

Executive Summary

# Economic Impact Potential and Characterization of Municipal Solid Waste in Michigan

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## **Authors**

Christopher John Cruz – Grand Valley State University

Daniel Schoonmaker – Michigan Sustainable Business Forum

Carrie Veldman – Michigan Sustainable Business Forum

## **Contributing Authors**

Paul Isely – Grand Valley State University

Aaron Lowen – Grand Valley State University

Hayden Strabel – Grand Valley State University

## **Research Fellows**

Amanda Diddams

Cameron Cleveland

Cyndie Roberts

Tiffany Win

## **Michigan Circular Economy Study Group**

Bradley Austin – Marquette County Solid Waste Management Authority

Kari Bliss – PADNOS

Russ Boersma – Arrow Waste

Dan Broersma – City of Holland

Janay Brower – Public Thread

Steve Faber – Kent County Department of Public Works

Matt Flechter – Michigan Department of Environment, Great Lakes, and Energy

Jason Kehr – Valley City Electronic Recycling

Vickie Lewis – VMX International

Jessica Loding – Schupan

Greg Mankowski – Organicycle

Jennifer McCullen – My Green Michigan

Kris Jolley – Michigan State University

Fred Sawyers – WM

Lindsey Walker – Emmet County Recycling

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## Executive Summary

Michigan is deeply invested in an economy-wide effort to achieve a 45 percent recycling rate. The state's circular economy decision makers need updated information to determine the value of potential new and expanded recycling streams, to assess the performance of programs, and define the environmental and economic costs of materials management. Sustainability professionals and recycling advocates need improved benchmarks to better communicate and support the value of landfill avoidance efforts.

The 2016 Michigan Municipal Solid Waste Characterization and Valuation Project created an important tool for the advancement of recycling, composting and the creation of a circular economy in the state. Through a series of sorting events at landfills and other disposal facilities, Michigan Sustainable Business Forum and its member collaborators worked to characterize economic and environmental opportunities available through sustainable materials management in Michigan. The ensuing report, *Economic Impact Potential and Characterization of Municipal Solid Waste in Michigan*, has been regularly cited by state and regional programs in the years since its publication. This project is intended to update that work.

## Summary of Work

The 2023 Michigan Municipal Solid Waste Characterization and Valuation Study performed statistically significant waste sorts at sites across the state, and through this provided an economic valuation for diversion in terms of real material value, job creation, and other positive economic and environmental impacts.

The following report details the results of this initiative according to five objectives:

- Determine composition of Michigan MSW now being disposed of in landfills and incinerators.
- Compare the composition of Michigan's MSW to the MSW of other Midwest states.
- Compare the 2023 composition of Michigan's MSW to its composition in 2016.
- Complete an economic analysis of MSW composition.
- Create datasets to inform discussions on Michigan deposit containers, lithium-ion batteries, and food waste.

## Summary of Findings

Material disposed of in Michigan’s municipal solid waste each year has an estimated market value of \$500 million to \$676 million. If this material were collected for recycling, it would have an estimated economic impact of \$609 million to \$825 million per year, creating as many as 4,500 jobs. This is shown in the table below.

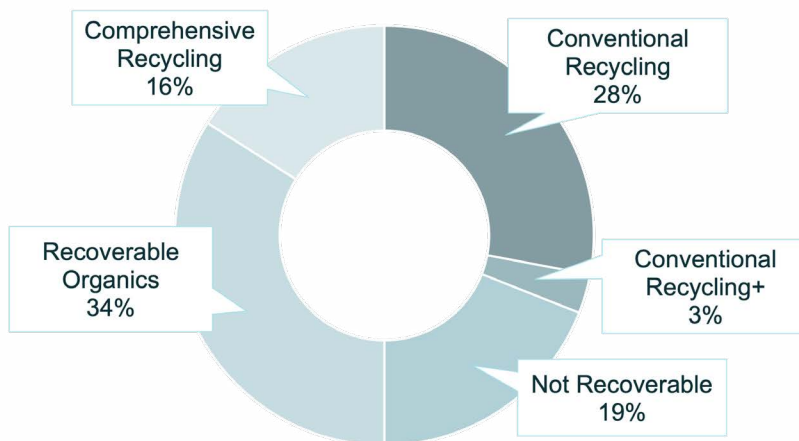
Value Reclaimed	Jobs Created	Total Effect Multiplier	Total Effect
\$499,627,857	3,317	1.22	\$609,764,673
\$676,224,324	4,490	1.22	\$825,289,659

