Advancing Sustainable Materials Management: 2015 Fact Sheet

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

July 2018

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 2015.

In 2015, in the United States, approximately 262 million tons (U.S. short tons unless specified) of MSW were generated (*See* Figure 1). Of the MSW generated, approximately 68 million tons of MSW were recycled and 23 million tons of MSW were composted. Together, more than 91 million tons of MSW were recycled and composted, equivalent to a 34.7 percent recycling and composting rate (*See* Figure 2). In addition, more than 33 million tons of MSW (12.8 percent) were combusted with energy recovery. Finally, more than 137 million tons of MSW (52.5 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 thinking beyond waste and instead 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 adverse environmental impacts from materials.

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 2015

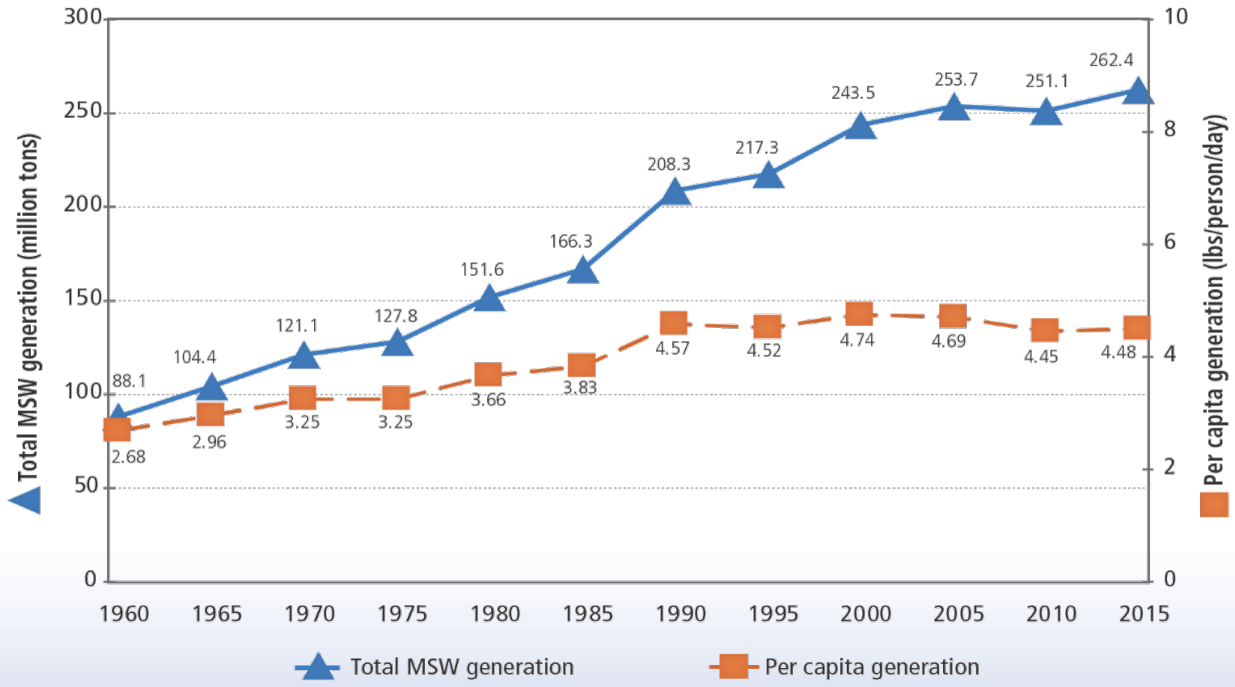


Figure 2. MSW Recycling and Composting Rates, 1960 to 2015

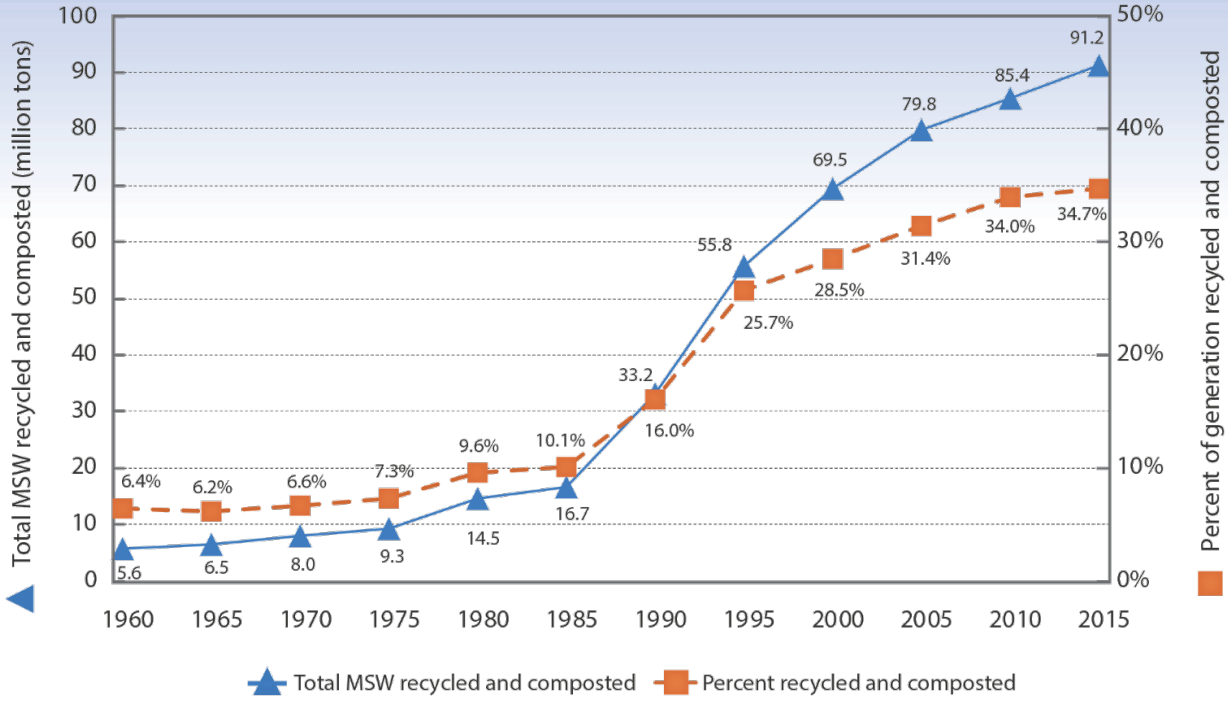


Figure 3. Management of MSW in the United States, 2015

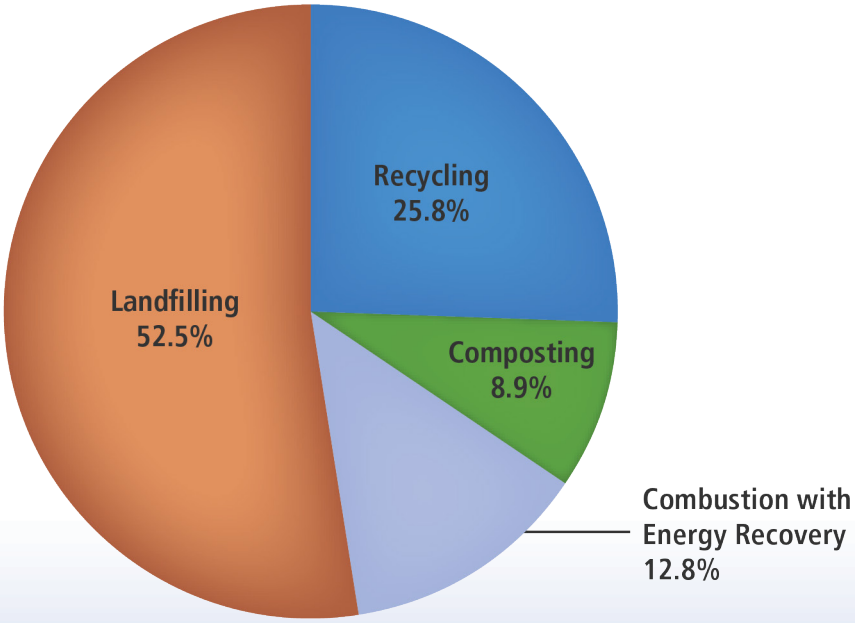


Table 1. Generation, Recycling, Composting, Combustion with Energy Recovery and Landfilling of Materials in MSW, 2015*
(in millions of tons and percent of generation of each material)

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	68.05	45.32	-	4.45	18.28	66.6%	-	6.5%	26.9%
Glass	11.47	3.03	-	1.47	6.97	26.4%	-	12.8%	60.8%
Metals									
Steel	18.17	6.06	-	2.14	9.97	33.3%	-	11.8%	54.9%
Aluminum	3.61	0.67	-	0.50	2.44	18.5%	-	13.9%	67.6%
Other nonferrous metals†	2.22	1.50	-	0.06	0.66	67.6%	-	2.7%	29.7%
Total metals	**24.00**	**8.23**	-	**2.70**	**13.07**	**34.3%**	-	11.2%	54.5%
Plastics	34.50	3.14	-	5.35	26.01	9.1%	-	15.5%	75.4%
Rubber and leather	8.48	1.51	-	2.49	4.48	17.8%	-	29.4%	52.8%
Textiles	16.03	2.45	-	3.05	10.53	15.3%	-	19.0%	65.7%
Wood	16.30	2.66	-	2.58	11.06	16.3%	-	15.8%	67.9%
Other materials	5.16	1.43	-	0.69	3.04	27.7%	-	13.4%	58.9%
Total materials in products	**183.99**	**67.77**	-	**22.78**	**93.44**	**36.8%**	-	**12.4%**	**50.8%**
Other wastes									
Food, other‡	39.73	-	2.10	7.38	30.25	-	5.3%	18.6%	76.1%
Yard trimmings	34.72	-	21.29	2.63	10.80	-	61.3%	7.6%	31.1%
Miscellaneous inorganic wastes	3.99	-	-	0.78	3.21	-	-	19.5%	80.5%
Total other wastes	**78.44**	-	**23.39**	**10.79**	**44.26**	-	**29.8%**	**13.8%**	**56.4%**
Total municipal solid waste	**262.43**	**67.77**	**23.39**	**33.57**	**137.70**	**25.8%**	**8.9%**	**12.8%**	**52.5%**

