Estimating the Environmental Benefits of Source Reduction, Reuse, and Recycling

An Environmental Benefits Calculator

Updated by Northeast Recycling Council, Inc. (NERC) and Abt Associates, Inc.

What Does the Calculator Do?

NERC's Environmental Benefits Calculator (in Microsoft Excel 2003; part of Office Professional Edition 2003) generates estimates of the environmental benefits of a study area, based on the tonnages of materials that are source reduced, reused, recycled, landfilled, or incinerated (includes waste-to-energy). The Calculator is based on per ton figures of the estimated energy use and emissions from several lifecycle analysis studies. The estimates are average figures based on "typical" facilities and operating characteristics existing in the United States. The Calculator incorporates U.S. EPA's most recent WARM Calculator, as well as facts and figures from the U.S. Department of Energy, Steel Recycling Institute, Glass Packaging Institute, and U.S. Climate Technology Cooperation Gateway, to name a few. More facts and figures can be found cited throughout the Calculator.

The Output Tables provided by the Calculator and the accompanying Fact Sheet are intended to be used as references by waste prevention officials and advocates in preparing outreach materials such as press releases, presentation slides, educational curricula, and articles. Completed Fact Sheets on the ten Northeast states can be found on NERC's website at www.nerc.org

By documenting some of the more important benefits of source reduction, reuse, and recycling, the Calculator can be used to educate the public, legislators, and others about these benefits, assist state and municipal employees to better understand the impacts of their waste management programs, support market development efforts, and to increase the public's understanding of source reduction, reuse, and recycling as a sustainable environmental strategy.

What Has Been Updated Since the Last Version?

NERC has updated its Environmental Benefits Calculator (EBC) so that it remains the most comprehensive and current EBC available in the United States. EPA has made several major revisions to its Waste Reduction Model (WARM), which is one of the major analytical tools embedded in the EBC. NERC also reviewed and updated calculations and figures from other sources. The following are the updates made to NERC's EBC:

- Added aluminum scrap metal, copper wire, and tires to the material types.
- Updated the greenhouse gas emissions and energy factors to match the latest WARM Model.
- Revised figures for energy use for an average household for one year, an average passenger car for one year, and energy content of gasoline.
- Added the following charts: How is Waste Diverted?; Impacts of Source Reduction/Reused and Disposal on GHG (MTCE/Year); and Impacts of Source Reduction/Reuse and Disposal on Energy Use (Million BTU/Year).
- Added glass recycling environmental benefits.
- Revised and automated the accompanying EBC Fact Sheet.
- To make the EBC more user-friendly, the list of materials has been divided into logical groupings, and the Environmental Benefits charts have been separated and made larger.

The biggest change to the EBC is the addition of five new environmental impact tables:

- Table 8: Reductions in Greenhouse Gas Emissions as of a Result of Recycling Items in a Typical Curbside Set-Out Container
- Table 9: Energy Savings as a Result of Recycling Items in a Typical Curbside Set-Out Container
- Table 12: Natural Resource Savings as a Result of Steel Source Reduction and Reuse
- Table 14: Number of Tree Seedlings Grown for 10 Years as a Result of Paper Recycling
- Table 15: Landfill Space Saved as a Result of Paper Recycling.

The following charts have been deleted from NERC's EBC because updated facts and figures were not available: Lifecycle Stage Comparisons; Air Emissions and Waterborne Waste as a Result of Recycling; and Acid Rain Emission Savings Comparison.

Who Can Use the Calculator?

The Calculator is usable by any state, region, county, town, institution, college, or business in the United States. It is limited to use in the U.S., because many of the data inputs and conversion factors are based on U.S.-specific data and technologies. In addition, the environmental savings presented in the Calculator are compared to state-specific data. This is important for local governments to keep in mind.

U.S.-based businesses are encouraged to use the calculator to determine the environmental benefits of recycling their office wastes and by-products. However, since recycling is only a portion of a business's activity, there is another model to assist in calculating the benefits of manufacturing and purchasing recycled content materials - The ReCon Tool may be found on the U.S.EPA Climate and Waste Program website, at http://www.epa.gov/climatechange/wycd/waste/calculators/ReCon_home.html

What Information Does the Calculator Produce?

The Calculator yields the following detailed tables with accompanying descriptive charts:
1. Materials Management Overview;
2. Reductions in Greenhouse Gas Emissions as a Result of Source Reduction and Reuse;
3. Reductions in Greenhouse Gas Emissions as a Result of Recycling;
4. Greenhouse Gas Savings Comparisons;
5. Energy Savings as a Result of Source Reduction and Reuse;
6. Energy Savings as a Result of Recycling;
7. Energy Savings Comparisons;
8. Reductions in Greenhouse Gas Emissions as of a Result of Recycling Items in a Typical Curbside Set-Out Container;
9. Energy Savings as of a Result of Recycling Items in a Typical Curbside Set-Out Container;
10. Energy Savings from Computer Source Reduction and Reuse;
11. Energy Savings from Computer Recycling;
12. Natural Resource Savings as a Result of Steel Source Reduction and Reuse;
13. Natural Resource Savings as a Result of Steel & Glass Recycling;
14. Number of Tree Saplings Grown for 10 Years that Sequester the Same Amount of Carbon as 1 Ton of Recycled Paper; and
15. Landfill Space Saved as a Result of Paper Recycling.

How Do You Use the Calculator?

Step 1

Go to Worksheet 1. Data Inputs to enter materials management data. Worksheet 1. Data Inputs is the place to input your area's data. This includes tonnages for source reduction, reuse, recycling, landfilling, and incineration/waste-to-energy. See notes to the right of the blue cells in the Worksheet 1. Data Inputs for additional tips on entering the materials management data. If seeking state-specific materials management data outside of the Northeast region, contact your state recycling agency for this information. The ten Northeast states' data is run through the Calculator on a yearly basis, and the Fact Sheets summarizing the results can be found on NERC's website at http://www.nerc.org/topic_areas/environmental_benefits_calculator.html

Step 2

Also in Worksheet 1. Data Inputs, enter state-specific data obtained through the Internet. This state-specific data includes statistics such as energy consumption and greenhouse gas emissions that puts your area's environmental benefits into context. Sources for this data and instructions for navigating through the sites to find your state's data are provided in each Input Section of the worksheet. Please note: This state-specific data is already maintained by NERC for the ten Northeast states. If your study area is within one of these states, contact Athena Lee Bradley (athena@nerc.org)

for a partially-completed version of the Calculator that includes this data.

Step 3

Click on Worksheet 2. Environmental Impacts, using the tabs at the bottom of the spreadsheet. This sheet provides 15 automatically-generated tables from your inputted data.

Produce a Fact Sheet Using a Mail Merge Word File. The link at the end of this paragraph takes you to a website page where you can download a Microsoft Word Fact Sheet that can be personalized by using the Mail Merge function. The resulting Microsoft Word Fact Sheet summarizes your area's environmental benefits from the Calculator into narrative form. The Fact Sheet is intended to be used as a marketing tool for educating the public about the environmental benefits of recycling. To create your area's data-specific Fact Sheet, follow these instructions. Save the latest version of your Calculator analysis. Open the blank Fact Sheet in Word http://www.nerc.org/documents/blank_fact_sheet.html

Step 4

In Word, display your Mail Merge toolbar by selecting "View" and then "Toolbars." From your Mail Merge toolbar, click on "Open Data Source." Select the Calculator Excel file. Select the tab "Wksh 5. Fact Sheet Outputs." Again, from your Mail Merge toolbar, click on "Merge to New Document." (Please note there are other routes to completing the mail merge through the main Word toolbar under "Tools.") Read through the resulting Fact Sheet and edit it to fit your circumstances and the data you entered. For example, if you did not enter any source reduction or reuse figures, delete these references.

Explanation of the Calculator Results

There are many details involved in deriving environmental benefit estimates. The Calculator uses statistics from many sources and involves important assumptions and caveats. Following is an explanation of each of the 15 Output Tables.

Table 1. Materials Management Overview is a restatement of the materials management data inputted by the Environmental Benefits Calculator user.

Table 2. Reductions in Greenhouse Gas Emissions as a Result of Source Reduction and Reuse is based on the data and methodology developed by the U.S. EPA[1]. EPA based its calculations on data from a number of academic, government, and private sector sources. For details on these data sources, see EPA's "Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks" report[2].

The reductions in emissions from source reduction are equal to the net emissions of disposed materials and those source reduced. Emission estimates are derived from estimated impacts of activities throughout the material lifecycle. Source reduction net emissions include raw material acquisition and manufacturing, processing, transportation, and forest carbon sequestration. Incineration/waste-to-energy net emissions include transportation, carbon dioxide (CO2) and nitrous oxide (N2O) from combustion, avoided utility emissions, and steel recovery. Landfill net emissions include transportation, methane (CH4) from landfills, avoided CO2 emissions from energy recovery, and landfill carbon sequestration. Column three is a weighted average of disposal emissions, based on the ratio between landfilling and incineration/waste-to-energy.

Table 3. Reductions in Greenhouse Gas Emissions as a Result of Recycling is based on the data and methodology developed by the U.S. EPA[1]. EPA based its calculations on data from a number of academic, government, and private sector sources. For details on these data sources, see EPA's "Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks" report[2].

The reductions in emissions from recycling are equal to the difference between the net emissions of disposed materials and those recycled. Emission estimates are derived from estimated impacts of activities throughout the material lifecycle. Recycling net emissions include raw material acquisition and manufacturing, processing, transportation, and forest carbon sequestration. Incineration and waste-to-energy net emissions include transportation, CO2 and N2O from combustion, avoided utility emissions, and steel recovery. Landfill net emissions include transportation, CH4 from landfills, avoided CO2 emissions from energy recovery, and landfill carbon sequestration. Column three in Table 2 is a weighted average of disposal emissions, based on the input ratio between landfilling and incineration/waste-to-energy.

EPA's data were used in NERC's Calculator because they are fast becoming the standardized source for greenhouse gas estimates used by states and other entities throughout the nation and because they represented recent revisions based on a broad review of sources. However, it should be noted that other sources are independently investigating the life-cycle environmental impacts of various industry processes and waste management practices; most notably the Environmental Defense Fund, International Council for Local Environmental Initiatives (ICLEI), EPA's Office of Research and Development, and Ecobilan.

Table 4. Greenhouse Gas Savings Comparisons compares the total greenhouse gas reduction estimate from *Table 2. Reductions in Greenhouse Gas Emissions as a Result of Source Reduction and Reuse* and *Table 3. Reductions in Greenhouse Gas Emissions as a Result of Recycling* to several other sources and sectors.

Table 5. Energy Savings as a Result of Source Reduction and Reuse is based on energy use estimates used in EPA's "WARM" model[1].

Table 6. Energy Savings as a Result of Recycling is based on energy use estimates used in EPA's "WARM" model[1].

Table 7. Energy Savings Comparisons compares the total energy savings estimate from *Table 5a. Energy Savings as a Result of Source Reduction and Reuse* and *Table 6a. Energy Savings as a Result of Recycling to Statewide Energy Consumption, Statewide Energy Expenditures, and Statewide Energy Generation.*

Table 8. Reductions in Greenhouse Gas Emissions as of a Result of Recycling Items in a Typical Curbside Set-Out Container is very similar to *Table 3. Reductions in Greenhouse Gas Emissions as a Result of Recycling*, but for selected types of commodities (those typically found in a set out container on curbside.) As in Table 3, this Table is based on the data and methodology developed by the U.S. EPA[1]. For details on these data sources, see EPA's "Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks" report[2].

Table 9. Energy Savings as of a Result of Recycling Items in a Typical Curbside Set-Out Container is very similar to *Table 6. Energy Savings as a Result of Recycling,* but for selected types of commodities (those typically found in a set out container on curbside). As in Table 6, this table is based on the data and methodology developed by the U.S. EPA[1]. For details on these data sources, see EPA's "Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks" report[2].

Table 10. Energy Savings from Computer Reuse determines the energy savings in Million BTUs from reusing whole computers (i.e., central processing unit, monitor and keyboard). The energy savings is equated to oil and gas saved, as well as, the number of cars that could be taken off the road for one year based on the amount of gasoline an average U.S. vehicle consumes in a year.

Table 11. Energy Savings from Computer Recycling determines the energy savings in Million BTUs from recycling whole computers. The energy savings is equated to oil and gas saved, as well as, the number of cars that could be taken off the road for one year based on the amount of gasoline an average U.S. vehicle consumes in a year.

