The Economic and Climate Benefits of Local Recycling Programs

Wednesday, November 15th, 2023

2023 Florida Recycles Day

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Dr. Timothy Townsend, Professor, University of Florida

FRP FLORIDA RECYCLING PARTNERSHIP FOUNDATION

UF UNIVERSITY of FLORIDA
The Foundation for The Gator Nation

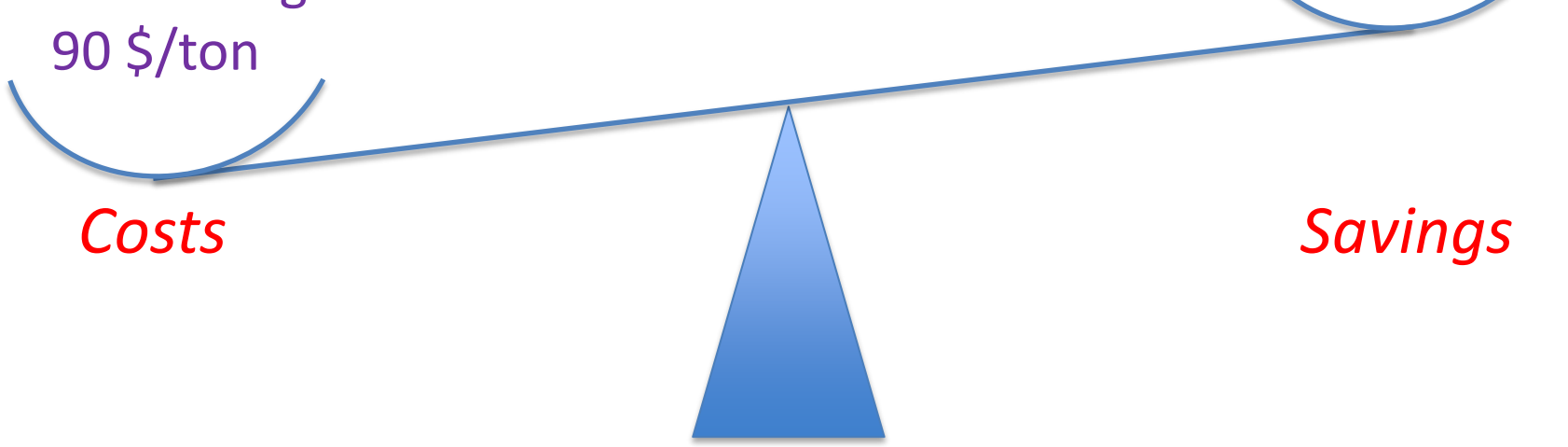
Hinkley Center for Solid and Hazardous Waste Management

FLORIDA POLYTECHNIC UNIVERSITY

Cost of Recycling

- Collection
  80 $/ton
- Processing
  90 $/ton

- Commodity
  100 $/ton
- No Landfill
  35 $/ton



Costs

Savings

Where do we go from here?

- Improve markets
- Recycle more efficiently, less “trash
- Alternative technologies and programs
- *Change recycling programs?*

Plastics Pile Up as China Refuses to Take the West's Recycling

with growing piles of plastics
y recyclables on Jan.1.

The time is right for recycling market development

Recycling represents a tangible solution for climate action and is an engine for economic development.

December 31, 2021

Bryce Hesterman & Melissa Radiwon

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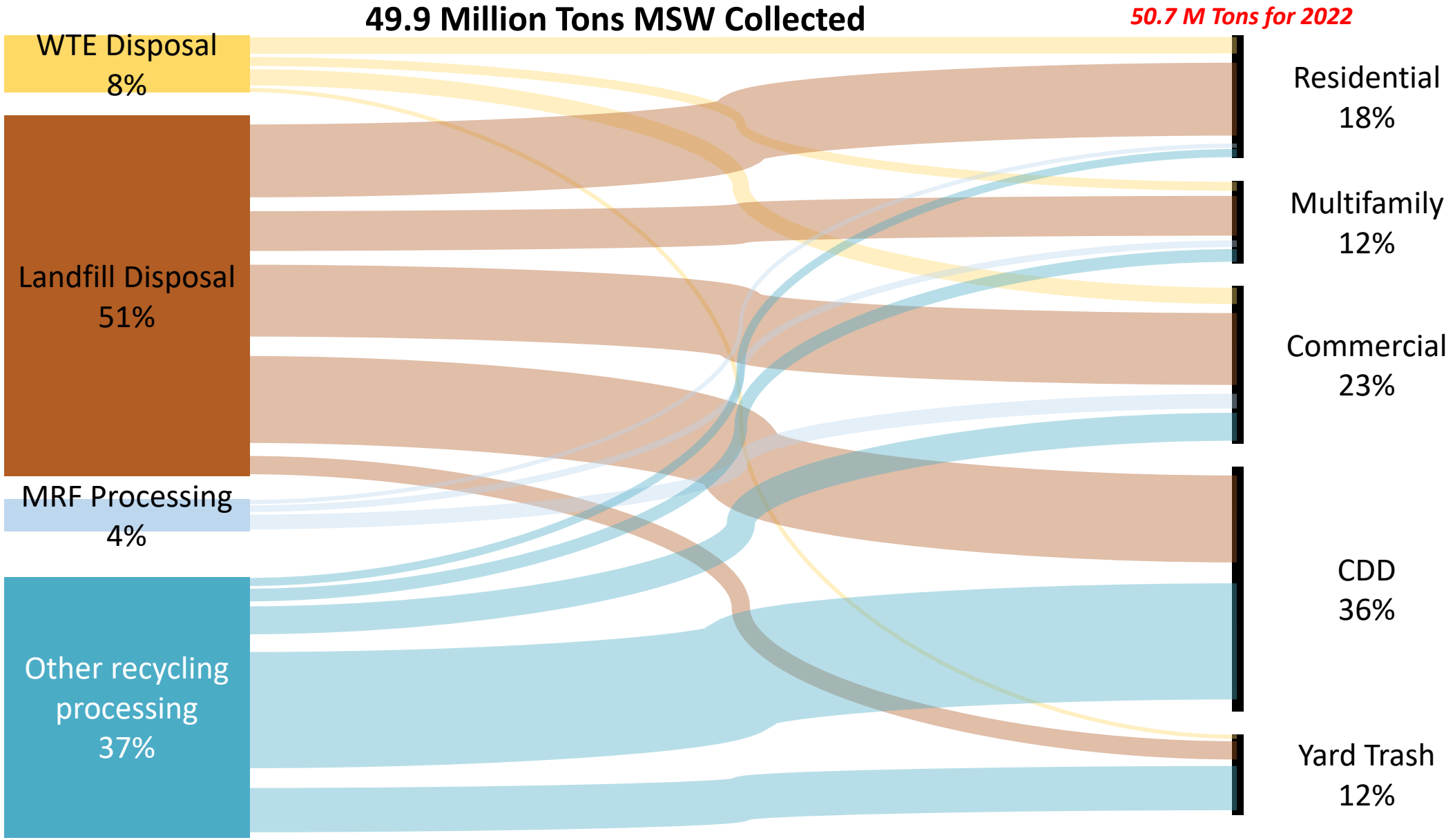
2021 Florida MSW Flows

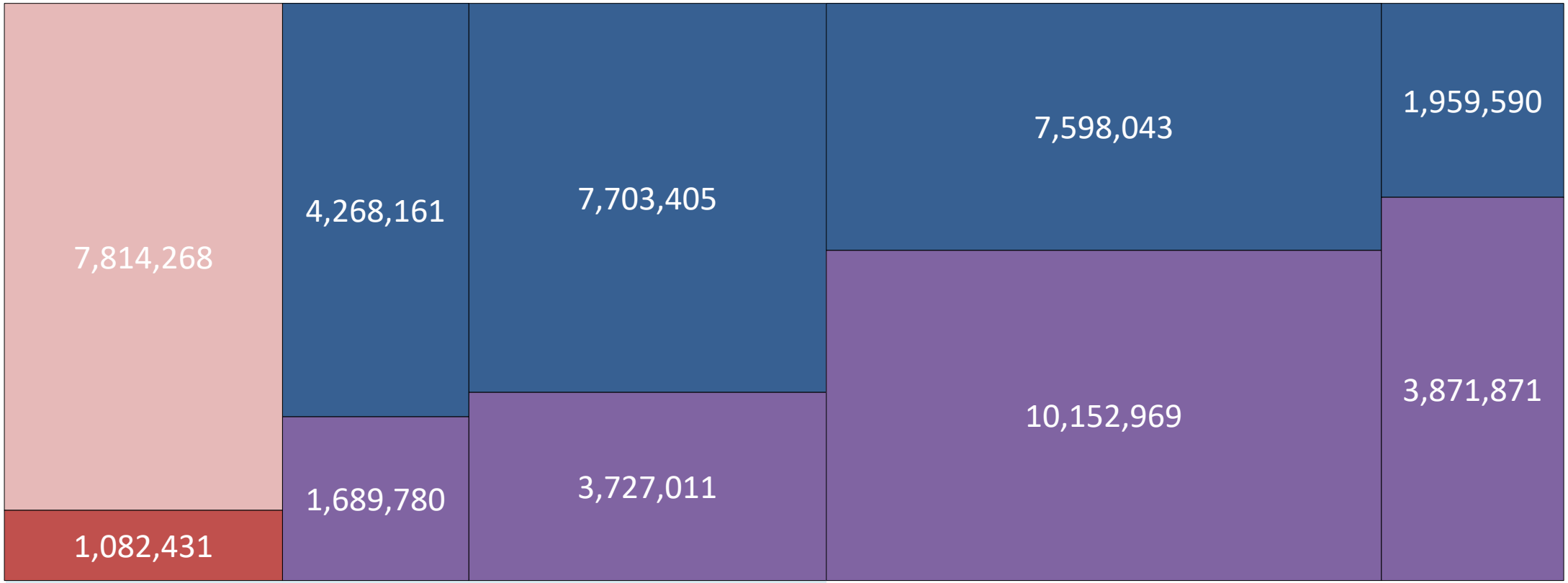


Original source data: FDEP 2021 Florida Solid Waste Management Report

2021 Florida MSW Flows

Garbage Collection : 29,343,467 Tons (59%)
Recycling Collection : 20,524,062 Tons (41%)

Total = 49,867,529 Tons Collected



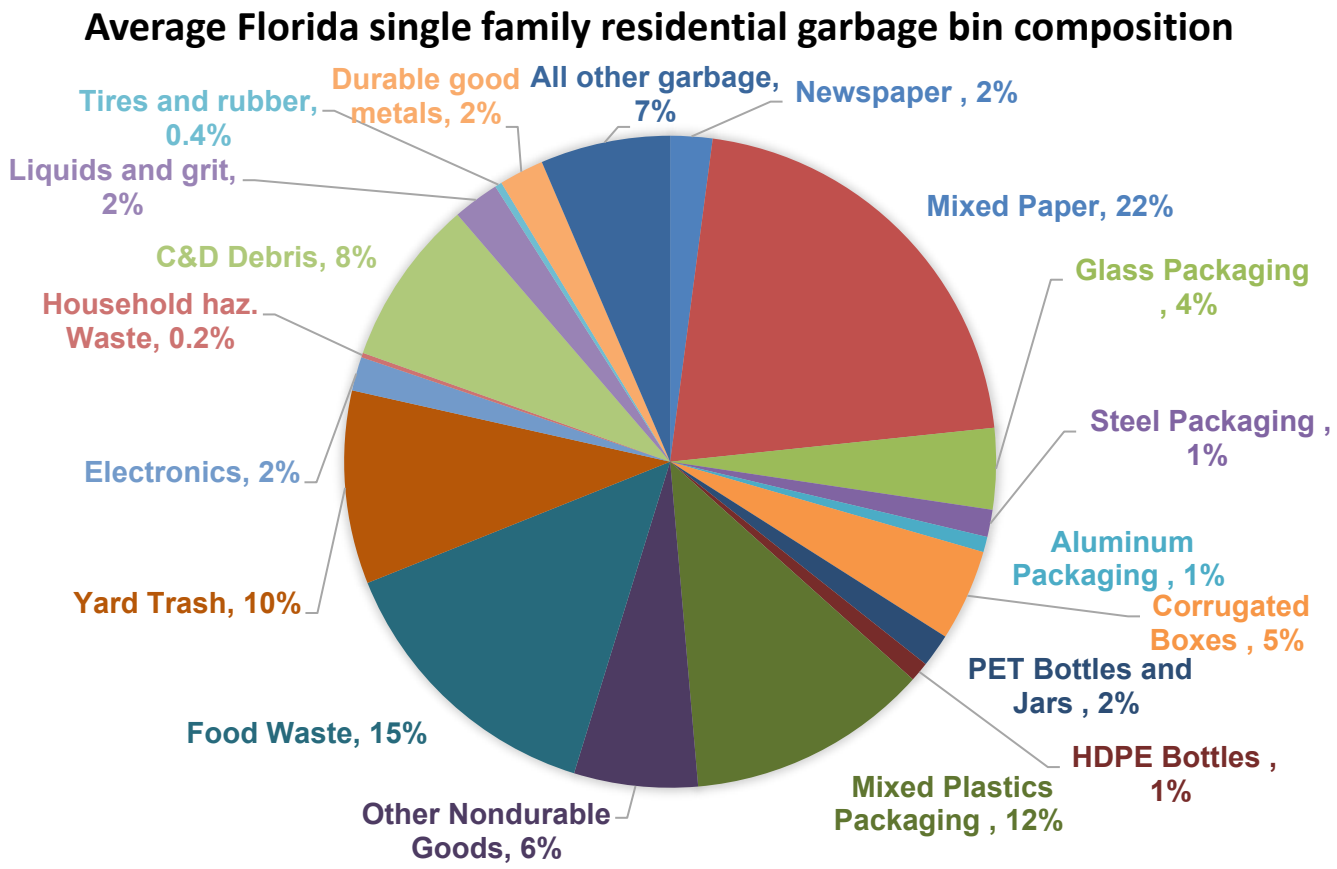
	Residential	Multifamily	Commercial	C&D Debris	Yard Trash
	8,896,699	5,957,941	11,430,416	17,751,012	5,831,461
Recycling Rate	**13.9%**	**28.4%**	**32.6%**	**57.2%**	**66.4%**

