

An Introduction to the Waste Reduction Model (WARM)

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U.S. EPA

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Where do I find WARM?

The Waste Reduction Model (WARM)

http://epa.gov/climatechange/wycd/waste/calculators/Warm_home.html

- WARM is available in two versions
 - ① Excel spreadsheet
 - ② Web-based calculator



The first screen is the input screen.

- ① Enter total **Tons Generated** for each material type.
- ② Enter current disposal method (**Recycled, Landfilled, Combusted, or Composted**). You use as many waste management scenarios as you like, but it must equal the total **Tons Generated**.

The screenshot shows the EPA Waste Reduction Model (WARM) input screen. The browser window title is "Waste Home - Waste Reduction Model (WARM) | Climate Change - What You Can Do | U.S. EPA - Microsoft Internet Explorer". The address bar shows the URL: "http://epa.gov/climatechange/wywd/waste/calculators/Warm_Form.html". The page header includes the EPA logo and the text "U.S. Environmental Protection Agency". The main heading is "Climate Change - Waste" and "Waste Reduction Model (WARM)". Below the heading, there is a search bar and a breadcrumb trail: "You are here: EPA Home » Climate Change » What You Can Do » Waste » Tools » WARM » WARM Online". The page content includes a version number (Version 8, 8/06), a description of the WARM tool, and instructions for using the worksheet. A "Tips" section provides guidance on data entry. The "Step 1. Baseline Scenario" section instructs users to enter the tons of each material type that is generated and disposed. A table is provided for data entry, with columns for Material, Tons Generated, Tons Recycled, Tons Landfilled, Tons Combusted, and Tons Composted. The table lists various materials such as Aluminum Cans, Steel Cans, Copper Wire, Glass, HDPE, LDPE, PET, Corrugated Cardboard, Magazines/third-class mail, and Newspaper. The "Tons Composted" column for all materials is marked as "N/A".

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Climate Change - Waste

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Waste Reduction Model (WARM)

(Version 8, 8/06)

EPA created WARM to help solid waste planners and organizations track and voluntarily report greenhouse gas emissions reductions and energy savings from several different waste management practices. WARM Online was last updated August 2006.

Use this worksheet to describe the baseline and alternative MSW management scenarios that you want to compare. Please follow the steps below to enter your material tonnage information in the input boxes in the tables, and select appropriate landfill and waste transport characteristics.

Tips:

- If the listed material is not generated in your community/organization or you do not want to analyze it, leave it blank or enter 0.
- Make sure that the total quantity generated equals the total quantity managed.
- If you have any questions, consult the [WARM User's Guide](#).

Step 1. Baseline Scenario

Please describe your current (or baseline) waste management scenario by entering the tons of each material type that is generated and disposed.

Material	Tons Generated	Tons Recycled	Tons Landfilled	Tons Combusted	Tons Composted
Aluminum Cans	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A
Steel Cans	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A
Copper Wire	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A
Glass	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A
HDPE	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A
LDPE	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A
PET	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A
Corrugated Cardboard	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A
Magazines/third-class mail	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A
Newspaper	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A

① Next, enter tonnage directed to each alternate waste disposal scenario. For example, in the previous step you may have landfilled the total tonnage and in this scenario you decide to recycle half of the total and landfill the remaining half.

② Verify the totals are equal to what you entered in the previous step. You do not enter a generation amount in this step.

Waste Home - Waste Reduction Model (WARM) | Climate Change - What You Can Do | U.S. EPA - Microsoft Internet Explorer

Please enter data in short tons (1 short ton = 2,000 lbs.)
 Please refer to the User's Guide if you need assistance completing this table.
 1 Recycled concrete used as aggregate in the production of new concrete
 2 Recycled fly ash is utilized to displace Portland cement in concrete production.
 3 Recycling tires is defined in this analysis as retreading and does not include other recycling activities (i.e. crumb rubber applications).

Step 2. Alternative Management Scenario

Please describe your alternate waste management scenario by entering the tons of each material type that is source reduced or disposed. Please note that the baseline generation tonnages will stay the same as those entered in Step 1.

Material	Tons Source Reduced	Tons Recycled	Tons Landfilled	Tons Combusted	Tons Composted
Aluminum Cans					N/A
Steel Cans					N/A
Copper Wire					N/A
Glass					N/A
HDPE					N/A
LDPE					N/A
PET					N/A
Corrugated Cardboard					N/A
Magazines/third-class mail					N/A
Newspaper					N/A
Office Paper					N/A
Phonebooks					N/A
Textbooks					N/A
Dimensional Lumber					N/A
Medium Density Fiberboard					N/A
Food Scraps	N/A	N/A			
Yard Trimmings	N/A	N/A			
Grass	N/A	N/A			

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As you scroll down the page there are options to change if you know about how far your waste travels and the landfills you use.

