Implementing Sustainable Materials Management in Florida

State of Florida 75% Recycling Goal
Technical Advisory Group (TAG) Meeting
October 11, 2017
Tampa, Florida

Issues with Mass-Based Recycling Rates

Accounting

- What counts?
  - Alternative daily cover (ADS) at landfills
  - WTE
  - Landfill gas to energy
  - Concrete and asphalt recycling
  - Biosolids recycling
  - Industrial waste recycling
- Creative Accounting
  - How good are the numbers?
  - How do you avoid cherry picking or double-counting?
- Total or per capita?

Substance

- Does not reflect source reduction (if you reduce the numerator, you also reduce the denominator)
- Treats all materials the same. We know materials have differing impacts with regard to environmental burdens, economics and landfill capacity consumption.

Alternative Approaches

- Set a target amount of material landfilled on an annual basis
  - What value do you set this to?
  - 2016 Florida generation: 10.2 pounds/person-day
  - 2016 Florida landfilling: 4.5 pounds/person-day

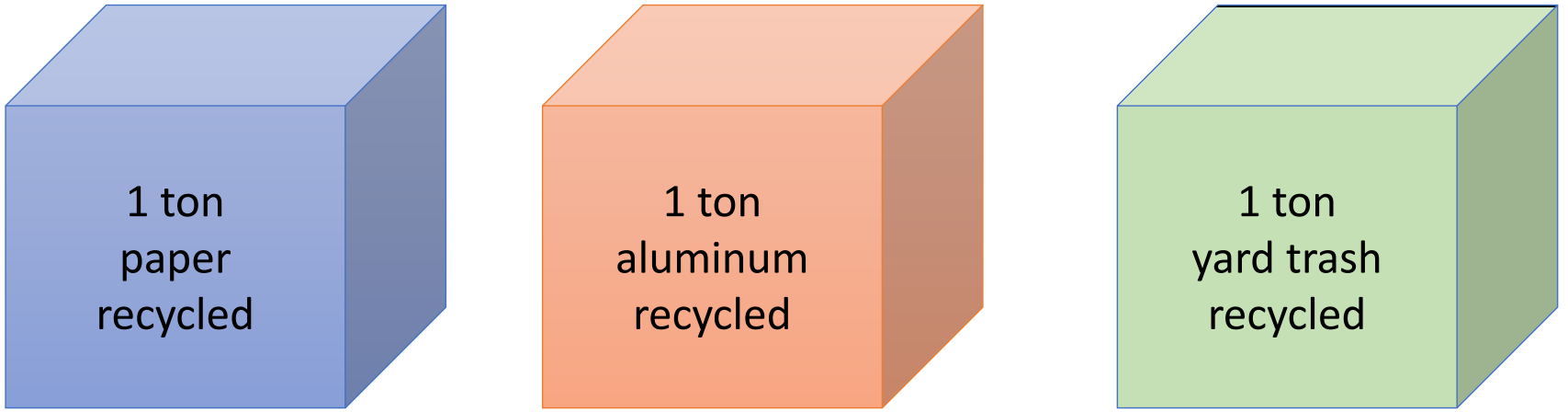
- This approach would allow us to incorporate source reduction, but would not differentiate among materials



