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?

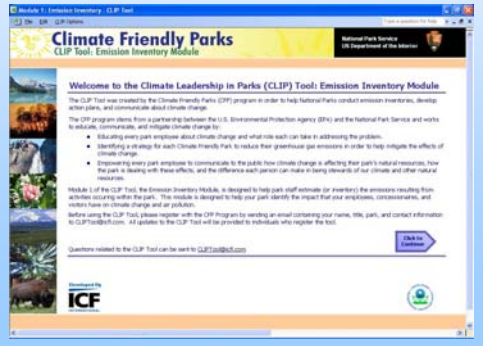
- Climate CHECK is an Excel-based kit designed to educate high school students about climate change.

- 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



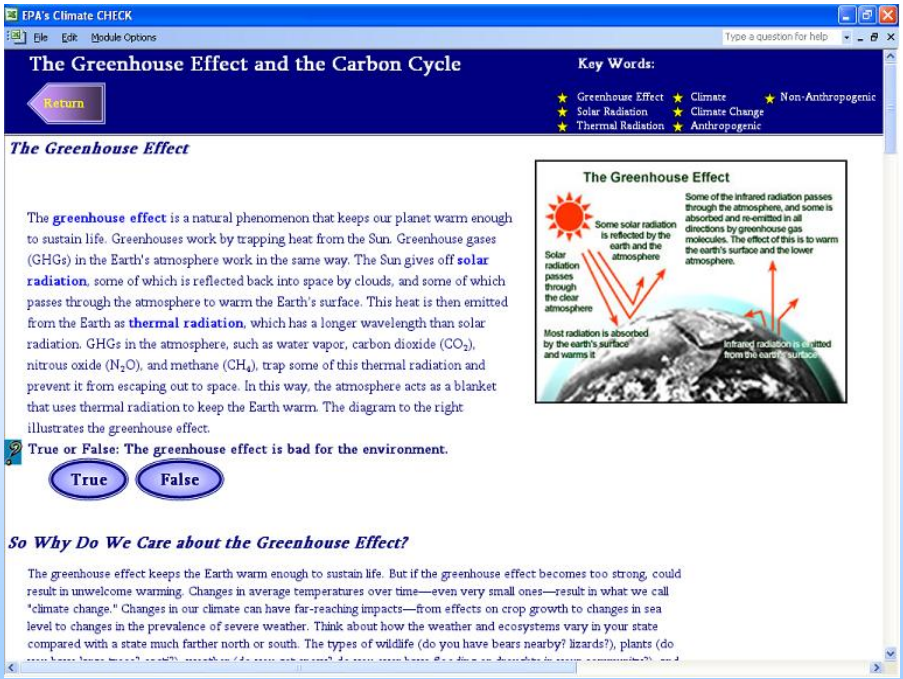
Climate CHECK Structure

- 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

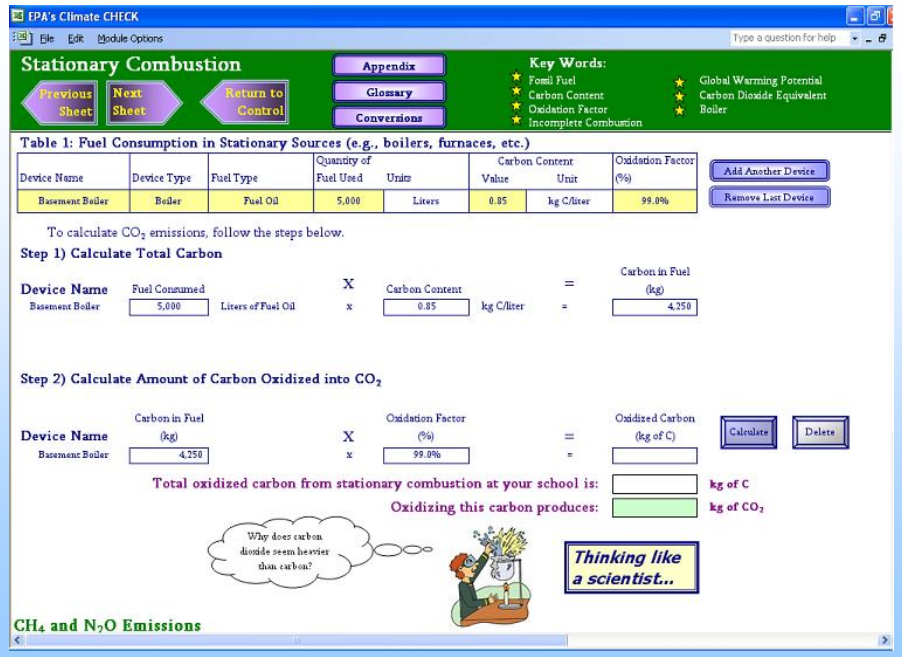
- Section 1 provides background sheets that contain information on the greenhouse effect, the carbon cycle, and climate-change drivers, science, and impacts.

