

Cool It! Greenhouse Gas Emissions Calculator (version 1.3 12/08/06)

Instructions for Completing a Cool It! Greenhouse Gas Inventory

A. Introduction:

Greenhouse gas emissions, especially carbon dioxide (CO₂) from the burning of fossil fuels, are the major cause of global warming. Scientists have calculated that humans around the globe emit over 7 billion tons of CO₂ into the atmosphere every year. About 25% of those emissions come from the United States. While global and national measurements are important for scientists and government leaders, they are too big and abstract for us to use. To better understand how our own local activities contribute to climate change and therefore how we can help solve the problem, we need to understand our local greenhouse gas emissions.

The **Cool It! Greenhouse Gas Emissions Calculator** is a tool to help you measure local sources of greenhouse gases. The process is simple. But, getting the information you need for the inventory may not be simple. You may not be able to get all the information you want. Try to get the best information you can. The first inventory will provide a starting point or baseline, from which improvements can be measured when the next inventory is done.

Note: The information and emissions factors used in this calculator are based on the most recent reliable sources we could find, including the US Environmental Protection Agency, ISO New England, and The Connecticut Department of Environmental Protection.

B. Guidelines for completing the Cool It! Greenhouse Gas emissions inventory

- The Calculator is flexible. It can be used to do an inventory of your school, community center, church, home(s), etc.. It may be best to start simple. Be sure to check your math.
- The calculator is divided into four sections: Electricity, Heating, Transportation, and Emissions Reductions. Each section deals with an important source of energy use and greenhouse gas emissions (or emission reductions). For each section you should end up with the number of pounds of CO₂ emitted (or saved) during the 12-month period your inventory covers. When you add these four sections together you determine your annual greenhouse gas emissions.
- Each section has instructions for a basic inventory and additional instructions for a more advanced inventory. All teams should complete all the Basic Inventory Items that they can. Teams wishing to do a more detailed inventory can complete any of the advanced items that are relevant to their Inventory site. Not all items will be appropriate to any inventory site.
- The calculator is in MS Word format. Teams should enter information right into the document.
- Before you begin gathering information you should review each section of the calculator and determine what information is appropriate for your inventory and how you will get it.

C. Step by Step Instructions-

a. Electricity:

Electricity generation is the largest single source of CO₂ emissions in the US, producing about 39% of all emissions. Electricity in Connecticut comes from many power plants that supply power to the New England electric grid. The US Environmental Protection Agency estimates that about 30% of our electricity came from Nuclear power, 17% from coal, 16% from oil, 21% from natural gas, 8% from hydro-electric, 7% from biomass, and about 1/10th of 1% from wind.

Basic Inventory Instructions

Electricity is measured in kilowatt-hours (kwh). You can find the monthly usage on monthly electric bills (use 12 consecutive months). It can also be obtained from your electric utility by phone or on their web site.

In Connecticut about 1.050 pounds of CO₂ are emitted for each kilowatt-hour of electricity used (2004).

- a. To calculate your CO₂ emissions from electricity multiply the number of kilowatt-hours used by 1.050.

Advanced Inventory Instructions:

Most Connecticut electric customers can buy electricity generated from sources that do not create CO₂ emissions (wind, landfill gas, and small hydro) from their electric utility through the “clean energy option” program. There is a small additional charge of about 1 cent per kwh. Electric customers can sign up to buy either 50% or 100% clean energy. If your inventory site purchases 50% clean energy multiply your total kilowatt-hours used by 0.5 and enter that number in 1-a. If the site purchases 100% clean energy the CO₂ emissions from electricity will be 0.

- b. Multiply the number of kilowatt-hours of “clean energy” used by 1.050.

Total Electricity emissions: subtract the results of line b from the results of line a to get total CO₂ emissions from electricity.

Heating:

Basic Inventory Instructions:

Most buildings are heated by natural gas or oil. Some use both. A few use electricity, coal, wood or solar. If the inventory site uses electric heat, include that in section 1-Electricity. If both oil and natural gas are used, complete lines c and a or b. Heating of domestic hot water should also be included in this section unless it is heated by electricity.

- a. If natural gas is used for heating, complete either the Therms or ccf portion of line a. based on which of these two units your natural gas supplier uses. (1 ccf = 100 cubic feet) (1 Therm = 100 000 Btus or 96.7 cubic feet).
- b. If # 2 heating oil is used for heat multiply the total gallons used by 22.38.

