Advancing Sustainable Materials Management: 2017 Fact Sheet

Assessing Trends in Material Generation, Recycling, Composting, Combustion with Energy Recovery and Landfilling in the United States

November 2019

Introduction

The U.S. Environmental Protection Agency (EPA) has collected and reported data on the generation and disposition of municipal solid waste (MSW) in the United States for more than 30 years. This information is used to measure the success of materials management programs across the country and to characterize the national waste stream. These facts and figures are based on the most recent information, which is from calendar year 2017.

In 2017, in the United States, approximately 268 million tons (U.S. short tons unless specified) of MSW were generated (*See* Figure 1). Of the MSW generated, approximately 67 million tons of MSW were recycled and 27 million tons of MSW were composted. Together, more than 94 million tons of MSW were recycled and composted, equivalent to a 35.2 percent recycling and composting rate (*See* Figure 2). In addition, more than 34 million tons of MSW (12.7 percent) were combusted with energy recovery. Finally, more than 139 million tons of MSW (52.1 percent) were landfilled (*See* Figure 3 and Table 1).

Information about waste generation and disposal is an important foundation for managing materials. Sustainably managing materials requires focusing on the life cycle of a product, from the time it is produced, used, reused and ultimately recycled or discarded. This is known as Sustainable Materials Management (SMM). SMM refers to the use and reuse of materials in the most productive and sustainable way across their entire life cycle. SMM conserves resources, reduces waste and minimizes the adverse environmental impacts of material use.

This report analyzes MSW trends in generation and management, materials and products, and economic indicators affecting MSW. It also includes a section on the generation of construction and demolition (C&D) debris, which is not a part of MSW, but comprises a significant portion of the non-hazardous solid waste stream.

Figure 1. MSW Generation Rates, 1960 to 2017

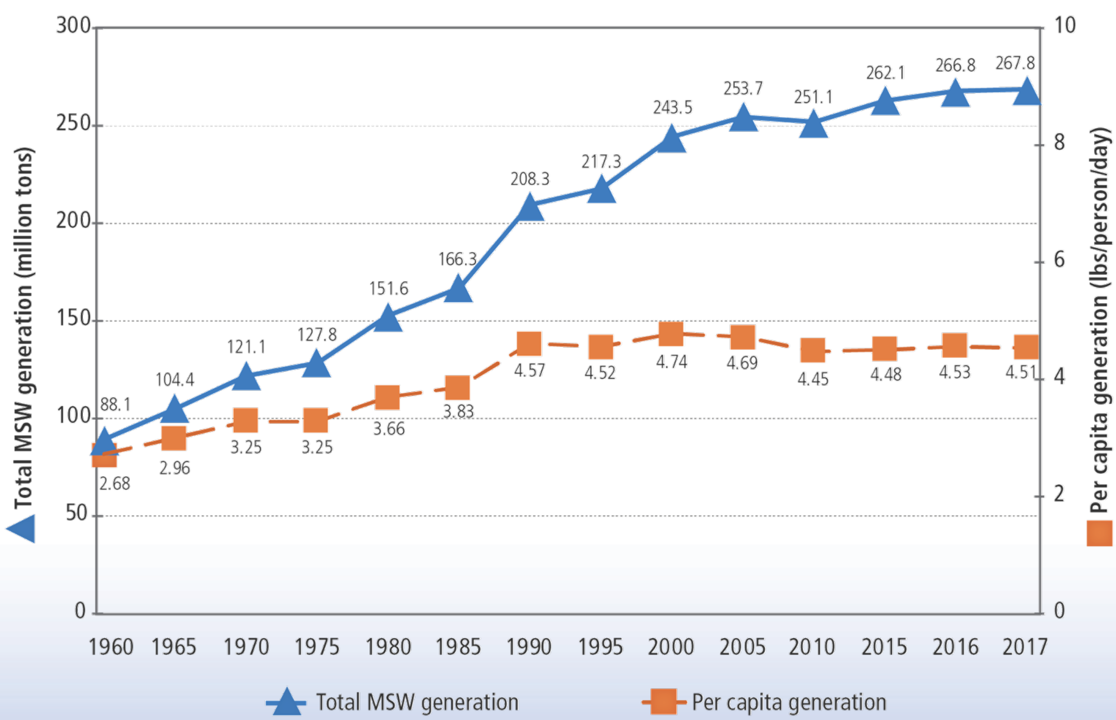


Figure 2. MSW Recycling and Composting Rates, 1960 to 2017

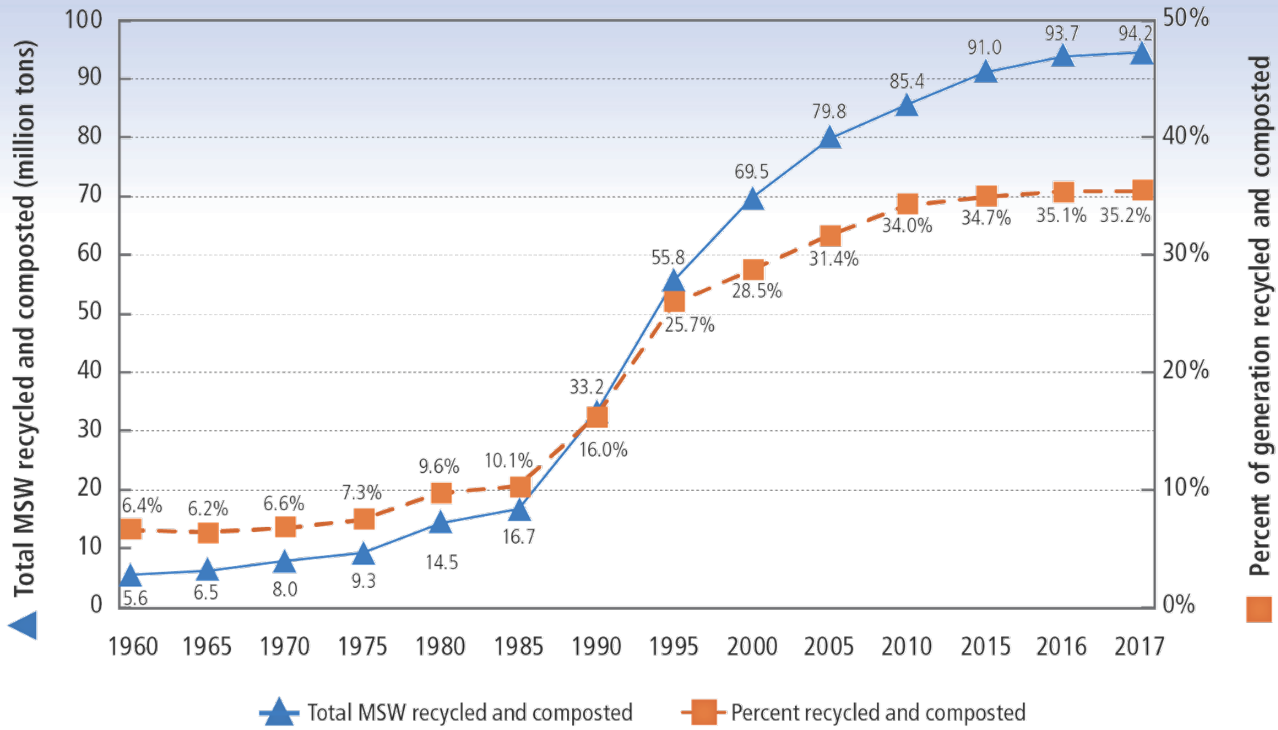


Figure 3. Management of MSW in the United States, 2017

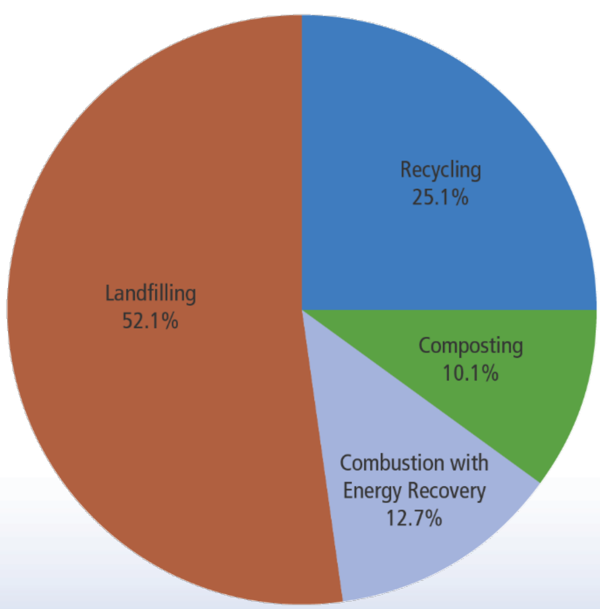


Table 1. Generation, Recycling, Composting, Combustion with Energy Recovery and Landfilling of Materials in MSW, 2017*
(in millions of tons and percent of generation of each material)