- The background information is provided as text followed by true or false and multiple-choice questions to help students gauge their understandings.



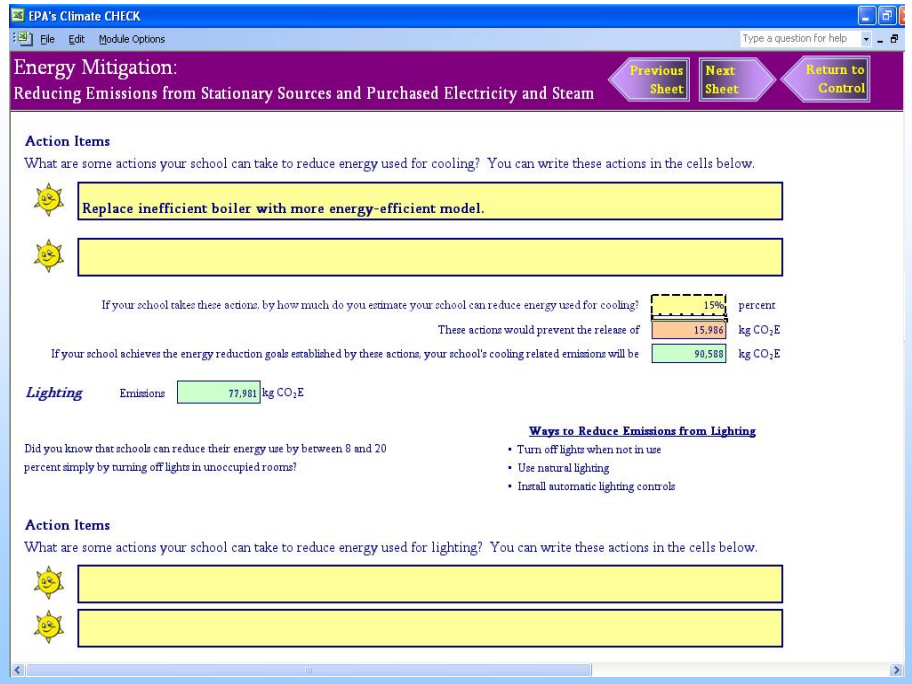
Estimate

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



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.



Additional Features

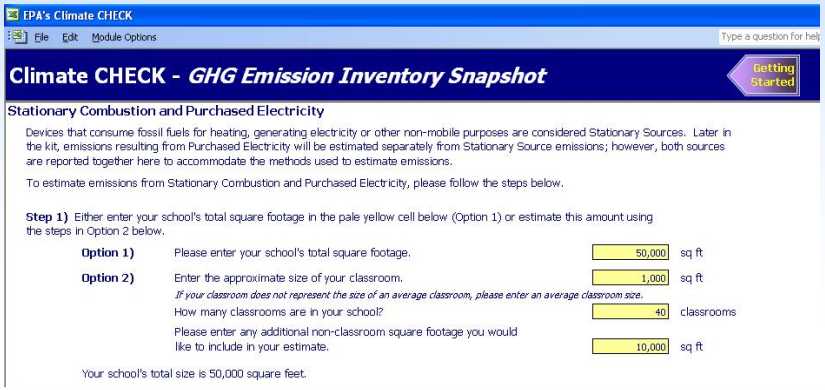
- Guidance and Units Discussion
- National Science Content Standards
- Inventory Snapshot and Data Needs
- Glossary
- Web Links
- Thinking Like a Scientist
- How’d They Do That?
- School District Compiler