Implementing SMM

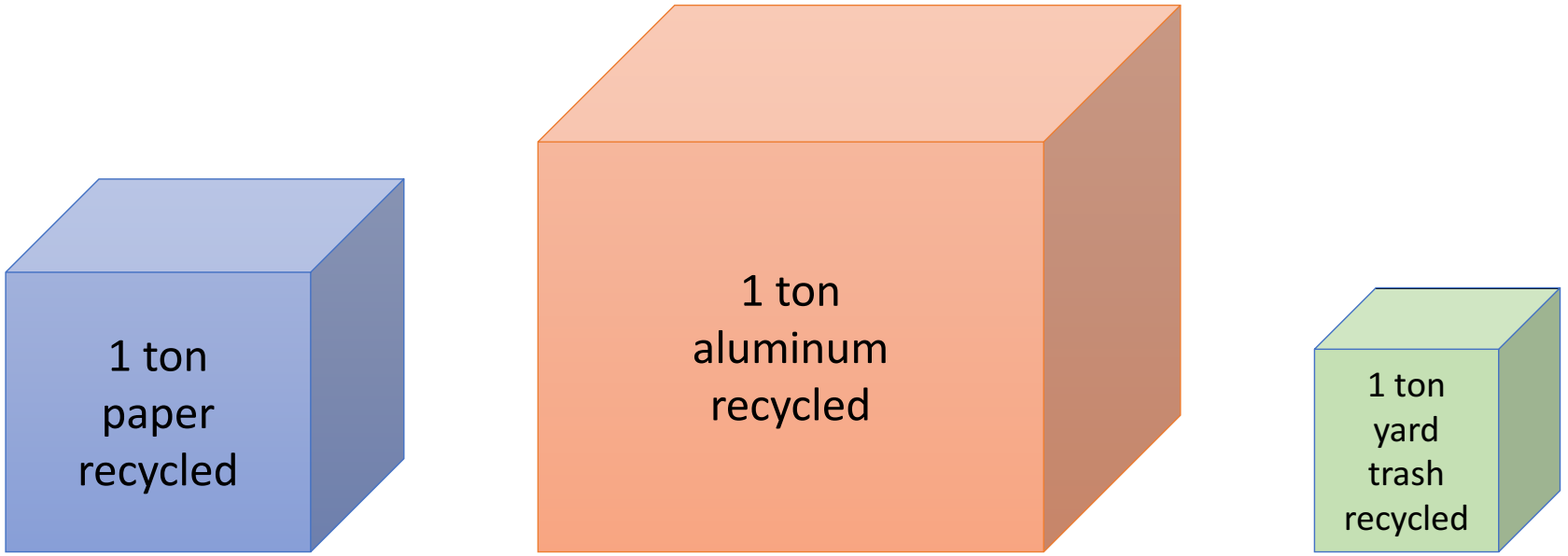
Key Understanding:
Materials are not equal with respect to environmental consequence

Current Approach:
All tons are the same



SMM Approach:

A ton of one material will result in a different consequence than one ton of another material



Which consequence do we look at?

- Landfill capacity
- Energy production/consumption
- Greenhouse gas emissions
- Impact on water
- Human toxicity
- Jobs

US EPA's WARM

For some of these consequences, life cycle assessment tools can be used to compare relative consequence

Example of how materials have different consequences: Energy

Aluminum

- Recycling → the amount of energy it takes to make a new aluminum product from a recycled aluminum product is much less
- WTE → no energy is produced from combusting aluminum
- Landfilling → no energy is produced from landfilling aluminum

Yard Trash

- Recycling → when yard trash is mulched, there is a net consumption of energy
- WTE → energy will be captured from combusting yard trash in energy facility
- Landfilling → energy may be captured from landfilling yard trash

Energy Factors in WARM

Units = million BTU/ton	Aluminum	Yard Trash
Recycle	152.8	-0.58
WTE	-0.60	2.48
Landfill	-0.27	-0.14

Notes:
Black numbers indicate a net energy production/off-set
Red numbers indicate a net energy consumption
Composting is assumed as recycling market for yard trash

