# Climate Neutral Network
# corporate-level greenhouse gas accounting worksheet

Prepared in collaboration with the Environmental Protection Agency

Version 11

Updated august 14, 2003.

# Climate Neutral Corporate-Level Greenhouse Gas Accounting Worksheet

The term “climate neutral” refers to products, services, activities, and enterprises that reduce or offset the climate gases with which they are associated to achieve a net zero impact on the earth’s climate. This greenhouse gas accounting tool addresses the requirements of a company that wishes to achieve the "climate neutral" designation. Specifically, a company can choose to become climate neutral by offsetting the climate impacts of its internal operations across critical areas, including manufacturing, administration, and transport of product to customers. However, as part of a climate neutral proposal, companies must be able to demonstrate outstanding performance in reducing greenhouse gas emissions internally, before purchasing offsets. The purpose of this worksheet is to help companies identify and inventory their internal sources of greenhouse gas emissions.

The Corporate-Level Greenhouse Gas Accounting Worksheet is designed to track major sources of emissions from companies in all sectors of the economy. It is geared especially towards small firms that may have resource constraints or limited experience in this area. While rate-based, or normalized, GHG reporting has been encouraged to promote efficiency without stifling economic growth, the function of a "climate neutral" entity demands an overall emissions picture. Accordingly, the accounting worksheet establishes a baseline emissions level that serves as the point from which efficiency measures and offset projects are counted against. Nevertheless, companies may find it helpful to take additional steps that tie emissions into some measure of output.

Each sheet embedded in this tool reflects a potential source of company-wide GHG emissions. Companies must determine which modules of the worksheet pertain to their operations. For instance, most firms will complete the Commuting and Electricity modules while On-Site Fuel use may not apply. Instructions for completing unique modules are included at the top of each, and relevant notes are attached at the bottom. If multiple facilities exist, modules should be filled out a corresponding number of times and the sum-total should be manually entered at the bottom of the sheet.

The worksheet uses a combination of national averages and emission factors, but requires the input of facility-specific data -- gray cells highlight where company data must be entered. Averages are built in to the calculations but may be replaced by more accurate facility information, if available. Comments have been inserted to clarify data sources and provide guidance on the location of facility data, and are denoted with a red triangle in the upper-right hand corner of a cell. Once data has been supplied and calculations performed, the total pounds CO2 emitted from that module will be automatically inserted as a factor in the company-total calculation. Appendix sheets are also provided, accessible via electronic links, for reference purposes.

# Climate Neutral Corporate-Level Greenhouse Gas Accounting Worksheet

**Commuting:**

STEP 1: for facility #1, fill in gray box by determining number employees at site.
Corresponding employee days per year, miles traveled per year, gallons of gas used, and lbs CO2 emitted are determined using national averages.

STEP 2: repeat for all company facilities and enter below.

STEP 3: compute sum of emissions from commuting -- equals sum of lbs $CO_2$ emitted for all facilities.

CNN Metric:

number employees * number days worked/year/employee = total employee days per year

| | | | | |
|---|---|---|---|---|
| | X | 240 | = | 0 |

total employee days * avg employee commute (miles) = total miles per year

| | | | | |
|---|---|---|---|---|
| 0 | X | 23.60 | = | 0 |

miles per year * avg miles/gallon gasoline = gallons gas used

| | | | | |
|---|---|---|---|---|
| 0 | / | 0.0 | = | #DIV/0! |

gallons gas used * lbs $CO_2$/gallon gas used = lbs $CO_2$ emitted

| | | | | |
|---|---|---|---|---|
| #DIV/0! | X | 19.56 | = | #DIV/0! |

total $CO_2$ emitted

EPA link

EIA

NPTS link

# Climate Neutral Corporate-Level Greenhouse Gas Accounting Worksheet

**Company Cars:**

STEP 1: for facility #1, fill in gray box with total number miles per year for all employees at site. Corresponding gallons of gas used and lbs $CO_2$ emitted are determined using national average emission factors.

STEP 2: repeat for all company facilities and enter below.