* 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 trash, or MSW, 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) and 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 have changed substantially. Solid waste generation peaked at 4.74 pounds per person per day in 2000. However, the rate of 4.48 pounds per person per day in 2015 is slightly higher than the 2014 rate, which was 4.45 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 34.7 percent in 2015 (*See* Figure 2). Without including composting, recycling alone rose from 14.5 million tons (9.6 percent of MSW) in 1980 to 67.8 million tons (25.8 percent) in 2015. Composting was negligible in 1980, and it rose to 23.4 million tons in 2015 (8.9 percent; *see* Figure 3 and Table 2 for details).

Food

Nationally, the composting of food rose from 1.94 million tons in 2014 (5 percent of food) to 2.10 million tons in 2015 (5.3 percent of food).

Combustion with energy recovery was less than 2 percent of generation in 1980 (2.8 million tons). In 2015, more than 33.5 million tons (12.8 percent of MSW generated) were combusted with energy recovery (*See* Table 2).

Since 1990, the total amount of MSW going to landfills dropped by 7.6 million tons, from 145.3 million to 137.7 million tons in 2015 (*See* Table 2). The net per capita 2015 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 2015 (in millions of tons)

Activity	1960	1970	1980	1990	2000	2005	2010	2014	2015
Generation	88.1	121.1	151.6	208.3	243.5	253.7	251.1	259.0	262.4
Recycling	5.6	8.0	14.5	29.0	53.0	59.2	65.3	66.6	67.8
Composting*	neg.	neg.	neg.	4.2	16.5	20.6	20.2	23.0	23.4
Combustion with energy recovery†	0.0	0.5	2.8	29.8	33.7	31.7	29.3	33.2	33.5
Landfilling and other disposal‡	82.5	112.6	134.3	145.3	140.3	142.2	136.3	136.2	137.7

* 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 or 0.05 percent.

Table 3. Generation, Recycling, Composting, Combustion with Energy Recovery and Landfilling of MSW, 1960 to 2015 (in pounds per person per day)

Activity	1960	1970	1980	1990	2000	2005	2010	2014	2015
Generation	2.7	3.3	3.7	4.6	4.7	4.7	4.4	4.4	4.5
Recycling	0.2	0.2	0.4	0.6	1.0	1.1	1.1	1.1	1.2
Composting*	neg.	neg.	neg.	0.1	0.3	0.4	0.4	0.4	0.4
Combustion with energy recovery†	0.0	neg.	0.1	0.7	0.7	0.6	0.5	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
Population (In millions)	180.0	204.0	227.3	249.9	281.4	296.4	309.1	318.9	320.9

* 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 or 0.05 percent.

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 sending them to 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 how to maximize source reduction, recycling and composting of materials.

Materials in MSW

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

Figure 4 below provides the breakdown of MSW generation by material. Paper and paperboard, and food continued to be the largest components of MSW generated. Paper and paperboard accounted for about 26 percent, while food accounted for 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 2015—an increase from 3,227 in 2002.
- Food composting curbside collection programs served 3.8 million households in 2015. About 5.4 million households had access to drop-off food collection programs that year.