WARM Energy Factors

Net Energy Produced, Consumed and Off-set → MMBTU

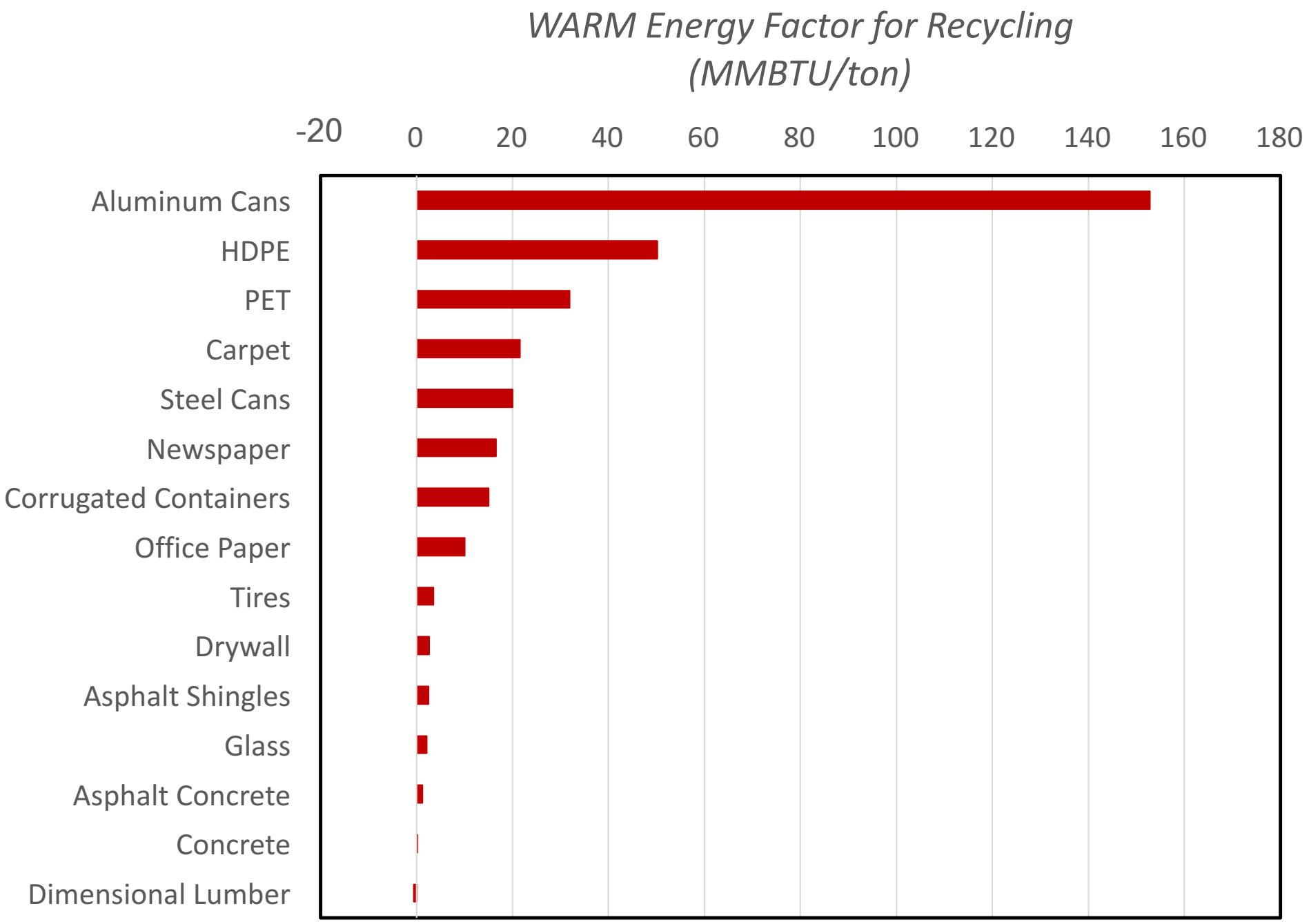
Mass of Waste

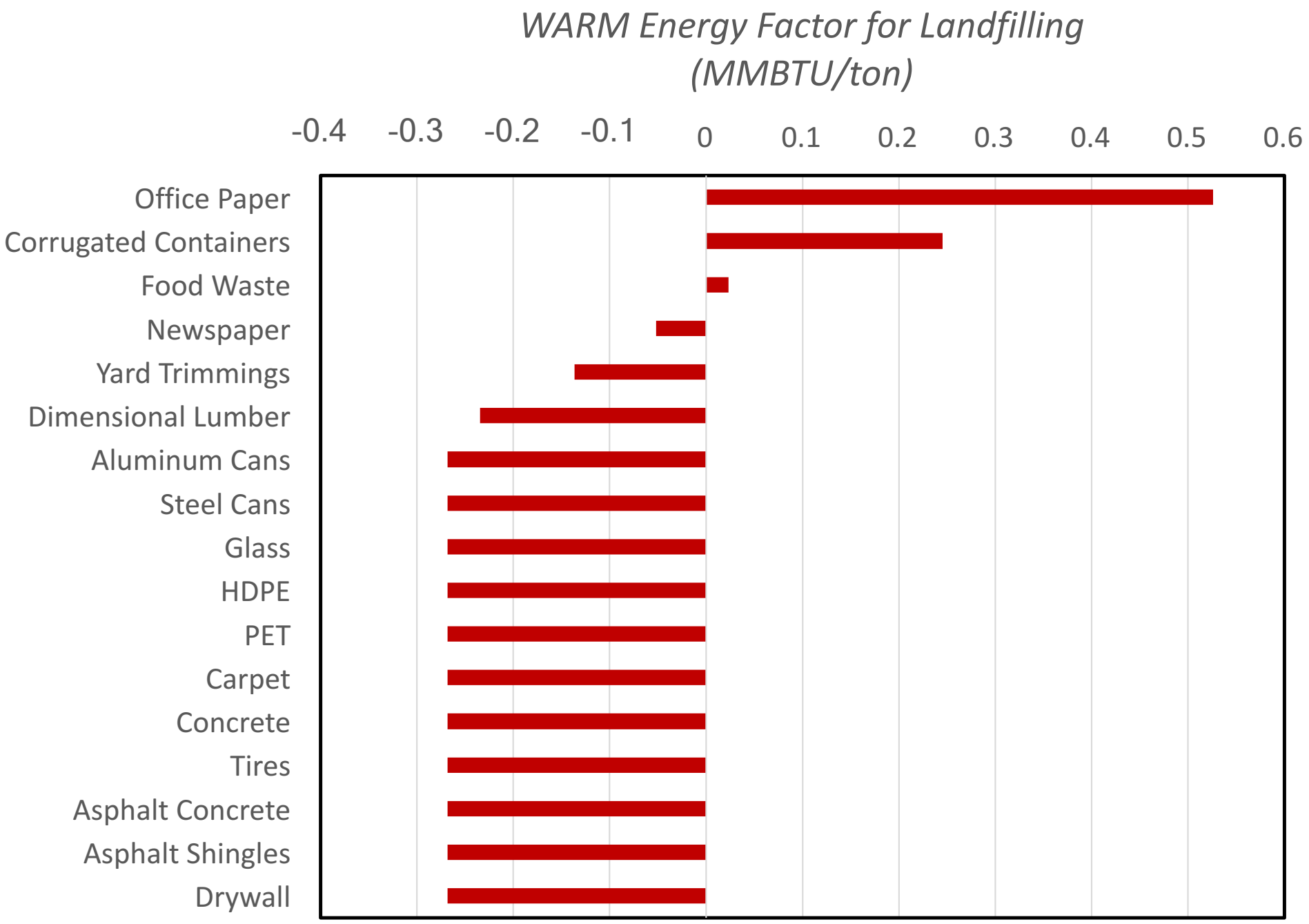
$$\frac{MMBTU}{Ton\ Waste}$$

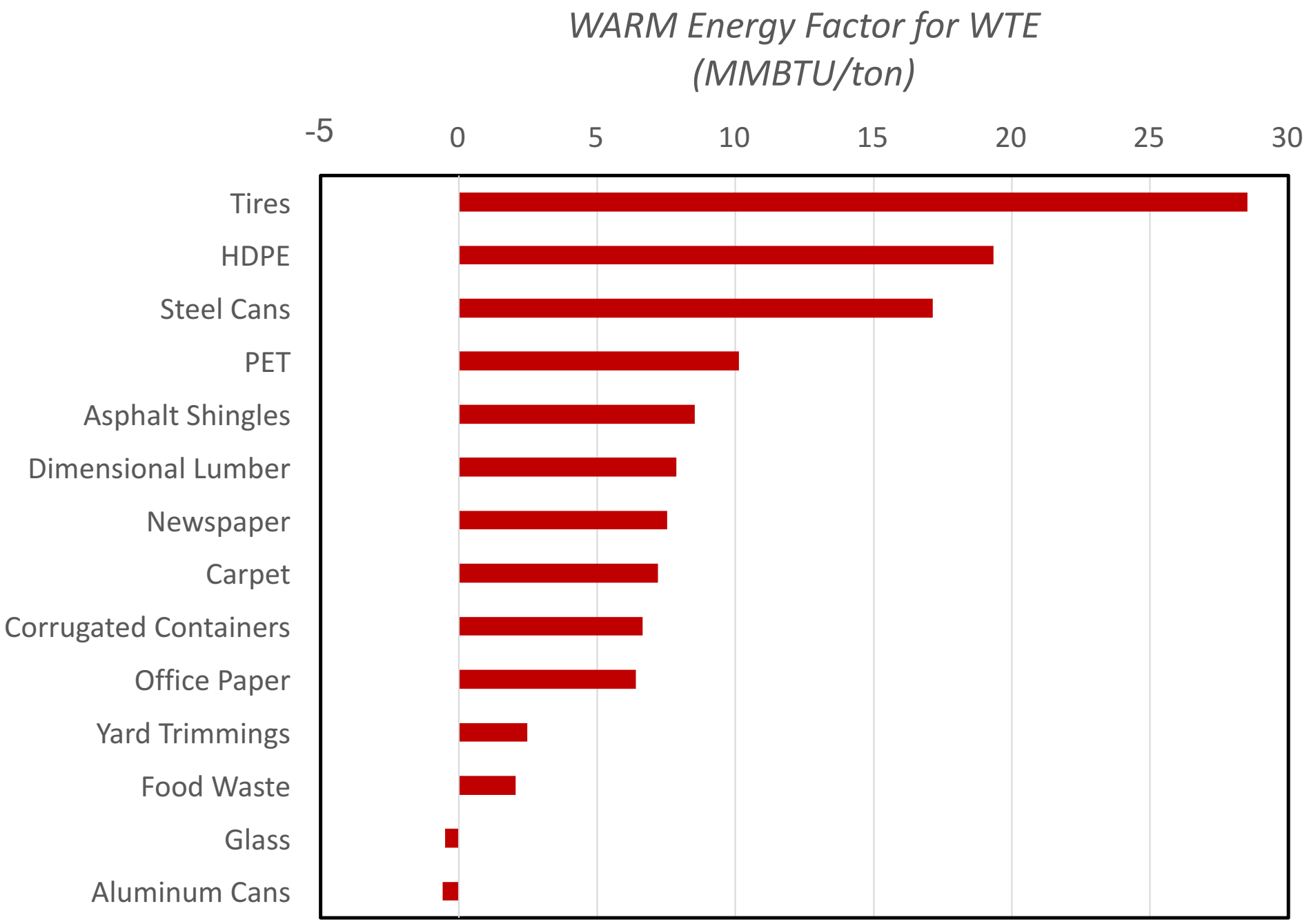
WARM Energy Factors

Per Ton Estimates of Energy Use for Alternative Management Scenarios

Material	Energy Savings per Ton of Material Source Reduced (million BTU)	Energy Savings per Ton of Material Recycled (million BTU)	Energy Savings per Ton of Material Landfilled (million BTU)	Energy Savings per Ton of Material