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

&

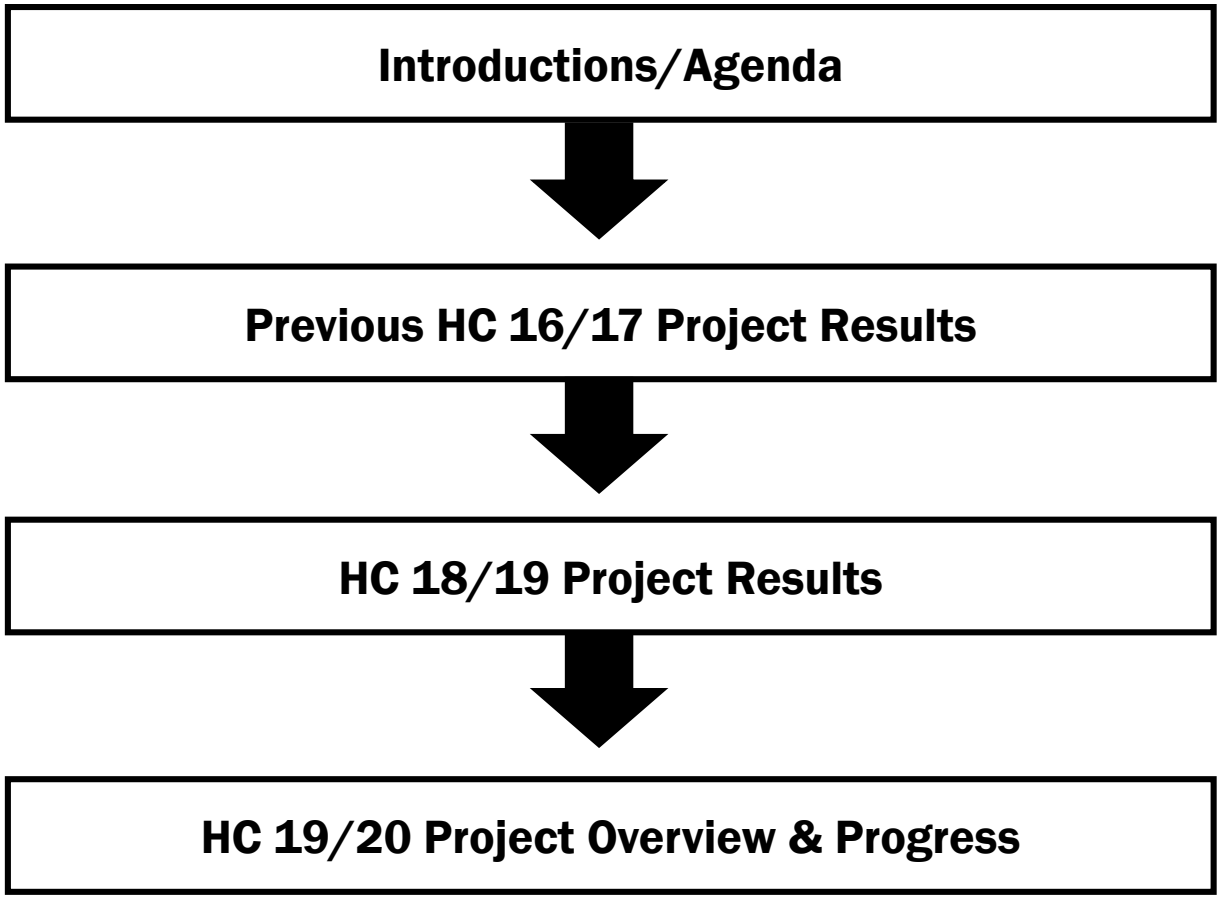
An Integrated Tool for Local Government to Track Materials Management and Progress toward Sustainability Goals

