EPA
United States
Environmental Protection
Agency

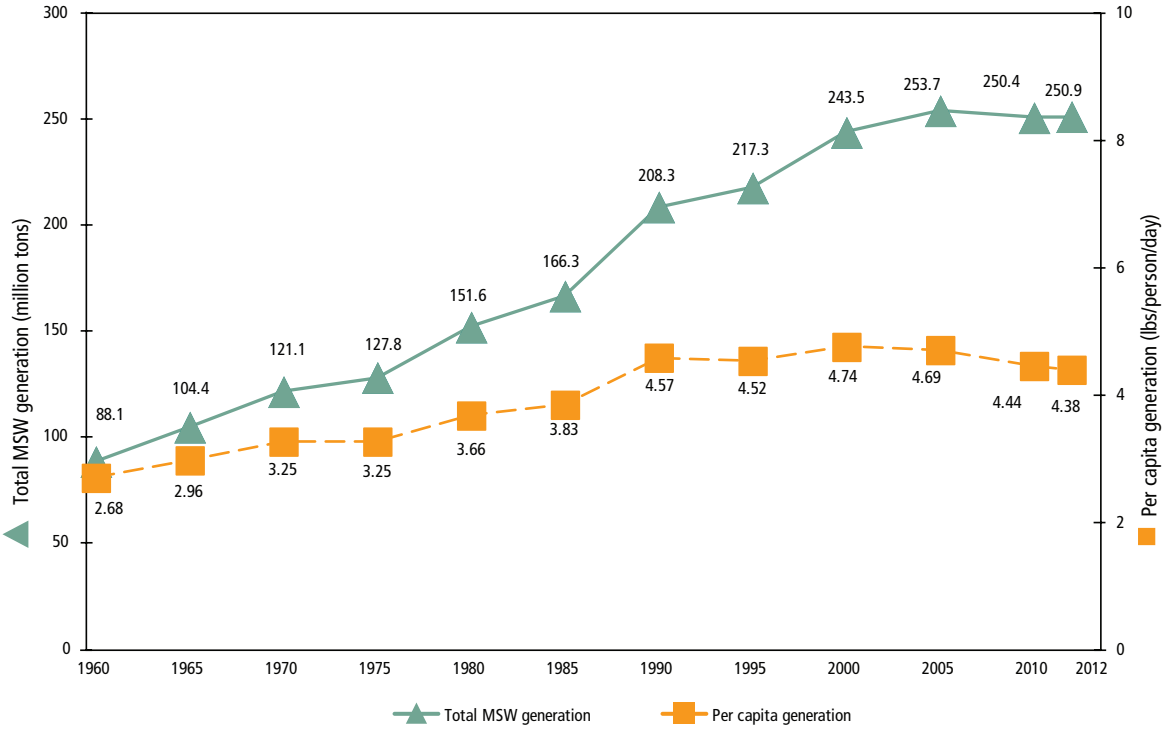
Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2012

The U.S. Environmental Protection Agency (EPA) has collected and reported data on the generation and disposal of waste in the United States for more than 30 years. We use this information to measure the success of waste reduction and recycling programs across the country. These facts and figures are current through calendar year 2012.

In 2012, Americans generated about 251 million tons[1] of trash and recycled and composted almost 87 million tons of this material, equivalent to a 34.5 percent recycling rate (See Figure 1 and Figure 2). On average, Americans recycled and composted 1.51 pounds out of our individual waste generation rate of 4.38 pounds per person per day.

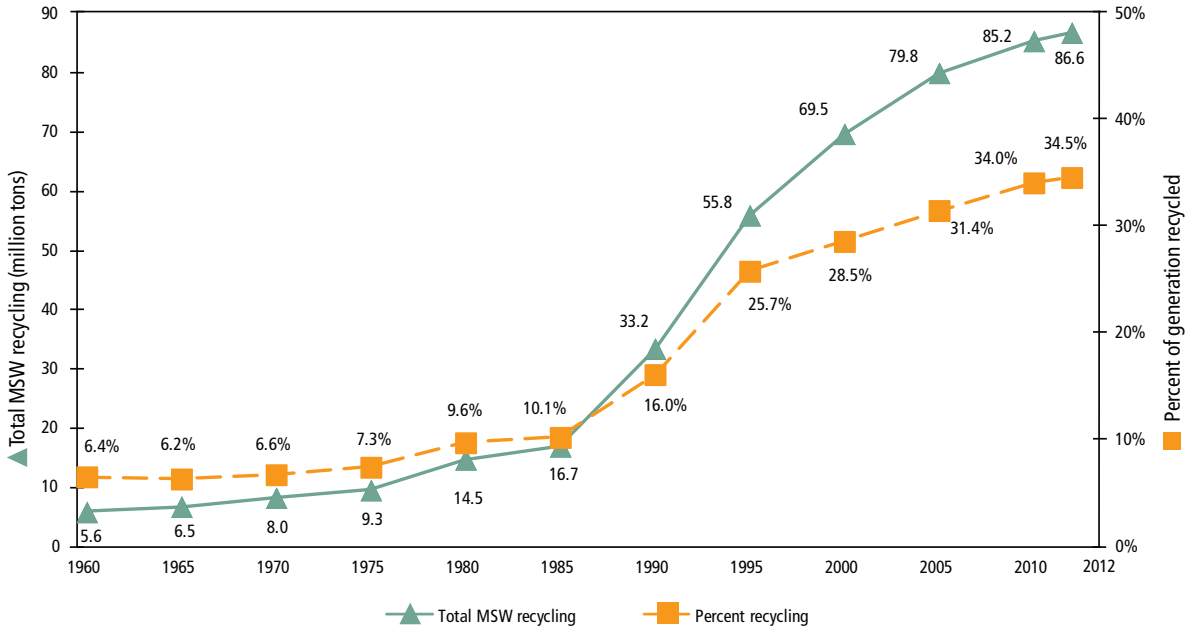
EPA is thinking beyond waste and seeking a systematic approach that provides a transition from waste management to sustainable materials management (SMM). In this year's report, EPA explores the connection between personal consumer expenditures and the generation of wastes. The transition is well under way, with the U.S. economy continuing to provide goods and services for household consumption more efficiently when looking at the MSW generated from consuming those goods and services.

