

Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2006

The U.S. Environmental Protection Agency has collected and reported data on the generation and disposal of waste in the United States for more than 30 years. We use the information to measure the success of waste reduction and recycling programs across the country and to highlight where we, as a nation, need to make environmental improvements. These facts and figures are current through calendar year 2006.

In 2006, Americans generated about 251 million tons of trash and recycled 82 million tons of materials, which is 32.5 percent. (See Figure 1 and Figure 2.) We recycled 1.5 pounds of our individual waste generation rate of 4.6 pounds per person per day.

Figure 1. MSW Generation Rates, 1960–2006

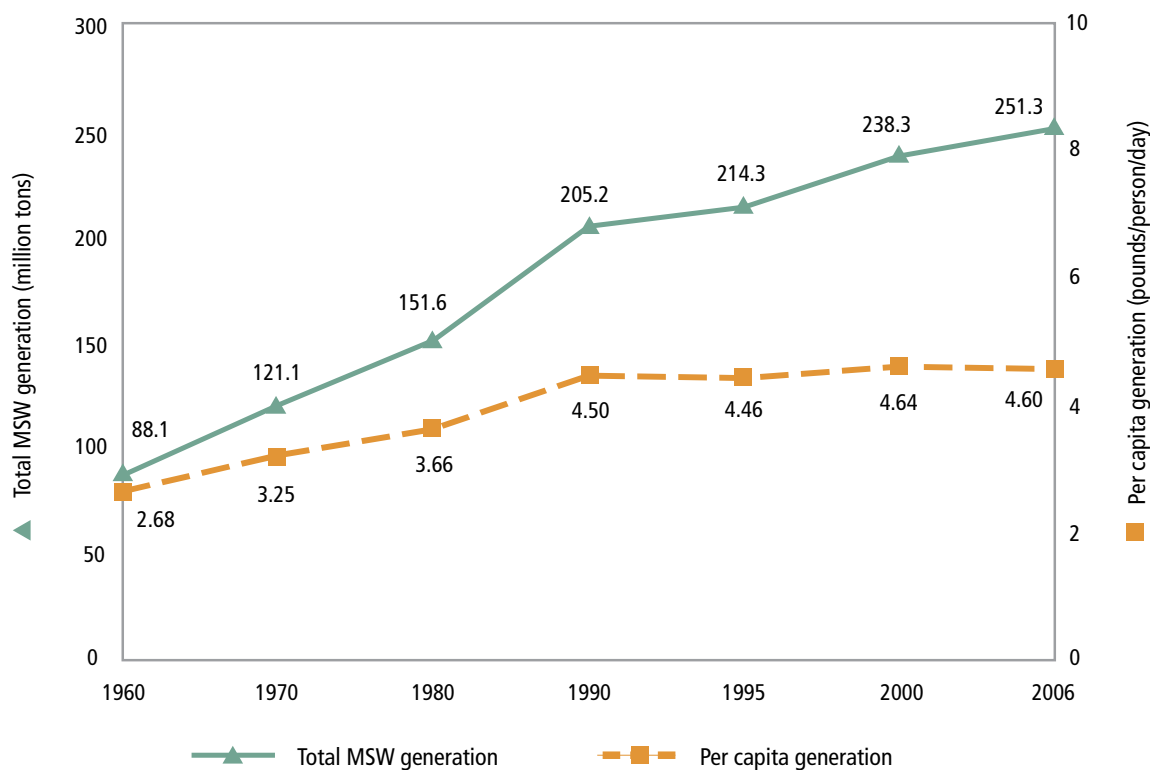
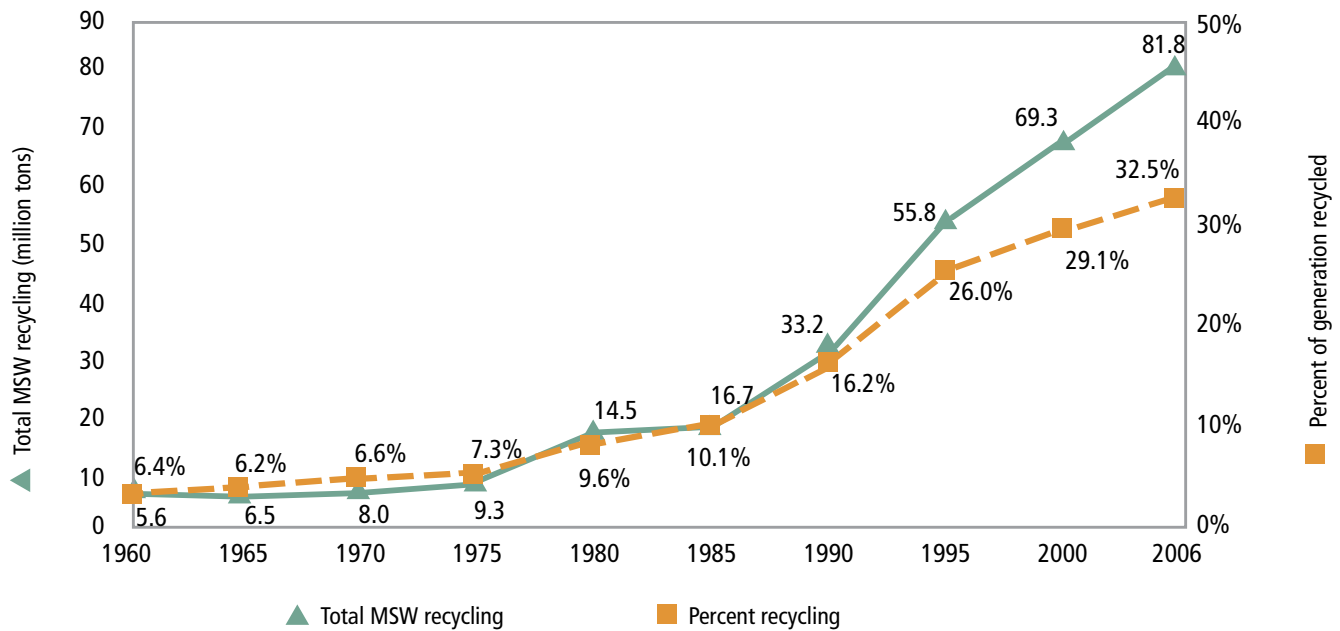


