

Stakeholder Working Group Meeting:
Looking beyond Florida's 75% Recycling Goal:
Development of a Methodology and Tool for
Assessing Sustainable Materials Management
Recycling Rates in Florida
&
An Integrated Tool for Local Government to Track
Materials Management
and Progress toward Sustainability Goals

January 10th, 2020



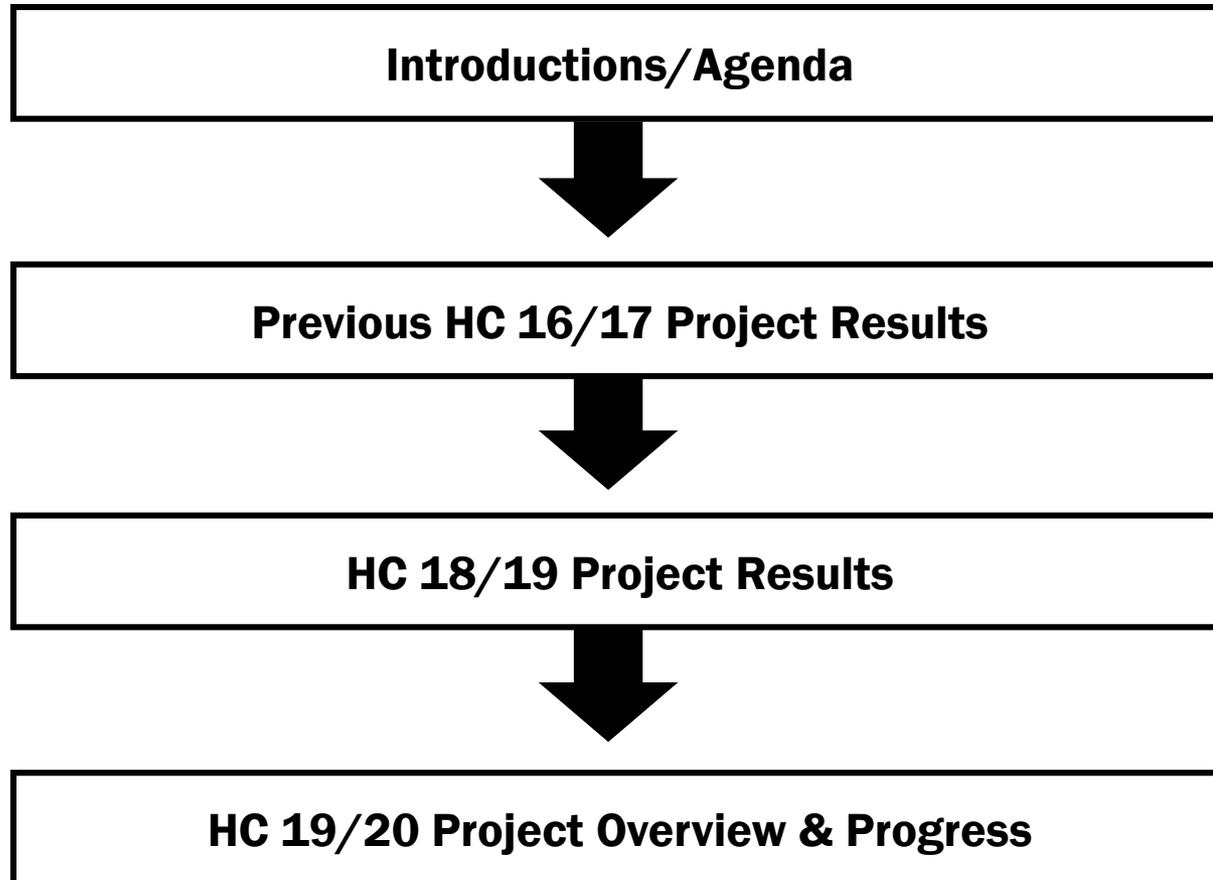
Department of Environmental Engineering Sciences
Engineering School for Sustainable Infrastructure and
Environment

University of Florida

Hinkley Center
for Solid and Hazardous
Waste Management



Today's Goals



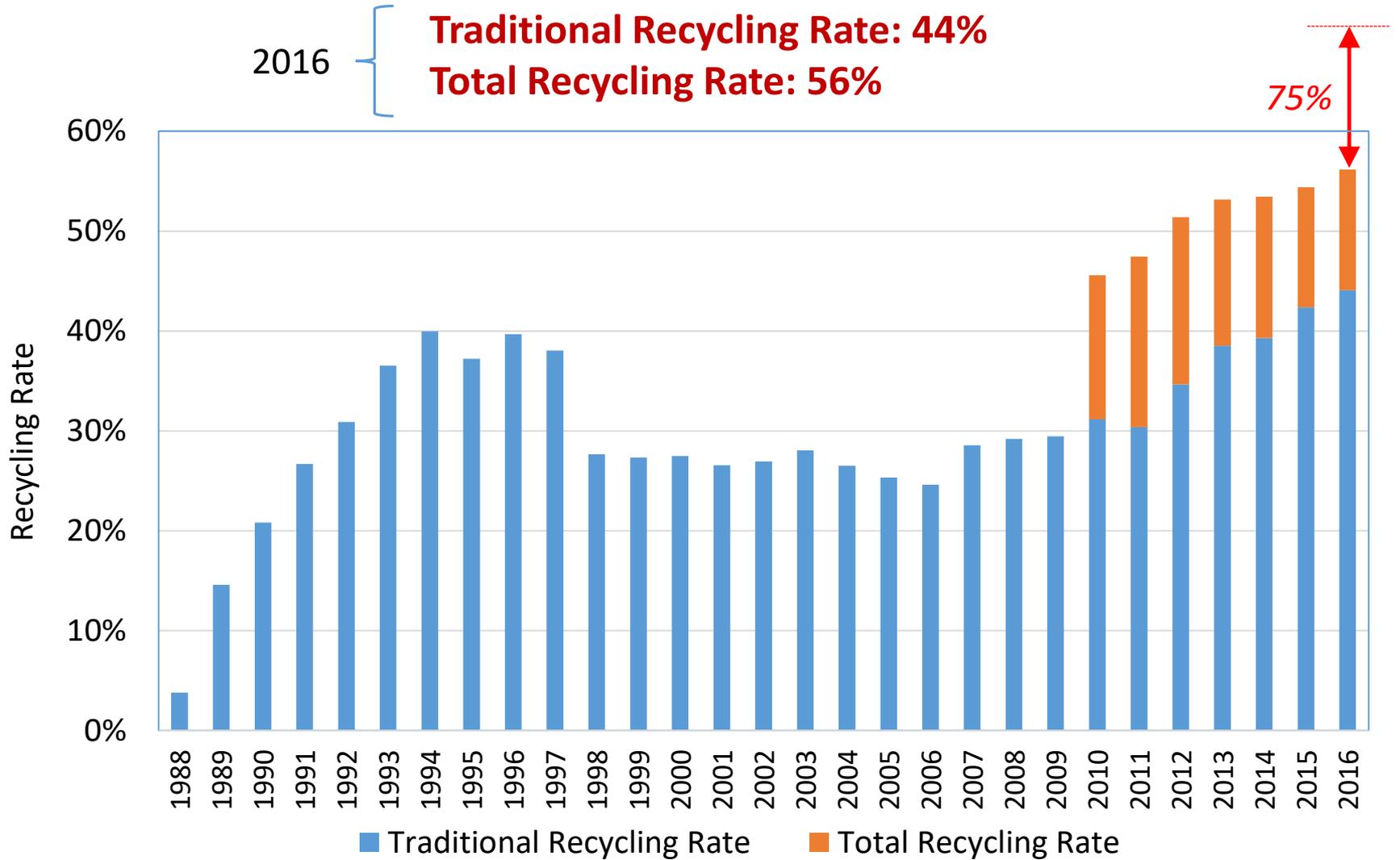
Projects History

2016

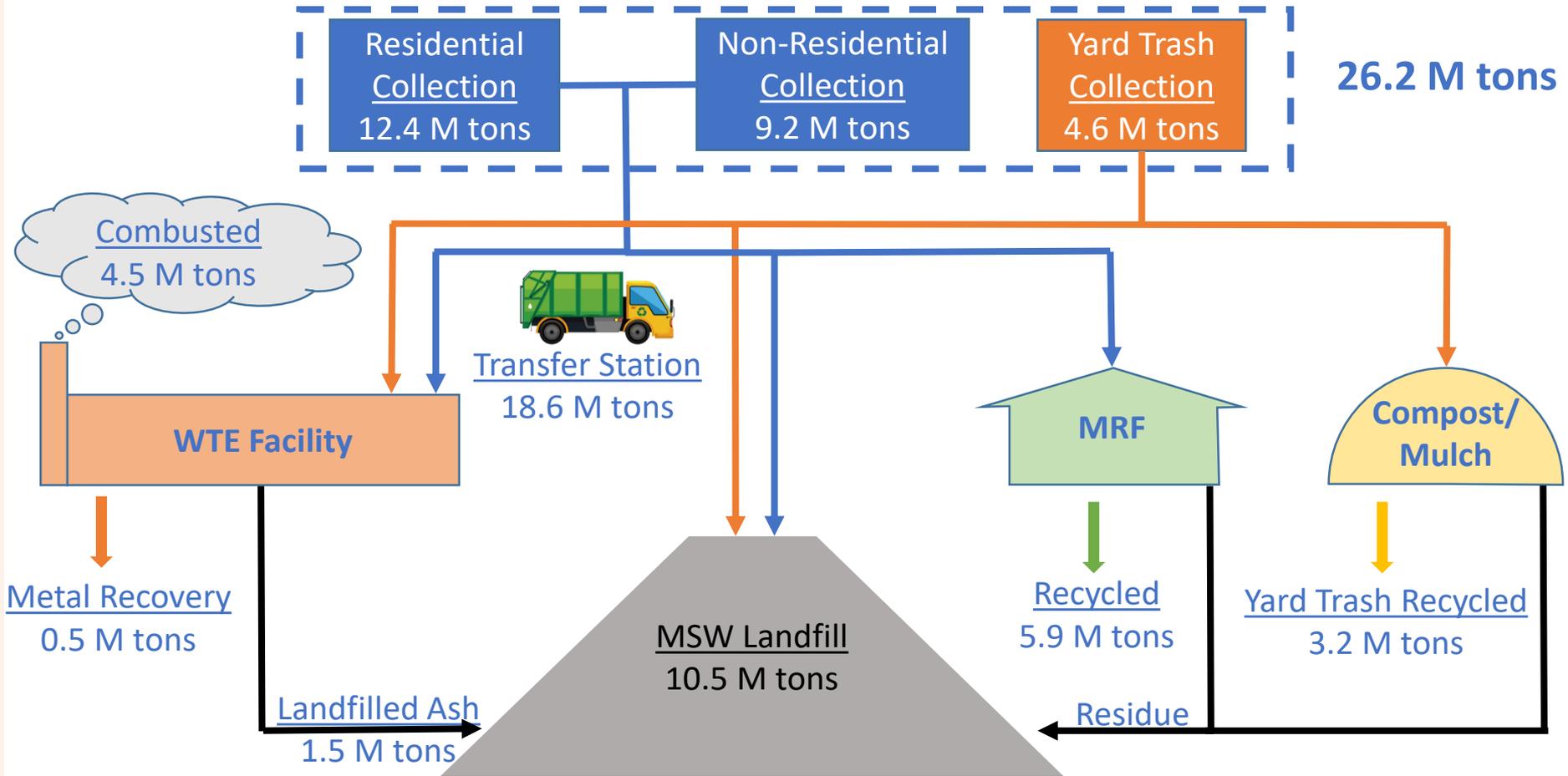


Hinkley Center
Florida Solid Waste
Management: State
of the State
(HC16/17 Project)