Figure 1. MSW Generation Rates, 1960 to 2012



[1] U.S. short tons unless specified.

Figure 2. MSW Recycling Rates, 1960 to 2012



Trends in Municipal Solid Waste in 2012

Our trash, or municipal solid waste (MSW), is comprised of various items Americans commonly throw away after being used. These include items such as packaging, food waste, grass clippings, sofas, computers, tires, and refrigerators. MSW does not include industrial, hazardous, or construction waste.

In 2012, Americans recovered over 65 million tons of MSW through recycling and over 21 million tons through composting. We combusted about 29 million tons for energy recovery (about 12 percent). Subtracting out what is recycled and composted, we combusted (with energy recovery) or discarded in landfills 2.9 pounds per person per day of MSW.

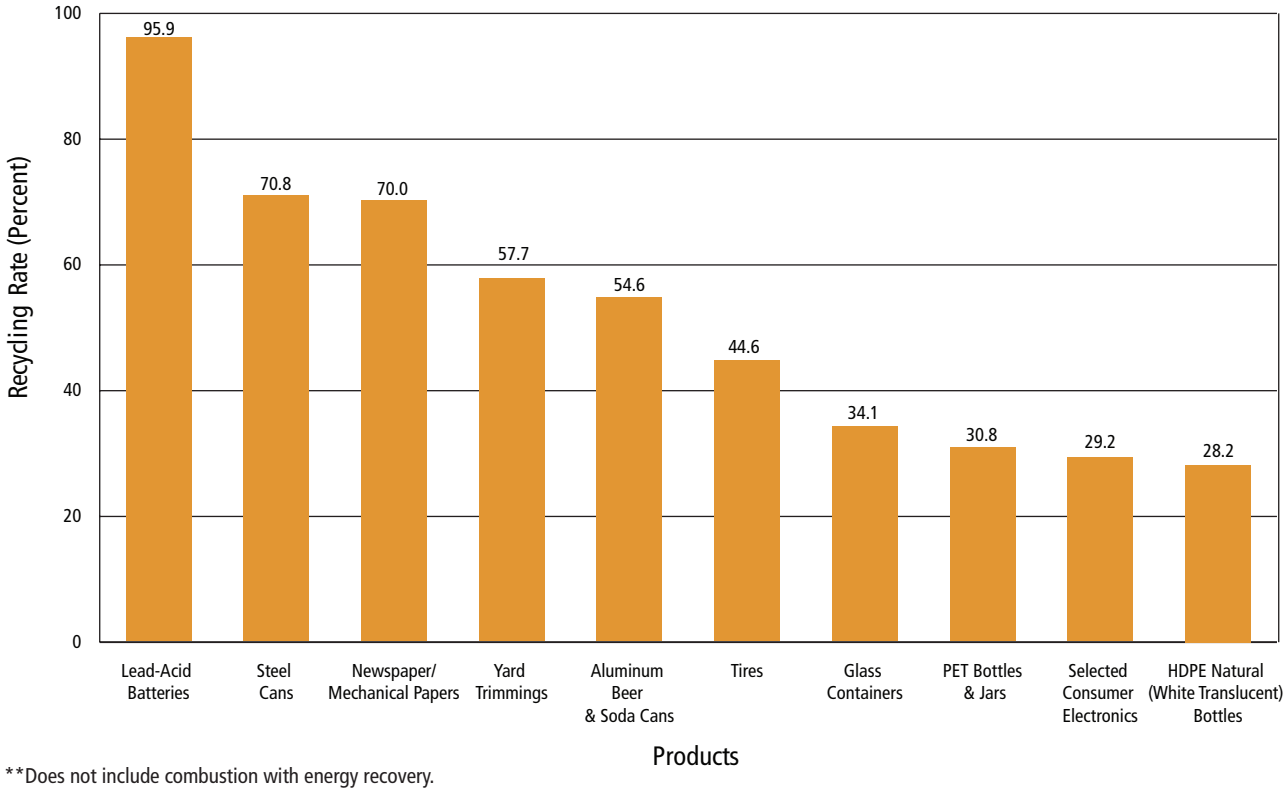
In 2012, lead-acid battery recovery was about 96 percent (2.8 million tons). Newspaper/mechanical papers recovery was about 70 percent (5.9 million tons), and over 57 percent of yard trimmings were recovered (19.6 million tons) (see Figure 3). About 135 million tons of MSW (53.8 percent) were discarded in landfills in 2012 (see Figure 4).