Material	Weight Generated	Weight Recycled	Weight Composted	Weight Combusted with Energy Recovery	Weight Landfilled	Recycling as Percent of Generation	Composting as Percent of Generation	Combustion as Percent of Generation	Landfilling as Percent of Generation
Paper and paperboard	67.01	44.17	-	4.49	18.35	65.9%	-	6.70%	27.38%
Glass	11.38	3.03	-	1.48	6.87	26.6%	-	13.01%	60.37%
Metals									
Steel	18.89	6.17	-	2.29	10.43	32.7%	-	12.12%	55.21%
Aluminum	3.83	0.62	-	0.56	2.65	16.2%	-	14.62%	69.19%
Other nonferrous metals†	2.33	1.54	-	0.07	0.72	66.1%	-	3.00%	30.90%
Total metals	**25.05**	**8.33**	-	**2.92**	**13.80**	**33.3%**	-	**11.66%**	**55.09%**
Plastics	35.37	2.96	-	5.59	26.82	8.4%	-	15.80%	75.83%
Rubber and leather	9.11	1.67	-	2.49	4.95	18.3%	-	27.33%	54.34%
Textiles	16.89	2.57	-	3.17	11.15	15.2%	-	18.77%	66.02%
Wood	17.99	3.00	-	2.85	12.14	16.7%	-	15.84%	67.48%
Other materials	5.10	1.45	-	0.67	2.98	28.4%	-	13.14%	58.43%
Total materials in products	**187.90**	**67.18**	-	**23.66**	**97.06**	**35.8%**	-	**12.59%**	**51.66%**
Other wastes									
Food, other‡	40.67	-	2.57	7.47	30.63	-	6.3%	18.37%	75.31%
Yard trimmings	35.18	-	24.42	2.11	8.65	-	69.4%	6.00%	24.59%
Miscellaneous inorganic wastes	4.04	-	-	0.79	3.25	-	-	19.55%	80.45%
Total other wastes	**79.89**	-	**26.99**	**10.37**	**42.53**	-	**33.8%**	**12.98%**	**53.24%**
Total municipal solid waste	**267.79**	**67.18**	**26.99**	**34.03**	**139.59**	**25.1%**	**10.1%**	**12.71%**	**52.13%**

* Includes waste from residential, commercial and institutional sources.

† Includes lead from lead-acid batteries.

‡ Includes collection 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.
A dash in the table means that data are not available.

Trends in Municipal Solid Waste

Our MSW, or trash, is comprised of various items consumers throw away. These items include packaging, food, yard trimmings, furniture, electronics, tires and appliances. MSW does not include industrial, hazardous or C&D waste. Sources of MSW include residential waste, including waste from multi-family housing, as well as waste from commercial and institutional locations, such as businesses, schools and hospitals.

Over the last few decades, the generation, recycling, composting, combustion with energy recovery and landfilling of MSW has changed substantially. Solid waste generation peaked at 4.74 pounds per person per day in 2000. The rate of 4.51 pounds per person per day in 2017 is slightly lower than the 2016 rate, which was 4.53 pounds per person per day (*See* Figure 1).

The combined recycling and composting rate increased from less than 10 percent of generated MSW in 1980 to 35.2 percent in 2017 (*See* Figure 2). Without including composting, recycling alone rose from 14.5 million tons (9.6 percent of MSW) in 1980 to 67.2 million tons (25.1 percent) in 2017. Composting was negligible in 1980, but it rose to 27.0 million tons in 2017 (10.1 percent; *See* Figure 3 and Table 2 for details).

Food

Nationally, the composting of food rose from 2.15 million tons in 2016 (5.3 percent of food generated) to 2.57 million tons in 2017 (6.3 percent).

Combustion with energy recovery was less than 2 percent of generation in 1980 at 2.8 million tons. In 2017, more than 34.0 million tons (12.7 percent of MSW generated) were combusted with energy recovery (*See* Table 2).

Since 1990, the total amount of MSW going to landfills has dropped by 5.7 million tons, from 145.3 million tons in 1990 to 139.6 million tons in 2017 (*See* Table 2). The net per capita 2017 landfilling rate was 2.3 pounds per day, which was lower than the 3.2 per capita rate in 1990 (*See* Table 3).

Table 2. Generation, Recycling, Composting, Combustion with Energy Recovery and Landfilling of MSW, 1960 to 2017 (in millions of tons)

Activity	1960	1970	1980	1990	2000	2005	2010	2015	2016	2017
Generation	88.1	121.1	151.6	208.3	243.5	253.7	251.1	262.1	266.8	267.8
Recycling	5.6	8.0	14.5	29.0	53.0	59.2	65.3	67.6	68.6	67.2
Composting*	neg.	neg.	neg.	4.2	16.5	20.6	20.2	23.4	25.1	27.0
Combustion with energy recovery†	0.0	0.5	2.8	29.8	33.7	31.7	29.3	33.5	33.9	34.0
Landfilling and other disposal‡	82.5	112.6	134.3	145.3	140.3	142.2	136.3	137.6	139.2	139.6

* Composting of yard trimmings, food 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).

‡ Landfilling after recycling, composting and combustion with energy recovery. Includes combustion without energy recovery.

Details might not add to totals due to rounding.

neg. (negligible) = less than 5,000 tons.

Table 3. Generation, Recycling, Composting, Combustion with Energy Recovery and Landfilling of MSW, 1960 to 2017 (in pounds per person per day)

Activity	1960	1970	1980	1990	2000	2005	2010	2015	2016	2017
Generation	2.7	3.3	3.7	4.6	4.7	4.7	4.4	4.5	4.5	4.5
Recycling	0.2	0.2	0.4	0.6	1.0	1.1	1.1	1.2	1.2	1.1
Composting*	neg.	neg.	neg.	0.1	0.3	0.4	0.4	0.4	0.4	0.5
Combustion with energy recovery†	0.0	neg.	0.1	0.7	0.7	0.6	0.5	0.6	0.6	0.6
Landfilling and other disposal‡	2.5	3.1	3.2	3.2	2.7	2.6	2.4	2.3	2.3	2.3
Population (In millions)	180.0	204.0	227.3	249.9	281.4	296.4	309.1	320.9	323.1	325.1

* Composting of yard trimmings, food, 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).

‡ Landfilling after recycling, composting, and combustion with energy recovery. Includes combustion without energy recovery.

Details might not add to totals due to rounding.

neg. (negligible) = less than 5,000 tons.

Analyzing MSW

EPA analyzes MSW by breaking down the data in two ways: by material or by product. Materials are made into products, which are ultimately reprocessed through recycling or composting, or managed by combustion with energy recovery facilities or landfills. Examples of materials that EPA tracks include paper and paperboard, plastics, metals, glass, rubber, leather, textiles, wood, food and yard trimmings. For a full list of materials, *see* Table 1.

Products are what people buy and handle, and they are manufactured out of the types of materials listed above. Product categories include containers and packaging, nondurable goods, durable goods, food and yard trimmings. Containers and packaging, such as milk cartons and plastic wrap, are assumed to be in use for a year or less; nondurable goods like newspaper and clothing are assumed to be in use for less than three years; and durable goods, such as furniture, are assumed to be in use for three or more years. Some products, such as appliances, may be made of more than one material. Information about products shows how consumers are using and discarding materials and offers strategies on ways to maximize the source reduction, recycling and composting of materials.

