An Introduction to the Waste Reduction Model (WARM)

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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**.

<table>
<thead>
<tr>
<th>Material</th>
<th>Tons Generated</th>
<th>Tons Recycled</th>
<th>Tons Landfilled</th>
<th>Tons Combusted</th>
<th>Tons Composted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum Cans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>Steel Cans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>Copper Wire</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>Glass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>HDPE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>LDPE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>PET</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>Corrugated Cardboard</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>Magazines/Third-class mail</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>Newspaper</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
</tbody>
</table>
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.
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.
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
Results

GHG Emissions Analysis -- Summary Report

(Version 9,005)

Analysis of GHG Emissions from Waste Management

<table>
<thead>
<tr>
<th>Material</th>
<th>Tons Recycled</th>
<th>Tons Landfilled</th>
<th>Tons Composted</th>
<th>Tons Composted</th>
<th>Total MTCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum Cans</td>
<td>0</td>
<td>103,890</td>
<td>0</td>
<td>N/A</td>
<td>1,077</td>
</tr>
<tr>
<td>Glass</td>
<td>10</td>
<td>7</td>
<td>0</td>
<td>N/A</td>
<td>-1</td>
</tr>
<tr>
<td>PET</td>
<td>0</td>
<td>871</td>
<td>0</td>
<td>N/A</td>
<td>7</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Material</th>
<th>Tons Reduced</th>
<th>Tons Recycled</th>
<th>Tons Landfilled</th>
<th>Tons Composted</th>
<th>Tons Composted</th>
<th>Total MTCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum Cans</td>
<td>0</td>
<td>103,890</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>384,479</td>
</tr>
<tr>
<td>Glass</td>
<td>0</td>
<td>17</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>-1</td>
</tr>
<tr>
<td>PET</td>
<td>0</td>
<td>671</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>-281</td>
</tr>
</tbody>
</table>

Total Change in GHG Emissions: 385,845 MTCE

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

a) 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 (EPA-430-R-06-013) – available on the Internet at http://www.epa.gov/epawaste/hw/mwqa/ghg/people/co2.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.

b) Emissions estimates provided by this model are intended to support voluntary GHG measurement and reporting initiatives.

c) Total emissions estimates provided by this model may not sum 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

EPA and its partners have developed several tools to help individuals and organizations determine the greenhouse gas (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 related reports.

**Recycled Content (RecCon) Tool**
The RecCon 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 RecCon 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 handling, recycling, 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 Corporation, 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**
(Note: NRC Members Only) The National Recycling Coalition (NRC) 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.

**NRC Environmental Benefits Calculator**
The Northeast Recycling Council's (NRC) Environmental Benefits Calculator is a free tool for states, counties, municipalities, schools, businesses, and industries to measure the environmental benefits from their recycling efforts. NRC'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, NRC's Calculator measures the energy savings from reusing or recycling computers. NRC also provides Fact Sheets to use with the calculator results for marketing and outreach purposes.
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.)