Each year that Michigan does not make the investments in infrastructure, adopt new business practices, provide the necessary education to stakeholders, or advance and execute the public policy needed to increase the recycling rate, the state will lose at least a half billion dollars of potential feedstock for its manufacturers, farms and other end markets. The estimated lost value per year is detailed below.

	2023	2025	2030	2035
Population Projection*	10,023,423	10,202,350	10,424,510	10,569,985
MSW (tons)	8,993,502	9,154,045	9,353,377	9,483,904
Low Price (Adj) Total Value	\$499,627,857	\$508,546,694	\$519,620,466	\$526,871,805
High Price (Adj) Total Value	\$676,224,324	\$688,295,577	\$703,283,441	\$713,097,809

Most material currently being disposed of through landfills and incinerators could be recycled or composted in most metropolitan communities without great difficulty. Approximately one third of material could be recycled in any community that meets the recycling benchmarks specified in the new Part 115 materials management law, shown below as Conventional Recycling and Conventional Recycling+, which includes glass and other materials not universally accepted in Michigan.

**Ease of Recycling for Materials in Michigan MSW  
(mean % by weight)**



In comparison to the 2016 study, there is a statistically significant decrease in materials commonly targeted by recent investments in recycling collection and infrastructure, specifically plastic and mixed paper, suggesting that those improvements are working.

# Composition Findings

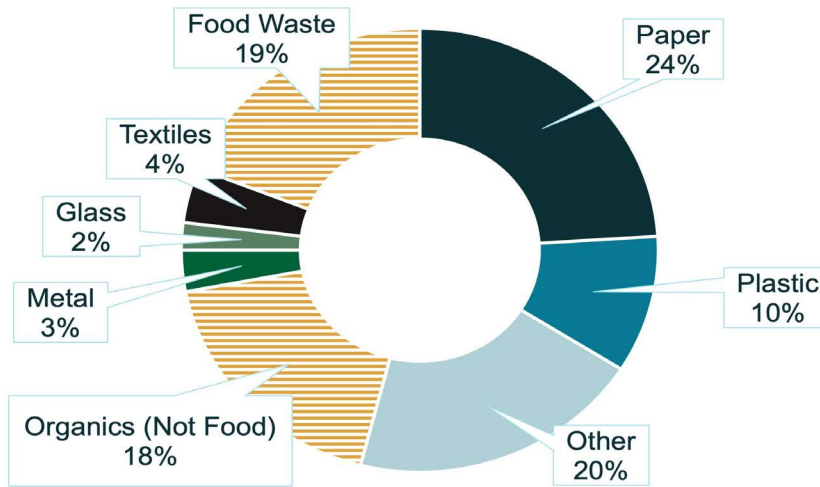
## Total Michigan MSW Landfilled and Incinerate

Michigan landfills report received volume to the Michigan Department of Environment, Great Lakes and Energy on an annual basis. Based on these regulatory filings there were 8,810,390 tons of MSW landfilled during the 2021-2022 fiscal year that came from Michigan. In addition, the Kent County Waste-to-Energy Facility in Grand Rapids incinerated about 183,112 tons of MSW during 2022. Between these two sources we estimate the state generates 8,993,502 tons of MSW available for screening for recycling.

