

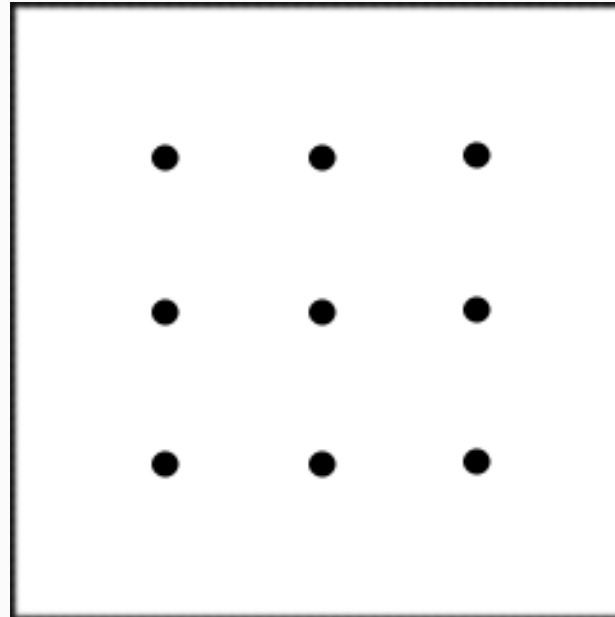


EPA's Sustainable Materials Management Program

**Ron Vance, Chief
Resource Conservation Branch
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Recovery**

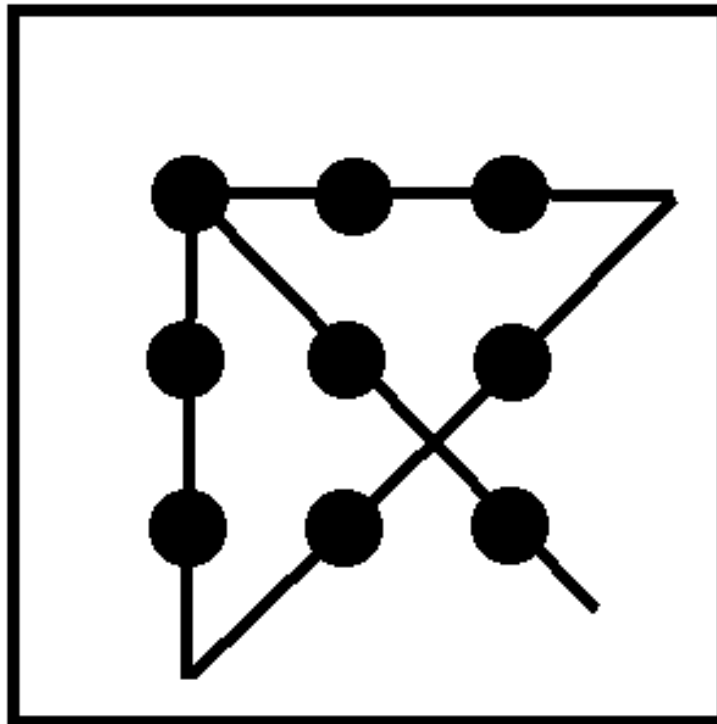
January 25, 2018

Connect the Dots

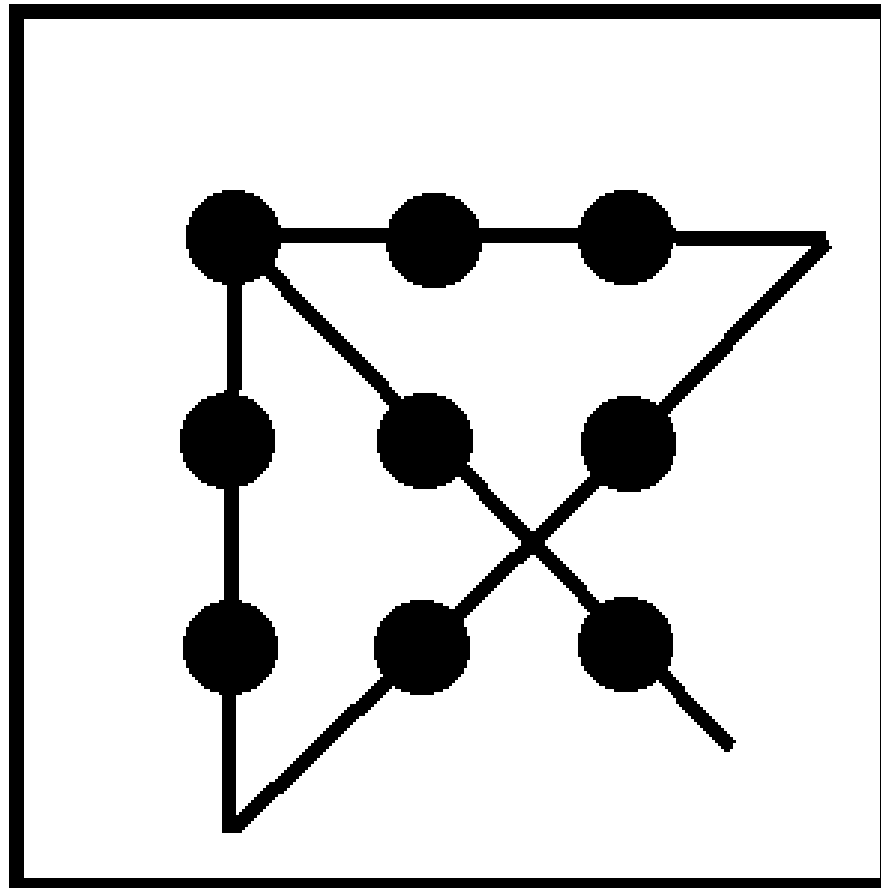


- Using four straight lines, without lifting pen off paper, connect the nine dots