January 10th, 2020

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

University of Florida

Today's Goals

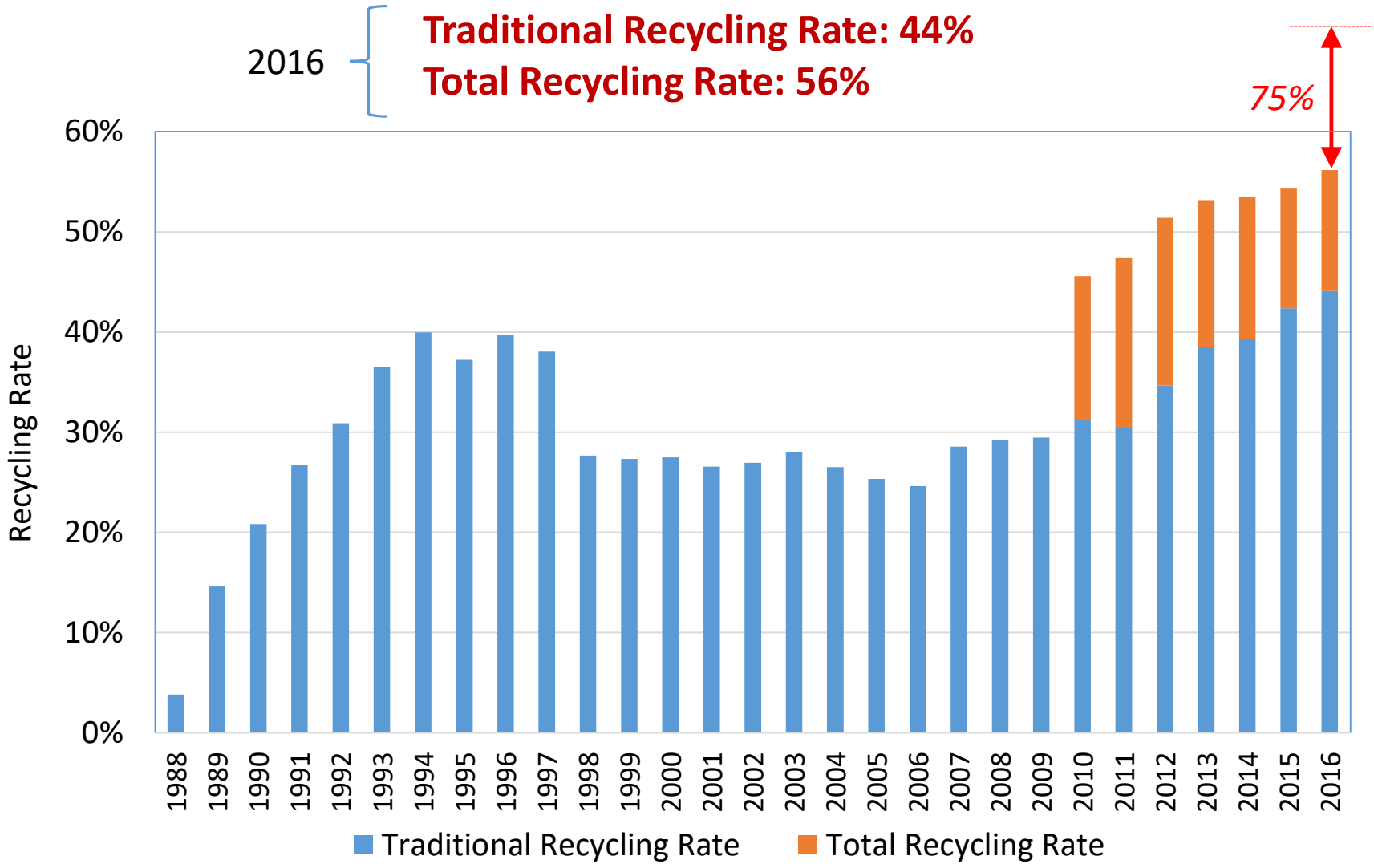


Projects History

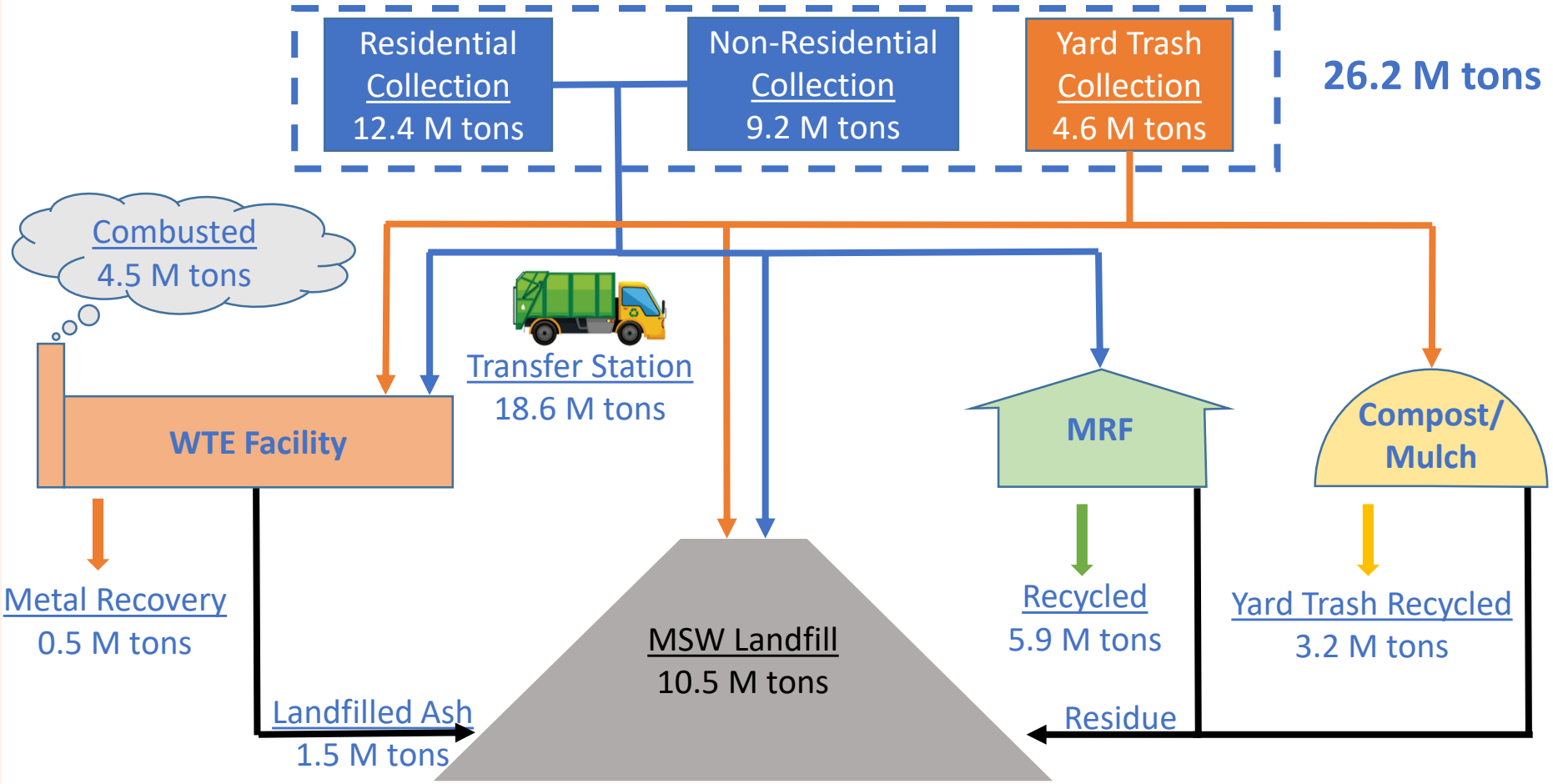
2016

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

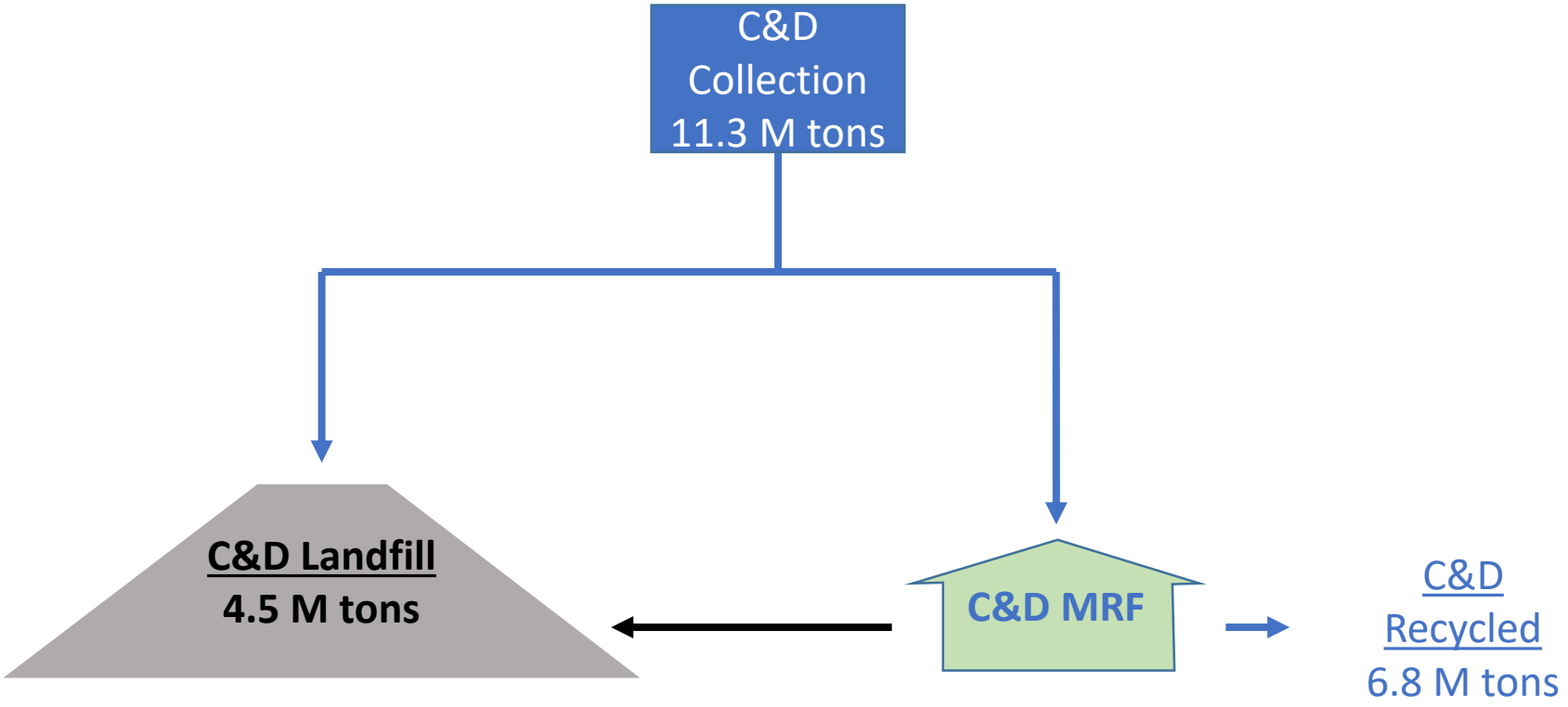
Florida's Recycling Rate



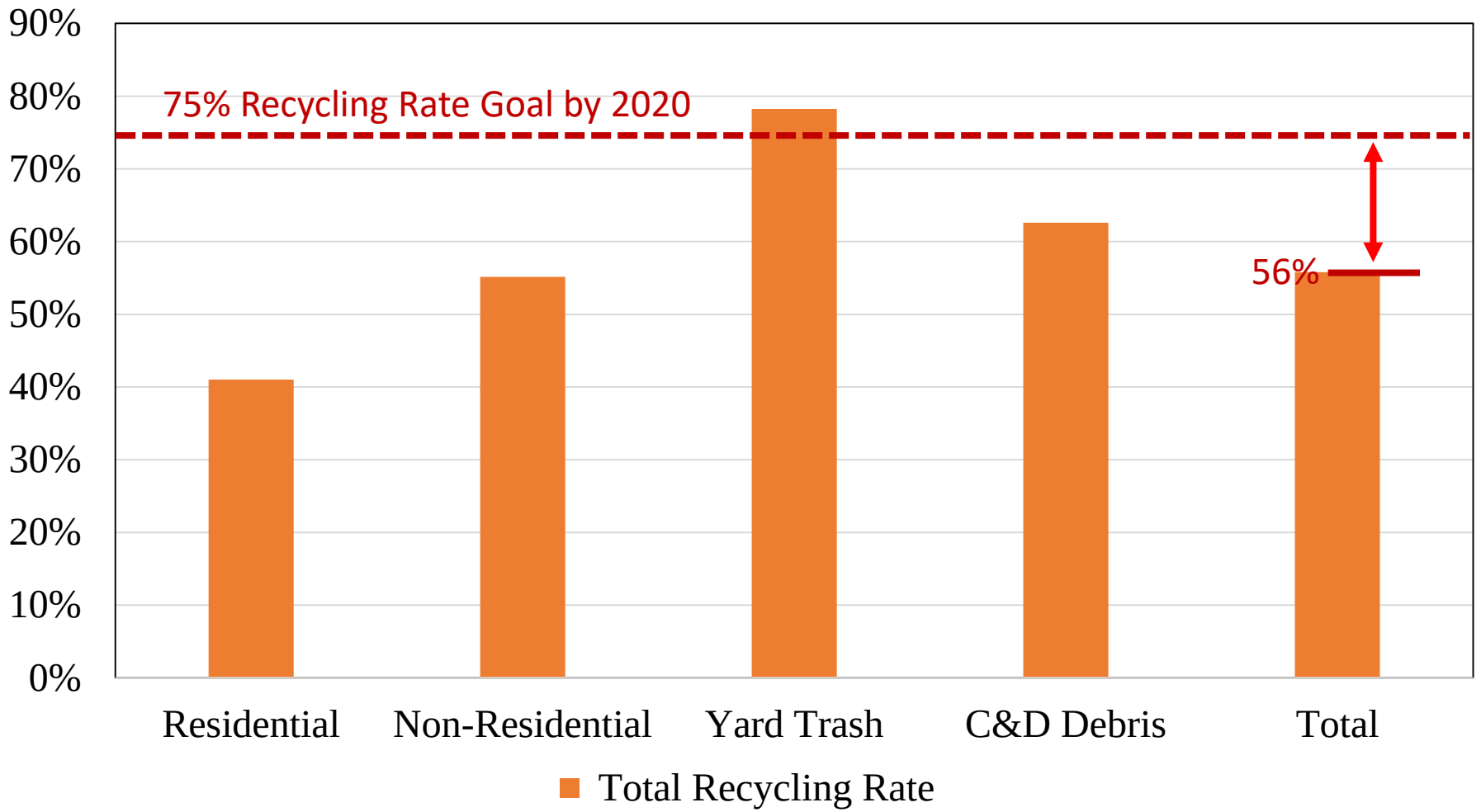
Florida Material Mass Flow (2016)



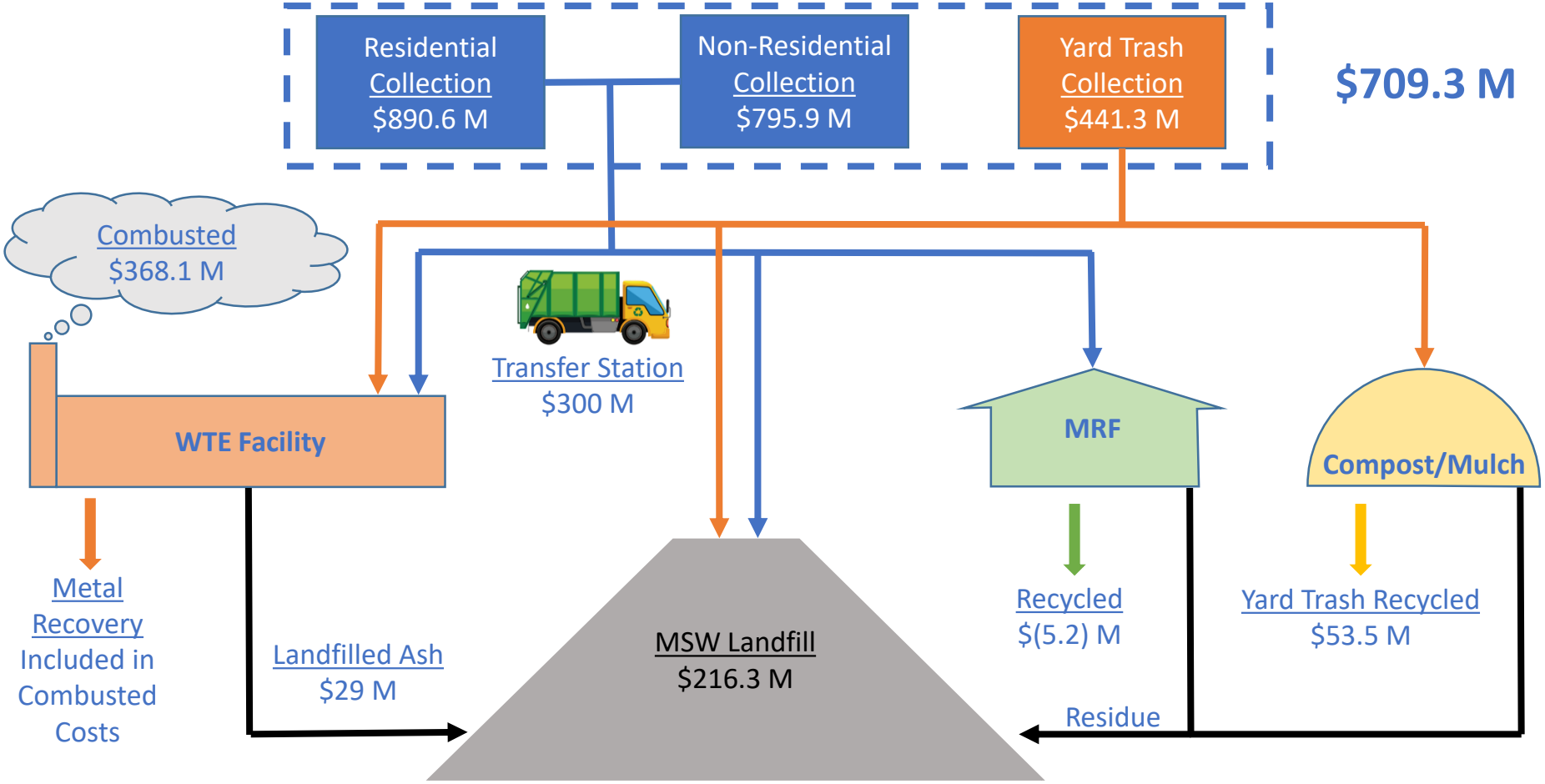
Florida Material Mass Flow (2016)



Generator Recycling Rates (2016)



Florida Material Cost Flow (2016)



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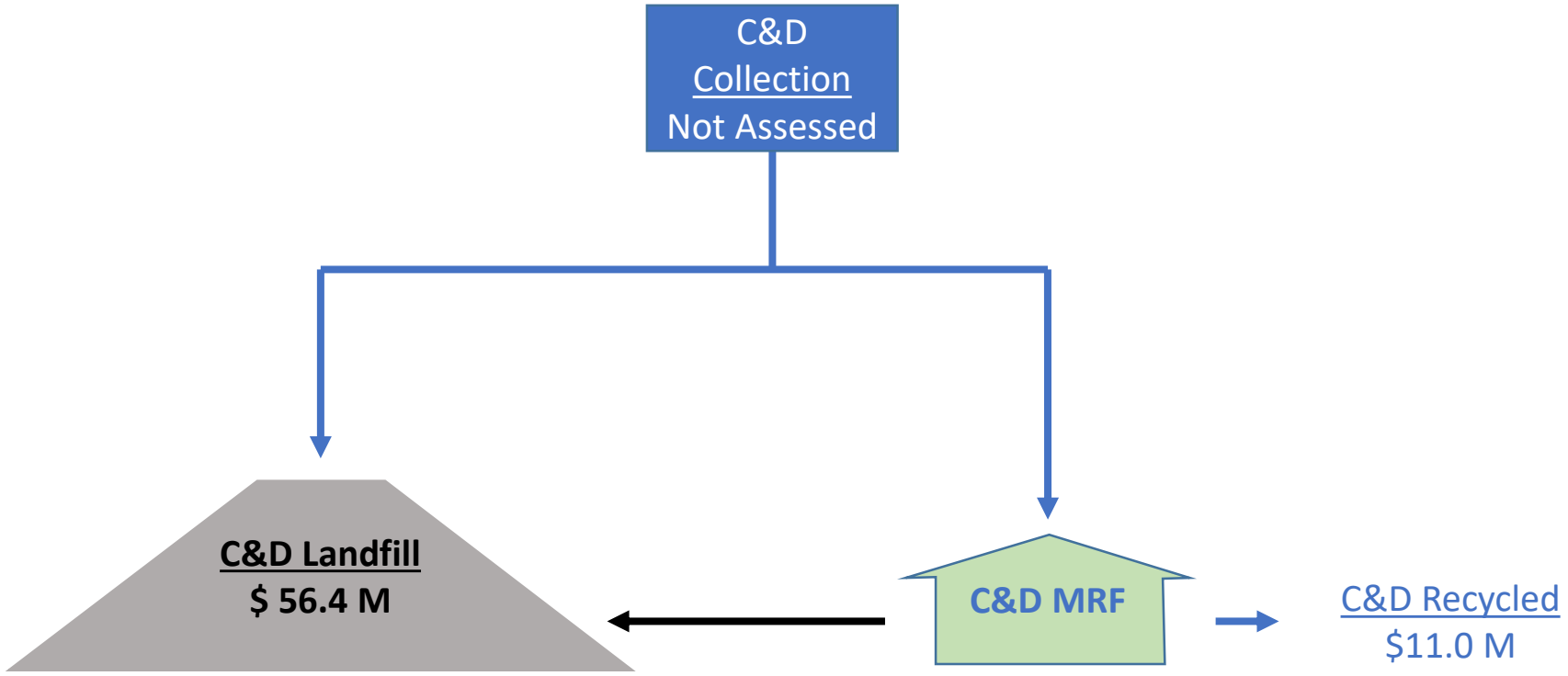


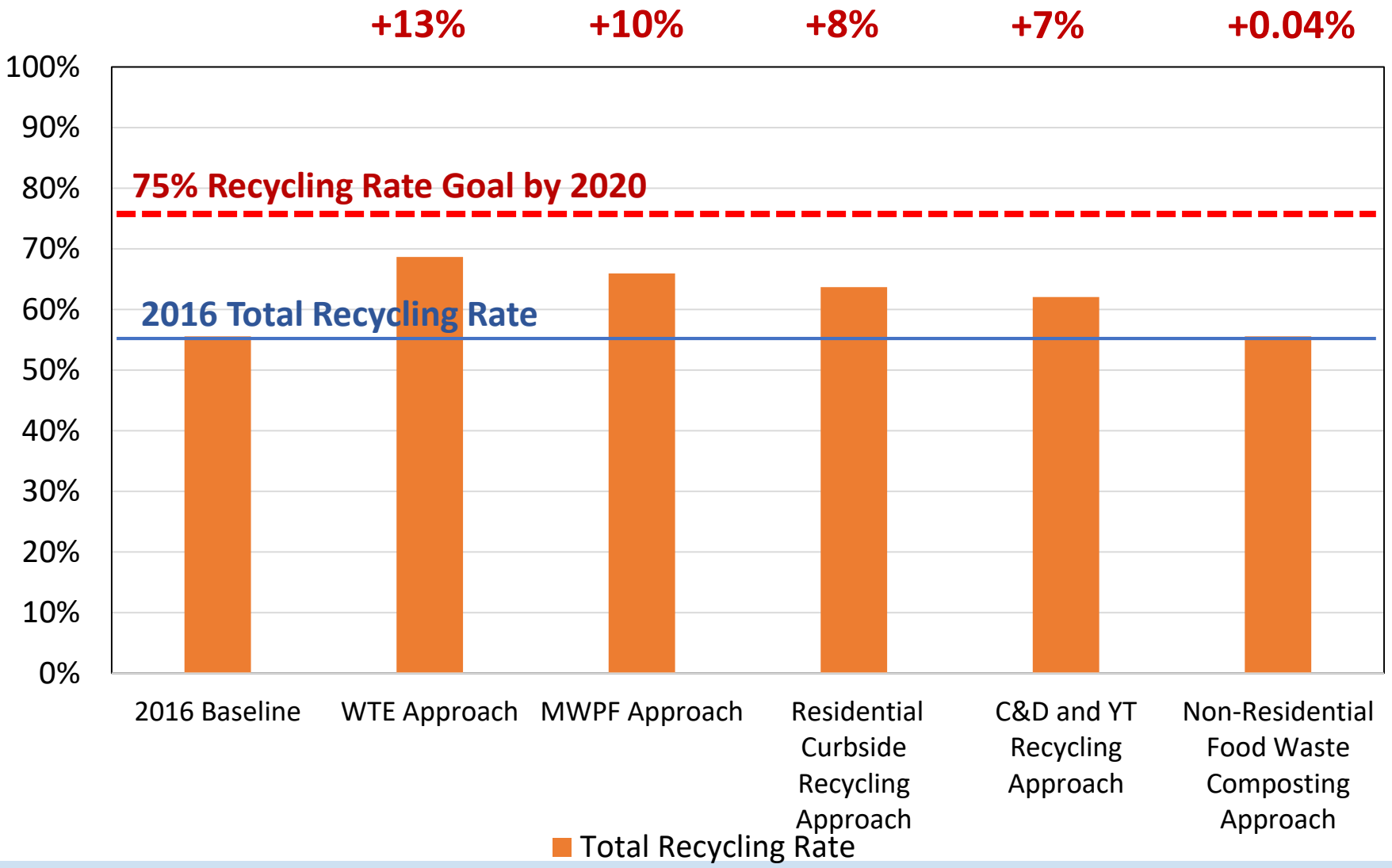
Total Costs (not including Transfer Station): $2.9 Billion
Total Costs (including Transfer Station): $3.2 Billion