Figure 5 provides the breakdown of MSW recycling by material. Paper and paperboard was the largest component of MSW recycling, representing nearly 67 percent. Metals made up 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. Yard trimmings made up 91 percent of MSW composted. Food made up the remaining 9 percent of material composted.

Figure 7 provides the breakdown of MSW combustion with energy recovery.

Figure 8 provides the breakdown of MSW landfilling.

Figure 4. Total MSW Generation (by material), 2015
262 Million Tons

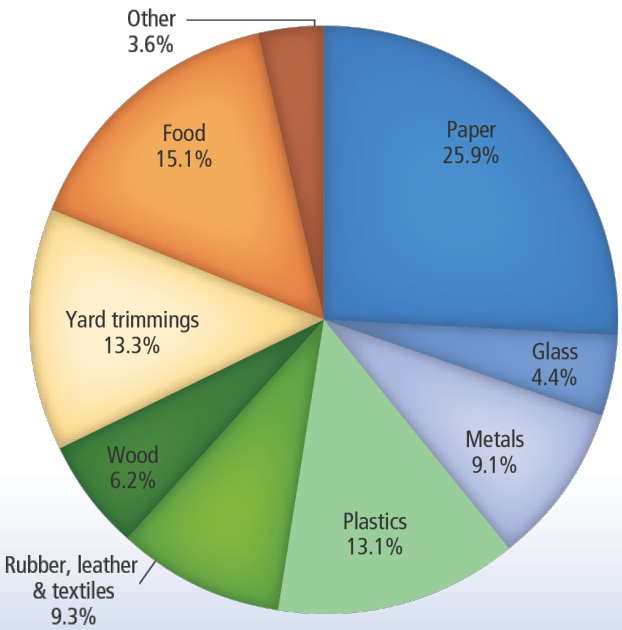


Figure 5. Total MSW Recycling (by material), 2015
68 Million Tons

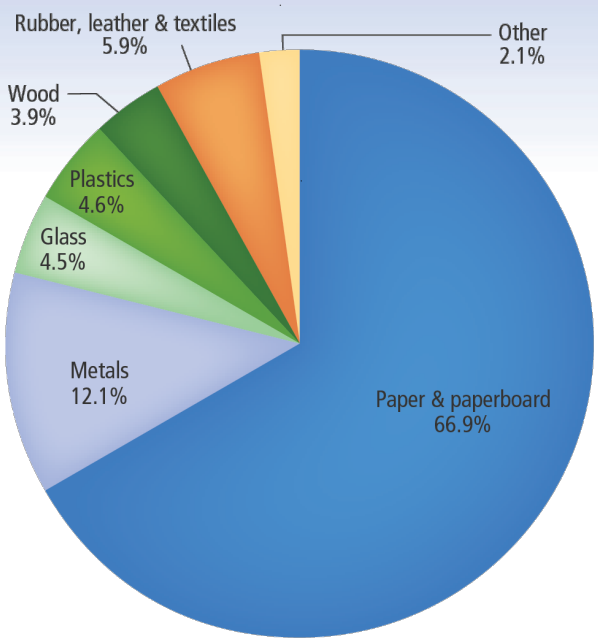


Figure 6. Total MSW Composting (by material), 2015
23 Million Tons

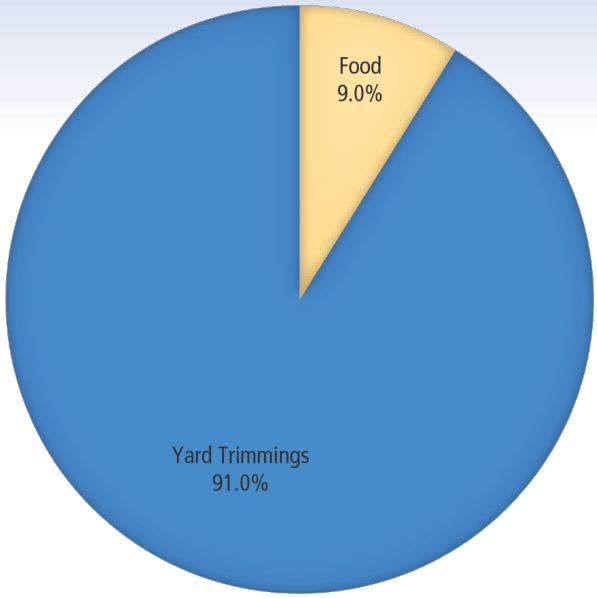


Figure 7. Total MSW Combusted with Energy Recovery (by material), 2015 34 Million Tons

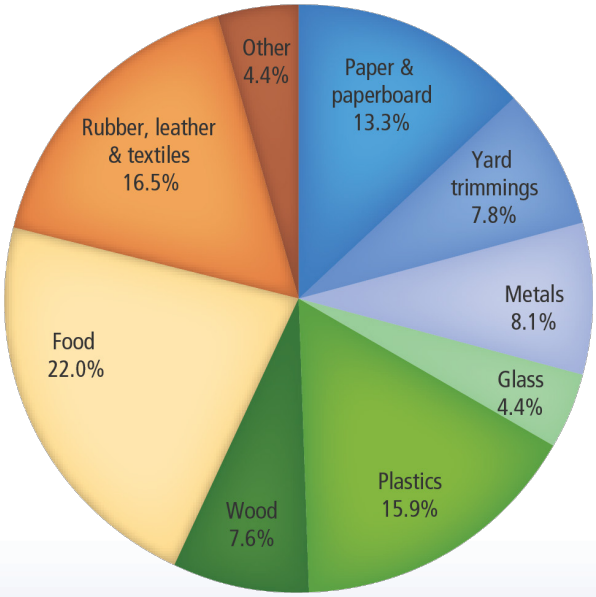
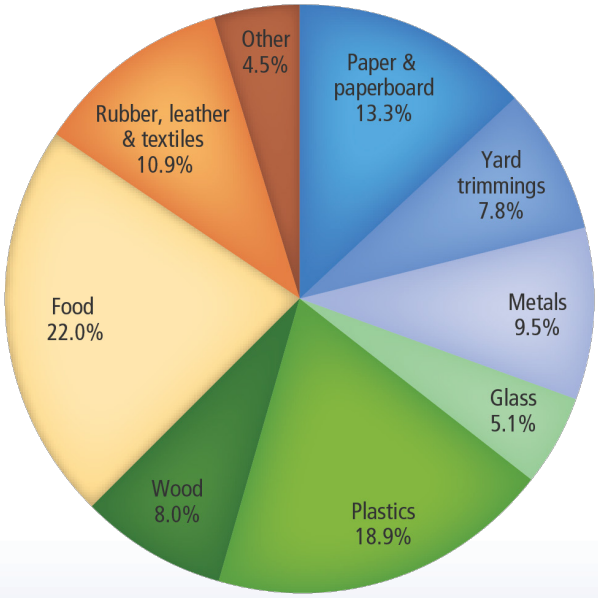


Figure 8. Total MSW Landfilled (by material), 2015
138 Million Tons



Products in MSW

The following information provides the details of the products found in municipal solid waste. Table 4 shows generation, recycling, composting, combustion with energy recovery and landfilling by product category, weight and percent of generation. Figure 9 displays selected products with high recycling and composting rates.