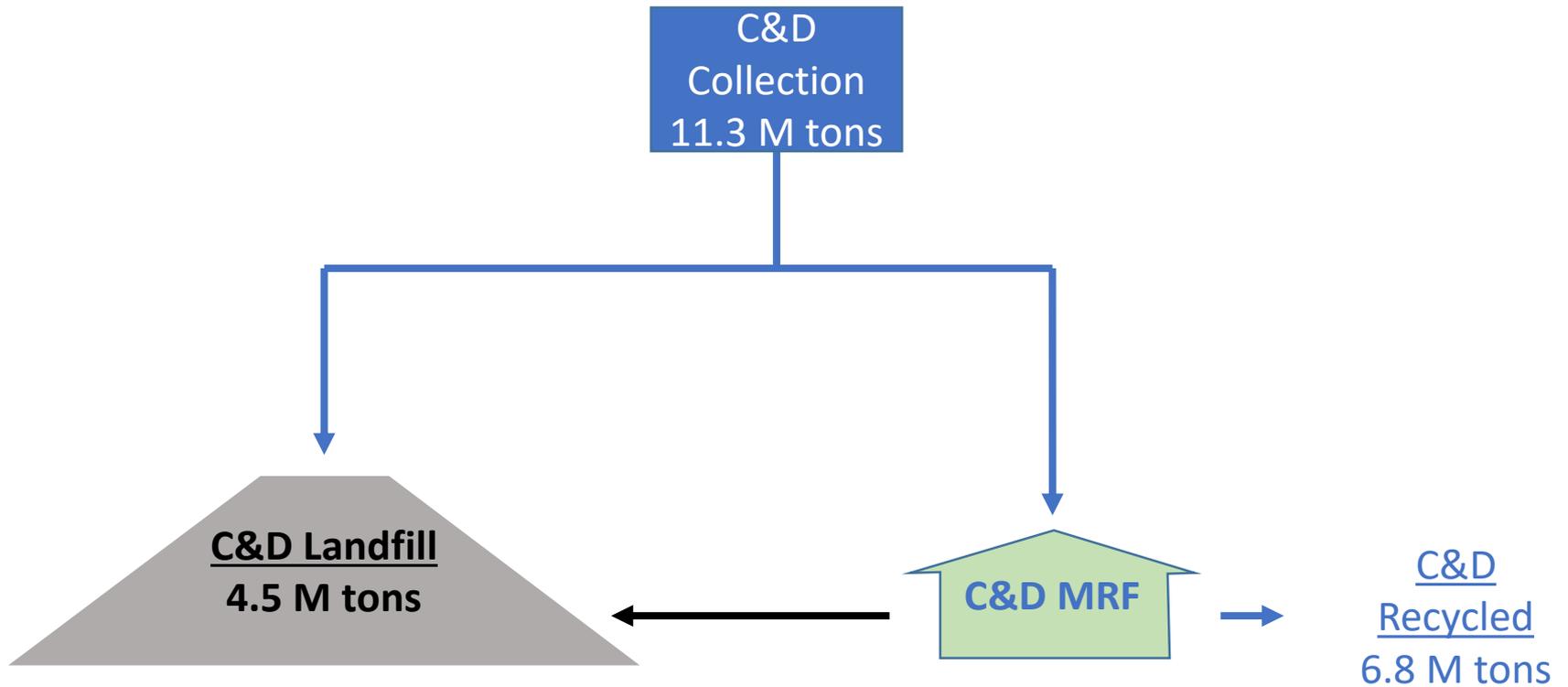
Florida's Recycling Rate



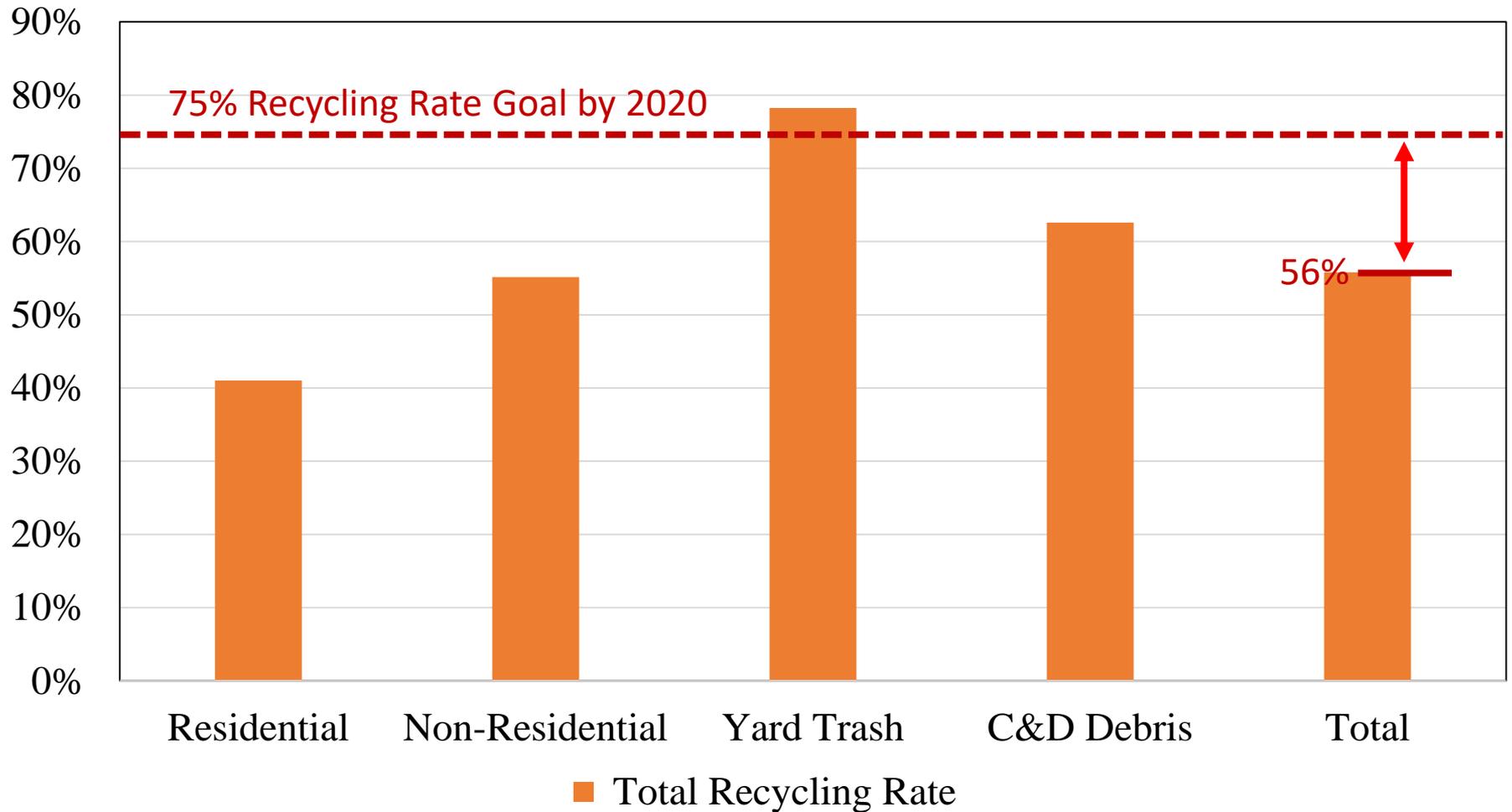
Florida Material Mass Flow (2016)



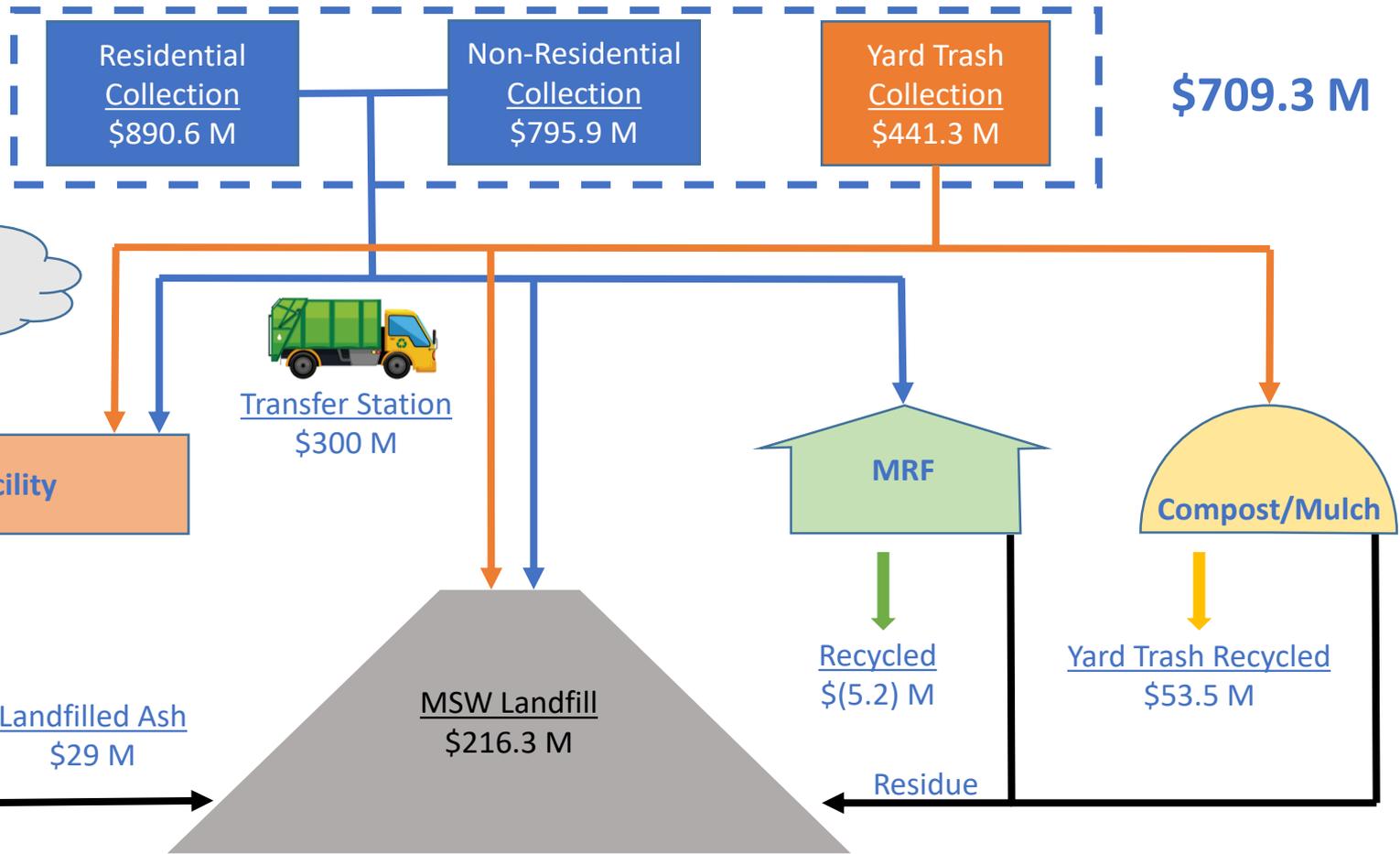
Florida Material Mass Flow (2016)



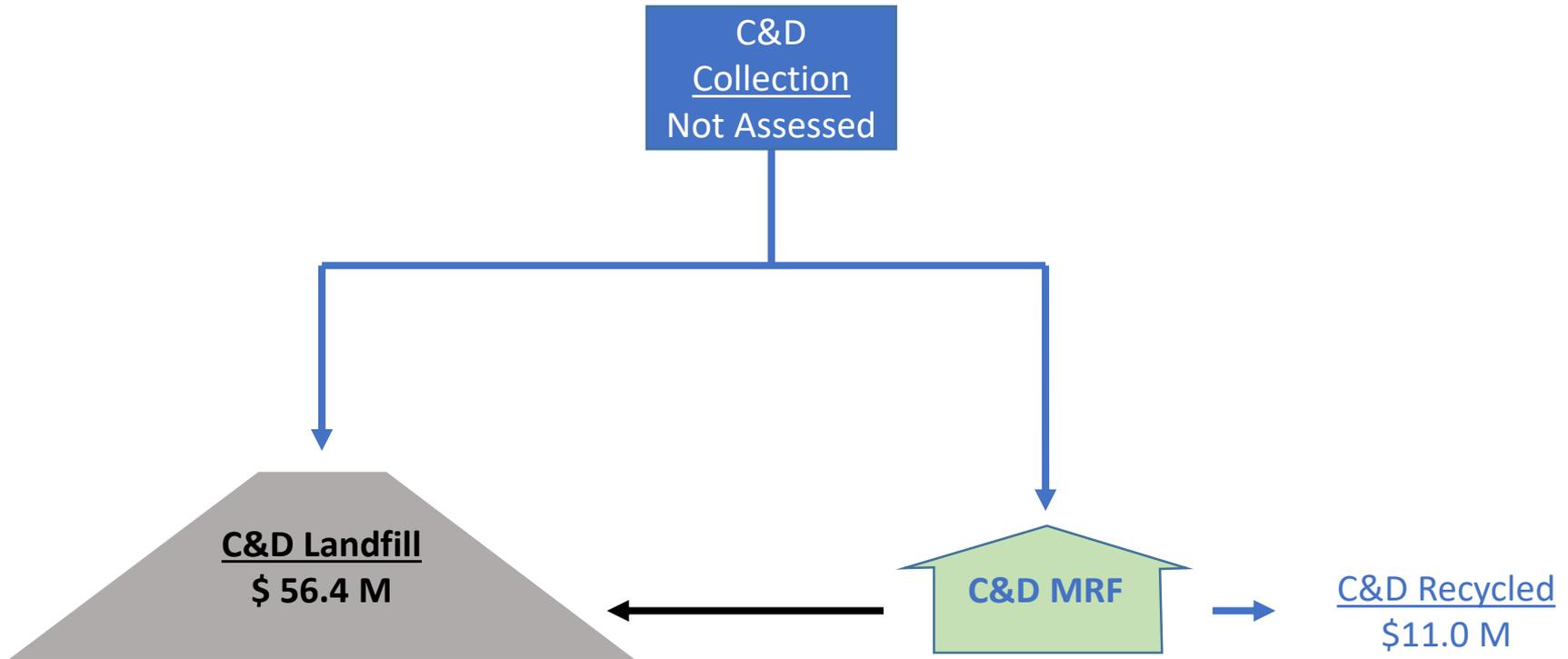
Generator Recycling Rates (2016)



Florida Material Cost Flow (2016)



Florida Material Cost Flow (2016)



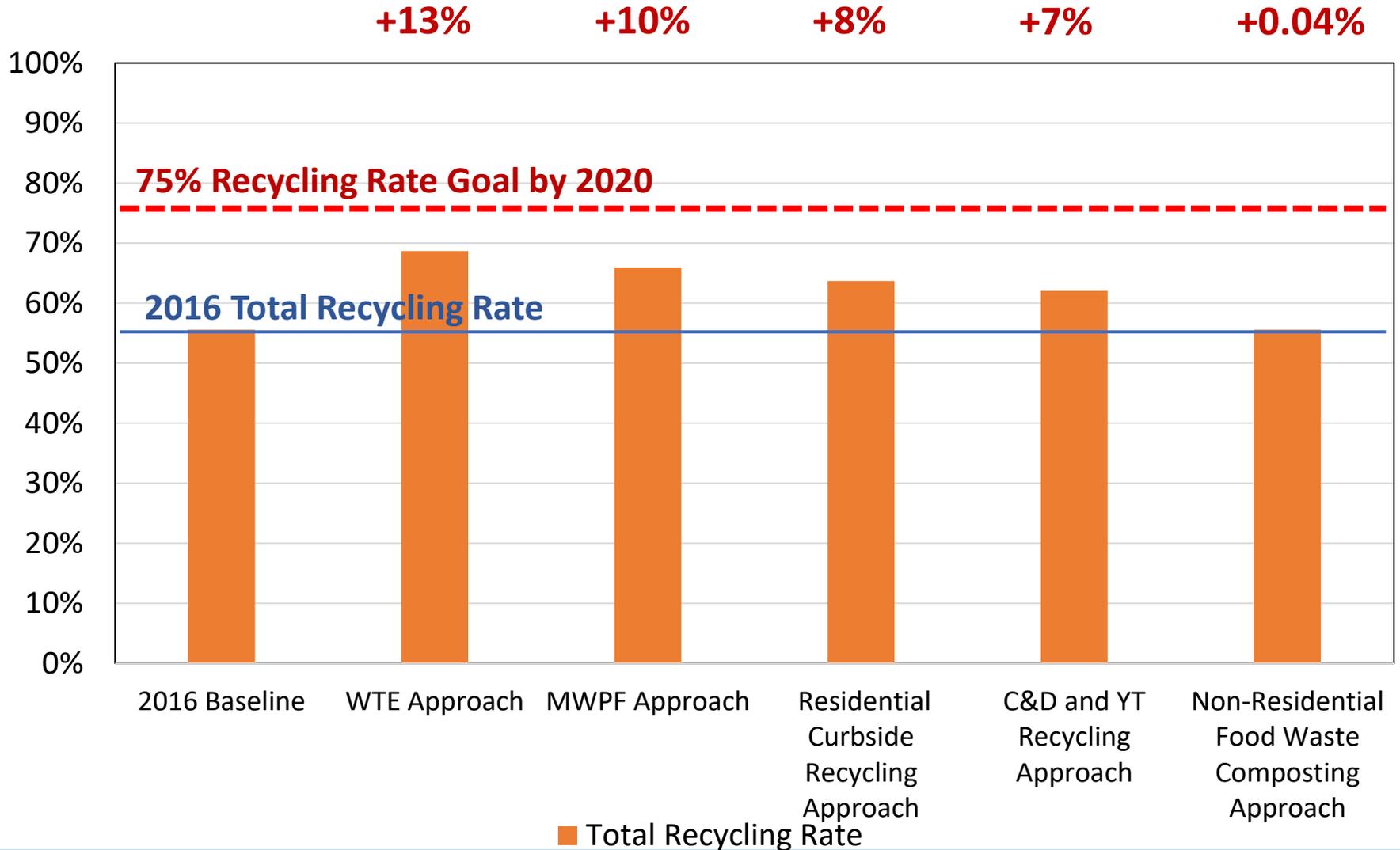
Total Costs (not including Transfer Station): \$2.9 Billion
Total Costs (including Transfer Station): \$3.2 Billion