Evaluating Reaching 75% Using Different Approaches

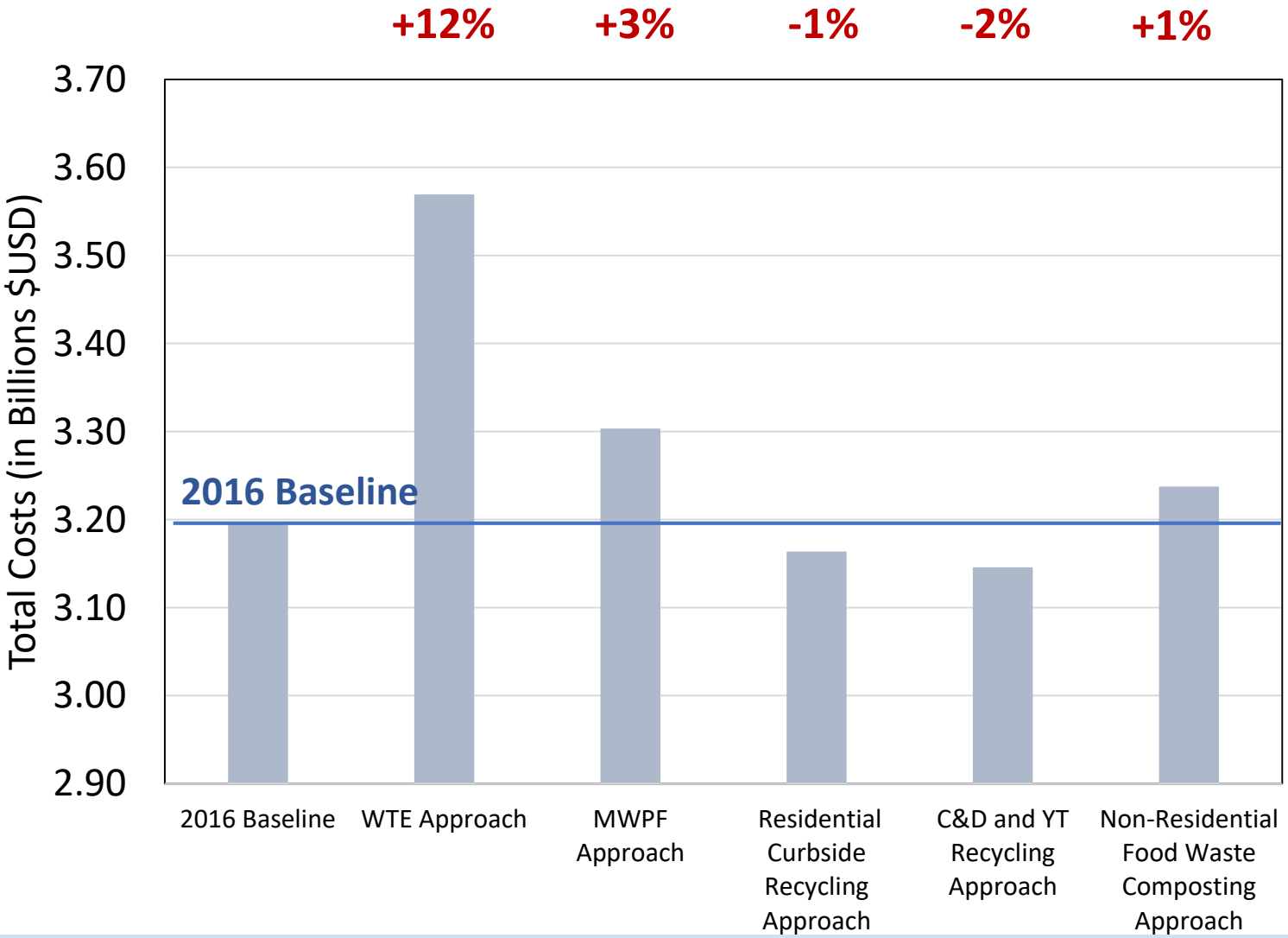
1. Waste-to-Energy (WTE) Approach
2. Mixed Waste Processing (MWP) Approach
3. Mandatory Residential Curbside Recycling Approach
4. Mandatory Construction & Demolition Debris (C&D) and Yard Trash (YT) Recycling Approach
5. Mandatory Non-Residential Food Waste Composting Approach

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

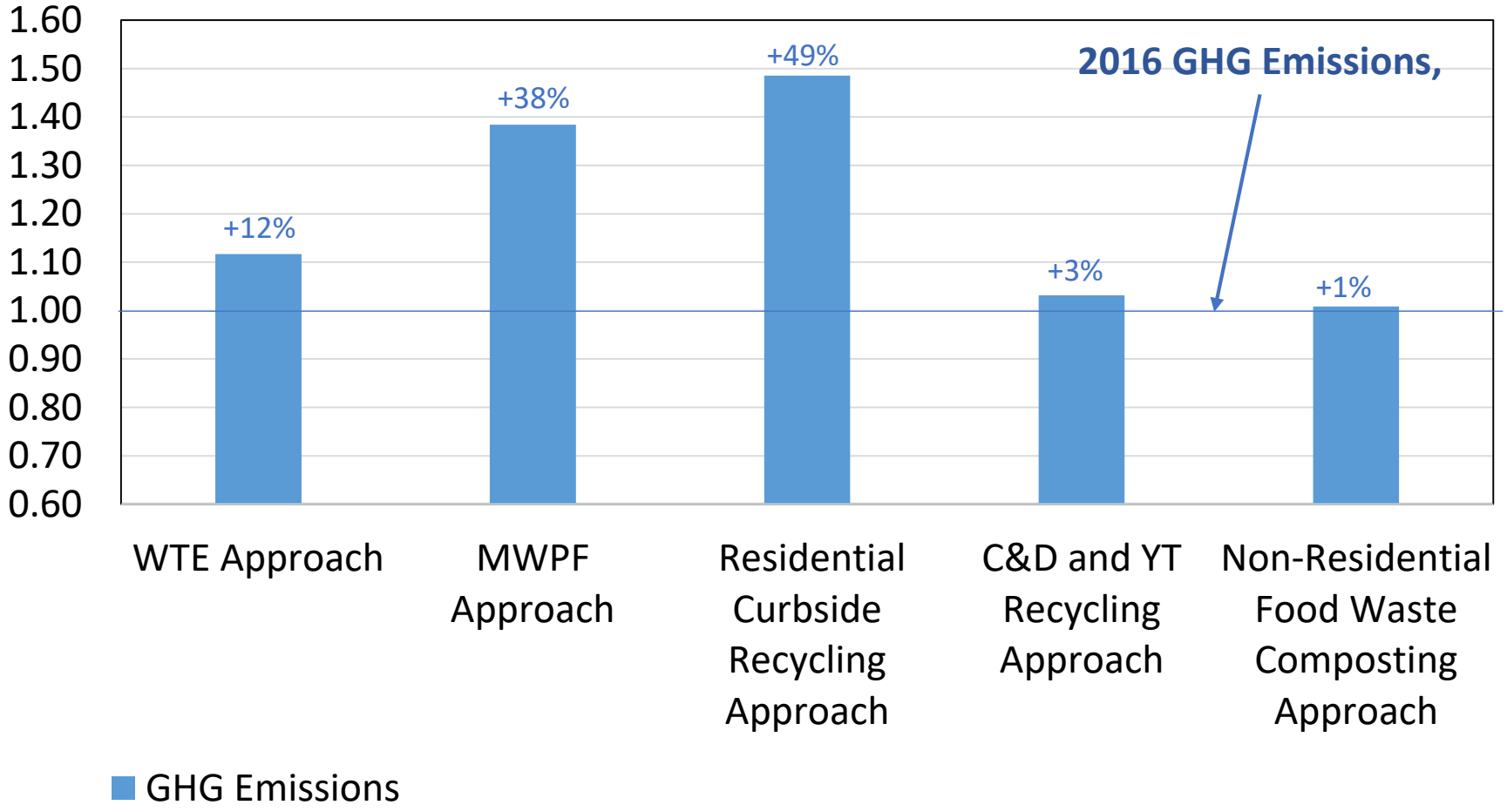
Impact on Recycling Rates (Percentage Points)



Impact on Costs (2016)

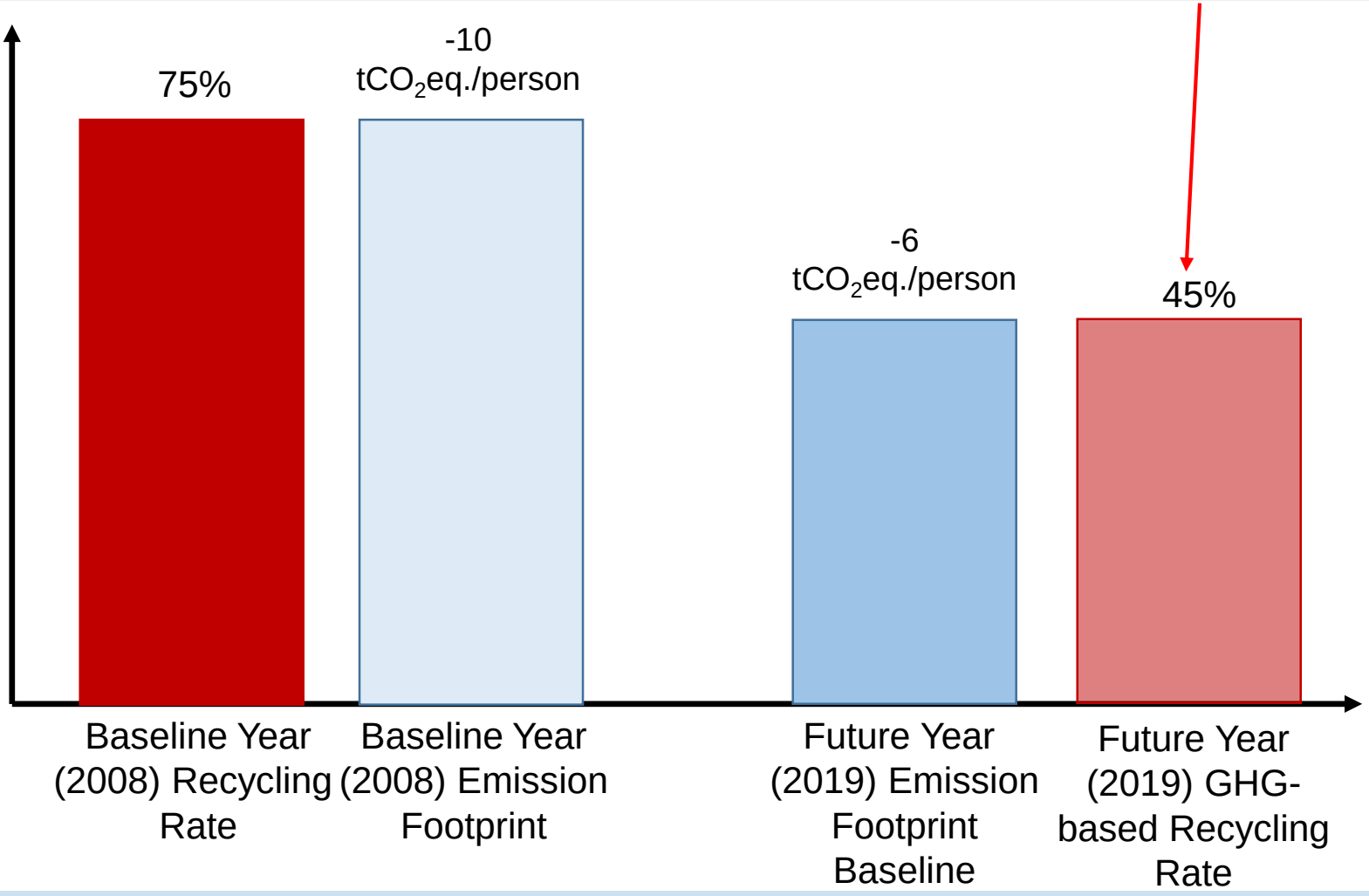


Impact on GHG Emissions (2016)



Using environmental impacts in goal setting

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



Projects History

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

FDEP WasteCalc Upate

WasteCalc Functionality

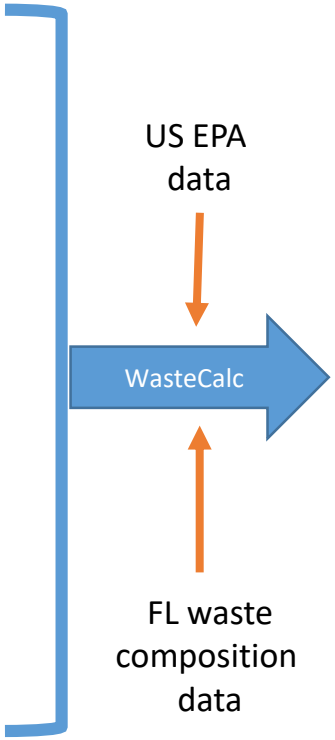
Input

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

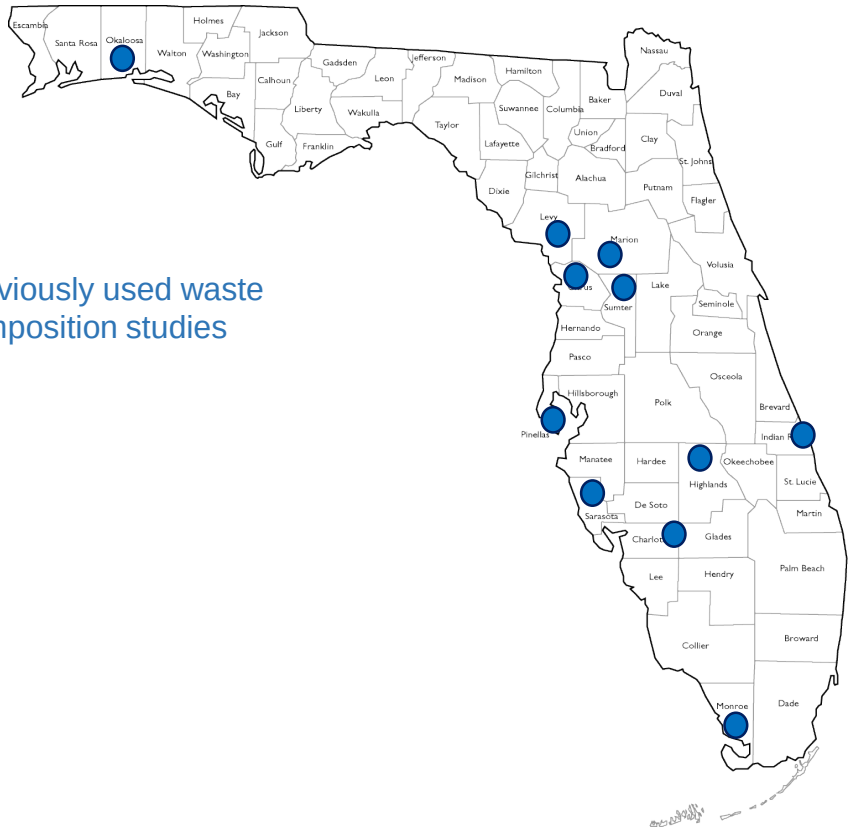
Landfilled Tons

Combusted Tons

Behind the Scenes



Waste Composition Data



Previously used waste composition studies

WasteCalc Functionality

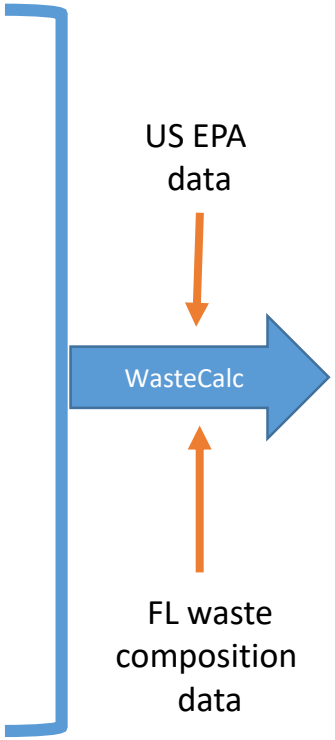
Input

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

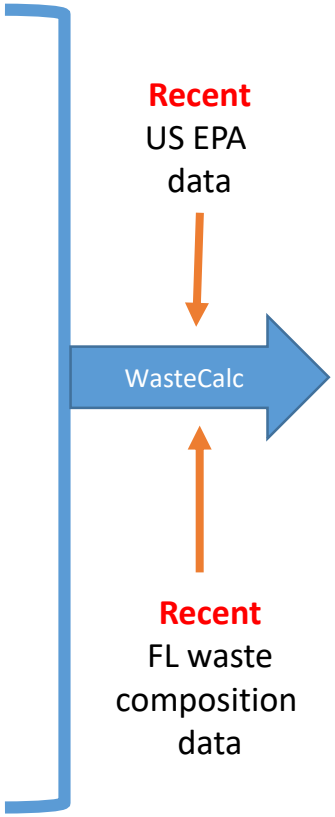
Recycled Tons	
Newspaper	Ferrous Metals
Glass	White Goods
Aluminum Cans	Non Ferrous Metals
Plastic Bottles	Other Paper
Steel Cans	Textiles
Corrugated Boxes	C&D Debris
Office Paper	Food Waste
Yard Trash	Miscellaneous
Other Plastics	Tires