Containers and packaging made up the largest portion of MSW generated at almost 78 million tons (29.7 percent). Nondurable and durable goods were more than 50 million tons each (about 20 percent for each). Food was 39.7 million tons (15.1 percent), yard trimmings were 34.7 million tons (13.2 percent), and other wastes were about four million tons (1.5 percent).

Containers and packaging was the product category with the highest recycling rate with approximately 53 percent of the generated materials recycled. Paper products, steel and aluminum were the most recycled materials by percentage in this category. The recycling of nondurable goods was approximately 31 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, about 19 percent of durable goods were recycled. With a 99 percent recycling rate, lead-acid batteries continued to be one of the most recycled products.

Yard trimmings was the product category with the highest composting rate at 61.3 percent. Food in MSW was composted at a rate of 5.3 percent.

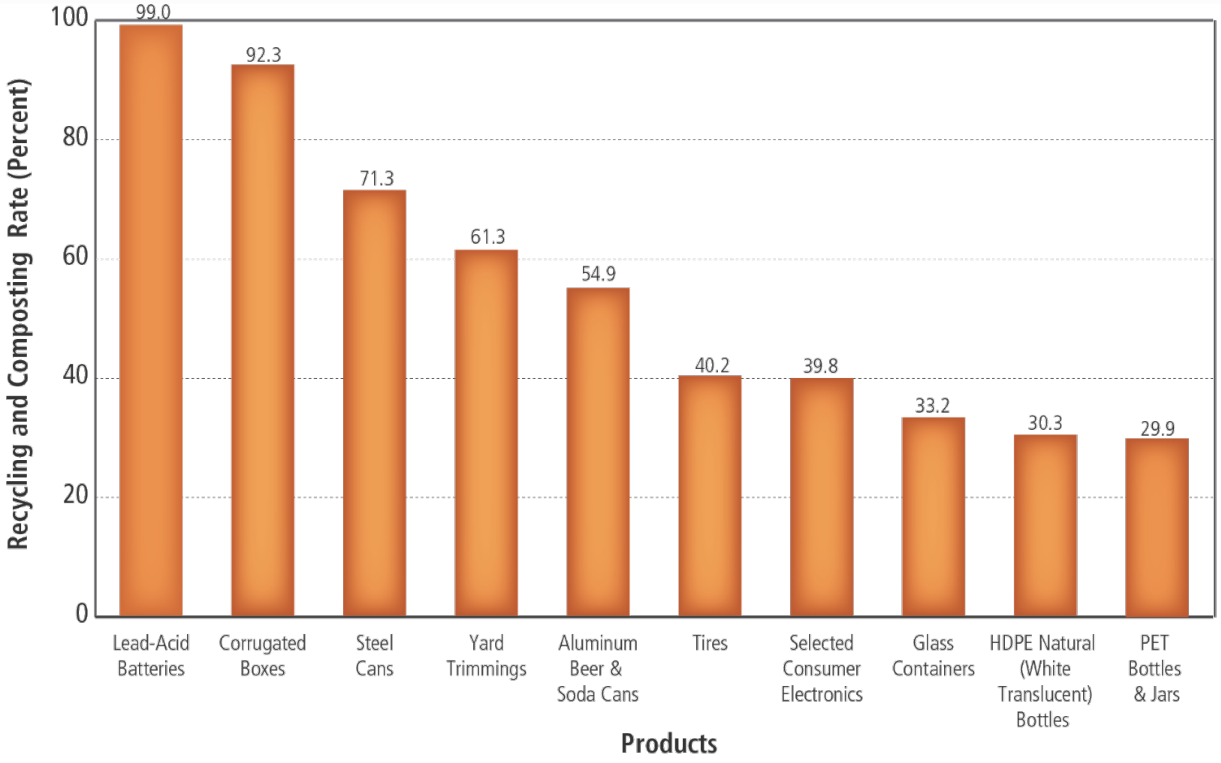
Food was the product category with the highest rate of combustion with energy recovery with a rate of nearly 19 percent. Durable goods were combusted at a rate of nearly 16 percent and nondurables at a rate of nearly 14 percent. Containers and packaging, and yard trimmings were combusted at rates below 10 percent.

Food was the product category with the highest landfill rate at 76 percent. Durable goods followed with a landfill rate of 65 percent. Nondurable goods had the third highest landfill rate at 55 percent. Containers and packaging, and yard trimmings were the product categories with the lowest landfill rates at 38 percent and 31 percent, respectively.

Recycling Rates

Measured by percentage of generation, products with the highest recycling rates in 2015 were lead-acid batteries (99 percent), corrugated boxes (92.3 percent), steel cans (71.3 percent), newspapers/mechanical papers (71.2 percent), major appliances (61.7 percent), aluminum cans (54.9 percent), mixed paper (43.6 percent), tires (40.2 percent) and selected consumer electronics (39.8 percent). The 2015 composting rate for yard trimmings was 61.3 percent (*See* 2015 data tables).

Figure 9. Selected Products with High Recycling and Composting Rates, 2015*



*Does not include combustion with energy recovery.