EPA Headquarters primarily uses the default options for Step 3 and Step 4. Unless you have good specific information about your landfill's management and the distance waste travels to reach a facility, it is recommend that you do not change these options. If you do change either of these options, it is important to note those changes when you report the results.

Please enter data in short tons (1 short ton = 2,000 lbs.)
Please refer to the User's Guide if you need assistance completing this table.
1 Recycled concrete used as aggregate in the production of new concrete
2 Recycled fly ash is utilized to displace Portland cement in concrete production.
3 Recycling tires is defined in this analysis as retreading and does not include other recycling activities (i.e. crumb rubber applications).

Step 3. Landfill Characteristics

The emissions from landfilling depend on whether the landfill where your waste is disposed has a landfill gas (LFG) control system. If you do not know whether your landfill has LFG control, select "National Average," which calculates emissions based on the proportions of landfills with LFG control in 2004. If your landfill does not have a LFG system, select "No LFG Recovery." If a LFG system is in place at your landfill, select "LFG Recovery" and click one of the indented buttons to indicate whether LFG is recovered for energy or flared.

- National Average
- No LFG Recovery
- LFG Recovery
- Recover for energy
- Flare

Step 4. Waste Transport Characteristics

Emissions that occur during transport of materials to the management facility are included in this model. You may use default transport distances, 20 miles, or provide information on the transport distances for the various MSW management options.

- Use default distance
- Define distance

Management Option	Distance (miles)
Landfill	20
Combustion	20
Recycling	20
Composting	20

Step 5. Results Output

- Metric Tons of Carbon Equivalent (MTCE)
- Metric Tons of Carbon Dioxide Equivalent (MTCO2E)
- Units of Energy (million BTU)

The following inputs are optional and may be used to customize your summary report.

Organization:

Name:

① To generate your results, select the preferred output units in Step 5.
WARM can generate results in three different units:
MTCE — Metric tons of Carbon Equivalent;
MTCO2E — Metric tons of Carbon Dioxide Equivalent;
BTU — Energy, British Thermal Units.

② Click on the **Create Summary** button

on the transport distances for the various MSW management options.

Use default distance
 Define distance

Management Option	Distance (miles)
Landfill	20
Combustion	20
Recycling	20
Composting	20

Step 5. Results Output

Metric Tons of Carbon Equivalent (MTCE)
 Metric Tons of Carbon Dioxide Equivalent (MTCO2E)
 Units of Energy (million BTU)

The following inputs are optional and may be used to customize your summary report.

Organization:

Name:

Reporting Period: / / To / /

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Results

WARM Summary - Microsoft Internet Explorer

File Edit View Favorites Tools Help

GHG Emissions Analysis -- Summary Report

(Version 8, 8/06)

Analysis of GHG Emissions from Waste Management

GHG Emissions from Baseline Waste Management (MTCE): 1,083

Material	Tons Recycled	Tons Landfilled	Tons Combusted	Tons Composted	Total MTCE
Aluminum Cans	0	103,890	0	N/A	1,077
Glass	10	7	0	N/A	-1
PET	0	671	0	N/A	7

GHG Emissions from Alternative Waste Management Scenario (MTCE): -384,762

Material	Tons Reduced	Tons Recycled	Tons Landfilled	Tons Combusted	Tons Composted	Total MTCE
Aluminum Cans	0	103,890	0	0	N/A	-384,479
Glass	0	17	0	0	N/A	-1
PET	0	671	0	0	N/A	-281

Total Change in GHG Emissions: -385,845 MTCE

Note: A negative value indicates an emission reduction; a positive value indicates an emission increase.

- For an explanation of the methodology used to develop emission factors, see EPA report: Greenhouse Gas Emissions from Management of Selected Materials in Municipal Solid Waste (EPA530-R-98-013) -- available on the Internet at <http://www.epa.gov/epaoswer/non-hw/muncpl/ghg/greengas.pdf> (1.1 Mb PDF file). Please note that some of the emission factors used to generate these results do not match those presented in the report due to recent additions and/or revisions. A 3rd edition of the report will be available in early Fall of 2006, which will include the latest emission factors.
- Emissions estimates provided by this model are intended to support voluntary GHG measurement and reporting initiatives.
- Total emissions estimates provided by this model may not sum due to independent rounding.