Figure 2. MSW Recycling Rates, 1960–2006



Trends in Municipal Solid Waste (MSW)

Our trash is made up of the things we commonly use and then throw away. These materials range from packaging, food scraps, and grass clippings to old sofas, computers, tires, and refrigerators. It does not include industrial, hazardous, or construction waste.

In 2006, Americans recovered 61 million tons (excluding composting) through recycling, which is 2.4 million tons more than in 2005. Composting recovered almost 21 million tons of waste. Subtracting out what we recycled, we incinerated (with energy recovery) or discarded just over 3 pounds per person per day.

In 2006, paper and paperboard recovery rose to over 50 percent (44 million tons), while metals were recycled at a rate of just over 36 percent, and 62 percent of yard trimmings were recovered. (See Figure 3.) By recycling nearly 7 million tons of metals (which includes aluminum, steel, and mixed metals), we eliminated greenhouse gas (GHG) emissions totaling close to 6.5 million metric tons of carbon equivalent (MMTCE). This is equivalent to removing more than 5 million cars from the road for one year. All benefit calculations such as these are derived from EPA's Waste Reduction Model (WARM).

More than 31 million tons (12.5 percent) of materials were combusted with energy recovery, and about 138 million tons (55 percent) were discarded in landfills. (See Figure 4.)

Recycling 82 million tons of MSW saved the energy equivalent of more than 10 billion gallons of gasoline.

Sources of MSW

We estimated residential waste (including waste from apartment houses) to be 55 percent to 65 percent of the total municipal solid waste generation. Waste from schools and commercial locations, such as hospitals and businesses, amounted to 35 to 45 percent.