C&D Debris and YT are not included as part of these numbers

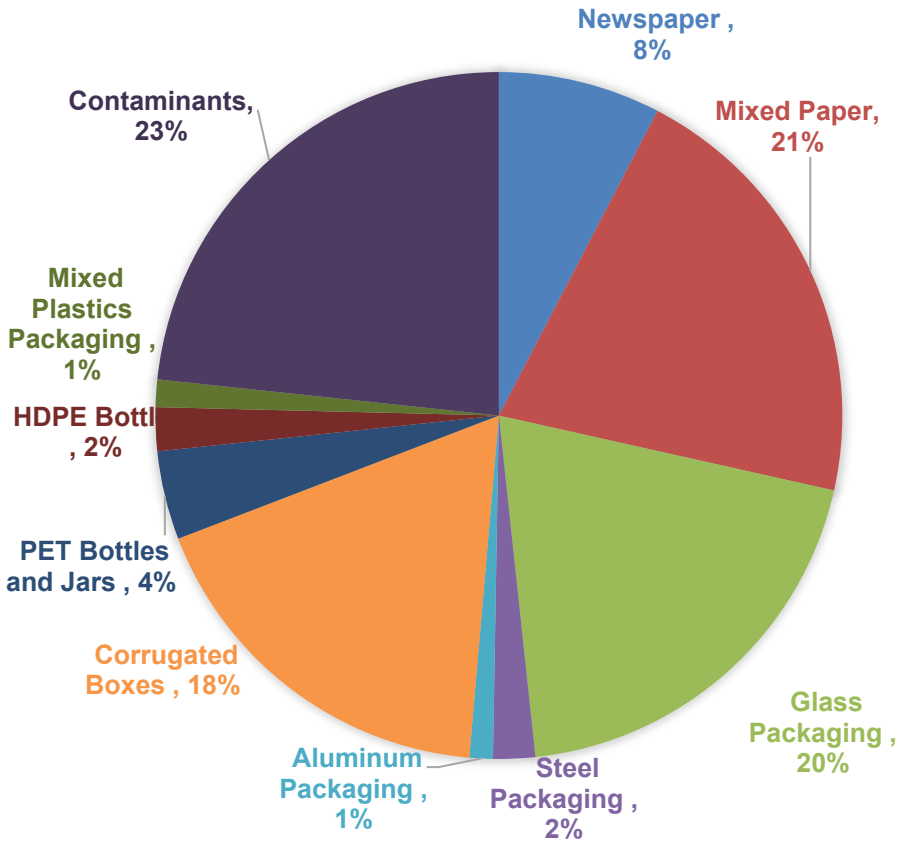
Original source data: FDEP 2021 Florida Solid Waste Management Report

Focus on Single-Family Residents

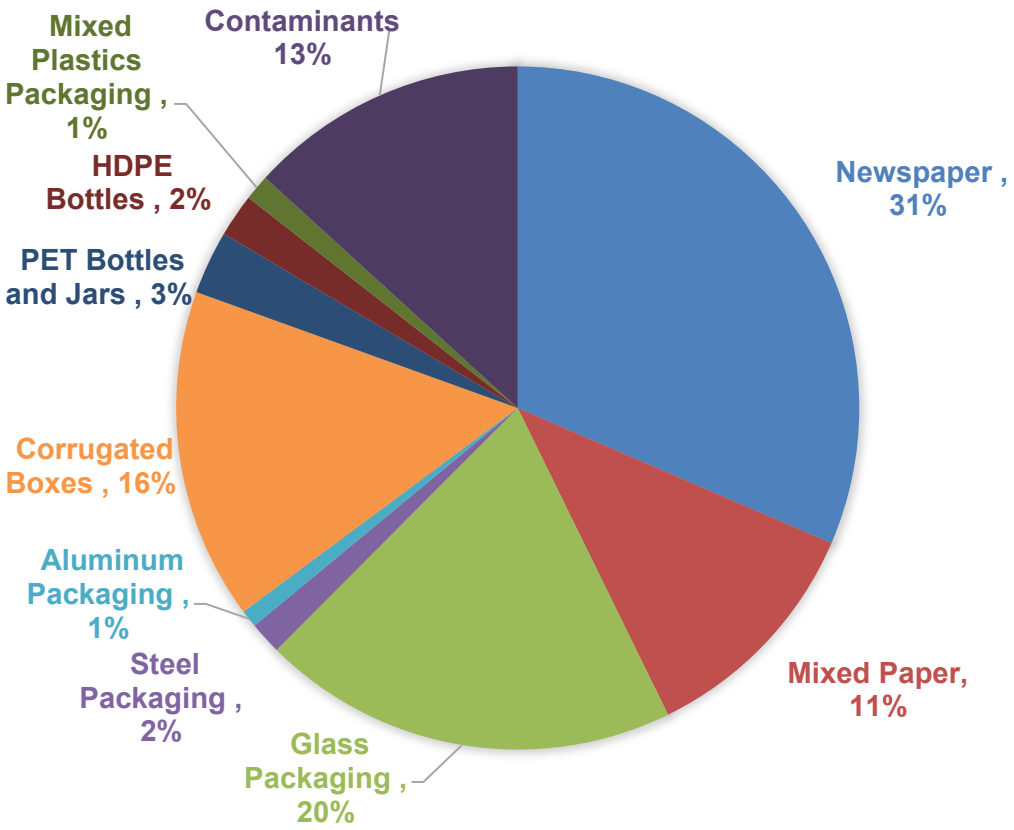
- Using FDEP data, estimated mass flows of garbage and recyclables and their corresponding costs for 2011 and 2020



Recycling Bin Composition



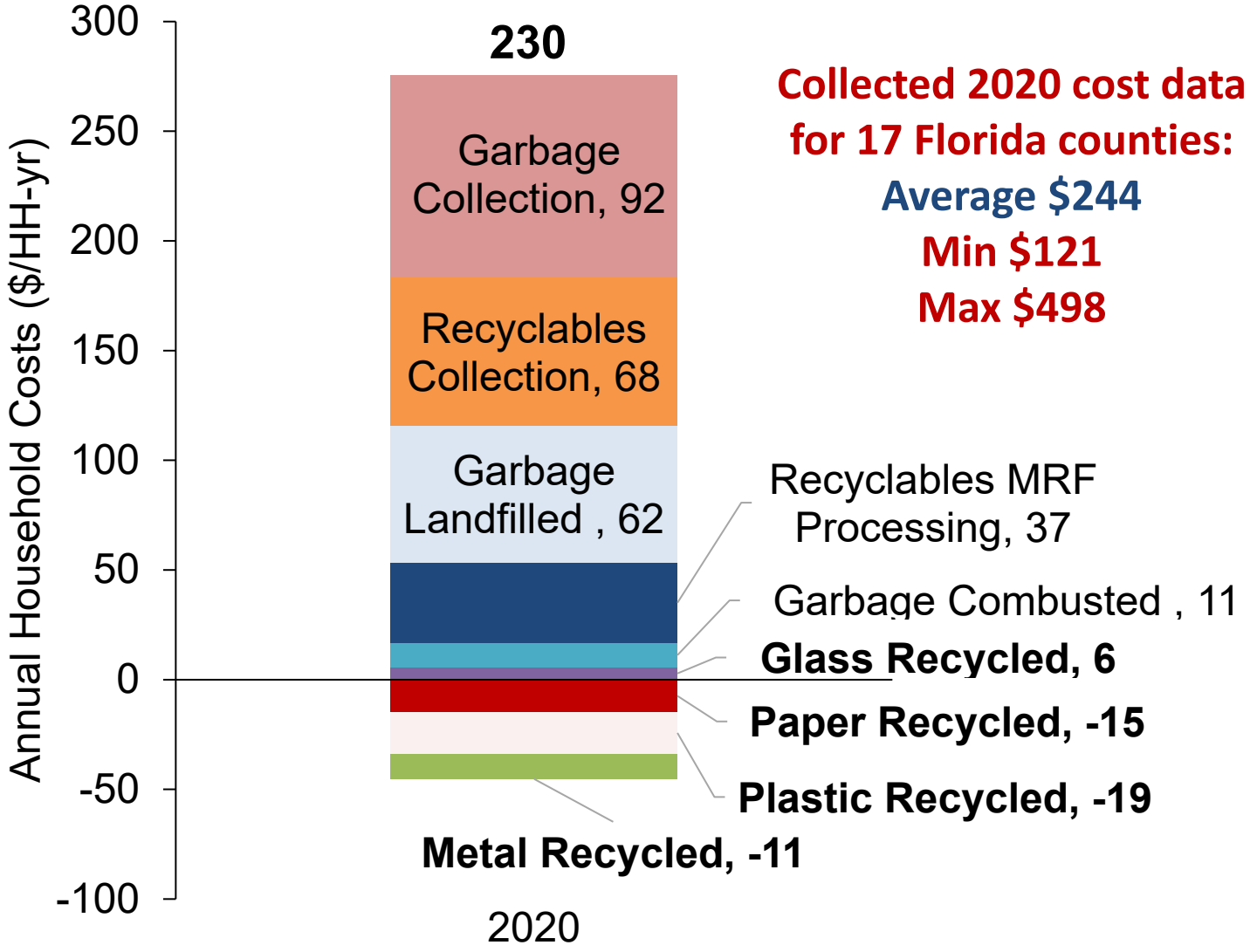
Average 2020 Florida MRF outgoing composition



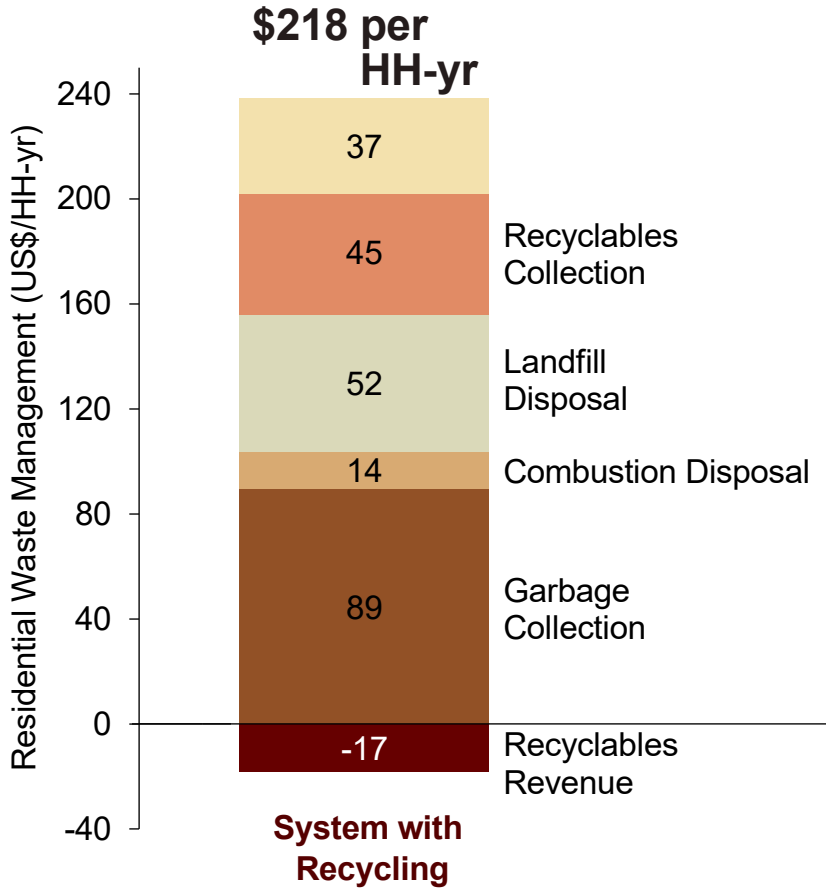
Average 2011 Florida MRF outgoing composition