Table 12. Natural Resource Savings as a Result of Steel Source Reduction and Reuse presents estimates of resource savings associated with ferrous steel source reduction and reuse (including iron ore, coal, and limestone).

Table 13. Selected Natural Resource Savings as a Result of Recycling presents estimates of resource savings associated with ferrous steel recycling (including iron ore, coal, and limestone) and paper recycling.

Table 14. Number of Tree Saplings Grown for 10 Years that Sequester the Same Amount of Carbon as 1 Ton of Recycled Paper presents estimates of resource savings (in terms of tree growth and forest sequestration) associated with paper recycling. The calculation involves taking U.S. EPA's forest carbon sequestration value and dividing it by a tree seedling value. This is based on a theory that any decrease in the production of virgin paper means that fewer trees need to be cut down. Hence, depending on assumptions about other factors that effect forest practices, there may be more carbon left standing in the woods for other trees to grow.

Table 15. Landfill Space Saved as a Result of Paper Recycling presents the amount of space saved in a landfill as a result of recycling paper.

Citations

1 U.S. EPA. "WARM Online, Version 9." (September 2008). September 08 http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_Form.html.

2 U.S. EPA. "Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks. 3rd edition." Sep 2006 http://www.epa.gov/climatechange/wycd/waste/SWMGHGreport.html.

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Worksheet 2. Environmental Impacts

Estimates of the Environmental Impacts of Recycling in 5-County Region

The following tables summarize the estimated environmental benefits of source reduction, reuse and recycling and provide comparison figures to put these estimates in context.

Date of Calculator Analysis: December 1, 2010

NOTE: If you have trouble with label formatting, see instructions at the bottom of the page.

Table 1. Materials Management Overview

Reporting Year	Tons Recycled 2009	Tons Source Reduced/Reused 2009	Tons Landfilled 2009	Tons Incinerated/ Waste-To-Energy 2009	Total Tons Disposed 2009
Aluminum Cans	238.50	0.00			
Steel Cans	11,839.30	0.00			
Glass	2,978.70	0.00			
HDPE	0.00	0.00			
LDPE	0.00	0.00			
PET	1,607.10	0.00			
Corrugated Cardboard	15,157.00	0.00			
Magazines/Third-class Mail	1,902.30	0.00			
Newspaper	3,444.90	0.00			
Office Paper	1,470.10	0.00			
Phonebooks	0.00	0.00			
Textbooks	0.00	0.00			
Whole Computers	0.00	0.00			
Food Scraps	1,299.70				
Yard Trimmings	7,103.50				
Grass	0.00				
Leaves	0.00				
Branches	19,522.30				
Ferrous Scrap Metal	0.00	0.00			
Aluminum Scrap Metal	0.00	0.00			
Copper Wire	0.00	0.00			
Tires	245.40	0.00			
Construction & Demolition	0.00	0.00			
Carpet	0.00	0.00			
Dimensional Lumber	0.00	0.00			
Medium-density Fiberboard	0.00	0.00			
Clay Bricks	0.00	0.00			
Aggregate	0.00	0.00			
Fly Ash	0.00	0.00			
Mixed Paper, Broad Definition	0.00	0.00			
Mixed Metals	0.00	0.00			
Mixed Plastics	0.00	0.00			
Mixed Recyclables	0.00	0.00			
Mixed Organics	0.00				
Other Recyclables	706.20	0.00			
Total	**67,515.00**	**0.00**	**266,153.30**	**0.00**	**266,153.30**

Rate (% of Generation)	**20.23%**	**0.00%**	**79.77%**	**0.00%**	
Rate (% of Disposal)			**100.00%**	**0.00%**	

Source:

Chart 1a. Amount of Materials Recycled

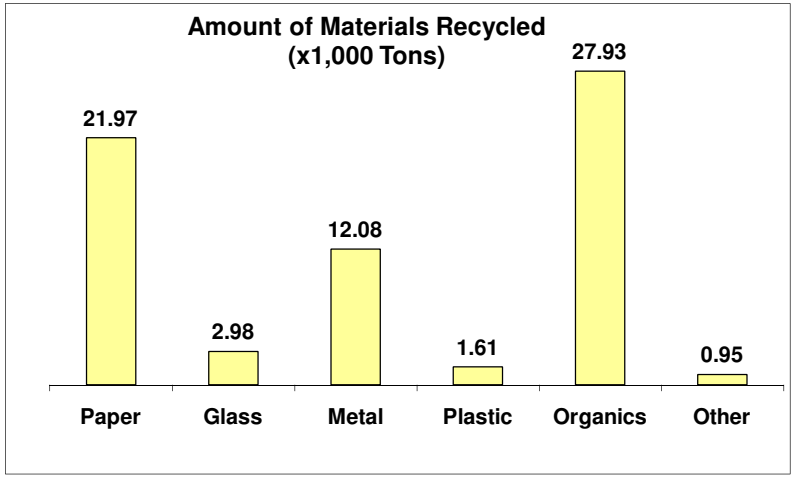


Chart 1b. Materials Management Overview

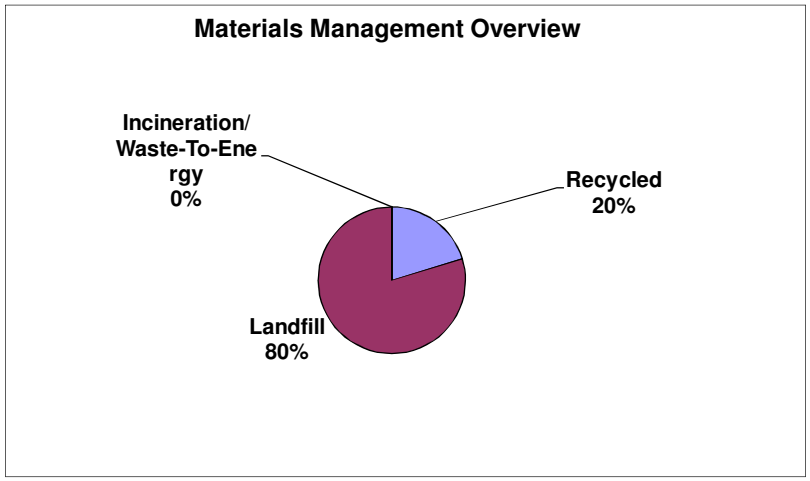


Chart 1c. Amount of Materials Source Reduced & Reused

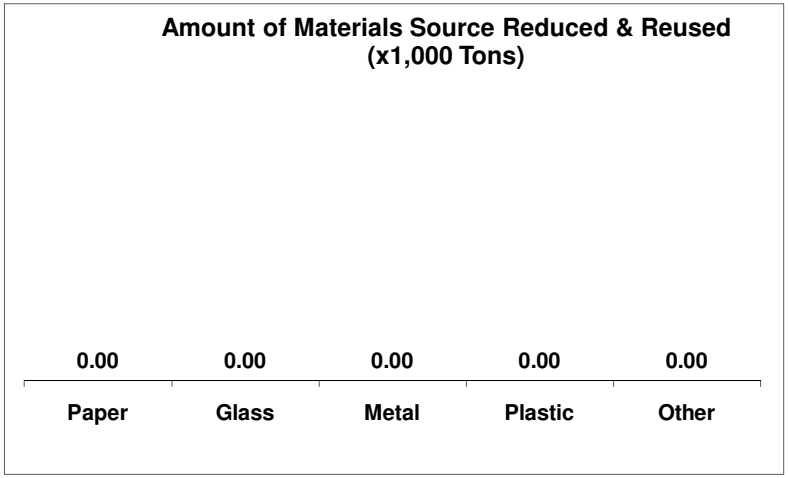


Chart 1d. How Waste is Diverted

Table 2. Reductions in Greenhouse Gas Emissions as a Result of Source Reduction and Reuse

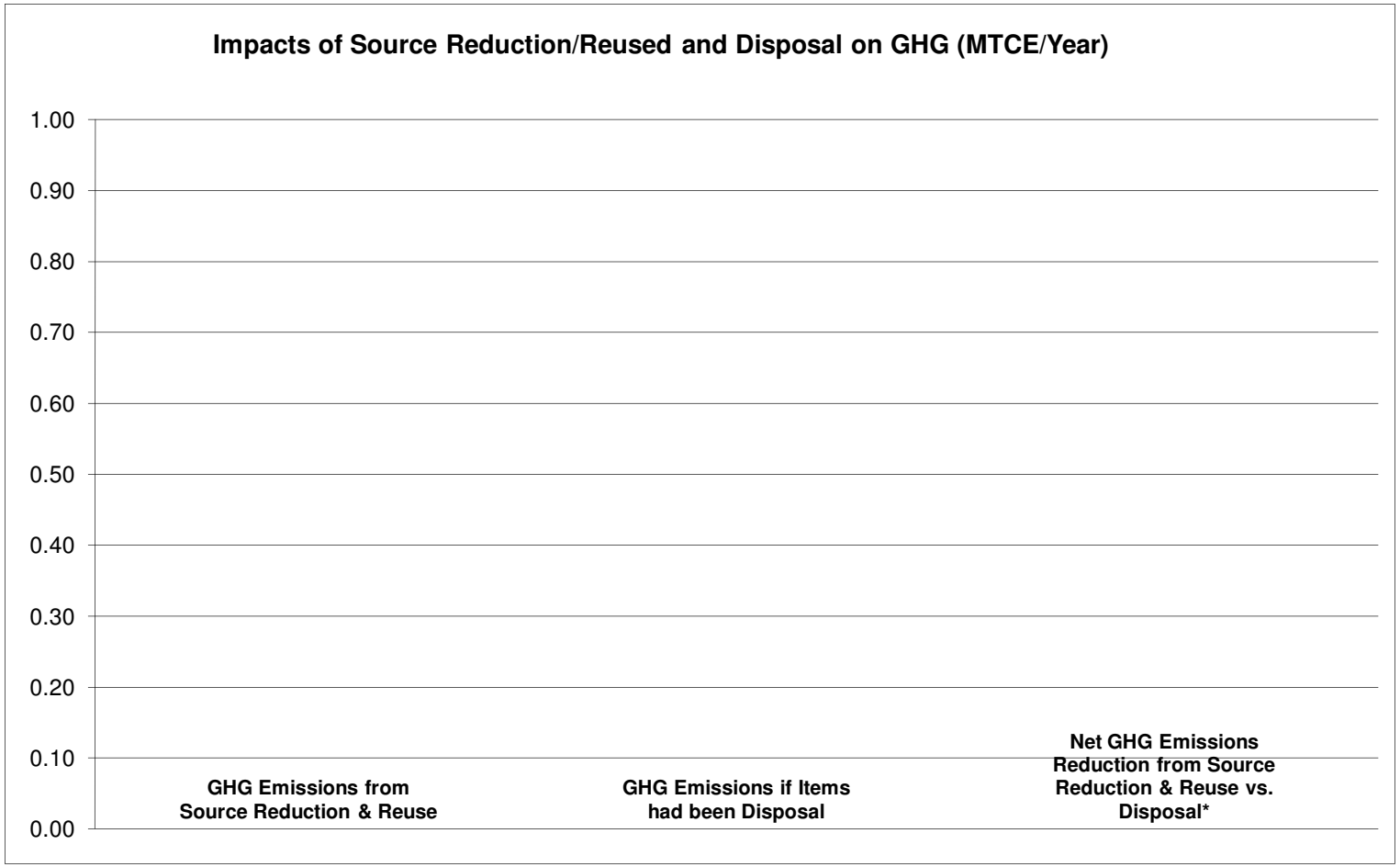
Reporting Year	Tons Source Reduced/ Reused 2009	Greenhouse Gas Emissions from Source Reduction and Reuse (MTCE)[1]	Greenhouse Gas Emissions if Items Had Been Disposed (MTCE)	Net Greenhouse Gas Emissions from Source Reduction and Reuse as Compared to Disposal (MTCE)
Aluminum Cans	0.00	0.00	0.00	0.00
Steel Cans	0.00	0.00	0.00	0.00
Glass	0.00	0.00	0.00	0.00
HDPE	0.00	0.00	0.00	0.00
LDPE	0.00	0.00	0.00	0.00
PET	0.00	0.00	0.00	0.00
Corrugated Cardboard	0.00	0.00	0.00	0.00
Magazines/Third-class Mail	0.00	0.00	0.00	0.00
Newspaper	0.00	0.00	0.00	0.00
Office Paper	0.00	0.00	0.00	0.00
Phonebooks	0.00	0.00	0.00	0.00
Textbooks	0.00	0.00	0.00	0.00
Whole Computers	0.00	0.00	0.00	0.00
Ferrous Scrap Metal	0.00	0.00	0.00	0.00
Aluminum Scrap Metal	0.00	0.00	0.00	0.00
Copper Wire	0.00	0.00	0.00	0.00
Tires	0.00	0.00	0.00	0.00
Construction & Demolition	0.00	NA	NA	NA
Carpet	0.00	0.00	0.00	0.00
Dimensional Lumber	0.00	0.00	0.00	0.00
Medium-density Fiberboard	0.00	0.00	0.00	0.00
Clay Bricks	0.00	0.00	0.00	0.00
Aggregate	0.00	NA	NA	NA
Fly Ash	0.00	NA	NA	NA
Mixed Paper, Broad Definition	0.00	NA	NA	NA
Mixed Metals	0.00	NA	NA	NA
Mixed Plastics	0.00	NA	NA	NA
Mixed Recyclables	0.00	NA	NA	NA
Other Recyclables	0.00	NA	NA	NA
Total as a Result of Source Reduction and Reuse	**0.00**	**0.00**	**0.00**	**0.00**

[1] MTCE is an abbreviation for Metric Tons of Carbon Equivalent. There is movement to use CO2 Equivalents (MTCO2) instead of Carbon Equivalents (MTCE), however EPA generally uses MTCE. To convert, multiply MTCE by 44/12 to receive MTCO2.