Landfilled Tons

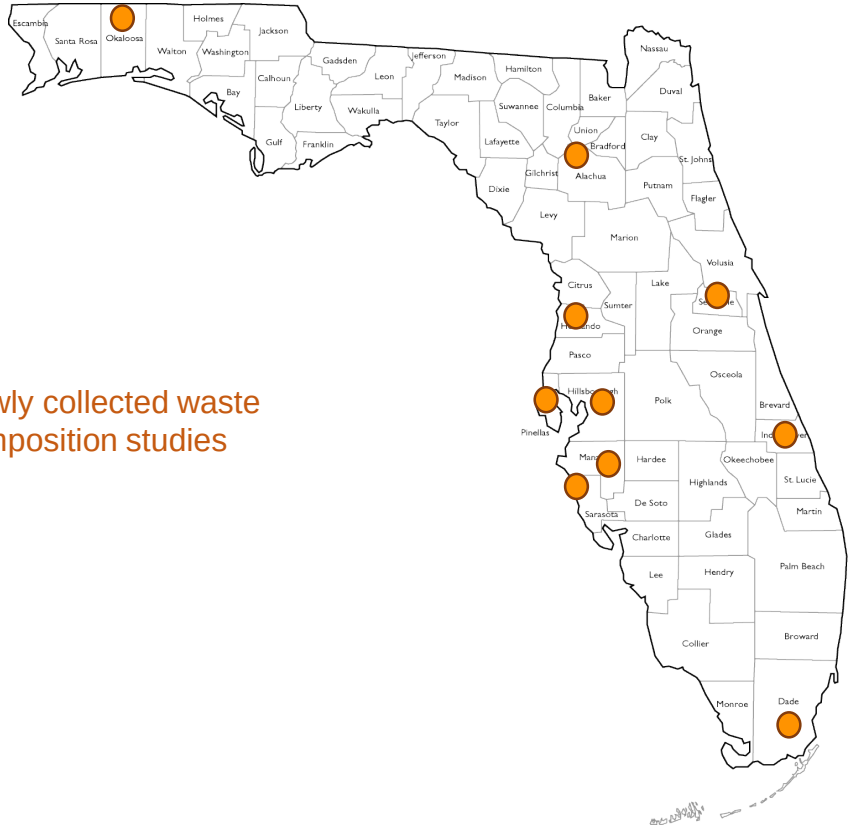
Combusted Tons

Collected C&D Tons

Behind the Scenes



Waste Composition Data



Newly collected waste composition studies

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

Behind the Scenes

Recent US EPA data

WasteCalc

Recent FL waste composition data

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

Projects History

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

FDEP WasteCalc Upate

Hinkley Center Looking beyond Florida's 75% Recycling Goal: Development of a Methodology and Tool for Assessing Sustainable Materials Management Recycling Rates in Florida **(HC17/18 Project)**

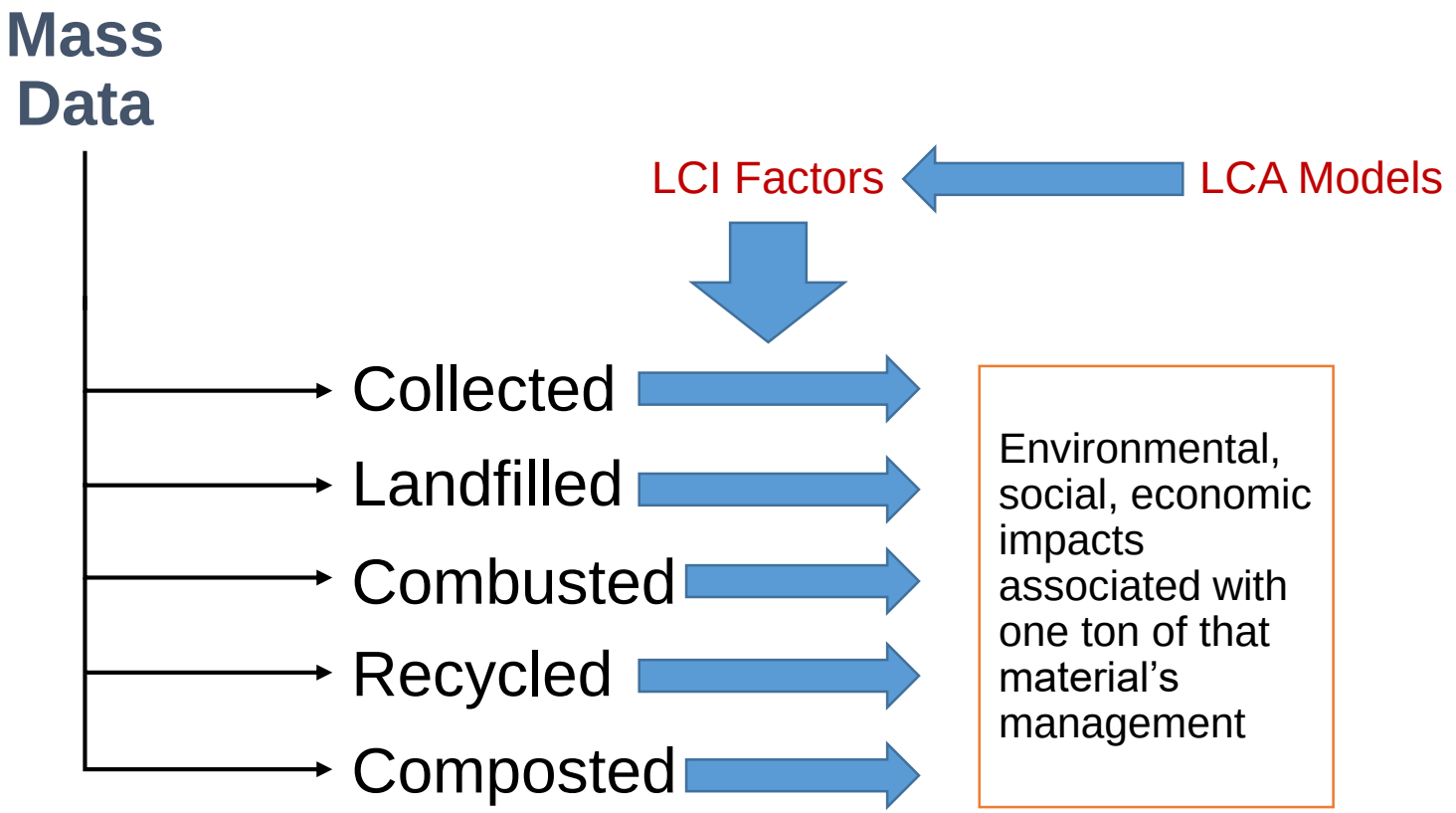
HC 18/19 Project Objectives

- **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

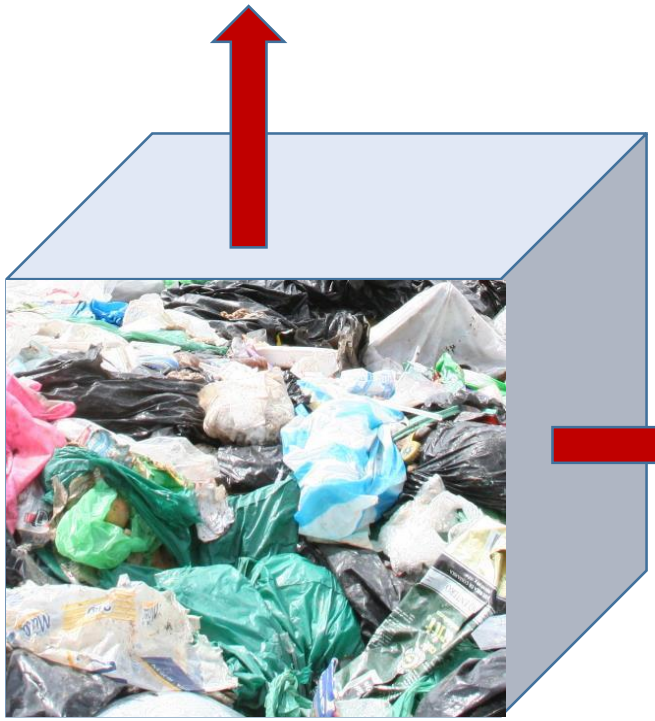
- **Task 1:** Compile available data on lifecycle impact factors
- **Task 2:** Develop lifecycle impact factors (LCI)
- **Task 3:** Create a LCA tool
- **Task 4**: Use the tool to evaluate best materials management approaches in Florida

Workbook-Based LCA Toolc



LCI Factors

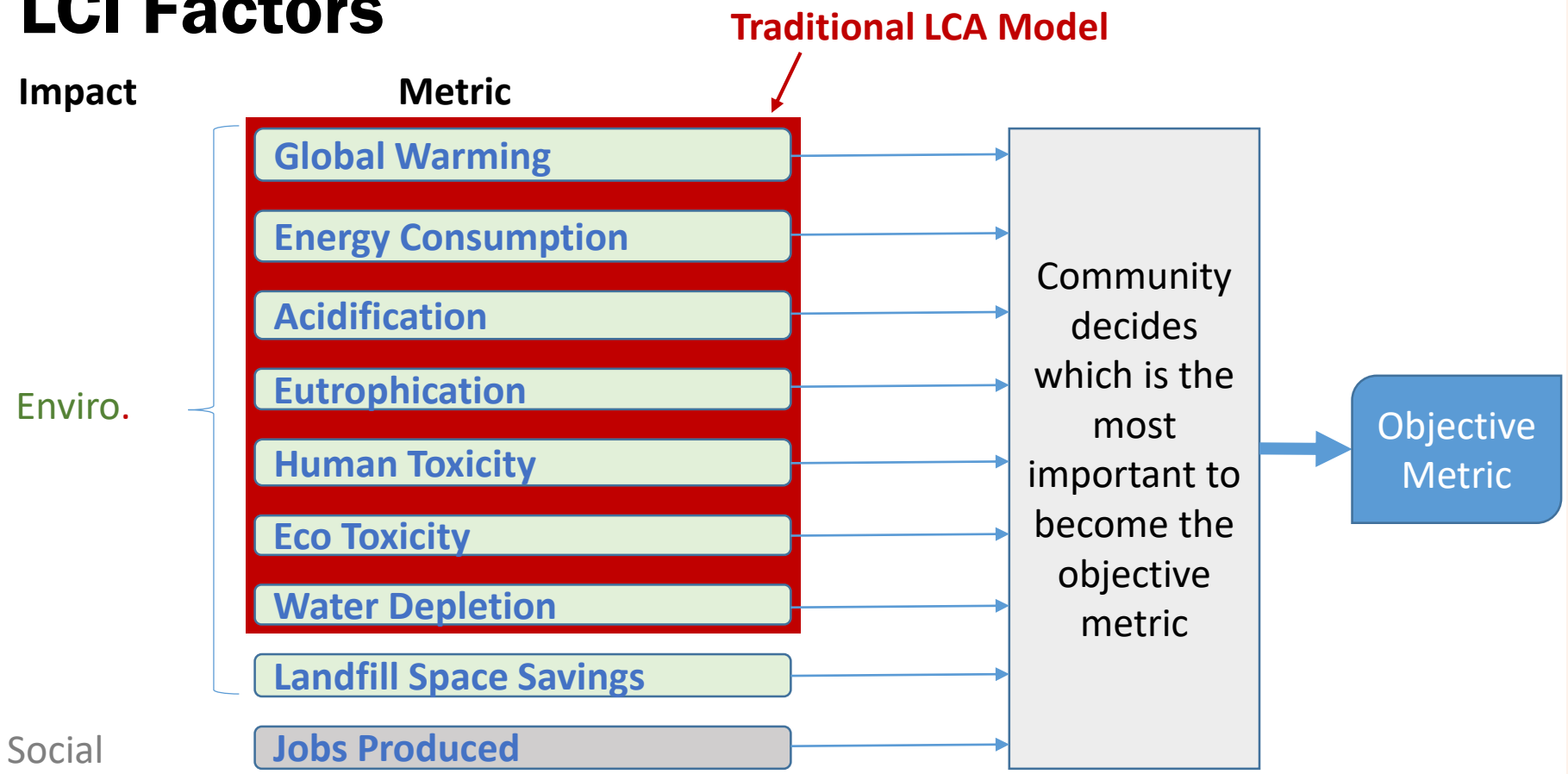
Metric Tons of CO_2 Equivalents (tCO2eq.)