Source: https://flrecycling.org/wp-content/uploads/2021/10/UF-MRF-Contamination-Report-Final.pdf

Florida Waste Management Economics

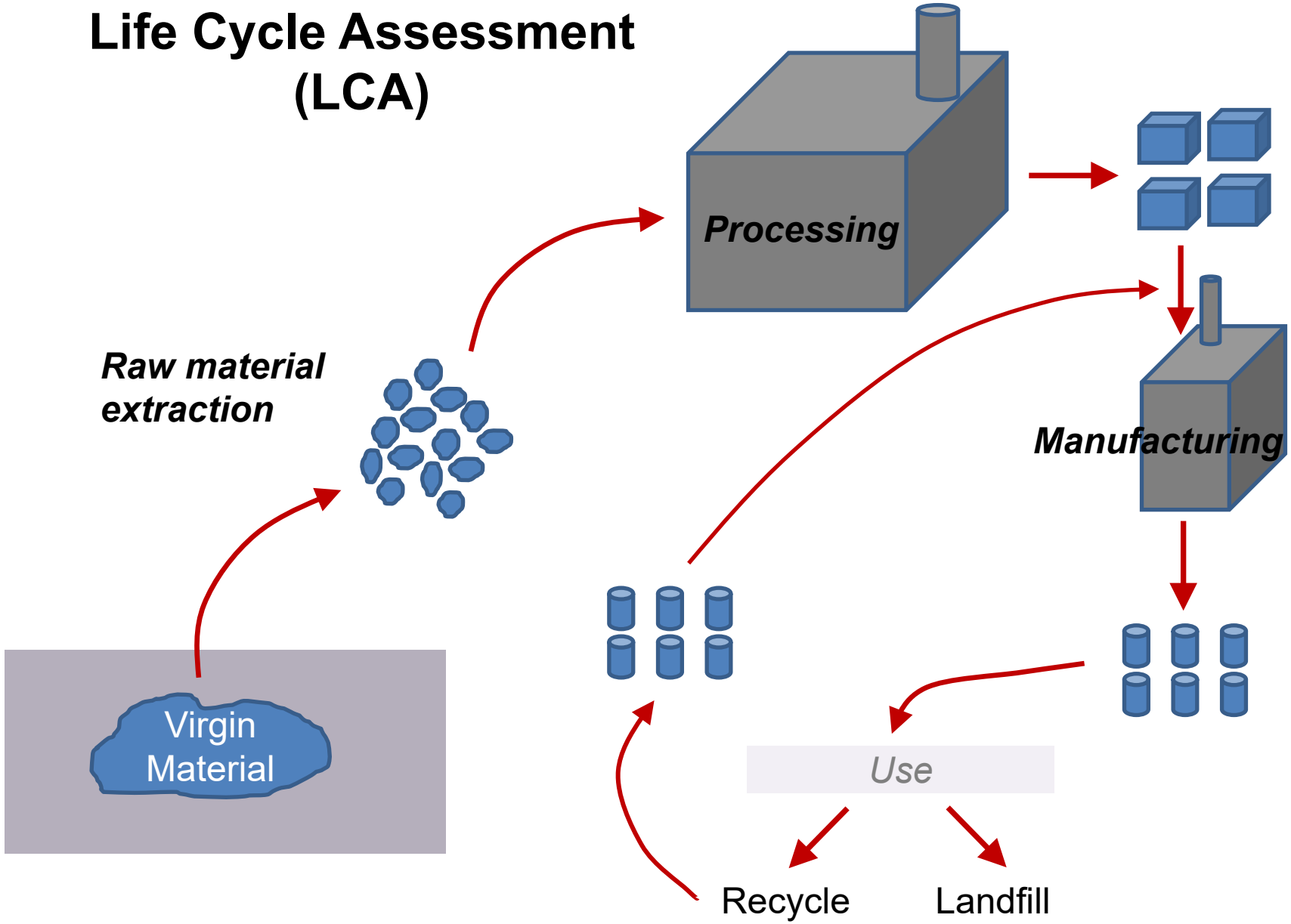


Collected 2020 cost data for 17 Florida counties:
Average $244
Min $121
Max $498

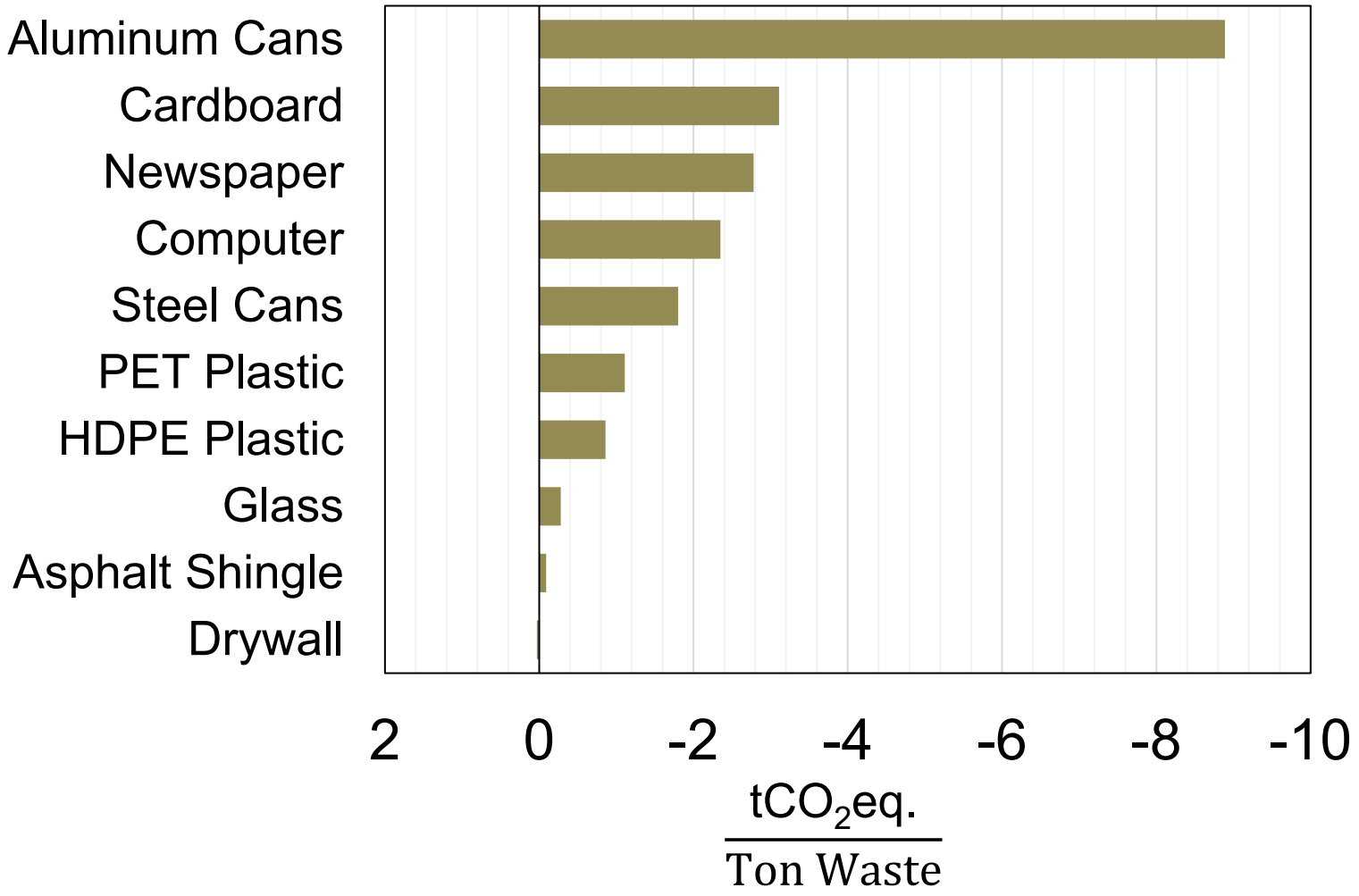


Source: Anshassi, M., Townsend, T.G., 2023. The hidden economic and environmental costs of eliminating kerb-side recycling. Nat Sustain 1–10. https://doi.org/10.1038/s41893-023-01122-8

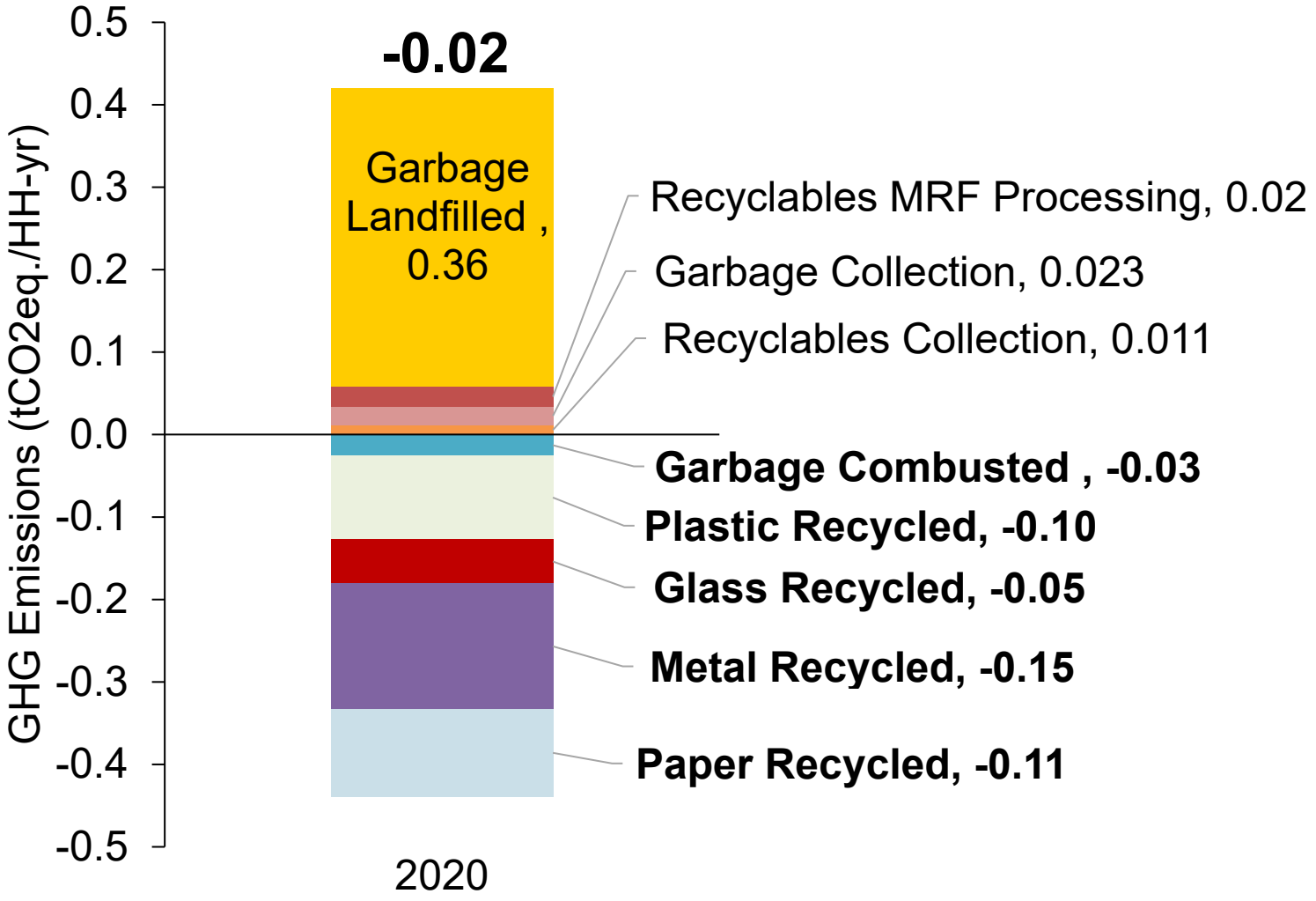
Life Cycle Assessment (LCA)