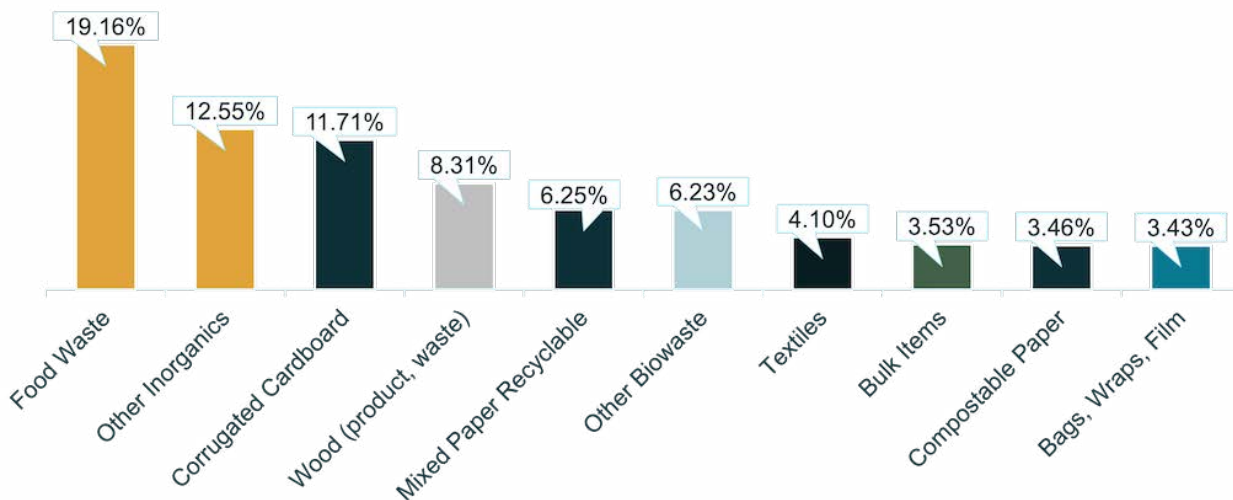
## Composition Results

The first objective of this study was to provide an estimate of the statewide aggregate mixed municipal solid waste composition for Michigan. These results are detailed in the following figures and the table on page 13.