Every ton of mixed paper recycled can save the energy equivalent of 185 gallons of gas.

Figure 3. Recycling Rates of Selected Materials, 2006

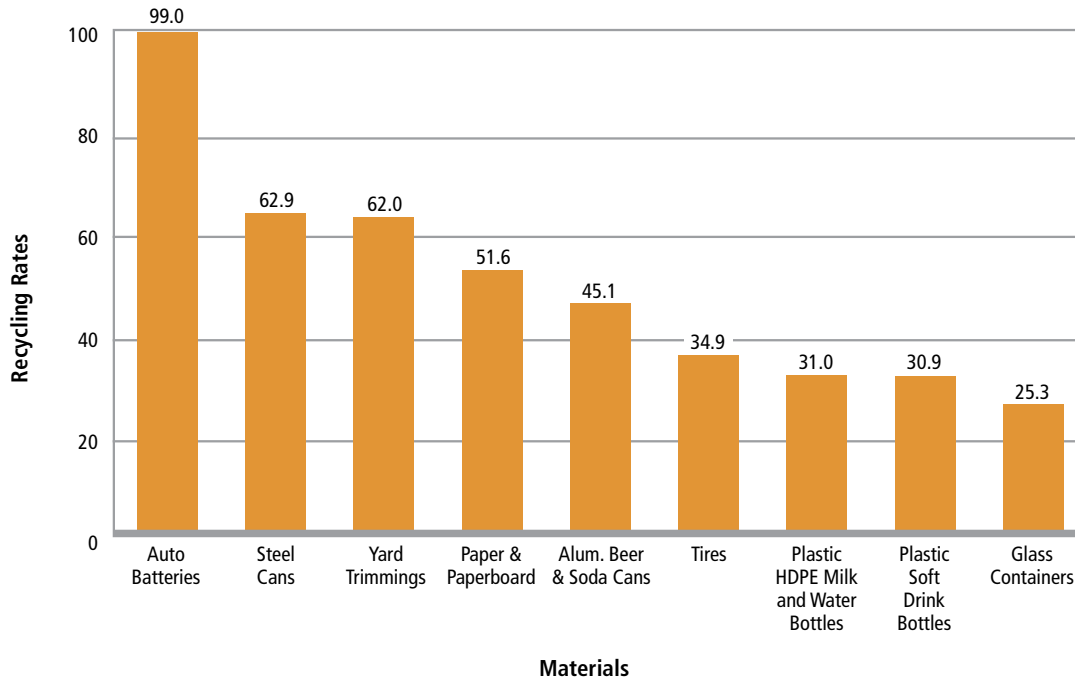
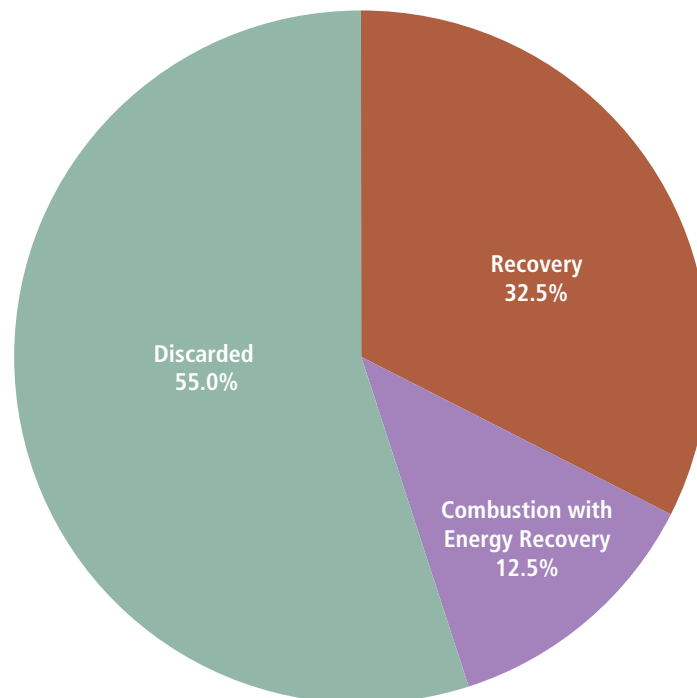


