

Alternative Metrics and Methods for 21st Century Waste Management

Ron Vance

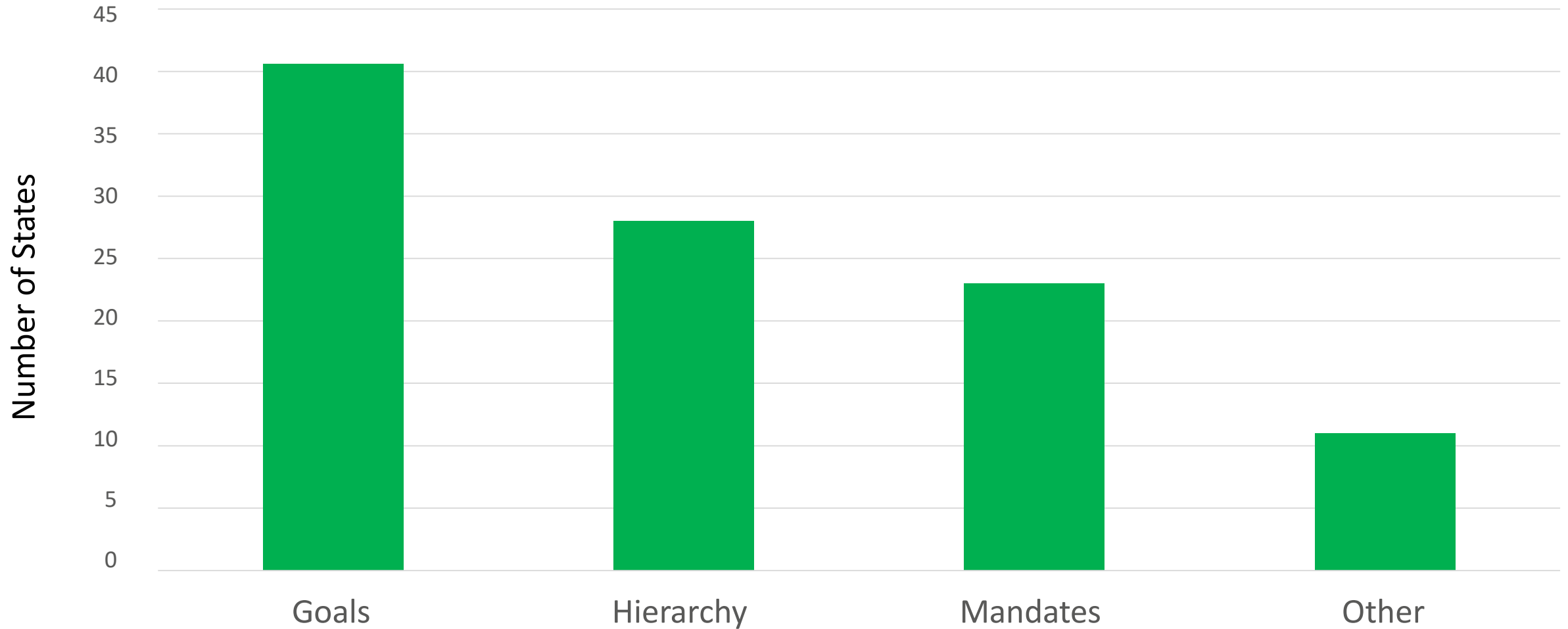
Chief, Resource Conservation Branch
U.S. Environmental Protection Agency