Back to WARM View Emission Factors



Interpreting Results

- ① The first set of boxes indicates the emissions from your baseline scenario in Step 1.
- ② The second set of boxes indicates the emissions from your alternate management scenario in Step 2.
- ③ The Total Change in GHG Emissions is the difference between the Total MTCE in the first set of boxes and the Total MTCE in the second set of boxes.
- A negative (-) number in the total change represents a reduction in GHG Emissions
- For example, in the summary report shown in the previous slide, GHG emissions are reduced by 384,479 MTCE when 103,890 tons of aluminum cans are recycled instead of landfilled



Other Tools

Waste Home - Tools | Climate Change - What You Can Do | U.S. EPA - Microsoft Internet Explorer

Address: <http://epa.gov/climatechange/wycd/waste/tools.html>

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Climate Change - Waste

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Tools ReCon WARM DGC

Tools

EPA and its partners have developed several tools to help individuals and organizations determine the greenhouse (GHG) impact of their purchasing, manufacturing, and waste management actions. Several of these tools are based on EPA research on emission factors, as reported in [Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks](#) and associated reports.

Recycled Content (ReCon) Tool. The ReCon Tool was developed to assist companies and individuals in estimating the life-cycle GHG and energy impacts of purchasing or manufacturing certain materials; it also calculates the GHG and energy benefits of increasing the recycled content of specific materials. The ReCon Tool was last updated August, 2006.

Waste Reduction Model (WARM). WARM was developed to assist solid waste managers in determining the GHG impacts of their waste management practices. WARM compares GHG and energy impacts of landfilling, recycling, incineration, composting, and source reduction. WARM was last updated August, 2006.

Durable Goods Calculator (DGC). The DGC was developed for individuals and companies who want to make informed decisions regarding the GHG and energy impact they will have by disposing of durable household goods; it also calculates the GHG and energy benefits of increasing the recycling rates of goods that are disposed. The Durable Goods Calculator was last updated August, 2006.

Greenhouse Gas Equivalencies Calculator. This calculator, developed by the U.S. Climate Technology Cooperation, expresses quantities of GHGs in terms of metrics such as number of cars, gallons of gasoline, acres of forest, etc. This calculator is useful for expressing GHG reductions or emissions in a way that is easier to comprehend.

NRC Environmental Benefits Calculator. [EXIT Disclaimer] (Note: NRC Members Only) The [National Recycling Coalition's](#) Environmental Benefits Calculator helps determine the GHG and energy benefits of current waste disposal practices. Users enter data on the amount of various waste materials they landfill, recycle, and incinerate, and the tool calculates how that waste disposal scenario compares with one in which all waste is landfilled. The tool reports the benefits in terms of GHGs and other air emissions, energy use, quantity of oil and gas consumed, waterborne wastes, and other metrics. Results are also displayed according to economic sector and life-cycle stage, and automatically-generated charts and graphs provide an illustrated view of the results. This versatile tool can be used by businesses, universities, and government agencies, and may be useful in demonstrating the benefits of recycling programs.

NERC Environmental Benefits Calculator. [EXIT Disclaimer] The Northeast Recycling Council's (NERC) Environmental Benefits Calculator is a free tool for states, counties, municipalities, schools, businesses, and institutions to measure the environmental benefits from their recycling efforts. NERC's Calculator measures these benefits in terms of savings in air emissions, energy use, quantity of oil and gas consumed, cars off the road, household energy use, waterborne pollutants and other metrics. In addition, NERC's Calculator measures the energy savings from reusing or recycling computers. NERC also provides Fact Sheets to use with the calculator results for marketing and outreach purposes.

Returning User?

If you're already familiar with the ReCon tool and WARM, you can skip the tool information pages and proceed directly to the tools by following the links below:

- [ReCon web-based calculator](#)
- [ReCon Microsoft Excel spreadsheet](#) (88 kb WinZip archive)
- [WARM Web-based calculator](#)
- [WARM Microsoft Excel spreadsheet](#) (502 kb WinZip archive)

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Trusted sites



Recycled Content Tool (ReCon)

- Estimates GHG and energy benefits of increasing recycled content

Durable Goods Calculator

- Assess GHG emissions benefits of different disposal methods for 14 durable goods (i.e., refrigerators, washers, dryers, PCs, autos, TVs, etc.)