**Michigan Municipal Solid Waste Composition  
(mean % by weight)**

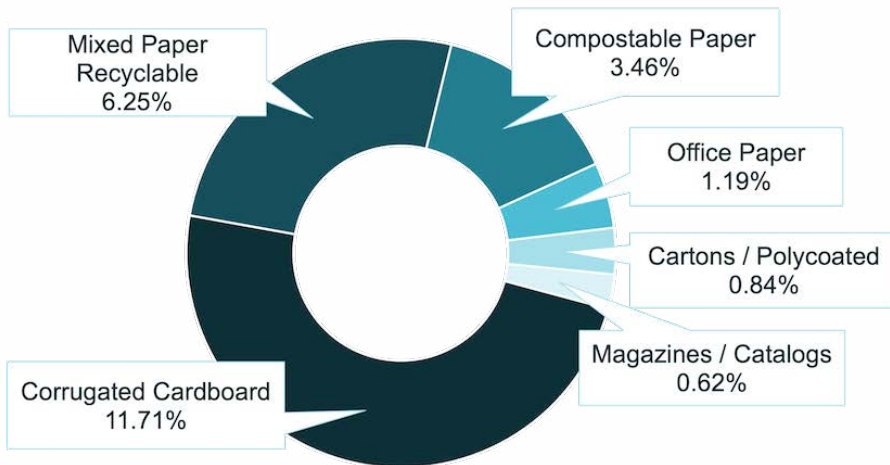


**Top Materials in Michigan MSW Composition  
(mean % by weight)**

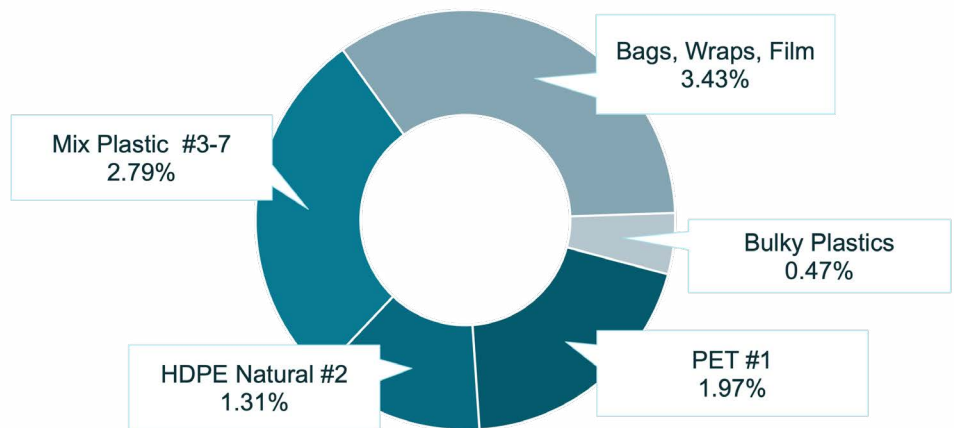




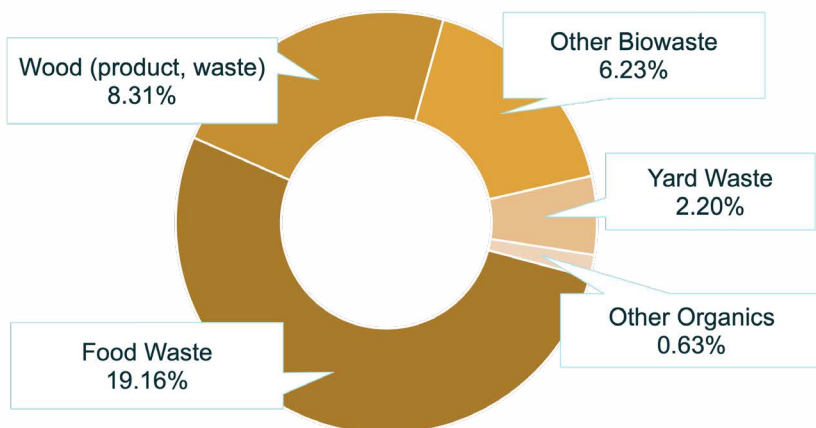
**Paper in Michigan MSW Composition  
(mean % by weight)**



**Plastic in Michigan MSW Composition  
(mean % by weight)**



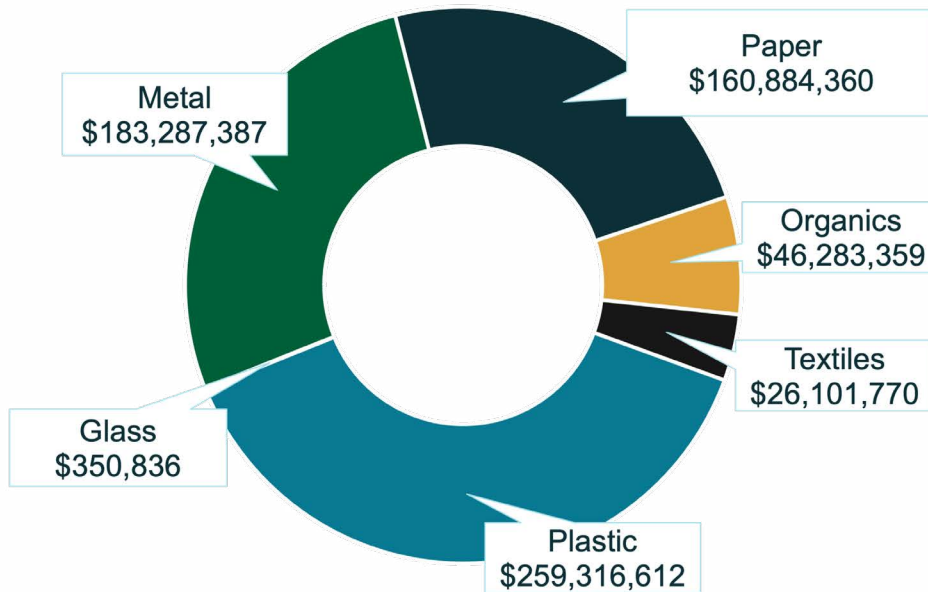
**Organics in Michigan MSW Composition  
(mean % by weight)**