2018 MRN & SWANA Mid-Atlantic Annual Conference
June 20, 2018



CHANGING HOW WE THINK ABOUT OUR RESOURCES FOR A BETTER TOMORROW

Key Drivers of State Programs



Waste Hierarchy

Waste Management Hierarchy

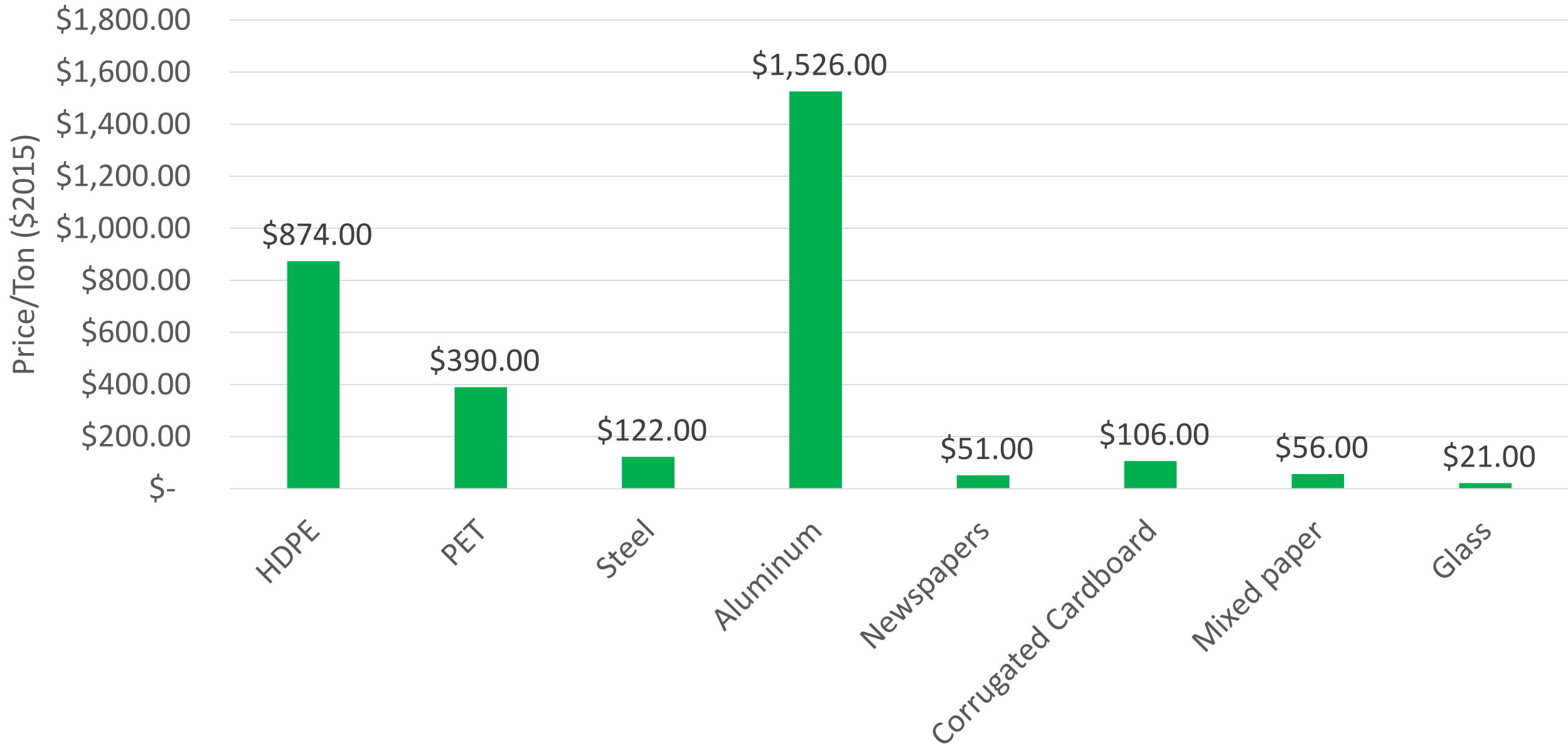


- Goal is set at one tier – Recycling
- What about:
 - Source Reduction & Reuse
 - Landfilling (Zero Waste)