Figure 4. Management of MSW in the United States, 2006

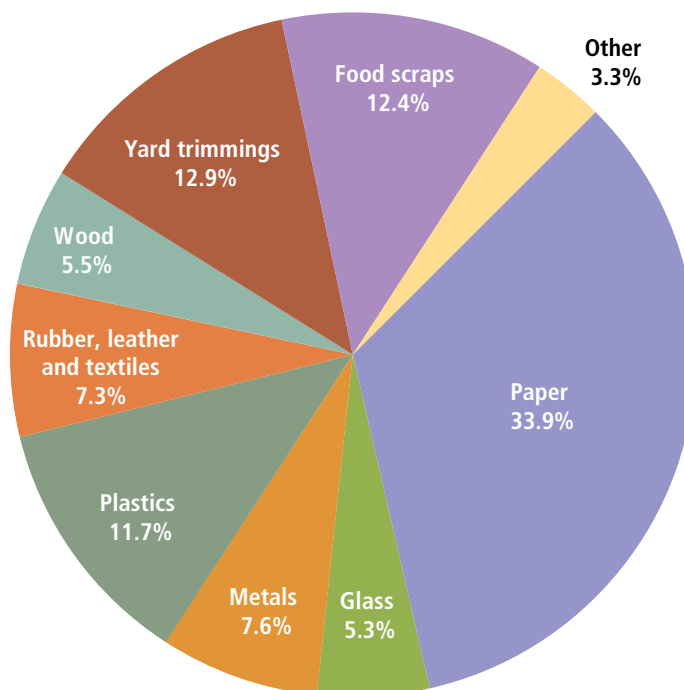


We analyze waste by material, such as paper and paperboard, yard trimmings, food scraps, and plastics, and by major product categories, which include durable goods (such as furniture), nondurable goods (such as paper or clothing), containers and packaging (such as milk cartons and plastic wrap), and other materials (such as food scraps).

Materials in MSW

Total MSW generation in 2006 was 251 million tons. Organic materials continue to be the largest component of MSW. Paper and paperboard products account for 34 percent, with yard trimmings and food scraps accounting for 25 percent. Plastics comprise 12 percent; metals make up 8 percent; and rubber, leather, and textiles account for 7 percent. Wood follows at 6 percent, and glass at 5 percent. Other miscellaneous wastes made up approximately 3 percent of the MSW generated in 2006. (See Figure 5.)

Figure 5. Total MSW Generation (by Material), 2006
251 Million Tons (Before Recycling)



Significant amounts of material from each category was recycled or composted in 2006. The highest recovery rates were achieved in yard trimmings, paper and paperboard products, and metal products. About 20 million tons of yard trimmings were composted, representing a five-fold increase since 1990. We recycled more than half the paper and paperboard we generated. Recycling these organic materials alone kept 25 percent of MSW out of landfills and combustion facilities. Recycling amounts and rates (recovery as a percent of generation) for all materials in 2006 are listed in Table 1.

Table 1. Generation and Recovery of Materials in MSW, 2006
(in millions of tons and percent of generation of each material)

Material	Weight Generated	Weight Recovered	Recovery as Percent of Generation
Paper and paperboard	85.3	44.0	51.6%
Glass	13.2	2.88	21.8%
Metals			
Steel	14.2	5.08	35.7%
Aluminum	3.26	0.69	21.2%
Other nonferrous metals*	1.65	1.18	71.5%
Total metals	19.1	6.95	36.3%
Plastics	29.5	2.04	6.9%
Rubber and leather	6.54	0.87	13.3%
Textiles	11.8	1.81	15.3%
Wood	13.9	1.31	9.4%
Other materials	4.55	1.13	24.8%
Total materials in products	184.0	61.0	33.2%
Other wastes			
Food, other**	31.3	0.68	2.2%
Yard trimmings	32.4	20.1	62.0%
Miscellaneous inorganic wastes	3.72	Negligible	Negligible
Total other wastes	67.4	20.8	30.8%
TOTAL MUNICIPAL SOLID WASTE	251.3	81.8	32.5%

Includes waste from residential, commercial, and institutional sources.