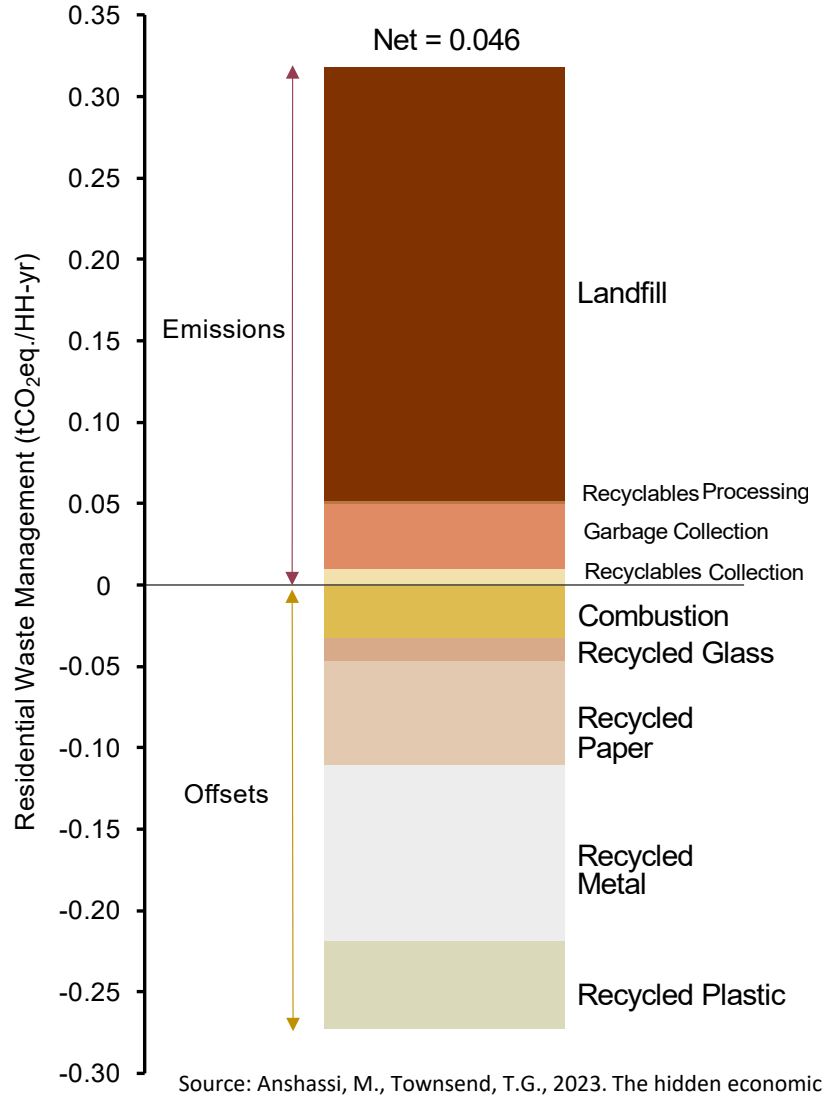


Environmental Impacts of Recycling



Florida Waste Management Environmental Impacts



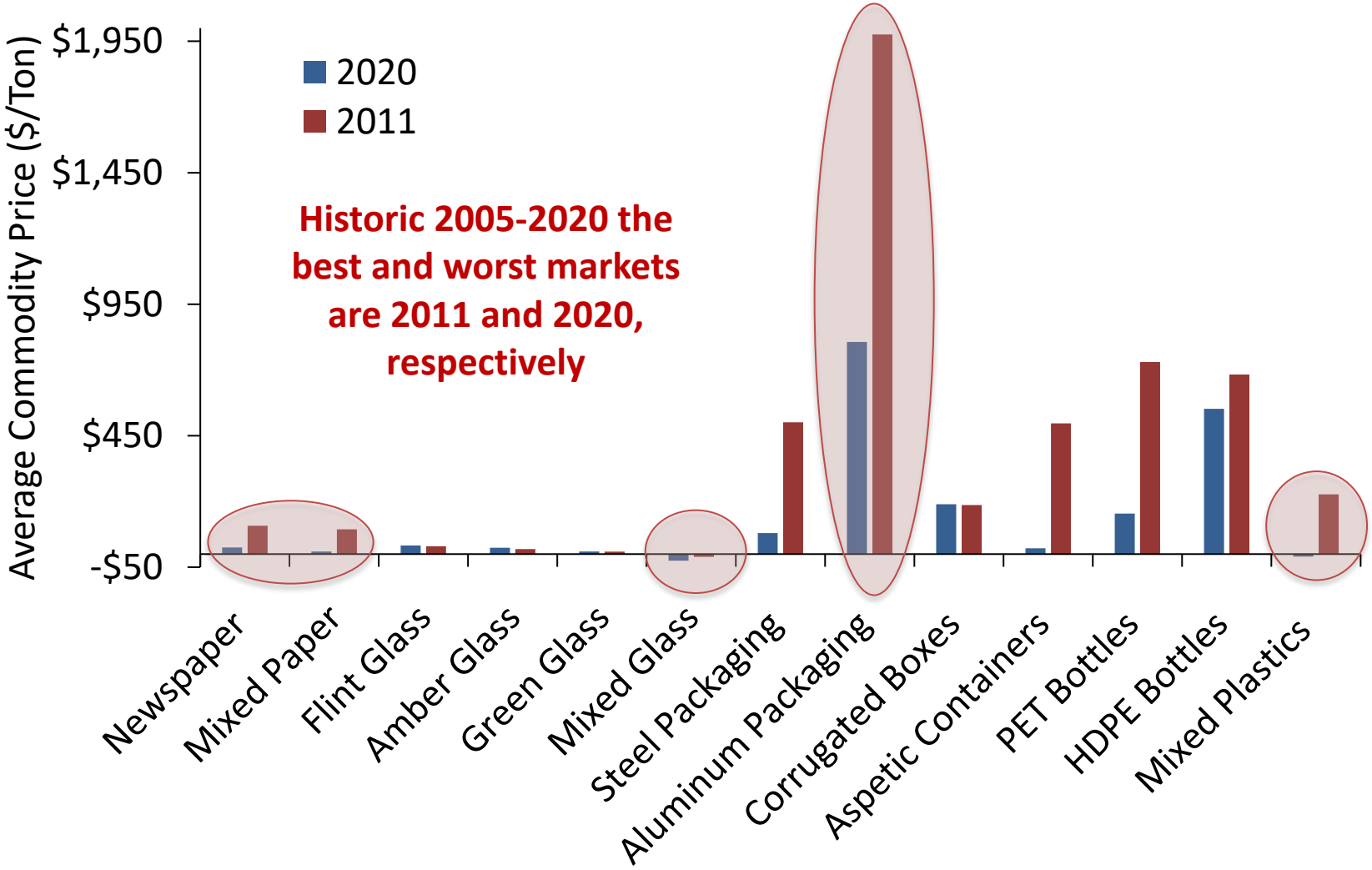


Source: Anshassi, M., Townsend, T.G., 2023. The hidden economic and environmental costs of eliminating kerb-side recycling. Nat Sustain 1–10. https://doi.org/10.1038/s41893-023-01122-8

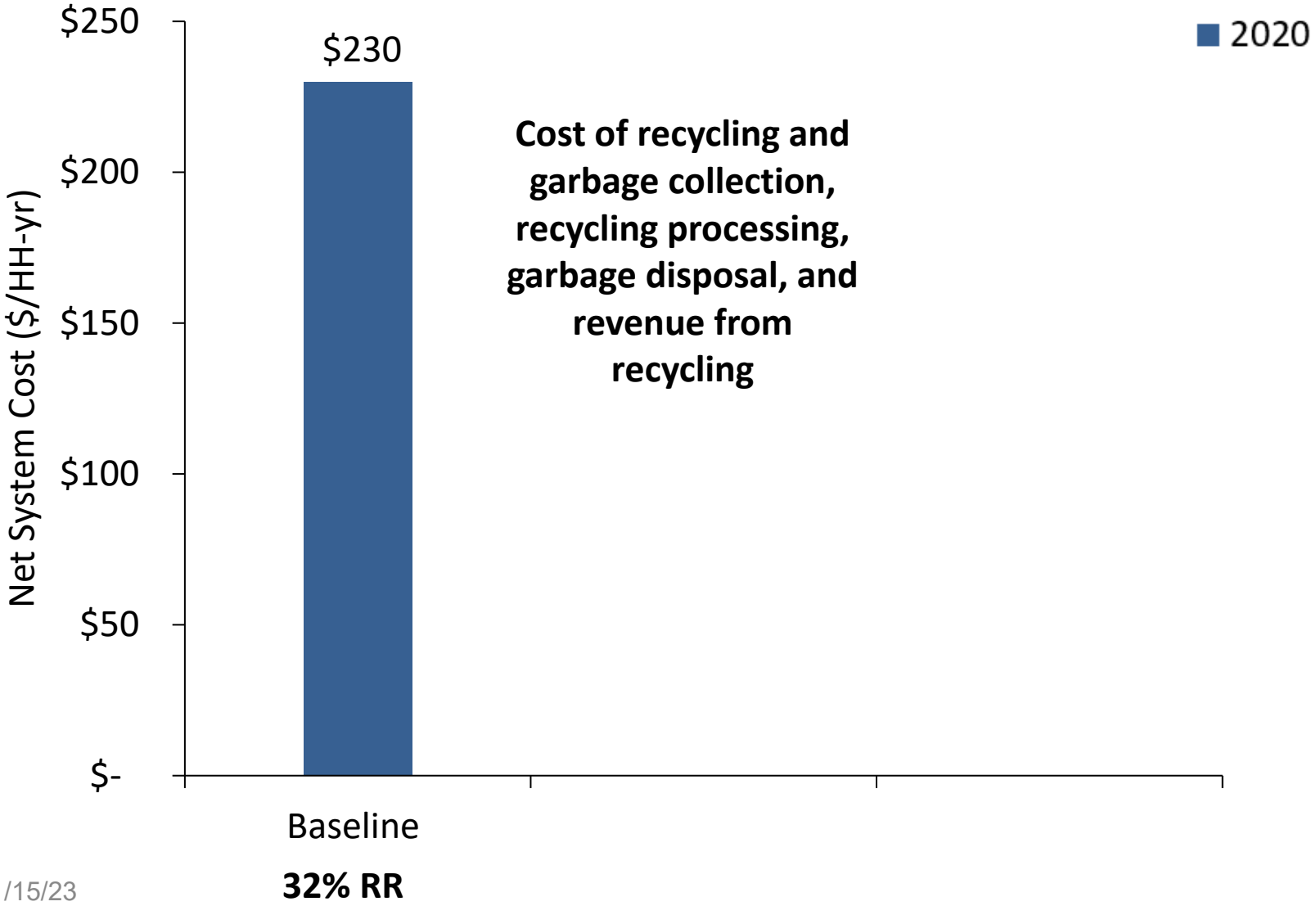
Alternative Recycling Approaches

- Change recyclables collection frequency
- Increase participation rate
- Increase recycling rate
- **Eliminate recycling**
- Eliminate certain materials from program
- **Target recycling certain materials only**

US Historic Commodity Prices ($/ton)



Florida Waste Management System Cost ($/HH-yr)



