



**Solid Waste**





## EXECUTIVE SUMMARY

The U.S. produced approximately 268 million tons of municipal solid waste (MSW) in 2017, or 4.51 pounds per person per day. This is a modest increase from the 4.4 pounds of MSW generated per person per day in 2014. Overall, 53% of waste is deposited in landfills, 25% is recycled, 10% is composted, and 13% is combusted for energy. The transport and disposal of MSW remains largely funded and managed by the private sector. However, the U.S. MSW management system faces a growing number of challenges such as plateauing recycling rates, emerging contaminants found in legacy landfills, and significantly changing global markets. Funding mechanisms are needed to invest in a nationwide solid waste infrastructure system that recognizes MSW as a resource to be utilized more so than waste to be disposed.

## INTRODUCTION

The Environmental Protection Agency (EPA) defines municipal solid waste (MSW) as, “everyday items such as product packaging, yard trimmings, furniture, clothing, bottles, cans, food, newspapers, appliances, electronics, and batteries” that are discarded from residential, commercial, or institutional sources.<sup>1</sup> However, the EPA’s MSW definition does not include industrial, hazardous, or construction and demolition (C&D) waste, which are covered in a separate report card chapter on hazardous waste.

Solid waste management includes infrastructure for landfills, converting waste to energy (WTE), and recycling or composting. MSW processing includes

shredding, compaction, incineration, or biological degradation to reduce MSW volume. Thereafter, the garbage may be transported to landfills, discrete areas, or excavations designed to protect the environment from potential contaminants.<sup>2</sup>

Another approach, the waste-to-energy (WTE) process, involves non-recyclables from the waste stream undergoing combustion, gasification, pyrolyzation, or anaerobic digestion to produce electricity and heat. Finally, recycling and composting efforts include collecting, sorting, processing, and remanufacturing materials and organics, respectively, that are otherwise considered waste.

Figure 1: Solid Waste Management Infrastructure and Processes<sup>3</sup>

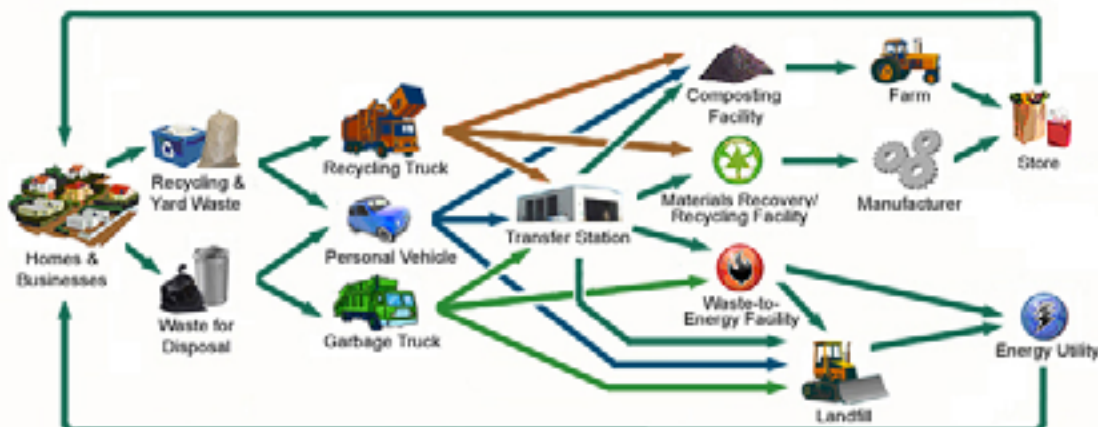


Diagram courtesy of the Commonwealth of Massachusetts

## CAPACITY & CONDITION

In 2017, the EPA reported that Americans generated nearly 268 million tons of MSW, up from 262 million tons in 2015 and 251 million tons in 2010. This represents a modest increase in the per capita MSW generation rate from 4.45 to 4.51 pounds per person per day between 2010 to 2017, respectively.<sup>4</sup> In the last few decades, an increasingly larger portion of America's MSW is diverted from landfills. In 2017, 25% of waste was recycled, 10% was composted, and nearly 13% was combusted via WTE processes. However, recent years have shown that the percentage of recycled and composted MSW materials has plateaued.<sup>5</sup>

Because there is no comprehensive database of landfills in the U.S., the exact number and age is difficult to determine.<sup>6</sup> Estimates show that more than 2,600

landfills exist, while over 1,250 are currently open with varying amounts of remaining capacity.<sup>7</sup> The average age of landfills is somewhere between 30 and 50 years old.<sup>8</sup> Also receiving MSW are the 75<sup>9</sup> WTE facilities across 20 states; the majority are in Florida and along the East Coast.<sup>10</sup> The most recent estimates of the nation's WTE facilities come from the U.S. Energy Information Administration, which shows in 2015, nearly 29 million tons, more than 10% of the nation's MSW, was burned, generating 2.3 gigawatts.<sup>11</sup> While no publicly available data exists to characterize the condition of the nation's materials recovery facilities, which sort and process recyclables, from 2009 to 2020 the U.S. Bureau of Labor Statistics reported an increase from 906<sup>12</sup> to 1,331<sup>13</sup> public and private materials recovery facilities.

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Minnesota Pollution Control Agency

A LANDFILL TRACTOR IN MINNESOTA.