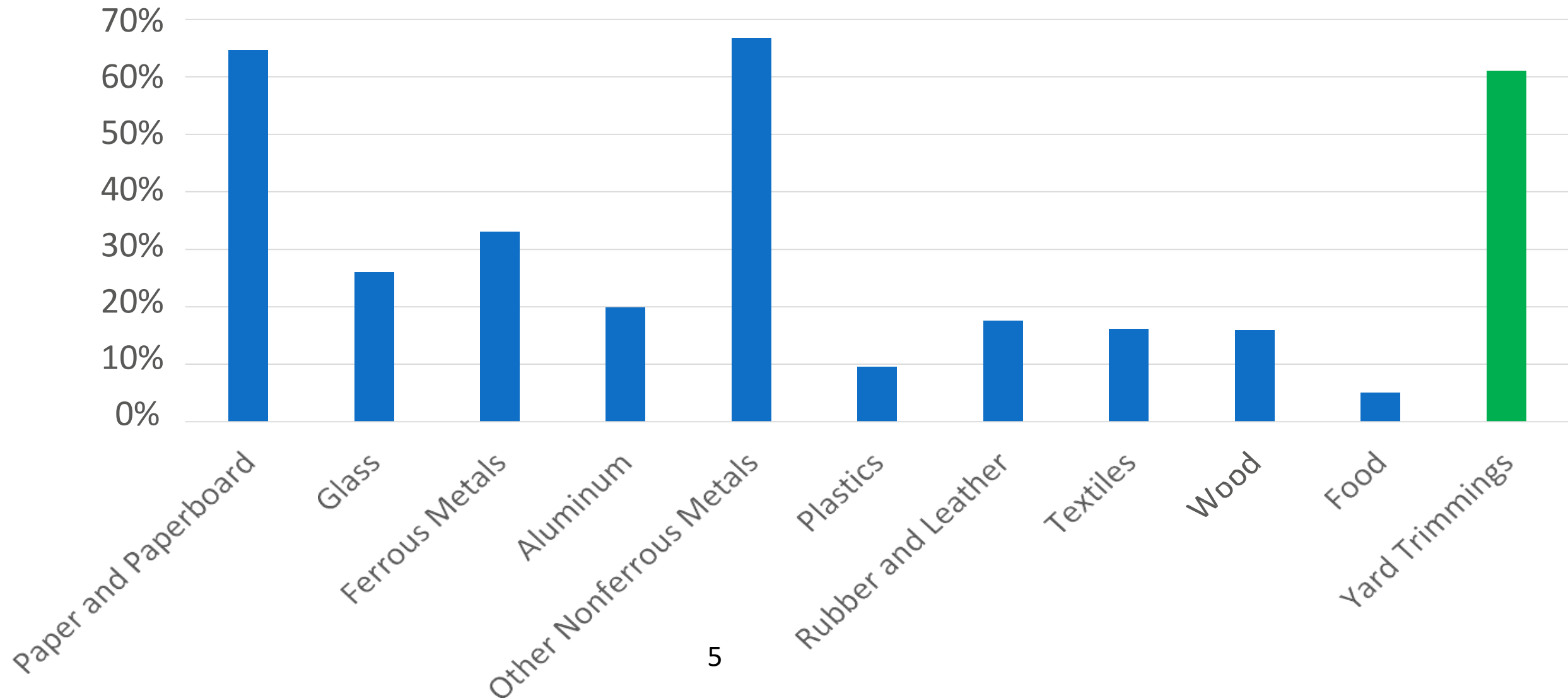
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