Materials in MSW

Table 1 and the following figures provide specific information about materials in MSW. Table 1 shows generation, recycling, composting, combustion with energy recovery and landfilling by material, weight and percent of generation.

Figure 4 below provides the breakdown of MSW generation by material. Paper and paperboard, along with food, continued to be the largest components of MSW generated. Paper and paperboard accounted for 25 percent, while food accounted for about 15 percent. Yard trimmings and plastics comprised about 13 percent each. The remaining amount of MSW generated consisted of rubber, leather and textiles; metals; wood; glass; and other materials.

Composting Collection Programs [1,2]

- About 3,860 community composting programs were documented in 2017—an increase from 3,227 in 2002.
- Food composting curbside collection programs served 6.1 million households in 2017. About 6.7 million households had access to drop-off food collection programs that year.

Figure 5 provides the breakdown of MSW recycling by material in 2017. Paper and paperboard composed the largest component of MSW recycling, representing nearly 66 percent. Metals made up over 12 percent of MSW recycled. The remaining amount of MSW recycled consisted of rubber, leather and textiles; plastics; glass; wood; and other materials.

Figure 6 provides the breakdown of MSW composting by material, Figure 7 provides the breakdown of MSW combustion with energy recovery, and Figure 8 provides the breakdown of MSW landfilling.

Figure 4. Total MSW Generation (by material), 2017
267.8 Million Tons

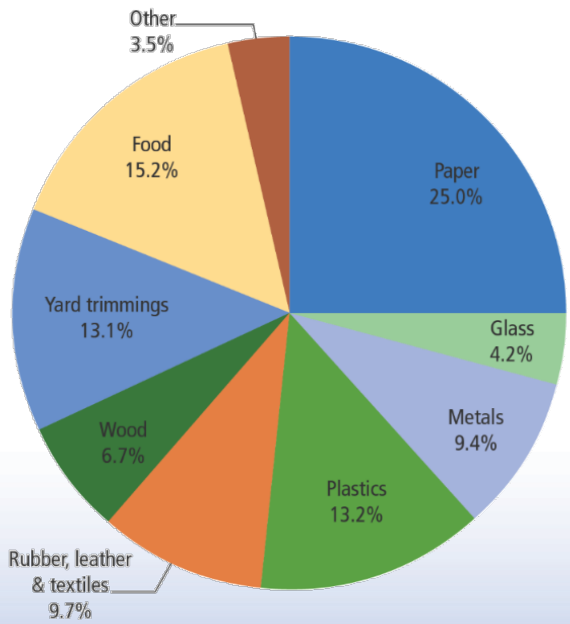


Figure 5. Total MSW Recycling (by material), 2017
67.2 Million Tons

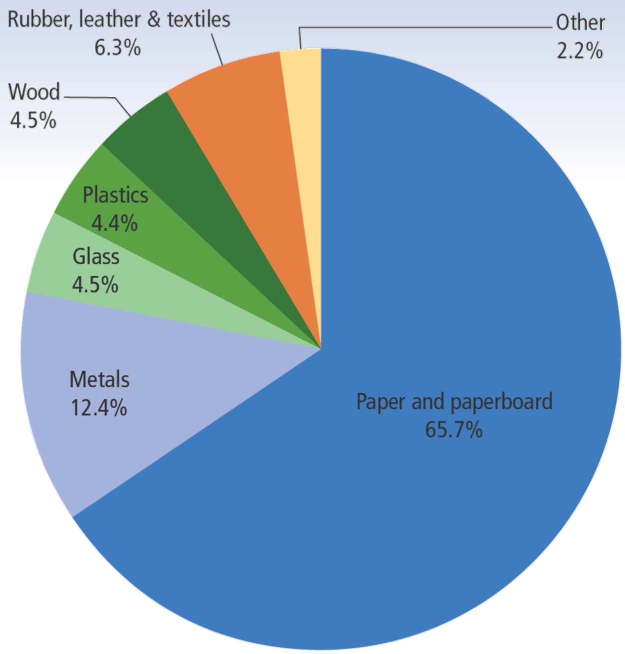


Figure 6. Total MSW Composting (by material), 2017
27.0 Million Tons

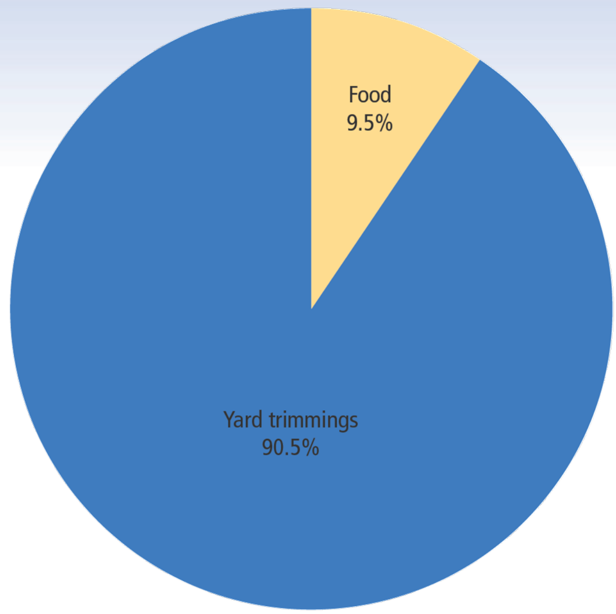


Figure 7. Total MSW Combusted with Energy Recovery (by material), 2017 34.0 Million Tons

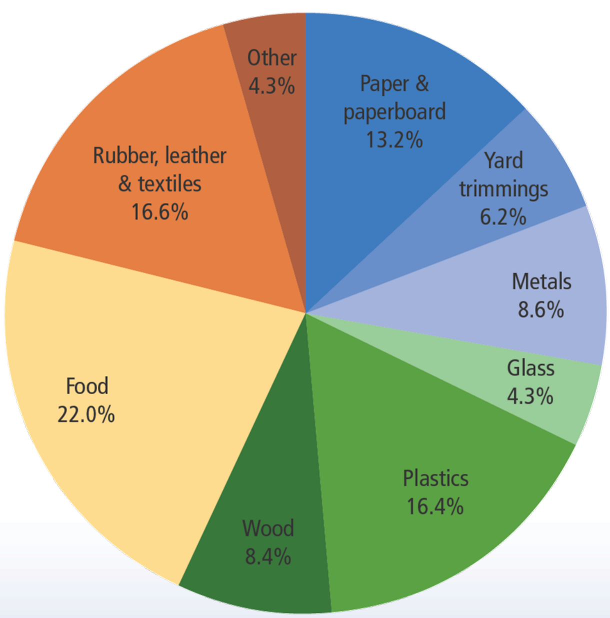
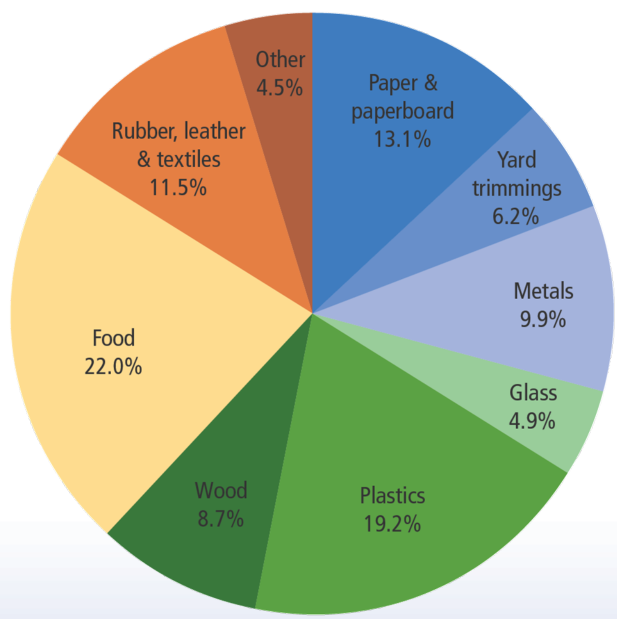


Figure 8. Total MSW Landfilled (by material), 2017
139.6 Million Tons



Products in MSW

The following information provides the details of the products found in MSW. Table 4 shows generation, recycling, composting, combustion with energy recovery and landfilling by product category, weight and percent of generation. The product categories include containers and packaging, durable goods, nondurable goods, and food and yard trimmings.