Over the last few decades, the generation, recycling, composting, and disposal of MSW have changed substantially. Solid waste generation per person per day peaked in 2000 while the 4.38 pounds per person per day is the lowest since the 1980's. The recycling rate has increased–from less than 10 percent of MSW generated in 1980 to over 34 percent in 2012. Disposal of waste to a landfill has decreased from 89 percent of the amount generated in 1980 to under 54 percent of MSW in 2012.

Sources of MSW

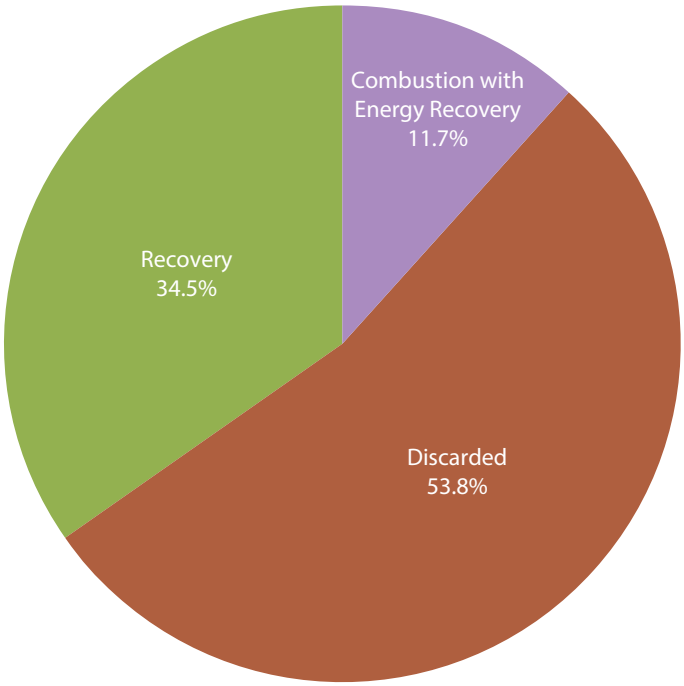
Sources of MSW include residential waste (including waste from apartment houses) and waste from commercial and institutional locations, such as businesses, schools, and hospitals.

Figure 3. Recycling Rates of Selected Products, 2012**



**Does not include combustion with energy recovery.

Figure 4. Management of MSW in the United States, 2012



Analyzing MSW

We analyze waste by material, such as plastics, and paper and paperboard, 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 waste).

Nationally, Americans recycled and composted almost 87 million tons of municipal solid waste. This provides an annual benefit of more than 168 million metric tons of carbon dioxide equivalent emissions reduced, comparable to the annual GHG emissions from over 33 million passenger vehicles.[2]

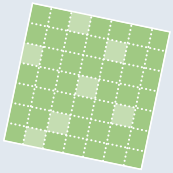
Materials in MSW

Total MSW generation in 2012 was 251 million tons. Figure 5 shows the breakdown of MSW generated, by material. Organic materials such as paper and paperboard, yard trimmings, and food waste continue to be the largest component of MSW. Paper and paperboard account for over 27 percent and yard trimmings and food waste accounts for another 28 percent. Plastics comprise about 13 percent; metals make up 9 percent; and rubber, leather, and textiles account for almost 9 percent. Wood follows at over 6 percent and glass at almost 5 percent. Other miscellaneous wastes make up approximately 3 percent of the MSW generated in 2012.

Total MSW recovery in 2012 was almost 87 million tons. Paper and paperboard account for over 51 percent and yard trimmings account for over 22 percent, while food waste accounts for another 2 percent. Metals comprise about 9 percent; glass about 4 percent; and plastic and wood about 3 percent each. Other miscellaneous materials make up about 6 percent of MSW recovery in 2012 (see Figure 6).

After MSW recovery through recycling and composting, 164 million tons of MSW were discarded in 2012. Food waste is the largest component of discards at 21 percent. Plastics comprise about 18 percent; paper and paperboard make up almost 15 percent; and rubber, leather, and textiles account for about 11 percent of MSW discards. The other materials account for less than 10 percent each (see Figure 7).

Recycling and composting almost 87 million tons of MSW saved more than 1.1 quadrillion Btu of energy; that's the same amount of energy consumed by almost 10 million U.S. households in a year.



Significant amounts of material from each category were recycled or composted in 2012. The highest recovery rates were achieved in paper and paperboard, yard trimmings, and metals. Americans recycled more than 64 percent of the paper and paperboard generated. Over 19 million tons of yard trimmings were composted, representing almost a five-fold increase since 1990. Recycling these three materials alone kept over 28 percent of MSW generated out of landfills and combustion facilities. Recycling amounts and rates (recovery as a percent of generation) for all materials in 2012 are listed in Table 1. This table also presents millions of tons of discarded materials.

[2] All benefit calculations in this fact sheet are derived from EPA's Waste Reduction Model (WARM). Please see www.epa.gov/warm. All benefits information that was included in last year's report only took into account the CO_2 reduction for recycling of materials. In the report this year, we are accounting for both the recycling of those materials and the CO_2 emissions that may occur in the alternative waste management scenarios of landfilling and combustion. This gives us the net overall benefit of recycling these materials.