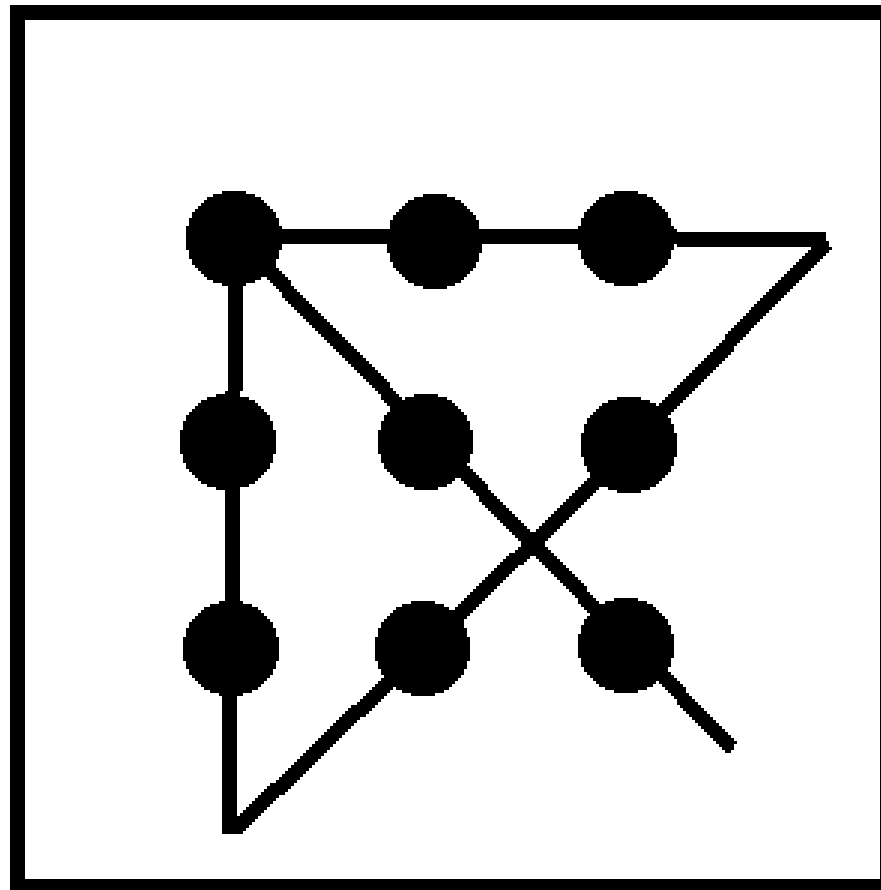
What made this difficult?



Our Thinking made it difficult!



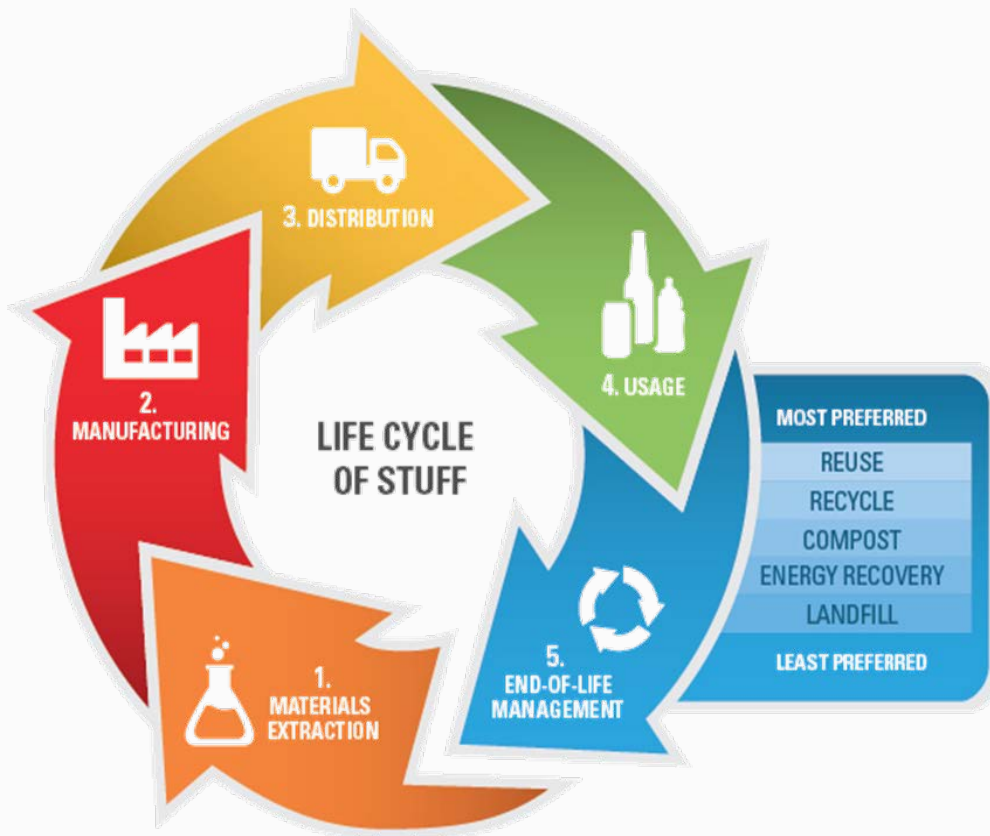
Today, I hope to challenge you to think outside "The Box"



Agenda

- Reshaping our Thoughts
- What is SMM
- How is SMM Different
- Why SMM
- How do we set Priorities
- What's in a Metric
- EPA's Priorities and Why
- EPA Tools

What is Sustainable Materials Management (SMM)?