## OPERATION & MAINTENANCE

States play a leading role in ensuring federal regulations are met for operating and maintaining MSW and industrial waste landfills. However, some states may set and follow more stringent requirements. In absence of an approved state program, the federal requirements must be met by waste facilities. Regulations address common problems associated with landfills, including location restrictions, liner requirements, leachate collection and removal systems, groundwater monitoring, and closure and post-closure care expectations.<sup>14</sup>

## PUBLIC SAFETY

An ongoing concern for landfills and other solid waste management systems are emerging contaminants, which are chemicals that are not commonly monitored but have the potential to enter the environment and cause known or suspected adverse ecological and/or human health effects. They consist of per- and polyfluoroalkyl substances (PFAS), pharmaceuticals, pesticides, industrial chemicals, surfactants, personal care products, and more. These substances are consistently being found in groundwater, surface water, wastewater, drinking water, and some food sources.<sup>17 18</sup>

## FUNDING AND FUTURE NEED

Funding for operation and maintenance (O&M) of landfills and recycling facilities is generated through trash collection fees. The national average annual trash collection or tipping fee increased from about \$48 per ton in 2016 to more than \$55 per ton in 2019.<sup>20</sup> Similarly, O&M efforts for WTE facilities are also self-funded and prove to be most cost competitive in areas with limited available land and dense populations.<sup>21</sup>

While recycling has made dramatic gains over the last decade, more recent figures show a leveling off as global markets for recycled materials dramatically changed. In 2018, China instituted the National Sword policy which halted the import of many types of solid waste,<sup>22</sup> effectively closing off the destination for two-thirds of the world's plastic waste.<sup>23</sup> Available data suggest that this policy caused as much as 92% of U.S. plastic in the first part of 2018 to be sent to other Southeast Asian countries.<sup>24</sup>

In 2020, to more sustainably manage the nation's solid waste, the EPA announced its National Recycling Goal, which set a 10-year benchmark to increase the recycling rate for all materials by 50%.<sup>15</sup> To achieve this goal, operational improvements include reducing the percentage of the wrong materials such as food and other contaminants entering into the recycling stream. Clean recyclables improve the efficiency of processing materials into new products or energy. The EPA notes that clear, consistent public education and outreach are critically important to achieving this goal.<sup>16</sup>

Over the past several years PFAS have become a major concern to human health and the environment, and the EPA has moved to list PFAS and associated chemicals as hazardous substances. PFAS were traditionally used in many products that are now ending up in landfills. As a result, landfills are having to manage PFAS in groundwater, especially at historic landfills that were not previously constructed to today's specifications. PFAS are also being identified in landfill leachate that is sent to wastewater treatment plants.<sup>19</sup>

Adapting to the loss of international markets, EPA's National Recycling Strategy focuses on improving and expanding domestic recycling markets.<sup>25</sup> Various companies plan to open new U.S. processing plants in Orangeburg, South Carolina, and Huntsville, Alabama. The companies will shred or pelletize materials like plastic food containers to make products such as artificial plants and hangers.<sup>26</sup>

There is, however, a lack of funding for research and seed capital to facilitate more marketable and innovative ways to manage MSW and recyclable materials for a useful purpose such as waste to energy (e.g., anaerobic digesters and plasma gasification) or through new technologies that prevent solid waste from entering a landfill. Additional funding mechanisms are needed to help transition to a system that recognizes MSW as more of a resource to be utilized than waste to be disposed.



Photo courtesy of Belish

From 2009 to 2020 the U.S. Bureau of Labor Statistics reported an increase from 906<sup>12</sup> to 1,331<sup>13</sup> public and private materials recovery facilities.

WASTE-TO-ENERGY PLANT.

## RESILIENCE AND INNOVATION

Landfills are often vulnerable to natural disasters such as hurricanes, earthquakes, and especially floods. Such events can have a large impact on groundwater conditions as well as the overall public health near landfills. Additionally, damage to other infrastructure systems such as roads, bridges, rail, the electric grid, inland waterways, and other systems causes interruption to MSW collection and disposal, which can lead to significant impacts on the public health.

New processes can help reduce waste, particularly plastics. There are researchers and companies in the U.S. that are implementing practices such as pyrolysis to break down polystyrene waste into its foundational material, styrene. Others are looking to use engineered enzymes that can break down polyethylene terephthalate (PET) into purified terephthalic acid (PTA). The advantage of using depolymerization processes to break down PET compared to mechanical processes is that it extends

the usefulness of the reprocessed PET, it can deal with the impurities that occur as a result of single-stream recycling, and it can be used with a variety of different types of plastics, not just the high quality plastics like single-use bottles. However, the problem with these technologies is they are still very expensive alternatives, and the scale of facility with throughput capable of processing all the plastic discarded by Americans is not yet available.<sup>27</sup> Therefore, some municipalities across the country are trying to reduce the amount of plastics entering MSW landfills by implementing bans on single-use plastic. On a global scale, for example, since 2018, Starbucks has been working to replace all plastic straws with strawless lids and to develop a fully recyclable and compostable cup.<sup>28</sup>



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### RECOMMENDATIONS TO RAISE THE GRADE

- Pass legislation limiting the amount of packaging used in various industries, setting standards for the recyclability of materials (e.g., single-use plastics), and addressing the true cost of waste by implementing deposits on bottles and fees on plastic bags.
- Strengthen domestic markets for recycled materials in the U.S. by supporting companies looking to build domestic reprocessing plastic facilities and reusing plastics.
- Change the way Americans think of solid waste beyond “garbage” or “trash,” to understand that “waste is not waste until it is wasted.” The materials Americans routinely discard are potential resources.
- Support research and invest in alternatives for the use of waste as resources, such as aerobic digesters and plasma gasification.
- Oppose federal legislation that would ban the interstate movement of municipal solid waste (MSW) to regional solid waste facilities designed in accordance with state and federal regulations, recognizing that such transport may be appropriate and beneficial in regional solid waste planning efforts.
- Encourage Congress to list polyfluoroalkyl substances (PFAS) as hazardous substances in Superfund.

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