delta institute

WASTE 101:
A SYSTEMS VIEW OF OUR REGIONAL WASTE SYSTEM

Waste management in the U.S. is a $43 billion dollar industry, employing 202,937 Americans.[1] Managed by municipalities at the city and county level, waste management is an economic driver and has the potential to support environmental sustainability goals as decision-makers pursue waste reduction, resource conservation, and material reuse.

Despite its significant economic and environmental impact, the waste industry is largely hidden from public view. When we do think about waste management, we often envision mounds of trash in an overflowing landfill. In reality, it is much more complex, encompassing many moving parts, such as transportation, collection, recycling and reuse, as well as waste generation by consumers and producers.

In 2011, Americans generated approximately 250 million tons of trash and recycled, then composted only 87 million tons of this material, equivalent to a 35% recycling rate. On average, Americans generate 4.4 pounds of waste per day and recycle only 1.5 of those pounds.[2] Cook County's recycling rate of 29% is below the national average, and per capita waste generation is higher than the national average at a little over 7 pounds per day, indicating room for improvement in the Chicagoland region.[3]

Figure 1. Image of construction and demolition debris at a waste facility.

[1] http://www.ibisworld.com/industry/default.aspx?indid=1506
[2] http://www.epa.gov/waste/nonhaz/municipal/
[3] http://www.cookcountylandbank.org/wp-content/uploads/2013/11/CCDDD-Presentation-for-CCLBA-January-30-2014.pdf