Combusted (million BTU)	Energy Savings per Ton of Material Composted (million BTU)	Energy Savings per Ton of Material Anaerobically Digested (million BTU)
Aluminum Cans	(89.69)	(152.76)	0.27	0.60	NA	NA
Aluminum Ingot	(126.95)	(113.85)	0.27	0.60	NA	NA
Steel Cans	(29.88)	(19.97)	0.27	(17.14)	NA	NA
Copper Wire	(122.36)	(82.59)	0.27	0.54	NA	NA
Glass	(6.90)	(2.13)	0.27	0.50	NA	NA
HDPE	(61.21)	(50.20)	0.27	(19.34)	NA	NA
LDPE	(71.02)	NA	0.27	(19.24)	NA	NA
PET	(50.26)	(31.87)	0.27	(10.13)	NA	NA
LLDPE	(66.37)	NA	0.27	(19.30)	NA	NA
PP	(66.59)	NA	0.27	(19.31)	NA	NA
PS	(74.99)	NA	0.27	(17.40)	NA	NA
PVC	(48.34)	NA	0.27	(7.46)	NA	NA
PLA	(30.69)	NA	0.27	(7.94)	0.58	NA
Corrugated Containers	(22.32)	(15.07)	(0.25)	(6.64)	NA	NA
Magazines/third-class mail	(33.23)	(0.69)	0.04	(4.89)	NA	NA
Newspaper	(36.46)	(16.49)	0.05	(7.53)	NA	NA
Office Paper	(36.60)	(10.08)	(0.53)	(6.40)	NA	NA


WARM Energy Factor for Recycling
(MMBTU/ton)
-20
0
20
40
60
80
100
120
140
160
180
Aluminum Cans
HDPE
PET
Carpet
Steel Cans
Newspaper
Corrugated Containers
Office Paper
Tires
Drywall
Asphalt Shingles
Glass
Asphalt Concrete
Concrete
Dimensional Lumber