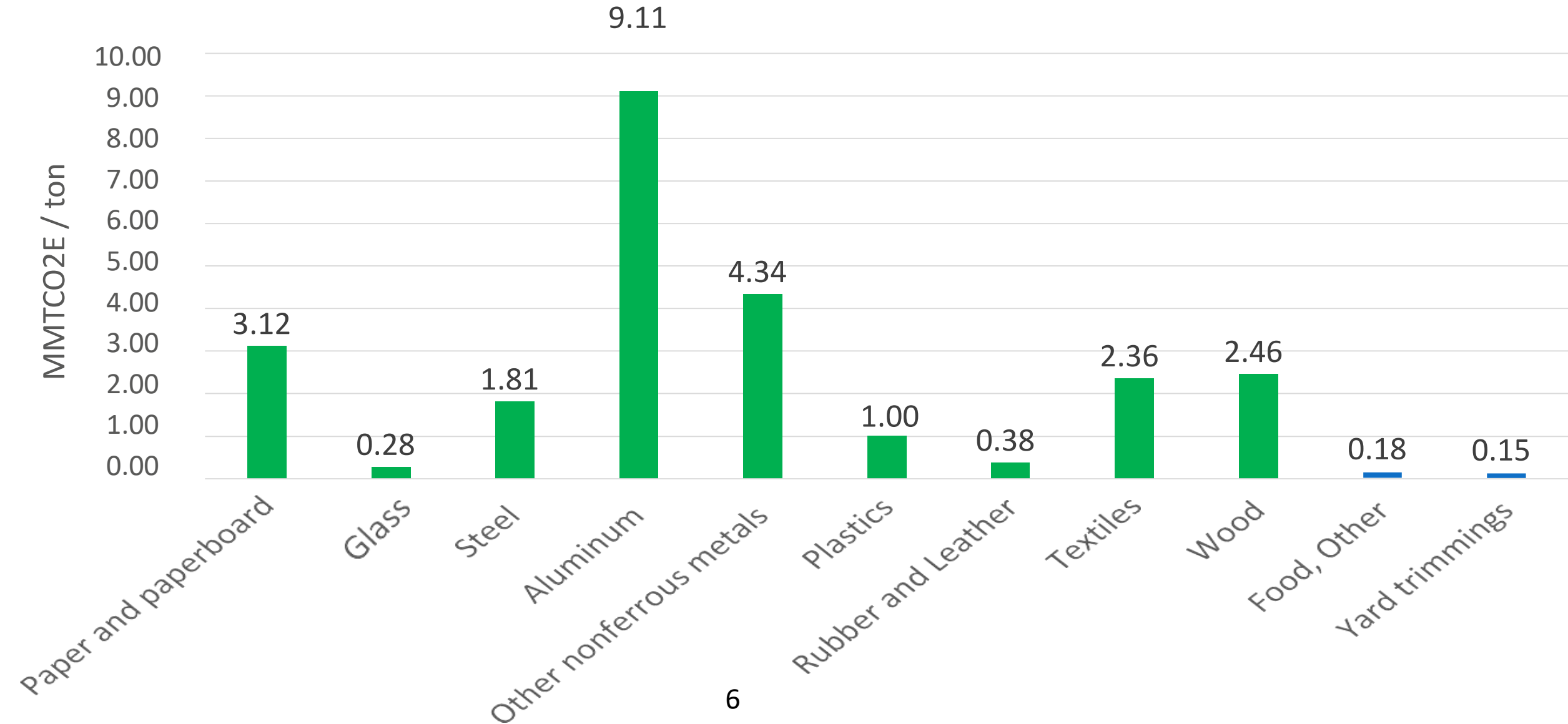
Measurement Focus: Commodity Value (\$)