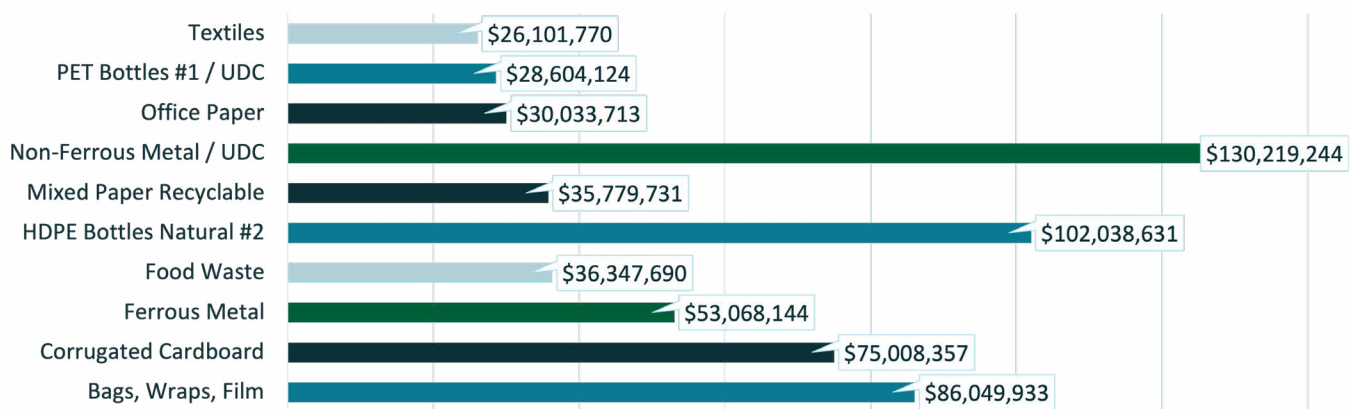
## Economic Value

As described in the summary findings, material disposed of in Michigan’s municipal solid waste each year has an estimated market value of \$500 million to \$675 million. This is detailed through the figures below and the table on the following page. In comparison, the 2016 Michigan MSW characterization study estimated the value of the state’s 8.4 million tons of landfilled materials at between \$293 million and \$368 million. As infrastructure and demand for recycled materials grow, so does the lost opportunity for economic impact.

### Total Value of Michigan MSW Material Disposed (\$)



### Top Commodities in Michigan MSW by Total Value





**Michigan Statewide Composition (by weight), Available Material Valuation (\$ in millions) and Net Recycling Value (\$ per ton)**

Material	Comp.	Value	Net	Material	Comp.	Value	Net
<b>Paper</b>				<b>Metals</b>			
Corrugated Cardboard	11.71%	\$75.0	\$340.47	Ferrous	2.20%	\$53.1	\$419.91
Mixed Paper Recyclable	6.25%	\$35.8	\$348.01	Non-Ferrous	0.69%	\$105.4	\$1,697.23
Compostable Paper	3.46%	\$6.8	\$302.60	UDC - Metal	0.22%	\$24.8	\$1,679.79
Office Paper - White & Color	1.19%	\$30.0	\$588.18	<b>Subtotal Metals</b>	<b>3.11%</b>	<b>\$183.3</b>	<b>-</b>
Cartons / Polycoated	0.84%	\$10.0	\$397.26				
Magazines / Catalogs	0.62%	\$3.3	\$377.83	<b>Organic</b>			
<b>Subtotal Paper</b>	<b>24.07%</b>	<b>\$160.9</b>	<b>-</b>	Food Waste	19.16%	\$36.4	\$307.18
				Wood (product, waste)	8.31%	\$8.0	\$259.59
<b>Plastic</b>				Other Biowaste	6.23%	-	-
PET Bottles #1	1.10%	\$25.8	\$476.52	Yard Waste	2.20%	\$1.9	\$259.59
UDC - Plastic	0.16%	\$2.8	\$199.59	Other Organics	0.63%	-	\$199.59
PET Packaging / Containers	0.71%	\$17.4	\$467.31	<b>Subtotal Organic</b>	<b>36.54%</b>	<b>\$46.3</b>	<b>-</b>
HDPE Natural #2	0.86%	\$102.0	\$1,527.31				
HDPE Color #2	0.45%	\$8.7	\$527.31	<b>Textiles</b>	4.10%	\$26.1	\$319.59
Expanded Polystyrene Foam	0.93%	-	\$223.50				
Mix Plastic Containers #3-7	0.93%	\$2.5	\$244.06	<b>Other Wastes</b>			
Polypropylene #5	0.93%	\$13.6	\$372.89	C & D	1.15%	-	\$199.60
Bags, Wraps, Film	3.43%	\$86.1	\$493.97	Electronics	1.52%	-	\$199.60
Bulky Plastics	0.47%	\$0.4	\$224.06	Bulk Items	3.53%	-	\$199.59
<b>Subtotal Plastic</b>	<b>9.98%</b>	<b>\$259.3</b>	<b>-</b>	Other Inorganics	12.55%	-	\$199.59
				Household Hazardous	1.42%	-	\$199.59
<b>Glass</b>				<b>Subtotal Other Wastes</b>	<b>20.17%</b>	<b>-</b>	<b>-</b>
Glass	1.84%	-	\$199.59				
UDC - Glass	0.19%	\$0.4	\$259.59				
<b>Subtotal Glass</b>	<b>2.03%</b>	<b>\$0.4</b>	<b>-</b>				