Evaluating Reaching 75% Using Different Approaches

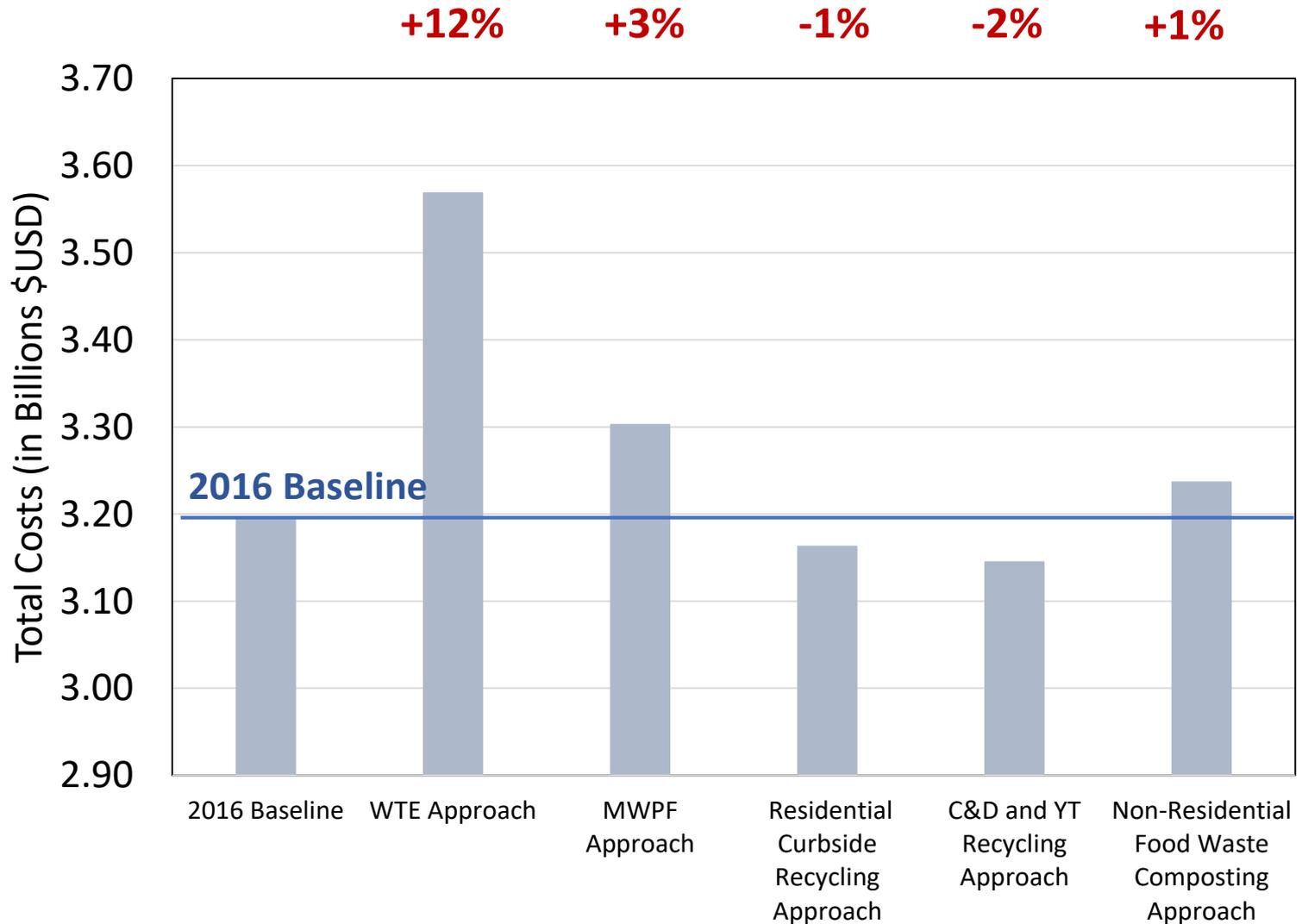
1. Waste-to-Energy (WTE) Approach
2. Mixed Waste Processing (MWP) Approach
3. Mandatory Residential Curbside Recycling Approach
4. Mandatory Construction & Demolition Debris (C&D) and Yard Trash (YT) Recycling Approach
5. Mandatory Non-Residential Food Waste Composting Approach

NOTE: Applied only to counties with populations of 150,000+

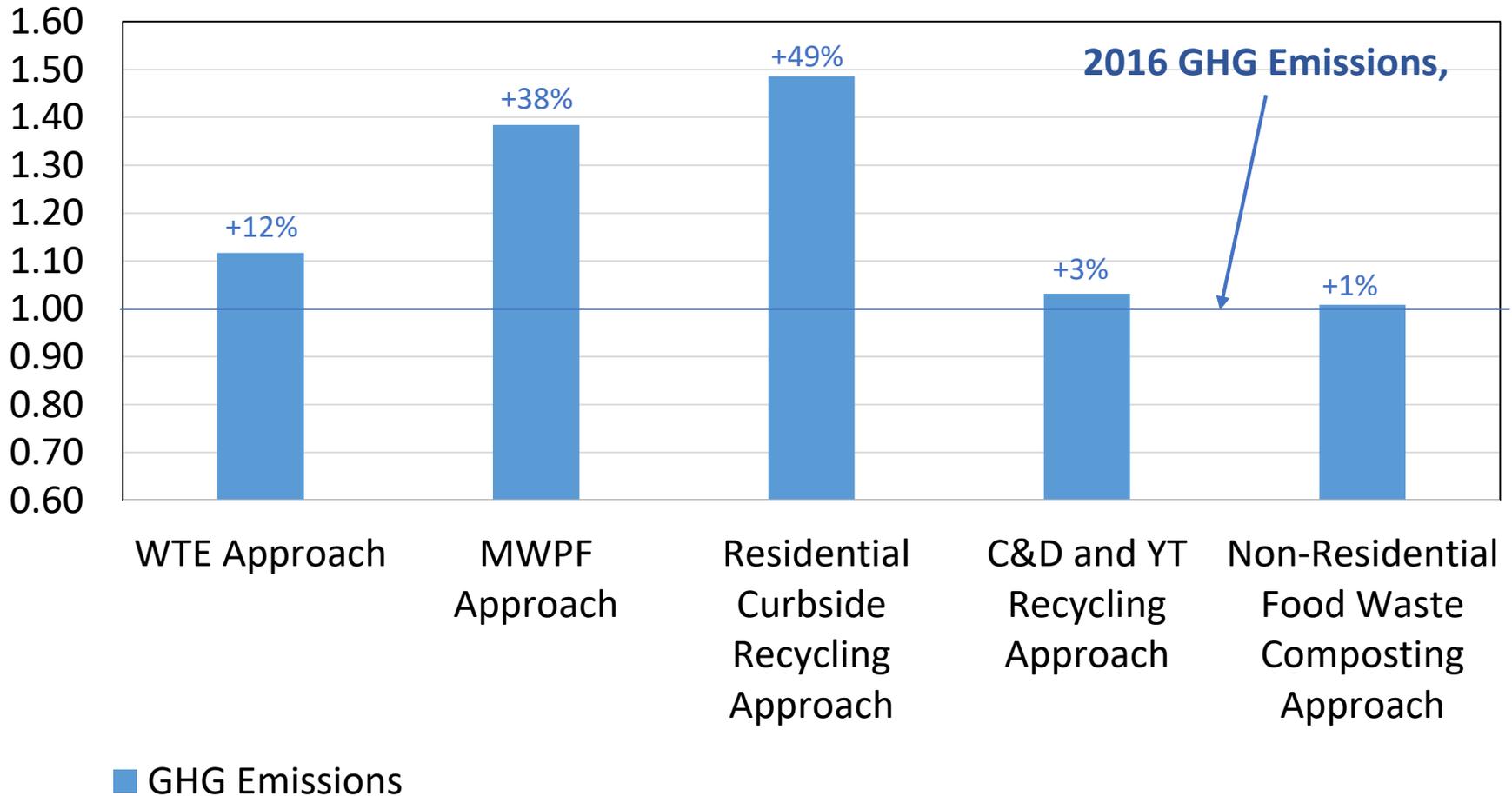
Impact on Recycling Rates (Percentage Points)



Impact on Costs (2016)

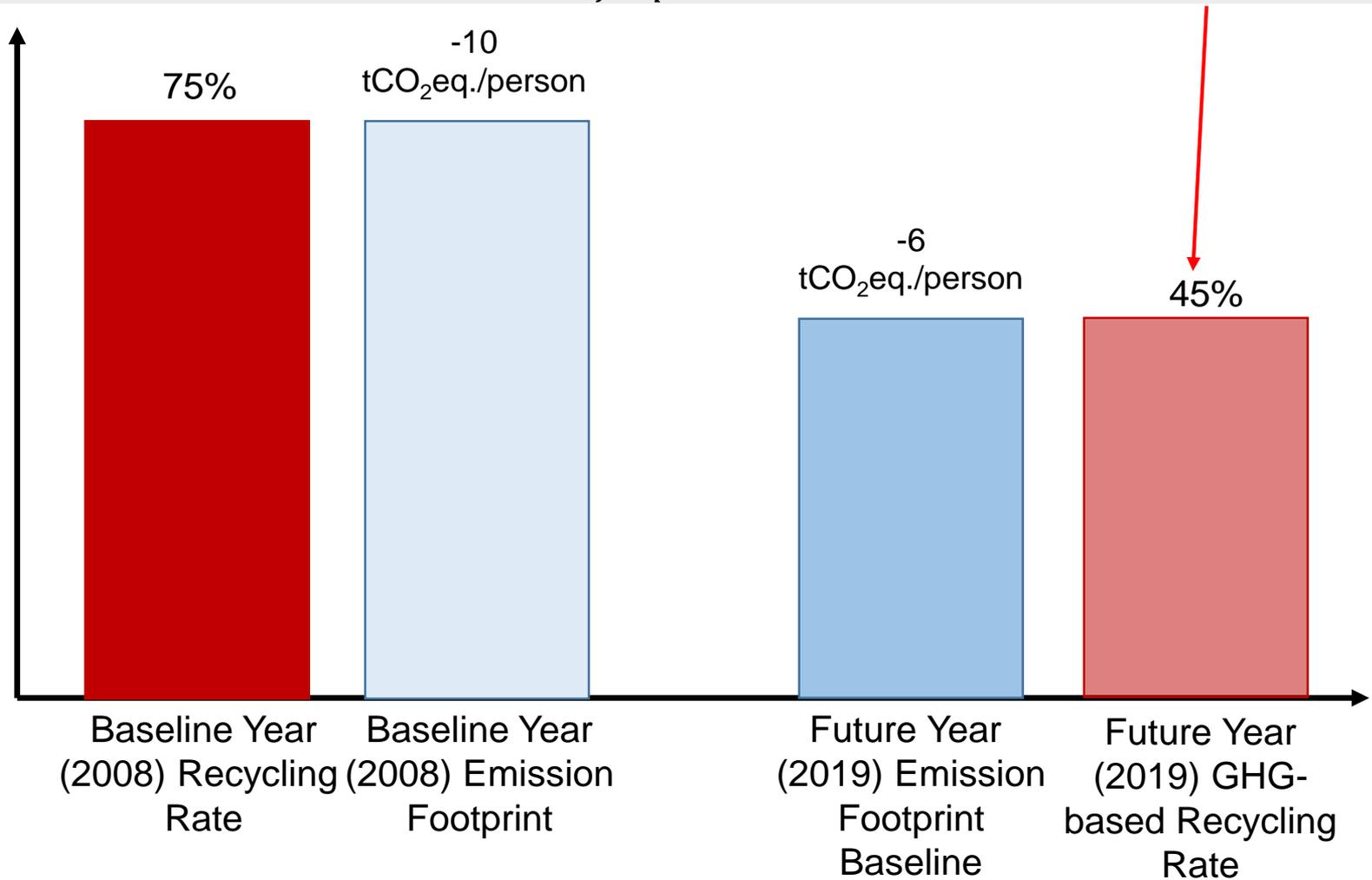


Impact on GHG Emissions (2016)



Using environmental impacts in goal setting

$$\text{GHG-Based Recycling Rate} = \frac{\text{Future Year GHG footprint}}{\text{Baseline Year GHG footprint}} (\text{Target Recycling Rate}) = X\%$$



Projects History

2016



Hinkley Center
Florida Solid Waste
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2018



FDEP
WasteCalc
Update

WasteCalc Functionality

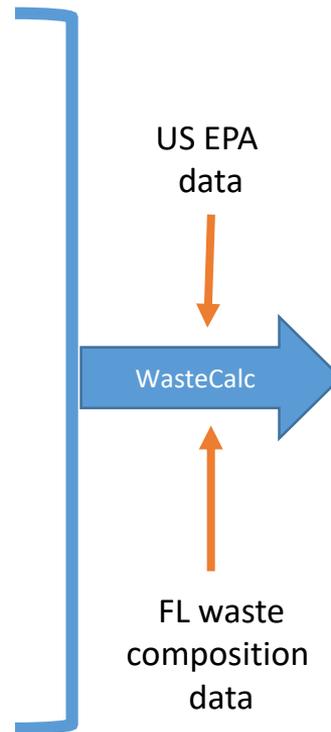
Input

Recycled Tons	
Newspaper	Ferrous Metals
Glass	White Goods
Aluminum Cans	Non Ferrous Metals
Plastic Bottles	Other Paper
Steel Cans	Textiles
Corrugated Boxes	C&D Debris
Office Paper	Food Waste
Yard Trash	Miscellaneous
Other Plastics	Tires