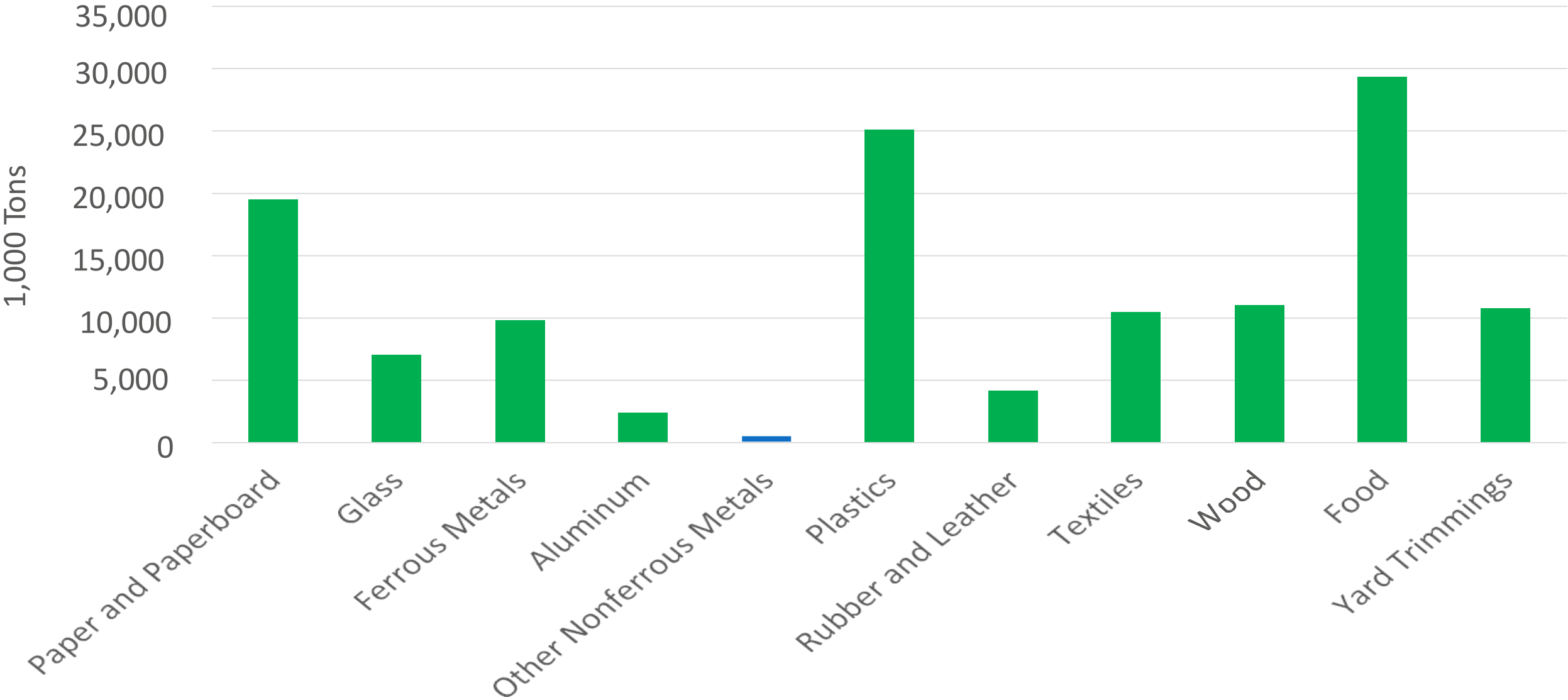
Measurement Focus: Recycling Rates



Measurement Focus: GHGs



Measurement Focus: Tons Landfilled



Measurement Focus: Multi-Attribute

Rank	Goods & Services	HHCan	HHNonCan	HHResp	EcoTox	GWrm	OzDepl	Smog	Acid	Eutro	Energy	Land	Water	Matl	Waste	Rank Value
1	Electric power generation, transmis...	6.9	3.0	14.3	1.3	15.1	<1	11.7	15.8	1.2	12.8	<1	14.4	2.0	1.5	35.4
2	Residential permanent site single- ...	3.7	3.7	3.5	2.2	3.1	2.0	4.6	2.3	<1	4.1	5.9	1.6	16.1	9.2	22.0
3	Animal (except poultry) slaughterin...	<1	<1	2.8	<1	2.3	<1	1.1	3.9	4.3	1.1	15.4	3.2	<1	7.6	18.8
4	Poultry processing	<1	<1	<1	<1	<1	<1	<1	1.6	16.2	<1	1.3	1.1	<1	3.7	16.8
5	Waste management and remediation se...	6.0	6.6	<1	12.2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	15.2
6	Greenhouse, nursery, and floricultu...	<1	<1	3.3	<1	<1	14.1	<1	<1	<1	<1	<1	<1	<1	<1	14.5
7	Food services and drinking places	3.9	3.3	3.2	3.1	3.4	2.1	2.8	3.1	3.9	3.8	4.0	5.6	1.0	6.7	14.2
8	Light truck and utility vehicle man...	5.9	9.6	1.2	5.0	2.1	3.1	1.9	1.2	<1	1.7	<1	<1	<1	2.6	13.5
9	Retail trade	4.4	4.5	3.4	4.7	3.9	3.2	3.8	3.3	1.6	4.9	1.7	3.4	<1	3.7	13.4
10	Truck transportation	<1	<1	1.3	<1	<1	<1	8.9	3.0	<1	2.9	<1	<1	<1	<1	9.9