Containers and packaging made up the largest portion of MSW generated at 80 million tons (29.9 percent) in 2017. More than 57 million tons (21.4 percent of MSW generation) of durable goods were generated, while more than 50 million tons (18.9 percent of MSW generation) of nondurable goods were generated. The generation of food in MSW was over 40 million tons (15.2 percent), yard trimmings generation was 35 million tons (13.1 percent), and the generation of other wastes was about four million tons (1.5 percent).

The Containers and packaging product category had the highest recycling rate at 50.1 percent in 2017. Paper products, steel and glass were the most recycled materials by percentage in this category. The recycling of nondurable goods was 32.1 percent. Paper products such as newspapers/mechanical papers were the most recycled nondurable goods. Newspapers/mechanical papers include newspapers, directories, inserts, as well as some advertisement and direct mail printing. Overall, 18.9 percent of durable goods were recycled. With a 99.1 percent recycling rate in 2017, lead-acid batteries continued to be one of the most recycled products.

Yard trimmings had the highest composting rate of all product categories at 69.4 percent. Food was composted at a rate of 6.3 percent.

Food was the product category with the highest rate of combustion with energy recovery with a rate of 18.4 percent. Durable goods were combusted at a rate of 15.9 percent and nondurables at a rate of 13.3 percent. Containers and packaging, along with yard trimmings, were combusted at rates below 10 percent.

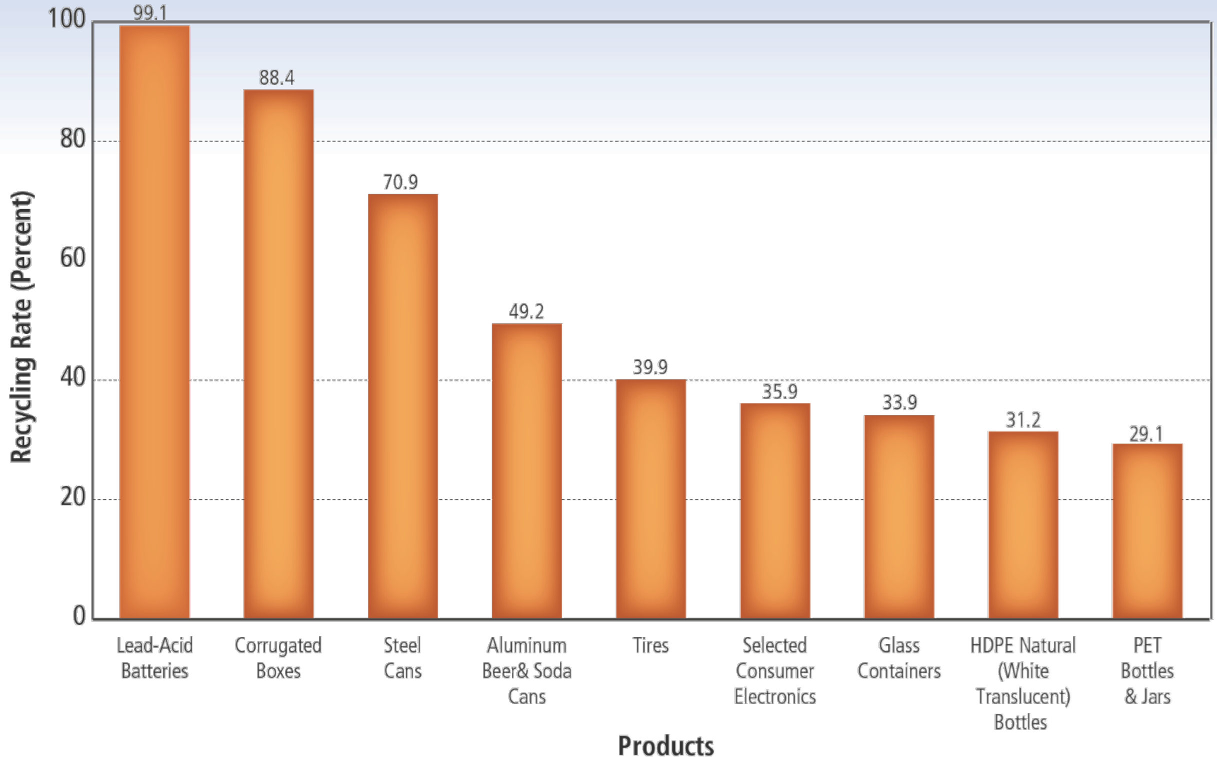
Food was the product category with the highest landfill rate at 75.3 percent. Durable goods followed with a landfill rate of 65.2 percent. Nondurable goods had the third highest landfill rate at 54.6 percent. Containers and packaging, along with yard trimmings, were the product categories with the lowest landfill rates at 40.1 percent and 24.6 percent, respectively.

Figure 9 displays selected individual products with high recycling rates.

Recycling Rates

Measured by percent of generation, individual products with the highest recycling rates in 2017 were lead-acid batteries (99.1 percent), corrugated boxes (88.4 percent), steel cans (70.9 percent), newspapers/mechanical papers (76.8 percent), major appliances (60.3 percent), aluminum cans (49.2 percent), mixed paper (48.3 percent), tires (39.9 percent) and selected consumer electronics (35.9 percent).

Figure 9. Selected Products with High Recycling Rates, 2017*



*Does not include combustion with energy recovery

Table 4. Generation, Recycling, Composting, Combustion with Energy Recovery and Landfilling of Products in MSW, 2017*
(in millions of tons and percent of generation of each product)

Products	Weight Generated	Weight Recycled	Weight Composted	Weight Combusted with Energy Recovery	Weight Landfilled	Recycling as Percent of Generation	Composting as Percent of Generation	Combustion as Percent of Generation	Landfilling as Percent of Generation
Durable goods									
Steel	16.88	4.70	-	2.19	9.99	27.8%	-	13.0%	59.2%
Aluminum	1.72	-	-	0.26	1.46	-	-	15.1%	84.9%
Other nonferrous metals†	2.33	1.54	-	0.07	0.72	66.1%	-	3.0%	30.9%
Glass	2.45	Negligible	-	0.32	2.13	Negligible	-	13.1%	86.9%
Plastics	13.46	0.85	-	1.72	10.89	6.3%	-	12.8%	80.9%
Rubber and leather	7.94	1.67	-	2.27	4.00	21.0%	-	28.6%	50.4%
Wood	6.59	Negligible	-	1.20	5.39	Negligible	-	18.2%	81.8%
Textiles	3.91	0.59	-	1.02	2.30	15.1%	-	26.1%	58.8%
Other materials	1.84	1.45	-	0.03	0.36	78.8%	-	1.6%	19.6%
Total durable goods	**57.12**	**10.80**	**-**	**9.08**	**37.24**	**18.9%**	**-**	**15.9%**	**65.2%**
Nondurable goods									
Paper and paperboard	25.95	14.09	-	2.33	9.53	54.3%	-	9.0%	36.7%
Plastics	7.42	0.22	-	1.40	5.80	3.0%	-	18.9%	78.2%
Rubber and leather	1.17	Negligible	-	0.22	0.95	Negligible	-	18.8%	81.2%
Textiles	12.68	1.98	-	2.09	8.61	15.6%	-	16.5%	67.9%
Other materials	3.48	Negligible	-	0.68	2.80	Negligible	-	19.5%	80.5%
Total nondurable goods	**50.70**	**16.29**	**-**	**6.72**	**27.69**	**32.1%**	**-**	**13.3%**	**54.6%**