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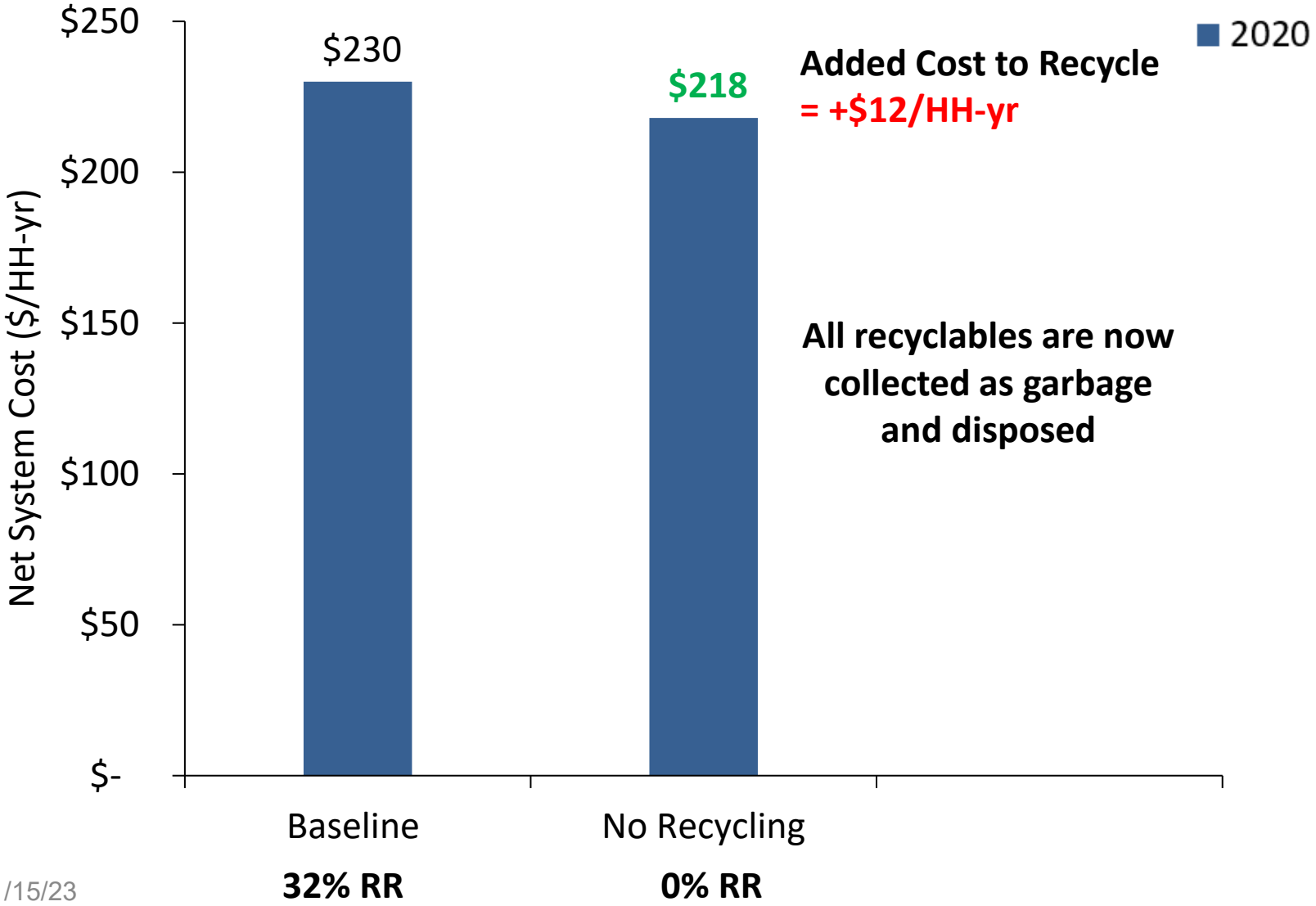
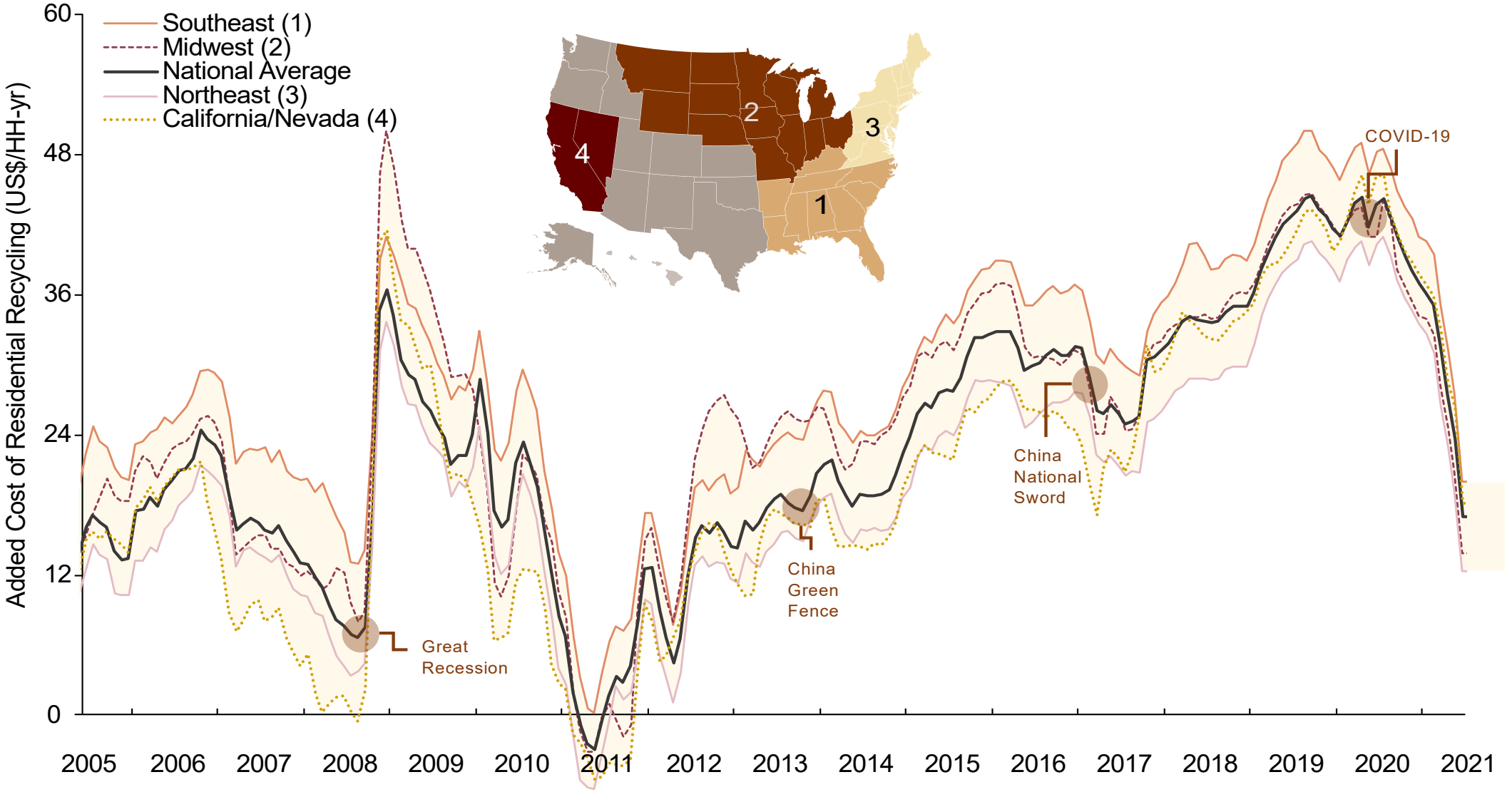


Added Cost to Recycle Across the US



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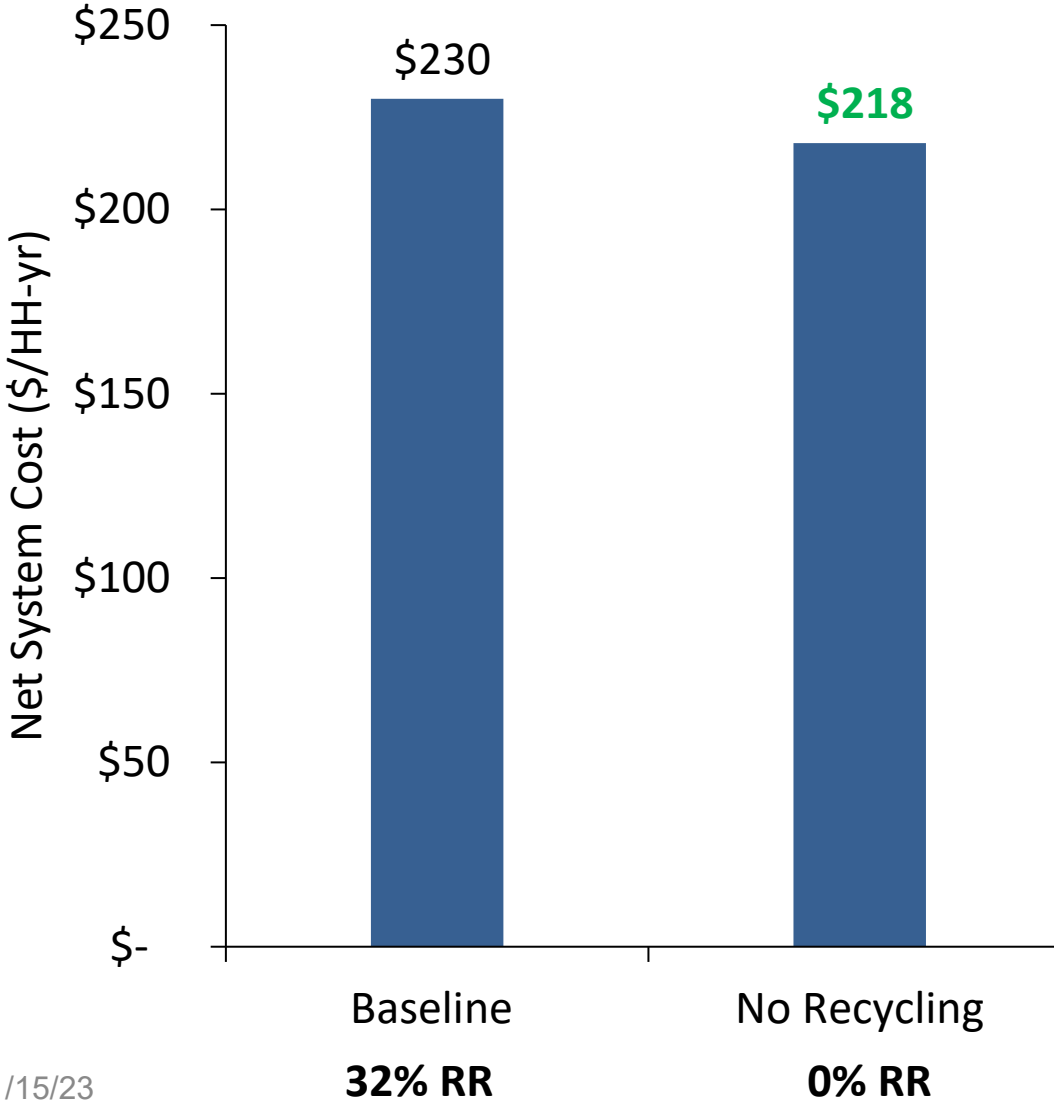
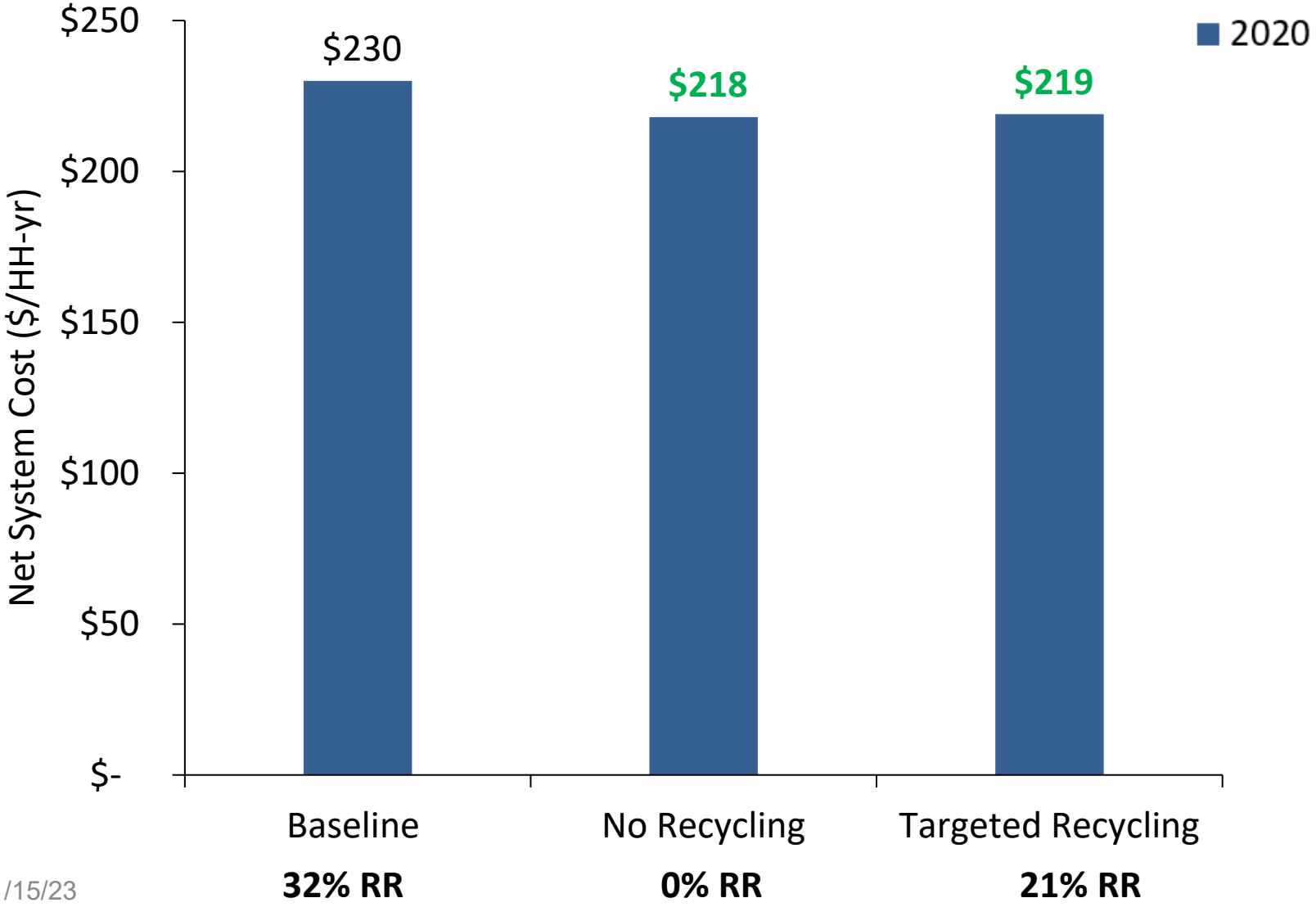