WARM Energy Factor for Landfilling
(MMBTU/ton)
-0.4
-0.3
-0.2
-0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
Office Paper
Corrugated Containers
Food Waste
Newspaper
Yard Trimmings
Dimensional Lumber
Aluminum Cans
Steel Cans
Glass
HDPE
PET
Carpet
Concrete
Tires
Asphalt Concrete
Asphalt Shingles
Drywall


WARM Energy Factor for WTE
(MMBTU/ton)
-5
0
5
10
15
20
25
30
Tires
HDPE
Steel Cans
PET
Asphalt Shingles
Dimensional Lumber
Newspaper
Carpet
Corrugated Containers
Office Paper
Yard Trimmings
Food Waste
Glass
Aluminum Cans

Estimating a State of Florida "Energy Savings Footprint" from Waste Management Practices

- If you can assign the each waste component to its corresponding disposition (landfill, recycling, WTE, compost), you can develop a net energy savings footprint.

$$\text{Net Energy Footprint} = \text{Net Energy from Recycling} + \text{Net Energy from Landfilling} + \text{Net Energy from WTE}$$

We could come up with similar footprints for other environmental consequences

SMM Based Materials Management

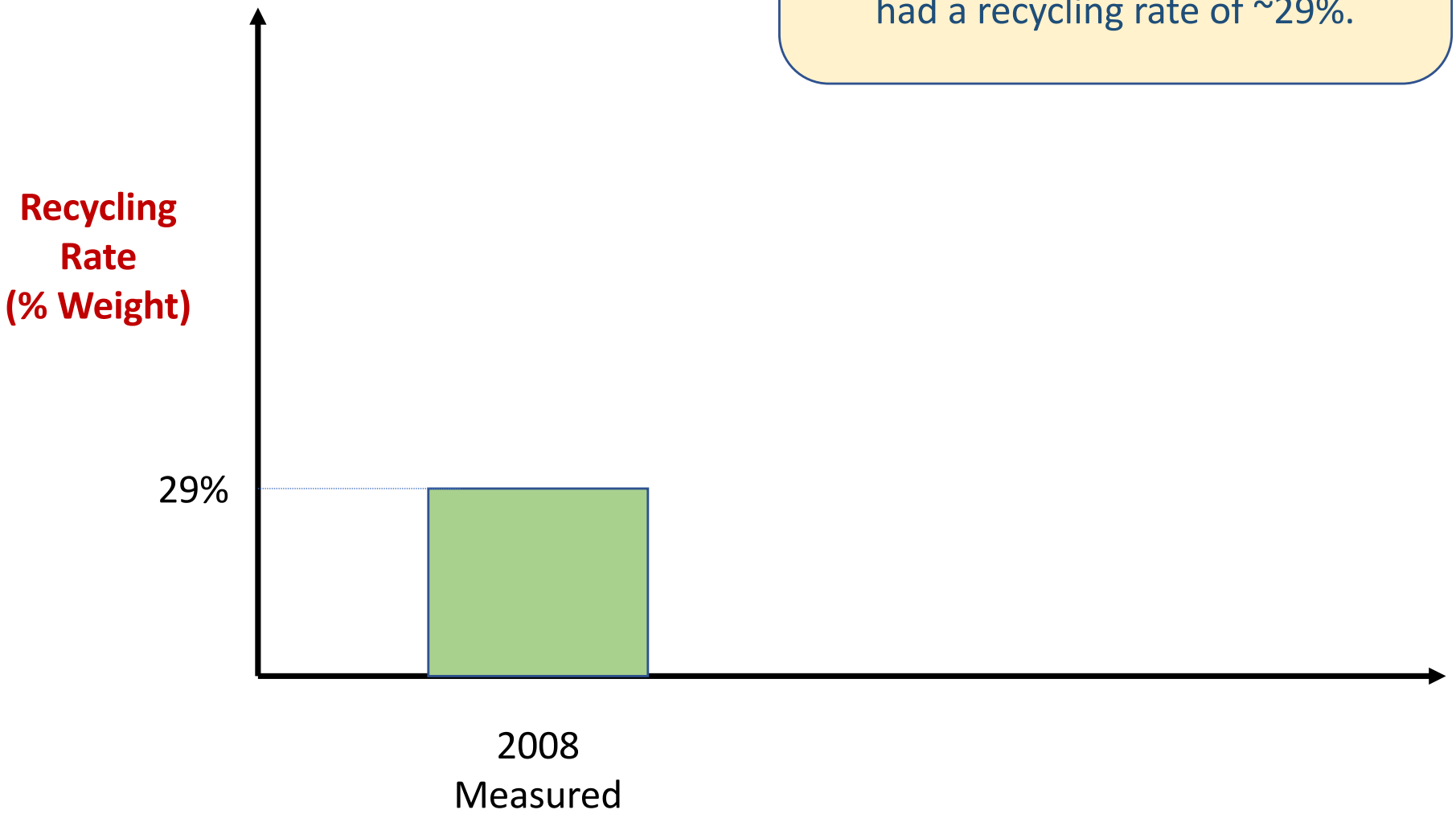
- We can develop a “footprint” for any environmental consequence if we have appropriate data. Examples:
  - Florida 2015 Energy Savings Footprint = 11.3 MMBTU/person
  - Florida 2015 Carbon Reduction Footprint = 1.02 MTCO2E/person
- Challenges:
  - What is our target?
  - Will a target value in units like MMBTU be transferable to policy makers and the public?
- Oregon DEQ is using these types of equations to shape materials management policy