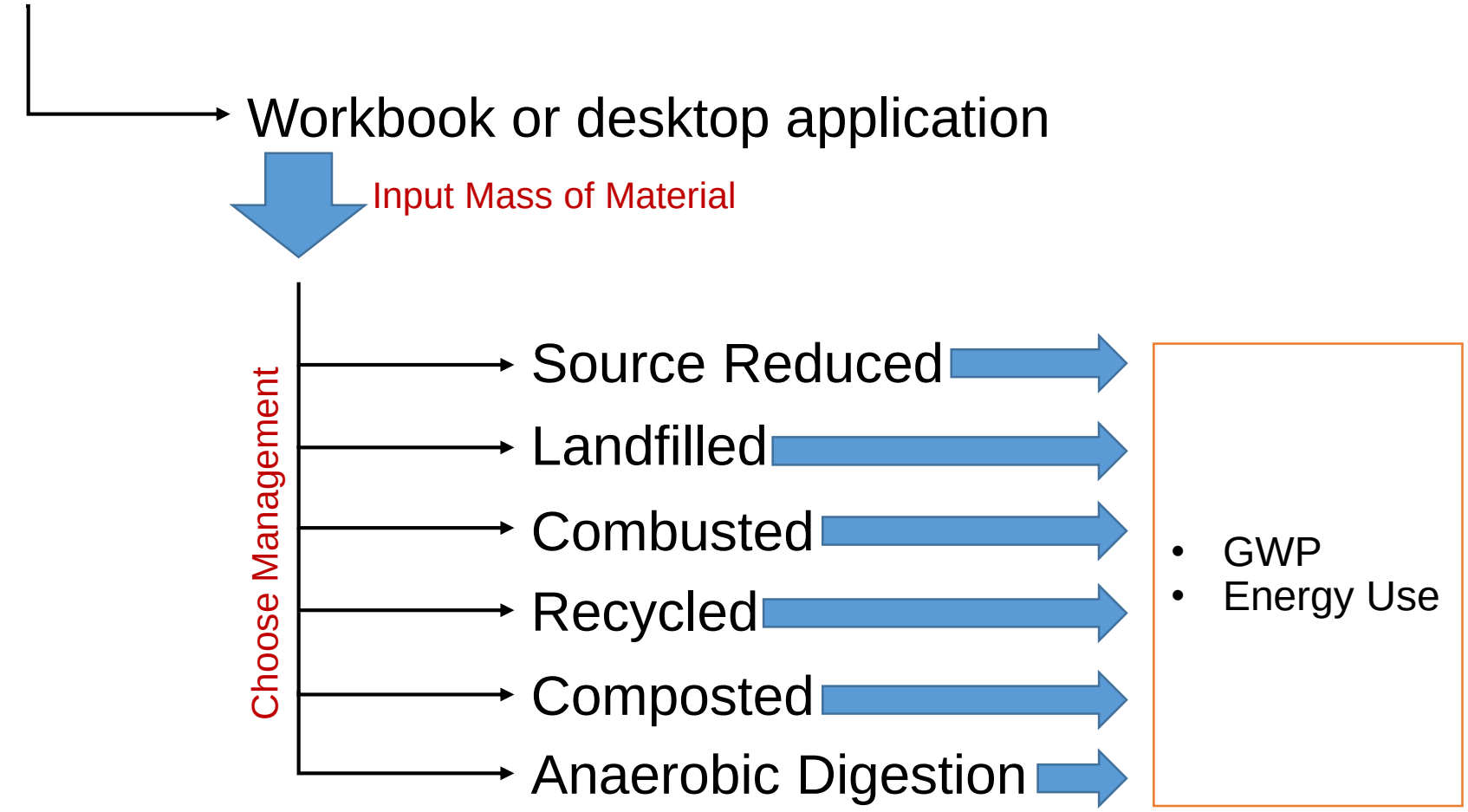
Mass of Waste

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

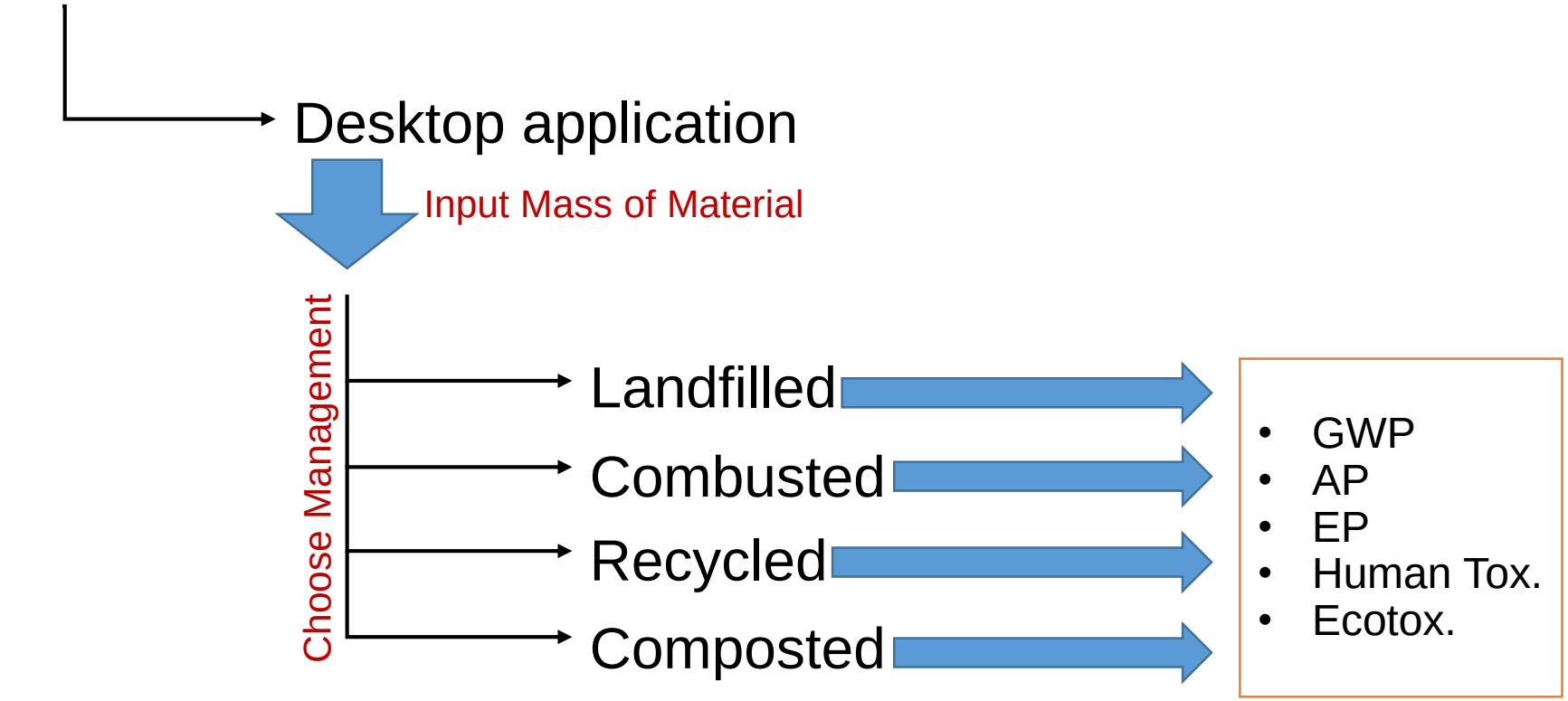
Methods of Obtaining Environmental-Based LCI Factors



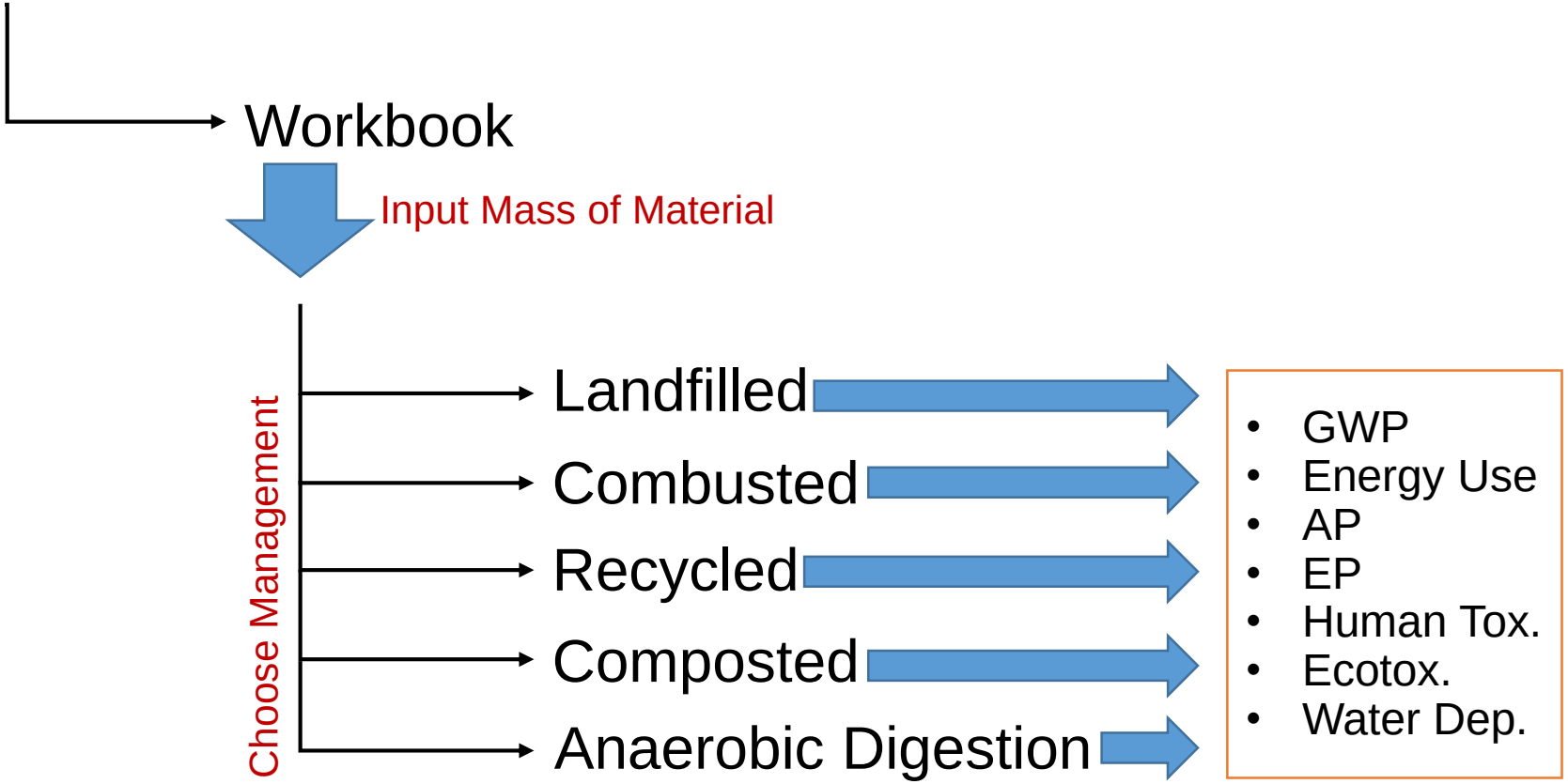
WARM (US, US EPA)



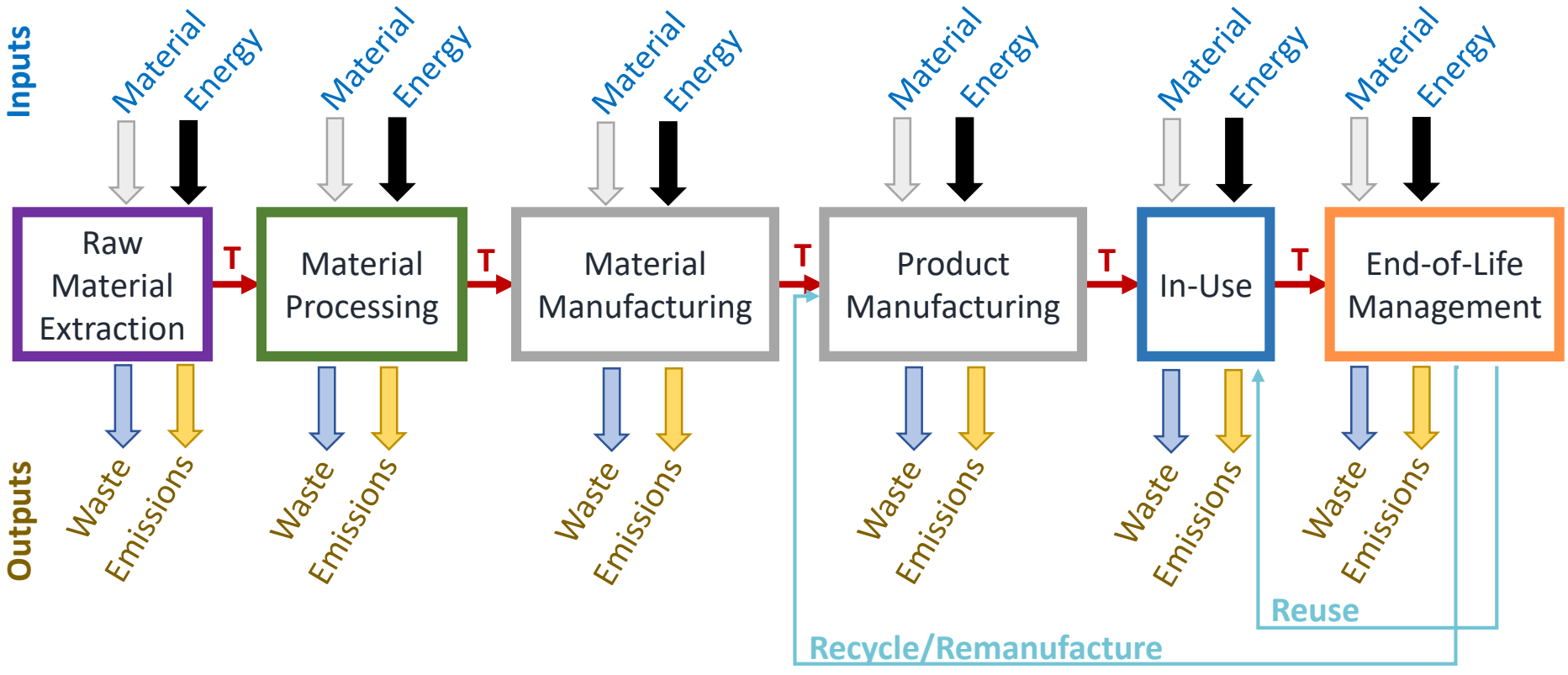
MSW-DST (US, US EPA)



SWOLF (US, NC State)