* Includes lead from lead-acid batteries.

** Includes recovery of other MSW organics for composting.

Details may not add to totals due to rounding.

Negligible = Less than 5,000 tons or 0.05 percent.

Products in MSW

The breakdown, by weight, of waste generated in 2006 by product category is shown in Figure 6. Containers and packaging made up the largest portion of waste generated, 31.7 percent or 80 million tons. The second largest portion came from nondurable goods, which amounted to 25.5 percent or 64 million tons. Durable goods make up the third largest segment, accounting for 16 percent or 40 million tons.

The generation and recovery of materials in the product categories, by weight and recovery as a percent of generation, are shown in Table 2. The table shows that the recovery of containers and packaging was the highest of the four product categories, with about 40 percent of the generated materials recycled. Steel, paper products, and aluminum were the most recycled materials by percentage in this category. More than 63 percent of steel packaging (mostly cans) was recycled. Fifty-nine percent of paper and paperboard containers and packaging was recycled, including 72 percent of all corrugated boxes. The aluminum recycling rate was 36 percent, including 45 percent of all aluminum beverage cans.

Around 25 percent of glass containers were recycled, while about 15 percent of wood packaging—mostly wood pallets—was recovered. More than 10 percent of plastic containers and packaging were recycled, mostly from soft drink, milk, and water bottles. Plastic bottles were the most recycled plastic products. Plastic milk bottles were recycled at a rate of 31 percent. Plastic HDPE, milk, and water bottles also were recovered at a rate of 31 percent.

Overall recovery of nondurable goods was nearly 34 percent in 2006. Nondurable goods generally last less than three years. Paper products, such as newspapers and high-grade office papers, were the most recycled materials. Newspapers alone were recycled at a rate of nearly 88 percent. Approximately 66 percent of high-grade office papers and 40 percent of magazines were recovered. Unwanted mail accounted for 39 percent of recovered papers, books were 26 percent, and telephone directories were 19 percent. Clothing and other textile products are included in the nondurable goods category. These products were recovered for recycling at a rate of 17 percent.

Figure 6. Total MSW Generation (by Category), 2006
251 Million Tons (Before Recycling)

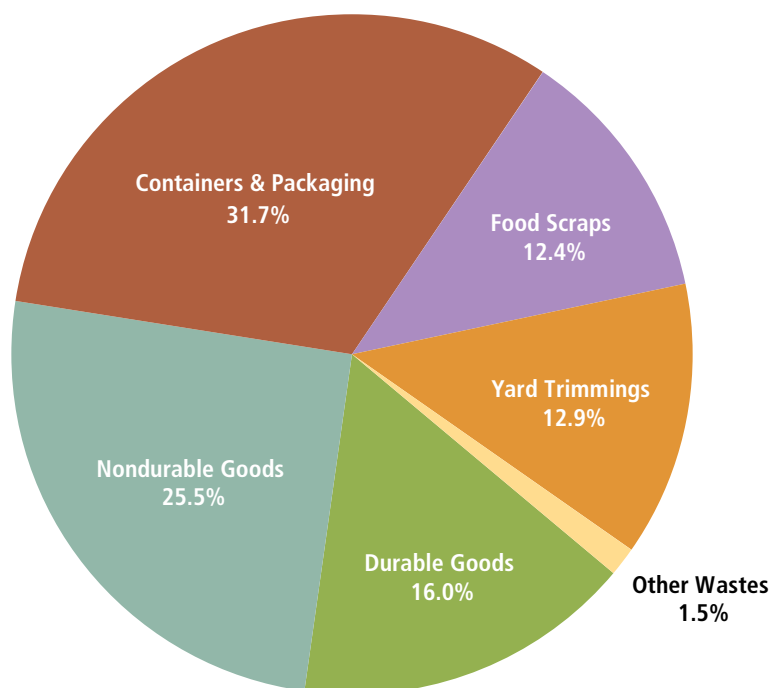


Table 2. Generation and Recovery of Materials in MSW, 2006
(in millions of tons and percent of generation of each material)