Advanced Inventory Instructions:

- Heating oil is sometimes blended with biodiesel fuel made from vegetable oil, usually in a blend of 5% (b5) or 20% (b20) biodiesel. Biodiesel is a “biogenic” fuel in which the CO₂ emitted when it is burned is taken up by the next year’s crop so it does not add to CO₂ in the atmosphere. If a biodiesel blend is used for oil heat subtract the percentage of biodiesel in the blend (as a decimal) from 1 and multiply the total amount of fuel used by the result to get “net” gallons used. [Example for 1000 gallons of b20: 20% =0.2; 1-0.2=0.8; 1000 x 0.8=800; 800 (net gallons) x 22.38 lbs. CO₂/gal. = 17,904 lbs CO₂.]

c. Other Heating Sources:

- Lower grade Residual Fuel (No. 5 and No. 6) is sometimes used for heating instead of #2 fuel oil. If No. 5 and No. 6 Fuel Oil is used for heating use 26.033 lbs. CO₂/gal. To calculate CO₂ emission instead of 22.38 lbs. CO₂/gal.
- If Propane is used for heat or hot water multiply the gallons used by 12.67.
- If coal is used in a coal stove or furnace multiply the tons burned by 3852.16.
- Wood: Burning wood in fireplaces or wood stoves creates 3400 pounds of CO₂ emissions per ton. (One cord of wood, 8 feet x 4 feet x 4 feet, weighs 2 tons). But, the carbon in wood is part of the natural carbon balance (like biodiesel) and will not add to atmospheric concentrations of CO₂ **IF** new trees are grown to replace the trees from which the wood is taken. You may use an emission factor of zero for wood that will be replaced by new tree growth. You can calculate CO₂ emissions for all, none, or a percentage of the wood burned, based on your local situation. For example, if it is determined that half of the trees cut down for firewood are replaced by new trees, multiply your total tons of wood burned by 0.5 and then multiply the result by 3400.
- Other heating related emissions: if other fuels are used for heating determine the CO₂ emissions and list them here. Emission factors for a number of fuel sources are listed at <http://www.eia.doe.gov/oiaf/1605/coefficients.html>.

Total Heating Emissions: Add the results from lines 2a, b and c (optional) for total Heating CO₂ emissions.

b. Transportation:

The United States has the largest transportation system in the world. About one third of all greenhouse gas emissions in the US come from transportation, which includes trucks, planes, ships, trains, buses and cars. 97% of the energy that powers transportation in the United States comes from petroleum.

Basic Inventory Instructions:

- a. Gasoline: Annual fuel use can be obtained either directly if actual fuel purchase information is available, or by dividing annual miles driven by average combined city/highway miles per gallon for each vehicle. (see www.fueleconomy.gov for vehicle mileage statistics).
- b. Diesel fuel: Same as for a. above
- c. Airline miles flown: Multiply the total airline miles flown during the year by 0.9 to get the lbs of CO₂ emitted. Frequent flyer programs usually provide detailed information on miles flown by their members.
 - For a household/family inventory, add miles flown by all household members (if a household inventory)
 - For school or organization inventory include all miles flown for official school or organization business, including miles flown by students for sports or other activities.

Advanced Inventory Instructions:

- d. Other transportation related emissions:
 - Intercity rail or bus: Add all intercity bus and train (Amtrak) travel during the year and multiply by 0.18 to get pounds of CO₂ emitted.
 - Local and Commuter rail or bus: For regular commuting, calculate the miles traveled daily by bus or train and multiply that by the number of days commuted to work or school. Add all local and commuter bus and train travel during the year and multiply by 0.76 to get pounds of CO₂ emitted.
 - Other transportation related emissions. Include any transportation related emissions not covered above here and describe in Sources and notes.

Total transportation emissions: Add 3-a,b,c and d (optional) to get your total transportation related CO₂ emissions.

c. **Emission Reductions:**

Each Connecticut resident creates an average of 4.2 pounds of trash (Municipal Solid Waste or MSW) every day. This waste is disposed of by being burned in waste to energy plants (60.9%) buried in Connecticut landfills (3.5%), sent out of state (10.6%) or recycled (25%).

