

# WARM Excel User's Guide – Version 16

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## *Calculating Greenhouse Gas Emissions, Energy Impacts, and Economic Impacts with the Excel Version of the Waste Reduction Model*

### **What is the Waste Reduction Model?**

EPA created the Waste Reduction Model (WARM) to provide high-level comparisons of potential greenhouse gas (GHG) emissions reductions, energy savings, and economic impacts when considering different materials management practices. Materials management practices include - source reduction, recycling, anaerobic digestion, combustion, composting and landfilling.

WARM is a comparative tool rather than a comprehensive measurement tool. WARM was not developed for and, as such, should not be used for final site-specific materials management decisions, when other human health and environmental impacts of the different management methods may need to be considered (such as air pollution, water pollution, noise, etc.). It also should not be used for developing GHG inventories, which need to establish a baseline and measure reductions over time on an annual basis for an entity.

WARM calculates GHG emissions, energy, and economic impacts for baseline and alternative waste management practices, including source reduction, recycling, combustion, composting, and landfilling. The model calculates emissions in metric tons of carbon dioxide equivalent (MTCO<sub>2</sub>E), energy in millions of BTUs (MMBTU), wage impacts, tax impacts, and labor hours supported across a wide range of material types commonly found in municipal solid waste (MSW).

The user can construct various scenarios by simply entering data on the amount of waste handled by material type and by management practice. WARM then automatically applies material-specific emission and economic factors for each management practice to calculate the GHG emissions, energy savings, and economic impacts of each scenario. Several key inputs, such as landfill gas recovery practices and transportation distances to MSW facilities, can be modified by the user.

The GHG emission factors used in WARM are based on a life cycle perspective. The [model documentation](#) describes this methodology in detail.

### **Who should use WARM?**

WARM was developed for solid waste managers (from state and local governments and other organizations) who want to estimate and compare the GHG emissions, energy savings and economic impacts associated with different waste management options. Emissions, energy and economic estimates provided by WARM are intended to support broad solid waste planning. WARM is a comparative tool rather than a comprehensive measurement tool. WARM was not developed for and, as such, should not be used for final site-specific materials management decisions, when other human health and environmental impacts of the different management methods may need to be considered (such as air pollution, water pollution, noise, etc.). It also

should not be used for developing GHG inventories, which need to establish a baseline and measure reductions over time on an annual basis for an entity.

## Using the Excel Version of WARM

Before using WARM, you first need to gather data on your baseline waste management practices and an alternative scenario. In order to effectively use the tool, users should know how many tons of waste you manage (or would manage) for a given time period under each scenario by material type and by management practice. The model allows you to customize your results based on project-specific landfill gas recovery practices, anaerobic digestion practices, and transportation distances. Note that you may use default values if you are unsure of landfill gas recovery practices, anaerobic digestion practices and/or transportation distances.

### Instructions:

- Click on the “Analysis Inputs” tab at the bottom center of the screen to open the input sheet. Follow the instructions for Steps 1 and 2. This involves filling in the tables describing your baseline and proposed alternative waste management scenarios. The "mixed" material types are defined as the following:
  - Mixed Metals: Aluminum Cans 35%, Steel Cans 65%
  - Mixed Plastics: HDPE 40%, PET 60%.
  - Mixed Electronics: Desktop CPUs 10%, Portable Electronic Devices 12%, Flat-Panel Displays 45%, CRT Displays 13%, Electronic Peripherals 2%, Hard-Copy Devices 19%
  - Mixed Paper (general): Corrugated Containers 48%, Magazines/Third-class Mail 8%, Newspaper 24%, Office Paper 20%
  - Mixed Paper (primarily residential): Corrugated Containers 53%, Magazines/Third-class Mail 10%, Newspaper 23%, Office Paper 14%
  - Mixed Paper (primarily from offices): Corrugated Containers 5%, Magazines/Third-class Mail 36%, Newspaper 21%, Office Paper 38%
  - Mixed Recyclables: Aluminum Cans 1.3%, Steel Cans 2.4%, Glass 6.0%, HDPE 1.2%, PET 1.8%, Corrugated Containers 56.8%, Magazines/Third-class Mail 7.3%, Newspaper 9.6%, Office Paper 7.8%, Phonebooks 0.1%, Textbooks 0.6%, Dimensional Lumber 5.2%
  - Food Waste: Beef 9%, Poultry 11%, Grains 13%, Fruits and Vegetables 49%, Dairy Products 18%
  - Food Waste (meat only): Beef 46%, Poultry 54%
  - Food Waste (non-meat): Grains 16%, Fruits and Vegetables 61%, Dairy Products 22%
  - Mixed Organics: Food Waste 53%, Yard Trimmings 47%.
  - Mixed MSW- represents the entire municipal solid waste stream as disposed.

For more information on these mixed material weightings, please reference the model documentation chapters specific to each material type.

- Fill in the data requested in Steps 3–9. WARM will use the answers to these questions to customize GHG estimates to reflect your waste management situation and location. For example, you are asked for data on transportation distances and on your landfill gas recovery systems, if applicable. If the requested data are not available, WARM will use the national average defaults.
- Step 10 allows you to customize your report, with your name, organization, and project period.
- Once you have completed Steps 1–9 on the “Analysis Inputs” sheet, WARM will calculate the GHG emissions, energy, and economic impacts attributable to the baseline and alternative waste management scenarios you have specified. Emissions, energy, and economic impact calculations are presented on separate output sheets, as described below. From the “Analysis Inputs” sheet, click on a tab at the bottom of the screen for the results sheet you want to view first.
- The “Summary Report” sheet provides a concise report of GHG emissions, energy, or economic results from the baseline and alternative waste management scenarios, as well as an estimate of net emissions, energy, wages, taxes, or labor hours.
- The “Analysis Results” sheet shows GHG emissions, energy, or economic results for each scenario in the units selected. You can compare the total impact of the baseline and alternative scenarios, or, if you want more detail, you can scroll down to view GHG emissions, energy, or economic results by material type and management practice. The bottom table shows the relative emissions, energy, wages, taxes, or labor hours difference between the alternative and baseline scenarios for each material type and management pathway.

## Assistance

If you need additional assistance with using WARM, please email [orcrWARMquestions@epa.gov](mailto:orcrWARMquestions@epa.gov).



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