change](#) » [What You Can Do](#) » [At School](#)

At School

Students, educators and school administrators can all play a key role in reducing greenhouse gas emissions. Here is a directory of some education and action planning resources to help you:

Students

1. **Bring science to life**
Explore the [Climate Change Kids Site](#) and watch [Climate Animations](#) that bring to life the science and impacts of climate change. The site also provides games that help students, their parents and their teachers learn about both the science of climate change and what actions they can take to reduce greenhouse gas emissions.
2. **High school students check your school's climate impact**
High school students can investigate the link between everyday actions at their high school, greenhouse gas emissions and climate change. Using EPA's [Climate Change Emission Calculator Kit \(Climate CHECK\)](#) (WinZip of Excel spreadsheet, 3.4 MB) students can learn about climate change, estimate their school's greenhouse gas emissions and conceptualize ways to mitigate their school's climate impact. Students gain detailed understandings of climate-change drivers, impacts, and science; produce an emission inventory and action plan; and can even submit the results of their emission inventory to their school district.

Related Links

- [Greenhouse Gas Emissions](#)
- [Newsroom](#)
- [Climate Change ListServs](#)
- [Related Educators Links](#)

Did You Know?

In the average home, 40% of all electricity used to power home electronics is consumed while the products are turned off. Nationwide, the total electricity consumed by electronics while idle equals the annual output of 12 power plants. Enabling your monitor's ENERGY STAR power management features can save you about \$15 a year on your energy bill. To save even more, replace your old monitor with an LCD display one. The energy consumption of an average LCD display monitor (flat-panel) is at least half of that for an average