Figure 5. Total MSW Generation (by material), 2012
251 Million Tons (before recycling)

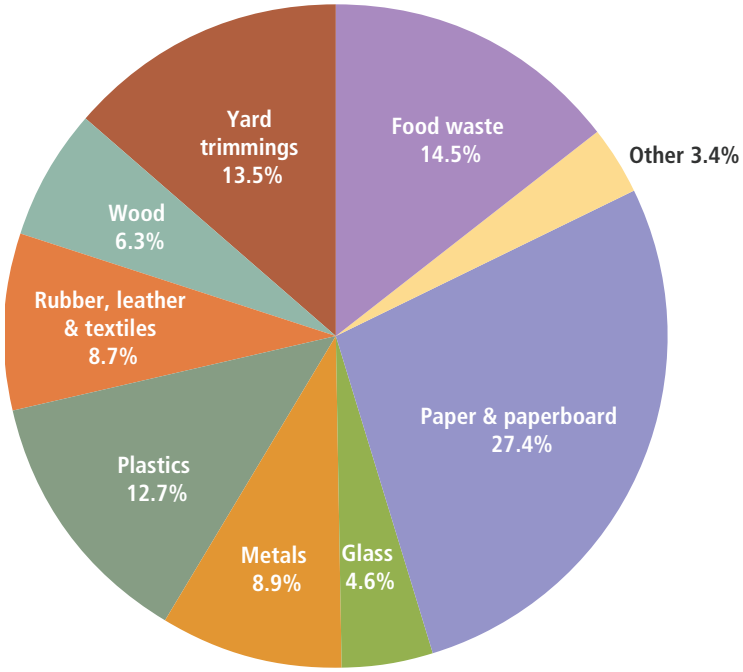


Figure 6. Total MSW Recovery (by material), 2012
87 Million Tons

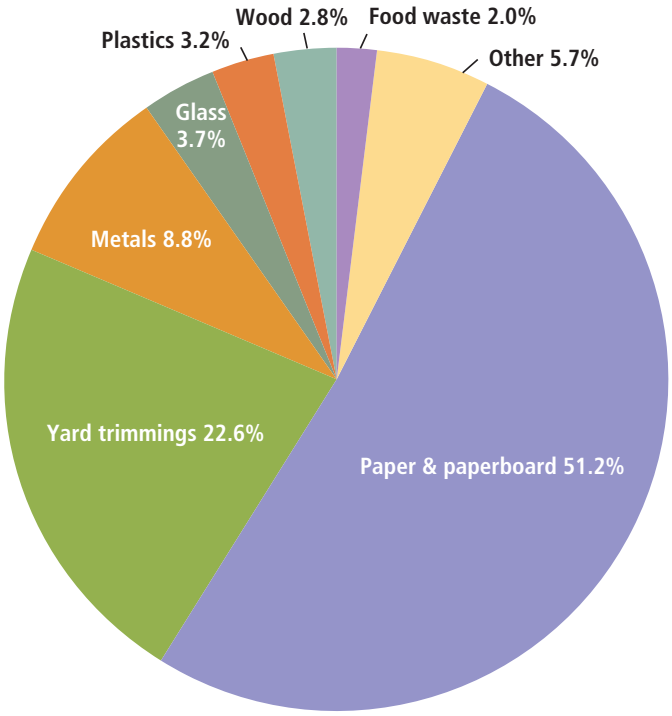


Figure 7. Total MSW Discards (by material), 2012
164 Million Tons (after recycling and composting)

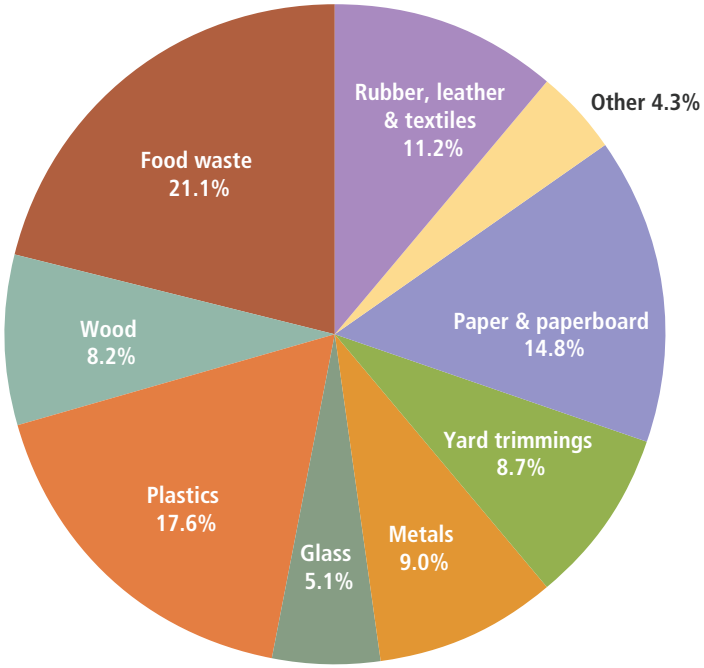


Figure 8. Total MSW Generation (by product category), 2012
251 Million Tons (before recycling)