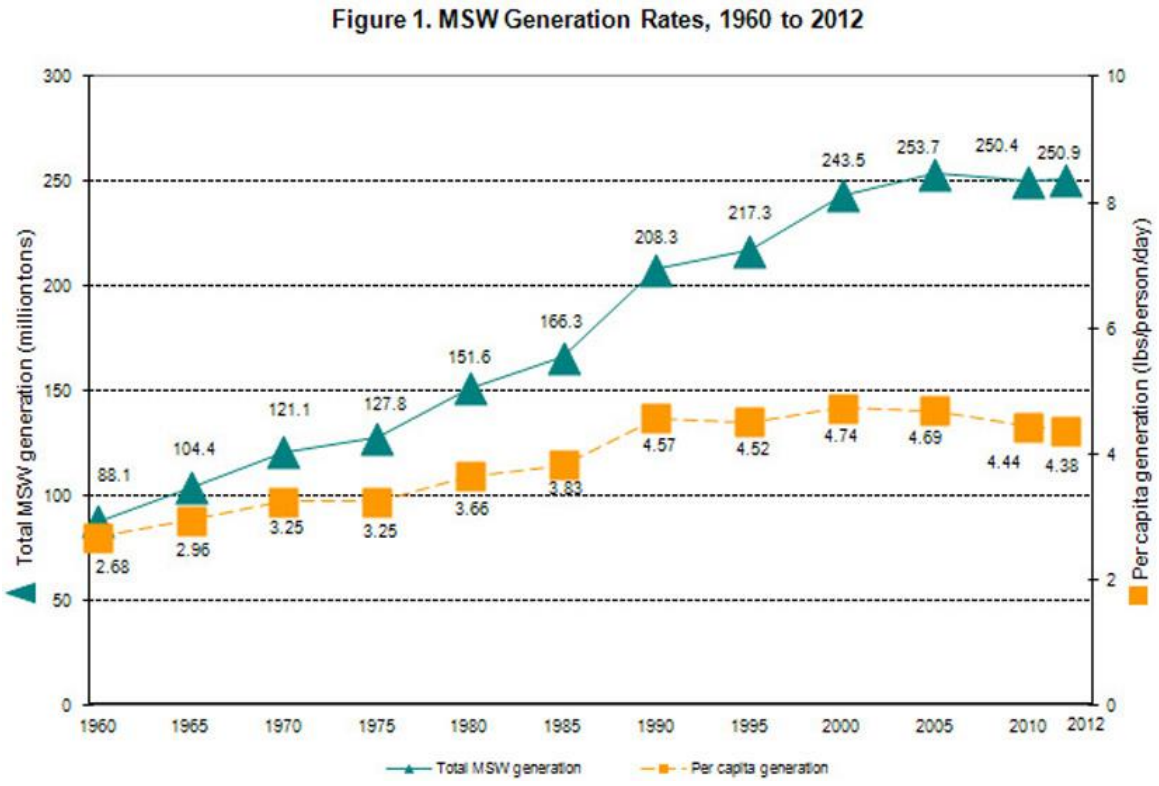


Figure 2. Image from http://www.epa.gov/waste/nonhaz/municipal/

This document will provide a systems-level perspective of our current waste system, including a brief history of how our system came to be, implications of current waste practices, and recommendations for systems-level changes that can help to build a more sustainable waste management system in the future.

History of U.S. Waste Management

Municipal solid waste management was established in the U.S. as an objective of public health and pollution control in the 19th century. In Chicago, the first "city scavengers" were hired in 1849 to collect trash across the city.[4] Much of the trash they collected was used as landfill so that marshy land could be filled and built upon. Following the Chicago Fire, the city found a practical use for the huge amounts of debris and ash that it had collected and extended Grant Park into the lake by using the waste deposits from the disaster.

Throughout the early 20th century, much of Chicago's solid waste was either dumped in waterways, incinerated, or brought directly to dumps that were operated within city limits by municipal workers. Starting in the 1960s, open and overflowing municipal dump sites drew the attention of the public, sparking a national movement to improve the quality of the system. The federal government recognized the need to develop new waste management solutions to mitigate public concerns, first through the Solid Waste Disposal Act of 1965 and subsequently through

[4] http://www.wbez.org/news/century-waste-evolution-chicago%E2%80%99s-garbage-collection-108529

the 1976 Resource Conservation and Recovery Act which set national goals for protecting health, conserving energy, reducing the amount of waste generated and managing waste in an environmentally sound manner.

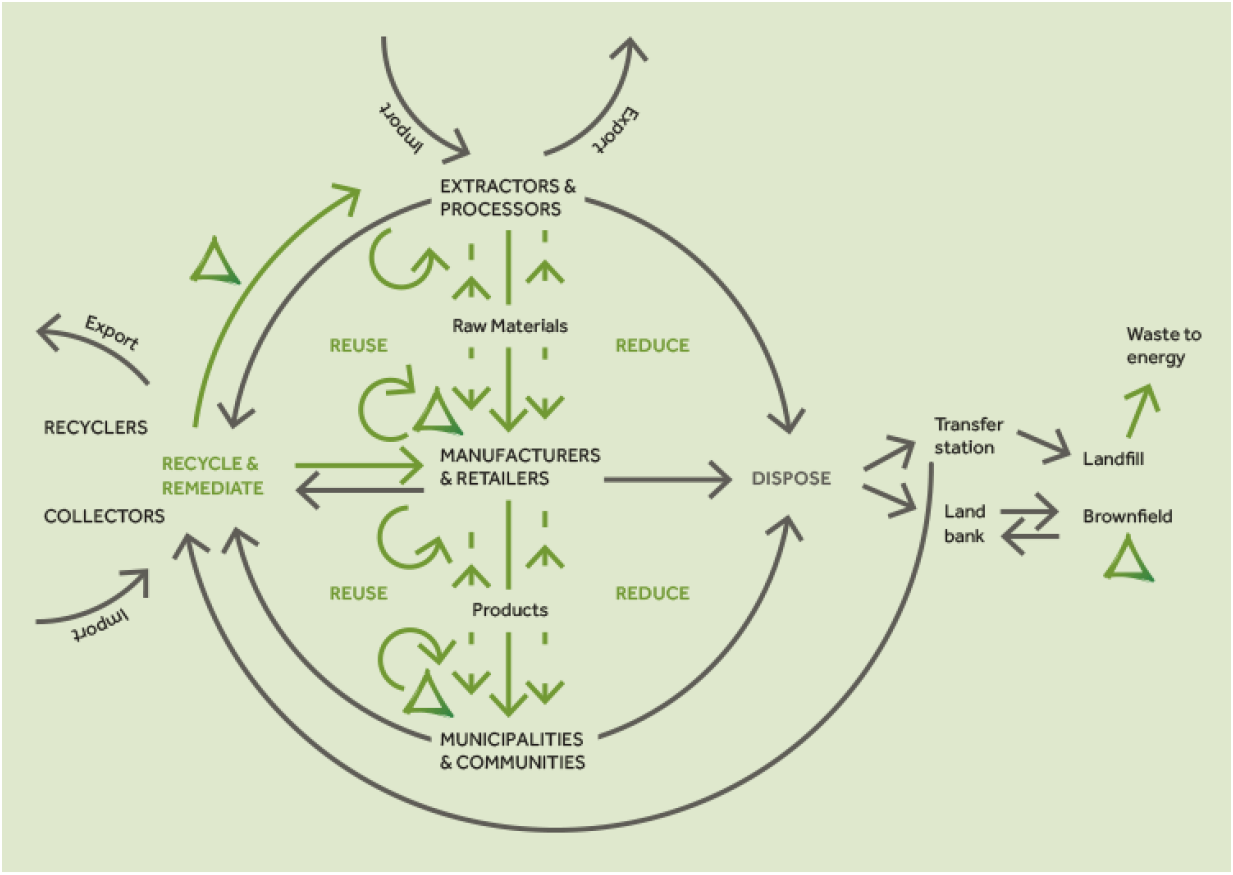
In response, local governments across America, driven by federal pressure to meet new environmental standards, began to transform their waste management systems through the decommissioning of local landfills and the creation of new landfills that adhered to new standards for containment of contaminants and were farther away from populated areas. In order to reduce waste flow to landfills and incinerators,[5] local governments began creating recycling programs.