Sources:

1. U.S. EPA. "WARM Online, Version 9." (September 2008). September 08 http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_Form.html
2. U.S. EPA. "Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks. 3rd edition." Sept. 2006 http://www.epa.gov/climatechange/wycd/waste/SWMGHGreport.html.

Chart 2. Reductions in Greenhouse Gas Emissions as a Result of Source Reduction and Reuse



*A negative value for disposal may be due to the following factors: 1) avoided greenhouse gas emissions at electric utilities due to energy production at landfills (using recovered methane) or waste incineration facilities; and/or 2) long-term storage of carbon in landfills.

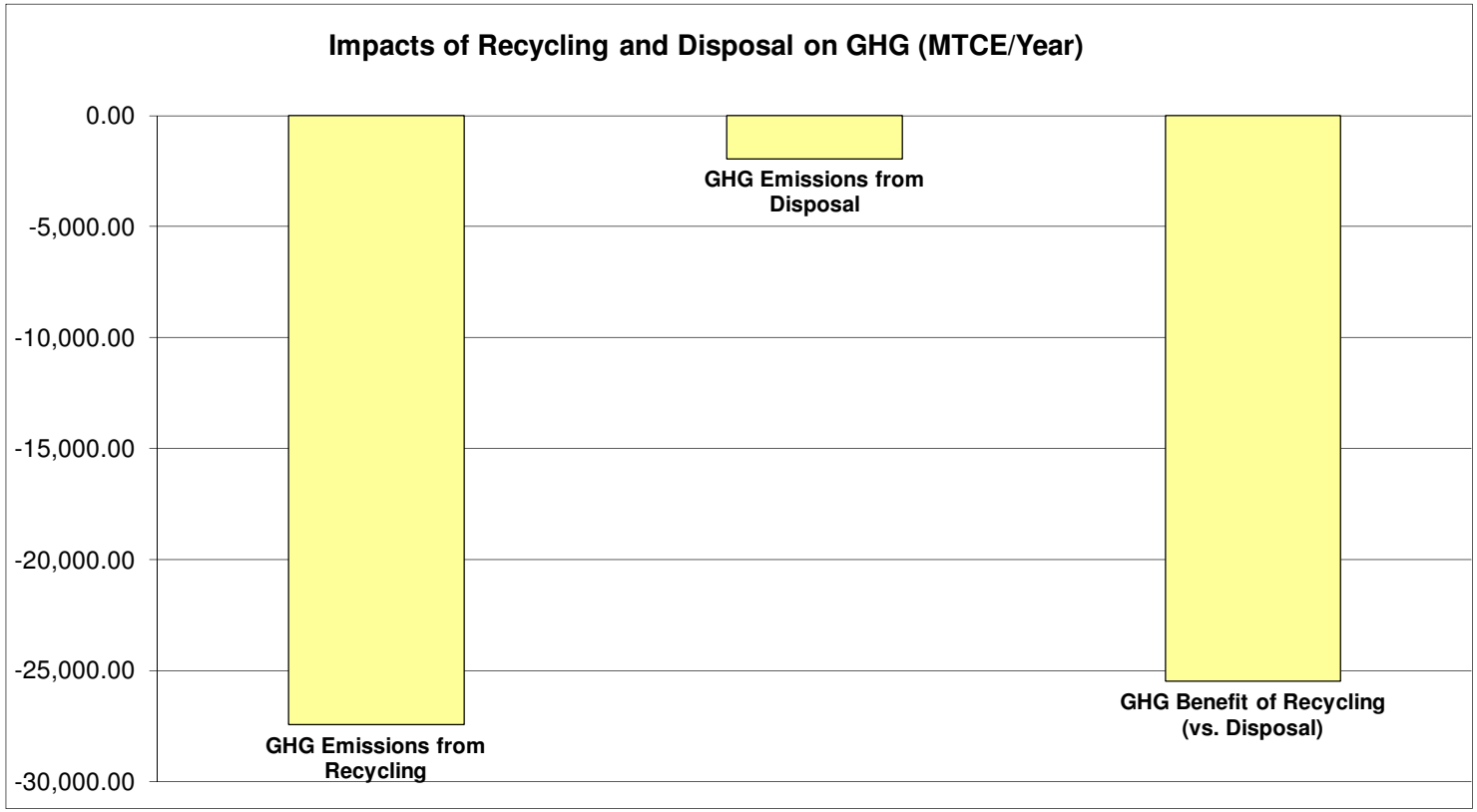
Table 3. Reductions in Greenhouse Gas Emissions as a Result of Recycling

Reporting Year	Tons Recycled 2009	Greenhouse Gas Emissions from Recycling (MTCE)	Greenhouse Gas Emissions if Recyclables Had Been Disposed (MTCE)	Net Greenhouse Gas Emissions from Recycling as Compared to Disposal (MTCE)
Aluminum Cans	238.50	-889.22	2.50	-891.72
Steel Cans	11,839.30	-5,799.91	123.96	-5,923.86
Glass	2,978.70	-226.52	31.19	-257.70
HDPE	0.00	0.00	0.00	0.00
LDPE	0.00	0.00	0.00	0.00
PET	1,607.10	-679.79	16.83	-696.62
Corrugated Cardboard	15,157.00	-12,859.49	1,374.41	-14,233.90
Magazines/Third-class Mail	1,902.30	-1,593.02	-170.29	-1,422.73
Newspaper	3,444.90	-2,629.23	-838.08	-1,791.16
Office Paper	1,470.10	-1,143.04	707.48	-1,850.52
Phonebooks	0.00	0.00	0.00	0.00
Textbooks	0.00	0.00	0.00	0.00
Whole Computers	0.00	0.00	0.00	0.00
Food Scraps	1,299.70	-70.23	241.03	-311.26
Yard Trimmings	7,103.50	-383.85	-667.56	283.70
Grass	0.00	0.00	0.00	0.00
Leaves	0.00	0.00	0.00	0.00
Branches	19,522.30	-1,054.93	-2,782.13	1,727.20
Ferrous Scrap Metal	0.00	0.00	0.00	0.00
Aluminum Scrap Metal	0.00	0.00	0.00	0.00
Copper Wire	0.00	0.00	0.00	0.00
Tires	245.40	-123.08	2.57	-125.65
Construction & Demolition	0.00	NA	NA	NA
Carpet	0.00	0.00	0.00	0.00
Dimensional Lumber	0.00	0.00	0.00	0.00
Medium-density Fiberboard	0.00	0.00	0.00	0.00
Clay Bricks	0.00	NA	NA	NA
Aggregate	0.00	0.00	0.00	0.00
Fly Ash	0.00	0.00	0.00	0.00
Mixed Paper, Broad Definition	0.00	0.00	0.00	0.00
Mixed Metals	0.00	0.00	0.00	0.00
Mixed Plastics	0.00	0.00	0.00	0.00
Mixed Recyclables	0.00	0.00	0.00	0.00
Mixed Organics	0.00	0.00	0.00	0.00
Other Recyclables	706.20	NA	NA	NA
Total as a Result of Recycling	**67,515.00**	**-27,452.32**	**-1,958.10**	**-25,494.21**
Total as a Result of Source Reduction, Reuse & Recycling	**67,515**	**-27,452**	**-1,958**	**-25,494**

Sources:
Table 2: Reductions in Greenhouse Gas Emissions as a Result of Source Reduction and Reuse

1. U.S. EPA. "WARM Online, Version 9." (September 2008). September 08 http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_Form.html.
2. U.S. EPA. "Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks. 3rd edition." Sept. 2006

Chart 3. Reductions in Greenhouse Gas Emissions as a Result of Recycling



*A negative value for disposal may be due to the following factors: 1) avoided greenhouse gas emissions at electric utilities due to energy production at landfills (using recovered methane) or waste incineration facilities; and/or 2) long-term storage of carbon in landfills.

Table 4. Greenhouse Gas Savings Comparisons

	Annual Emissions (MTCE)	Percent of Total Emissions	Source Reduction, Reuse and Recycling Emission Reductions as a Percent of Emissions
MAJOR GHG EMISSION SOURCES			
Reporting Year	**2001**		
Industry	367,200,000.00	19.75	0.01
Utility	606,000,000.00	32.59	0.00
Waste	39,872,727.27	2.14	0.06
Transportation	527,154,545.45	28.35	0.00
Other	319,418,181.82	17.18	0.01
Total	**1,859,645,454.55**	**100.00**	**0.00**
MAJOR CO_2 EMISSION SECTORS FROM FOSSIL FUEL COMBUSTION			
Reporting Year	**2007**		
Commercial	3,310,909.09	4.43	0.77
Industrial	12,553,636.36	16.78	0.20
Residential	5,948,181.82	7.95	0.43
Transportation	19,489,090.91	26.05	0.13
Utility	33,504,545.45	44.79	0.08
Total	**74,806,363.64**	**100.00**	**0.03**

Sources:

1. Table 2. Reductions in Greenhouse Gas Emissions as a Result of Source Reduction and Reuse
2. Table 3. Reductions in Greenhouse Gas Emissions as a Result of Recycling
3. World Resources Institute. "Climate Analysis Indicators Tool http://cait.wri.org/
4. U.S. EPA. "Energy CO2 Inventories." (2006). 1 Sept. 06 http://epa.gov/climatechange/emissions/state_energyco2inv.html

