

PAYNE INSTITUTE COMMENTARY SERIES: **STUDENT VIEWPOINT**

## **Trashy Data, an Examination of Organic Compost Diverted from Municipal Solid Waste Streams**

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### **Abstract**

Recycling policy regarding Municipal Solid Waste (MSW) varies by region, county, and city. This research examined the type of policy that leads to the largest diversion of compostable materials from landfills. The data was gathered by performing small case studies of a handful of US cities that have established voluntary, mandatory, or incentivized composting programs. The author found that the mandatory programs showed the highest compost diversion rates because there was likely enough political will, and by proxy, public intent to implement the program. The timing of this study is crucial as many municipalities are in the fledgling stages of environmental improvement programs. Also, world economic factors have driven the cost of recycling beyond a profitable range. This will squeeze local governments into creative solutions to maximize their diverted MSW.

### **Keywords**

Municipal Solid Waste, MSW, Composting, Recycling, Mandatory, Incentivized, Waste Tonnage, Diversion

## 1. Introduction

Modern recycling in the United States originated in the environmental movement of the 1960s and 70s. Rachel Carson's *Silent Spring* and other influential works sparked the national consciousness. Since that time, the public discourse has ebbed and flowed around the sustainability of disposable society, usually spurred by a technological milestone or an energy shortage. Within the last three decades however, these sentiments have germinated as world-wide climate targets like the Kyoto Protocol and the Paris Agreement. When the US pulled out of the Paris Agreement, a coalition of state governors pledged their support despite the federal balking. (US Climate Alliance n.d.) To meet these ambitious targets, every source of carbon, or carbon-equivalent, emissions must be considered. So, while recycling and landfilling is a smaller contributor to greenhouse gases than transportation or fossil-fuel power-generation, it is low-hanging, literally rotten, fruit. For the average citizen, recycling programs can provide a tangible proxy for climate change and generate buy-in to larger public policy. Also, elected leaders can showcase short-term data within a voting cycle whereas most climate change policies need several years to produce causal data.

According to the EPA, in 2017, 267.8 million tons of municipal solid waste (MSW), was generated in the United States. That equates to about 4.5 pounds per person per day. Of the 267.8 million, 94 million tons was diverted from landfills as either recycling or compost. This is an effective rate of 35.2 percent of the total MSW. (Environmental Protection Agency 2019) Superficially, this qualitatively feels like a reasonable landfill mitigation attempt. However, this data is based on reported values from local and state governments and does not specifically follow a full life-cycle assessment of a single piece of waste. It also has been shown that not all recycling waste is eventually recycled. If it is exported there is a possibility that the chain of custody terminates in a southeast-Asian landfill. (CNN, Ivan Watson, Jo Shelley, Sugam Pokharel and Ushar Daniele 2019)

In 2018, China stopped purchasing recyclable materials from the US. (World Trade Organization 2017) It was then uncovered that some of the material they claimed was being recycled was actually ending up in Malaysian landfills. (CNN, Ivan Watson, Jo Shelley, Sugam Pokharel and Ushar Daniele 2019) In light of these events, the cost of recycling skyrocketed. In New Hampshire, one small town had been breaking even on their recycling program by selling it to a Chinese buyer for \$6 per ton. Now a domestic company charges the town \$125 per ton for recycling and \$68 per ton for incinerating the waste. (Semuels 2019) This wild shift in pricing is enough to cancel many local diversion programs.

Good intentions are being driven awry by cost. But despite the unfavorable economic pressure, there still seems to be enough political and public will to enhance existing or create new waste diversion programs. "Zero Waste" programs are being adopted or codified by major metropolitan areas like

Washington DC, Austin, San Francisco, and Seattle. Notably, the title of the program is a misnomer, especially in DC where their “Zero Waste” target is only an 80% diversion rate. Still, the intention is being clearly stated. (Crunden 2019) Also, an 80% diversion rate would be more than two times the current national diversion rate of 35 percent, as stated above.

This research focused on organic waste that can be composted. Compost was selected because it is not subject to the justifiable cynicism and wild price swings attached to recycling in general. Again, according to the EPA, of the 267.8 million tons of MSW in 2017, 27 million tons was composted for an effective rate of less than 10%. (Environmental Protection Agency 2019) This is a much more accurate metric of landfill diversion than the total recycling rates cited at the beginning of this section and is therefore worthy of further investigation.

This research is vital to the leaders that have pledged their name to the Paris targets since it can inform which way the composting lever should be pushed or pulled within the MSW portfolio. This author posits that by implementing a variety of public policy strategies local governments can increase their composting rate, and thus reduce their overall emissions. Specifically, it will inform them if it is most beneficial to implement a voluntary, mandatory, or incentivized residential composting program.