Modern Waste Systems

Our current system addresses the concerns we held in the 20th century. Today's landfill design criteria mandate that landfills are constructed with a number of safeguards, including clay or plastic lining to contain water that leaches from the solid waste, nearby wells to monitor ground water quality, and methane gas recovery systems.[6] In addition, waste is typically compacted in order to increase its density and stability.

The process for transporting waste to landfills also has evolved significantly. The creation of waste transfer stations and material recovery facilities in the modern waste management system separated the public and municipal waste haulers from interacting directly with landfills. A transfer station is a regional center where waste is processed and compacted, and material recovery facilities receive, separate, and prepare recyclable materials for end-use manufacturers. Waste that needs to be landfilled is then transferred from these interim facilities to the landfill for final disposal.

[5] http://upstreampolicy.org/unintended-consequences-municipal-solid-waste-management-and-the-throwaway-society/
[6] http://oceanworld.tamu.edu/resources/environment-book/groundwatercontamination.html



This map of our current waste management system demonstrates the flow of materials throughout the life of the material. Materials begin their use in the hands of extractors, followed by manufacturers, and then consumers. Each step in this process has the potential to recycle and reuse and each step has the potential to create waste that goes to landfill. It takes intervention in each aspect of the waste management cycle to effectively and sustainably manage our waste.

While the changes that created the current waste system have helped to mitigate the effects that our waste has on the environment and economy, in order to be truly sustainable, further change is necessary. Current landfills close to population centers are reaching capacity and requiring waste to be sent even further away. By throwing things away, we end the economic viability of materials, and in using virgin materials rather than recycled materials, we increase the scarcity of our resources. Growing demand for newly manufactured goods made from virgin materials will only increase the price of raw materials, as well as consumer goods.

In addition to the economic cost, the environmental costs will increase if our waste system remains unchanged. A 2009 Illinois Waste Characterization and Generation Study estimated that of the annual landfilled waste

of 15.3 million tons, approximately 8.9 million metric tons of carbon dioxide equivalent methane[7] were generated. Methane from landfills is a major contributor to climate change, as is the significant diesel emissions that result from inefficient waste transportation.

These costs are evidence of the fact that our current system is unsustainable and that a change in mentality as well as a systems-level infrastructure change is necessary. We believe that with innovative, market-driven solutions we can transform waste from an environmental liability to an economic asset.