“An approach to serving human needs by using/reusing resources productively and sustainably throughout their life cycles, generally minimizing the amount of materials involved and all associated environmental impacts.”

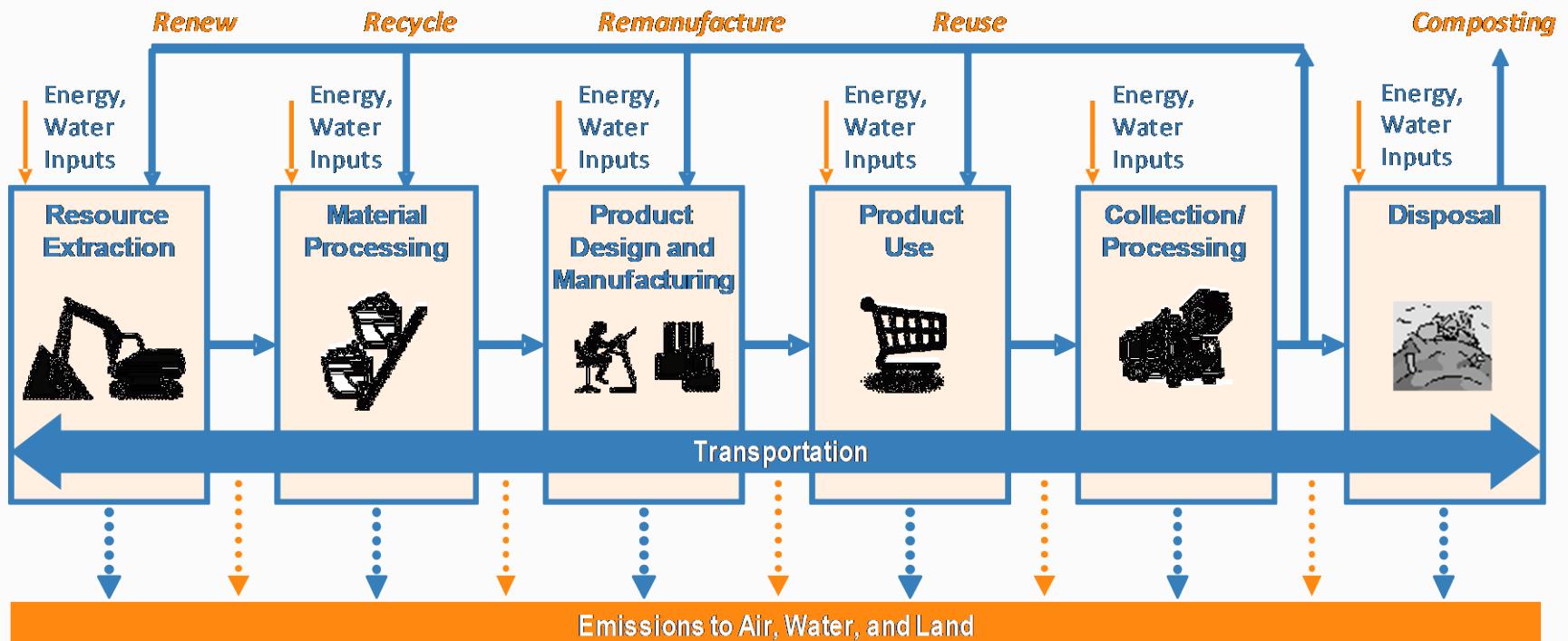
Sustainable Materials Management: The Road Ahead, EPA (2009)

Advantages of Life-Cycle Thinking

Life cycle information offers greater “return on investment.”

- Prioritizing and strategic planning.
- Challenging preconceived ideas about how materials can and should be managed avoiding unintended consequences.
- It's not always about recycling or landfilling, it's about finding the best use/place for the material.

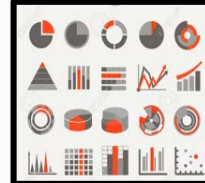
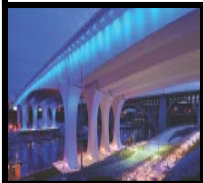
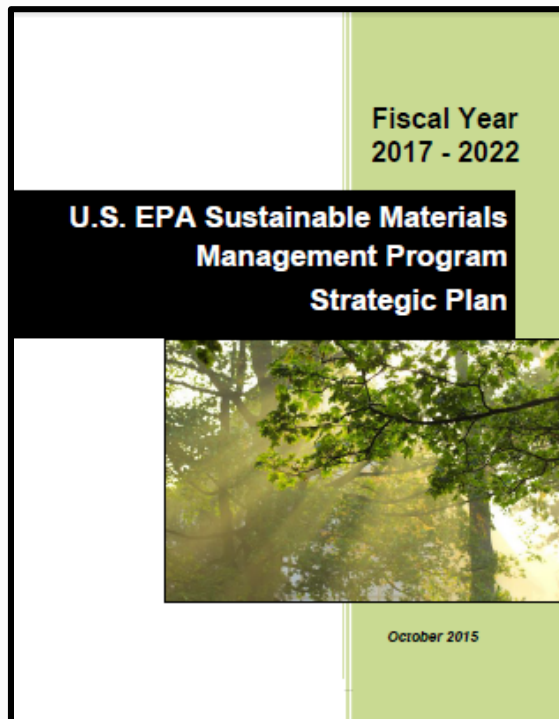
Material/Product Life Cycle