Non-recycled waste in Connecticut is, on balance, carbon neutral. Although waste to energy plants do emit CO₂ the biomass-derived portion, plants and trees that make up the paper, food, and other biogenic waste, is considered to be part of the Earth's natural carbon cycle. The electricity produced by these plants also reduces the demand for electricity produced by burning fossil fuels like coal, oil or natural gas. Other waste does create greenhouse gas emissions, which offset the savings of the waste to energy plants. Therefore non-recycled Connecticut MSW will not be calculated in this inventory.

Recycled waste has a positive impact on the environment and climate. When paper, bottles and cans are recycled, new trees don't have to be cut down; oil or natural gas is not used to make new plastic; or aluminum mined to make soda cans. This saves trees, petroleum and other raw materials and a lot of energy. For every pound of material that is recycled instead of being thrown in the trash 2.61 pounds of CO₂ are NOT emitted into the atmosphere.

Other emission reduction activities include buying Renewable Energy Certificates, known as RECs or Green Tags. When you buy a REC you are buying the environmental benefit of electricity that has been generated using renewable energy sources like wind farms. This renewable electricity displaces electricity from burning fossil fuels and reduces the greenhouse gasses that would have been emitted. You can subtract the CO₂ that was saved from your other emissions. You can buy Green Tags to offset greenhouse gas emissions from electricity, heating, driving and air travel. For more information visit: www.nativeenergy.com/services.html.

Advanced Inventory Instructions:

- a. For every pound of waste that is recycled 2.6 pounds of CO₂ are NOT emitted into the atmosphere. Calculate the total amount of newspapers, cardboard, glass and plastic bottles, and aluminum cans that are recycled over the 12 month period and enter it in line 4a and multiply by 2.6 to get emissions savings.
 - One way to estimate average annual recycling is to calculate the weight of recycled materials during a one or two week period and multiply that by the number of weeks recycling is done. (The regular school year is usually 36 weeks, some schools also operate in the summer, for homes you might start with 52 weeks and subtract those weeks when your family is away on vacation, etc.)
- b. Calculate the pounds of CO₂ offset by any RECs (Green Tags) purchased and enter that in line 4b.
- c. Calculate any other ghg emissions reductions and enter that in line 4c.

Add the amounts in lines 4a, b and c and enter that total in line 4d. This will be subtracted from the results of sections 1, 2 and 3 when you calculate total emissions.

d. Total:

- a. Add up the total ghg emissions from lines 1s, 2g and 3f and then subtract the total emission reductions from line 4d. This is your total annual greenhouse gas emissions for the period of this inventory.

- e. **Sources and Notes:** This section of the calculator is critical for making your inventory a valuable record and tool. Your team has gone through a lot of work to collect and analyze the information in your inventory. In this section you will describe where the information in each section came from and how you calculated it.

For instance in Section 3-Transportation, line a. is for gasoline used. In Sources and Notes you should describe (as briefly and clearly as possible) how you determined the number of gallons of gasoline used. If your family has a two and a half year old 6-cylinder Dodge Caravan with 36,000 miles on it and you don't know how much gas was purchased or exactly how many miles were driven in the last year you might enter the following:

Dodge Caravan: 36,000 miles driven in 30 months at 21 miles/gal average city/highway
mpg = 1200 miles/month x 12 months = 14,400 / 21 mpg = 686 gallons of gas.

This information will make it much easier for you or others to do future inventories and compare them with this one. It will also help you know what information you should be keeping track of for future inventories. For instance, you may want to record the actual mileage on a vehicle every month or every six months, or even record all gasoline purchases, so your inventories become more accurate over time.

Congratulations! You've completed your Cool It! Greenhouse Gas Inventory.

Give yourselves a pat on the back. You deserve it.

Of course, what you learn is only as valuable as what you do with it. What are you going to do with your new knowledge? Here are a few ideas:

(These are suggested activities; they are not part of the official inventory.)

- Determine per student/per family member or other per person emissions.
- Determine the percentage of emissions from electricity, heating and transportation, and from the different activities in each section.
- Find global, national or state averages to compare your emissions with.
- Work with your school, organization, or family to find the best, lowest cost ways to reduce your emissions. You can set goals, make a plan and schedule a second inventory to measure your progress.
- Offer to help another local school, organization or family to conduct an inventory. Your experience and knowledge should make their process much easier.