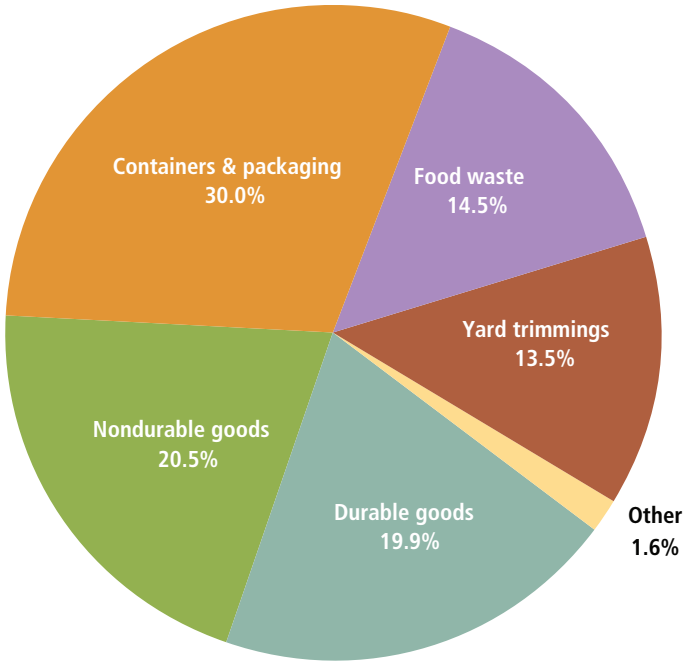


Table 1. Generation, Recovery, and Discards of Materials in MSW, 2012*
(in millions of tons and percent of generation of each material)

Material	Weight Generated	Weight Recovered	Recovery as Percent of Generation	Weight Discarded
Paper and paperboard	68.62	44.36	64.6%	24.26
Glass	11.57	3.20	27.7%	8.37
Metals				
Steel	16.80	5.55	33.0%	11.25
Aluminum	3.58	0.71	19.8%	2.87
Other nonferrous metals†	2.00	1.36	68.0%	0.64
Total metals	**22.38**	**7.62**	**34.0%**	**14.76**
Plastics	31.75	2.80	8.8%	28.95
Rubber and leather	7.53	1.35	17.9%	6.18
Textiles	14.33	2.25	15.7%	12.08
Wood	15.82	2.41	15.2%	13.41
Other materials	4.60	1.30	28.3%	3.30
Total materials in products	**176.60**	**65.29**	**37.0%**	**111.31**
Other wastes				
Food, other‡	36.43	1.74	4.8%	34.69
Yard trimmings	33.96	19.59	57.7%	14.37
Miscellaneous inorganic wastes	3.90	Negligible	Negligible	3.90
Total other wastes	**74.29**	**21.33**	**28.7%**	**52.96**
Total municipal solid waste	**250.89**	**86.62**	**34.5%**	**164.27**

* Includes waste from residential, commercial, and institutional sources.

† Includes lead from lead-acid batteries.

‡ Includes recovery of other MSW organics for composting.

Details might not add to totals due to rounding.

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

Materials and Products

We track both materials and products. Materials are what products are made of and will ultimately be what is recovered and be reprocessed in the recycling process. Examples are metals and plastic. Products are what people buy and handle. Products are manufactured out of materials. Examples include packaging and newspapers. We track products to learn how people are consuming, using, and discarding materials. This information allows us to target activities that will ultimately maximize the recovery of materials.

Products in MSW

The breakdown of MSW generated in 2012 by product category is shown in Figure 8. Containers and packaging made up the largest portion of MSW generated: 30 percent, or over 75 million tons. The second largest portion came from nondurable goods, which amounted to over 20 percent, or about 51 million tons. Durable goods make up the third largest segment, accounting for about 20 percent, or 50 million tons.

Recycling Trends

In percentage of total MSW generation, recycling (including composting) did not exceed 15 percent until 1990. Growth in the recycling rate was significant over the next 15 years. The recycling rate has grown more slowly over the last five years.

The generation, recovery, and discards of materials in the product categories, by weight and recovery as a percent of generation, are shown in Table 2. This table shows that the recovery of containers and packaging was the highest of the four product categories, with over 51 percent of the generated materials recycled. Paper products, steel, and aluminum were the most recycled materials by percentage in this category. Over 76 percent of paper and paperboard containers and packaging was recycled. Over 72 percent of steel packaging (mostly cans) was recycled. The recycling rate for aluminum packaging was 38 percent, including almost 55 percent of aluminum beverage cans.

Over 34 percent of glass containers were recycled while about 25 percent of wood packaging, mostly wood pallets, was recovered. About 14 percent of plastic containers and packaging were recycled, mostly from soft drink, milk, and water bottles. Plastic bottles were the most recycled plastic products. Polyethylene terephthalate (PET) bottles and jars were recovered at about 31 percent. Recovery of high density polyethylene (HDPE) natural (white translucent) bottles was also estimated at over 28 percent (see 2012 MSW full data tables).

Overall recovery of nondurable goods was about 34 percent in 2012. Nondurable goods generally last less than three years. Newspapers/mechanical papers and other paper products were the most recycled nondurable goods. Newspapers/mechanical papers include newspapers, directories, inserts, and some advertisement and direct mail printing. Seventy percent of newspapers/mechanical papers were recovered. Collectively, the recovery of other paper products such as office paper and magazines was over 43 percent in 2012. Clothing, footwear, and other textile products are included in the nondurable goods category. These products were recovered for recycling at a rate of over 16 percent.

Overall, more than 18 percent of durable goods was recovered in 2012. Nonferrous metals other than aluminum had one of the highest recovery rates due to the high rate of lead recovery from lead-acid batteries. With an almost 96 percent recycling rate, lead-acid batteries continue to be one of the most recovered products. Recovery of steel in all durable goods was 27 percent, with high rates of recovery from appliances and other miscellaneous items. Recovery of selected consumer electronics was 29% (see 2012 MSW full data tables).