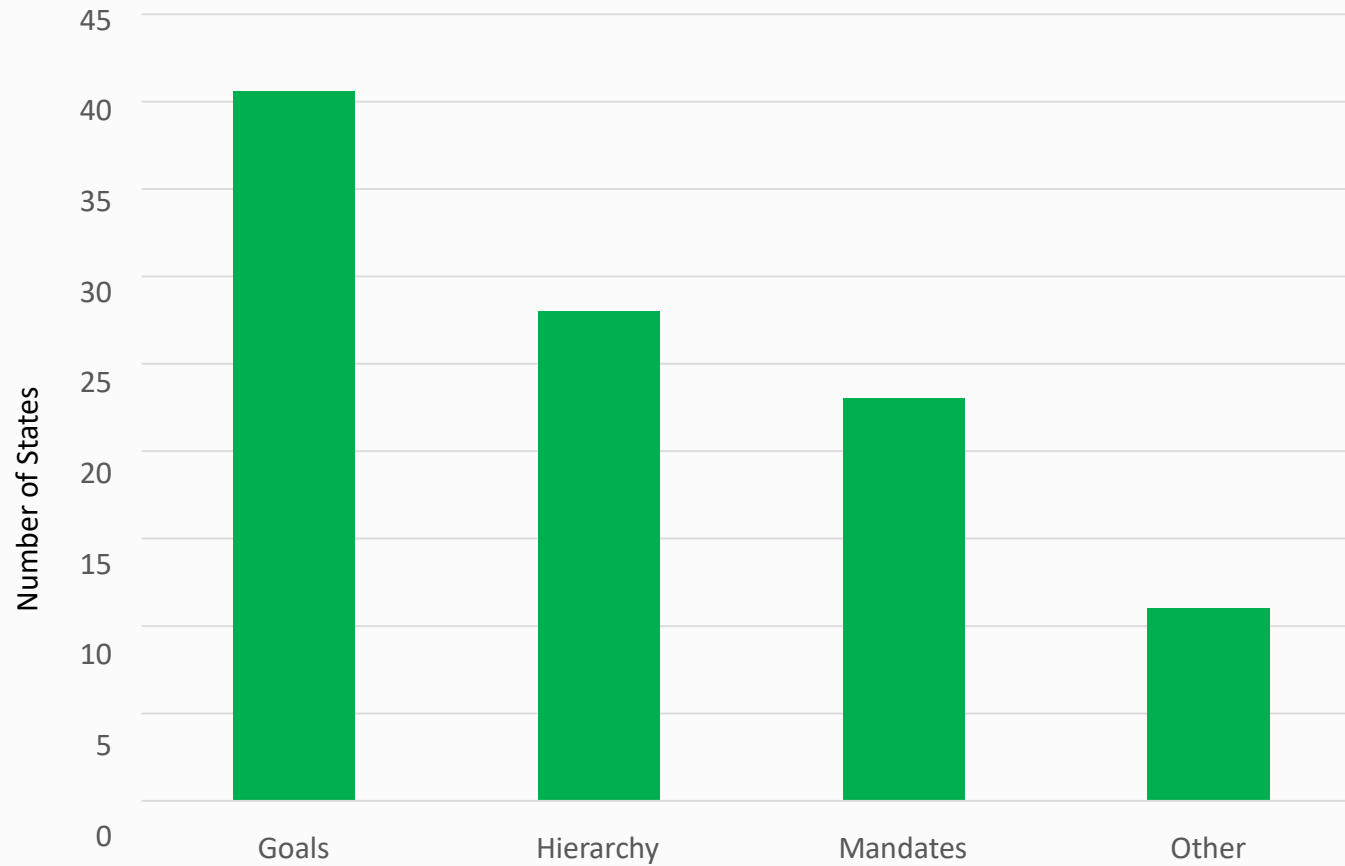
Where are the opportunities to extend material use?

EPA's SMM Strategic Plan

- Built Environment (buildings, roads, bridges, infrastructure)
- Sustainable Management of Food
- Sustainable Packaging
- Sustainable Electronics Management
- Life Cycle Thinking
- Measurement
- International Efforts