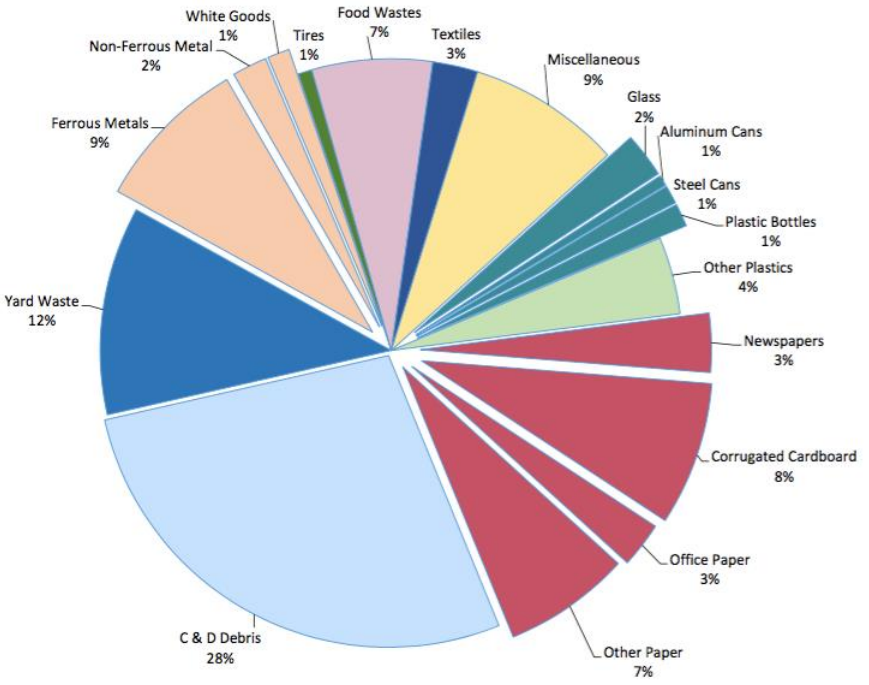
LCA Model Scope



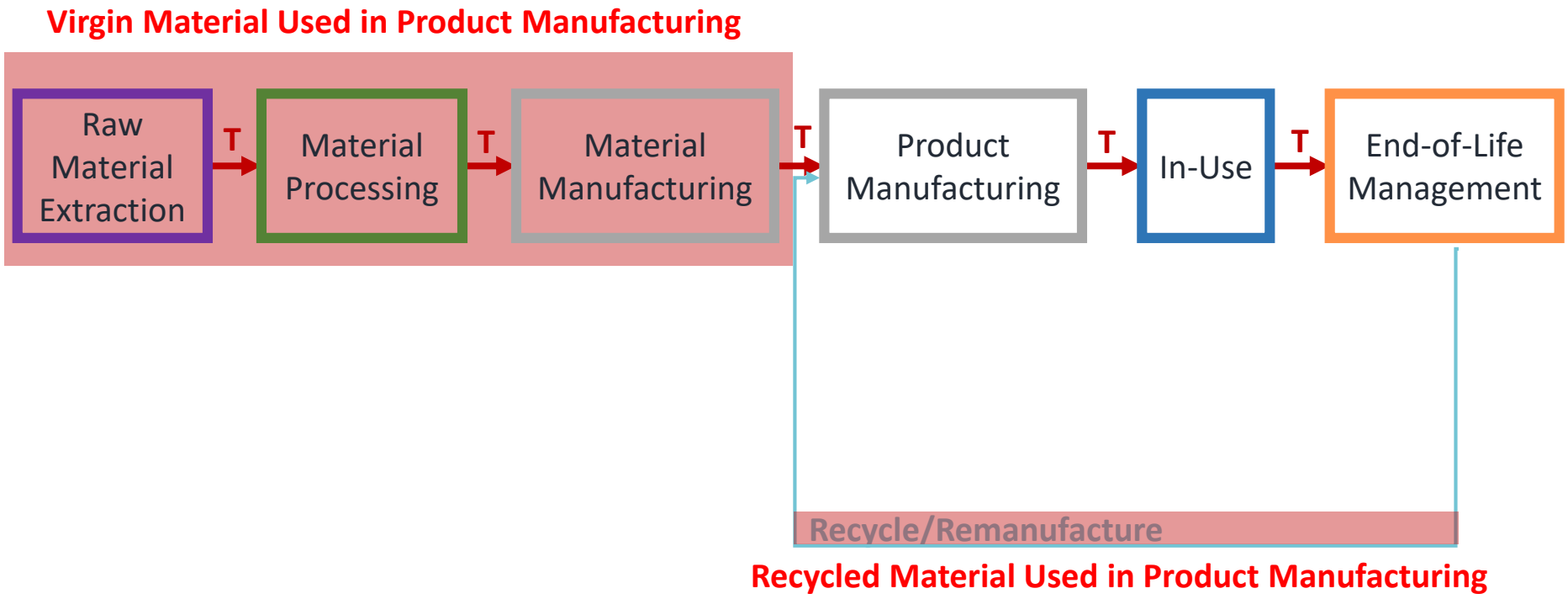
Use LCA to translate the inputs and outputs to environmental impacts (e.g., global warming potential)