Material	Weight Generated	Weight Recovered	Recovery as Percent of Generation
Durable Goods			
Steel	11.5	3.34	29.1%
Aluminum	1.10	Negligible	Negligible
Other non-ferrous metals*	1.65	1.18	71.5%
Glass	1.81	Negligible	Negligible
Plastics	8.79	0.53	6.0%
Rubber and leather	5.44	0.87	16.0%
Wood	5.40	Negligible	Negligible
Textiles	3.11	0.38	12.2%
Other materials	1.39	1.13	81.3%
Total durable goods	40.2	7.43	18.5%
Nondurable Goods			
Paper and posterboard	44.8	20.2	45.0%
Plastics	6.47	Negligible	Negligible
Rubber and leather	1.06	Negligible	Negligible
Textiles	8.43	1.43	17.0%
Other materials	3.38	Negligible	Negligible
Total nondurable goods	64.2	21.6	33.6%
Containers and Packaging			
Steel	2.75	1.74	63.3%
Aluminum	1.94	0.69	35.6%
Glass	11.4	2.88	25.3%
Paper and paperboard	40.4	23.9	59.0%
Plastics	14.2	1.51	10.6%
Wood	8.53	1.31	15.4%
Other materials	0.34	Negligible	Negligible
Total containers and packaging	79.6	32.0	40.2%
Other wastes			
Food, other**	31.3	0.68	2.2%
Yard trimmings	32.4	20.1	62.0%
Miscellaneous inorganic wastes	3.72	Negligible	Negligible
Total other wastes	67.4	20.8	30.8%
TOTAL MUNICIPAL SOLID WASTE	251.3	81.8	32.5%

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* Includes lead from lead-acid batteries.

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Details may not add to totals due to rounding.

Negligible = Less than 5,000 tons or 0.05 percent.

Overall, more than 18 percent of durable goods were recovered in 2006. Nonferrous metals other than aluminum had one of the highest recovery rates—around 72 percent—due to the high rate of lead recovery from lead-acid batteries. With a 99 percent recycling rate, lead-acid batteries were one of the most recovered products in 2006. Recovery of steel in all durable goods was 29 percent, with high rates of recovery from appliances and other miscellaneous items.

Specific types of products with particularly high recovery rates were newspapers (about 88 percent), corrugated boxes (about 72 percent), major appliances (67 percent), steel cans (about 63 percent), and aluminum beverage cans (about 45 percent). Additionally, nearly 35 percent of rubber tires were recycled, while other tires were re-treaded or used as a fuel.

Disposing of MSW

While the number of U.S. landfills has steadily declined over the years, the average landfill size has increased. (See Figure 7.) At the national level, landfill capacity appears to be sufficient, although it is limited in some areas.

- Since 1990, the total volume of MSW going to landfills dropped by 4 million tons, from 142.3 million to 138.2 million tons in 2006. (See Table 3.)
- The net per capita discard rate (after recycling, composting, and combustion for energy recovery) was 2.53 pounds per person per day, similar to the 2.55 per capita rate in 2004. (See Table 4.)

Recycling and Composting Collection Programs

- Approximately 8,660 curbside recycling programs exist nationwide, down from 8,875 in 2002.
- About 3,470 community composting programs are operational, an increase from 3,227 in 2002.

Source: *Biocycle Magazine* 2006

Energy Recovered from Waste Combustion

- In 2006, approximately 31.4 million tons of materials, or 12.5 percent, were combusted for energy recovery.
- MSW combustion for energy recovery has remained fairly constant since 1990.