Our findings are derived entirely from field studies, verifiable market prices for recycled commodities, and peer-reviewed academic studies. In the table above we have summarized our findings for material composition and valuation, as well as the net recycling value per ton after accounting for indirect benefits and processing costs. Together this data quantifies characterization of Michigan MSW disposed in landfills and incinerators by aggregate commodity value and as a net impact for recyclers and recycling communities.

## Food Waste

There is substantially more food waste in Michigan landfills than currently believed, and its contributions to greenhouse gas emissions are greater than previously known. This should be the largest priority in future efforts to divert materials from landfills.

- Michigan disposes of an estimated 1.5 to 2 million tons of food waste through its municipal solid waste each year. It was the most common material characterized at 19.16 percent of samples by weight.
- This was also the case in 2016, when it was 13.5 percent of samples by weight. At the time, we predicted that food waste would become more prevalent as a percentage of MSW as conventional recycling programs improve. This was proven true.
- If this material was used as feedstock for compost in Michigan, it would be worth an estimated \$18 million to \$36 million annually.
- Food waste was found disproportionately in residential loads: 23.8 percent by weight, compared to 9.1 percent for samples from commercial properties.

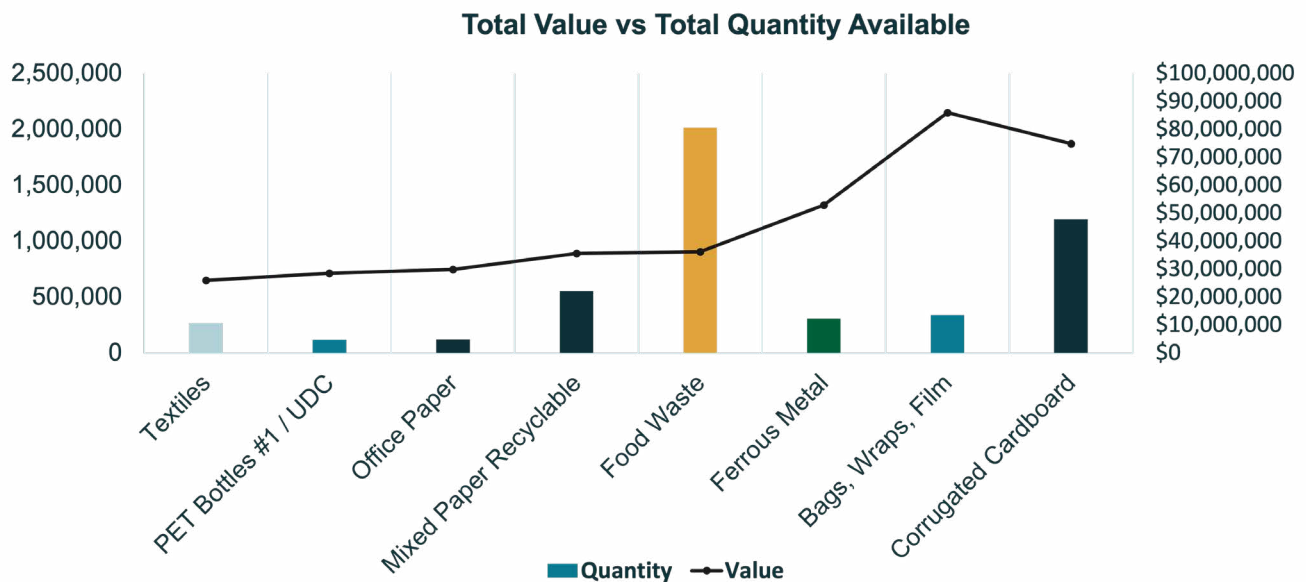
Our findings are consistent with characterization reports from peer states.