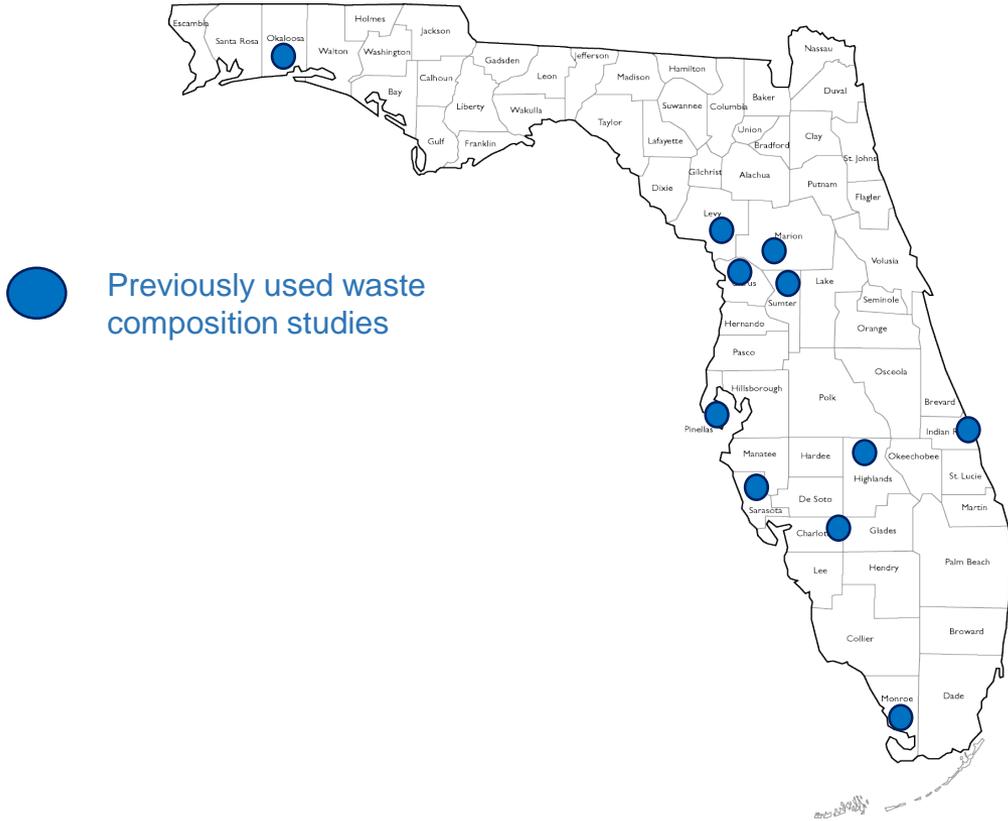
Landfilled Tons

Combusted Tons

Behind the Scenes



Waste Composition Data



WasteCalc Functionality

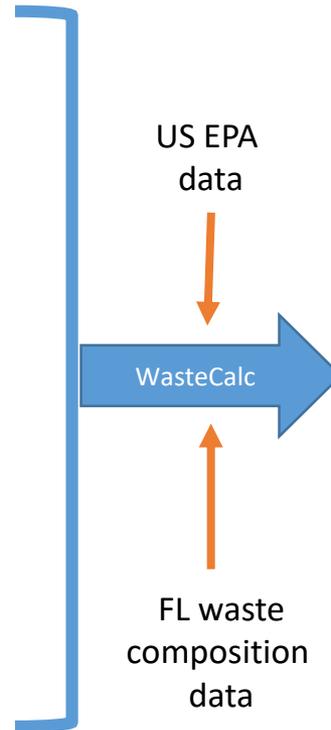
Input

Recycled Tons	
Newspaper	Ferrous Metals
Glass	White Goods
Aluminum Cans	Non Ferrous Metals
Plastic Bottles	Other Paper
Steel Cans	Textiles
Corrugated Boxes	C&D Debris
Office Paper	Food Waste
Yard Trash	Miscellaneous
Other Plastics	Tires

Landfilled Tons

Combusted Tons

Behind the Scenes



Output

% MSW Composition

Newspaper
Glass
Aluminum Cans
Plastic Bottles
Steel Cans
Corrugated Boxes
Office Paper
Yard Trash
Other Plastics
Ferrous Metals
White Goods
Non Ferrous Metals
Other Paper
Textiles
C&D Debris
Food Waste
Miscellaneous
Tires

WasteCalc Functionality

Input

Recycled Tons	
Newspaper	Ferrous Metals
Glass	White Goods
Aluminum Cans	Non Ferrous Metals
Plastic Bottles	Other Paper
Steel Cans	Textiles
Corrugated Boxes	C&D Debris
Office Paper	Food Waste
Yard Trash	Miscellaneous
Other Plastics	Tires

Landfilled Tons

Combusted Tons

Collected C&D Tons

WasteCalc Functionality

Input

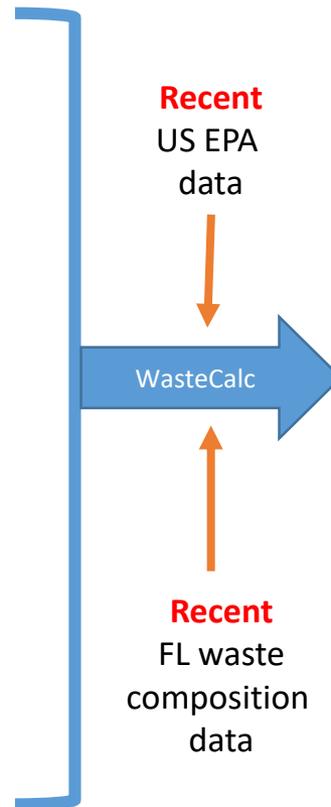
Recycled Tons	
Newspaper	Ferrous Metals
Glass	White Goods
Aluminum Cans	Non Ferrous Metals
Plastic Bottles	Other Paper
Steel Cans	Textiles
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Office Paper	Food Waste
Yard Trash	Miscellaneous
Other Plastics	Tires

Landfilled Tons

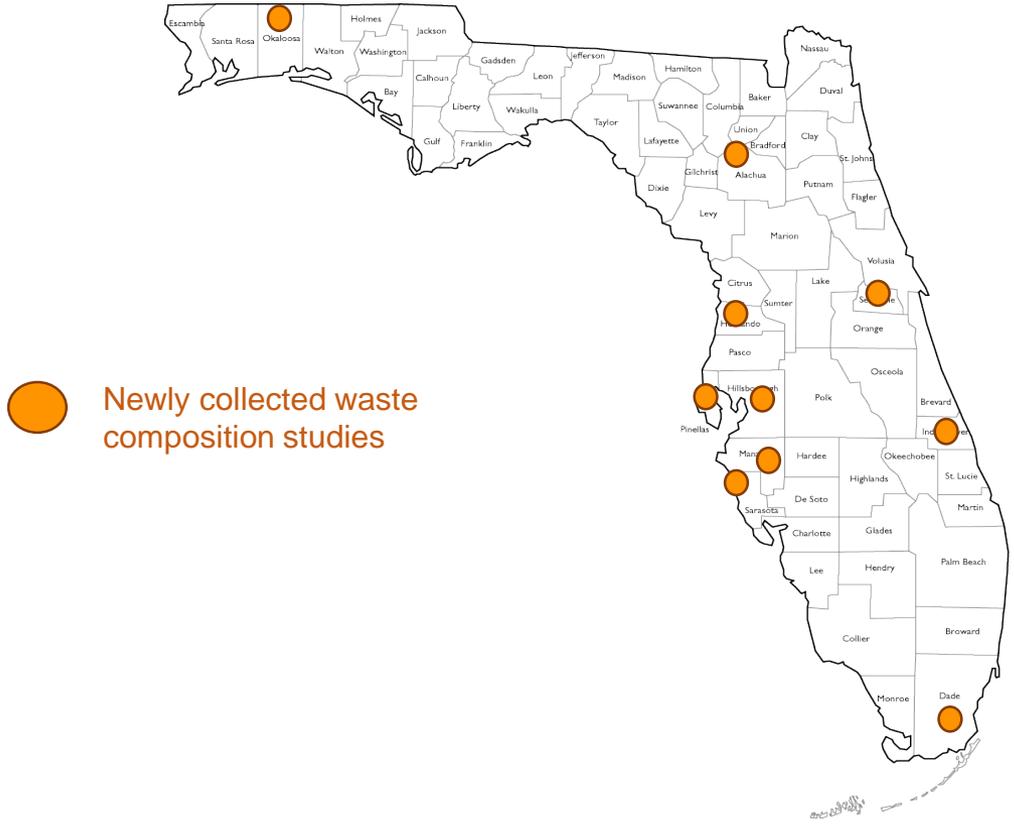
Combusted Tons

Collected C&D Tons

Behind the Scenes



Waste Composition Data



WasteCalc Functionality

Input

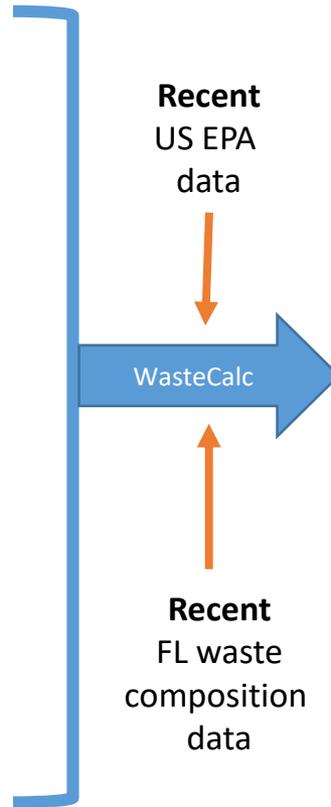
Recycled Tons	
Newspaper	Ferrous Metals
Glass	White Goods
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Office Paper	Food Waste
Yard Trash	Miscellaneous
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Landfilled Tons

Combusted Tons

Collected C&D Tons

Behind the Scenes



Output

% MSW Composition

Newspaper
Glass
Aluminum Cans
Plastic Bottles
Steel Cans
Corrugated Boxes
Office Paper
Yard Trash
Other Plastics
Ferrous Metals
White Goods
Non Ferrous Metals
Other Paper
Textiles
C&D Debris
Food Waste
Miscellaneous
Tires

Tons MSW Composition

Newspaper
Glass
Aluminum Cans
Plastic Bottles
Steel Cans
Corrugated Boxes
Office Paper
Yard Trash
Other Plastics
Ferrous Metals
White Goods
Non Ferrous Metals
Other Paper
Textiles
C&D Debris
Food Waste
Miscellaneous
Tires

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HC 18/19 Project Objectives

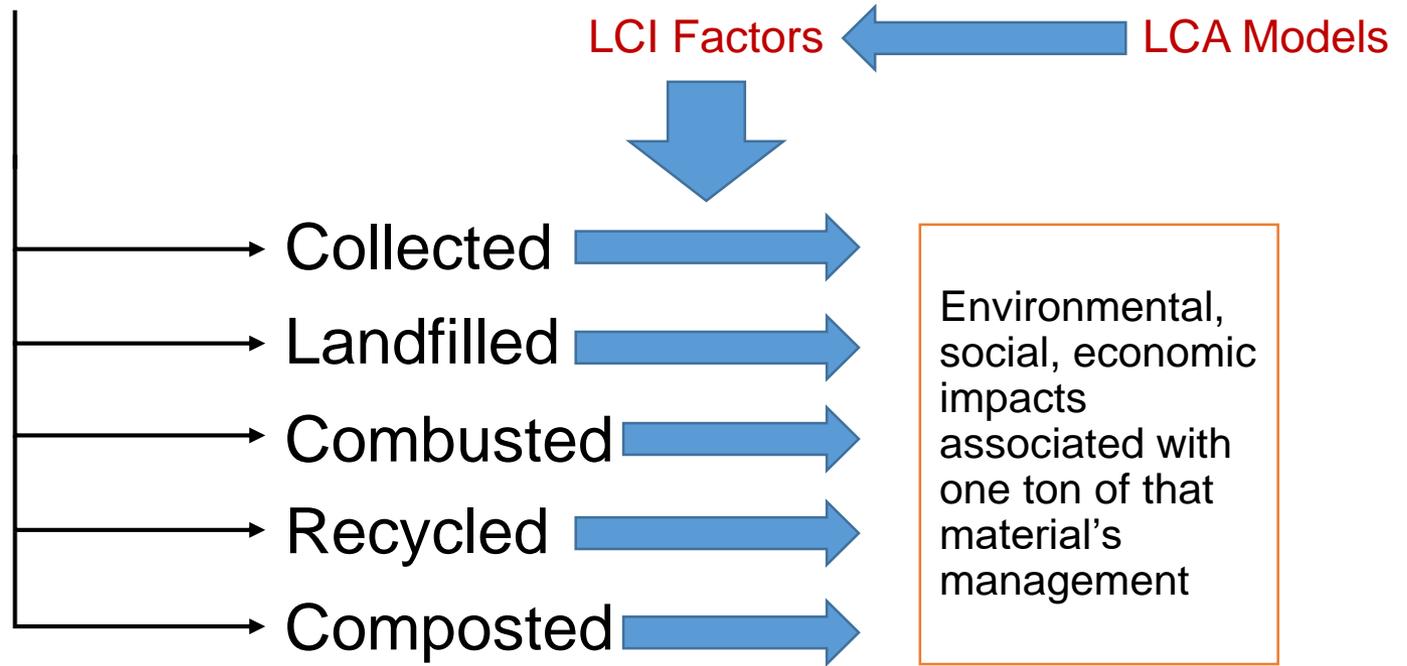
- **Develop a publicly available LCA tool** used to measure and compare social, economic, and environmental impacts for various Florida solid waste management approaches.
- **Develop additional lifecycle impact (LCI) factors** (e.g., energy use, emissions, etc.) that will allow users to consider a wider variety of impacts associated with various materials management approaches.

HC 18/19 Project Tasks

- **Task 1:** Compile available data on lifecycle impact factors
- **Task 2:** Develop lifecycle impact factors (LCI)
- **Task 3:** Create a LCA tool
- **Task 4:** Use the tool to evaluate best materials management approaches in Florida

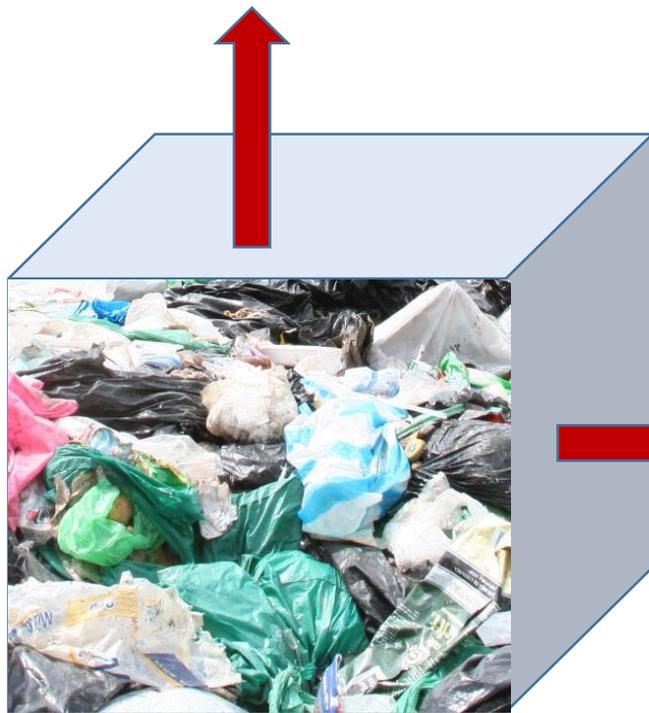
Workbook-Based LCA Toolc

Mass
Data



LCI Factors

Metric Tons of
CO₂ Equivalents
(tCO₂eq.)