Table 4 (continued). Generation, Recycling, Composting, Combustion with Energy Recovery and Landfilling of Products in MSW, 2017*
(in millions of tons and percent of generation of each product)

Products	Weight Generated	Weight Recycled	Weight Composted	Weight Combusted with Energy Recovery	Weight Landfilled	Recycling as Percent of Generation	Composting as Percent of Generation	Combustion as Percent of Generation	Landfilling as Percent of Generation
Containers and packaging									
Steel	2.01	1.47	-	0.10	0.44	73.1%	-	5.0%	21.9%
Aluminum	1.89	0.62	-	0.26	1.01	32.8%	-	13.8%	53.4%
Glass	8.93	3.03	-	1.16	4.74	33.9%	-	13.0%	53.1%
Paper and paperboard	41.06	30.08	-	2.16	8.82	73.3%	-	5.3%	21.5%
Plastics	14.49	1.89	-	2.47	10.13	13.0%	-	17.0%	69.9%
Wood	11.40	3.00	-	1.65	6.75	26.3%	-	14.5%	59.2%
Other materials	0.30	Negligible	-	0.06	0.24	Negligible	-	20.0%	80.0%
Total containers and packaging	**80.08**	**40.09**	**-**	**7.86**	**32.13**	**50.1%**	**-**	**9.8%**	**40.1%**
Other wastes									
Food, other‡	40.67	-	2.57	7.47	30.63	-	6.3%	18.4%	75.3%
Yard trimmings	35.18	-	24.42	2.11	8.65	-	69.4%	6.0%	24.6%
Miscellaneous inorganic wastes	4.04	-	-	0.79	3.25	-	-	19.6%	80.4%
Total other wastes	**79.89**	**-**	**26.99**	**10.37**	**42.53**	**-**	**33.8%**	**13.0%**	**53.2%**
Total municipal solid waste	**267.79**	**67.18**	**26.99**	**34.03**	**139.59**	**25.1%**	**10.1%**	**12.7%**	**52.1%**

* Includes waste from residential, commercial and institutional sources.

† Includes lead from lead-acid batteries.

‡ Includes collection 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. A dash in the table means that data are not available.

Environmental and Economic Benefits

Environmental Benefits of Recycling and Composting

The energy and greenhouse gas (GHG) benefits of recycling, composting and combustion with energy recovery that are shown in Table 5 are calculated using EPA's WARM (Waste Reduction Model) tool (*See*: https://www.epa.gov/warm). WARM calculates and totals the GHG emissions of baseline and alternative waste management practices, including source reduction, recycling, composting, combustion with energy recovery and landfilling. For example, paper and paperboard recycling, at about 44.2 million tons, resulted in a reduction of about 148 $MMTCO_2E$ in 2017. This reduction is equivalent to removing over 31 million cars from the road for one year.

> In 2017, more than 94 million tons of MSW in the U.S. were recycled and composted, saving over 184 $MMTCO_2E$. This is comparable to the emissions that could be reduced from taking over 39 million cars off the road in a year.

Table 5. 2017 Environmental Benefits

(The numbers in the Recycled, Composted, Combustion with Energy Recovery and Landfilled columns are listed by weight of material* in millions of tons)

Material	Recycled	Composted	Combustion with Energy Recovery	Landfilled	GHG Benefits ($MMTCO_2E$)	Number of Cars Taken Off the Road Per Year (millions of cars)
Paper and paperboard	44.17	-	4.49	18.35	(147.97)	(31.42)
Glass	3.03	-	1.48	6.87	(0.89)	(0.19)
Metals						
Steel	6.17	-	2.29	10.43	(15.12)	(3.21)
Aluminum	0.62	-	0.56	2.65	(5.66)	(1.20)
Other nonferrous metals**	1.54	-	0.07	0.72	(6.87)	(1.46)
Total metals	**8.33**	**-**	**2.92**	**13.8**	**(27.65)**	**(5.87)**
Plastics	2.96	-	5.59	26.82	3.82	0.81
Rubber and leather†	1.67	-	1.74	0.78	0.17	0.04
Textiles	2.57	-	3.17	11.15	(2.76)	(0.59)
Wood	3.00	-	2.85	12.14	(3.15)	(0.67)
Food, other‡	-	2.57	7.47	30.63	(6.90)	(1.46)
Yard trimmings	-	24.42	2.11	8.65	0.85	0.18
Miscellaneous inorganic wastes	-	-	0.79	3.25	(0.27)	(0.58)
Totals	**65.73**	**26.99**	**32.61**	**132.44**	**(184.74)**	**(39.22)**

*Includes material from residential, commercial and institutional sources.

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

†Only includes rubber from tires.

‡Includes collection of other MSW organics for composting.

These calculations do not include an additional 10.02 million tons of MSW that could not be addressed in the WARM model. $MMTCO_2E$ is million metric tons of carbon dioxide equivalent. Numbers in parentheses indicate a reduction in either greenhouse gases or vehicles, and therefore represent environmental benefits.

Source: WARM model Version 15 (https://www.epa.gov/warm)

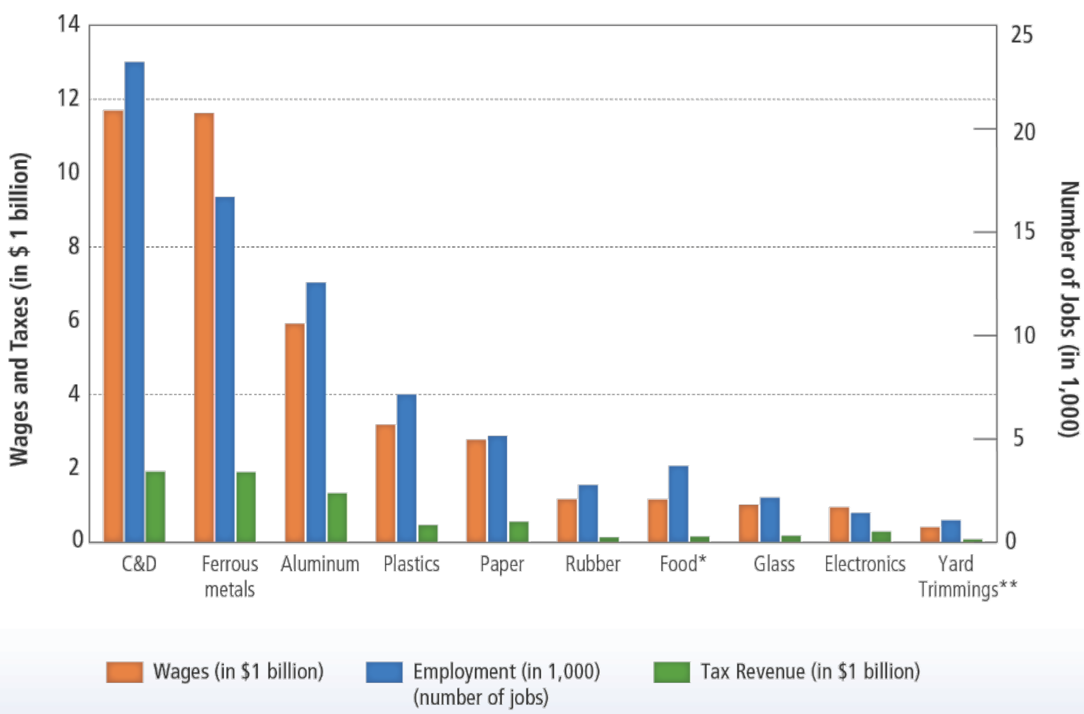
Economic Indicators

Economic Benefits of Recycling and Composting

How our nation uses materials is fundamental to our economic and environmental future. Global competition for finite resources is expected to continue to increase. A more productive and less impactful use of materials helps our society remain economically competitive, contributes to our prosperity and protects the environment. By using waste materials as valuable raw materials, recycling creates jobs, builds more competitive manufacturing industries and significantly contributes to the U.S. economy.