STEP 3: compute sum of emissions from company cars -- equals sum of lbs $CO_2$ emitted for all facilities.


miles per year * avg miles/gallon gasoline = gallons gas used

| | | | | |
|---|---|---|---|---|
| | / | 23.8 | = | 0 |

gallons gas used * lbs $CO_2$/gallons gas used = lbs $CO_2$ emitted

| | | | | |
|---|---|---|---|---|
| 0 | X | 19.56 | = | 0 |


# Climate Neutral Corporate-Level Greenhouse Gas Accounting Worksheet

**Non Motor-Vehicle Employee Travel:**

STEP 1: for facility #1, fill in gray boxes with number of miles traveled by air and rail. If such data is not available, you can input number of tickets purchased to calculate an estimate of miles traveled.
national average emission factors per passenger mile then determine total CO2 emissions.
STEP 2: repeat for all facilities and enter below
STEP 3: compute total emissions from air and rail travel -- equals sum of lbs $CO_2$ emitted for all employee trips.

CNN Metric:

*travel by plane:*

total number employee trips * avg distance (miles)/trip (r/t) = total employee-miles traveled

| | | | | |
|---|---|---|---|---|
| | X | 1,190 | = | 0 |

employee miles traveled * lbs $CO_2$ per passenger mile = lbs $CO_2$ emitted

| | | | | |
|---|---|---|---|---|
| 0 | X | 0.63 | = | 0 |

Pounds of CO2 * two = lbs CO2 equivalent emitted

| | | | | |
|---|---|---|---|---|
| 0 | X | 2 | = | 0 |

*travel by train:*

total number employee trips * avg distance (miles)/trip (r/t) = total employee-miles traveled

| | | | | |
|---|---|---|---|---|
| | X | | = | 0 |

total employee-miles traveled * lbs $CO_2$ emitted/employee-mile = total lbs $CO_2$ emitted

| | | | | |
|---|---|---|---|---|
| 0 | X | 0.1207 | = | 0 |

**total $CO_2$ emitted from non motor-vehicle employee travel =** 0

total $CO_2$ emitted

BTS

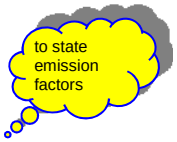
GHG Protocol link

EIA

# Climate Neutral Corporate-Level Greenhouse Gas Accounting Worksheet

**Energy Usage:**

STEP 1: for facility #1, fill in gray boxes with total annual electricity usage (in kWh) and state emission factor Corresponding average amount CO2 emitted per kWh determined using state or national averages.
STEP 2: enter total annual consumption of each fuel for facility #1 in the gray boxes.
STEP 3: repeat for all facilities and enter below.
STEP 4: compute sum of electricity emissions -- equals sum of lbs $CO_2$ emitted for all fuel types at all facilities -- and manually enter into total lbs $CO_2$ emitted box.


*electricity usage:* kWh used * state avg lbs $CO_2$/kWh = lbs $CO_2$ emitted

| | | | | |
|---|---|---|---|---|
| | X | | = | 0 |

*amount Natural Gas consumed:* therms natural gas consumed * lbs $CO_2$/therm = lbs $CO_2$ emitted

| | | | | |
|---|---|---|---|---|
| | X | 11.708 | = | 0 |

*amount Propane:* gallons propane consumed * lbs $CO_2$/gallon = lbs $CO_2$ emitted from consumption

| | | | | |
|---|---|---|---|---|
| | X | 12.669 | = | 0 |

*amount distillate fuel:* *(diesel fuel, fuel oil 1, 2 and 4, )* gallons distillate fuel oil consumed * lbs CO2/gallon = lbs $CO_2$ emitted from consumption

| | | | | |
|---|---|---|---|---|
| | X | 22.384 | = | 0 |

*amount residual fuel (fuel oil 5 and 6)* gallons residual fuel consumed * lbs $CO_2$/gallon = lbs $CO_2$ emitted from consumption

| | | | | |
|---|---|---|---|---|
| | X | 26.033 | = | 0 |

*amount bituminous coal:* short tons bituminous coal consumed * lbs $CO_2$/short ton = lbs $CO_2$ emitted from consumption

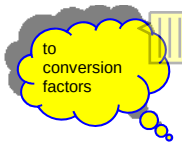
| | | | | |
|---|---|---|---|---|
| | X | 4,931.30 | = | 0 |

*amount anthracite coal:* short tons anthracite coal consumed * lbs $CO_2$/short ton = lbs $CO_2$ emitted from consumption

| | | | | |
|---|---|---|---|---|
| | X | 3,852.16 | = | 0 |

*amount wood and wood waste:* short tons wood waste consumed * lbs $CO_2$/short ton = lbs $CO_2$ emitted from consumption

| | | | | |
|---|---|---|---|---|
| | X | 3814.0 | = | 0 |




**total lbs $CO_2$ from energy use =** 0

*Conversion:*

MM Btu's natural gas consumed * 10 = Therms natural gas consumed

| | | | | |
|---|---|---|---|---|
| | X | 10 | = | |

Note: Wood emissions are not added to your footprint but should be reported here to develop a complete picture of your energy profile.