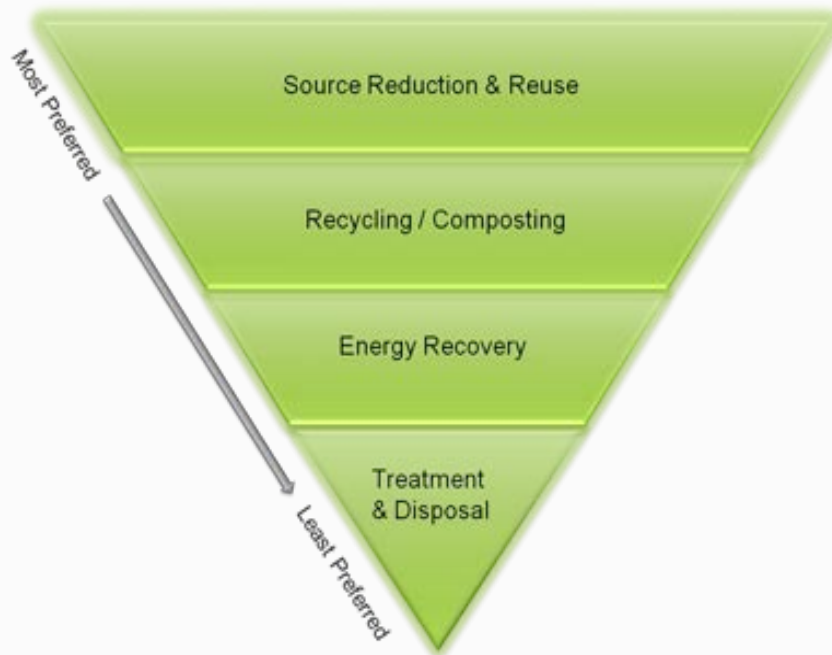


Key Drivers of State Programs



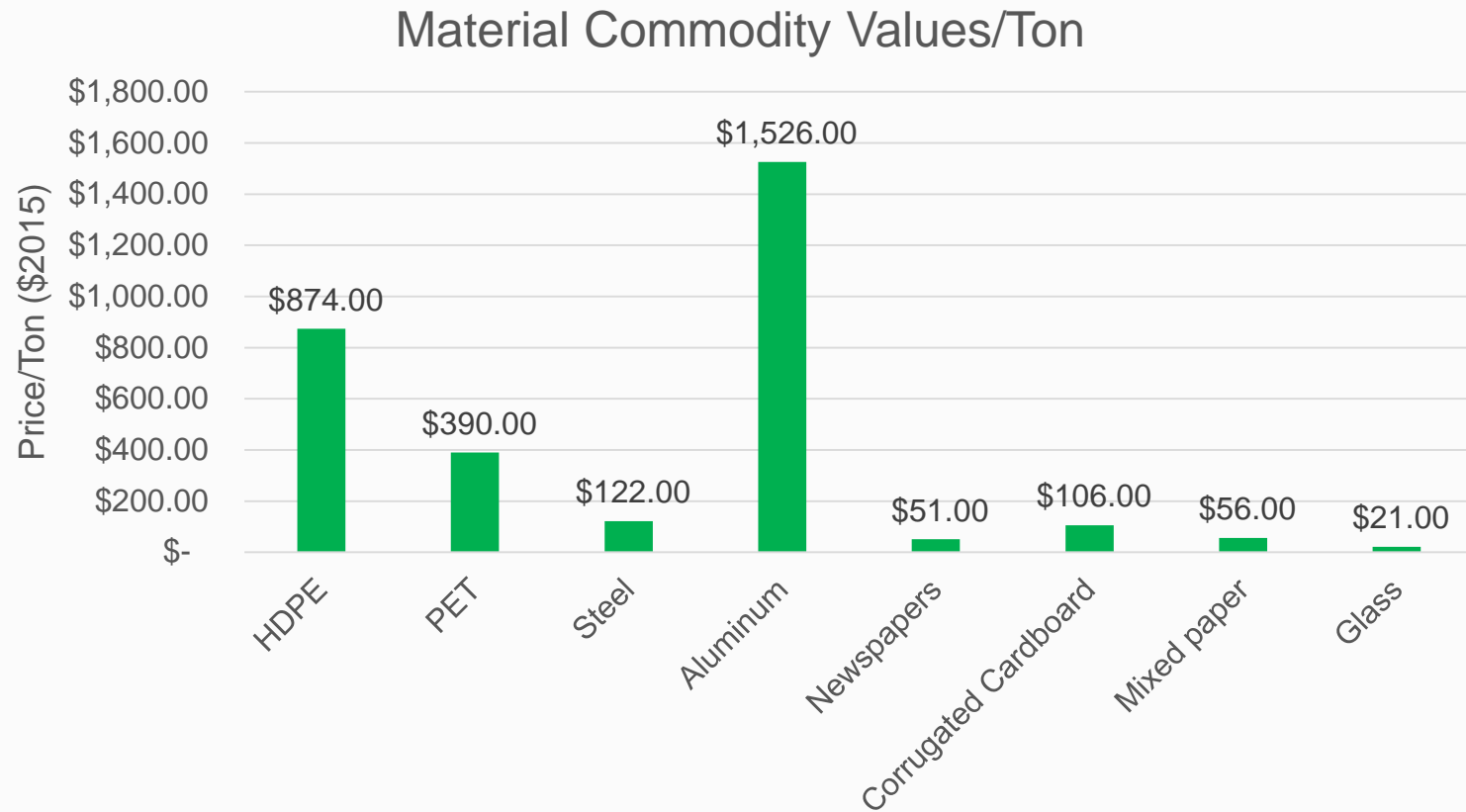
Waste Hierarchy

Waste Management Hierarchy

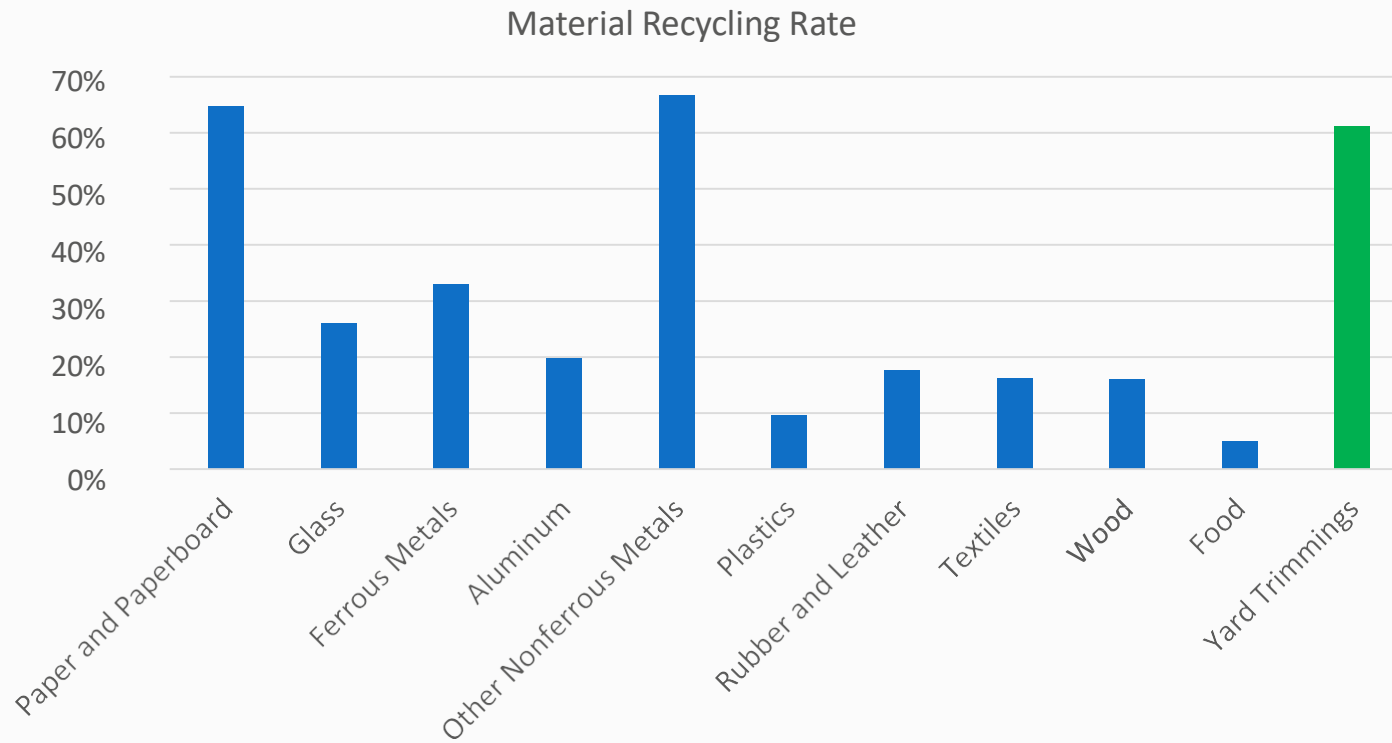