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



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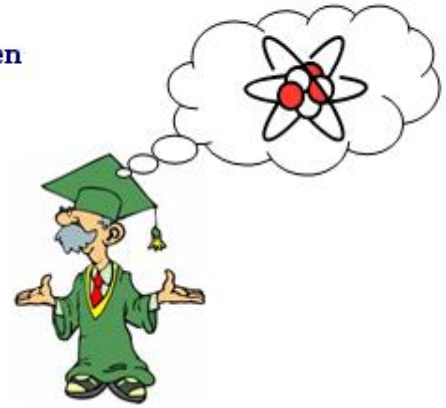
Thinking Like a Scientist…

Return

Carbon (C) vs. Carbon Dioxide (CO_2)

In 2003, U.S. emissions of CO_2 equaled 5,842 million metric tons. These CO_2 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 CO_2.
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:	12	(mean relative)	Correct!
Atomic mass of an **oxygen** atom:	16	(mean relative)	Correct!

The mass of a molecule of CO_2 is equal to:

The mass of **one** carbon atom: 12 plus the mass of **two** oxygen atoms: 16 + 16 = 32

The mass of a molecule of CO_2 is: 12 + 32 = 44

The percent of carbon in CO_2 is equal to the mass of carbon: 12 mass of a carbon atom Correct!

…divided by the mass of CO_2: 44 mass of a CO_2 molecule Correct!

27.27% percent of carbon in carbon dioxide

Carbon has 27.27 percent as much mass as carbon dioxide.

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File Edit Module Options

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How'd they do that? *Calculation Explanations*

Return

Methane (CH_4) and Nitrous Oxide (N_2O) 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 CH_4 or N_2O emission factor.

Factors:

	Heat Content		CH_4 and N_2O Emissions Factors			
	Value	Unit	CH_4	Unit	N_2O	Unit
Coal	23.38	MMBtu/ mt	10	g/GJ	1.4	g/GJ
Natural Gas	0.036	MMBtu/ l	5	g/GJ	0.1	g/GJ
Propane	0.031	MMBtu/ l	10	g/GJ	0.6	g/GJ
Gasoline	0.044	MMBtu/ l	10	g/GJ	0.6	g/GJ
Diesel Fuel	0.049	MMBtu/ l	10	g/GJ	0.6	g/GJ
Fuel Oil	0.053	MMBtu/ l	10	g/GJ	0.6	g/GJ
Kerosene	0.048	MMBtu/ l	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 CH_4 does the school produce through this combustion? _____ kg round to the nearest whole number

How many **kilograms** of N_2O does the school produce through this combustion? _____ kg round to the nearest whole number

Hide Answers

Methane from Natural Gas

$$5{,}000{,}000\ \text{liters} \times \frac{0.036\ \text{MMBtu}}{1\ \text{liter}} \times \frac{1\ \text{GJ}}{1{,}055\ \text{MMBtu}} \times \frac{5\ \text{grams}\ CH_4}{\text{GJ}} \times \frac{1\ \text{kg}}{1000\ \text{grams}} = \mathbf{853\ kg\ CH_4}$$

Nitrous Oxide from Natural Gas

$$5{,}000{,}000\ \text{liters} \times \frac{0.036\ \text{MMBtu}}{1\ \text{liter}} \times \frac{1\ \text{GJ}}{1{,}055\ \text{MMBtu}} \times \frac{0.1\ \text{grams}\ N_2O}{\text{GJ}} \times \frac{1\ \text{kg}}{1000\ \text{grams}} = \mathbf{17\ kg\ N_2O}$$

Sources:

[1] IPCC Stationary Emissions Factors Tier 1 (Residential)

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File Edit Module Options

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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

Import single 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

Import multiple schools

2 ***Calculate Totals***

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

Calculate Totals

3 ***Set up the results viewer***

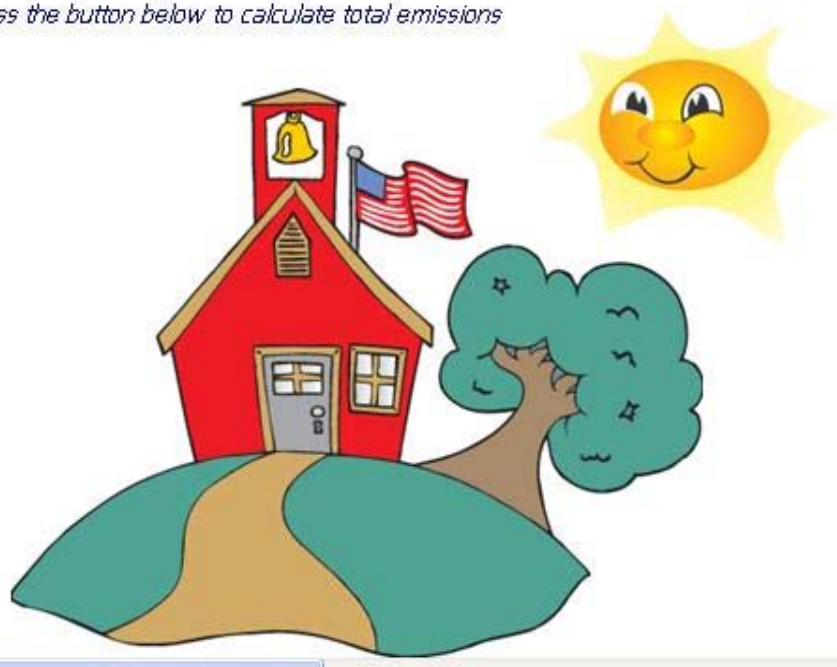
Click the button below to prepare the viewer

Prepare Results

4 ***View the results***

Pick different schools or total

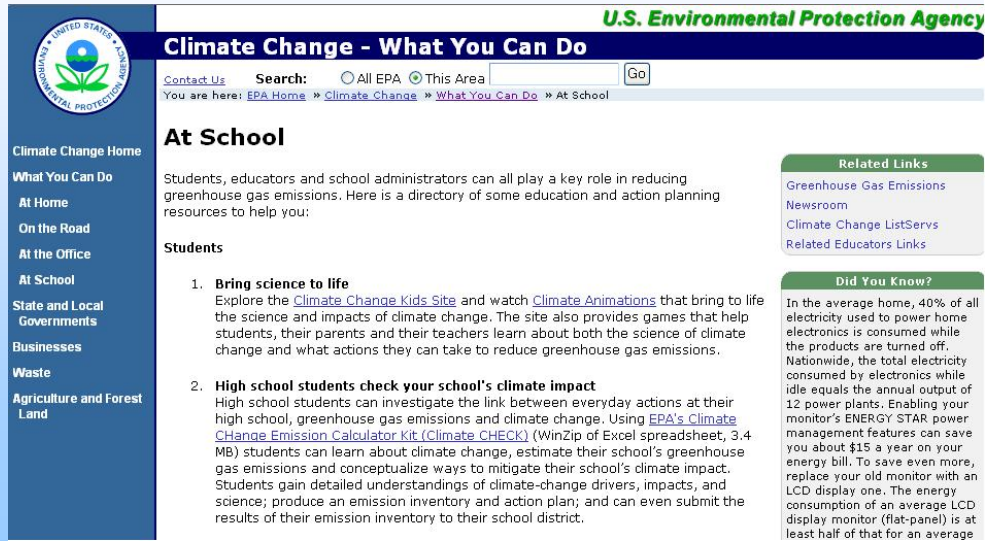
School Information	
School	0
Year	0



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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