Table 4. Generation, Recycling, Composting, Combustion with Energy Recovery and Landfilling of Products in MSW, 2015*
(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	15.95	4.44	-	2.02	9.49	27.8%	-	12.7%	59.5%
Aluminum	1.55	-	-	0.22	1.33	-	-	14.2%	85.8%
Other nonferrous metals†	2.22	1.50	-	0.06	0.66	67.6%	-	2.7%	29.7%
Glass	2.35	Negligible	-	0.27	2.08	Negligible	-	11.5%	88.5%
Plastics	12.50	0.83	-	1.49	10.18	6.6%	-	11.9%	81.5%
Rubber and leather	7.35	1.51	-	2.27	3.57	20.5%	-	30.9%	48.6%
Wood	6.48	Negligible	-	1.18	5.30	Negligible	-	18.2%	81.8%
Textiles	3.94	0.54	-	1.06	2.34	13.7%	-	26.9%	59.4%
Other materials	1.81	1.43	-	0.03	0.35	79.0%	-	1.7%	19.3%
Total durable goods	**54.15**	**10.25**	**-**	**8.60**	**35.30**	**18.9%**	**-**	**15.9%**	**65.2%**
Nondurable goods									
Paper and paperboard	28.12	14.12	-	2.74	11.26	50.2%	-	9.8%	40.0%
Plastics	7.32	0.16	-	1.40	5.76	2.2%	-	19.1%	78.7%
Rubber and leather	1.13	Negligible	-	0.22	0.91	Negligible	-	19.5%	80.5%
Textiles	11.77	1.91	-	1.93	7.93	16.2%	-	16.4%	67.4%
Other materials	3.58	Negligible	-	0.70	2.88	Negligible	-	19.6%	80.4%
Total nondurable goods	**51.92**	**16.19**	**-**	**6.99**	**28.74**	**31.2%**	**-**	**13.5%**	**55.3%**

(Continued on next page)

Table 4. Generation, Recycling, Composting, Combustion with Energy Recovery and Landfilling of Products in MSW, 2015*
(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	2.22	1.62	-	0.12	0.48	73.0%	-	5.4%	21.6%
Aluminum	1.84	0.67	-	0.24	0.93	36.4%	-	13.0%	50.6%
Glass	9.12	3.03	-	1.20	4.89	33.2%	-	13.2%	53.6%
Paper and paperboard	39.92	31.20	-	1.71	7.01	78.2%	-	4.3%	17.5%
Plastics	14.68	2.15	-	2.46	10.07	14.6%	-	16.8%	68.6%
Wood	9.82	2.66	-	1.40	5.76	27.1%	-	14.3%	58.6%
Other materials	0.32	Negligible	-	0.06	0.26	Negligible	-	18.8%	81.2%
Total containers and packaging	**77.92**	**41.33**	**-**	**7.19**	**29.40**	**53.1%**	**-**	**9.2%**	**37.7%**
Other wastes									
Food, other‡	39.73	-	2.10	7.38	30.25	-	5.3%	18.6%	76.1%
Yard trimmings	34.72	-	21.29	2.63	10.80	-	61.3%	7.6%	31.1%
Miscellaneous inorganic wastes	3.99	-	-	0.78	3.21	-	-	19.5%	80.5%
Total other wastes	**78.44**	**-**	**23.39**	**10.79**	**44.26**	**-**	**29.8%**	**13.8%**	**56.4%**
Total municipal solid waste	**262.43**	**67.77**	**23.39**	**33.57**	**137.70**	**25.8%**	**8.9%**	**12.8%**	**52.5%**

* Includes waste from residential, commercial and institutional sources.

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Economic Indicators

The Benefits of Recycling

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.

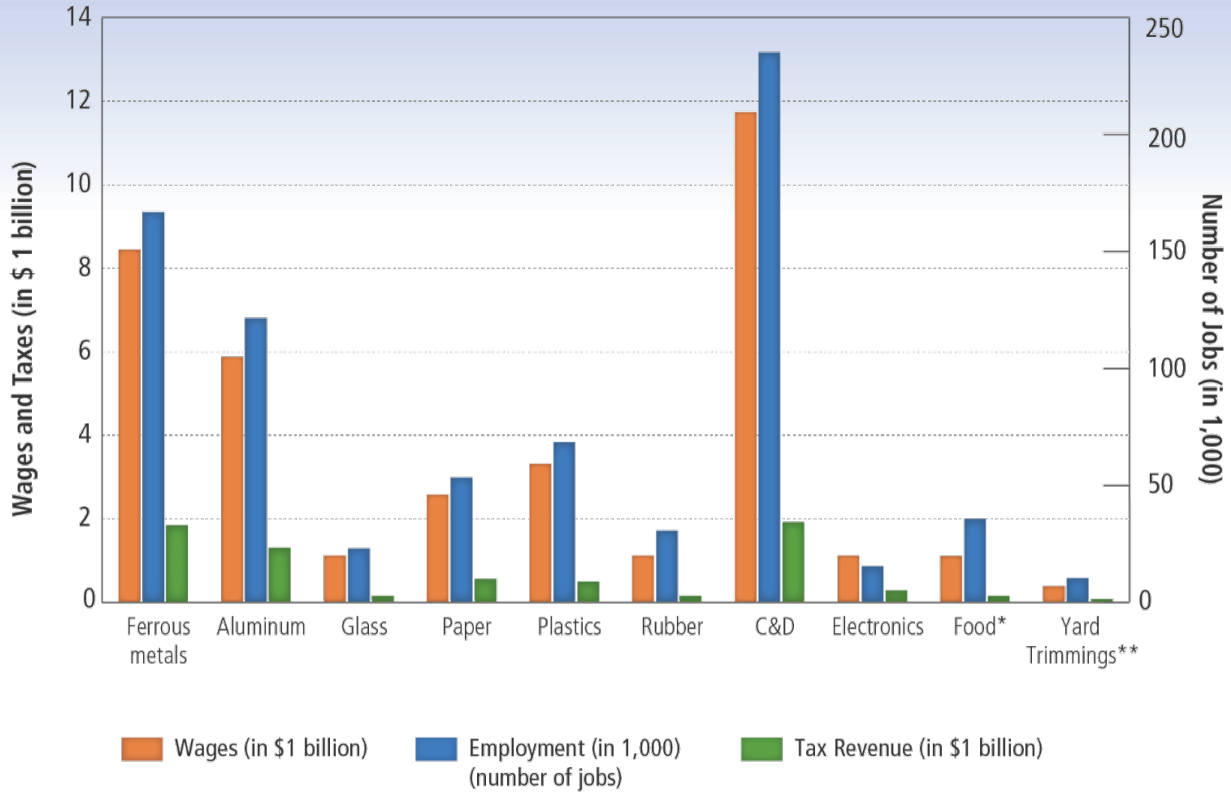
EPA's 2001 Recycling Economic Information (REI) Study evaluated the number of recycling jobs, wages and tax revenue. The Agency updated the study with a 2016 REI Report[3] to increase the understanding of the economic implications of material reuse and recycling. The 2016 REI Report included updated 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 while also generating local and state tax revenues. The data from the most recent year available (2007) 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 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.

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.