Table 5. Energy Savings as a Result of Source Reduction and Reuse

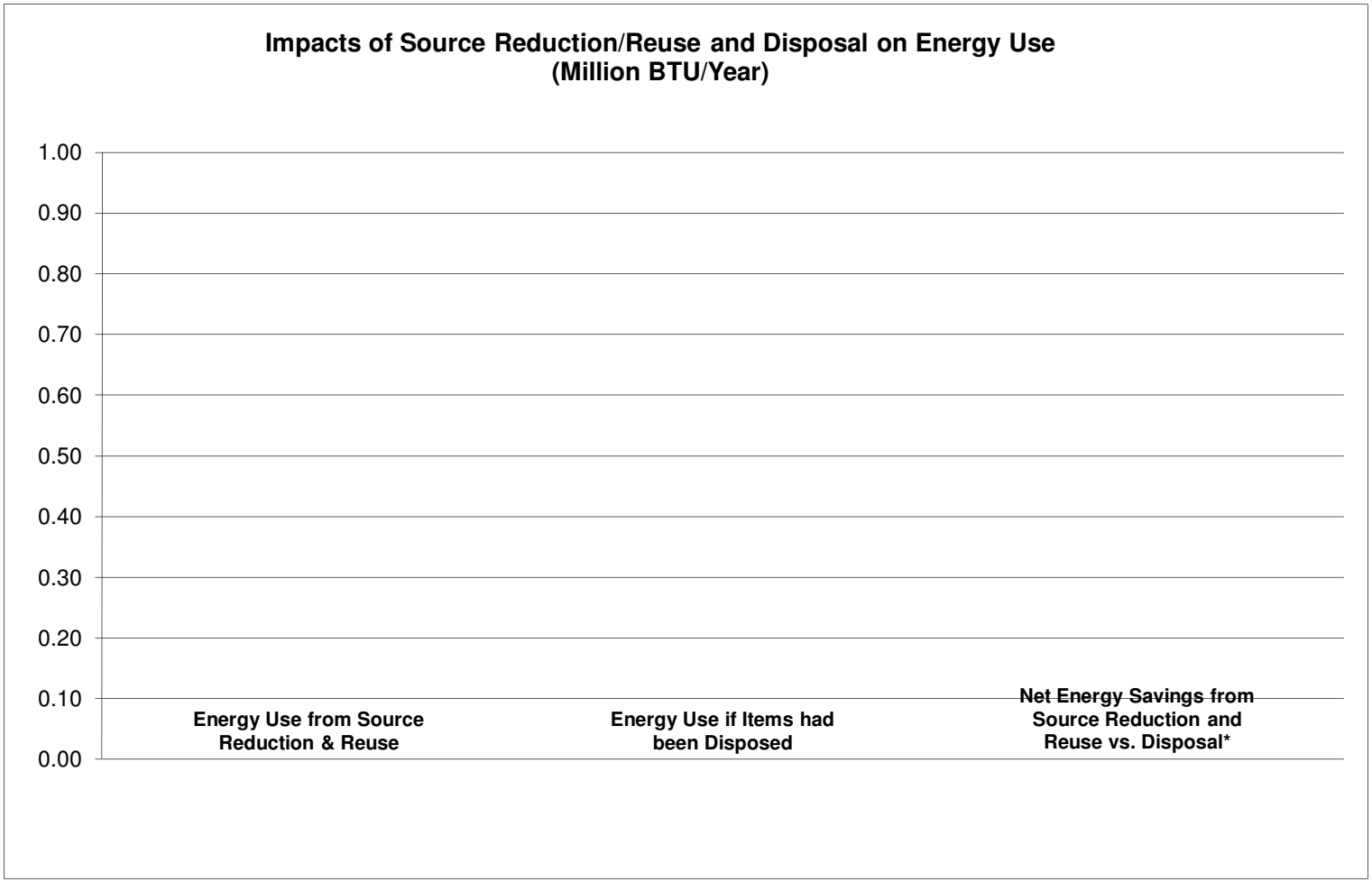
Note: Negative numbers denote energy savings.

Reporting Year	Tons Source Reduced/ Reused 2009	Energy Use if Source Reduced and Reused (Million BTUs)	Energy Use if Items Had Been Disposed (Million BTUs)	Net Energy Consumption from Source Reduction and Reuse as Compared to Disposal (Million BTUs)	Oil Saved (Barrels)	Gas Saved (Gallons)	Reduction of "Average" Passenger Cars on the Road/Year	Reduction of Car Emissions (CO_2 Tons/Year)	Energy Savings in Per "Average" Household (No. of Houses/Year)
Aluminum Cans	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Steel Cans	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Glass	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDPE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LDPE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PET	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Corrugated Cardboard	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Magazines/Third-class Mail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Newspaper	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Office Paper	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Phonebooks	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Textbooks	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Whole Computers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferrous Scrap Metal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aluminum Scrap Metal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Copper Wire	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tires	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Construction & Demolition	0.00	NA	NA	NA	NA	NA	NA	NA	NA
Carpet	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dimensional Lumber	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Medium-density Fiberboard	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Clay Bricks	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aggregate	0.00	NA	NA	NA	NA	NA	NA	NA	NA
Fly Ash	0.00	NA	NA	NA	NA	NA	NA	NA	NA
Mixed Paper, Broad Definition	0.00	NA	NA	NA	NA	NA	NA	NA	NA
Mixed Metals	0.00	NA	NA	NA	NA	NA	NA	NA	NA
Mixed Plastics	0.00	NA	NA	NA	NA	NA	NA	NA	NA
Mixed Recyclables	0.00	NA	NA	NA	NA	NA	NA	NA	NA
Other Recyclables	0.00	NA	NA	NA	NA	NA	NA	NA	NA
Total as a Result of Source Reduction & Reuse	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Sources:

1. U.S. EPA. "WARM Online, Version 9." (September 2008) http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_Form.html
2. U.S. EPA. "Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks. 3rd edition." Sept. 2006 http://www.epa.gov/climatechange/wycd/waste/SWMGHGreport.html
3. U.S. Department of Energy. Office of Energy Efficiency and Renewable Energy. "2008 Buildings Energy Databook: 2.1.4 Residential Delivered and Primary Energy Consumption Intensities, by Year." (2008). 15 Dec 08 http://buildingsdatabook.eren.doe.gov/TableV
4. Federal Highway Administration (FHWA). "Table VM-1: Annual Vehicle Distance Traveled in Miles and Related Data- 2004". (2006) 1 Sept 06 http://www.fhwa.dot.gov/policy/ohim/hs04/pdf/vm1.pdf
5. Energy Information Administration (EIA). "Annual Energy Review 2005: Table A3: Approximate Heat Content of Petroleum Consumption, Selected Years, 1949-2005." (2006). 1 Sept 06 http://www.eia.doe.gov/emeu/aer/pdf/pages/sec13_3.pdf
6. Another source: Energy Information Administration (EIA). "Annual Energy Review 2005: Table A2: Approximate Heat Content of Petroleum Production, Imports, and Exports, Selected Years, 1949-2005." (2006). 1 Sept 06 http://www.eia.doe.gov/emeu/aer/pdf/pages/sec13_2.pdf
7. U.S. Climate Technology Cooperation Gateway. "Greenhouse Gas Equivalencies Calculator." 18 Jan 06 http://www.epa.gov/cleanenergy/energy-resources/refs.html#vehicles

Chart 5. Energy Savings as a Result of Source Reduction and Reuse



*A negative value for disposal is due to avoided energy use for electricity generation resulting from energy production at landfills (using recovered methane) and/or waste

Table 6. Energy Savings as a Result of Recycling

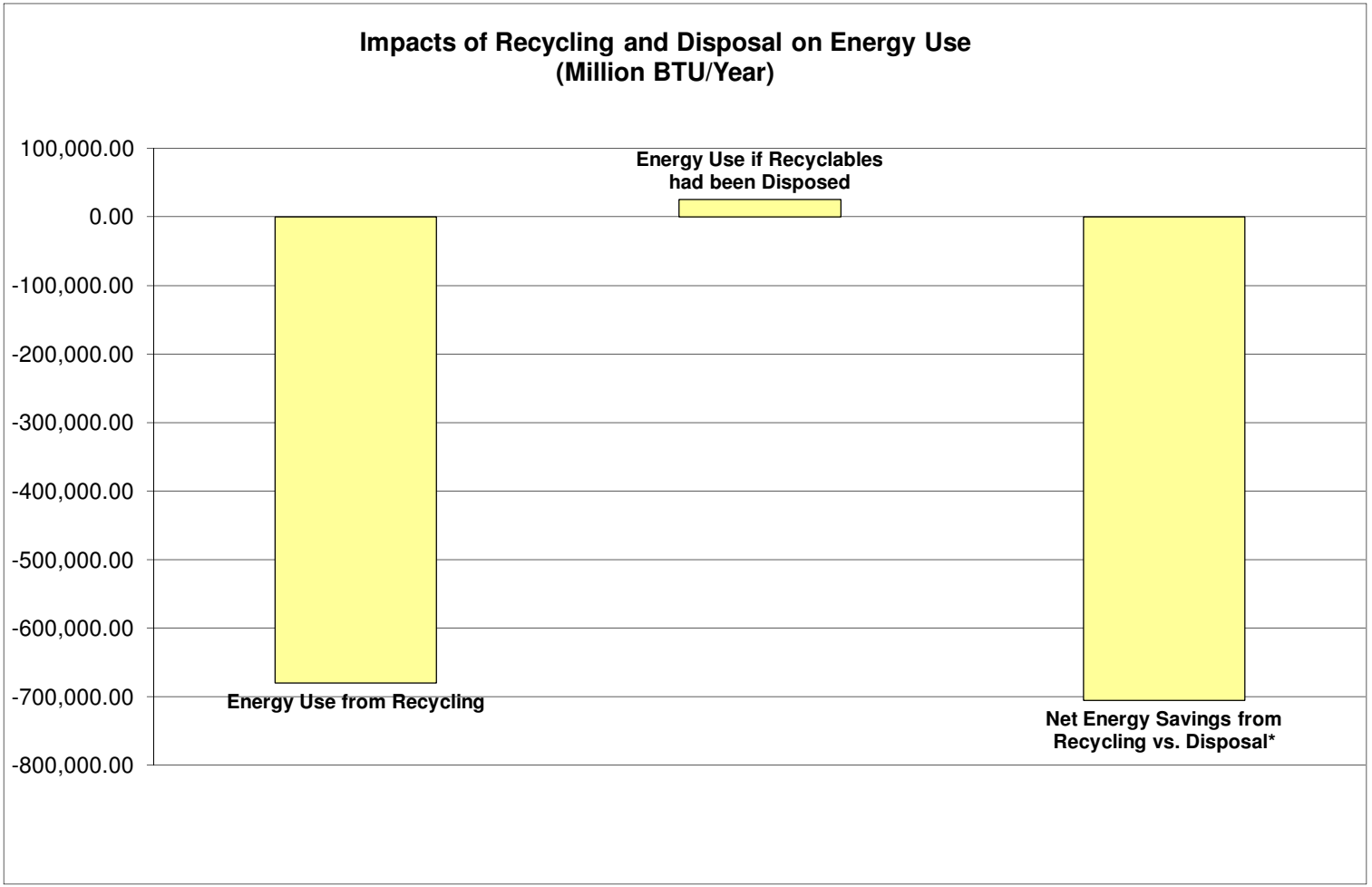
Note: Negative numbers denote energy savings.

Reporting Year	Tons Recycled 2009	Energy Use if All Recycled (Million BTUs)	Energy Use if Recyclables Had Been Disposed (Million BTUs)	Net Energy Consumption from Recycling as Compared to Disposal (Million BTUs)	Oil Saved (Barrels)	Gas Saved (Gallons)	Reduction of "Average" Passenger Cars on the Road/Year	Reduction of Car Emissions (CO_2 Tons/Year)	Energy Savings in Per "Average" Household (No. of Houses/Year)
Aluminum Cans	238.50	-49,231.17	125.78	-49,356.95	-8,509.82	-397,277.14	-713.24	-3,894.31	-482.47
Steel Cans	11,839.30	-236,430.82	6,244.05	-242,674.87	-41,840.49	-1,953,304.80	-3,506.83	-19,147.30	-2,372.19
Glass	2,978.70	-6,344.63	1,570.97	-7,915.60	-1,364.76	-63,713.13	-114.39	-624.55	-77.38
HDPE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LDPE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PET	1,607.10	-84,903.09	847.58	-85,750.68	-14,784.60	-690,212.43	-1,239.16	-6,765.82	-838.23
Corrugated Cardboard	15,157.00	-233,720.94	3,467.93	-237,188.87	-40,894.63	-1,909,147.67	-3,427.55	-18,714.45	-2,318.56
Magazines/Third-class Mail	1,902.30	-1,312.59	773.92	-2,086.51	-359.74	-16,794.41	-30.15	-164.63	-20.40
Newspaper	3,444.90	-56,806.40	1,451.20	-58,257.60	-10,044.41	-468,919.00	-841.87	-4,596.58	-569.48
Office Paper	1,470.10	-14,818.61	33.91	-14,852.52	-2,560.78	-119,548.83	-214.63	-1,171.88	-145.19
Phonebooks	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Textbooks	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Whole Computers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Food Scraps	1,299.70	753.83	434.49	319.34	55.06	2,570.37	4.61	25.20	3.12
Yard Trimmings	7,103.50	4,120.03	3,007.52	1,112.51	191.81	8,954.66	16.08	87.78	10.87
Grass	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Leaves	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Branches	19,522.30	11,322.93	7,283.77	4,039.17	696.41	32,511.51	58.37	318.69	39.48
Ferrous Scrap Metal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aluminum Scrap Metal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Copper Wire	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tires	245.40	-12,750.98	129.42	-12,880.41	-2,220.76	-103,675.19	-186.13	-1,016.28	-125.91
Construction & Demolition	0.00	NA	NA	NA	NA	NA	NA	NA	NA
Carpet	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dimensional Lumber	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Medium-density Fiberboard	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Clay Bricks	0.00	NA	NA	NA	NA	NA	NA	NA	NA
Aggregate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fly Ash	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixed Paper, Broad Definition	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixed Metals	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixed Plastics	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixed Recyclables	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixed Organics	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Recyclables	706.20	NA	NA	NA	NA	NA	NA	NA	NA
Total as a Result of Recycling	**67,515.00**	**-680,122.45**	**25,370.54**	**-705,492.99**	**-121,636.72**	**-5,678,556.05**	**-10,194.89**	**-55,664.12**	**-6,896.31**
Totals as a Result of Source Reduction, Reuse & Recycling				**-705,492.99**	**-121,636.72**	**-5,678,556.05**	**-10,194.89**	**-55,664.12**	**-6,896.31**