Measured by percentage of generation, products with the highest recovery rates in 2012 were lead-acid batteries (96 percent), corrugated boxes (91 percent), steel cans (71 percent), newspapers/mechanical papers (70 percent), major appliances (64 percent), yard trimmings (58 percent), aluminum cans (55 percent), tires (45 percent), and mixed paper (43 percent) (see 2012 MSW full data tables).

Every ton of mixed paper recycled can save the energy equivalent of 165 gallons of gasoline.

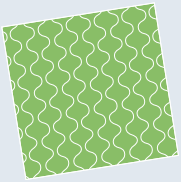


Table 2. Generation, Recovery, and Discards of Products in MSW, 2012*
(in millions of tons and percent of generation of each product)

Products	Weight Generated	Weight Recovered	Recovery as Percent of Generation	Weight Discarded
Durable goods				
Steel	14.57	3.94	27.0%	10.63
Aluminum	1.52	Not Available	Not Available	1.52
Other non-ferrous metals†	2.00	1.36	68.0%	0.64
Glass	2.19	Negligible	Negligible	2.19
Plastics	11.46	0.77	6.7%	10.69
Rubber and leather	6.52	1.35	20.7%	5.17
Wood	6.16	Negligible	Negligible	6.16
Textiles	3.88	0.55	14.2%	3.33
Other materials	1.73	1.30	75.6%	0.42
Total durable goods	**50.03**	**9.27**	**18.5%**	**40.76**
Nondurable goods				
Paper and paperboard	30.60	15.44	50.5%	15.16
Plastics	6.51	0.13	2.0%	6.38
Rubber and leather	1.01	Negligible	Negligible	1.01
Textiles	10.15	1.70	16.7%	8.45
Other materials	3.07	Negligible	Negligible	3.07
Total nondurable goods	**51.34**	**17.27**	**33.6%**	**34.07**
Containers and packaging				
Steel	2.23	1.61	72.2%	0.62
Aluminum	1.87	0.71	38.0%	1.16
Glass	9.38	3.20	34.1%	6.18
Paper and paperboard	38.01	28.92	76.1%	9.09
Plastics	13.78	1.90	13.8%	11.88
Wood	9.66	2.41	24.9%	7.25
Other materials	0.30	Negligible	Negligible	0.30
Total containers and packaging	**75.23**	**38.75**	**51.5%**	**36.48**
Other wastes				
Food, other‡	36.43	1.74	4.8%	34.69
Yard trimmings	33.96	19.59	57.7%	14.37
Miscellaneous inorganic wastes	3.90	Negligible	Negligible	3.90
Total other wastes	74.29	21.33	28.7%	52.96
Total municipal solid waste	**250.89**	**86.62**	**34.5%**	**164.27**

* Includes waste from residential, commercial, and institutional sources.
† Includes lead from lead-acid batteries.
‡ Includes recovery of other MSW organics for composting.
Details might not add to totals due to rounding.
Negligible = less than 5,000 tons or 0.05 percent.

Disposing of MSW

While the number of U.S. landfills has steadily declined over the years, the average landfill size has increased. At the national level, landfill capacity appears to be sufficient for our current disposal practices, although it is limited in some areas.

- Since 1990, the total amount of MSW going to landfills dropped by over 11 million tons, from 145.3 million to 135.0 million tons in 2012 (see Table 3).
- The net per capita discard rate to landfills (after recycling, composting, and combustion for energy recovery) was 2.36 pounds per day, lower than the 3.19 per capita rate in 1990 (see Table 4).

Composting Collection Programs[3]

- About 3,120 community composting programs were documented in 2012, a decrease from 3,227 in 2002.
- Over 2.4 million households were served with food waste composting collection programs in 2012.

Table 3. Generation, Materials Recovery, Composting, Combustion With Energy Recovery, and Discards of MSW, 1960 to 2012 (in millions of tons)

Activity	1960	1970	1980	1990	2000	2005	2008	2010	2011	2012
Generation	88.1	121.1	151.6	208.3	243.5	253.7	252.5	250.4	250.4	250.9
Recovery for recycling	5.6	8.0	14.5	29.0	53.0	59.2	61.9	65.0	66.3	65.3
Recovery for composting*	Negligible	Negligible	Negligible	4.2	16.5	20.6	22.1	20.2	20.6	21.3
Total materials recovery	5.6	8.0	14.5	33.2	69.5	79.8	84.0	85.2	86.9	86.6
Discards after recovery	82.5	113.0	137.1	175.0	174.0	173.9	168.5	165.3	163.5	164.3
Combustion with energy recovery†	0.0	0.4	2.7	29.7	33.7	31.6	31.6	29.3	29.3	29.3
Discards to landfill, other disposal‡	82.5	112.6	134.4	145.3	140.3	142.3	136.9	136.0	134.2	135.0

* Composting of yard trimmings, food waste, 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, tire-derived fuel).

‡ Discards after recovery minus combustion with energy recovery. Discards include combustion without energy recovery.

Details might not add to totals due to rounding.

[3] Source: For 2002 data: BioCycle 2006.
For 2012 data: EPA, Municipal Solid Waste in the United States: 2012 data tables and BioCycle, 2013.