Solutions

Systems thinking around waste will help reduce the life-cycle impacts of products on our environment and mitigate waste generation overall going into the future. Solutions begin with accountability. Municipalities and counties are responsible for local waste management and infrastructure, and they need to assess their waste management practices and identify ways to encourage waste reduction, recycling and composting. At the county level, policymakers must consider the entire waste system and identify areas where policy changes can help to optimize waste management. Beyond infrastructure and policy, transforming the public perception of waste, from a liability to an asset, will also help to improve our diversion rate through changes in individual behavior. Some specific areas where recycling and reuse can be increased include:

- Paper and metals
- Material recovery
- Food scrap and other organic wastes
- Construction and demolition wastes

Material recovery, or recycling, is a necessary component to improved waste management. Many local governments have sustainability goals and waste management plans that establish recycling targets and diversion policies. Recycling and composting diverted 34.5% of U.S. municipal solid waste from landfill in 2012, which is up from 9.6% in 1980.[8] In addition, increased recycling rates can also mean increased local economic activity. Recycling sustains 10 times more jobs per ton of waste than landfills, and for every job created from landfilling, 25 material reuse jobs can be created[9]. With improvements in recycling infrastructure and updates to waste-related policies, municipalities can continue to increase recycling rates and create local economic development opportunities.

Managing food scrap and organic wastes through anaerobic digestion and composting can also divert waste from landfills and reduce environmental impacts. Nationwide, 21% of municipal solid waste is food scrap. Rotting food results in methane, which has 21 times the global warming potential of carbon dioxide. Landfills are a major source of human-related methane emissions in the United States, accounting for more than 20% of all methane

[7] Illinois Department of Commerce & Economic Opportunity, Illinois Recycling Coalition, and CDM. Illinois Commodity/Waste Generation and Characterization Study. http://www2.illinois.gov/gov/green/documents/waste%20study.pdf
[8] http://www.epa.gov/waste/facts-text.htm#chart2
[9] http://www.recyclingworkscampaign.org/2011/11/more-jobs-less-pollution/

emissions. Composting and anaerobic digestion can result in faster decomposition and environmentally beneficial bi-products,[10] while reducing harmful methane emissions.

Construction and demolition waste provides an opportunity for significant waste diversion, as building waste comprises about 40% of our landfills[11]. Greener demolition practices, such as deconstruction, can divert more than 75% of construction and demolition waste from going to landfills. Deconstruction enables the harvesting of valuable materials and can lead to local economic opportunities as those materials are sold and reused. Considering the growing market for reclaimed lumber regionally and nationally, it is clear that building material reuse is a viable opportunity to decrease waste generation and create economic opportunity.

Manufacturers and retailers are at the center of the waste system, which involves a complex flow of materials. With product stewardship laws enacted in many states across the country, companies are now taking more responsibility for the life-cycle of their product, such as paying for recycling.[12] On the demand side, ethical consumerism is also on the rise as consumers have begun paying closer attention to what's in their products, where these products are coming from, and how they choose to dispose of these products, in order to reduce their environmental impact.[13]Continued consumer education and awareness around the impacts of their consumption habits will help change behaviors and build public support for a more sustainable waste system.

Envisioning a Sustainable Future

Our waste management system has come a long way since its inception, but there is more work to be done to make it truly sustainable. By implementing strategic changes in our waste system, we can reduce the need for additional landfills, reduce transportation costs and greenhouse gas emissions related to hauling waste, and realize the economic potential in the waste we are tossing out.

Implementing these solutions requires innovative policy, infrastructure improvements to overcome market barriers, and a cultural shift on the part of waste managers and consumers. However, these solutions can offer a more sustainable system. Recovering materials such as construction materials, food, organic materials, and finding greener sources for commercial products will help to reduce our greenhouse gas emissions, the amount of contaminants that we release into the environment, and create markets around reused materials.

Taking a systems approach to our waste management system helps us find solutions that can go a long way in mitigating the effects that humans have on climate change, improving environmental, social and economic conditions. As our actions continue to affect the world around us it is important that we see the potential in our waste management practices, and enact impact-driven changes in order to create healthier, more livable communities.

[10] http://www.conserve-energy-future.com/Composting.php
[11] http://www.sustainable-chicago.com/2014/06/25/recycling-our-cities-cook-countys-demolition-debris-diversion-program/
[12] http://www.productstewardship.us/
[13] Image from http://delta-institute.org/tools/