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

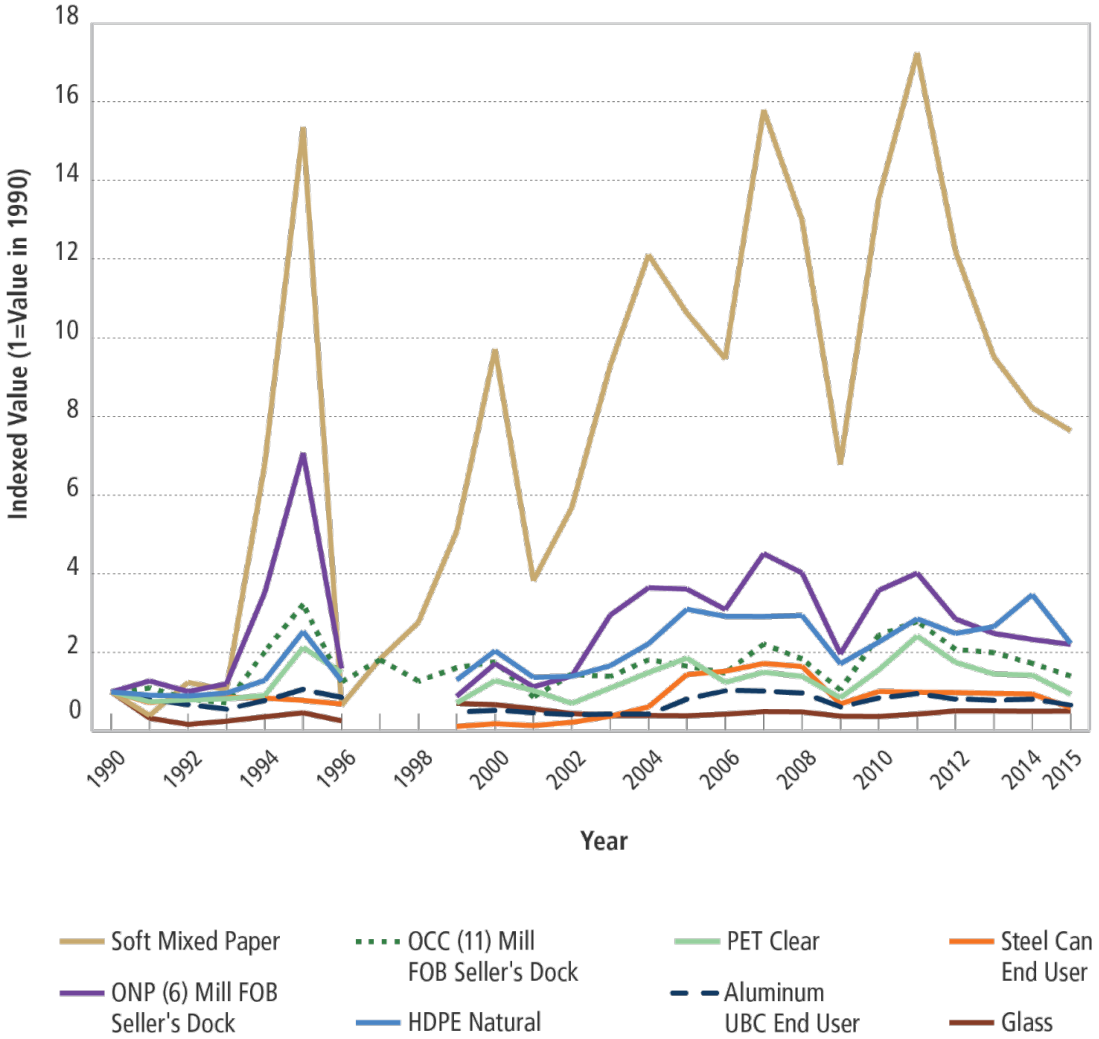
Normalized to 2015, using the Consumer Price Index (CPI) from the Bureau of Labor Statistics to account for inflation, Figure 11 depicts the commodity values for high-density polyethylene (HDPE) natural bottles; polyethylene terephthalate (PET) clear bottles; aluminum used beverage cans (UBC); steel cans; old newspaper (ONP) (grade 6); old corrugated containers (OCC) (grade 11); paper stock (PS) (grade 1) soft mixed paper; and glass containers from 1990 to 2015.

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.

Figure 11 shows the indexed values by year for the recycled commodities. It is 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. In this case, if the 1990 value were 400, then the resulting year's value would be 800.

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 their values in 1990. Additionally, many commodities, such as plastics and papers, also experienced a price spike in 2000, 2007 and 2011. In contrast, the indexed lines for glass (which represent an average of flint, amber and green glass container values), aluminum and steel cans appear to fluctuate less frequently.

Figure 11. Indexed Recycled Commodity Values by Year



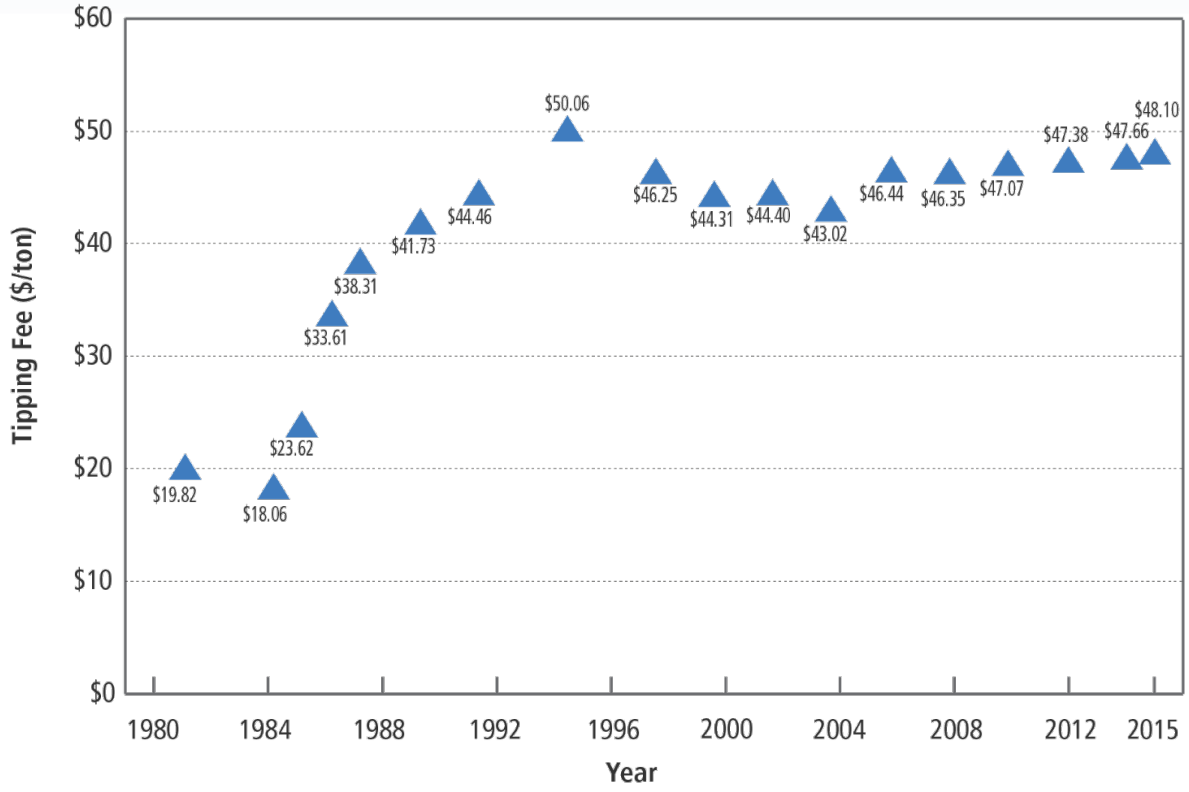
National mean annual commodity values were normalized to constant $2015 using the Consumer Price Index (CPI) from the Bureau of Labor Statistics to allow meaningful comparisons. 1990 has an indexed value of 1. Soft mixed paper consists of a clean, sorted mixture of various qualities of paper not limited 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.