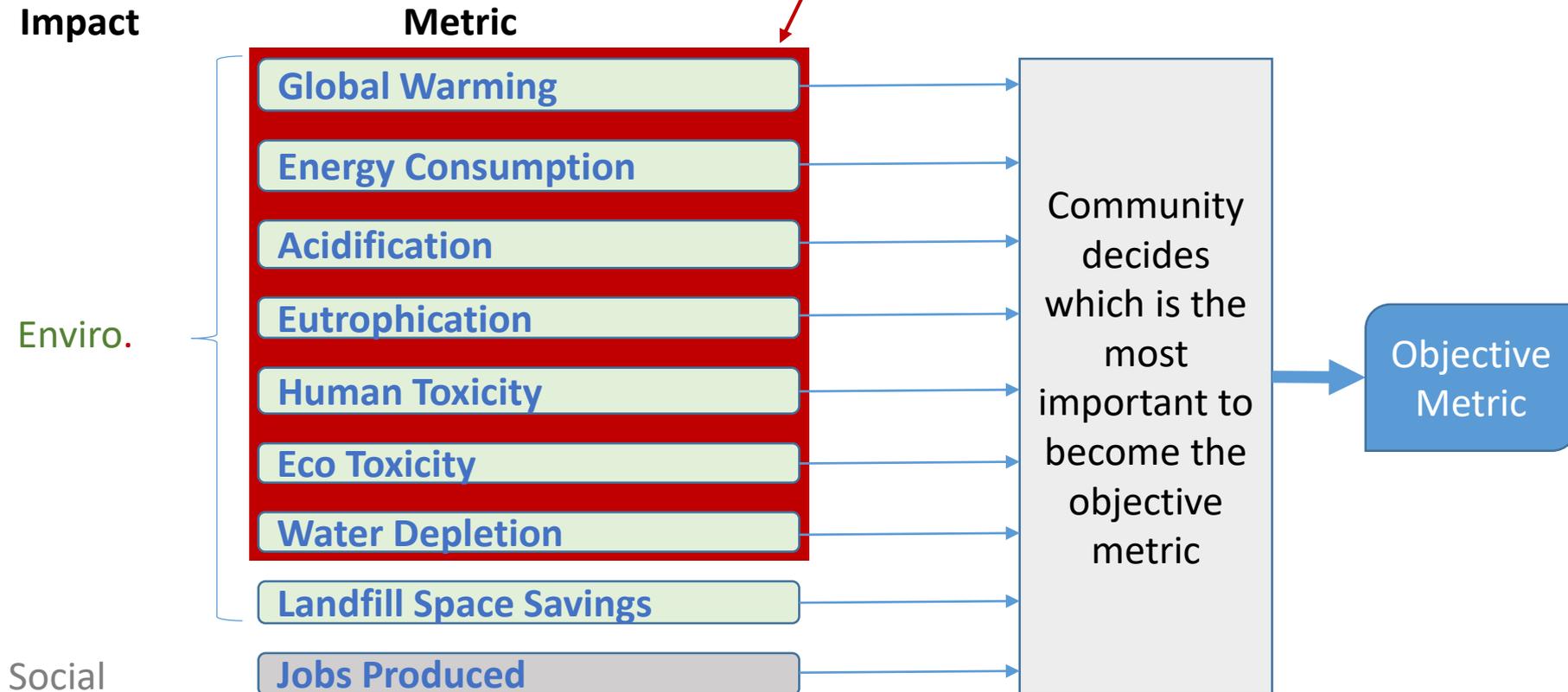


Mass of
Waste

$$\frac{tCO_2eq.}{Ton\ Waste}$$

Methods of Obtaining Environmental-Based LCI Factors

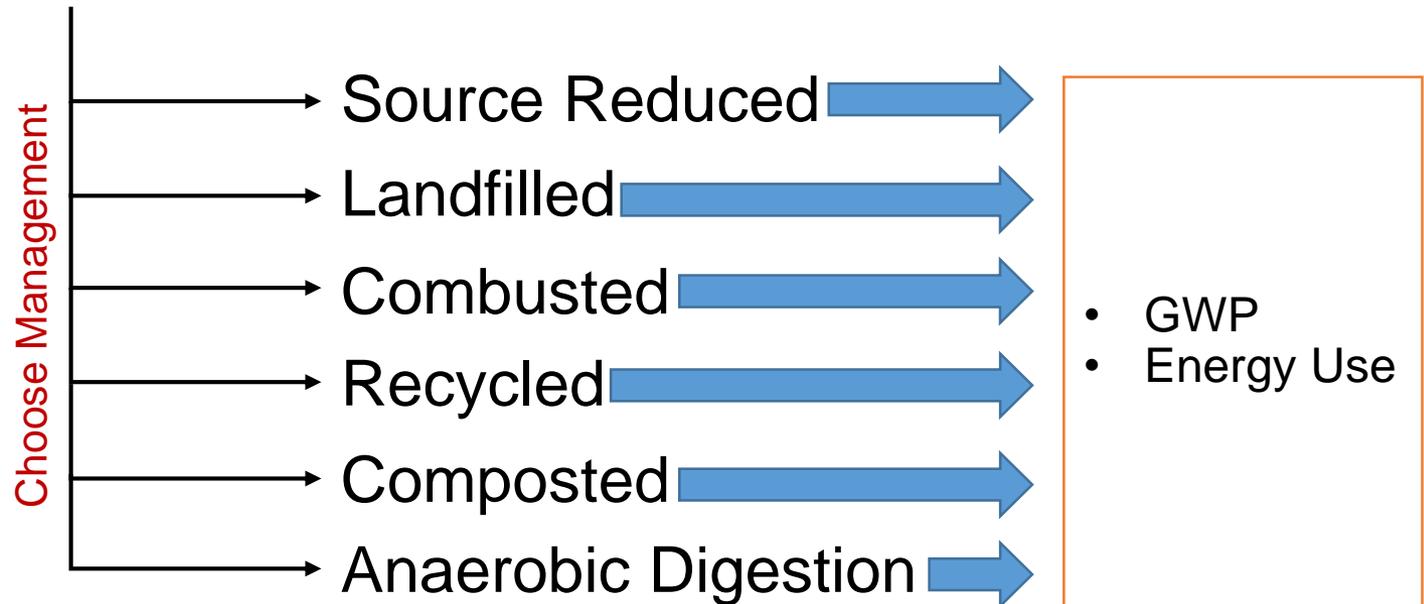
Traditional LCA Model



WARM (US, US EPA)

Workbook or desktop application

Input Mass of Material

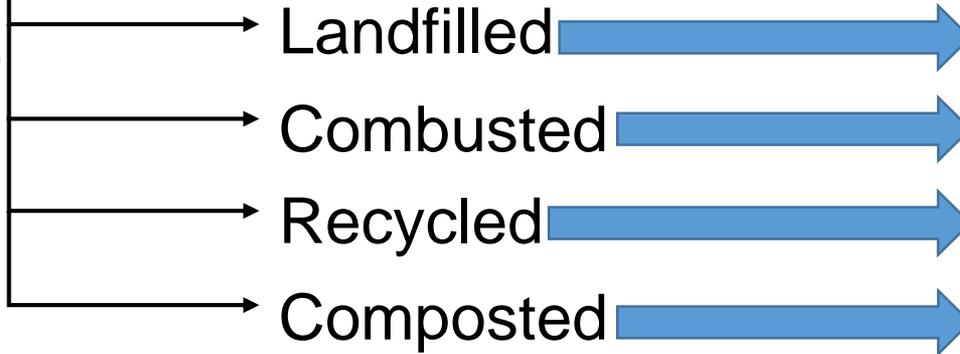


MSW-DST (US, US EPA)

Desktop application

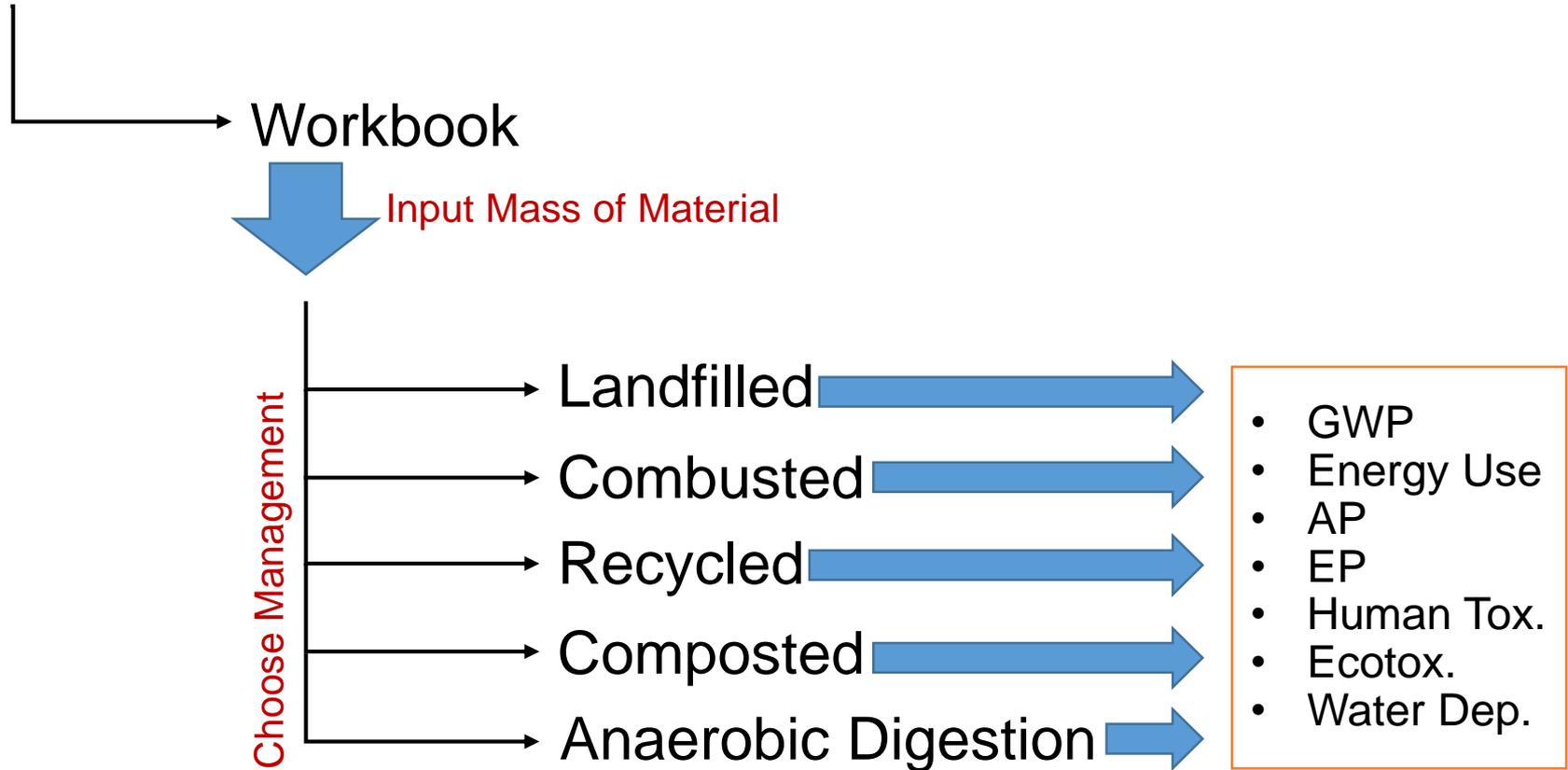
Input Mass of Material

Choose Management

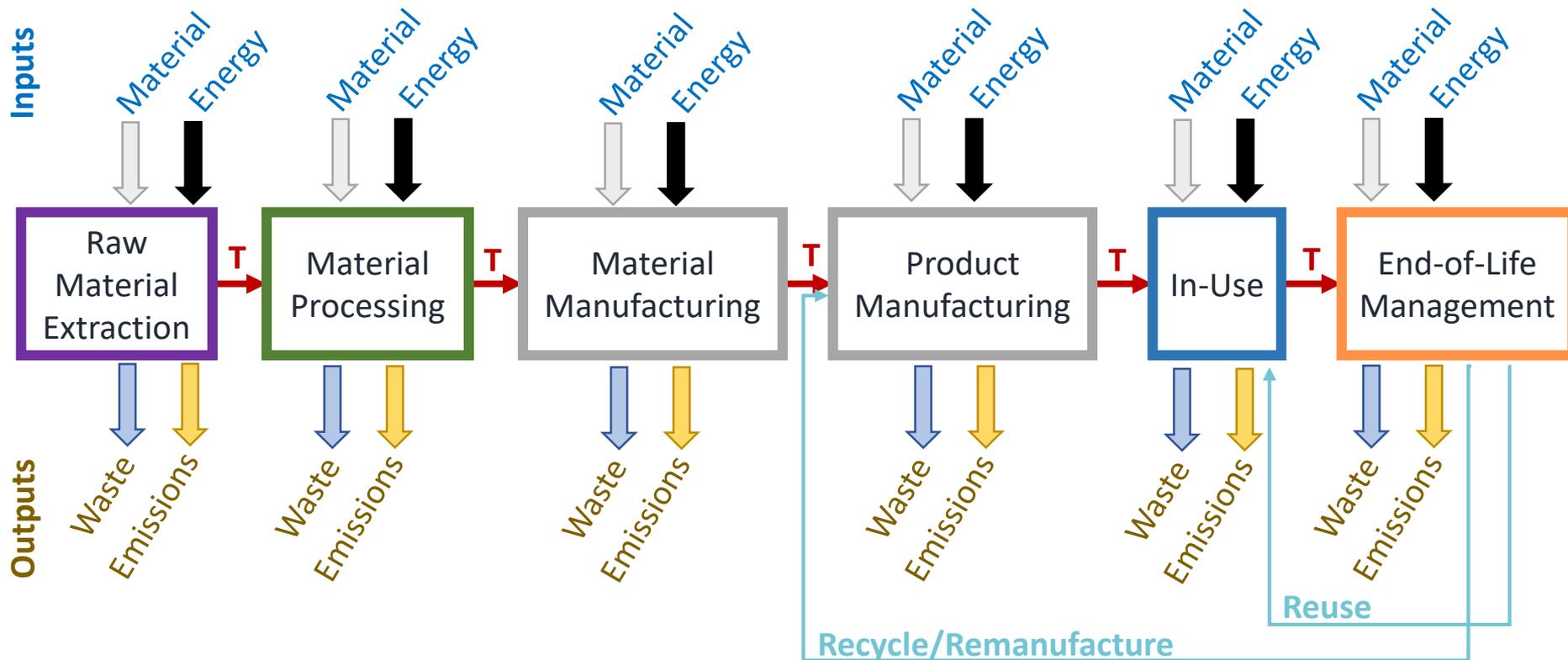


- GWP
- AP
- EP
- Human Tox.
- Ecotox.