**total lbs $CO_2$ emitted =**


NOTE: For amount unspecified energy, use statewide electricity factors by clicking on the link. Or, use national average lbs/carbon dioxide which is 1.341. The source of this 1999 average is: http://www.eia.doe.gov/cneaf/electricity/page/… co2_report/co2report.html See page 1

# Climate Neutral Corporate-Level Greenhouse Gas Accounting Worksheet

**Product Transport:** (from firm to users)

STEP 1: for facility #1, fill in gray boxes with total number of shipments, average distance per shipment, and average tonnes of product shipped. If you already know your tonne-miles enter this directly. Corresponding total tonne- and product-miles shipped, and total CO2 emitted by mode of transport are determined using average emissions factors.

STEP 2: repeat for all facilities and enter below.

STEP 3: compute total CO2 emitted from firm-to-user product transport -- equals sum of $CO_2$ emitted for all shipments. Information about shipments from suppliers to firm should not be included.


*tractor trailer freight:*

number shipments * avg distance (miles)/shipment = total product-miles shipped

| | | | | |
|---|---|---|---|---|
| | X | | = | 0 |

total product-miles shipped * avg tonnes of product shipped = total tonne-miles shipped

Note: 1 tonne equals 2,204.6 pounds

| | | | | |
|---|---|---|---|---|
| 0 | X | | = | 0 |

total tonne-miles shipped * lbs CO2 emitted per tonne-mile = total lbs CO2 emitted by train freight

| | | | | |
|---|---|---|---|---|
| 0 | X | | = | 0 |

*train freight:*

number shipments * avg distance (miles)/shipment = total product-miles shipped

| | | | | |
|---|---|---|---|---|
| | X | | = | 0 |

total product-miles shipped * avg tonnes of product shipped = total tonne-miles shipped

Note: 1 tonne equals 2,204.6 pounds

| | | | | |
|---|---|---|---|---|
| 0 | X | | = | 0 |

total tonne-miles shipped * lbs CO2 emitted per tonne-mile = total lbs CO2 emitted by train freight

| | | | | |
|---|---|---|---|---|
| 0 | X | 0.1669 | = | 0 |

*marine freight:*

number shipments * avg distance (miles)/shipment = total product-miles shipped

| | | | | |
|---|---|---|---|---|
| | X | | = | 0 |

total product-miles shipped * avg tonnes of product shipped = total tonne-miles shipped

Note: 1 tonne equals 2,204.6 pounds

| | | | | |
|---|---|---|---|---|
| 0 | X | | = | 0 |

total tonne-miles shipped * lbs CO2 emitted per tonne-mile = total lbs CO2 emitted by marine freight

| | | | | |
|---|---|---|---|---|
| 0 | X | 0.0355 | = | 0 |

*air freight:*

number shipments * avg distance (miles)/shipment = total product-miles shipped

| | | | | |
|---|---|---|---|---|
| | X | | = | 0 |

total product-miles shipped * avg tonnes of product shipped = total tonne-miles shipped

Note: 1 tonne equals 2,204.6 pounds

| | | | | |
|---|---|---|---|---|
| 0 | X | | = | 0 |

total tonne-miles shipped * lbs CO2 emitted per tonne-mile = total lbs CO2 emitted by air freight

| | | | | |
|---|---|---|---|---|
| 0 | X | 3.0815 | = | 0 |

**total $CO_2$ emitted from firm-to-user product transport =** 0

total $CO_2$ emitted

Use organization-wide data to record average tonnage of product shipped to distributor.
Make sure to include only information on deliveries from facility to users.