Source: Pulp & Paper Global Fact & Price Book, 2003-2004. Page 128. Paperloop, Inc. 2004.
Secondary Materials Pricing and Secondary Fiber Pricing. 2003-2015. Released September 2017. Available at http://www.recyclingmarkets.net/. Accessed September 2017.
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.

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 2015 dollars.

Figure 12. National Landfill Tipping Fees, 1982-2015 ($2015 per ton)



National mean annual landfill tipping fees were normalized to constant $2015 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 $3.20 per year followed by a steady decrease of $0.78 per year followed by an increase of $0.46 per year from 2004 to 2015.

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).

MSW Generation and Household Spending

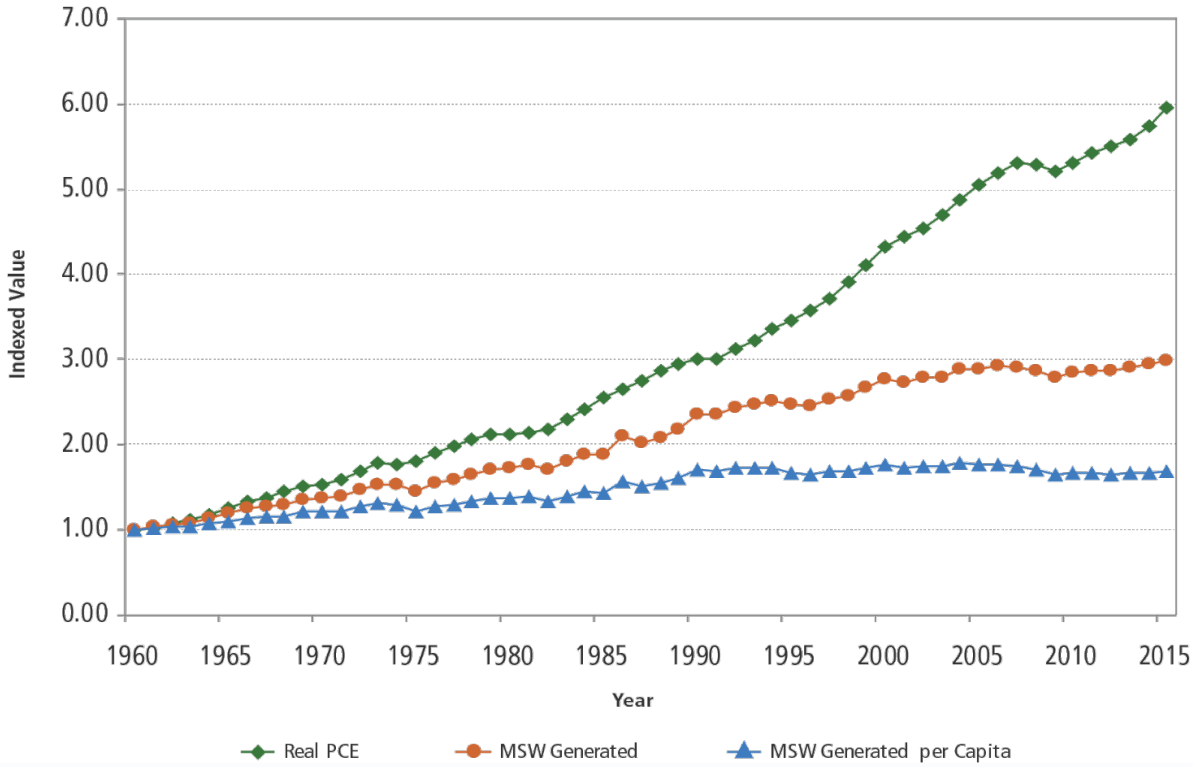
In the U.S., the change in the amount of MSW generated typically mirrors trends in how much money households spent on goods and services. Personal Consumer Expenditures (PCE) measure household spending on goods and services such as food, clothing, vehicles and recreation services. PCE is one of the four 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 since 1960.

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 were 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 2015 MSW per capita generation indexed value is 1.7, which means 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 metric indicates 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 (1960-2015)



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 will continue to explore options for alternative measurement quantifications 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, we estimate 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

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 2015, 548 million tons of C&D debris were generated. Figure 14 shows the 2015 generation composition for C&D debris. C&D concrete was the largest portion at 70 percent, followed by asphalt concrete at 15 percent. C&D wood products made up 7 percent, and the other products accounted for 8 percent combined. The 2015 generation estimates are presented in more detail in Table 5. 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), 2015
548 Million Tons

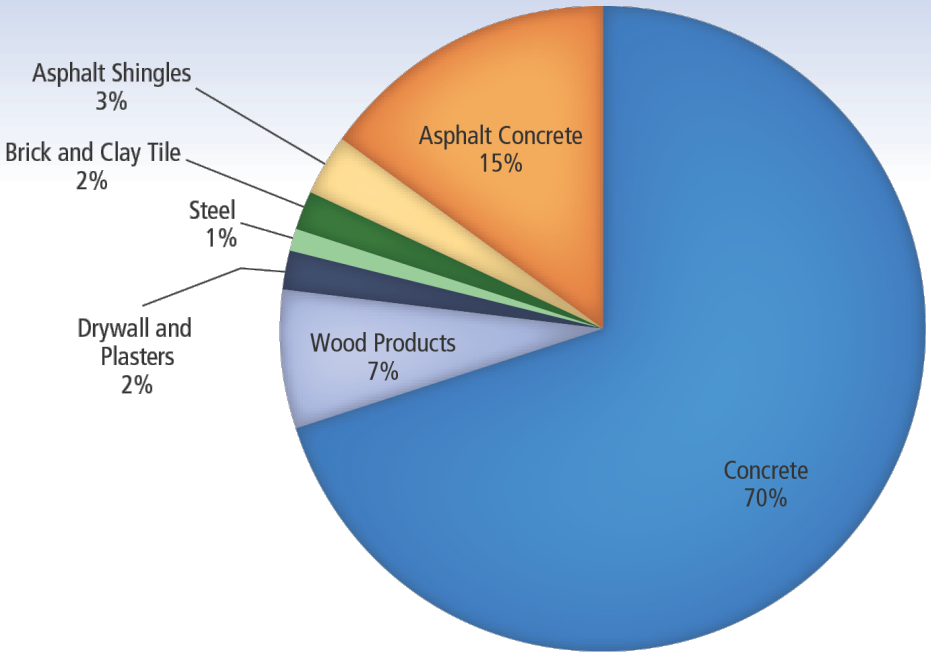


Table 5. C&D Debris Generation by Material and Activity, 2015 (in millions of tons)