Target only high commodity materials:

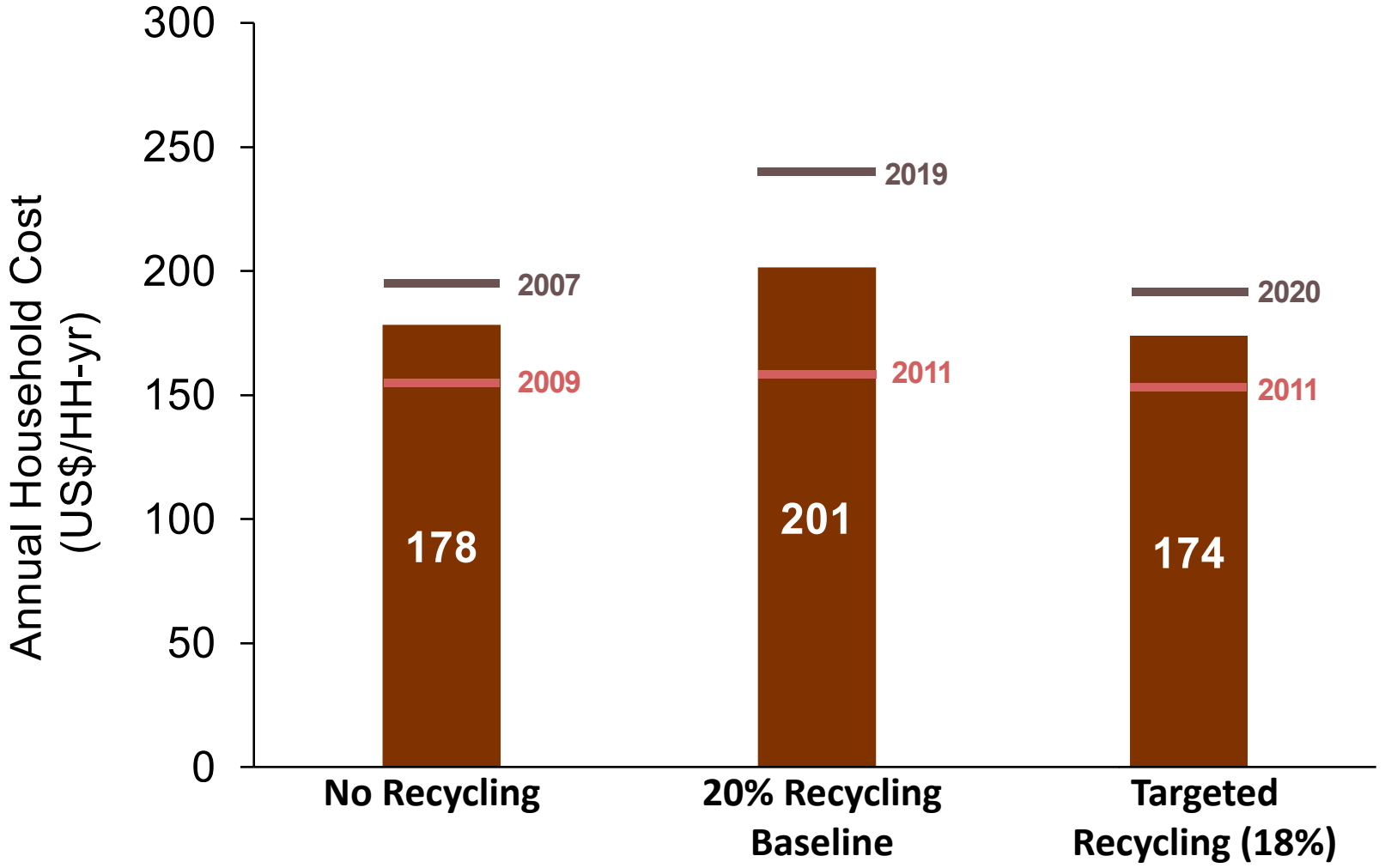
1. Newspaper
2. Steel Cans
3. Al. Cans
4. Cardboard
5. PET
6. HDPE

Assume each of these materials recycling rate increases to 50%

Florida Waste Management System Cost ($/HH-yr)

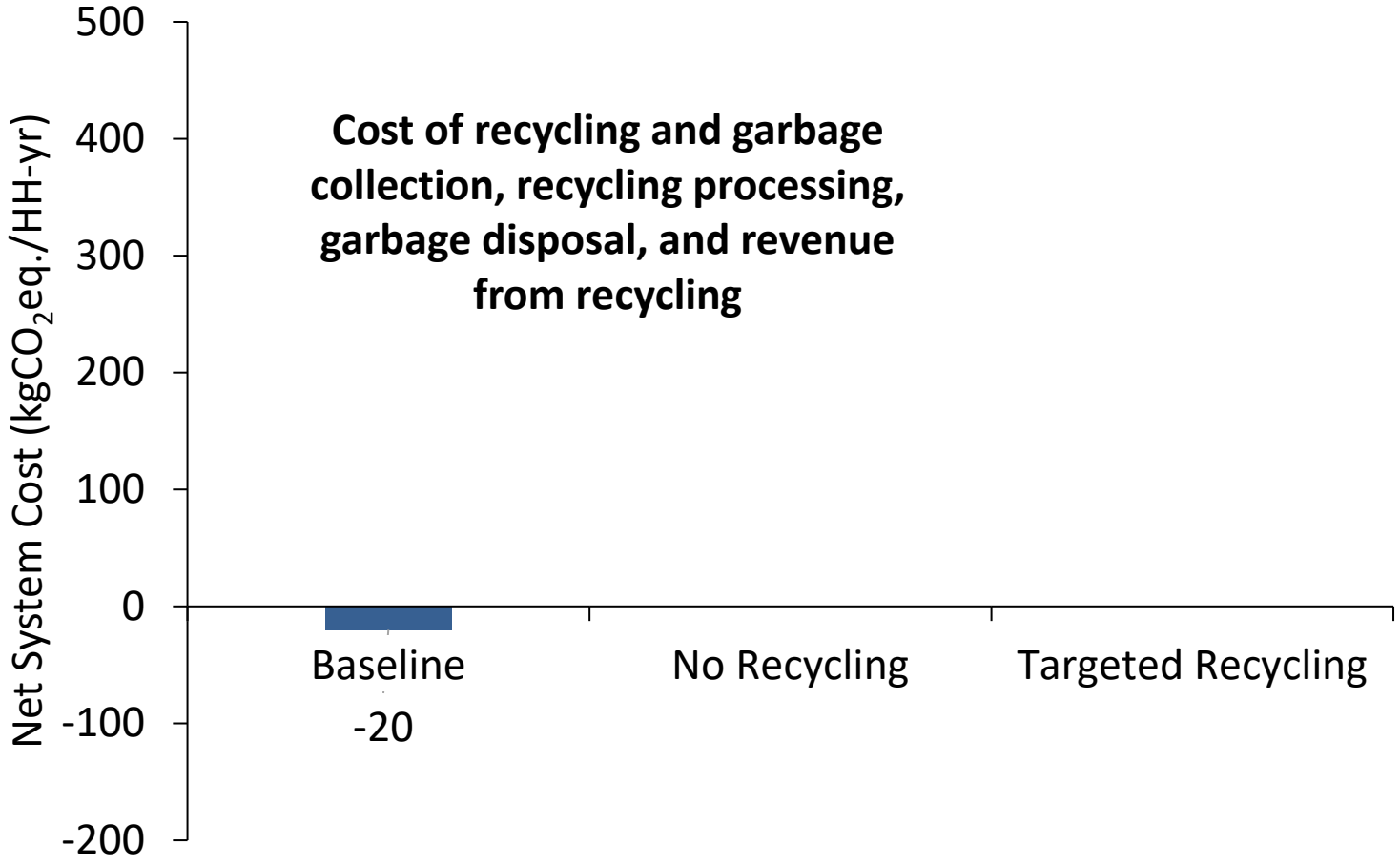


US Waste Management System Cost ($/HH-yr)



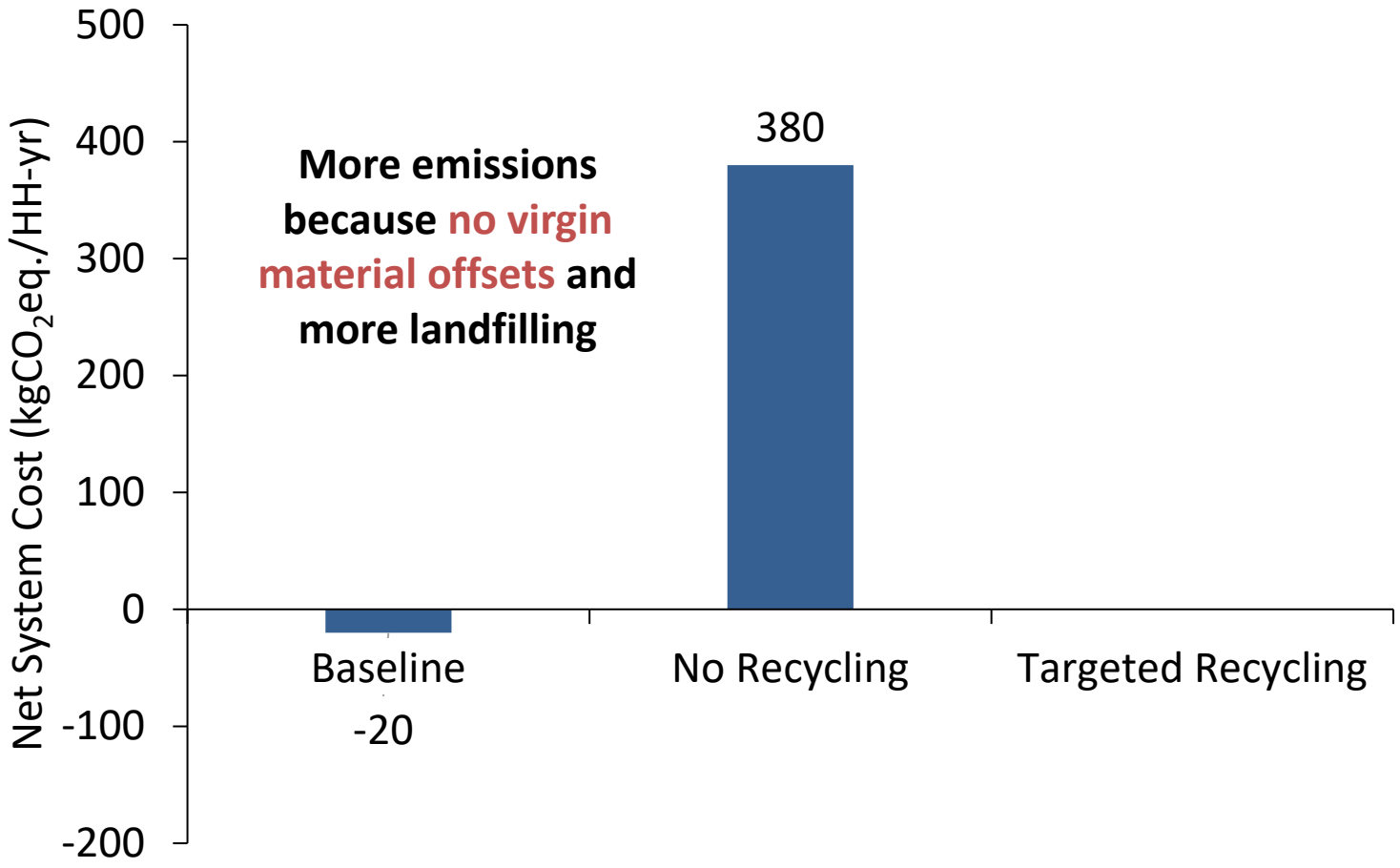
Source: Anshassi, M., Townsend, T.G., 2023. The hidden economic and environmental costs of eliminating kerb-side recycling. Nat Sustain 1–10. https://doi.org/10.1038/s41893-023-01122-8