Figure 7. Number of Landfills in the United States, 1988–2006

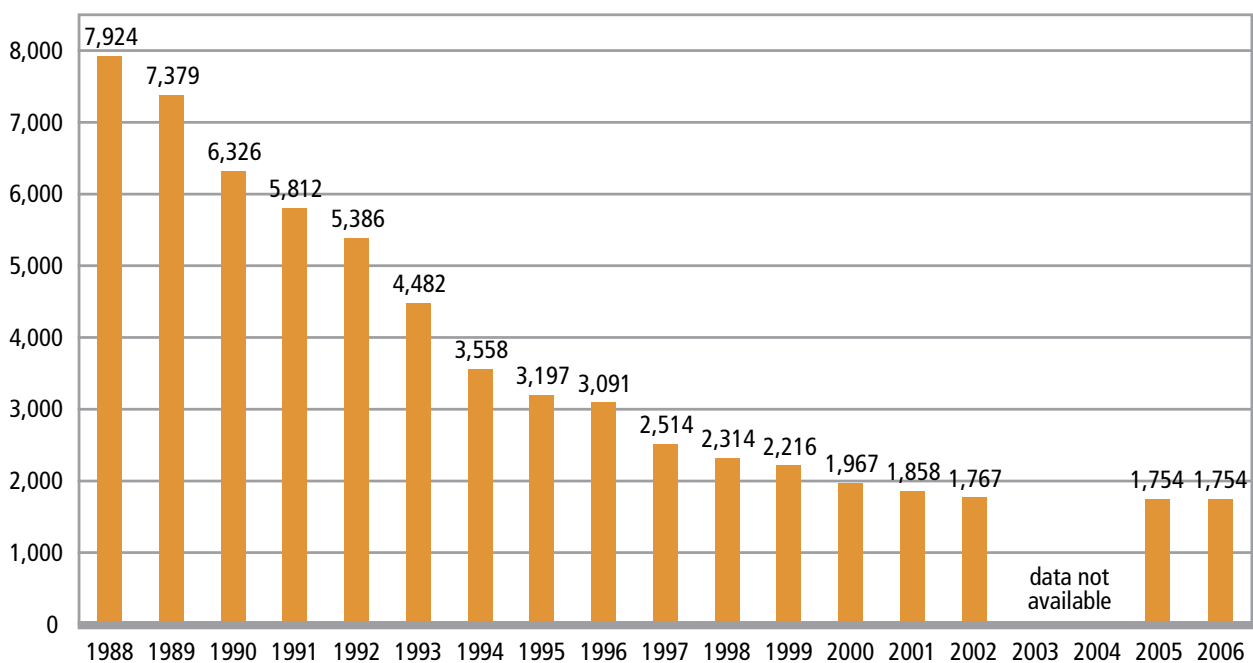


Table 3. Generation, Materials Recovery, Composting, Combustion with Energy Recovery, and Discards of MSW, 1960–2006 (in millions of tons)

Activity	1960	1970	1980	1990	2000	2002	2004	2005	2006
Generation	88.1	121.1	151.6	205.2	238.3	239.4	249.2	248.2	251.3
Recovery for recycling	5.6	8.0	14.5	29.0	52.8	53.8	57.5	58.6	61.0
Recovery for composting*	Negligible	Negligible	Negligible	4.2	16.5	16.7	20.5	20.6	20.8
Total materials recovery	5.6	8.0	14.5	33.2	69.3	70.6	77.9	79.1	81.8
Combustion with energy recovery†	0.0	0.4	2.7	29.7	33.7	33.4	34.4	33.4	31.4
Discards to landfill, other disposal‡	82.5	112.7	134.4	142.3	135.3	135.5	136.9	135.6	138.2

* Composting of yard trimmings, food scraps, and other MSW organic material. Does not include backyard composting.

† Includes combustion of MSW in mass burn or refuse-derived fuel form, and combustion with energy recovery of source-separated materials in MSW (e.g., wood pallets and tire-derived fuel).

‡ Discards after recovery minus combustion with energy recovery. Discards include combustion without energy recovery. Details may not add to totals due to rounding.