CO2 indicator link

# Climate Neutral Corporate-Level Greenhouse Gas Accounting Worksheet

**Methane Emissions from Waste:**

STEP 1: for facility #1, fill in gray box with amount of waste sent to landfilll.
STEP 2: adjust waste composition averages based on facility's best information (if unavailable, use national averages provided below). Corresponding lbs CO2-equivalent emitted from landfill waste determined using national average emission factors and global warming potentials.
STEP 2: repeat for all company facilites and enter below.
STEP 3: compute sum of landfill emissions -- equals sum of lbs $CO_2$ equivalent emitted for all facilities.

CNN Metric:

| | |
|---|---|
| **tons of waste sent to landfill (W) =** | 0 |
| *average waste composition (wet %)*: | |
| yard trimmings, leaves = | 4.1% |
| yard trimmings, grass = | 6.8% |
| yard trimmings, branches = | 2.7% |
| old newsprint = | 5.2% |
| old corr. cardboard = | 13.9% |
| office paper = | 3.3% |
| coated paper = | 1.2% |
| miscellaneous paper = | 16.1% |
| food waste = | 6.4% |
| non-decomposable waste = | 40.3% |
| *calculated landfill gas yield potential, $ft^3$/ton (Lo)*: | 5,159 |
| *percent of gas collected*: | 75% |
| *calculated tons of methane emitted*: | 0 |
| **tons $CO_2$-e emitted per reporting year =** | **0** |

to waste default values

total $CO_2$-e emitted

NOTE: This sheet accounts for the portion of waste-related indirect landfill methane emissions that the reporting company is responsible for. The underlying assumption here is that all biodegradable waste decomposes according to the equation described in the Waste Defaults appendix. Emissions here are reported as a lump sum, not over time as they are emitted from the landfill. The reason is that reporters will not have access to landfill operating characteristics to calculate annual decomposition.

# Climate Neutral Corporate-Level Greenhouse Gas Accounting Worksheet

**Direct Emissions from Industrial Processes:** (GHGs from non energy-related sources)
STEP 1: for facility #1, fill in gray boxes with greenhouse gas name and amount directly emitted. Corresponding lbs CO2 equivalents determined using GWP's.
STEP 2: repeat for all facilities and enter below.
STEP 3: compute total CO2 emitted from industrial processes -- equals sum of CO2 equivalents from all industrial process-related emissions.

CNN Metric:

to process emissions

| | amount gas (in lbs) | * global warming potential | = lbs $CO_2$ equivalents |
|---|---|---|---|
| *amount carbon dioxide ($CO_2$)* : | | X 1 = | 0 |
| *amount methane ($CH_4$)* : | | X 21 = | 0 |
| *amount nitrous oxide ($N_2O$)* : | | X 310 = | 0 |
| *amount sulfur hexafluoride ($SF_6$)* : | | X 23,900 = | 0 |
| *amount chlorofluorocarbon (CFCs)* : | | X | = 0 |
| *amount hydrofluorocarbon (HFCs)* : | | X | = 0 |

to global warming potentials

**total $CO_2$-e emitted from industrial processes =** 0

total $CO_2$ emitted

GHG Protocol link

# Climate Neutral Corporate-Level Greenhouse Gas Accounting Worksheet

**Total:** (sum of subtotals for all modules)

STEP 1: for all facilities, compute sum of all modules. Corporate-level totoal emissions converted to short tons for reporting purposes.


commuting + company vehicles + other employee travel + electricity + on-site fuel + product transport + waste emissions + process-related emissions = total lbs CO2 emitted for firm

| | | | | | | |
|---|---|---|---|---|---|---|
| #DIV/0! | + | 0 | + | 0 | + | |
| 0 | + | | + | 0 | | |
| 0 | + | 0 | | | = | #DIV/0! |