Climate Change Impact



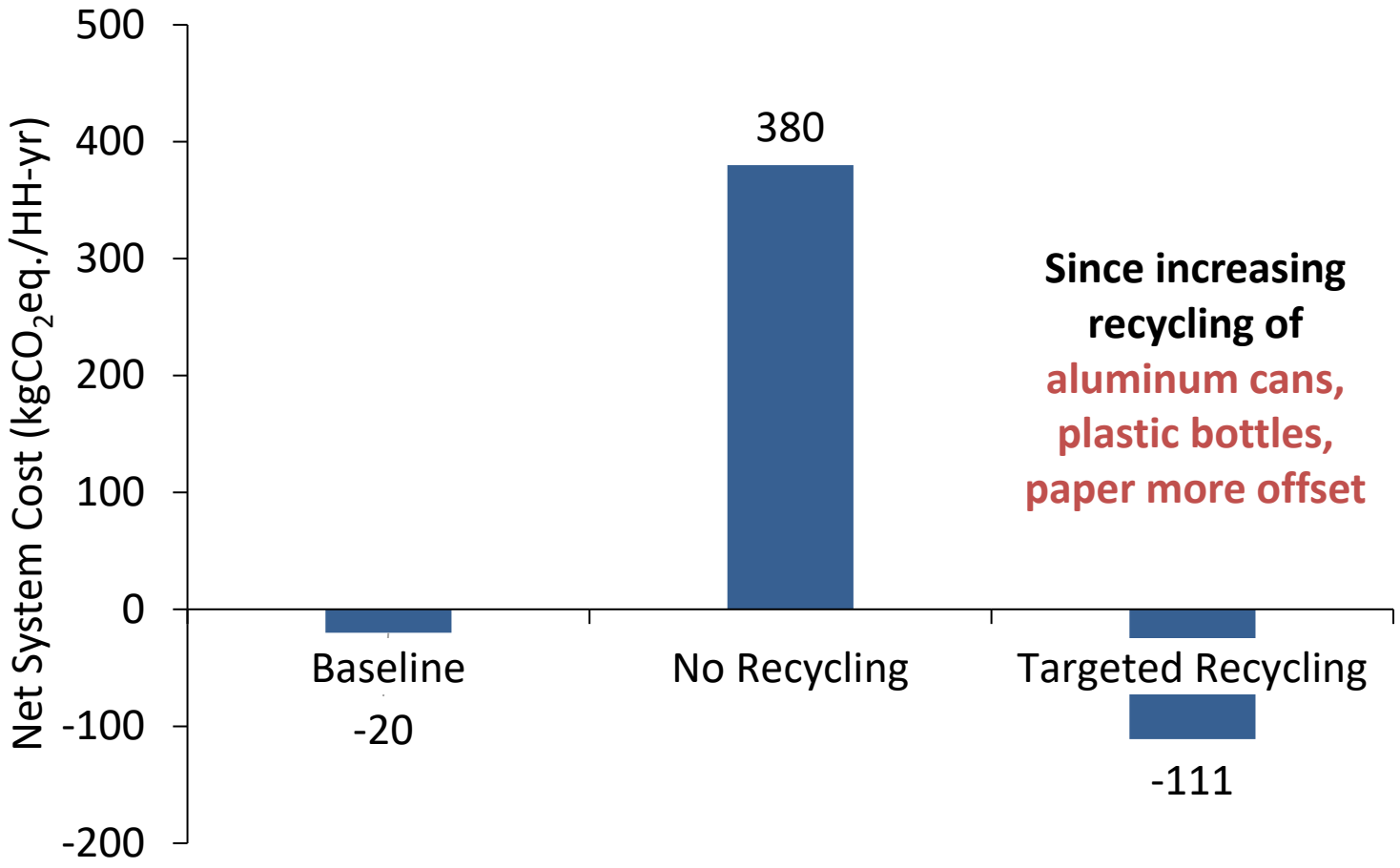
32% RR

Climate Change Impact



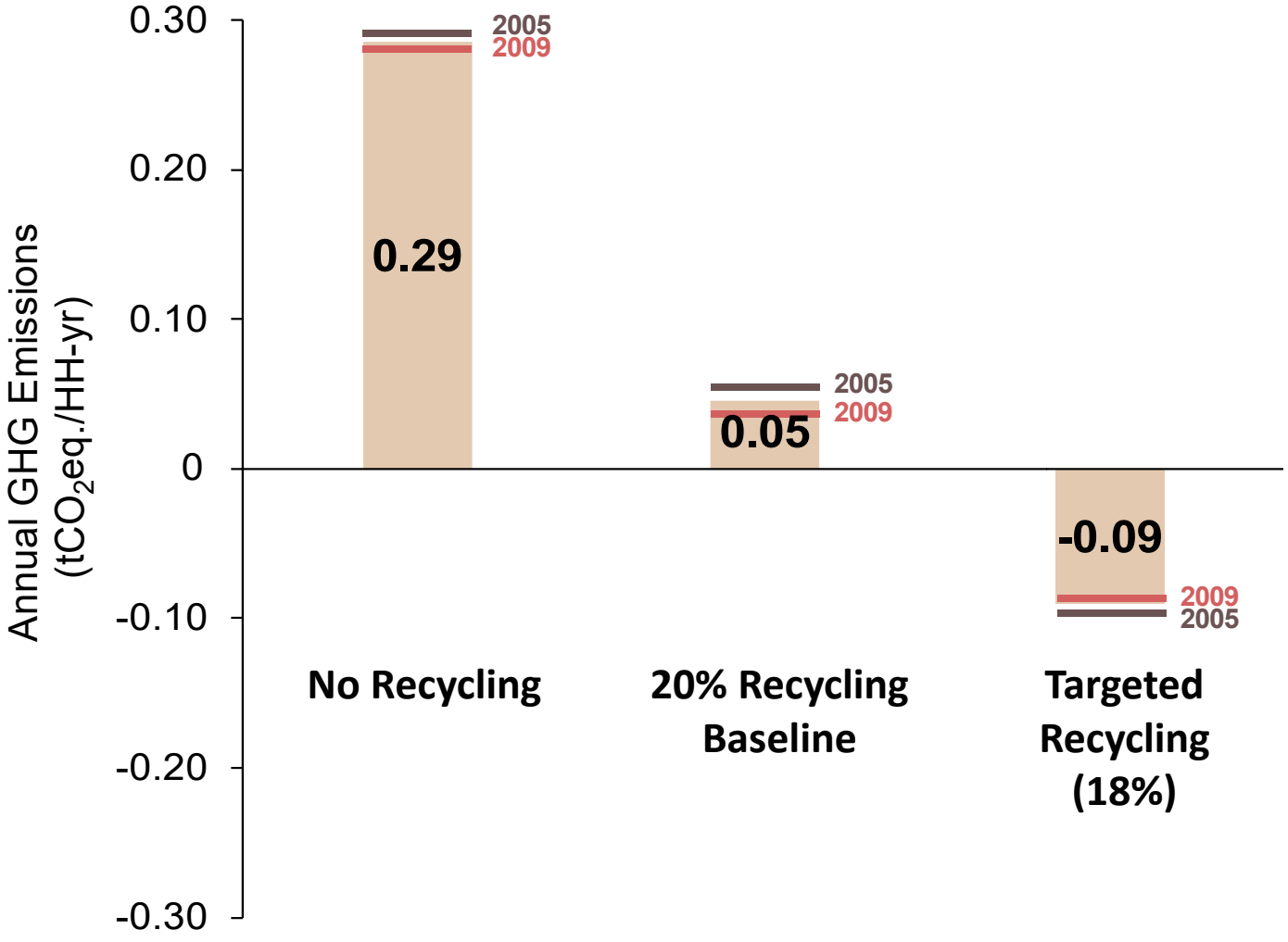
32% RR **0% RR**

Climate Change Impact



32% RR **0% RR** **21% RR**

Climate Change Impact



Source: Anshassi, M., Townsend, T.G., 2023. The hidden economic and environmental costs of eliminating kerb-side recycling. Nat Sustain 1–10. https://doi.org/10.1038/s41893-023-01122-8

Understanding Each Material's Impacts

GHG Emissions Offset When Recycled
Aluminum Cans
Mixed Paper*
Corrugated Paper*
Office Paper*
Newspaper*
Steel Cans
PET Bottles
Mixed Plastics
HDPE Bottles
Glass

Greatest Offset

Least Offset

Commodity Value
Aluminum Cans
HDPE Bottles
PET Bottles
Steel Cans
Office Paper
Corrugated Paper
Mixed Plastics
Newspaper
Mixed Paper
Glass

Greatest Value

Least Value

Depends on whether including the assumption that recycling paper results in soil carbon storage from not harvesting trees** ***(if not including it all expect for newspaper would be lower than glass)

Understanding Each Material's Impacts

Table 4
Materials ranked from largest to smallest impact to reduce the 2015 GHG emissions or energy use footprint when an individual material mass recycled was increased by 5%.

	US	California	Florida	Maryland	Minnesota
Material Organized by Their Impact to Reduce the 2015 GHG Emissions Footprint (Larger to Smaller)	Corrugated Paper Mixed Paper Electronics Newspaper Aluminum Cans Textiles Steel Cans Tires Plastic Bottles Mixed Plastics Food Waste Glass **Yard Trash**	Corrugated Paper Mixed Paper Electronics Newspaper Textiles Aluminum Cans Steel Cans Food Waste Plastic Bottles Glass Mixed Plastics Tires **Yard Trash**	Mixed Metals Corrugated Paper Mixed Paper Newspaper Aluminum Cans Mixed Plastics Textiles Plastic Bottles Glass Steel Cans Tires Food Waste **Yard Trash**	Mixed Metals Mixed Paper Corrugated Paper Newspaper Food Waste Mixed Plastics Aluminum Cans Textiles Glass Electronics Tires Plastic Bottles Steel Cans **Yard Trash**	Mixed Metals Corrugated Paper Mixed Paper Newspaper Aluminum Cans Food Waste Mixed Plastics Electronics Glass Textiles Plastic Bottles **Yard Trash**
Material Organized by Their Impact to Reduce the 2015 Energy Use Footprint (Larger to Smaller)	Corrugated Paper Mixed Paper Electronics Aluminum Cans Newspaper Plastic Bottles Textiles Mixed Plastics Steel Cans Glass **Food Waste** **Yard Trash** **Tires**	Corrugated Paper Mixed Paper Electronics Aluminum Cans Newspaper Textiles Plastic Bottles Mixed Plastics Steel Cans Glass Tires **Food Waste** **Yard Trash**	Mixed Metals Corrugated Paper Mixed Paper Aluminum Cans Mixed Plastics Newspaper Plastic Bottles Textiles Steel Cans Glass **Food Waste** **Tires** **Yard Trash**	Mixed Metals Mixed Paper Corrugated Paper Mixed Plastics Newspaper Aluminum Cans Electronics Plastic Bottles Textiles Glass Steel Cans **Tires** **Food Waste** **Yard Trash**	Mixed Metals Mixed Paper Corrugated Paper Aluminum Cans Newspaper Mixed Plastics Plastic Bottles Electronics Glass Textiles **Yard Trash** **Food Waste**

Note: Non-bolded materials are associated with an environmental avoidance and bolded materials are associated with a GHG emission or energy use. The environmental impact of recycling C&D debris and miscellaneous are not included for any regions, for California mixed metals are not included, for Florida electronics are not included, and for Minnesota tires and steel cans are not included.

Source: Anshassi et al., 2019; Approaches to integrate sustainable materials management into waste management planning and policy https://doi.org/10.1016/j.resconrec.2019.04.011

KEY INSIGHTS

The study uncovered three key insights about Florida's recycling programs:

The elimination of municipal recycling programs **is not an effective strategy** to contain costs and manage the environmental impact of waste.

Florida municipalities should consider a **targeted recycling system,** which means targeting high-value recycling commodities, such as plastic bottles, jugs, and tubs; aluminum and steel cans; and newspaper and cardboard to generate savings and mitigate the impact of waste on the environment.