- Goal is set at one tier – Recycling
- What about:
 - Generation
 - Landfilling (Zero Waste)

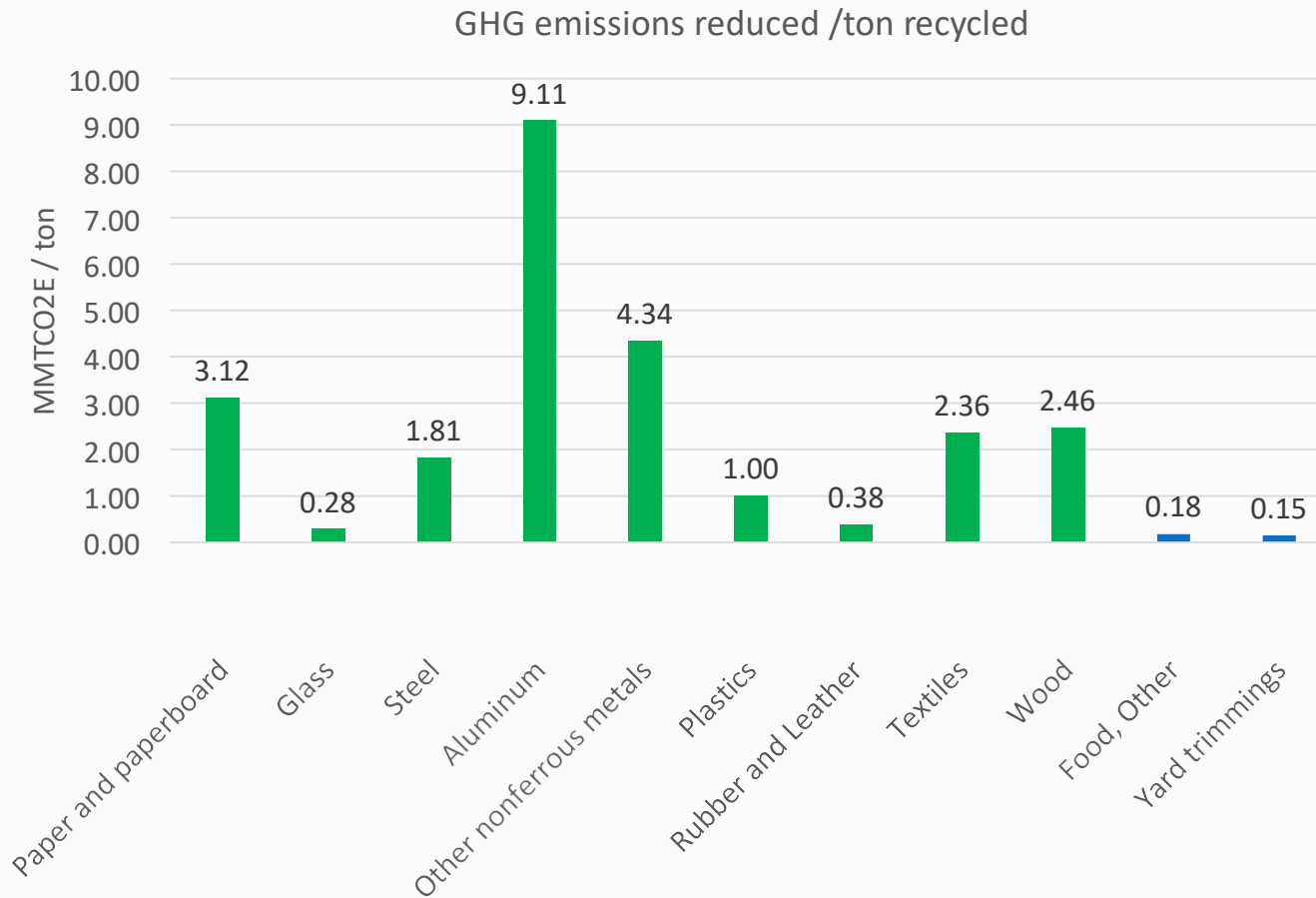
Measurement Focus: Value (\$)