**total metric tonnes $CO_2$ emitted for corporation =** #DIV/0!

overall $CO_2$ emitted for corporation

## Average Electricity Emissions Factors by State and Region

| Region/State | $CO_2$ Emission Factors | | | $CH_4$ | $N_2O$ |
|---|---|---|---|---|---|
| | lbs/kWh | short tons/MWh | metric tons/MWh | lbs/MWh | lbs/MWh |
| **New England** | **0.98** | **0.491** | **0.446** | **0.0207** | **0.0146** |
| Connecticut | 0.94 | 0.471 | 0.427 | 0.0174 | 0.012 |
| Maine | 0.85 | 0.426 | 0.386 | 0.0565 | 0.027 |
| Massachusetts | 1.28 | 0.639 | 0.579 | 0.0174 | 0.0159 |
| New Hampshire | 0.68 | 0.341 | 0.31 | 0.0172 | 0.0141 |
| Rhode Island | 1.05 | 0.526 | 0.477 | 0.0068 | 0.0047 |
| Vermont | 0.03 | 0.014 | 0.013 | 0.0096 | 0.0039 |
| **Mid Atlantic** | **1.04** | **0.52** | **0.471** | **0.0093** | **0.0145** |
| New Jersey | 0.71 | 0.353 | 0.32 | 0.0077 | 0.0079 |
| New York | 0.86 | 0.429 | 0.389 | 0.0081 | 0.0089 |
| Pennsylvania | 1.26 | 0.632 | 0.574 | 0.0107 | 0.0203 |
| **East-North Central** | **1.63** | **0.815** | **0.74** | **0.0123** | **0.0257** |
| Illinois | 1.16 | 0.582 | 0.528 | 0.0082 | 0.018 |
| Indiana | 2.08 | 1.038 | 0.942 | 0.0143 | 0.0323 |
| Michigan | 1.58 | 0.79 | 0.717 | 0.0146 | 0.025 |
| Ohio | 1.8 | 0.9 | 0.817 | 0.013 | 0.0288 |
| Wisconsin | 1.64 | 0.821 | 0.745 | 0.0138 | 0.026 |
| **West-North Central** | **1.73** | **0.864** | **0.784** | **0.0127** | **0.0269** |
| Iowa | 1.88 | 0.941 | 0.854 | 0.0138 | 0.0298 |
| Kansas | 1.68 | 0.842 | 0.764 | 0.0112 | 0.0254 |
| Minnesota | 1.52 | 0.762 | 0.691 | 0.0157 | 0.0247 |
| Missouri | 1.84 | 0.92 | 0.835 | 0.0126 | 0.0288 |
| Nebraska | 1.4 | 0.7 | 0.635 | 0.0095 | 0.0219 |
| North Dakota | 2.24 | 1.121 | 1.017 | 0.0147 | 0.0339 |
| South Dakota | 0.8 | 0.399 | 0.362 | 0.0053 | 0.0121 |
| **South Atlantic** | **1.35** | **0.674** | **0.612** | **0.0127** | **0.0207** |
| Delaware | 1.83 | 0.915 | 0.83 | 0.0123 | 0.0227 |
| Florida | 1.39 | 0.697 | 0.632 | 0.015 | 0.018 |
| Georgia | 1.37 | 0.683 | 0.619 | 0.0129 | 0.0226 |
| Maryland (*) | 1.37 | 0.683 | 0.62 | 0.0118 | 0.0206 |
| North Carolina | 1.24 | 0.621 | 0.563 | 0.0105 | 0.0203 |
| South Carolina | 0.83 | 0.417 | 0.378 | 0.0091 | 0.0145 |
| Virginia | 1.16 | 0.582 | 0.528 | 0.0137 | 0.0192 |
| West Virginia | 1.98 | 0.988 | 0.897 | 0.0137 | 0.0316 |
| **East-South Central** | **1.49** | **0.746** | **0.677** | **0.0128** | **0.024** |
| Alabama | 1.31 | 0.656 | 0.595 | 0.0137 | 0.0223 |
| Kentucky | 2.01 | 1.004 | 0.911 | 0.014 | 0.0321 |