## 2. Materials and Methods

The key metric is compost tonnage generated by single-family houses versus the total amount of MSW that same house would generate. Total recycling or diverted tonnage was the secondary data point collected. It serves as context and comparison for the first data point because the compost tonnage is included in the total recycling tonnage. Also, using the total recycled tonnage ensures that the calculated values for the compost data that were not available in the source data are not wrong by an order of magnitude.

Multifamily, commercial, and public collection points were not considered in this investigation. Out of the 10 cities researched, only a handful used the exact same metrics in their overall reporting. So, providing a 1:1 comparison was nearly impossible. Isolating single-family homes was the only way to use all the sources to create coherent comparisons. Also, some cities, like Austin, have voluntary compost collection for residential participants, but mandatory composting requirements for businesses that have license to sell food. So, a disparity in legal obligations could skew the data if taken from a broader lens. (Austin Resource Recovery n.d.)

Most of the source data for this investigation included the household compost or organic waste as part of the total recycled percentage on the summary page. The compost data was calculated by combing through the line-items on secondary pages. For example, the data for Austin was derived by adding the weekly collected organics compared to neighbors that directly disposed similar material and multiplying that by 52. The amount of compost diverted through personal or backyard devices was ignored in this research. This is a value found in some source studies but is derived from self-reporting and may not be as accurate as the scales at a transfer station. Also, yard trimmings were included in a household's compost waste for each data point.

Seattle, Denver, Austin, and Minneapolis were all evaluated using this methodology. Seattle's data is from 2017 but issued in the 2018 report. Denver is from 2017. Austin is from 2014 and Minneapolis is from 2016. Inconsistencies in the metrics prohibited generating a larger data set. For example, San Francisco uses a single private waste collection company. So, all the data is reported as a financial data sheet. (Recology San Francisco, Recology Golden Gate, Recology Sunset Scavenger 2017) This makes it very difficult to calculate into the likely tonnage composted by a single-family home.

### **3. Results**

Seattle was the only municipality that is considered a mandatory environment. Residents are occasionally fined for improperly disposing wastes in the wrong receptacle. (City of Seattle 2014) Denver was categorized as voluntary. Residents must pay an additional fee every month for a separate curbside bin. (Denver 2019) Minneapolis and Austin are both considered Incentivized. In Minneapolis, compost collection is free. (Recycling, City of Minneapolis Garbage & n.d.) In Austin, the service is free to sign up for, but a \$1 fee is applied to everyone regardless of program participation. So, this is a hybrid of mandatory and incentivized. Ultimately this study has categorized it as incentivized because residents are eligible for a \$75 reimbursement if they purchase a backyard or personal composting device. (Austin Resource Recovery n.d.)

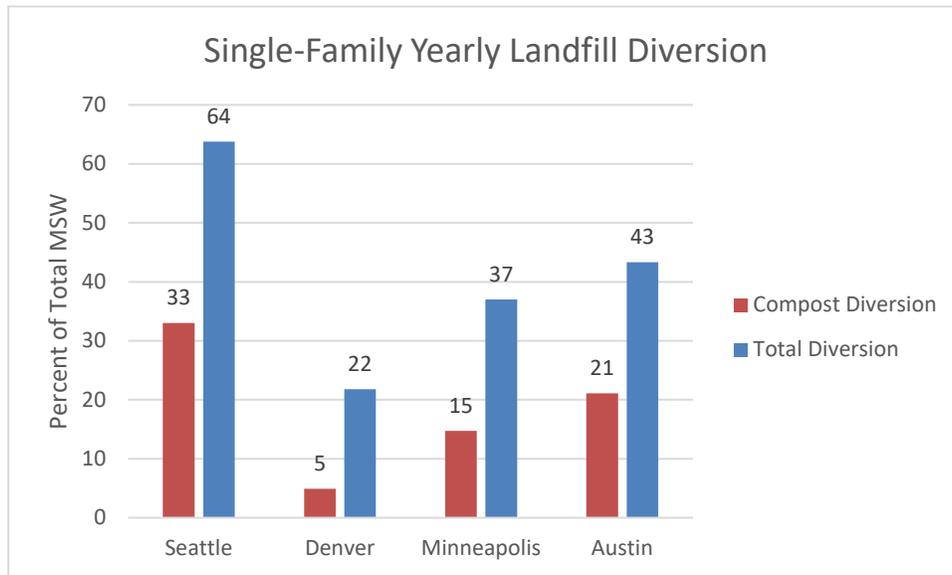


Figure 1. The amount of MSW composted as a percentage of the total MSW produced by a single-family household in a year. (City of Denver 2017) (City of Seattle 2018) (Austin Resource Recovery 2014) (Foth, Louis Berger, MSW Consultants, GRG Analysis 2016)

Seattle has the highest rate of landfill diversion and the highest rate of composting. Denver had the worst rates for each category. Minneapolis and Austin were not as high as Seattle, but higher than Denver. The mandatory program showed the highest rate of composting at 33%. The voluntary program, where residents must make a special effort to participate showed the lowest at 5%. The incentivized programs showed relative parity to each other at 15% and 21%. So, the jump from voluntary to incentivized was at least 3 times, but the jump from incentivized to mandatory was 1.5 times.