WARM version 14 in openLCA

EPA The Waste Reduction Model (WARM) tool and LCI database built on openLCA **GreenDelta**

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www.epa.gov/research | www.greendelta.com

What is WARM?

WARM calculates GHG emissions and energy consumption of waste management practices — source reduction, recycling, composting, anaerobic digestion and landfilling for 54 material types, including those commonly found in municipal solid waste, as well as others such as construction waste. The model calculates emissions in the following units: metric tons of carbon dioxide equivalent (MTCO₂e), metric tons of carbon equivalent (MTCe), and energy units (million BTU).

Who should use it?

- State and local governments,
- Solid waste planners,
- Students,
- Small businesses, and
- Other organizations interested in the energy and GHG impacts for materials management decisions.

WARM & openLCA

Goal: to make EPA life cycle tools more standardized and interoperable with LCA practice and tools. Method: the WARM spreadsheet was converted into an inventory database in openLCA. The LCI database is used in the background by a new standalone application.

The openLCA WARM database

- It includes over 1900 process data sets inventorying the GHG emissions and energy consumption from the 6 main waste management practices in the U.S. and the 54 materials considered in WARM.
- Electricity grid mixes are regionalized for different regions in the U.S.
- Exchange use parameters, if possible (>1000 different process and global parameters used).
- The effect of carbon storage in soils, forests, etc. in the overall GHG emissions is also inventoried.
- Different landfill characteristics are considered (i.e. landfill type, gas recovery, moisture conditions and decay rates), leading to over 30 different landfilling processes per relevant material in the database.
- Multiple scenarios can be compared using the database in openLCA.

WARM standalone tool

1 Scenarios The user can define a baseline and alternative scenarios including all or some of the 54 materials listed in the user-friendly UI.

2 Further characteristics Some settings of the model can be changed: location, manager, diameter, type of material source reduced (i.e. virgin, current mix), and landfill and anaerobic digestion characteristics.

3 General information Optional data can be included to customize the results summary report (e.g. organization, description, date, etc.).

4 Calculation The result output unit can be selected between MTCO₂e, MTCe and million BTU. After the calculation, results are presented through several tables and contribution charts, and can be exported as a HTML report.

Example: Impact of U.S. 2030 Food Loss & Waste Reduction Goal on GHG emissions and energy consumption

95% of the 37 million tons of food waste generated yearly in U.S. is discarded to landfill or incinerated. The effect of an alternative scenario with 50% of food waste source reduced, as aimed by the "U.S. 2030 Food Loss and Waste Reduction Goal", was assessed with the WARM tool. Default transport distances of 20 miles and National average electricity mix and landfill characteristics were used in both scenarios.

Comparison of GHG emissions between baseline and alternative scenario:

Increased GHG emissions from alternative scenario to MTCO₂e (i.e. negative values refer to avoided GHG emissions compared to baseline scenario)

Change in Energy Use in the alternative scenario

Energy saved equivalent to:

- 2.35 million Households' Annual Energy
- 2.00 billion Gallons of Gasoline
- 44.6 million Barrels of Oil

Conclusions & Outlook

- The WARM tool includes a user-friendly UI and multiple result visualizations that facilitates the comparison of baseline and alternative scenarios using different waste management practices for 54 material types.
- By using the WARM LCI database in a LCA software like openLCA, users can benefit from additional features and analysis available in the software, as well as from combining it with other LCI databases.
- This new version of WARM is currently being updated to align with WARM v14 and will replace the former WARM web calculator on the EPA WARM website.