	Waste During Construction	Demolition Debris	Total C&D Debris
Concrete	23.1	358.7	381.8
Wood Products[1]	2.8	36.1	38.9
Drywall and Plasters	2.5	10.5	13.0
Steel[2]	0.0	4.5	4.5
Brick and Clay Tile	0.3	11.9	12.2
Asphalt Shingles	0.9	12.6	13.5
Asphalt Concrete	0.0	83.9	83.9
Total	**29.6**	**518.2**	**547.8**

[1] 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.

[2] 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.

Figure 15. Contribution of Construction and Demolition Phases to Total 2015 C&D Debris Generation

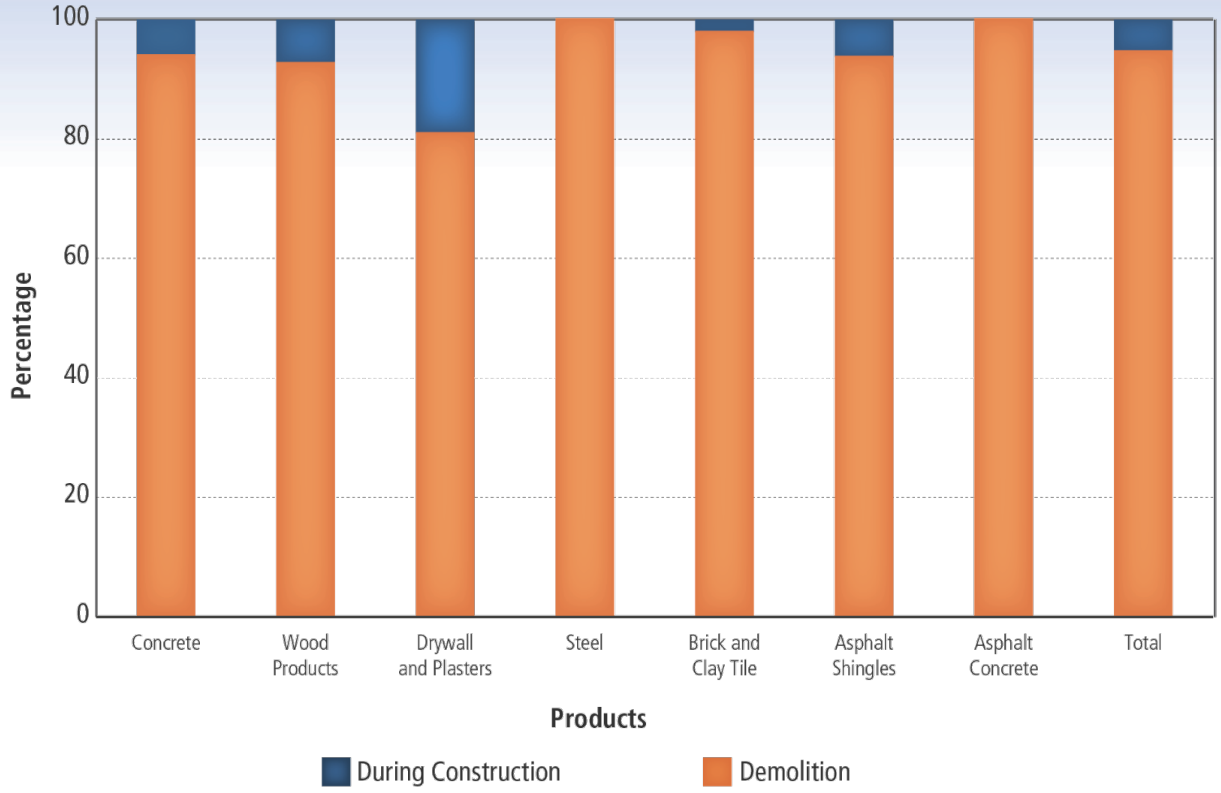


Table 6 displays the amount of C&D debris generation from buildings, roads and bridges and other structures for each material. The "other structures" category includes C&D debris generation estimates from communication, power, transportation, sewer and waste disposal, water supply, conservation and development and the manufacturing infrastructure. In 2015, 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 6. C&D Debris Generation by Source, 2015 (in millions of tons)

	Buildings	Roads and Bridges	Other
Concrete	88.4	158.4	135.0
Wood Products[1]	37.6	-	1.4
Drywall and Plasters	13.0	-	-
Steel[2]	4.5	-	-
Brick and Clay Tile	12.1	-	-
Asphalt Shingles	13.5	-	-
Asphalt Concrete	-	83.9	-
Total	**169.1**	**242.3**	**136.4**

[1] 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.

[2] 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.

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

Thinking Beyond Waste

Measuring and understanding the data on MSW generation, recycling, composting, combustion with energy recovery and landfilling is an important foundation for knowing where these valuable resources are going. It is a starting point to figure out trends and ways to more efficiently use these resources and how to keep them in use. EPA is helping change the way our society views the materials and resources in solid waste by thinking beyond recycling, composting, combustion and landfilling. By going beyond the concept of "Reduce, Reuse, Recycle," EPA is employing a systemic approach to reduce material use and associated environmental impacts over the entire life cycle of materials through a process called Sustainable Materials Management (SMM). This process starts with the extraction of natural resources and material processing through product design and manufacturing, followed by the product use stage, then collection/processing, and lastly, end-of-life management. 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 fewer materials and products, and reducing environmental impacts throughout the life cycle of a material. See https://www.epa.gov/smm for more information.

Resources

The 2015 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

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 2015 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. Programs included are programs with startup dates in 2015 or earlier. Programs started in 2016 and 2017 are excluded. Programs with no startup date provided in the source document or identified through internet searches are also excluded.
3. US EPA. 2016. "Recycling Economic Information Report" (2016). https://www.epa.gov/smm/recycling-economic-information-rei-report.

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