| | | | | | |
|---|---|---|---|---|---|
| Mississippi | 1.29 | 0.647 | 0.587 | 0.0132 | 0.0165 |
| Tennessee | 1.3 | 0.648 | 0.588 | 0.0105 | 0.0212 |
| **West-South Central** | **1.43** | **0.714** | **0.648** | **0.0087** | **0.0153** |
| Arkansas | 1.29 | 0.643 | 0.584 | 0.0125 | 0.0203 |
| Louisiana | 1.18 | 0.589 | 0.534 | 0.0094 | 0.0112 |
| Oklahoma | 1.72 | 0.861 | 0.781 | 0.011 | 0.0223 |
| Texas | 1.46 | 0.732 | 0.664 | 0.0077 | 0.0146 |
| **Mountain** | **1.56** | **0.781** | **0.709** | **0.0108** | **0.0236** |
| Arizona | 1.05 | 0.525 | 0.476 | 0.0068 | 0.0154 |
| Colorado | 1.93 | 0.963 | 0.873 | 0.0127 | 0.0289 |
| Idaho | 0.03 | 0.014 | 0.013 | 0.008 | 0.0033 |
| Montana | 1.43 | 0.717 | 0.65 | 0.0108 | 0.0227 |
| Nevada | 1.52 | 0.759 | 0.688 | 0.009 | 0.0195 |
| New Mexico | 2.02 | 1.009 | 0.915 | 0.0131 | 0.0296 |
| Utah | 1.93 | 0.967 | 0.878 | 0.0134 | 0.0308 |
| Wyoming | 2.15 | 1.073 | 0.973 | 0.0147 | 0.0338 |
| **Pacific Contiguous** | **0.45** | **0.224** | **0.203** | **0.0053** | **0.0037** |
| California | 0.61 | 0.303 | 0.275 | 0.0067 | 0.0037 |
| Oregon | 0.28 | 0.141 | 0.127 | 0.0033 | 0.0034 |
| Washington | 0.25 | 0.123 | 0.111 | 0.0037 | 0.004 |
| **Pacific Non-contiguous** | **1.56** | **0.78** | **0.707** | **0.0161** | **0.0149** |
| Alaska | 1.38 | 0.69 | 0.626 | 0.0068 | 0.0089 |
| Hawaii | 1.66 | 0.831 | 0.754 | 0.0214 | 0.0183 |
| **U.S. Average** | **1.34** | **0.668** | **0.606** | **0.0111** | **0.0192** |

* Includes the District of Columbia

Source: Energy Information Administration, Updated State-level Greenhouse Gas Emission Factors for Electricity Generation 1998-2002 (April 2002) see:
http://eia.doe.gov/oiaf/1605/techassist.html

## Reference Documents


Bureau of Transportation Statistics "National Tranportation Statistics 1999"
available at www.bts.gov/ntda/nts/NTS99/data/Chapter 4/content.pdf

Thomas, Charles and Tessa Tennant for UNEP, "Creating a Standard for a Corporate CO2 Indicator"
Working Document 26 May 1998

"Carbon Dioxide Emissions from the Generation of Electric Power in the United States
DOE and EPA July 2000
http://www.eia.doe.gov/cneaf/electricity/page/co2_report/co2report.html

US Environmental Protection Agency, *Inventory of US Greenhouse Gas Emissions and* Sinks: 1990-1997. EPA 236-R-99-003, April 1999.

IPCC (1996) GHG Inventory Reference Manual, Revised 1996 IPCC Guidelines for National GHG Inventories

U.S. Department of Energy/Energy Information Agency,
"*Instructions for Form 1605: Voluntary Reporting of Greenhouse Gases for Data through 2000",* February 2001

EIA Monthy Energy Review http://www.eia.doe.gov/emeu/mer/txt/mer1-10

## Global Warming Potentials

| Greenhouse Gas: | Global Warming Potential: |
|---|---|
| Carbon dioxide (CO2) | 1 |
| Methane (CH4) | 21 |
| Nitrous Oxide (N2O) | 310 |
| HFC-23 | 11,710 |
| HFC-125 | 2,800 |
| HFC-134a | 1,300 |
| HFC-143a | 3,800 |
| HFC-152a | 140 |
| HFC-227ea | 2,900 |
| HFC-236fa | 6,300 |
| HFC-4310mee | 1,300 |
| CF4 | 6,500 |
| C2F6 | 9,200 |
| C4F10 | 7,000 |
| C6F14 | 7,400 |
| SF6 | 23,900 |


Source: US Environmental Protection Agency, *Inventory of US Greenhouse Gas Emissions and Sinks: 1990-1997*. EPA 236-R-99-003, April 1999.