Scope For Collection

$tCO_2eq.$



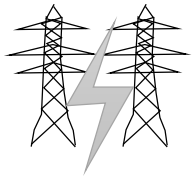
Scope For Recycling



Scope For Compositing

$tCO_2eq.$

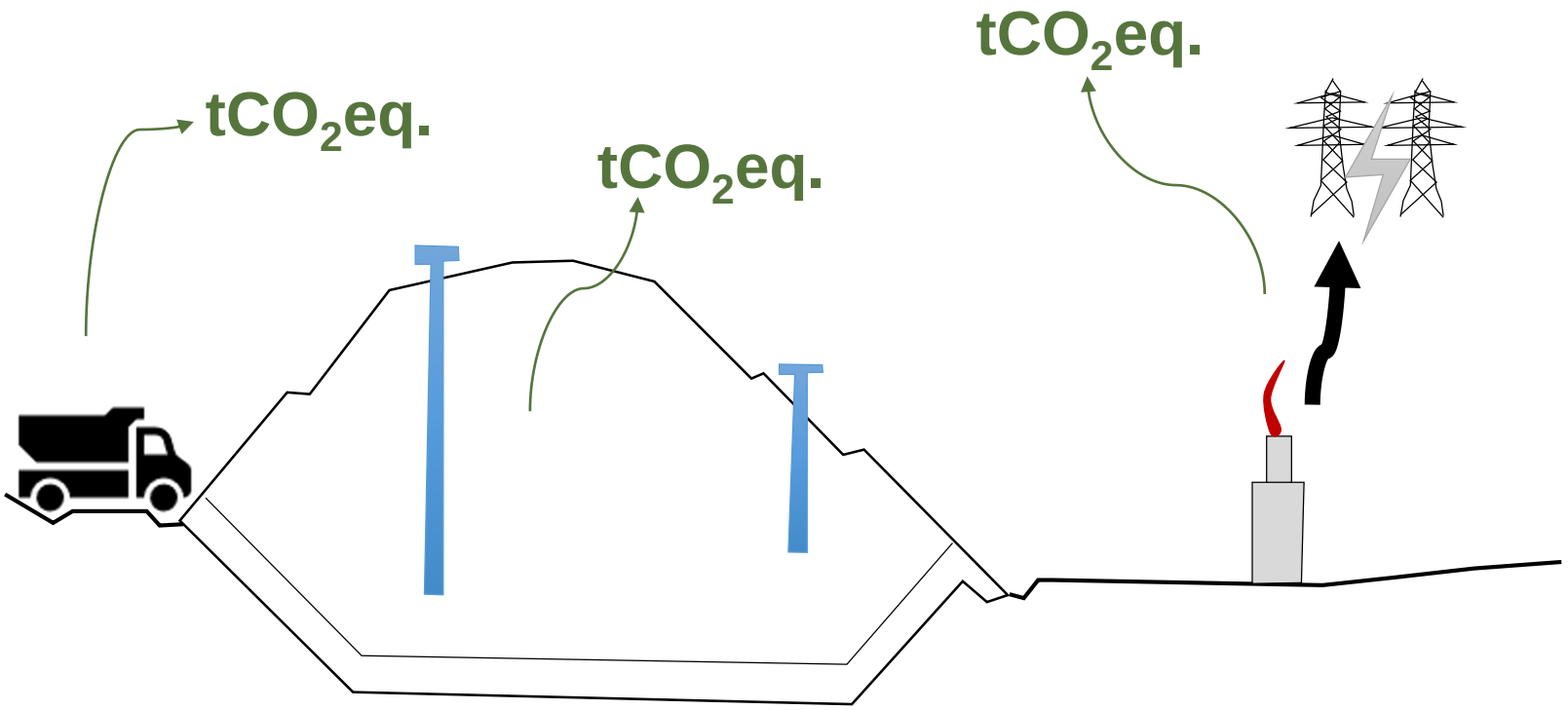
Scope For Anaerobic Digestion



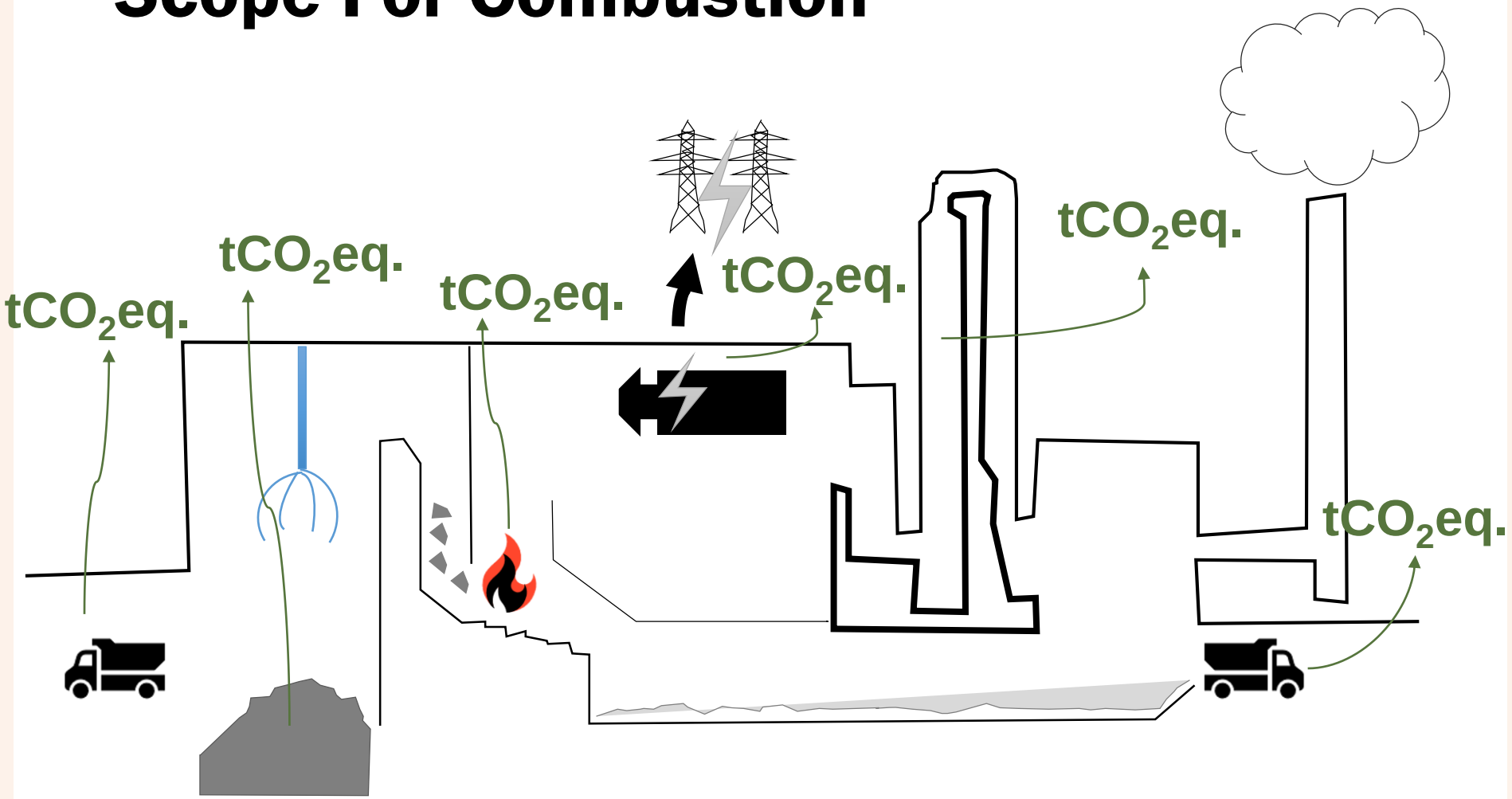
$tCO_2eq.$

$tCO_2eq.$

Scope For Landfill

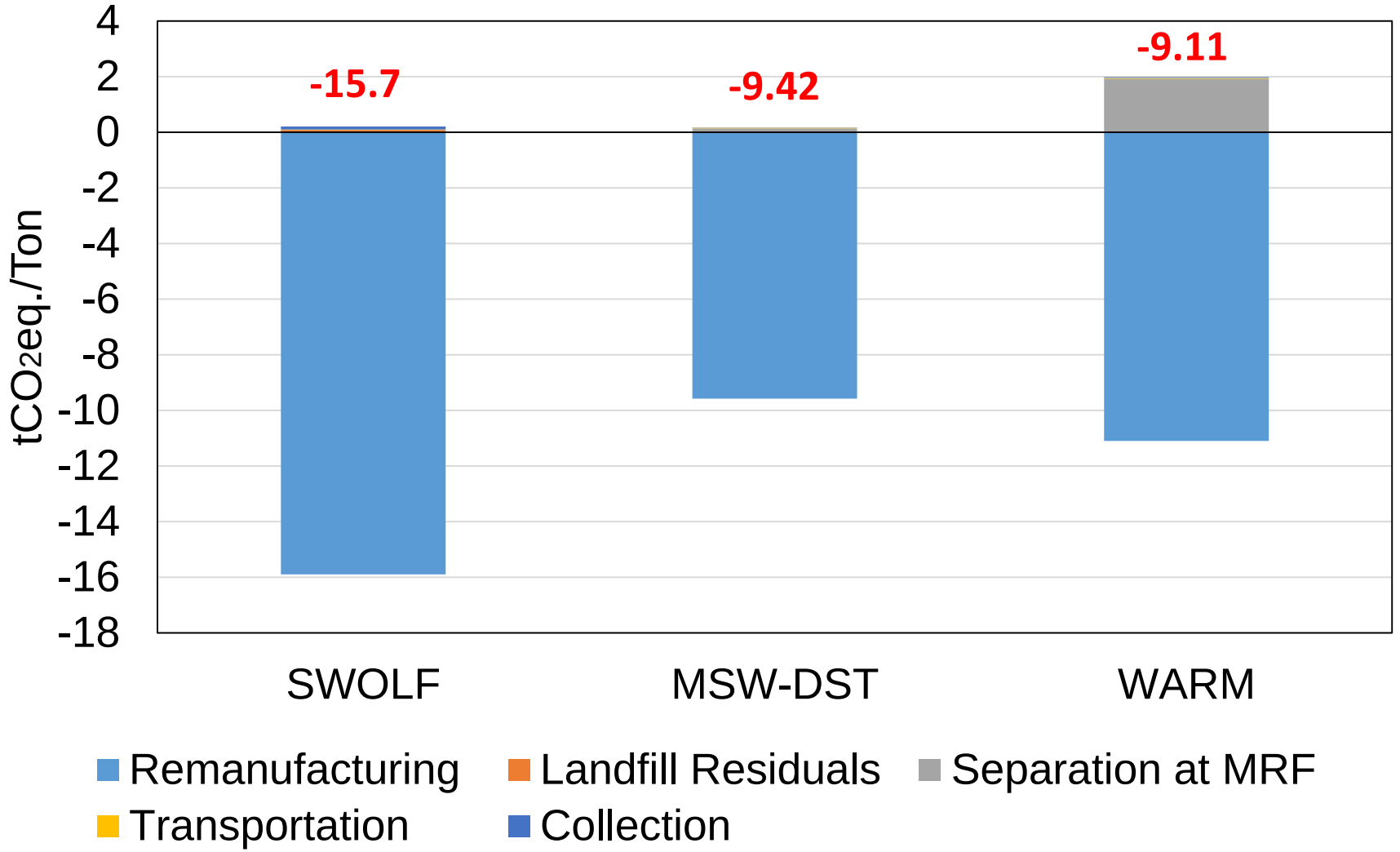


Scope For Combustion



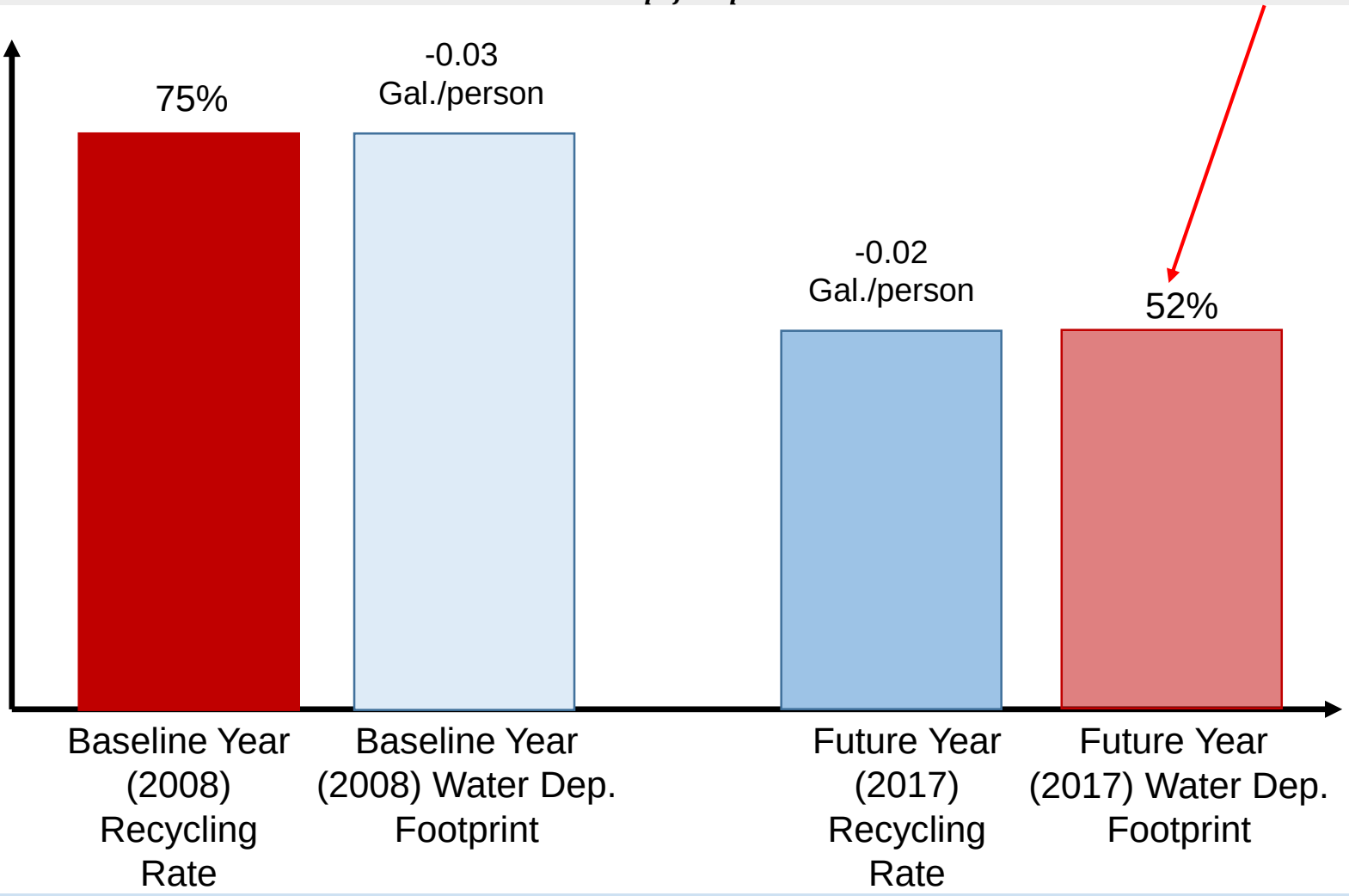
HC18/19 Workbook Tool

Recycling Aluminum Cans GHG Emission Factor ($tCO_2eq./ton$)



Using environmental impacts in goal setting

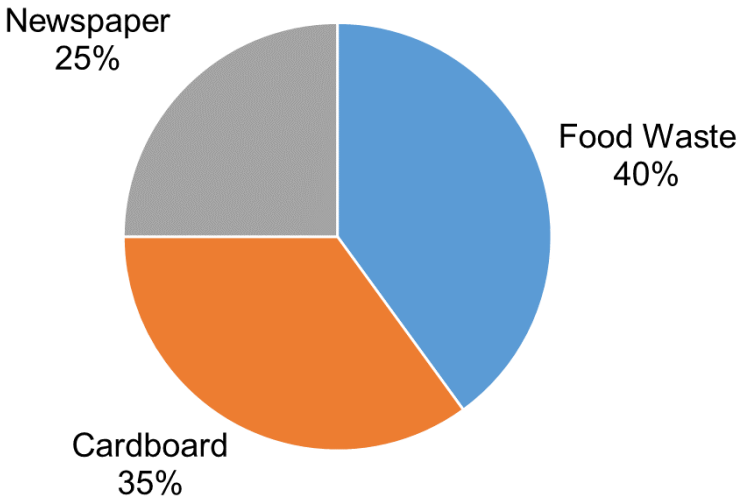
$$\text{Water Dep.-Based Recycling Rate} = \frac{\textit{Future Year Water Dep. footprint}}{\textit{Baseline Year Water Dep. footprint}} \left(\textbf{Target Recycling Rate}\right) = \text{X\%}$$



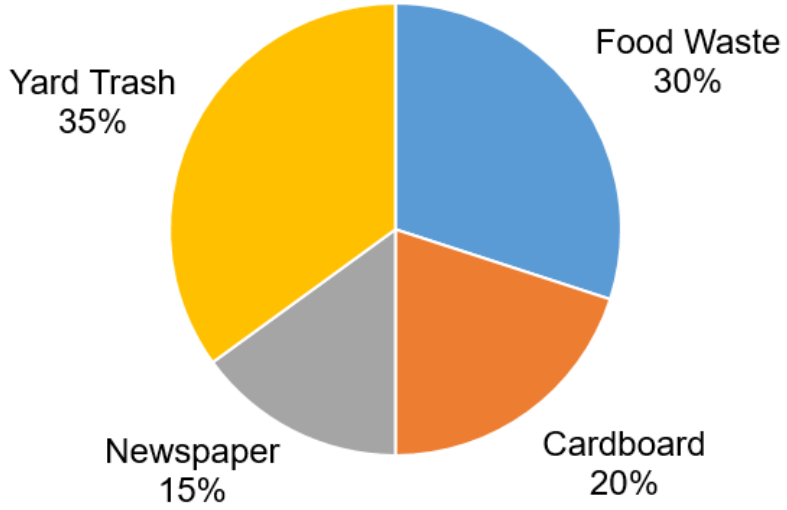
Task 4: Use the tool to evaluate best materials management approaches in Florida

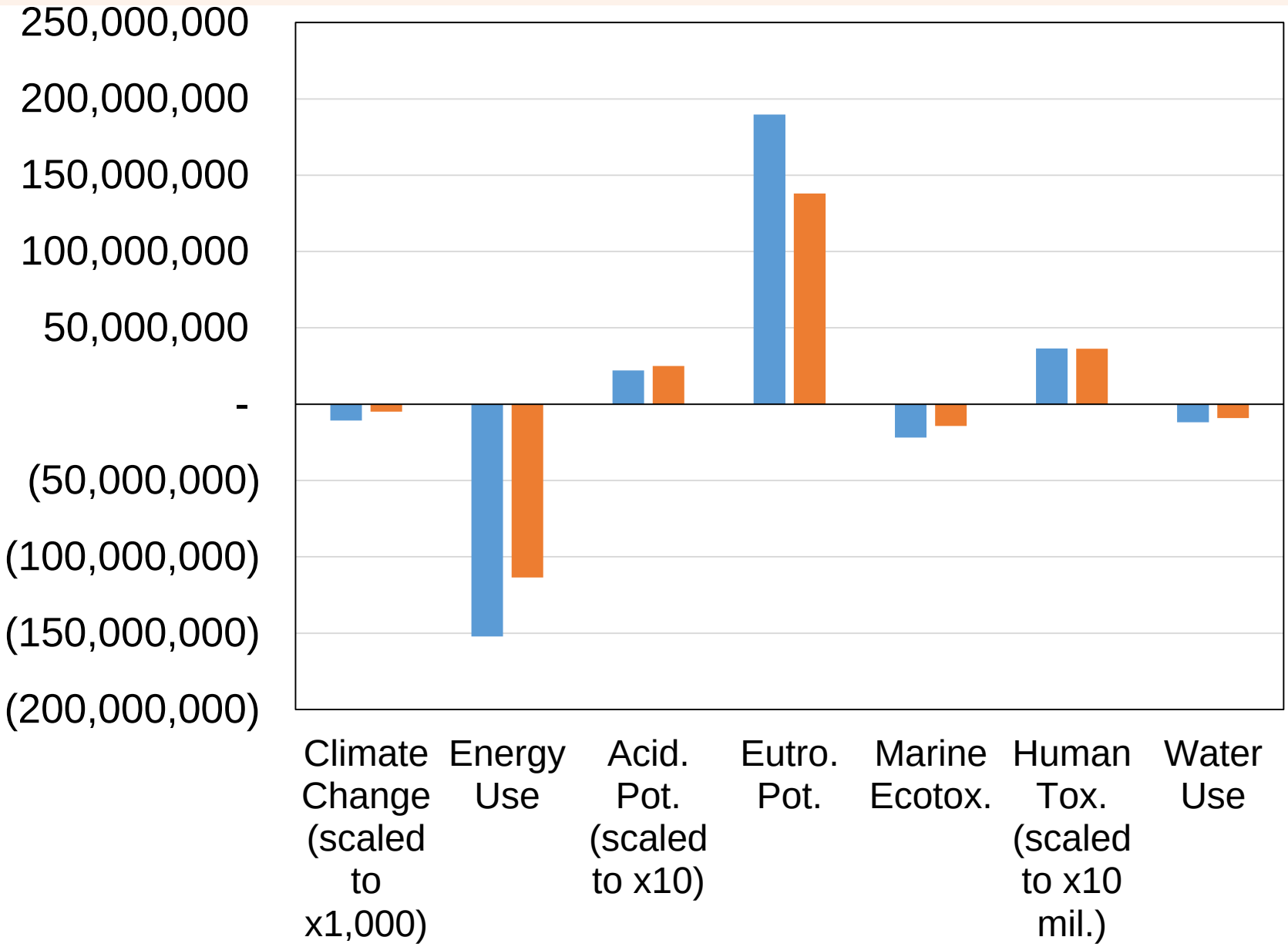
Hypothetical: 100,000 Tons with two varying compositions and desired to be anaerobically digested