## Paper and Corrugated Cardboard

Corrugated cardboard is a unique opportunity for the state. Arguably, it is the easiest material to recycle, universally accepted by residential programs and the material most commonly recycled by businesses. Yet it is 11.71 percent of MSW in Michigan by weight, a commodity value of \$75 million during a depressed regional market for the material. At various points over the past five years it would have been worth two or three times more. Paper products are a combined 24 percent of MSW in Michigan. Although total paper is consistent with peer states, Michigan has more cardboard than any of its peers.

The material is disproportionately from business (16.5% to 8.6%). This may explain why cardboard is the only commonly accepted material that has not decreased in prevalence since 2016, as recent investments have favored residential waste streams.

The table below shows the quantity of available material in the state in comparison to the total value of the material. Cardboard is the one material with a large quantity of available material and a large total value.



## Plastic and Metal

Metal is only three percent of MSW, but approximately a third of the commodity value (\$183 million). When including environmental and social benefits, recycling a ton of non-ferrous metal has a net recycling value of \$1,697 per ton, the most of any material.

Recoverable plastic is 10 percent of MSW in Michigan, with a total annual commodity value of \$259 million disposed of each year in MSW. A majority of that value is from two categories: HDPE Natural (0.86%, \$102 million) and Plastic Film (3.43%, \$86 million).

- Although less than 1 percent of MSW, HDPE is a substantial opportunity. With a net recycling value of \$1,527 per ton, there is an economic and environmental case for collection programs targeting that material specifically, similar to scrap programs for metal.
- The value of Plastic Bags, Wraps, Film may not accurately represent the investment opportunity. It increased from 2016, possibly due to a shift in recycling options for plastic bags from curbside recycling programs to retail drop-off locations. Bags tangle processing equipment and impair MRF operations - enough so that many facilities do not accept the material.

## Other Findings

- There was a statistically significant increase in unclaimed bottle bill deposit containers in comparison to the previous study. There are now an estimated 1.3 million unclaimed bottle bill containers in the municipal waste stream, three times more than in 2016.
- Non-food, non-fiber organic waste was 17.4 percent of total samples. Wood was the most prevalent material. As much as 34 percent of non-food organic material could be composted, although this may overstate the compostability of wood and paper products.
- The share of electronic waste has decreased by more than half since 2015. It is now approximately 1.5 percent of MSW. Although a characterization of electronic waste to precisely determine the presence of lithium-ion batteries was not possible, we can confidently estimate that there are no less than 30 million lithium-ion batteries in the state's municipal solid waste stream.
- There are an estimated 29 million "vape pens" in the municipal solid waste stream. These are a large, if not the largest, vector for lithium-ion batteries in the state's MSW, and could be a contributing factor to the increasing number of fires at solid waste management facilities in the state.
- There is a robust secondary and tertiary market for textile products, especially used clothing. However, industry stakeholders highlight that all textiles do eventually end up in the landfill, and it is difficult to determine where materials sampled in this study currently were in the product life cycle. We estimate that Michigan disposes of 271,893 tons of textile waste through MSW, a total commodity value of \$26 million.
- Recycling facilities that process MSW universally indicate that glass has a negative value in their operations, meaning that they have to pay their customers to take it. However, glass that is processed through the deposit redemption program is sold to end markets in Michigan for \$60 per ton.

This study is intended to demonstrate the economic and environmental benefits of recycling in its various forms. We have done so. The economic opportunity is substantial and should be met with a sense of urgency. Likewise, in a vacuum, recycling provides a measurable environmental benefit over the landfill. But not all recycling (or composting) is mutually beneficial. As a general rule, prevention of waste through source reduction and reuse are beneficial to recycling, and should be prioritized. The full report is available at [misbf.org/msw](https://misbf.org/msw).