Table 4. Generation, Materials Recovery, Composting, Combustion With Energy Recovery, and Discards of MSW, 1960 to 2012 (in pounds per person per day)

Activity	1960	1970	1980	1990	2000	2005	2008	2010	2011	2012
Generation	2.68	3.25	3.66	4.57	4.74	4.69	4.55	4.44	4.40	4.38
Recovery for recycling	0.17	0.22	0.35	0.64	1.03	1.10	1.12	1.15	1.17	1.14
Recovery for composting*	Negligible	Negligible	Negligible	0.09	0.32	0.38	0.40	0.36	0.36	0.37
Total Materials Recovery	0.17	0.22	0.35	0.73	1.35	1.48	1.52	1.51	1.53	1.51
Discards after recovery	2.51	3.03	3.31	3.84	3.39	3.21	3.03	2.93	2.87	2.87
Combustion with energy recovery†	0.00	0.01	0.07	0.65	0.66	0.58	0.57	0.52	0.51	0.51
Discards to landfill, other disposal‡	2.51	3.02	3.24	3.19	2.73	2.63	2.46	2.41	2.36	2.36
Population (millions)	179.979	203.984	227.255	249.907	281.422	296.410	304.060	309.051	311.592	313.914

* Composting of yard trimmings, food waste, 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, tire-derived fuel).

‡ Discards after recovery minus combustion with energy recovery. Discards include combustion without energy recovery.

Details might 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 with which it's made to its final method of disposal. By utilizing used, unwanted, or obsolete materials as industrial feedstocks or for new materials or products, Americans can each do our part to make recycling, including composting work. Aside from reducing GHG emissions, which contribute to global warming, recycling, including composting also provides significant economic and job creation impacts.

The energy and GHG benefits of recycling and composting shown in Table 5 are calculated using EPA's WARM methodology (see: www.epa.gov/warm). WARM calculates and totals GHG emissions of baseline and alternative waste management practices, including source reduction, recycling, composting, combustion, and landfilling. Paper and paperboard recovery at about 44 million tons resulted in a reduction of 130 MMTCO2E in 2012. This is equivalent to removing 27 million cars from the road in one year.

In 2012, nationally, we recycled and composted almost 87 million tons of MSW. This provides an annual benefit of more than 168 million metric tons of carbon dioxide equivalent emissions reduced, comparable to removing the emissions from over 33 million passenger vehicles from the road in one year.

Table 5. Greenhouse Gas Benefits Associated with Recovery of Specific Materials, 2012*
(in millions of tons recovered, $MMTCO_2E$ and in numbers of cars taken off the road per year)

Material	Weight Recovered (millions of tons)	GHG Benefits $MMTCO_2E$	Numbers of Cars Taken Off the Road per Year
Paper and paperboard	44.4	130.5	27 million
Glass	3.20	1	210 thousand
Metals			
Steel	5.55	9	1.9 million
Aluminum	0.71	6.3	1.3 million
Other nonferrous metals†	1.36	5.3	1.1 million
Total metals	**7.62**	**20.6**	**4.3 million**
Plastics	2.80	3.2	670 thousand
Rubber and leather‡	1.35	0.7	145 thousand
Textiles	2.25	5.7	1.2 million
Wood	2.41	4.2	900 thousand
Other wastes			
Food, other^	1.74	1.4	290 thousand
Yard trimmings	19.6	0.8	170 thousand

* Includes materials from residential, commercial, and institutional sources.
These calculations do not include an additional 1.30 million tons of MSW recovered that could not be addressed in the WARM model. $MMTCO_2E$ is million metric tons of carbon dioxide equivalent.
All benefits information that was included in last year's report only took into account the CO_2 reduction for recycling of materials. In the report this year, we are accounting for both the recycling of those materials and the CO_2 emissions that may occur in the alternative waste management scenarios of landfilling and combustion. This gives us the net overall benefit of recycling these materials.

† Includes lead from lead-acid batteries. Other nonferrous metals calculated in WARM as mixed metals.

‡ Recovery only includes rubber from tires.

^ Includes recovery of other MSW organics for composting.

Source: WARM model (www.epa.gov/warm)

MSW Generation and Household Spending

Over the years, the change in the amount of MSW generated has typically imitated trends in how much money American households spend on goods and services. Personal Consumer Expenditures (PCE) measures U.S. household spending on goods and services such as food, clothing, vehicles, and recreation services. PCE accounts for approximately 70 percent of U.S. Gross Domestic Product, a key indicator of economic growth. PCE adjusted for inflation is referred to as real PCE. This is a more useful metric in making comparisons over time because it normalizes the value of a dollar by considering how much a dollar could purchase in the past versus today. Figure 9 explores the relationship between MSW generated and real PCE since 1960.

Figure 9 is an indexed graph showing the relative changes in real PCE, MSW generated, and MSW generated per capita

Recycling just 1 ton of aluminum cans conserves more than 153 million Btu, the equivalent of 26 barrels of oil, or 1,665 gallons of gasoline.