New Approach

- Let’s equate a measurement such as an energy footprint with what we are used to: a weight-based recycling rate

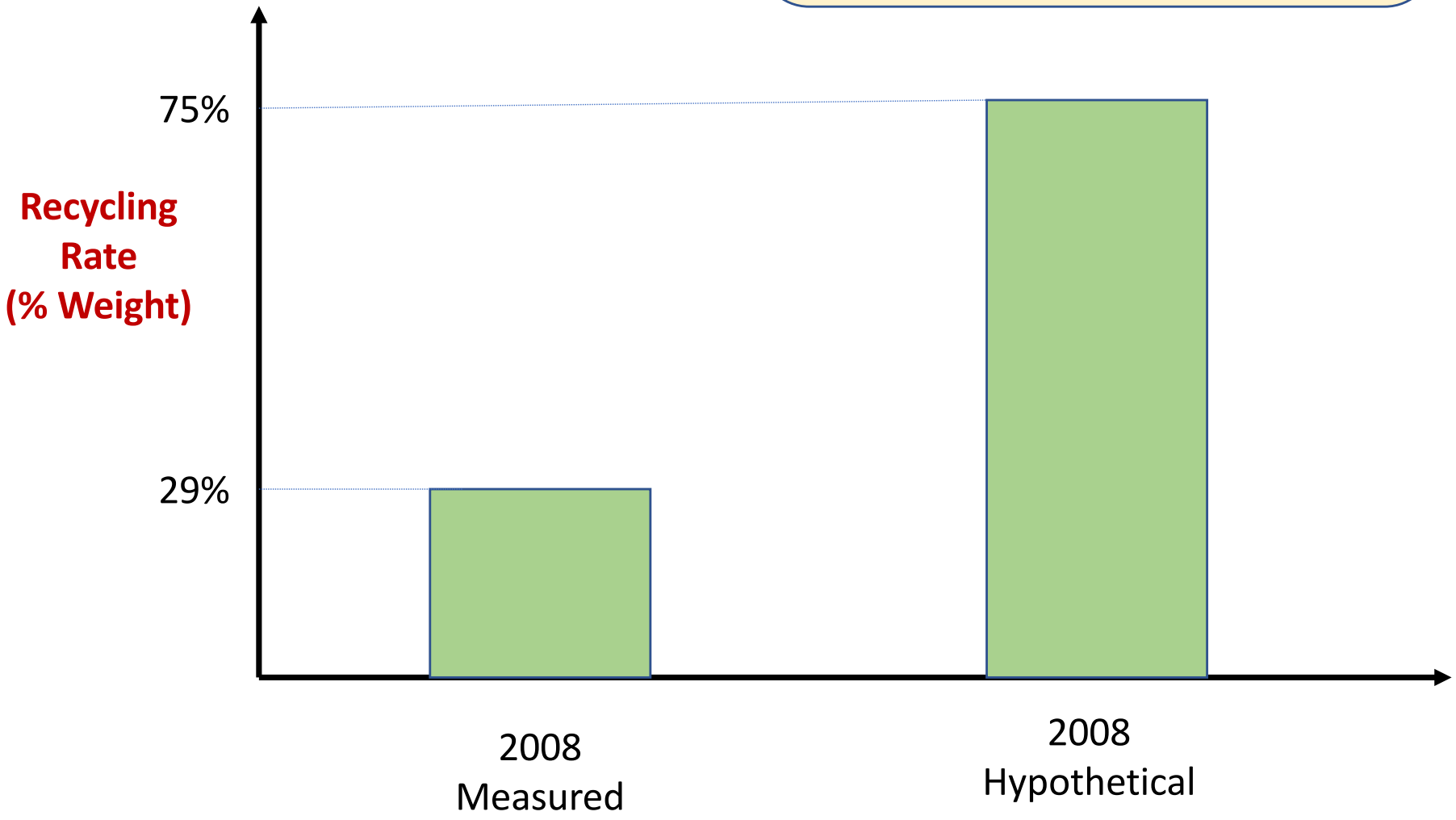
Approach

Since the statute was passed in 2008, let's set this as our baseline year. Originally