WARM openLCA (v14)

- Same functionality as WARM version 14 Excel
- Database vs. Excel spreadsheet
- Interoperable data
- Flexible for future updates



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EPA Facts & Figures

CHARACTERIZATION OF MUNICIPAL SOLID WASTE IN THE UNITED STATES

1996 UPDATE

Prepared for

U.S. Environmental Protection Agency
Municipal and Industrial Solid Waste Division
Office of Solid Waste
Report No. EPA530-R-97-015

by

Franklin Associates, Ltd.
Prairie Village, KS

June 1997

Printed on recycled paper

United States Environmental Protection Agency Solid Waste and Emergency Response (5305) EPA530-R-99-015 July 2000 www.epa.gov

Municipal Solid Waste The United States: 1999 Facts and Figures

reuse
Source
Reduce
recycle
Disposal

EPA United States Environmental Protection Agency

Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2003

The Environmental Protection Agency has collected and reported data on the generation and disposal of waste in the United States for more than 30 years. We use the information to measure the success of municipal solid waste (MSW) reduction and recycling programs across the country. The data also shows us where we, as a nation, need to make environmental improvements. Because we only report this information every ten years, these facts and figures are state through calendar year 2003. Both 2003 and 2002 data are reported here for first time.

TRENDS IN MUNICIPAL SOLID WASTE

Municipal solid waste (MSW), usually known as trash or garbage, is made up of things we commonly throw away. This household type of waste ranges from package wrapping, food scraps, and grass clippings to car oil, tires, computers, and refrigerators. It does not contain industrial, hazardous, or construction waste. Despite sustained improvements in waste reduction, household waste remains a constant concern because trends indicate that the overall tonnage we create continues to increase.

Since 1960, the total annual generation of MSW has increased more than 50 percent to the 2003 level of just over 236 million tons, just year—upping 2002 by more than a half million tons. Excluding

Recycling and Composting Programs for MSW
The latest recycling and composting figures we have are for 2003. In that year:

- About 8,976 curbside recycling programs existed nationwide, down somewhat from 9,700 in 2001.
- About 3,227 community composting programs were operational, a slight decrease from 2001 figures.

The decrease in recycling and composting programs may be the result of some states of curbside recycling programs or lower states reporting composting data.

MUNICIPAL SOLID WASTE IN THE UNITED STATES

2005 FACTS AND FIGURES

EPA United States Environmental Protection Agency

Advancing Sustainable Materials Management: 2014 Fact Sheet

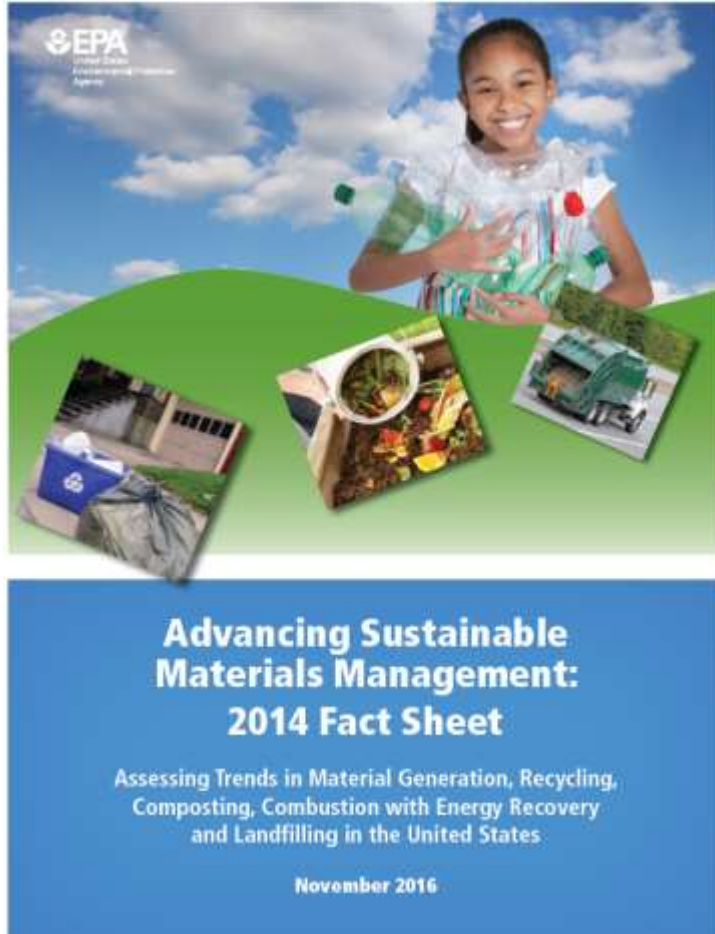
Assessing Trends in Material Generation, Recycling, Composting, Combustion with Energy Recovery and Landfilling in the United States