EPA's 2001 Recycling Economic Information (REI) Study evaluated the number of recycling jobs, wages and tax revenue. The Agency updated the study with a 2016 REI Report[3] to increase the understanding of the economic implications of material reuse and recycling. The 2016 REI Report included updated information about the number of recycling jobs, wages and tax revenue (*See* Figure 10). The report showed that the recycling and reuse of materials creates jobs and also generates local and state tax revenues. The data from the most recent year available showed that in 2007, recycling and reuse activities in the United States accounted for: 757,000 jobs; $36.6 billion in wages; and $6.7 billion in tax revenues. This calculation equates to 1.57 jobs for every 1,000 tons of materials recycled. Construction and demolition debris provided the largest contribution to all three categories (jobs, wages and tax revenue), followed by ferrous metals and nonferrous metals, such as aluminum.

Figure 10. Wages, Taxes and Jobs Attributed to Recycling



*Food category includes animal feed, meal, meat, fat, oils and tallow, as well as community food service

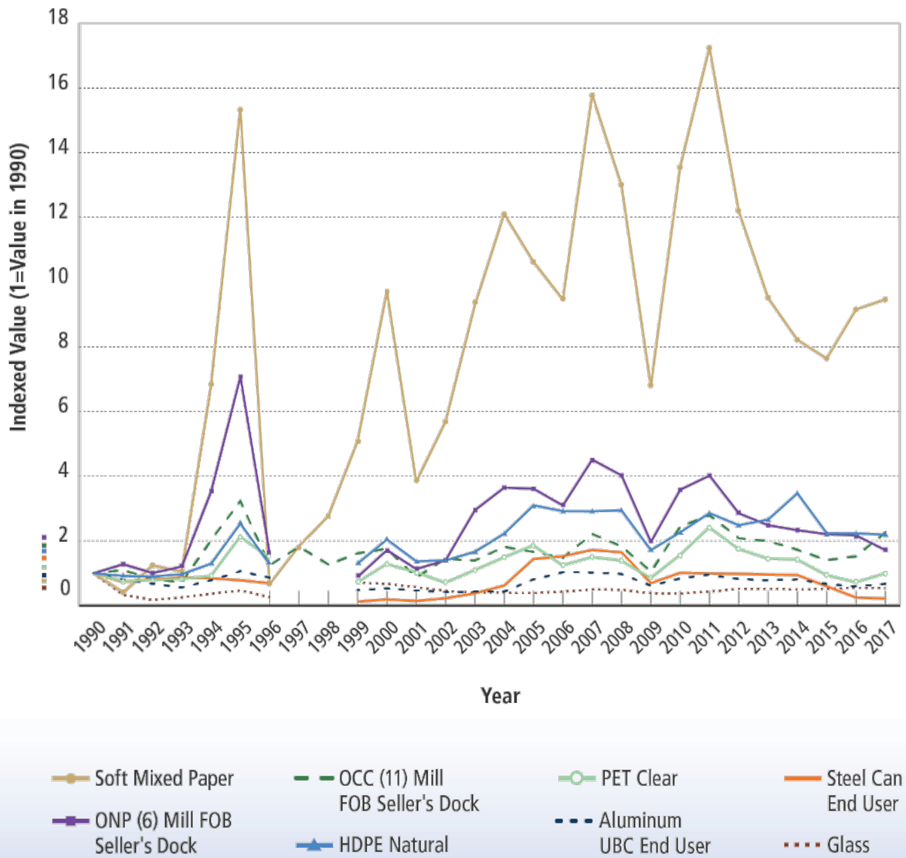
**Yard Trimmings category includes biodiesel, biogas, compost, mulch and wood chips

Recycled Commodity Values

Figure 11 shows the indexed values by year for the following recycled commodities from 1990 to 2017: high-density polyethylene (HDPE) natural bottles; polyethylene terephthalate (PET) clear bottles; aluminum used beverage cans (UBC); steel cans; old newspaper (ONP) (grade 6); old corrugated containers (OCC) (grade 11); paper stock (PS) (grade 1) soft mixed paper; and glass containers .The values are normalized to 2017 using the Consumer Price Index (CPI) from the Bureau of Labor Statistics (BLS).They are indexed to allow commodity values with different metrics, such as dollars per ton, dollars per gross ton and dollars per short ton, to be shown on the same graph and to compare their relative rates of change. The indexed value indicates the change in value of the data since 1990, where one is equal to the value in 1990. For example, if for a given year, the indexed value were two, then the commodity value for that year would be two times the 1990 value.

Figure 11 shows similar trends across all commodities for indexed values. For example, values for plastics and papers spiked in 1995, and values for most commodities dipped in 2009, relative to 1990. Additionally, many commodities, such as plastics and papers, also experienced a price spike in 2000, 2007 and 2011, followed by a dip in 2015. In contrast, the indexed lines for glass, aluminum and steel cans appear to fluctuate less frequently.

Figure 11. Indexed Recycled Commodity Values by Year



Source: Pulp & Paper Global Fact & Price Book, 2003-2004. Page 128. Paperloop, Inc. 2004. See endnotes for additional sources[4]

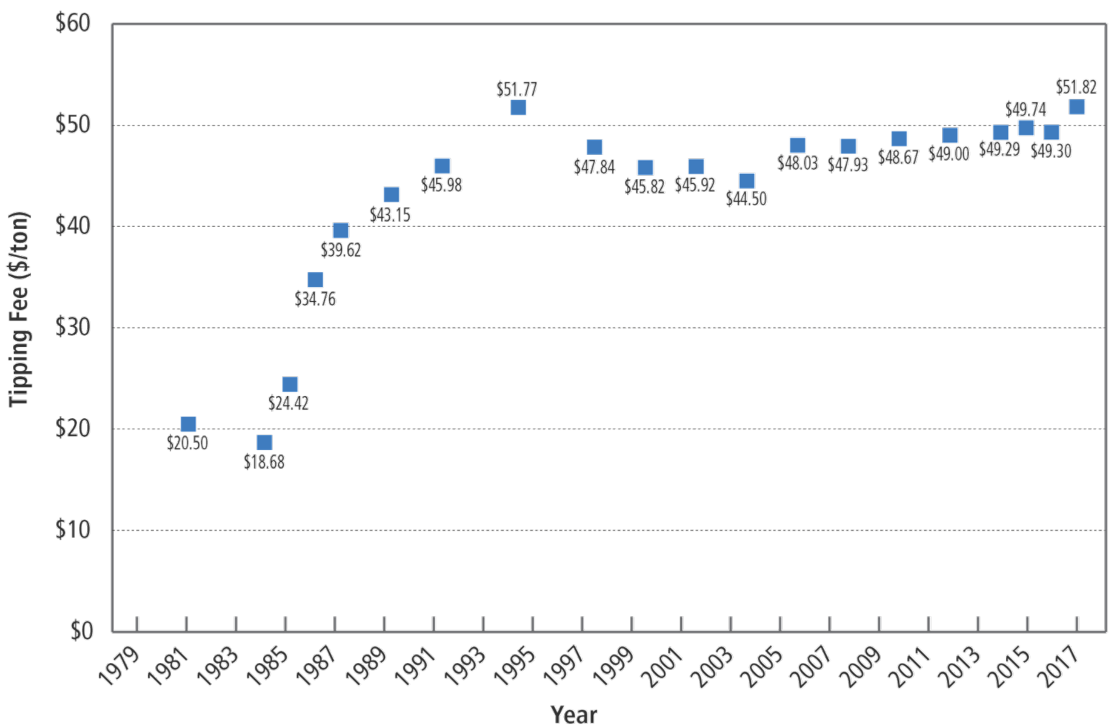
Landfill Tipping Fees

From 1985 to 1995, there was a rapid rise in national landfill tipping fees, followed by a steady decrease from 1995 to 2004. Since 2004, there has been a slow and steady average increase of about one percent per year in landfill tipping fees (*See* Figure 12). The tipping fees are expressed in constant 2017 dollars.