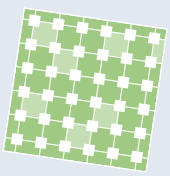
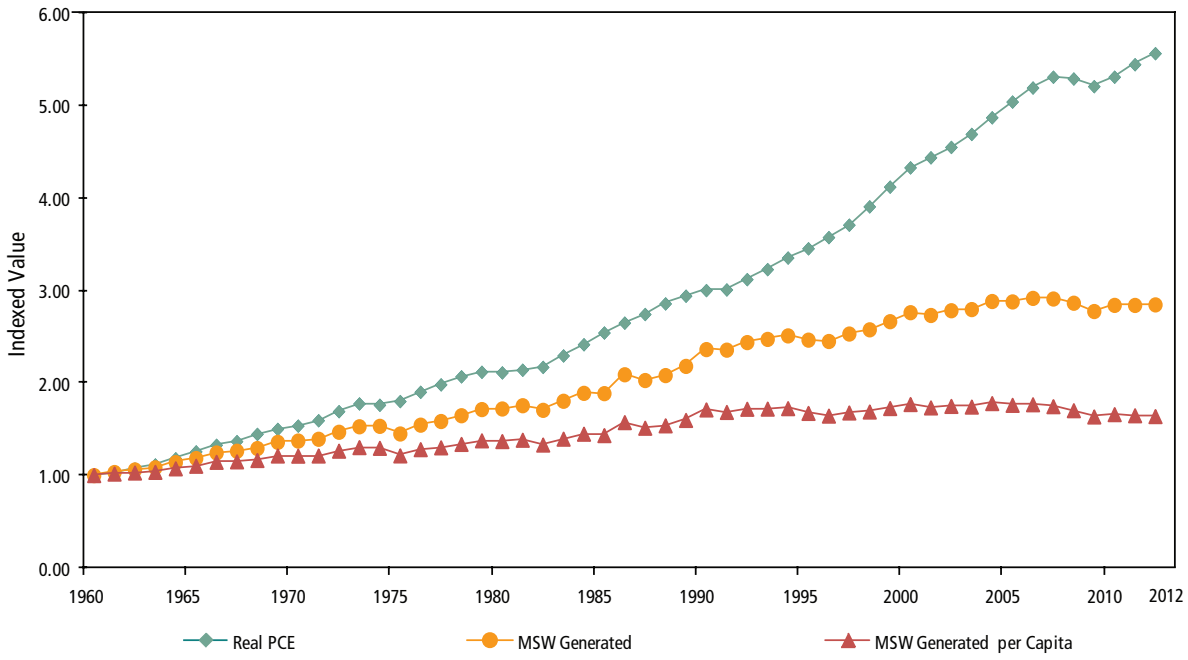


Figure 9. Indexed MSW Generated and Real PCE over Time (1960-2012)



over time. It is indexed to allow all three of these metrics to be shown on the same graph and compare their relative rates of change since 1960. The indexed value indicates the change in the value of the data since 1960. For example, if for a given year the value is three then the data value for that year would be three times the 1960 value. In this case, if the 1960 value was 200 then the resulting year's value would be 600. The 2012 MSW per capita generation indexed value is 1.6 which means MSW per capita generation has increased by 60 percent since 1960.

Figure 9 shows that real PCE has increased at a faster rate than MSW generation, and the disparity has become even more distinct since the mid 1990s. This indicates the amount of MSW generated per dollar spent is falling. In other words, our economy has been able to enjoy dramatic increases in household spending on consumer goods and services without this being at the expense of the societal impact of similarly increasing MSW generation rates. This figure also shows that the MSW generated per capita leveled off in the early- to mid-2000s and has fallen since then. This is important because as population continues to grow, it will be necessary for MSW generated per capita to continue to fall to maintain or decrease the total amount of MSW generated as a country.

Thinking Beyond Waste

EPA is helping change the way our society protects the environment and conserves resources for future generations by thinking beyond recycling, composting, and disposal. Building on the familiar concept of Reduce, Reuse, Recycle, the Agency is employing a systemic approach that seeks to reduce materials use and associated environmental impacts over their entire life cycle, called sustainable materials management

Energy Recovered from Waste Combustion

- In 2012, over 29 million tons of materials, or 11.7 percent, were combusted for energy recovery.
- MSW combustion for energy recovery has decreased from about 34 million tons in 2000 to 29 million tons in 2012.

(SMM). This starts with extraction of natural resources and material processing through product design and manufacturing then the product use stage followed by collection/processing and final end of life (disposal). By examining how materials are used throughout their life cycle, an SMM approach seeks to use materials in the most productive way with an emphasis on using less; reducing toxic chemicals and environmental impacts throughout the material's life cycle; and assuring we have sufficient resources to meet today's needs and those of the future. Data on municipal solid waste generation, recycling and disposal is an important starting point for the full SMM approach.

Resources

The data summarized in this fact sheet characterizes the MSW 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 plus recycled paper exported, instead of counting paper collected for recycling 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.

The benefits of recycling and composting, such as elimination of GHG emissions, are calculated using EPA's WARM methodology. WARM calculates and totals GHG emissions of baseline and alternative waste management practices including source reduction, recycling, composting, combustion, and landfilling. The model calculates emissions in metric tons of carbon equivalent (MTCE), metric tons of carbon dioxide equivalent ($MTCO_2E$), and energy units (million Btu) across a wide range of material types commonly found in MSW. EPA developed GHG emissions reduction factors through a life-cycle assessment methodology. Please see: www.epa.gov/warm.

Full data tables on MSW characterization that support this Report and Summaries of the MSW characterization methodology and WARM are available on the EPA website along with information about waste reduction and recycling. Please see:

www.epa.gov/epawaste/nonhaz/municipal/msw99.htm

www.epa.gov/recycle

United States
Environmental Protection
Agency

United States Environmental Protection Agency
Solid Waste and Emergency Response (5306P)
Washington, DC 20460

Official Business
Penalty for Private Use $300

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