SWOLF (US, NC State)



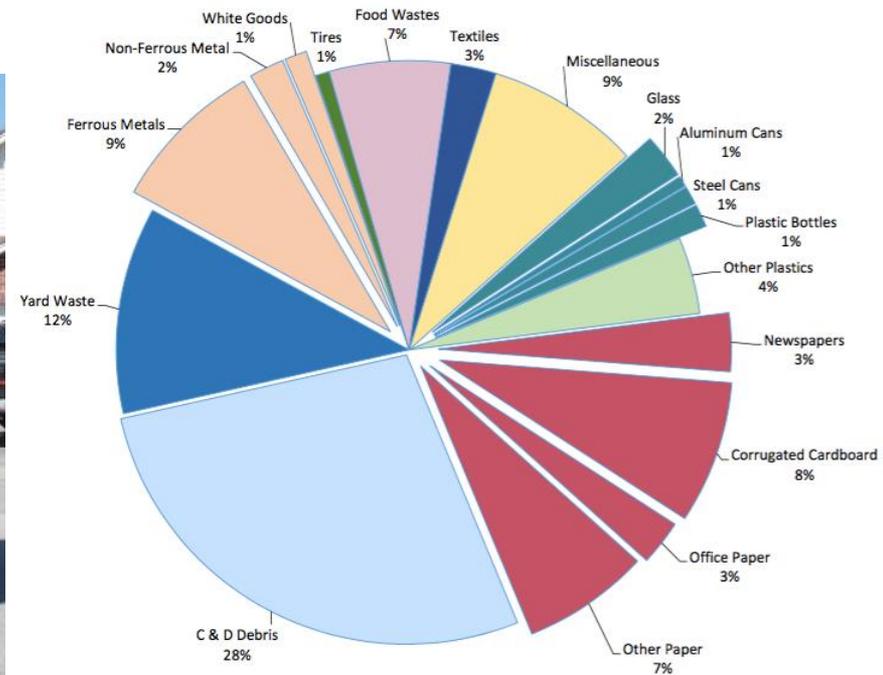
LCA Model Scope



Use LCA to translate the inputs and outputs to environmental impacts
(e.g., global warming potential)

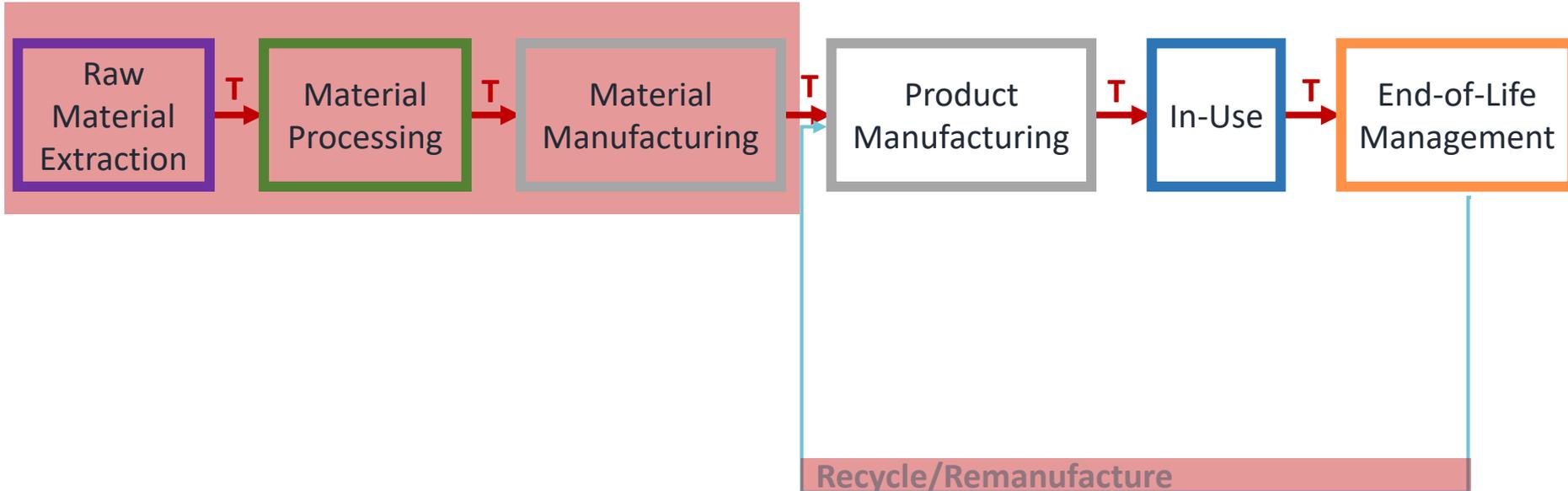
Scope For Collection

tCO₂eq.



Scope For Recycling

Virgin Material Used in Product Manufacturing



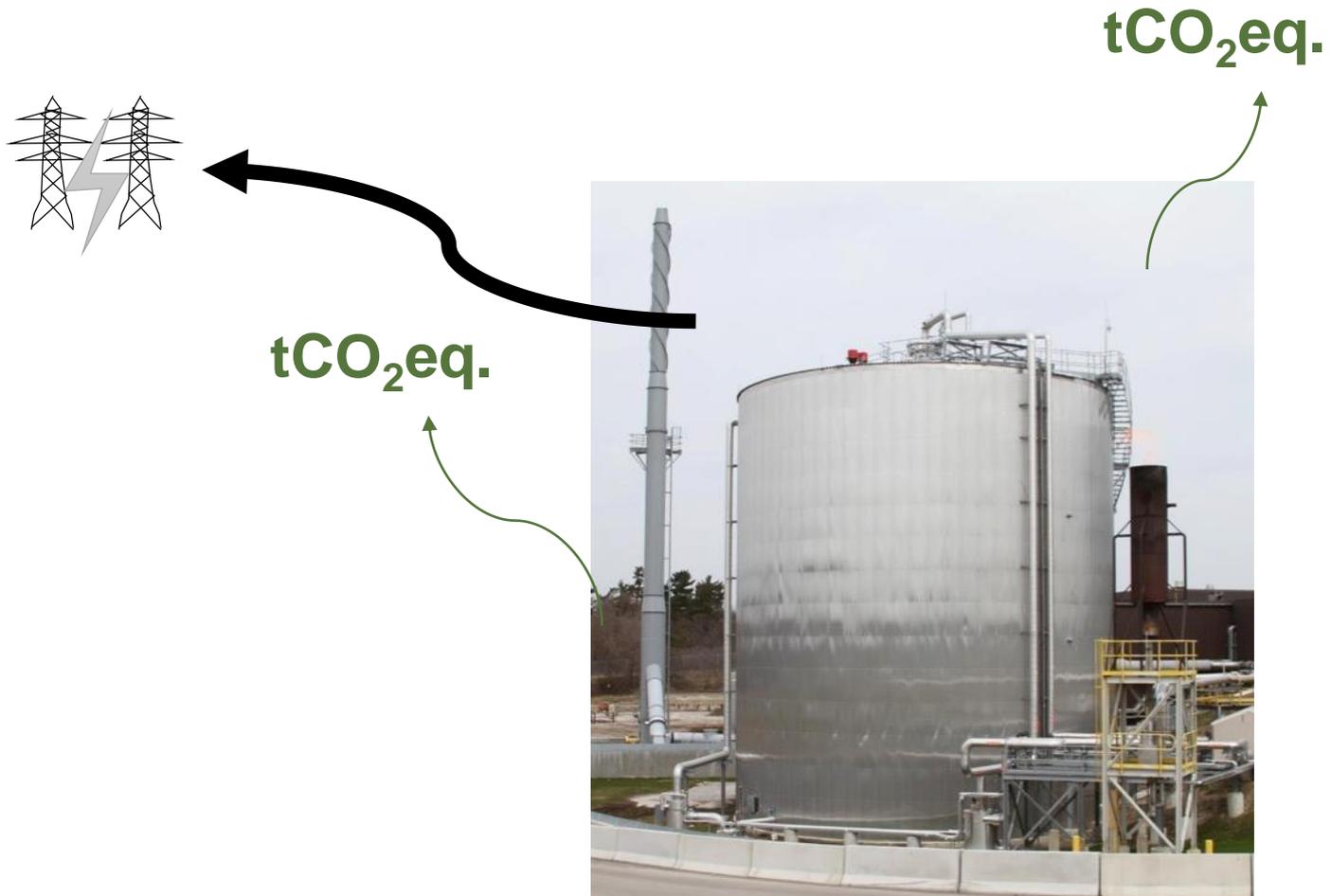
Recycled Material Used in Product Manufacturing

Scope For Compositing

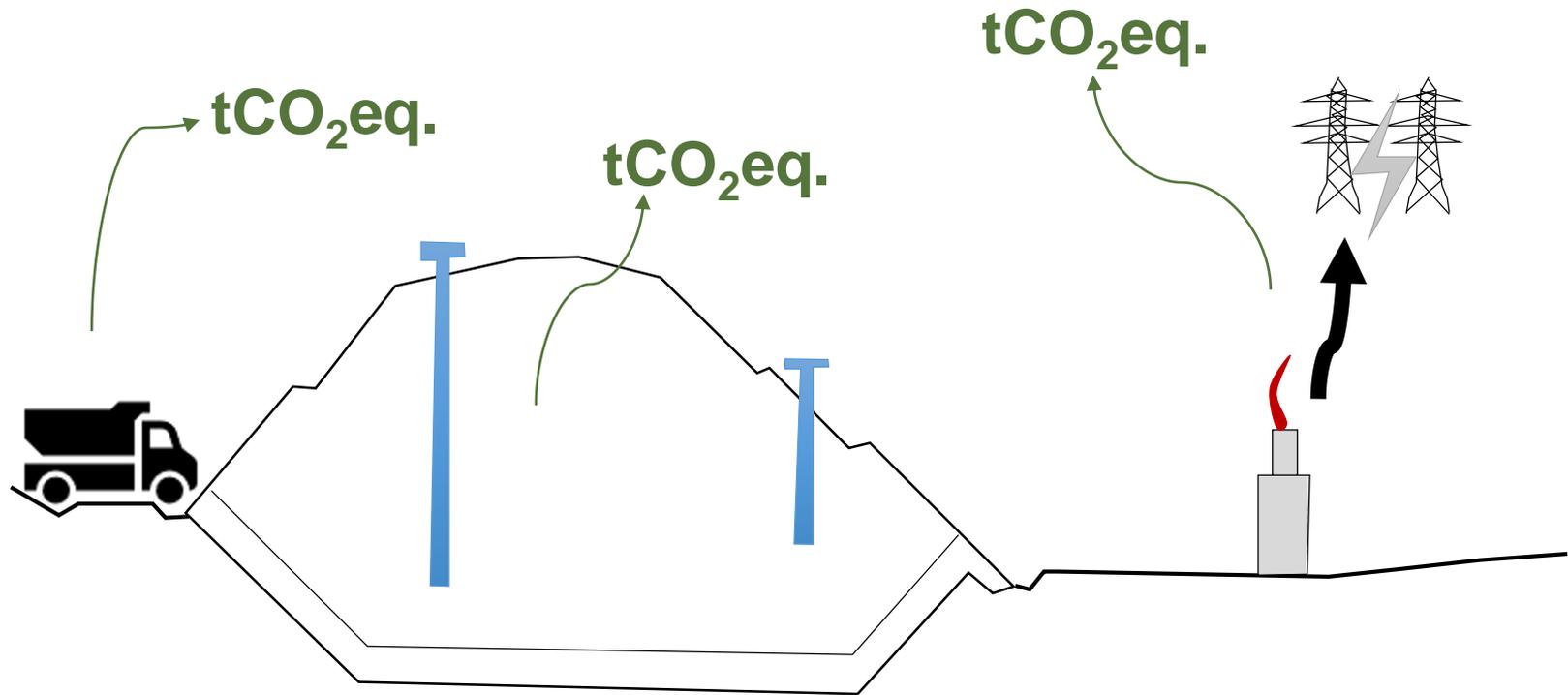
tCO₂eq.