November 2016

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Recent Report Enhancements



- Replaced recovery and disposal with generation, recycling, combustion and landfilling.
- Methodology updates for electronics and construction and demolition (C&D).
- Per Capita vs PCE comparison

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2018 Transition to the Web

Facts and Figures About Materials, Waste and Recycling

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Learn about the Facts and Figures

- [Materials](#)
- [Products](#)

OUR TRASH, OR MUNICIPAL SOLID WASTE,
IS COMPRISED OF VARIOUS MATERIALS AMERICANS COMMONLY THROW AWAY AFTER BEING USED.



NOTE:

Set

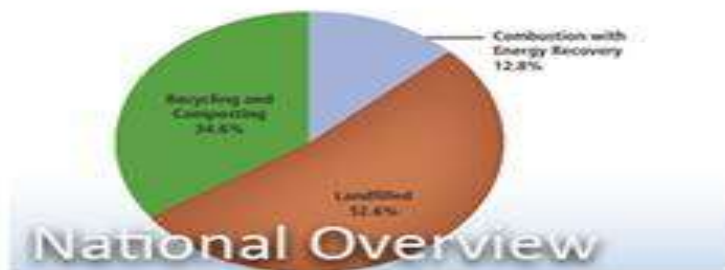
Current statistics reflect data from 2014. Data is only representative of the United States.

EPA expects to update this information with 2015 data in 2018.

The Facts and Figures data looks at generation, recycling, composting, combustion with energy recovery and landfilling for a variety of materials and products. View our [A to Z Directory](#).



Basic Information



National Overview



Common Materials and Products

Recycling Economic Information (REI) Report

- Recycling accounts for:
 - 757,000 jobs
 - 1.57 jobs per 1,000 tons
 - \$36.6 billion in wages
 - \$6.7 billion in tax revenues
- Most significant contributors to the national economy
 - Metals (ferrous and non-ferrous)
 - Construction and demolition (C&D)



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Scoping Work in Progress: Industrial Materials

- **Studying five different categories of non-hazardous industrial materials:**
 - Coal Combustion Residuals (CCRs), Iron and Steel Slag, Spent Foundry Sands, Mining, Mineral Processing, and Biosolids
- **Utilizing publicly available data:**
 - Government sources
 - Industry Trade Associations
 - Academic Papers
- **Current status:**
 - Investigating data source
 - Tentative estimations by the end of the 2018



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Recycling System Performance Measures

- Capacity (Collection, Processing, & Reutilization)
- Utilization of Capacity (Participation Rate & Capture Rate)
- Contamination (Collection & Final Bale)
- Processing Efficiency & Effectiveness (Yield, Loss, Residual)
- Economics (Market Value, Collection & Processing Costs)



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Thank you!

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epa.gov/smm



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Facebook: facebook.com/EPA

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