Sources:

1. U.S. EPA. "WARM Online, Version 9." (September 2008). September 08 http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_Form.html
2. U.S. EPA. "Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks. 3rd edition." Sept. 2006 http://www.epa.gov/climatechange/wycd/waste/SWMGHGreport.html
3. Table 5. Energy Savings as a Result of Source Reduction and Reuse
   U.S. Department of Energy. Office of Energy Efficiency and Renewable Energy. "2008 Buildings Energy Databook: 2.1.4 Residential Delivered and Primary Energy Consumption Intensities, by Year." (2008). 15 Dec 08 http://buildingsdatabook.eren.doe.gov/TableV
4. Federal Highway Administration (FHWA). "Table VM-1: Annual Vehicle Distance Traveled in Miles and Related Data- 2004". (2006) 1 Sept 06 http://www.fhwa.dot.gov/policy/ohim/hs04/pdf/vm1.pdf
5. Energy Information Administration (EIA). "Annual Energy Review 2005: Table A3: Approximate Heat Content of Petroleum Consumption, Selected Years, 1949-2005." (2006). 1 Sept 06 http://www.eia.doe.gov/emeu/aer/pdf/pages/sec13_3.pdf
6. Another source: Energy Information Administration (EIA). "Annual Energy Review 2005: Table A2: Approximate Heat Content of Petroleum Production, Imports, and Exports, Selected Years, 1949-2005." (2006). 1 Sept 06 http://www.eia.doe.gov/emeu/aer/pdf/pages/sec13_2.pdf
7. U.S. Climate Technology Cooperation Gateway. "Greenhouse Gas Equivalencies Calculator." 18 Jan 06 http://www.epa.gov/cleanenergy/energy-resources/refs.html#vehicles

Chart 6a. Energy Savings as a Result of Recycling



*A negative value for disposal is due to avoided energy use for electricity generation resulting from energy production at landfills (using recovered methane) and/or waste

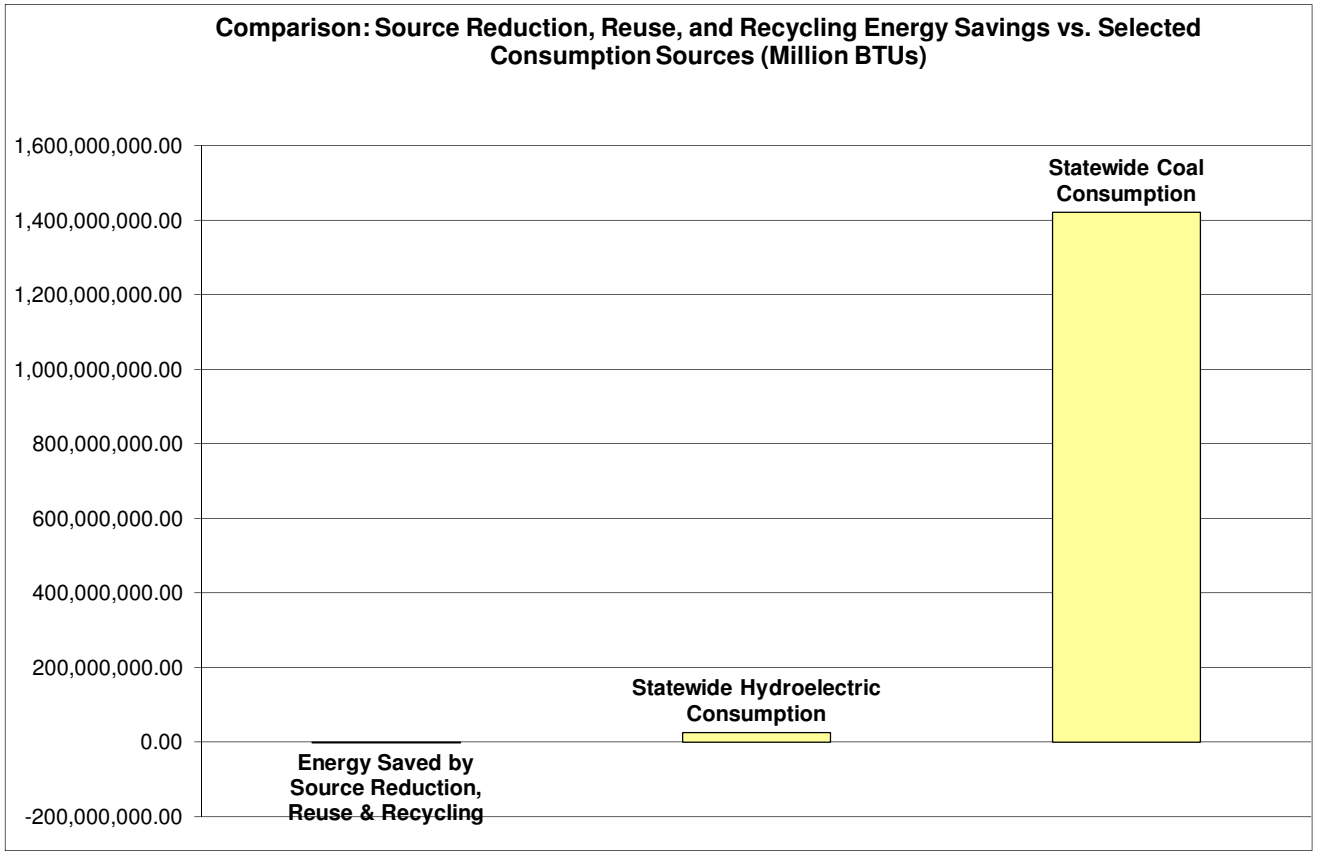
Table 7. Energy Savings Comparisons

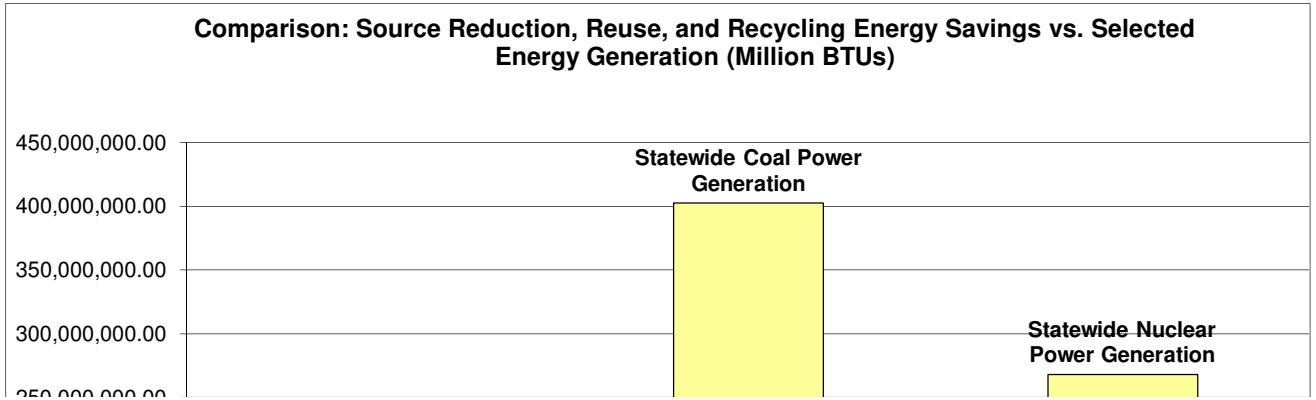
	CONSUMPTION COMPARISONS		EXPENDITURE COMPARISONS		GENERATION COMPARISONS	
	Statewide Consumption (Million BTUs)	Source Reduction, Reuse and Recycling Energy Savings as a Percentage of Each Sector & Source Consumption	Statewide Expenditures (Million Nominal Dollars)	Value of Source Reduction, Reuse and Recycling Energy Savings (Million Nominal Dollars)	Statewide Energy Generation by Source (Million BTUs)	Source Reduction, Reuse and Recycling Energy Savings as a Percent of Each Generation Source
ENERGY SECTOR						
Reporting Year	**2008**		**2008**			
Residential	941,100,000.00	0.07	12,697.40	951.86		
Commercial	706,000,000.00	0.10	7,435.50	743.02		
Industrial	1,255,800,000.00	0.06	10,435.20	586.24		
Transportation	996,800,000.00	0.07	24,963.20	1,766.79		
Total Consumption	3,546,300,000.00	0.02	55,531.30	1,104.73		
ENERGY SOURCE						
Reporting Year	**2008**				**2008**	
Petroleum	1,346,800,000.00	0.05				
Natural Gas	778,300,000.00	0.09				
Coal	1,421,100,000.00	0.05			402,788,941.98	0.18
Hydroelectric	25,100,000.00	2.81				
Nuclear	822,200,000.00	0.09			268,272,491.47	0.26
Total	4,393,500,000.00	0.02			760,409,556.31	0.09
OTHER COMPARISONS						
Million BTUs Per Household	197.01	(Based on the number of households reported in 2000)				

Sources:

1. Table 5. Energy Savings as a Result of Source Reduction and Reuse
2. Table 6. Energy Savings as a Result of Recycling
3. U.S. Energy Information Administration (EIA). "State Energy Consumption, Price, and Expenditure Estimates (SEDS)." (2006). 1 Sept 06 http://www.eia.doe.gov/emeu/states/_seds.html
4. U.S. Department of Commerce. "State and Metropolitan Area Data Book: 2006." 21 Aug 08.Scroll down in "Contents" to "Tables." Select the PDF file for "States." Click on the bookmark for "Natural Resources, Energy, and Utilities." Scroll to Table A-55, Electric Industry (p. 76). http://www.census.gov/prod/www/abs/smadb.htm
5. U.S. Census Bureau. "State and County QuickFacts." (2000). 21 Dec 05 http://quickfacts.census.gov/qfd/

Chart 7. Energy Savings Comparisons





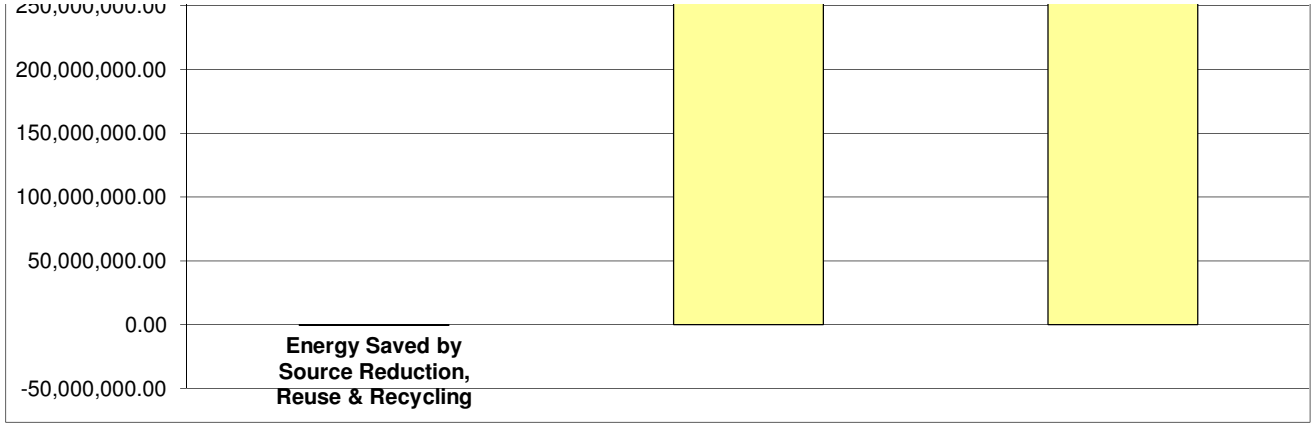

250,000,000.00
200,000,000.00
150,000,000.00
100,000,000.00
50,000,000.00
0.00
-50,000,000.00
Energy Saved by Source Reduction, Reuse & Recycling

Table 8. Reductions in Greenhouse Gas Emissions as of a Result of Recycling Items in a Typical Curbside Set-Out Container

Note: This data is based on an average mix of recyclables in a set-out container or blue bin. This could be placed at curbside or dropped off at a Recycling Center or Transfer Station.