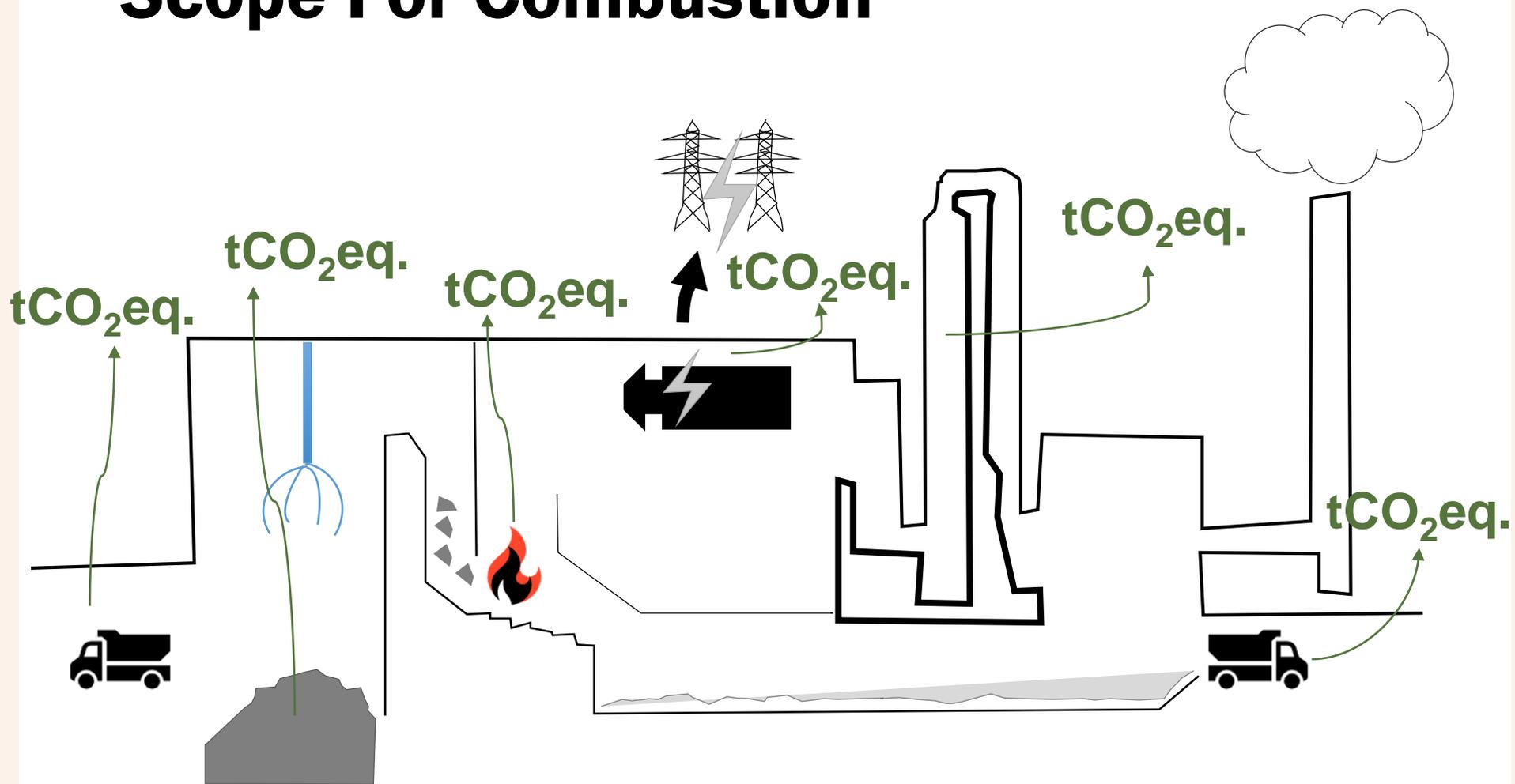
Scope For Anaerobic Digestion



Scope For Landfill

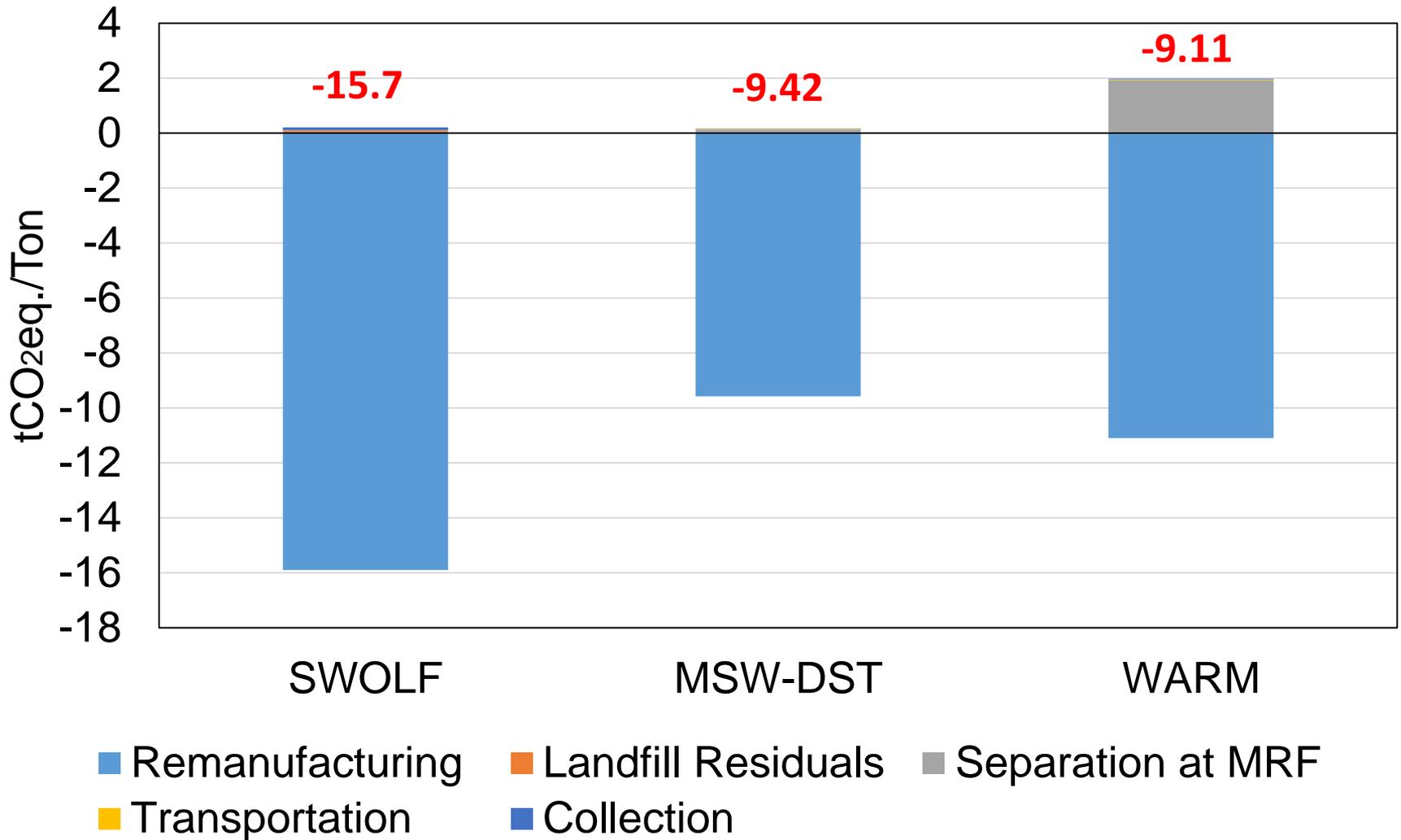


Scope For Combustion



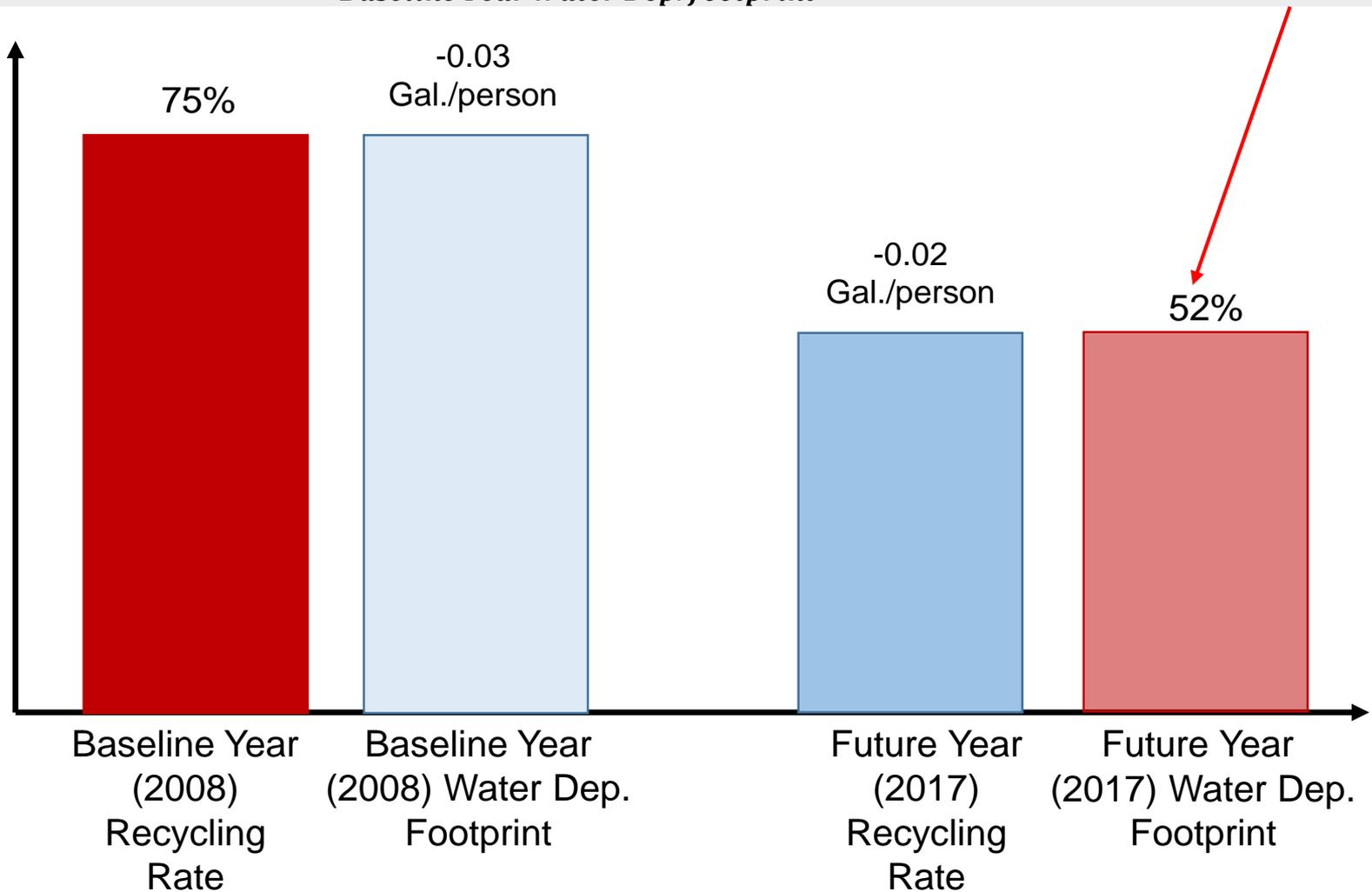
HC18/19 Workbook Tool

Recycling Aluminum Cans GHG Emission Factor (tCO₂eq./ton)



Using environmental impacts in goal setting

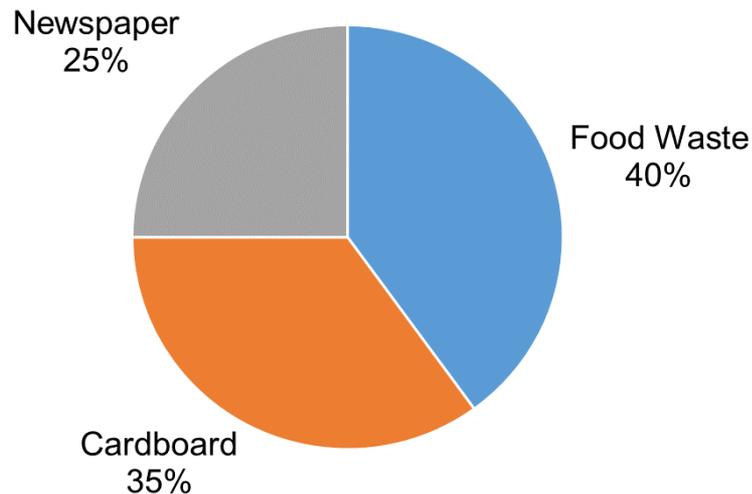
$$\text{Water Dep.-Based Recycling Rate} = \frac{\text{Future Year Water Dep. footprint}}{\text{Baseline Year Water Dep. footprint}} (\text{Target Recycling Rate}) = X\%$$



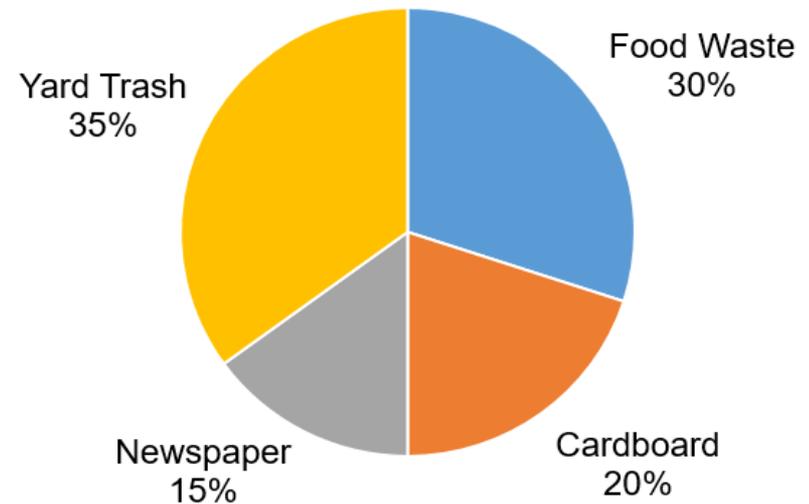
Task 4: Use the tool to evaluate best materials management approaches in Florida

Hypothetical: 100,000 Tons with two varying compositions and desired to be anaerobically digested

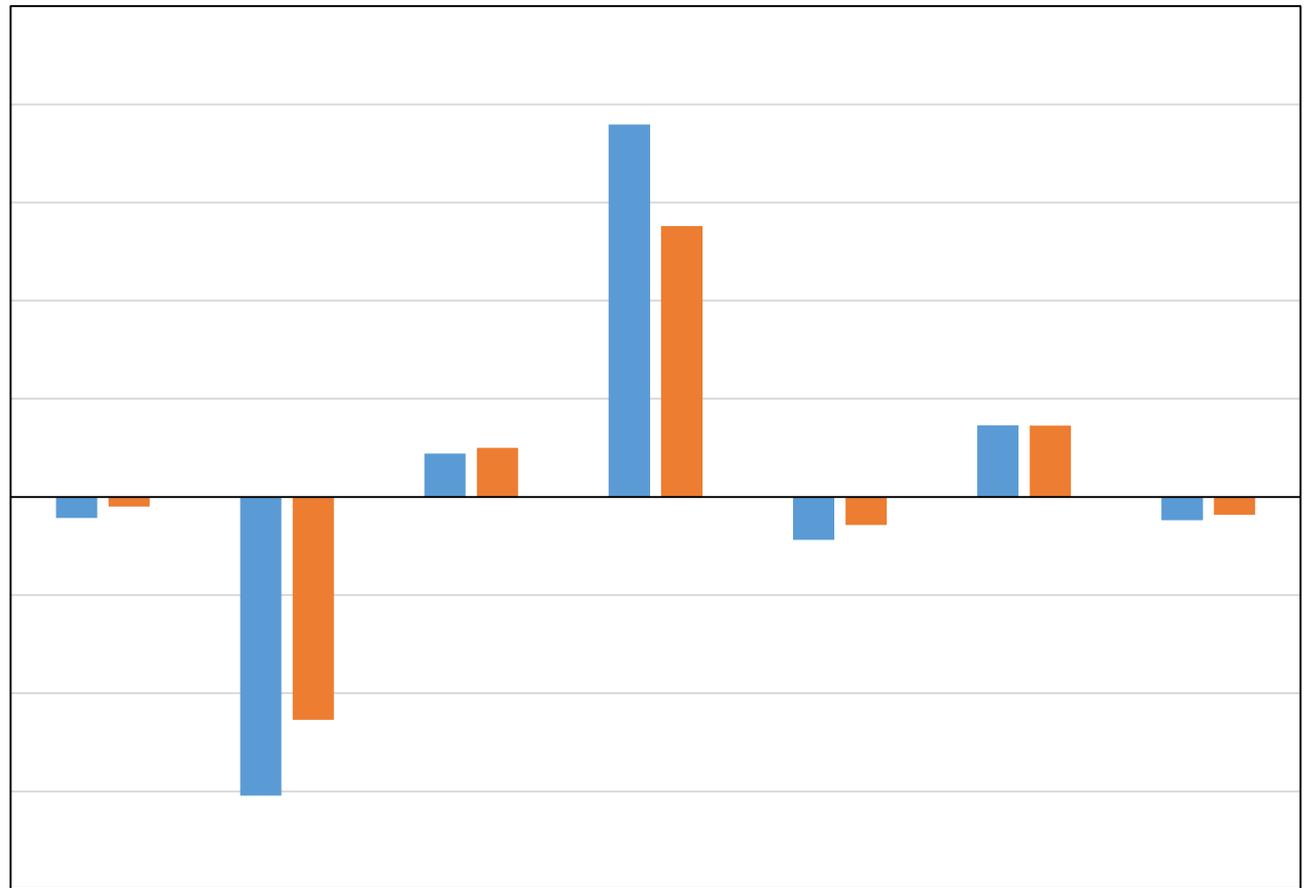
Scenario 1



Scenario 2



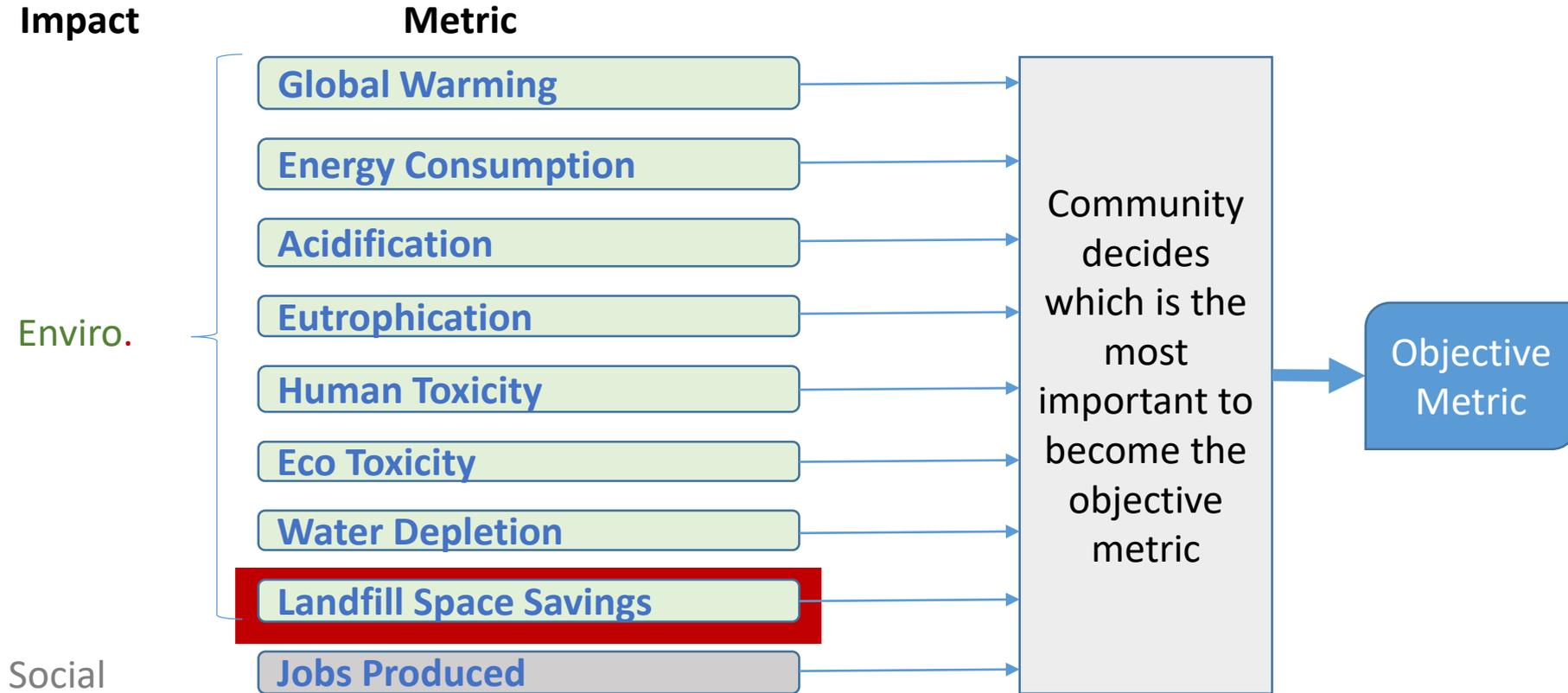
250,000,000
 200,000,000
 150,000,000
 100,000,000
 50,000,000
 -
 (50,000,000)
 (100,000,000)
 (150,000,000)
 (200,000,000)