Recycling **education is essential,** and municipalities should work with producers to invest in educational initiatives.

nature sustainability

Article

https://doi.org/10.1038/s41893-023-01122-8

The hidden economic and environmental costs of eliminating kerb-side recycling

Received: 20 October 2022

Accepted: 18 April 2023

Published online: 22 May 2023

Check for updates

Malak Anshassi [1] & Timothy G. Townsend [2]

Local governments provide household collection of garbage and recyclables on a routine schedule, and these recycling programmes represent the most visible opportunity for everyday citizens to engage in sustainable practices. In the face of unprecedented challenges, and citing costs as the major driver, many US communities are shrinking or eliminating kerb-side recycling. Here we show that when recycling commodity markets were most lucrative in 2011, net US recycling costs were as little as US$3 per household annually, and when markets reached a minimum (in 2018–2020), the annual recycling-programme costs ranged from US$34 to US$42 per household. This investment offsets the greenhouse gas emissions from non-recycled household waste buried in landfills. If local governments restructure recycling programmes to target higher value and embodied carbon-intensive materials, recycling can pay for itself and reduce greenhouse gas emissions. Our analysis highlights that kerb-side recycling provides communities a return on investment similar to or better than climate change mitigation strategies such as voluntary green power purchases and transitioning to electric vehicles. Eliminating recycling squanders one of the easiest opportunities for communities and citizens to mitigate climate change and reduce natural resources demands.

https://www.nature.com/articles/s41893-023-01122-8

INVESTIGATING THE ECONOMICS OF CURRENT AND FUTURE RECYCLING PROGRAMS IN FLORIDA

2022

Prepared for:
Florida Recycling Partnership Foundation

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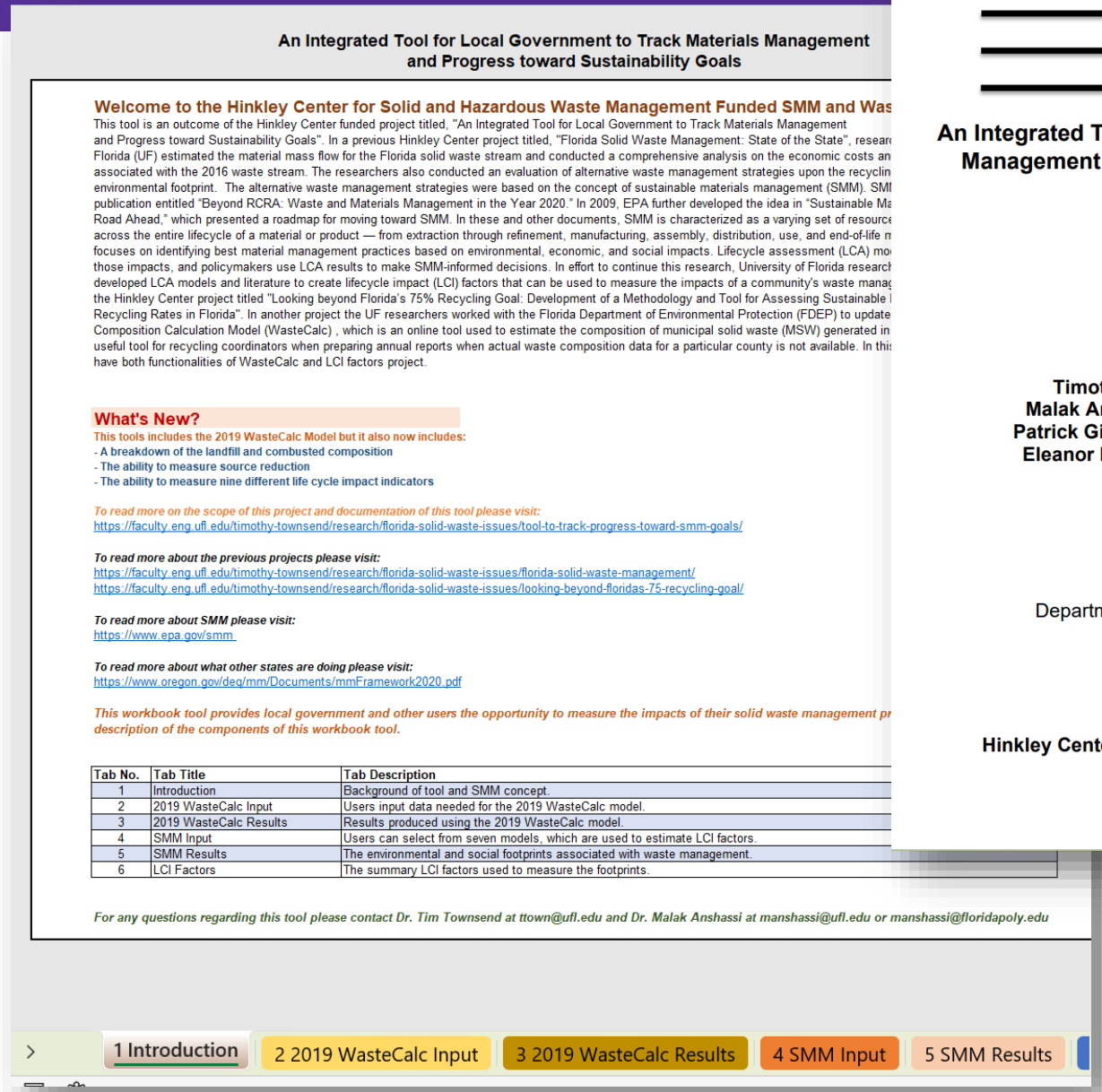
Engineering School of Sustainable Infrastructure and Environment

https://flrecycling.org/wp-content/uploads/2023/01/Investigating-the-Economics-of-Current-and-Future-Recycling-Programs-in-Florida-UF-Study.pdf



An Integrated Tool for Local Government to Track Materials Management and Progress toward Sustainability Goals

Welcome to the Hinkley Center for Solid and Hazardous Waste Management Funded SMM and Was

This tool is an outcome of the Hinkley Center funded project titled, "An Integrated Tool for Local Government to Track Materials Management and Progress toward Sustainability Goals". In a previous Hinkley Center project titled, "Florida Solid Waste Management: State of the State", researc Florida (UF) estimated the material mass flow for the Florida solid waste stream and conducted a comprehensive analysis on the economic costs an associated with the 2016 waste stream. The researchers also conducted an evaluation of alternative waste management strategies upon the recyclin environmental footprint. The alternative waste management strategies were based on the concept of sustainable materials management (SMM). SM publication entitled "Beyond RCRA: Waste and Materials Management in the Year 2020." In 2009, EPA further developed the idea in "Sustainable Ma Road Ahead," which presented a roadmap for moving toward SMM. In these and other documents, SMM is characterized as a varying set of resourc across the entire lifecycle of a material or product — from extraction through refinement, manufacturing, assembly, distribution, use, and end-of-life m focuses on identifying best material management practices based on environmental, economic, and social impacts. Lifecycle assessment (LCA) mo those impacts, and policymakers use LCA results to make SMM-informed decisions. In effort to continue this research, University of Florida researc developed LCA models and literature to create lifecycle impact (LCI) factors that can be used to measure the impacts of a community's waste manag the Hinkley Center project titled "Looking beyond Florida's 75% Recycling Goal: Development of a Methodology and Tool for Assessing Sustainable Recycling Rates in Florida". In another project the UF researchers worked with the Florida Department of Environmental Protection (FDEP) to update Composition Calculation Model (WasteCalc) , which is an online tool used to estimate the composition of municipal solid waste (MSW) generated in useful tool for recycling coordinators when preparing annual reports when actual waste composition data for a particular county is not available. In this have both functionalities of WasteCalc and LCI factors project.

What's New?

This tools includes the 2019 WasteCalc Model but it also now includes:
- **A breakdown of the landfill and combusted composition**
- **The ability to measure source reduction**
- **The ability to measure nine different life cycle impact indicators**

To read more on the scope of this project and documentation of this tool please visit:
https://faculty.eng.ufl.edu/timothy-townsend/research/florida-solid-waste-issues/tool-to-track-progress-toward-smm-goals/

To read more about the previous projects please visit:
https://faculty.eng.ufl.edu/timothy-townsend/research/florida-solid-waste-issues/florida-solid-waste-management/
https://faculty.eng.ufl.edu/timothy-townsend/research/florida-solid-waste-issues/looking-beyond-floridas-75-recycling-goal/

To read more about SMM please visit:
https://www.epa.gov/smm

To read more about what other states are doing please visit:
https://www.oregon.gov/deq/mm/Documents/mmFramework2020.pdf

This workbook tool provides local government and other users the opportunity to measure the impacts of their solid waste management pr description of the components of this workbook tool.

Tab No.	Tab Title	Tab Description
1	Introduction	Background of tool and SMM concept.
2	2019 WasteCalc Input	Users input data needed for the 2019 WasteCalc model.
3	2019 WasteCalc Results	Results produced using the 2019 WasteCalc model.
4	SMM Input	Users can select from seven models, which are used to estimate LCI factors.
5	SMM Results	The environmental and social footprints associated with waste management.
6	LCI Factors	The summary LCI factors used to measure the footprints.

For any questions regarding this tool please contact Dr. Tim Townsend at ttown@ufl.edu and Dr. Malak Anshassi at manshassi@ufl.edu or manshassi@floridapoly.edu

1 Introduction | 2 2019 WasteCalc Input | 3 2019 WasteCalc Results | 4 SMM Input | 5 SMM Results

An Integrated Tool for Local Government to Track Materials Management and Progress toward Sustainability Goals

June 2021

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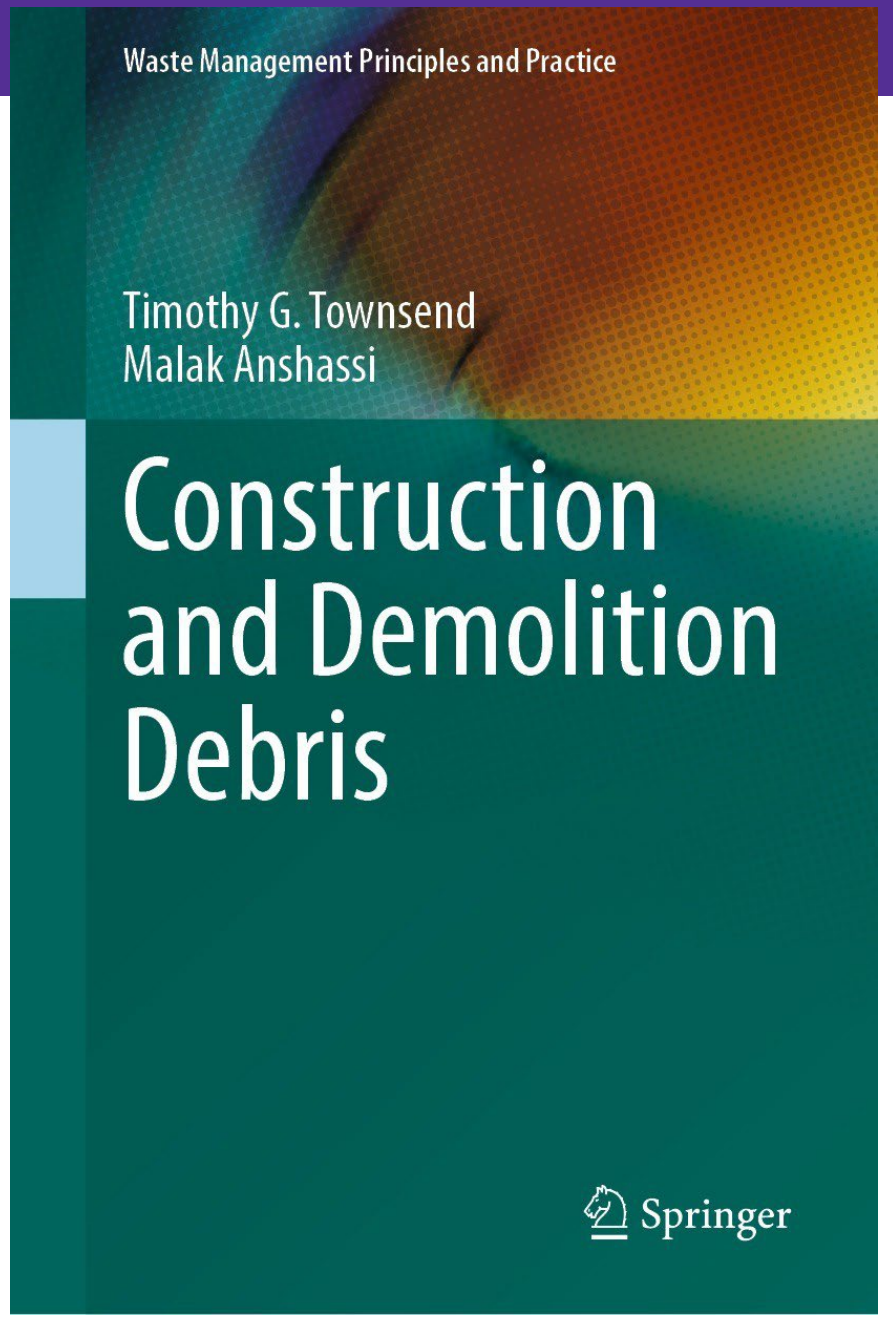
Learn More!

https://link.springer.com/book/10.1007/978-3-031-25013-2



State of Recycling in Florida: Understanding the Costs, Environmental Impacts, and Ways to Improve Project Website:
https://sites.google.com/view/anshassipolyhc/home?authuser=1

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FLORIDA POLYTECHNIC UNIVERSITY

Project Website

Thank You for Your Time!