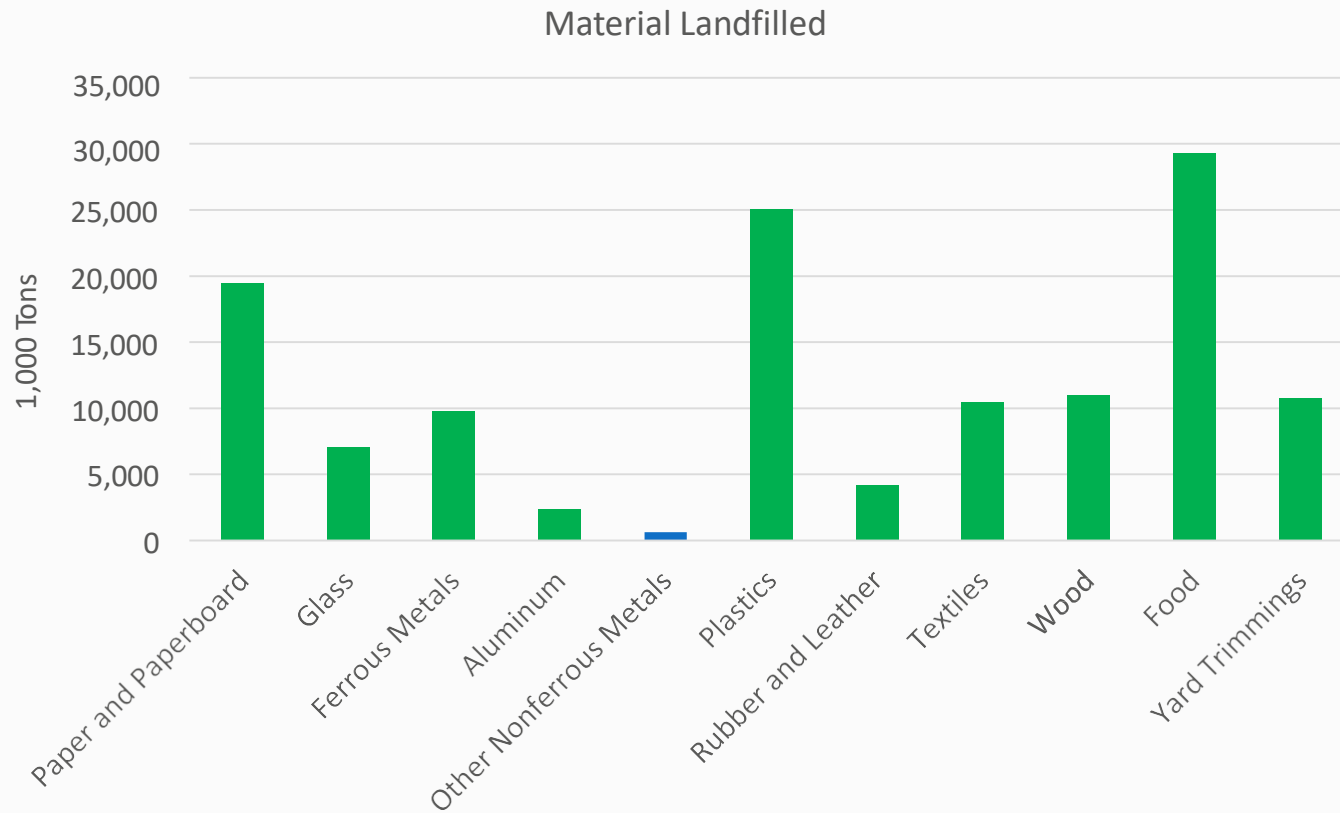
Measurement Focus: Recycling Rates



Measurement Focus: GHGs



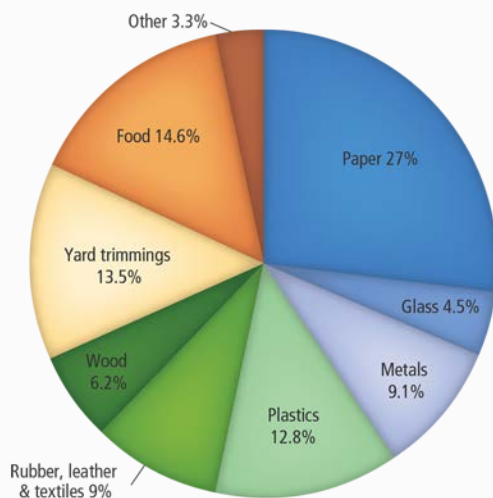
Measurement Focus: Tons



Advancing SMM Through Policies and Tools

- Applied Research
- Business Models
- Convening Stakeholders
- Procurement Practices
- Voluntary Standards (life-cycle based)
- Tools (SMM Prioritization Tool, WARM)

SMM Measurement and Analyses



Advancing Sustainable Materials Management: Facts and Figures

- Published annually – 2016 report (2014 data).
- Summarizes Municipal Solid Waste (MSW) generation and management data.
- Also includes C&D generation (since 2013).