Table 4. Generation, Materials Recovery, Composting, Combustion with Energy Recovery, and Discards of MSW, 1960–2006 (in pounds per person per day)

Activity	1960	1970	1980	1990	2000	2002	2004	2005	2006
Generation	2.68	3.25	3.66	4.50	4.64	4.55	4.65	4.59	4.60
Recovery for recycling	0.17	0.22	0.35	0.64	1.03	1.02	1.07	1.08	1.12
Recovery for composting*	Negligible	Negligible	Negligible	0.09	0.32	0.32	0.38	0.38	0.38
Total materials recovery	0.17	0.22	0.35	0.73	1.35	1.34	1.45	1.46	1.50
Combustion with energy recovery†	0.0	0.01	0.07	0.63	0.66	0.63	0.64	0.62	0.57
Discards to landfill, other disposal‡	2.51	3.02	3.24	3.12	2.63	2.58	2.55	2.51	2.53
Population (millions)	179.979	203.984	227.255	249.907	281.442	287.985	293.660	296.410	299.398

* Composting of yard trimmings, food scraps, and other MSW organic material. Does not include backyard composting.

† Includes combustion of MSW in mass burn or refuse-derived fuel form, and combustion with energy recovery of source-separated materials in MSW (e.g., wood pallets and tire-derived fuel).

‡ Discards after recovery minus combustion with energy recovery. Discards include combustion without energy recovery. Details may not add to totals due to rounding.

The Benefits of Recycling

Recycling has environmental benefits at every stage in the life cycle of a consumer product—from the raw material that it's made with to its final method of disposal. Aside from cutting greenhouse gas emissions, which contribute to global warming, recycling also reduces air and water pollution associated with making new products from raw materials. By seeing used, unwanted, or obsolete materials as industrial feedstock or new materials or products, we can each do our part to make recycling work.

Nationally, we recycled 82 million tons of municipal solid waste. This provides an annual benefit of 49.7 million metric tons of carbon equivalent emissions reduced, comparable to removing 39.4 million passenger cars from the road each year. But the ultimate benefits from recycling are cleaner land, air, and water, and overall better health.

More Information

This report characterizes the municipal solid waste stream as a whole by using a materials flow methodology that relies on a mass balance approach. For example, to determine the amounts of paper recycled, information is gathered on the amounts processed by paper mills and made into new paper on a national basis, instead of counting paper collected at curbside on a state-by-state basis. Using data gathered from industry associations, businesses, and government sources, such as the U.S.

Department of Commerce and the U.S. Census Bureau, we estimate tons of materials and products generated, recycled, and discarded. Other sources of data, such as waste characterizations and research reports performed by governments, industry, or the press, supplement these data.

Information on the benefits of recycling, such as elimination of greenhouse gas (GHG) emissions, comes from EPA's WASTE Reduction Model (WARM). WARM calculates and totals GHG emissions of baseline and alternative waste management practices—source reduction, recycling, composting, combustion, and landfilling. The model calculates emissions in metric tons of carbon equivalent (MTCE), metric tons of carbon dioxide equivalent (MTCO₂E), and energy units (million BTUs) across a wide range of material types commonly found in MSW. EPA developed GHG emissions reduction factors through a life-cycle assessment methodology. EPA's report, *Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks* (EPA 530-R-02-006), describes this methodology in detail (www.epa.gov/epaoswer/non-hw/muncpl/ghg/greengas.pdf).

Full data tables on MSW characterization that support this report and summaries of the MSW characterization methodology and WARM are available on the U.S. EPA Web site along with information about waste reduction and recycling. Please see:

www.epa.gov/epaoswer/non-hw/muncpl/msw99.htm

www.epa.gov/epaoswer/non-hw/muncpl/reduce.htm

Did You Know?

- Recycling just 1 ton of aluminum cans rather than throwing them away conserves more than 207 million BTUs, the equivalent of 36 barrels of oil or 1,655 gallons of gasoline.



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