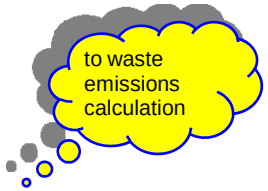
## Landfill Gas Generation Equation

$$G = WL_o \frac{k+s}{s}(1-e^{-s(t-t_i)})(ke^{-k(t-t_i)})$$

Where:
G = landfill total gas generation at time t (ft3/yr)
W = waste in place (tons)
Lo = landfill gas yield potential (ft3/ton of waste)
t = time after initial waste placement (yr)
ti = lag time (between placement and start of generation) (yr)
k = first order decay rate constant (1/yr)
s = first order rise phase constant (1/yr)

## Default Values for Landfill Gas Methane Production Modeling

| Waste Components | Waste Properties | |
|---|---|---|
| | Moisture Content | Gas Yield ($ft^3$/ton dry comp.) |
| Yard Trimmings, Leaves | 60% | 2,543 |
| Yard Trimmings, Grass | 60% | 11,301 |
| Yard Trimmings, Branches | 60% | 5,227 |
| Old Newsprint | 6% | 6,174 |
| Old Corr. Cardboard | 5% | 12,656 |
| Office Paper | 6% | 18,057 |
| Coated Paper | 6% | 7,013 |
| Miscellaneous Paper | 6% | 10,977 |
| Food Waste | 70% | 24,987 |
| Percent Methane in Landfill Gas = | | 55% |
| Oxidation Factor = | | 0 |

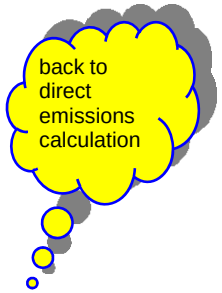



## Conversion Factors for Measuring Waste

| To Convert: | To: | Multiply By: |
|---|---|---|
| $ft^3$ | moles of gas | 1.16 |
| moles of methane gas | grams $CH_4$ | 16 |
| tons | grams | 1.10 E-06 |
| tons CH4 | tons $CO_2$-e | 21 |

## potential industrial process emissions

| Process | Greenhouse Gas | | | | | |
|---|---|---|---|---|---|---|
| | CO2 | CH4 | N20 | PFC | SF6 | HFC |
| Mineral Products | | | | | | |
| cement production | X | | | | | |
| lime production | X | | | | | |
| limestone use | X | | | | | |
| soda ash production | X | | | | | |
| brick manufacture | X | | | | | |
| Chemical Industry | | | | | | |
| ammonia | X | | | | | |
| nitric acid | | | X | | | |
| adipic acid | | | X | | | |
| urea | | | X | | | |
| Metal Production | | | | | | |
| iron and steel | X | X | | | | |
| aluminum | X | X | | X | X | |
| magnesium | X | | | | X | |
| Energy Industry | | | | | | |
| coal mining | X | X | | | | |
| oil production | X | X | | | | |
| gas production | X | X | | | | |
| solid fuel transformation | X | | | | | |




Source: IPCC (1996) GHG Inventory Reference Manual, Revised 1996 IPCC Guidelines for National GHG Inventories

**Conversion Factors for Units of Measure**

| To Convert: | To: | Multiply By: |
|---|---|---|
| feet | meters | 0.3048 |
| miles | kilometers | 1.6093 |
| square feet | acres | $2.2957 * 10^{-5}$ |
| hectares | acres | 2.47 |
| cubic feet | liters | 28.32 |
| pounds | grams | 453.6 |
| British thermal units (Btu) | joules | 1055.1 |
| Foot pounds | Btu | $1.285 * 10^{-5}$ |
| kilowatt hours (kWh) | Btu | 3413 |
| quads (quadrillion Btu) | kWh | $2.93 * 10^{11}$ |
| (short) tons | metric tons | 0.9072 |
| barrels | gallons | 42 |
| quadrillion Btu | Btu | $1 * 10^{15}$ |
| pounds | tons | $5 * 10^{-4}$ |
| million metric tons $CO_2$ per quad | pounds $CO_2$ per Btu | $2.2046 * 10^{-6}$ |
| lb/Mwh | lb/kWh | 0.001 |
| carbon (tons) | $CO_2$ (tons) | 3.67 *or* 44/12 |
| $CO_2$ (metric tons) | $CO_2$ (tons) | 1.102 |
| $CO_2$ (pounds) | $CO_2$ (metric tons) | $4.535 * 10^{-4}$ |
| $CO_2$ (billion pounds) | carbon (million metric tons carbon equivalent) | 0.1237 |
| MMBtu | Btu | $1 * 10^{6}$ |
| therms | Btu | $1 * 10^{5}$ |

back to accounting worksheet

Sources: US Department of Energy/Energy Information Administration, Form EIA-1605 (2000).