State Measurement Program

- Voluntary program started in 2013 providing MSW, recycling and other SMM data from states.

New U.S. Recycling Economic Information (REI) Jobs Study Report

- New numbers on jobs, wages, and tax revenues.
- Refined methodology for estimating true costs of recycling.

Measuring SMM



U.S. Top Ten Most Impactful Goods and Services

Rank	Goods & Services	HCa n	HHNonC an	HHRes p	EcoTo x	GW r m	OzDe pl	Smo g	Acid d	Eutr o	Energy	Lan d	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) slaughtering...	<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 floriculture...	<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

SMM Prioritization Tool Suite – National and State Tools

1. Select Good or Service

2. Identify Issues

3. Operations vs. Supply Chain

4. Impactful Purchases

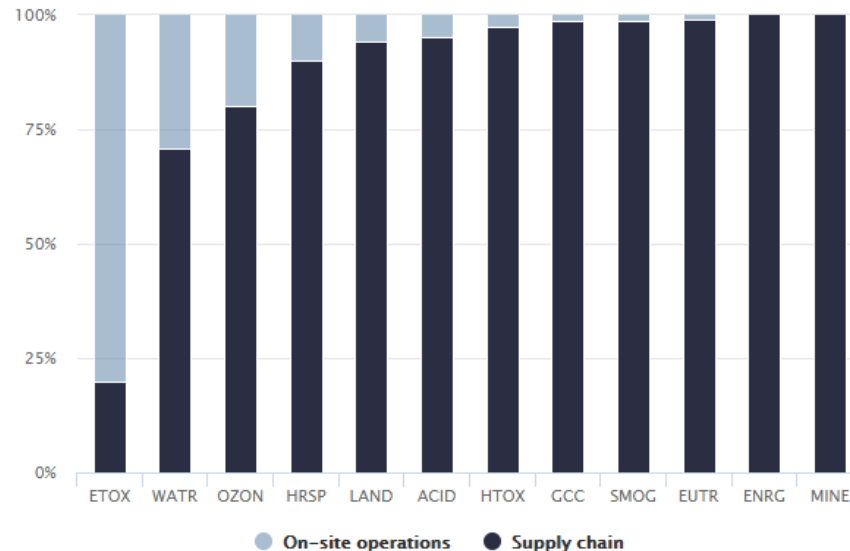
5. Supply Chain Hotspots

6. Summary

What's this?

Should a provider of *Fresh fruits and tree nuts* consider prioritizing actions that target environmental issues in operations or in the supply chain?

The chart below shows the share of environmental issues associated with on-site operations and the supply chain for *Fresh fruits and tree nuts*. Supply chain refers to the entire network of activities required to produce and deliver a good or service purchased by an organization. This includes Tier 1 suppliers, as well as those that support them (i.e., Tier 2, 3, and so on).



WARM openLCA version 14

www.epa.gov/research

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

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What is WARM?

WARM calculates GHG emissions and energy consumption of waste management practices —source reduction, recycling, combustion, 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: metric tons of carbon dioxide equivalent (MTCOE), 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.
- Exchanges are parameterized, 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 20 different landfilling processes per relevant material in the database.
- Multiple scenarios can be compared using the database in openLCA.

Figure 1. Excerpt of WARM database in the navigation pane, openLCA 1.3

Figure 2. Input/Output in the process editor of WARM landfilling of Food Waste, openLCA 1.3

WARM standalone tool

1 Scenarios

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

Material	Baseline Scenario				Alternative Scenario			
	Yes	No	Yes	No	Yes	No	Yes	No
Food Packaging	Y		N		Y		N	
Food Waste	N		Y		Y		N	
Food Trays	N		Y		Y		N	

2 Further characteristics

Some settings of the model can be changed: location, transport distances, 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 MTCOE, 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 landfills 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 scenarios

Material	Baseline (MTCOE)	Alternative (MTCOE)	Change (MTCOE)
Food Packaging	1000000	970000	-30000
Food Waste	1000000	500000	-500000
Food Trays	1000000	970000	-30000

Change in Energy Use in the alternative scenario

Material	Baseline (MTCOE)	Alternative (MTCOE)	Change (MTCOE)
Food Packaging	1000000	970000	-30000
Food Waste	1000000	500000	-500000
Food Trays	1000000	970000	-30000

Figure 3. "Landfill type" options in the sub "Further characteristics" of the WARM tool

Figure 4. Excerpt of the "Scenarios" tab of the WARM tool, showing 3 of the 54 materials included, and containing the amounts of food waste per treatment and scenario used in the example

Figure 5. "Landfill type" options in the sub "Further characteristics" of the WARM tool

Figure 6. Incremental GHG emissions from alternative scenario in MTCOE (i.e. negative values refer to avoided GHG emissions compared to baseline scenario)

Figure 7. Excerpt of "Energy Analysis - Summary report" of the WARM tool

Goal: This update will make the WARM Tool more standardized and interoperable with other LCA tools.

- New background database and user interface.
- Same functionality as WARM version 14.
- Flexible for future updates.

Energy saved equivalent to

2.35 million Households Annual Energy

2.08 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.

DISCLAIMER: The U.S. EPA through its Office of Research and Development collaborated in the research described here. It has not been subject to Agency review and does not necessarily reflect the views of the Agency. No official endorsement should be inferred.

U.S. Environmental Protection Agency
Office of Research and Development



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