This data was either generated from or directly observed in the annual report for each waste collection group. (City of Seattle 2018) (City of Denver 2017) (Foth, Louis Berger, MSW Consultants, GRG Analysis 2016) (Austin Resource Recovery 2014)

## 4. Discussion

Seattle was used as the model of reporting for the data sets. This investigation was able to create a single normalized data set by “back” calculating from raw data provided in the respective other cities’ annual reports. However, slight inconsistencies may be present in places where source data is not the same. For example, special collection for yard trimmings may not be included in the source data in one city but calculated into the result.

Seattle also has historical information of recycling and composting rates by both percentage and tonnage. Future studies may be able to compare current data in each city and draw conclusions across time. As public participation and perception shifts over time, it may yield different results in the compost diversion rates as compared to their voluntary or mandatory participation. It is possible that the difference between mandatory and incentivized programs could shrink.

The age of each program is also a variable that could be considered. For example, Denver has a composting program that is less than 2 years old whereas Seattle has a program that dates to the early 2000s. (City of Denver 2017) (City of Seattle 2018) As more people expect composting to be included in the umbrella of utilities services, the gap between all program rates may be less dependent on carrot or stick policies and more dependent on the overall age of the program.

The spring legislative session for the State of Colorado could see up to 5 bills introduced from the Zero Waste and Recycling Interim Committee. They plan to introduce a glass and plastic bottle deposit program and enhance the existing recycling and composting programs. They also intend to fund outreach efforts to minimize the overall MSW stream and maximize upstream sorting. As these efforts are implemented, the rate of composting will also increase due to public awareness. (Randell 2019) (Ecocycle 2019)

In cases where the data could not be normalized, this investigation attempted to pull interesting information that could inform policymakers. For example, Miami collected 4.5 million tons of MSW and recycled 1.5 million tons in 2017. However, they burned close to 650,000 tons of MSW. (State of Florida 2019) It is unclear how much of that 650,000 was incinerated versus gasified for energy production. The entire country of Sweden has reported a 99% landfill diversion rate in 2017. (Hinde 2019) This was achieved through recycling programs and, like Miami, gasification for energy generation.

Tonnage may not be the best metric to evaluate the efficacy of a given recycling program. The Minneapolis annual report did use tonnage, but in the context of potential. As packaging materials and other recyclable materials become lighter, it could skew historical comparisons. In Seattle's case, it made the growth of the recycling program appear to shrink even though more households were registered participants year over year. (City of Seattle 2018) However, tonnage is an appropriate metric with respect to compostable material. Most food waste will have the same density unless people begin to dehydrate their scraps before disposal. Also, it is easier for the source data to be generated if tonnage is used. Minneapolis was able to use potential percentage because they performed random inspections of households. (Recycling, City of Minneapolis Garbage & n.d.) The other cities used scales at transfer stations. In other words, Minneapolis went looking for this metric, while other cities simply gleaned the data from existing efforts.

Composting efforts could also be increased if the potential energy in organic waste is harvested through decomposition. In 2017, a large digester facility was shut down in Weld County Colorado, just northwest of Denver. It could produce an equivalent of 20 megawatts of power in the form of methane. They had a contract to ship their product through existing gas lines to California. The project was shut down due to the smell of the digestors. (Turner 2017)

## 5. Conclusion

As global space for waste becomes scarce, or simply unappealing, the cost to blanketly dispose a single stream will continue to trend upwards. Simultaneously, digesters and combustible gas harvesting technology will continue to decrease in price. So regardless of carrot or stick policies, the likelihood of composting will increase if either, or both, the disposal costs increase or technology costs decrease enough so the municipalities profit from a diversion program.

But until the day that the economic scales are tipped, composting will become an easily identifiable and consistently quantifiable portion of the MSW diversion plans. The clear winner, in this study, is mandatory programs. However, it is possible that the age of the program may have more to do with its success than the policy approach. Education, outreach, and ubiquity of recycling and composting programs are the key to creating more program participants; which subsequently produces more diversion. Perhaps as the awareness of the programs increase, the inherent value will be reflected in the voluntary and incentivized programs as well.

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