Tipping fees are important to consider as they typically increase as landfill capacity decreases. The difference in tipping fees regionally is correlated to landfill capacity, as the average tipping fee in Western states ($35.69) with more available space for landfills (e.g., Texas, Colorado, Idaho, Montana, Nevada) is less than half of the average in the Northeast ($74.75).[5]

National mean annual landfill tipping fees were normalized to the value of the dollar in 2017 using the Consumer Price Index (CPI) from the Bureau of Labor Statistics to allow meaningful comparisons. This figure shows an average increase from 1985 to 1995 of $3.31 per year, followed by a steady decrease of $0.81 per year through 2004 and an average increase of $0.56 per year from 2004 to 2017.

Figure 12. National Landfill Tipping Fees, 1982-2017 ($2017 per ton)



Source: National Solid Wastes Management Association (NSWMA) Municipal Solid Waste Landfill Facts. October 2011 (Data from 1985 to 2008). Waste Business Journal. "The Cost to Landfill MSW Continues to Rise Despite Soft Demand." July 11, 2017 (Data for 2010 to 2015). "Analysis of MSW Landfill Tipping Fees" April 2018 (Data for 2016 and 2017). https://erefdn.org/product/analysis-msw-landfill-tipping-fees-2/

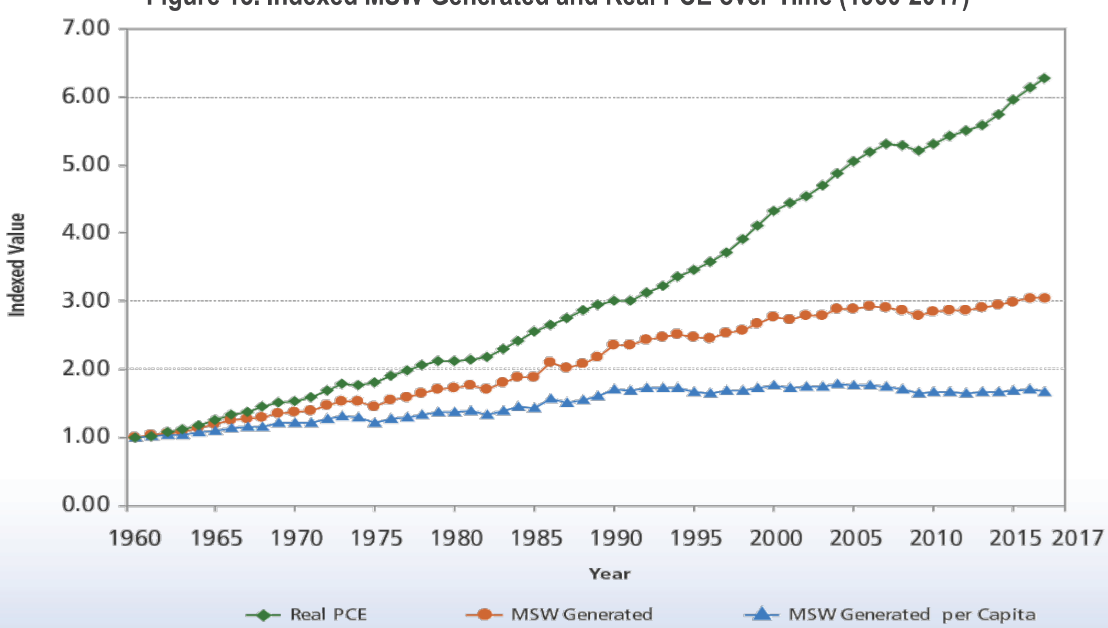
MSW Generation and Household Spending

In the United States, the change in the amount of MSW generated typically mirrors trends in how much money households spent on goods and services. Personal Consumer Expenditures (PCE) measure household spending on goods and services such as food, clothing, vehicles and recreation services. PCE is one of the four components of economic growth, along with government spending, private investments and net exports. As PCE is an indicator of the household consumption of goods and services, which make up nearly 70 percent of the gross domestic product (GDP), PCE has a stronger conceptual tie to MSW generation than the other three GDP components. PCE adjusted for inflation is referred to as real PCE. This metric is more useful 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 13 explores the relationship between MSW generated and real PCE.

Figure 13 is an indexed graph, showing the relative changes in real PCE, MSW generated and MSW generated per capita over time. It is indexed to allow all three of these metrics to be shown on the same graph and to 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 was three, then the data value for that year would be three times the 1960 value. In this case, if the 1960 value were 200, then the resulting year's value would be 600. The 2017 MSW per capita generation indexed value is 1.7, which means that MSW per capita generation has increased by 70 percent since 1960.

Figure 13 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 index indicates that the amount of MSW generated per dollar spent is falling. In other words, the U.S. economy has been able to enjoy dramatic increases in household spending on consumer goods and services without 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.

Figure 13. Indexed MSW Generated and Real PCE over Time (1960-2017)



Source: See endnotes[6]

MSW Methodology

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. EPA recognizes that there are several approaches to measuring material flows, such as by volume. To be consistent, EPA reports the quantities of materials in tons in the current fact sheet, but the Agency will continue to explore options for alternative measurement methodologies to describe materials management in the United States.

EPA has consistently used materials flow analysis to allow for the comparison of data over the last three decades. EPA recognizes that this methodology differs from other methodologies that also estimate the generation of MSW and other waste data. EPA will continue to work with stakeholders to identify methodologies and additional publicly available data to improve our national understanding of materials flow in the United States.

Using data gathered from industry associations, businesses and government sources, such as the U.S. Department of Commerce and the U.S. Census Bureau, EPA estimates the weight in tons of all MSW materials and products generated, recycled, composted, combusted with energy recovery and landfilled. Other sources of data, such as waste characterizations and research reports performed by governments, industry or the press, supplement these data.

Construction and Demolition (C&D) Debris Generation Results

Construction and demolition (C&D) debris is a type of waste that is not included in MSW. Materials included in C&D debris are steel, wood products, drywall and plaster, brick and clay tile, asphalt shingles, concrete and asphalt concrete. These materials are used in buildings, roads and bridges, and other structures. The generation estimate represents C&D debris amounts from construction, renovation and demolition activities for buildings, roads and bridges, and other structures.

In 2017, 569 million tons of C&D debris were generated. Figure 14 shows the 2017 generation composition for C&D debris. C&D concrete was the largest portion at 69.7 percent, followed by asphalt concrete at 15.0 percent. C&D wood products made up 7.1 percent, and the other products accounted for 8.1 percent combined. The 2017 generation estimates are presented in more detail in Table 6. As shown in Figure 15, demolition represented over 90 percent of total C&D debris generation. Construction, on the other hand, represented under 10 percent.

Figure 14. C&D Generation Composition by Material (before processing), 2017
569 Million Tons

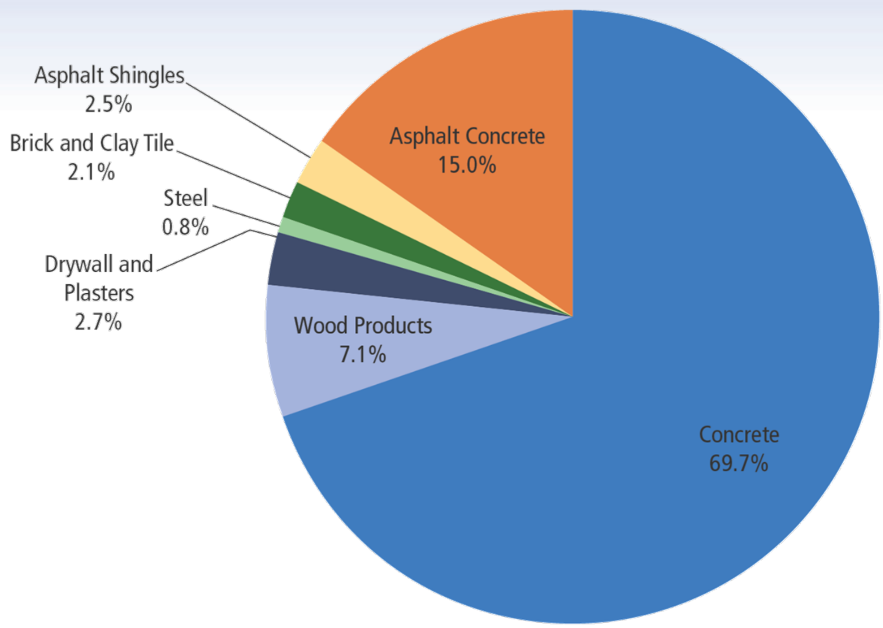


Table 6. C&D Debris Generation by Material and Activity, 2017 (in millions of tons)

	Waste During Construction	Demolition Debris	Total C&D Debris
Concrete	24.0	373.0	397.0
Wood Products[7]	3.3	36.9	40.2
Drywall and Plasters	4.3	11.0	15.3
Steel[8]	0	4.6	4.6
Brick and Clay Tile	0.3	11.9	12.2
Asphalt Shingles	1.4	13.0	14.4
Asphalt Concrete	0	85.7	85.7
Total	**33.3**	**536.1**	**569.4**

[7,8] See endnotes.