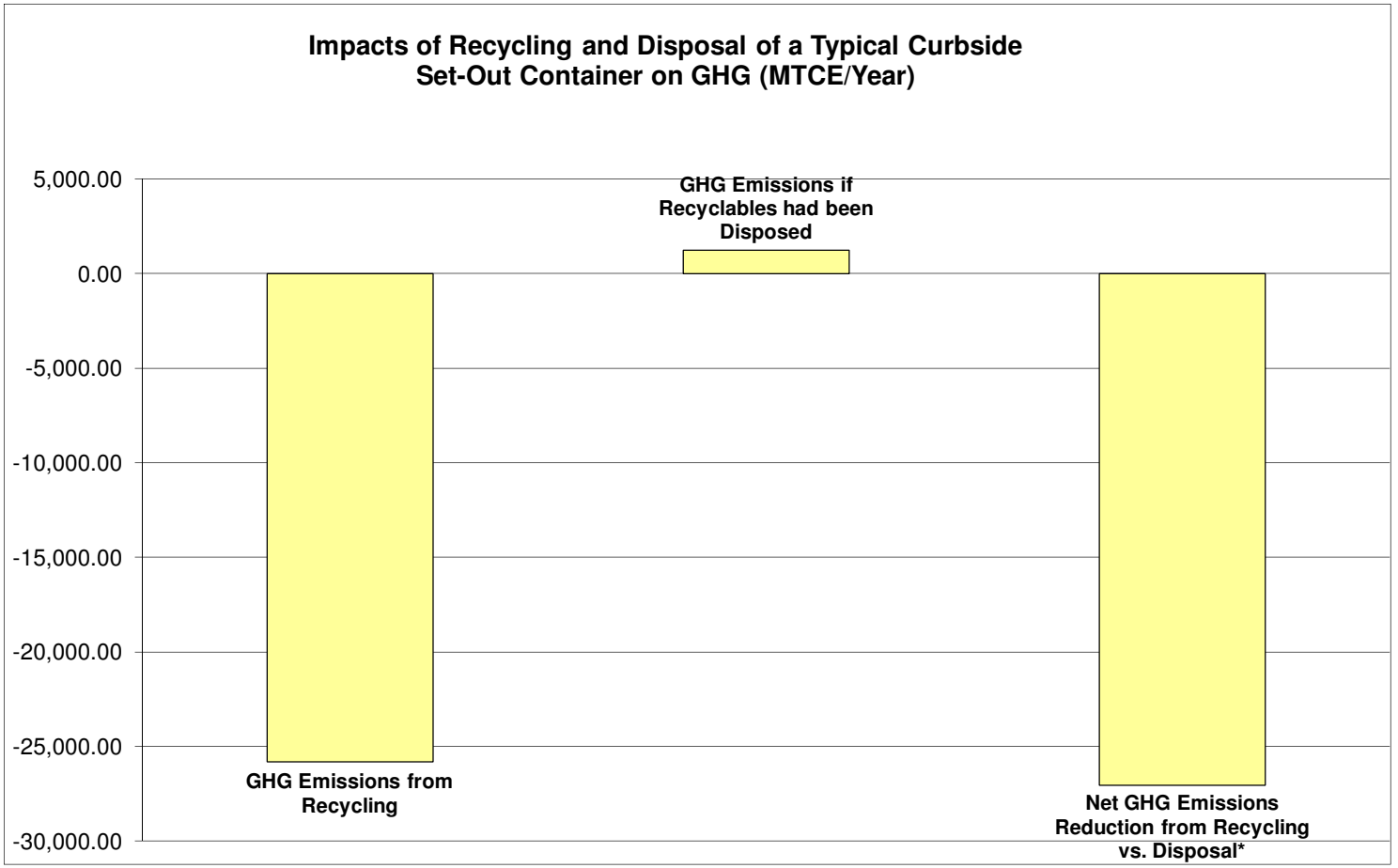
Reporting Year	Tons Recycled 2009	Greenhouse Gas Emissions from Recycling (MTCE)	Greenhouse Gas Emissions if Recyclables Had Been Disposed (MTCE)	Net Greenhouse Gas Emissions from Recycling as Compared to Disposal (MTCE)
Aluminum Cans	238.50	-889.22	2.50	-891.72
Steel Cans	11,839.30	-5,799.91	123.96	-5,923.86
Glass	2,978.70	-226.52	31.19	-257.70
HDPE	0.00	0.00	0.00	0.00
LDPE	0.00	0.00	0.00	0.00
PET	1,607.10	-679.79	16.83	-696.62
Corrugated Cardboard	15,157.00	-12,859.49	1,374.41	-14,233.90
Magazines/Third-class Mail	1,902.30	-1,593.02	-170.29	-1,422.73
Newspaper	3,444.90	-2,629.23	-838.08	-1,791.16
Office Paper	1,470.10	-1,143.04	707.48	-1,850.52
Phonebooks	0.00	0.00	0.00	0.00
Textbooks	0.00	0.00	0.00	0.00
Mixed Paper, Broad Definition	0.00	0.00	0.00	0.00
Mixed Plastics	0.00	0.00	0.00	0.00
Mixed Recyclables	0.00	0.00	0.00	0.00
Total	**38,637.90**	**-25,820.23**	**1,247.99**	**-27,068.21**

Sources:

1. U.S. EPA. "Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks. 3rd edition." Sept. 2006 http://www.epa.gov/climatechange/wycd/waste/SWMGHGreport.html

2. U.S. EPA. "WARM Online, Version 9." (September 2008). September 08 http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_Form.html

Chart 8. Reductions in Greenhouse Gas Emissions as of a Result of Recycling Items in a Typical Curbside Set-Out Container



*A negative value for disposal may be due to the following factors: 1) avoided greenhouse gas emissions at electric utilities due to energy production at landfills (using recovered methane) or waste incineration facilities; and/or 2) long-term storage of carbon in landfills.

Table 9. Energy Savings as of a Result of Recycling Items in a Typical Curbside Set-Out Container

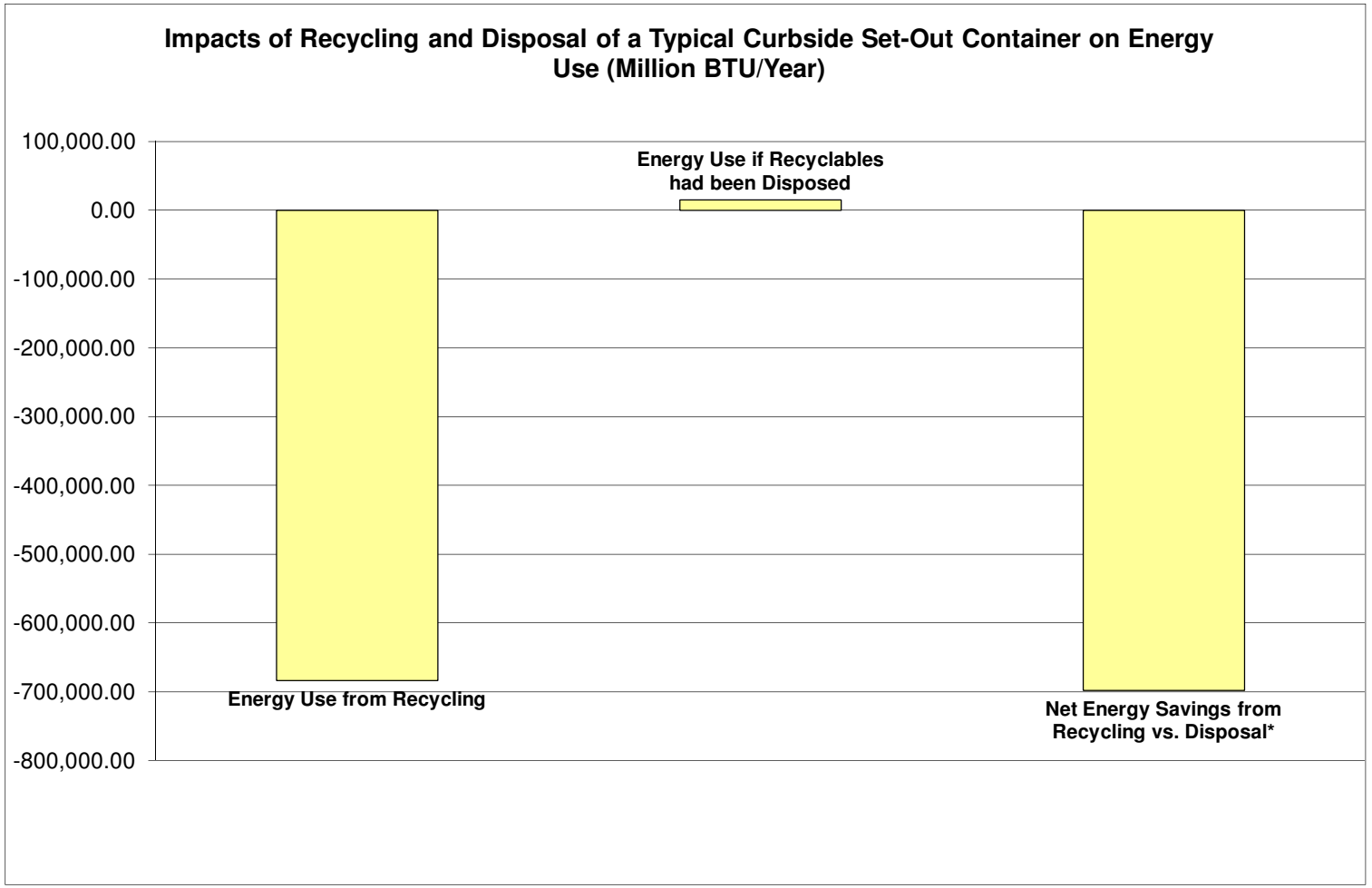
Note: Negative numbers denote energy savings.
Note: This data is based on an average mix of recyclables in a set-out container or blue bin. This could be placed at curbside or dropped off at a Recycling Center or Transfer Station.

Reporting Year	Tons Recycled 2009	Energy Use if All Recycled (Million BTUs)	Energy Use if Recyclables Had Been Disposed (Million BTUs)	Net Energy Consumption from Recycling as Compared to Disposal (Million BTUs)	Oil Saved (Barrels)	Gas Saved (Gallons)	Reduction of "Average" Passenger Cars on the Road/Year	Reduction of Car Emissions (CO_2 Tons/Year)
Aluminum Cans	238.50	-49,231.17	125.78	-49,356.95	-8,509.82	-397,277.14	-713.24	-3,894.31
Steel Cans	11,839.30	-236,430.82	6,244.05	-242,674.87	-41,840.49	-1,953,304.80	-3,506.83	-19,147.30
Glass	2,978.70	-6,344.63	1,570.97	-7,915.60	-1,364.76	-63,713.13	-114.39	-624.55
HDPE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LDPE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PET	1,607.10	-84,903.09	847.58	-85,750.68	-14,784.60	-690,212.43	-1,239.16	-6,765.82
Corrugated Cardboard	15,157.00	-233,720.94	3,467.93	-237,188.87	-40,894.63	-1,909,147.67	-3,427.55	-18,714.45
Magazines/Third-class Mail	1,902.30	-1,312.59	773.92	-2,086.51	-359.74	-16,794.41	-30.15	-164.63
Newspaper	3,444.90	-56,806.40	1,451.20	-58,257.60	-10,044.41	-468,919.00	-841.87	-4,596.58
Office Paper	1,470.10	-14,818.61	33.91	-14,852.52	-2,560.78	-119,548.83	-214.63	-1,171.88
Phonebooks	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Textbooks	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixed Paper, Broad Definition	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixed Plastics	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixed Recyclables	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**38,637.90**	**-683,568.25**	**14,515.34**	**-698,083.59**	**-120,359.24**	**-5,618,917.39**	**-10,087.82**	**-55,079.51**

Sources:

1. U.S. EPA. "WARM Online, Version 9." (September 2008). September 08 http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_Form.html
2. U.S. EPA. "Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks. 3rd edition." Sept. 2006 http://www.epa.gov/climatechange/wycd/waste/SWMGHGreport.html
3. Federal Highway Administration (FHWA). "Table VM-1: Annual Vehicle Distance Traveled in Miles and Related Data- 2004". (2006) 1 Sept 06 http://www.fhwa.dot.gov/policy/ohim/hs04/pdf/vm1.pdf
4. Energy Information Administration (EIA). "Annual Energy Review 2005: Table A3: Approximate Heat Content of Petroleum Consumption, Selected Years, 1949-2005." (2006). 1 Sept 06 http://www.eia.doe.gov/emeu/aer/pdf/pages/sec13_3.pdf
5. Another source: Energy Information Administration (EIA). "Annual Energy Review 2005: Table A2: Approximate Heat Content of Petroleum Production, Imports, and Exports, Selected Years, 1949-2005." (2006). 1 Sept 06 http://www.eia.doe.gov/emeu/aer/pdf/pages/sec13_2.pdf
6. U.S. Climate Technology Cooperation Gateway. "Greenhouse Gas Equivalencies Calculator." 18 Jan 06 http://www.epa.gov/cleanenergy/energy-resources/refs.html#vehicles

Chart 9. Energy Savings as of a Result of Recycling Items in a Typical Curbside Set-Out Container



*A negative value for disposal is due to avoided energy use for electricity generation resulting from energy production at landfills (using recovered methane) and/or waste incineration facilities.