Scenario 1

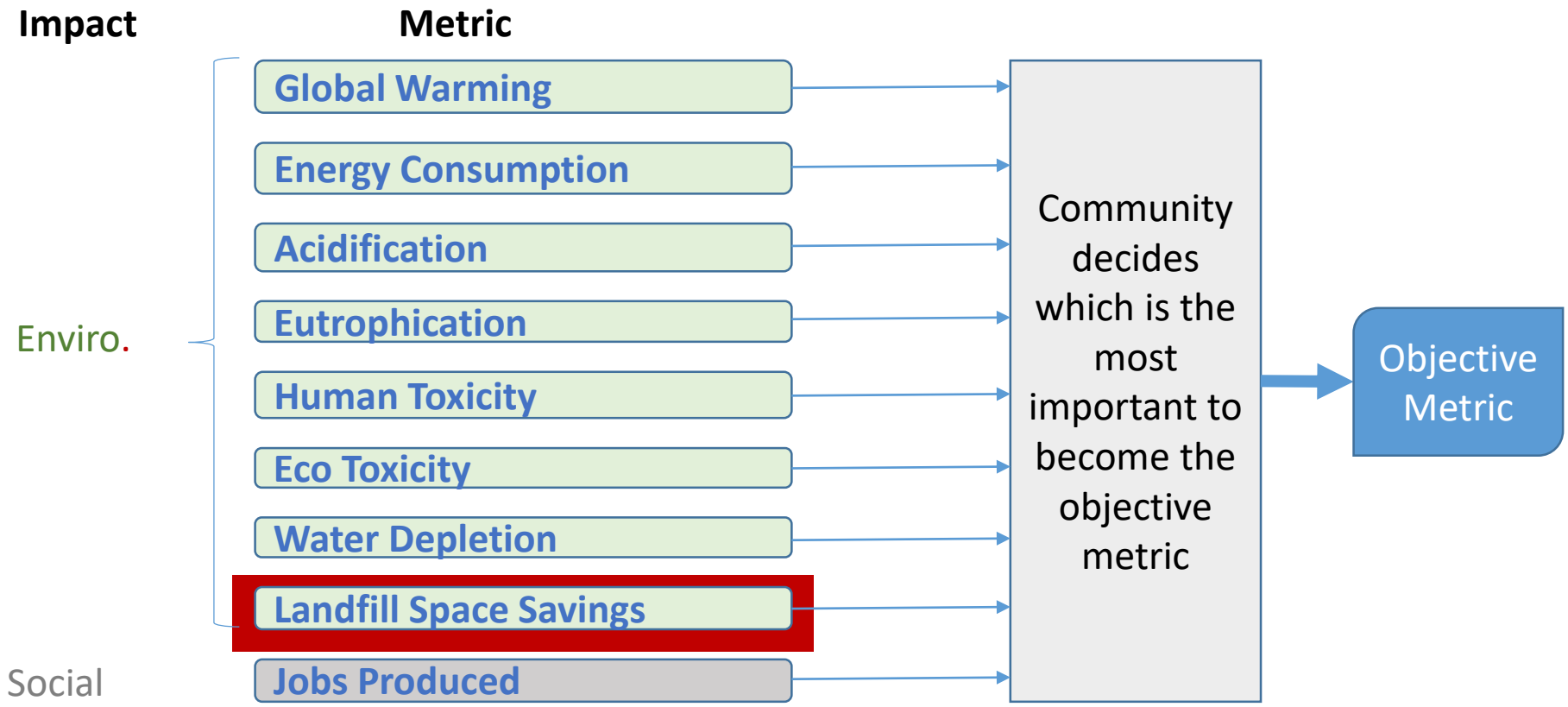


Scenario 2




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

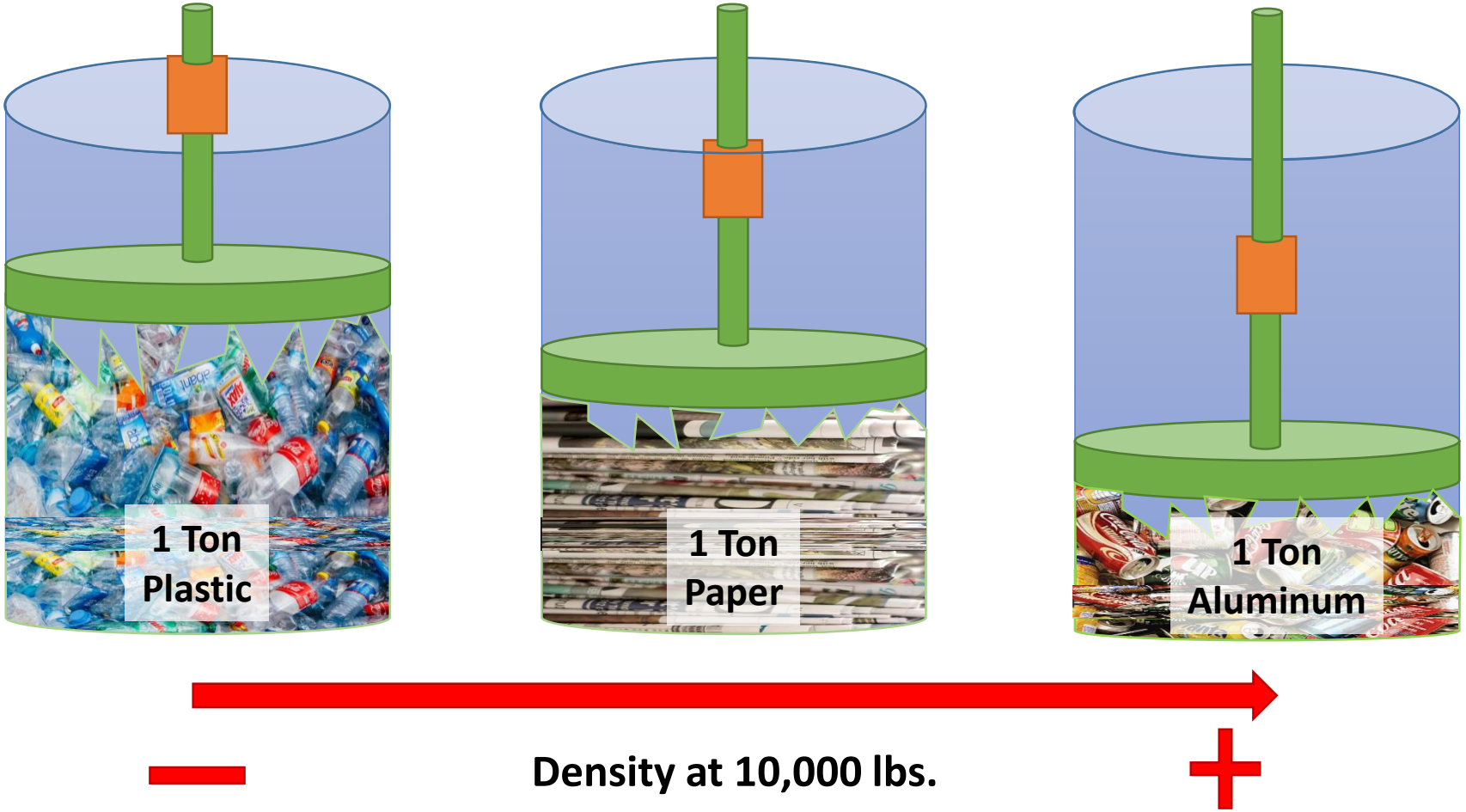


Landfill Space Savings

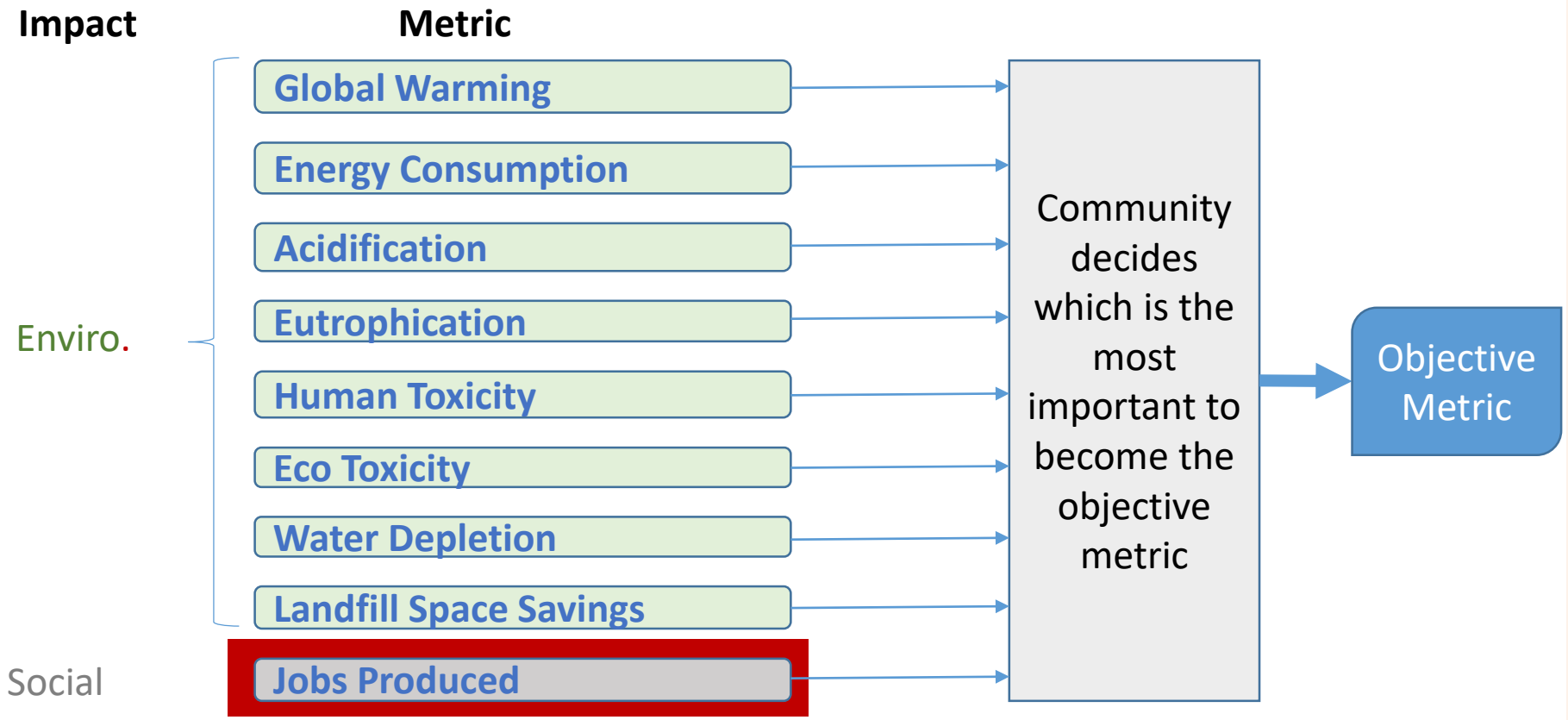
Waste Compacted
In Landfill that is 100 ft deep

Landfill Space Savings

Landfill Space Savings



Methods of Obtaining Environmental-Based LCI Factors



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FDEP WasteCalc Upate

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FDEP WasteCalc & Waste Compositions

WasteCalc Workbook

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FDEP WasteCalc Upate

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(HC17/18 Project)

FDEP WasteCalc & Waste Compositions

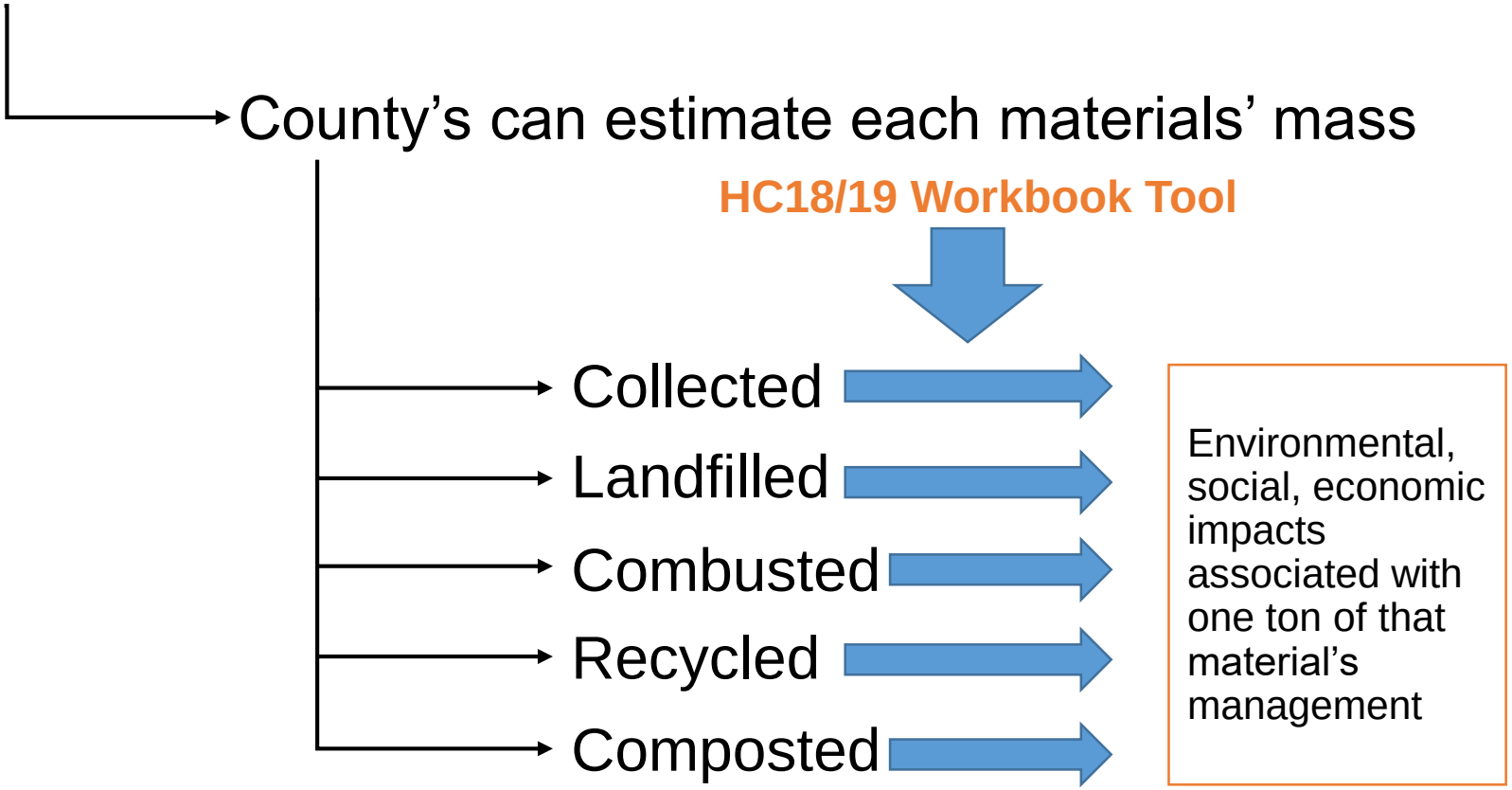
Hinkley Center An Integrated Tool for Local Government to Track Materials Management and Progress toward Sustainability Goals
(HC19/20 Project)

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



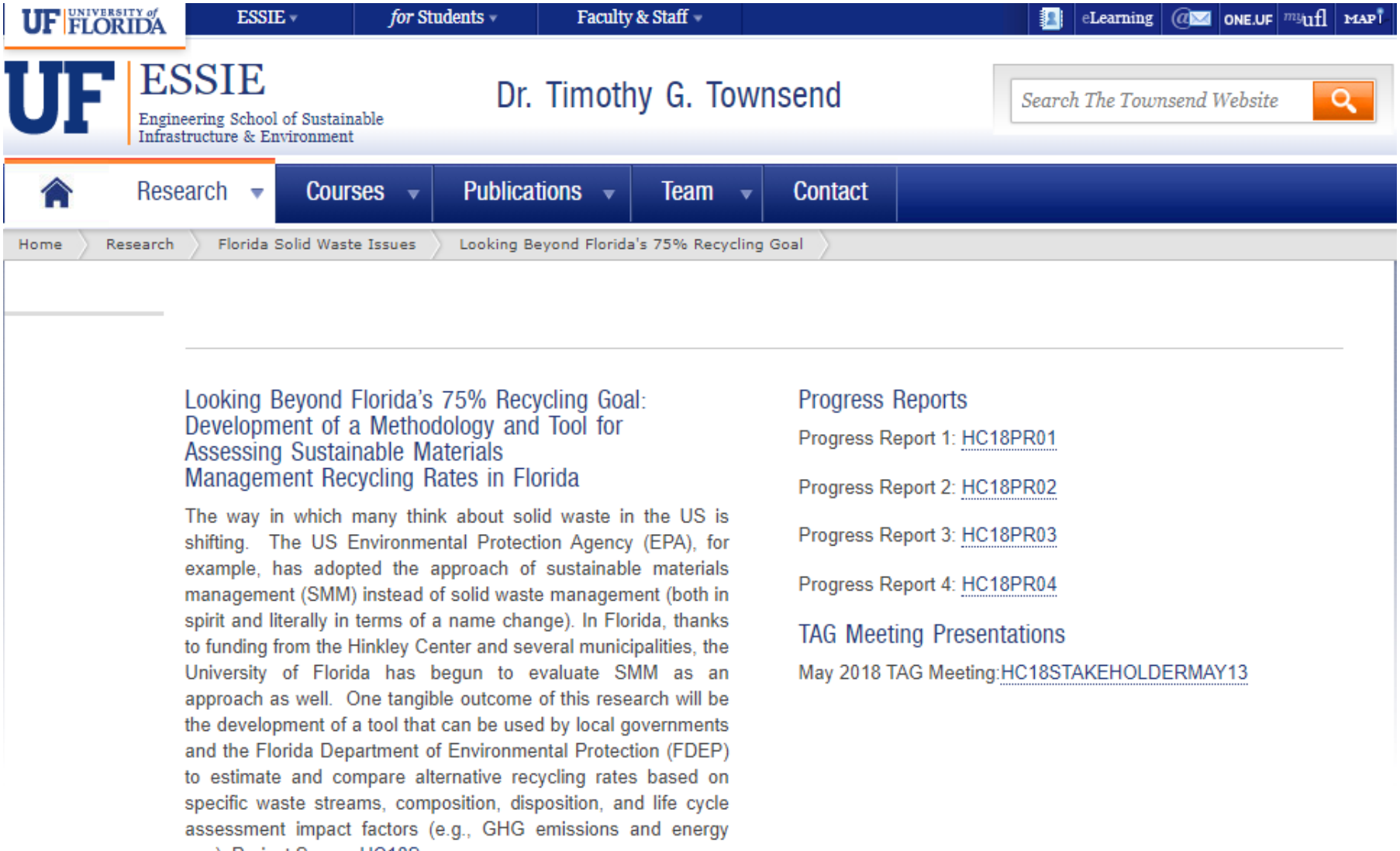
HC 19/20 Tasks

- **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?

https://www.essie.ufl.edu/home/townsend/research/florida-solid-waste-issues/hc18/



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Thank You!