Climate Change (scaled to x1,000) Energy Use Acid. Pot. (scaled to x10) Eutro. Pot. Marine Ecotox. Human Tox. (scaled to x10 mil.) Water Use

■ Scenario 1 ■ Scenario 2

Methods of Obtaining Environmental-Based LCI Factors



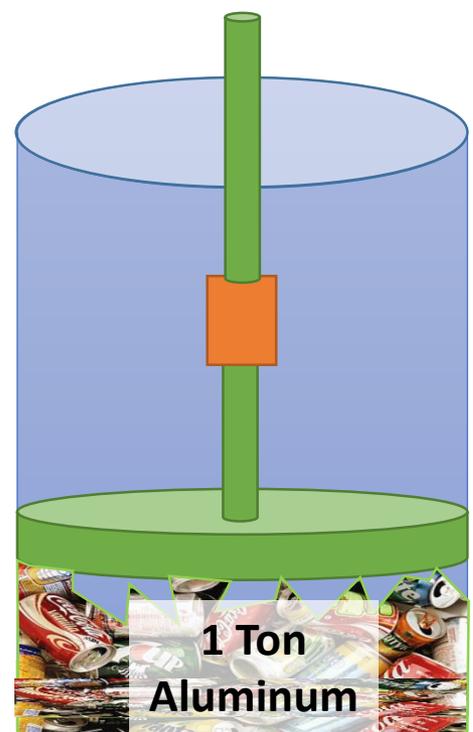
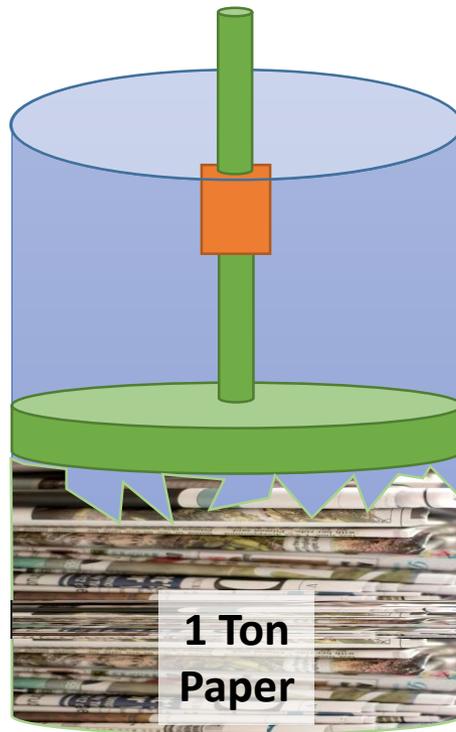
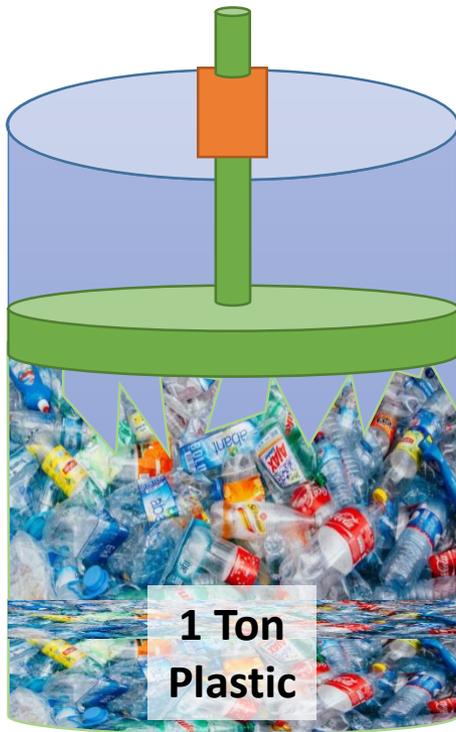
Landfill Space Savings



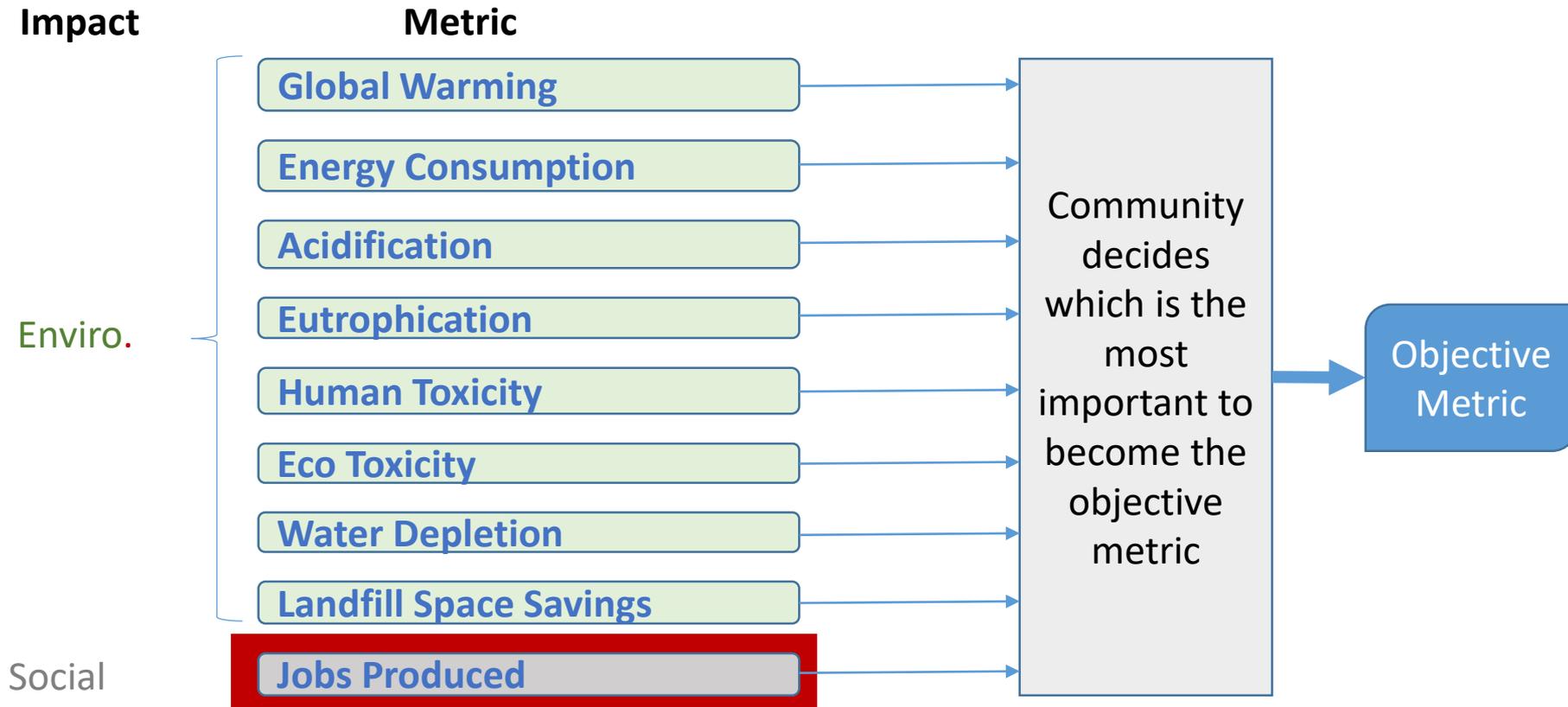
Landfill Space Savings



Landfill Space Savings



Methods of Obtaining Environmental-Based LCI Factors



Projects History

2016



Hinkley Center
Florida Solid Waste
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2018



FDEP
WasteCalc
Update

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Hinkley Center
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(HC17/18 Project)

2019



FDEP
WasteCalc &
Waste
Compositions



WasteCalc Workbook

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2019

FDEP
WasteCalc &
Waste
Compositions

2020

Hinkley Center
An Integrated
Tool for Local
Government to
Track Materials
Management
and Progress
toward
Sustainability
Goals
(HC19/20 Project)

HC 19/20 Objectives

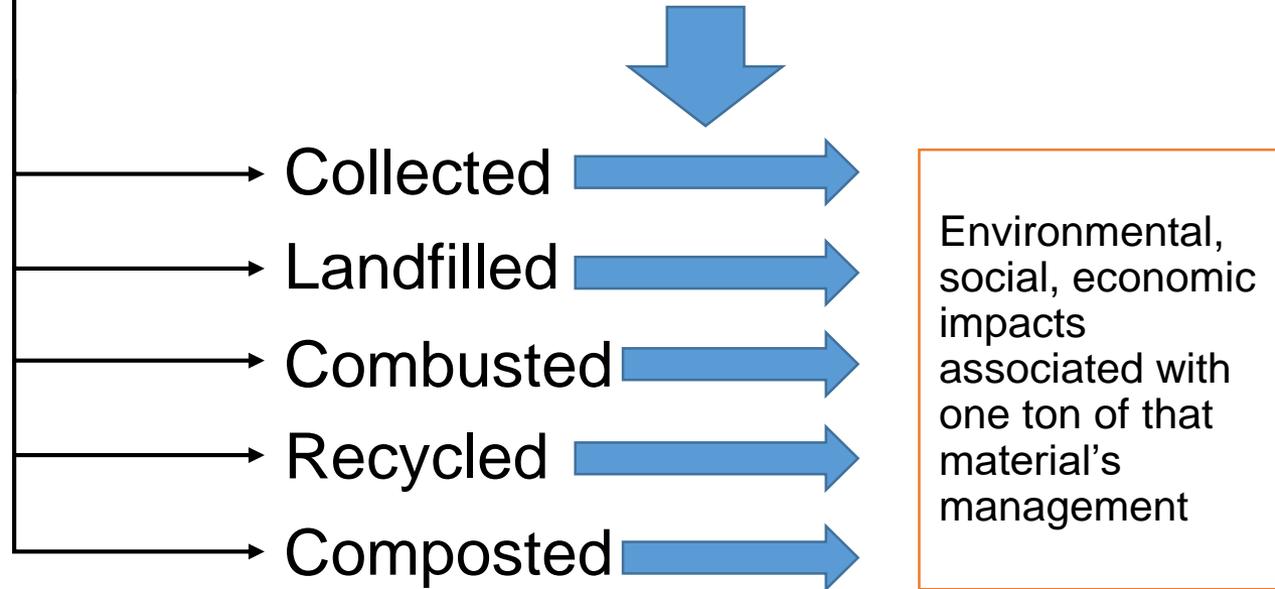
- **Refinements to the WasteCalc model** in a manner that retains its existing functionality
- **Incorporate SMM using metrics to measure environmental, social, and economic impacts** developed from the FY18/19 project, include new waste categories, and provide a **means to better integrate source reduction activities**
- **Develop necessary support materials** for future users and developers

HC19/20 Workbook-Based LCA Tool

WasteCalc and New
Data Collected

County's can estimate each materials' mass

HC18/19 Workbook Tool



HC 19/20 Tasks

- **Task 1:** Research on source reduction and material reuse
- **Task 2:** Identify missing material categories
- **Task 3:** Develop missing impact factors
- **Task 4:** Refine the WasteCalc Model
- **Task 5:** Provide training and training materials

Discussion

- How should we define source reduction?
- How is source reduction reported?
- Are there any reuse facility operators?
- How can we get data from operations like Goodwill Ind.?
- Which material categories should be tracked but are not?

Looking Beyond Florida's 75% Recycling Goal: Development of a Methodology and Tool for Assessing Sustainable Materials Management Recycling Rates in Florida

The way in which many think about solid waste in the US is shifting. The US Environmental Protection Agency (EPA), for example, has adopted the approach of sustainable materials management (SMM) instead of solid waste management (both in spirit and literally in terms of a name change). In Florida, thanks to funding from the Hinkley Center and several municipalities, the University of Florida has begun to evaluate SMM as an approach as well. One tangible outcome of this research will be the development of a tool that can be used by local governments and the Florida Department of Environmental Protection (FDEP) to estimate and compare alternative recycling rates based on specific waste streams, composition, disposition, and life cycle assessment impact factors (e.g., GHG emissions and energy use). Project Scope: [HC18Scope](#)

Progress Reports

- Progress Report 1: [HC18PR01](#)
- Progress Report 2: [HC18PR02](#)
- Progress Report 3: [HC18PR03](#)
- Progress Report 4: [HC18PR04](#)

TAG Meeting Presentations

- May 2018 TAG Meeting: [HC18STAKEHOLDERMAY13](#)



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Dr. Timothy G. Townsend

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Research

Florida Solid Waste Issues

Tool to Track Progress Toward SMM Goals

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

In SMM it is important to evaluate the economic, social, and environmental impacts of a decision. Results from the Hinkley Center FY18/19 project can be used in conjunction with WasteCalc to produce estimates of these impacts. Another important SMM principle is reducing consumption of materials. Examples of activities that lead to less materials consumed include reusing products or instructing consumers to change their purchasing habits. Many of these activities are referred to as source reduction activities which may be defined as changes in design, manufacture, purchase or use of materials that reduces the amount of materials entering the waste stream. A need exists to incorporate measuring and tracking source reduction activities in Florida. We propose to develop a comprehensive tool that includes: 1) the WasteCalc functions and refined functions; 2) metrics to measure environmental, social, and economic impacts developed from the FY18/19 project; and 3) a method to measure Florida source reduction activities.

Project Scope: [HC19Scope](#)

Progress Reports

Thank You!