Table 10: Energy Savings from Computer Source Reduction and Reuse

Note: Negative numbers denote energy savings.
To calculate oil saved in gallons: multiply oil saved in barrels by 42.

Reporting Year	Tons Source Reduced/ Reused 2009	Energy Use if Source Reduced and Reused (Million BTUs)	Energy Use if Items Had Been Disposed (Million BTUs)	Net Energy Consumption from Source Reduction and Reuse as Compared to Disposal (Million BTUs)	Oil Saved (Barrels)	Gas Saved (Gallons)	Reduction of "Average" Passenger Cars on the Road/Year	Reduction of Car Emissions (CO_2 Tons/Year)
Reused Whole Computers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Sources:

1. U.S. EPA. "WARM Online, Version 9." (September 2008). September 08 http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_Form.html
2. U.S. EPA. "Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks. 3rd edition." Sept. 2006 http://www.epa.gov/climatechange/wycd/waste/SWMGHGreport.html
3. Federal Highway Administration (FHWA). "Table VM-1: Annual Vehicle Distance Traveled in Miles and Related Data- 2004". (2006) 1 Sept 06 http://www.fhwa.dot.gov/policy/ohim/hs04/pdf/vm1.pdf
4. Energy Information Administration (EIA). "Annual Energy Review 2005: Table A3: Approximate Heat Content of Petroleum Consumption, Selected Years, 1949-2005." (2006). 1 Sept 06 http://www.eia.doe.gov/emeu/aer/pdf/pages/sec13_3.pdf
5. Another source: Energy Information Administration (EIA). "Annual Energy Review 2005: Table A2: Approximate Heat Content of Petroleum Production, Imports, and Exports, Selected Years, 1949-2005." (2006). 1 Sept 06 http://www.eia.doe.gov/emeu/aer/pdf/pages/sec13_2.pdf
6. U.S. Climate Technology Cooperation Gateway. "Greenhouse Gas Equivalencies Calculator." 18 Jan 06 http://www.epa.gov/cleanenergy/energy-resources/refs.html#vehicles

Table 11: Energy Savings from Computer Recycling

Note: Negative numbers denote energy savings.
To calculate oil saved in gallons: multiply oil saved in barrels by 42.

Reporting Year	Tons Recycled 2009	Energy Use if All Recycled (Million BTUs)	Energy Use if Recyclables Had Been Disposed (Million BTUs)	Net Energy Consumption from Recycling as Compared to Disposal (Million BTUs)	Oil Saved (Barrels)	Gas Saved (Gallons)	Reduction of "Average" Passenger Cars on the Road/Year	Reduction of Car Emissions (CO_2 Tons/Year)
Recycled Whole Computers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Sources:

1. U.S. EPA. "WARM Online, Version 9." (September 2008). September 08 http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_Form.html
2. U.S. EPA. "Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment http://www.epa.gov/climatechange/wycd/waste/SWMGHGreport.html
3. Federal Highway Administration (FHWA). "Table VM-1: Annual Vehicle Distance Traveled in Miles and Related Data- 2004". (2006) 1 Sept 06 http://www.fhwa.dot.gov/policy/ohim/hs04/pdf/vm1.pdf
4. Energy Information Administration (EIA). "Annual Energy Review 2005: Table A3: Approximate Heat Content of Petroleum Consumption, Selected Years, 1949-2005." (2006). http://www.eia.doe.gov/emeu/aer/pdf/pages/sec13_3.pdf
5. Another source: Energy Information Administration (EIA). "Annual Energy Review 2005: Table A2: Approximate Heat Content of Petroleum Production, Imports, and Exports, Selected Years, 1949-2005." (2006). 1 Sept 06 http://www.eia.doe.gov/emeu/aer/pdf/pages/sec13_2.pdf
6. U.S. Climate Technology Cooperation Gateway. "Greenhouse Gas Equivalencies http://www.epa.gov/cleanenergy/energy-resources/refs.html#vehicles

Table 12. Natural Resource Savings as a Result of Steel Source Reduction and Reuse

Reporting Year	Tons Source Reduced/ Reused 2009	Limestone Saved Through Source Reduction and Reuse (Tons)	Iron Ore Saved Through Source Reduction and Reuse (Tons)	Coal Saved Through Source Reduction and Reuse (Tons)	Total Resources Saved Through Source Reduction and Reuse (Tons)
Ferrous Steel	0.00	0.00	0.00	0.00	0.00

Sources:

1. Steel Recycling Institute. "Fact Sheet: What are other benefits of steel recycling?" 18 Jan 2006 http://www.recycle-steel.org/PDFs/brochures/buyrec.pdf
2. Personal communication with Steel Recycling Institute. January 2006.

Table 13. Natural Resource Savings as a Result of Steel & Glass Recycling

Reporting Year	Tons Recycled 2009	Limestone Saved Through Recycling (Tons)	Iron Ore Saved Through Recycling (Tons)	Coal Saved Through Recycling (Tons)	Sand Saved Through Recycling (Tons)	Soda Ash Saved Through Recycling (Tons)	Feldspar Saved Through Recycling (Tons)	Total Resources Saved Through Recycling (Tons)
Ferrous Steel	11,839.30	710.36	14,799.13	8,287.51				23,796.99
Glass	2,978.70	565.95			1,936.16	610.63	238.30	3,351.04
Total	**14,818.00**	**1,276.31**	**14,799.13**	**8,287.51**	**1,936.16**	**610.63**	**238.30**	**27,148.03**

Sources:

1. Steel Recycling Institute. "Fact Sheet: What are other benefits of steel recycling?" 18 Jan 2006 http://www.recycle-steel.org/PDFs/brochures/buyrec.pdf
2. Personal communication with Steel Recycling Institute. January 2006.
3. Glass Packaging Institute. "Glass Recycling and the Environment" (2005). 14 Aug 2006 http://www.gpi.org/recycle-glass/environment/

Table 14: Number of Tree Saplings Grown for 10 Years that Sequester the Same Amount of Carbon as 1 Ton of Recycled Paper

Reporting Year	Tons Recycled 2009	Number of Tree Seedlings Grown for 10 Years
Newspaper & Phone Books	3,444.90	179,134.80
Office Paper, Textbooks, Magazines, Cardboard	18,529.40	1,445,293.20
Total	21,974.30	1,624,428.00

Sources:

1. U.S. Climate Technology Cooperation Gateway. "Greenhouse Gas Equivalencies Calculator." 18 Jan 06 http://www.epa.gov/cleanenergy/energy-resources/refs.html#seedlings
2. U.S. EPA. "WARM Online, Version 9." (September 2008). September 08 http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_Form.html
3. U.S. EPA. "Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks. 3rd edition." Sept. 2006 http://www.epa.gov/climatechange/wycd/waste/SWMGHGreport.html

Table 15. Landfill Space Saved as a Result of Paper Recycling

Reporting Year	Tons Recycled 2009	Landfill Space Saved (Cubic Yards)
Paper	21,974.30	72,515.19

Sources:

US EPA, Common Waste and Materials - Paper Recycling. Accessed January 30, 2009.

Estimating the Environmental Benefits of Source Reduction, Reuse and Recycling

Updated by Northeast Recycling Council, Inc. (NERC) and Abt Associates, Inc.

Worksheet 3. Conversion Factors

Table 1. Greenhouse Gas Emissions from MSW Management Options

Note: When users indicate that they are "recycling" materials like yard trimmings, food scraps, mixed organics, etc, U.S. EPA calculates the benefit of composting these materials.

Material	Net Greenhouse Gas Emissions from MSW Management Options (MTCE/Ton)				
	Source Reduction/ Reuse	Recycling	Composting	Combustion	Landfilling
Aluminum Cans	-2.26	-3.73	NA	0.02	0.01
Steel Cans	-0.87	-0.49	NA	-0.42	0.01
Copper Wire	-2.02	-1.36	NA	0.02	0.01
Aluminum Scrap Metal	-2.26	-3.73	NA	0.02	0.01
Ferrous Scrap Metal	-0.87	-0.49	NA	-0.42	0.01
Glass	-0.16	-0.08	NA	0.01	0.01
HDPE	-0.49	-0.38	NA	0.25	0.01
LDPE	-0.62	-0.47	NA	0.25	0.01
PET	-0.58	-0.42	NA	0.29	0.01
Corrugated Cardboard	-1.53	-0.85	NA	-0.18	0.09
Magazines/Third-class Mail	-2.36	-0.84	NA	-0.13	-0.09
Newspaper	-1.33	-0.76	NA	-0.20	-0.24
Office Paper	-2.18	-0.78	NA	-0.17	0.48
Phonebooks	-1.73	-0.73	NA	-0.20	-0.24
Textbooks	-2.50	-0.85	NA	-0.17	0.48
Dimensional Lumber	-0.55	-0.67	NA	-0.21	-0.14
Medium-density Fiberboard	-0.61	-0.67	NA	-0.21	-0.14
Food Scraps	NA	NA	-0.05	-0.05	0.19
Yard Trimmings	NA	NA	-0.05	-0.06	-0.09
Grass	NA	NA	-0.05	-0.06	0.04
Leaves	NA	NA	-0.05	-0.06	-0.16
Branches	NA	NA	-0.05	-0.06	-0.14
Mixed Paper, Broad Definition	NA	-0.96	NA	-0.18	0.07
Mixed Paper, Resid.	NA	-0.96	NA	-0.18	0.05
Mixed Paper, Office	NA	-0.93	NA	-0.16	0.10
Mixed Metals	NA	-1.43	NA	-0.29	0.01
Mixed Plastics	NA	-0.42	NA	0.27	0.01
Mixed Recyclables	NA	-0.79	NA	-0.16	0.02
Mixed Organics	NA	NA	-0.05	-0.06	0.04
Carpet	-1.10	-1.97	NA	0.10	0.01
Whole Computers	-15.26	-0.62	NA	-0.06	0.01
Clay Bricks	-0.08	NA	NA	NA	0.01
Aggregate	NA	0.00	NA	NA	0.01
Fly Ash	NA	-0.24	NA	NA	0.01
Tires	-1.09	-0.50	NA	0.02	0.01

Sources: U.S. EPA. "WARM Online, Version 9." (September 2008). September 08 http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_Form.html.
U.S. EPA. "Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks. 3rd edition." Sept. 2006 http://www.epa.gov/climatechange/wycd/waste/SWMGHGreport.html.

Table 2. Net Energy Consumed from Various MSW Management Options

Note: When users indicate that they are "recycling" materials like yard trimmings, food scraps, mixed organics, etc, U.S. EPA calculates the benefit of composting these materials.