Figure 15. Contribution of Construction and Demolition Phases to Total 2017 C&D Debris Generation

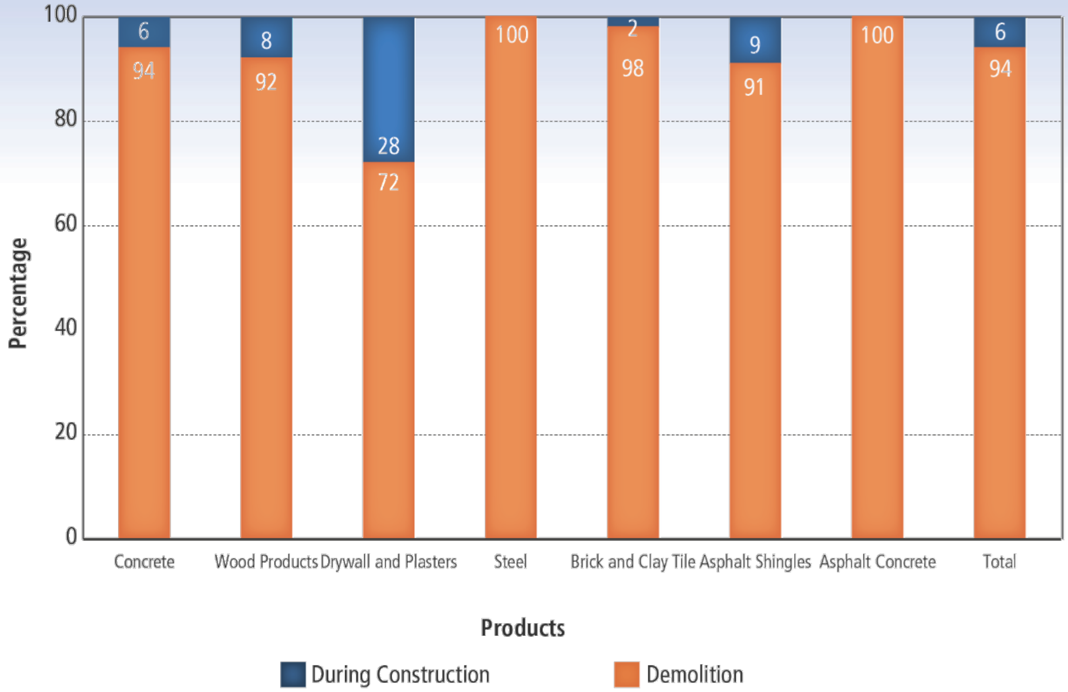


Table 7 displays the amount of C&D debris generation from buildings, roads and bridges, and other structures for each material. The "other structures" category includes C&D debris generation estimates from communication, power, transportation, sewer and waste disposal, water supply, conservation and development, and the manufacturing infrastructure. In 2017, roads and bridges contributed significantly more to C&D debris generation than buildings and other structures, and concrete made up the largest share of C&D debris generation for all three categories.

Table 7. C&D Debris Generation by Source, 2017 (in millions of tons)

	Buildings	Roads and Bridges	Other
Concrete	98.8	164.5	133.7
Wood Products[7]	38.9	-	1.3
Drywall and Plasters	15.3	-	-
Steel[8]	4.6	-	-
Brick and Clay Tile	12.2	-	-
Asphalt Shingles	14.4	-	-
Asphalt Concrete	-	85.7	-
Total	**184.2**	**250.2**	**135.0**

[7,8] See endnotes.

A dash in the table means that data are not available.

Resources

The 2017 data tables and the summary of the MSW characterization methodology are available on the EPA website, along with information about waste reduction, recycling and sustainable materials management.

Please visit:

https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling
https://www.epa.gov/recycle
https://www.epa.gov/smm
https://www.epa.gov/warm

Endnotes

1. Source for 2002 community composting program data: "The State of Garbage In America." Simmons, Phil, Scott M. Kaufman, and Nickolas J. Themelis. *BioCycle* 47, no. 4, p. 26 (2006). Source for 2017 data: Goldstein, N. 2017, "The State of Organics." *BioCycle*, October, p. 5, Table 2. Facilities composting yard trimmings, yard trimmings and food, and mixed organics. Excludes 740 facilities composting manure, biosolids, mixed MSW or not defined.
2. Sources for food composting collection programs: Streeter, V.; Platt B. 2017. Residential Food Waste Collection Access in the U.S. *BioCycle* December.
3. US EPA. 2016. "Recycling Economic Information Report" (2016). https://www.epa.gov/smm/recycling-economic-information-rei-report. The 2016 REI Report used an updated analytical framework and a new Waste Input-Output methodology, which focused on the life cycle of materials. These refinements offered significant improvements over the original 2001 REI Study by providing a better definition of recycling and addressing double counting. This new methodology assists decision makers and researchers in more accurately estimating the economic benefits of recycling, and it creates a foundation upon which additional studies can be built.
4. Recycled Commodity Values. Soft mixed paper consists of a clean, sorted mixture of various qualities of paper not limited as to type of fiber content. Prohibitive Materials may not exceed 1 percent. There are specific limits on the percent of contaminants allowed in soft mixed paper. Data were not available for ONP, metals, plastics and glass in 1997 and 1998. For plastics, glass and metals, there was a transition in data sources between 1996 and 1999 and between 2004 and 2005, so some of the change between years could be due to the methodology of the data source for capturing data.

   Additional sources include Secondary Materials Pricing and Secondary Fiber Pricing. 2003-2017. Released December 2017. Available at http://www.recyclingmarkets.net/. 1970 to 2004 historical data tabulated from weekly or monthly industry publications and averaged annually during the time periods shown. Publications included Waste Age Recycling Times, Waste News, Paper Recycler, Miller Freeman, Inc.
5. Solid Waste Environmental Excellence Protocol. "No End in Sight to US Landfill Cost Increases — Pacific Region to Experience Highest Growth". June 13, 2018. https://nrra.net/sweep/no-end-in-sight-to-us-landfill-cost-increases-pacific-region-to-experience-highest-growth/
6. MSW Generation: US EPA. 2019. Solid Waste in the United States: 2016 and 2017 Facts and Figures working papers.
   Population: U.S. Census Bureau. Population Division. Annual Estimates of the Resident Population.
   PCE: Bureau of Economic Analysis (BEA). 2019. Tables 2.3.4 and 2.3.5.
7. Wood consumption in buildings also includes some lumber consumed for the construction of other structures. Data were not available to allocate lumber consumption for non-residential and unspecified uses between buildings and other structures except for railroad ties. Since non-residential buildings such as barns, warehouses and small commercial buildings are assumed to consume a greater amount of lumber than other structures, the amount of lumber for construction remaining after the amount for railroad ties is split out is included in the buildings source category.
8. Steel consumption in buildings also includes steel consumed for the construction of roads and bridges. Data were not available to allocate steel consumption across different sources, but buildings are assumed to consume the largest portion of steel for construction.

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