	Net Energy Consumed from Source Reduction and MSW Management Options (Assuming Initial Production Using the Current Mix of Virgin and Recycled Inputs) (Million BTU/Ton)					
Material	**Source Reduction/ Reuse**	**Recycling**	**Composting**	**Combustion**	**Landfilling**	
Aluminum Cans	-126.18	-206.42	NA	0.67	0.53	
Steel Cans	-30.79	-19.97	NA	-17.08	0.53	
Copper Wire	-122.31	-82.59	NA	0.60	0.53	
Aluminum Scrap Metal	-126.18	-206.42	NA	0.67	0.53	
Ferrous Scrap Metal	-30.79	-19.97	NA	-17.08	0.53	
Glass	-7.53	-2.13	NA	0.56	0.53	
HDPE	-63.68	-50.90	NA	-20.44	0.53	
LDPE	-73.92	-56.01	NA	-20.44	0.53	
PET	-70.67	-52.83	NA	-10.47	0.53	
Corrugated Cardboard	-21.91	-15.42	NA	-7.52	0.23	
Magazines/Third-class Mail	-33.21	-0.69	NA	-5.54	0.41	
Newspaper	-36.45	-16.49	NA	-8.52	0.42	
Office Paper	-36.58	-10.08	NA	-7.25	0.02	
Phonebooks	-39.87	-11.42	NA	-8.52	0.42	
Textbooks	-35.30	-0.53	NA	-7.25	0.02	
Dimensional Lumber	-3.53	0.59	NA	-8.91	0.37	
Medium-density Fiberboard	-11.51	0.86	NA	-8.91	0.37	
Food Scraps	NA	NA	0.58	-2.33	0.33	
Yard Trimmings	NA	NA	0.58	-2.81	0.42	
Grass	NA	NA	0.58	-2.81	0.43	
Leaves	NA	NA	0.58	-2.81	0.45	
Branches	NA	NA	0.58	-2.81	0.37	
Mixed Paper, Broad Definition	NA	-22.94	NA	-7.55	0.25	broad mixed = 24% Onp, 48% OCC, 20% OP & 8% coated paper
Mixed Paper, Residential	NA	-22.94	NA	-7.51	0.26	residential mixed = 23% ONP, 53% OCC,14% OP & 10% coated paper
Mixed Paper, Office	NA	-13.95	NA	-6.91	0.26	mixed office = 21% ONP, 5% OCC, 38% OP & 36% coated paper.
Mixed Metals	NA	-80.87	NA	0.57	0.53	
Mixed Plastics	NA	-52.51	NA	-16.13	0.53	
Mixed Recyclables	NA	-16.66	NA	-7.55	0.31	
Mixed Organics	NA	NA	0.58	-2.44	0.38	
Carpet	-91.06	-105.58	NA	-14.87	0.53	
Whole Computers	-956.74	-43.44	NA	-5.85	0.53	
Clay Bricks	-5.13	NA	NA	NA	0.53	
Aggregate	NA	-0.11	NA	NA	0.53	
Fly Ash	NA	-4.77	NA	NA	0.53	
Tires	-88.17	-51.96	NA	-15.15	0.53	

Sources: U.S. EPA. "WARM Online, Version 9." (September 2008). September 08
http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_Form.html.
U.S. EPA. "Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks. 3rd edition." Sep 2006
http://www.epa.gov/climatechange/wycd/waste/SWMGHGreport.html.

Table 3. Miscellaneous Energy Conversion Factors

Conversion Type	Value	Unit	Sources
Household			
Energy use for an "average" household for one year	102.30	Million BTU/Year	U.S. Department of Energy. Office of Energy Efficiency and Renewable Energy. "2008 Buildings Energy Databook: 2.1.4 Residential Delivered and Primary Energy Consumption Intensities, by Year." (2008). 15 Dec 08 http://buildingsdatabook.eren.doe.gov/TableV
Vehicle			
Energy use for an "average" passenger car for one year	69.20	Million BTU/Year	Calculated using fuel use for an "average" passenger car for one year in gallons and energy content of gasoline in million BTU/gallon.
Fuel use for an "average" passenger car for one year	557.00	Gallons/Year	Federal Highway Administration (FHWA). "Table VM-1: Annual Vehicle Distance Traveled in Miles and Related Data-2004". (2006) 1 Sept 06 http://www.fhwa.dot.gov/policy/ohim/hs04/pdf/vm1.pdf.
Energy content of gasoline	5.22	Million BTU/Barrel	Energy Information Administration (EIA). "Annual Energy Review 2005: Table A3: Approximate Heat Content of Petroleum Consumption, Selected Years, 1949-2005." (2006). 1 Sept 06 http://www.eia.doe.gov/emeu/aer/pdf/pages/sec13_3.pdf.
Energy content of gasoline	42.00	Gallons/ Barrel	Basic conversion
Energy content of gasoline	0.12	Million BTU/Gallon	Calculated by dividing the energy content of gasoline in million BTU/barrel by the energy content of gasoline in gallons/barrel.
Energy content of oil	5.80	Million BTU/Barrel	U.S. EPA and ICF Consulting Group. "Waste Management and Energy Savings: Benefits by the Numbers." (2005). 18 Jan 06 http://yosemite.epa.gov/OAR/globalwarming.nsf/UniqueKeyLookup/TMAL6GDR3K/$File/Energy%20Savings.pdf. Another source: Energy Information Administration (EIA). "Annual Energy Review 2005: Table A2: Approximate Heat Content of Petroleum Production, Imports, and Exports, Selected Years, 1949-2005." (2006). 1 Sept 06 http://www.eia.doe.gov/emeu/aer/pdf/page
Energy content of oil	42.00	Gallons/Barrel	U.S. EPA and ICF Consulting Group. "Waste Management and Energy Savings: Benefits by the Numbers." (2005). 18 Jan 06 http://yosemite.epa.gov/OAR/globalwarming.nsf/UniqueKeyLookup/TMAL6GDR3K/$File/Energy%20Savings.pdf.
CO_2 Emissions per "average" car	5.46	CO_2 Tons/Vehicle/Year	U.S. Climate Technology Cooperation Gateway. "Greenhouse Gas Equivalencies Calculator." 18 Jan 06 http://www.epa.gov/cleanenergy/energy-resources/refs.html#vehicles.

Table 4. Natural Resource Conversion Factors

Ferrous Steel Conversion Factors		Glass Conversion Factors	
Material	**Pounds of Material Saved per Ton of Steel Recycled or Reused**	**Material**	**Pounds of Material Saved per Ton of Glass Recycled**
Limestone	120	Limestone	380
Iron Ore	2,500	Sand	1300
Coal	1,400	Soda Ash	410
		Feldspar	160

Sources:

Steel Recycling Institute. "Fact Sheet: What are other benefits of steel recycling?" 18 Jan 2006 http://www.recycle-steel.org/PDFs/brochures/buyrec.pdf.

Personal communication with Steel Recycling Institute. January 2006.

Glass Packaging Institute. "Glass Recycling and the Environment" (2005). 14 Aug 2006 http://www.gpi.org/recycle-glass/environment/.

Table 5. Number of Tree Saplings Grown for 10 Years that Sequester the Same Amount of Carbon as 1 Ton of Recycled Paper

Notes: These figures are determined by taking US EPA's forest carbon sequestration value (0.55 MTCE/ton for mechanically and 0.83 MTCE/ton for chemically pulped papers and divide it by a tree seedling value (0.011 MTCE per tree seedling grown for 10 years).

	Number of Tree Saplings Grown for 10 Years per Ton of Recycled Paper
Newspaper & Phone Books	52
Office Paper, Textbooks, Magazines, & Cardboard	78

Sources: U.S. Climate Technology Cooperation Gateway. "Greenhouse Gas Equivalencies Calculator." 18 Jan 06 http://www.epa.gov/cleanenergy/energy-resources/refs.html#seedlings.

U.S. EPA. "WARM Online, Version 9." (September 2008). September 08 http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_Form.html.

U.S. EPA. "Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks. 3rd edition." Sep 2006 http://www.epa.gov/climatechange/wycd/waste/SWMGHGreport.html.

Personal communication with ICF Consulting. July 2006.

Table 6. Landfill Space Saved as a Result of Paper Recycling

Item	Cubic Yards of Landfill Space Saved per Ton of Paper Recycled
Landfill Space	3.3

Sources: US EPA, Common Waste and Materials - Paper Recycling. Accessed January 30, 2009. http://www.epa.gov/epawaste/conserve/materials/paper/basics/index.htm

Table 7. Unit Conversion Factors

Conversion Type	Value	Unit	Sources
Billion kWh to Million BTU	Billion kWh multiplied by 1000		
1 metric ton	2204.60	Pounds	Personal communication with ICF Consulting. August 2003.

Table 8. Other Conversion Factors

% steel in mixed metal	0.71
% aluminum in mixed metal	0.29

Estimating the Environmental Benefits of Source Reduction, Reuse and Recycling

Updated by Northeast Recycling Council, Inc. (NERC) and Abt Associates, Inc.

Worksheet 4. Calculations Worksheet

Note: This sheet contains miscellaneous figures used in calculations and graphs elsewhere in NERC's Calculator.

Materials Management Type	Amount (Tons)
Recycled	67,515.00
Landfill	266,153.30
Incineration/ Waste-To-Energy	0.00
Total	**333,668.30**

Percentages of Disposal Options	
Percent of disposed incinerated/ waste-to-energy	0.00%
Percent of disposed landfilled	100.00%

Recycled Materials	Amount Recycled (x1,000 Tons)
Paper	21.97
Glass	2.98
Metal	12.08
Plastic	1.61
Organics	27.93
Other	0.95
Total	**67.52**

Reused Materials	Amount Source Reduced & Reused (x1,000 Tons)
Paper	0.00
Glass	0.00
Metal	0.00
Plastic	0.00
Other	0.00
Total	**0.00**

How is Waste Diverted?	Amount (Tons)
Recycled	67,515.00
Source Reduced and Reused	0.00

Total	**67,515.00**

Impacts of Source Reduction/Reuse and Disposal on GHG	**MTCE**
GHG Emissions from Source Reduction and Reuse	0.00
GHG Emissions from Disposal	0.00
GHG Benefit of Source Reduction and Reuse (vs. Disposal)	0.00

Impacts of Recycling and Disposal on GHG	**MTCE**
GHG Emissions from Recycling	-27,452.32
GHG Emissions from Disposal	-1,958.10
GHG Benefit of Recycling (vs. Disposal)	-25,494.21

Impacts of Source Reduction/Reuse and Disposal on Energy Use	**Million BTUs**
Net Energy from Source Reduction and Reuse	0.00
Net Energy from Disposal	0.00
Energy Savings Due to Source Reduction and Reuse	0.00

Impacts of Recycling and Disposal on Energy Use	**Million BTUs**
Net Energy from Recycling	-680,122.45
Net Energy from Disposal	25,370.54
Energy Savings Due to Recycling	-705,492.99

Comparison: Source Reduction, Reuse, and Recycling Energy Savings vs. Selected Consumption Sources	**Million BTUs**
Energy Saved by Source Reduction, Reuse & Recycling	-705,492.99
Statewide Hydroelectric Consumption	25,100,000.00
Statewide Coal Consumption	1,421,100,000.00

Comparison: Source Reduction, Reuse, and Recycling Energy Savings vs. Selected Generation	**Million BTUs**
Energy Saved by Source Reduction, Reuse & Recycling	-705,492.99
Statewide Coal Power Generation	402,788,941.98
Statewide Nuclear Power Generation	268,272,491.47

Impacts of Recycling and Disposal of a Typical Curbside Set-Out Container on GHG	MTCE
GHG Emissions from Recycling	-25,820.23
GHG Emissions from Disposal	1,247.99
GHG Benefit of Recycling (vs. Disposal)	-27,068.21

Impacts of Recycling and Disposal of a Typical Curbside Set-Out Container on Energy Use	Million BTUs
Net Energy from Recycling	-683,568.25
Net Energy from Disposal	14,515.34
Energy Savings Due to Recycling	-698,083.59

Area Name	Year	State	Net GHG Savings from Source Reduction, Reuse, and Recycling (MTCE)	Net GHG Savings from Recycling - CURBSIDE ONLY (MTCE)	Percent of Industrial Carbon Emissions from Fossil Fuel Combustion (%)	GHG Reductions as Percent of Total GHG Emissions (%)	Net Energy Savings from Source Reduction, Reuse and Recycling (Million BTUs)	Net Energy Savings from Recycling - CURBSIDE ONLY (Million BTUs)	Percent of Total Energy Used by Industry (%)	Gas Saved (Gallons)	Total Recycled Materials (Tons)	Recycled Steel & Glass (Tons)	Limestone Saved from Recycling Steel and Glass (Tons)	Iron Ore Saved from Recycling Steel and Glass (Tons)	Coal Saved from Recycling Steel and Glass (Tons)	Sand Saved from Recycling Steel and Glass (Tons)	Soda Ash Saved from Recycling Steel and Glass (Tons)	Feldspar Saved from Recycling Steel and Glass (Tons)	Total Recycled Paper (Tons)	Recycled Paper, not Including Mixed Paper (Tons)	Landfill Space Saved by Recycling	Number of Tree Seedlings Grown	Energy Savings in Terms of Average Households (No. of Houses/Year) Based on the average household energy consumption for (select one): ◉ National Average (DOE) ○ Regional Average (Calculated)*
5-County Region	2009	Pennsylvania	25,494.21	27,068.21	0.20	0.00	705,492.99	698,083.59	0.06	5,678,556.05	67,515.00	14,818.00	1,276.31	14,799.13	8,287.51	1,936.16	610.63	238.30	21,974.30	21,974.30	72,515.19	1,624,428.00	6,896.31

*The regional average is calculated based on user input. Values are reported in Wksht 3. Conversion Factors are provided in Table 3.