in that year Florida had a recycling rate of ~29%.



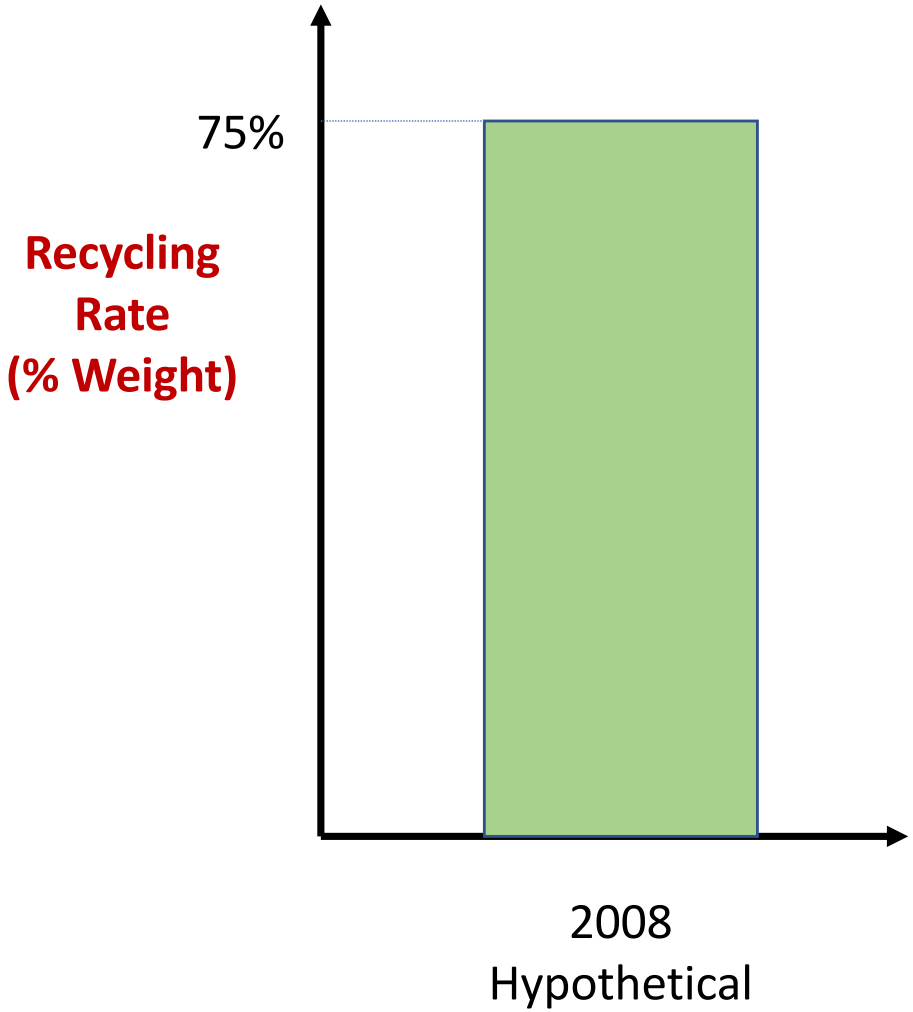
Approach

Then we come up with a hypothetical waste management scenario that reached 75% in 2008. We will use this to set the threshold the state will aspire to.



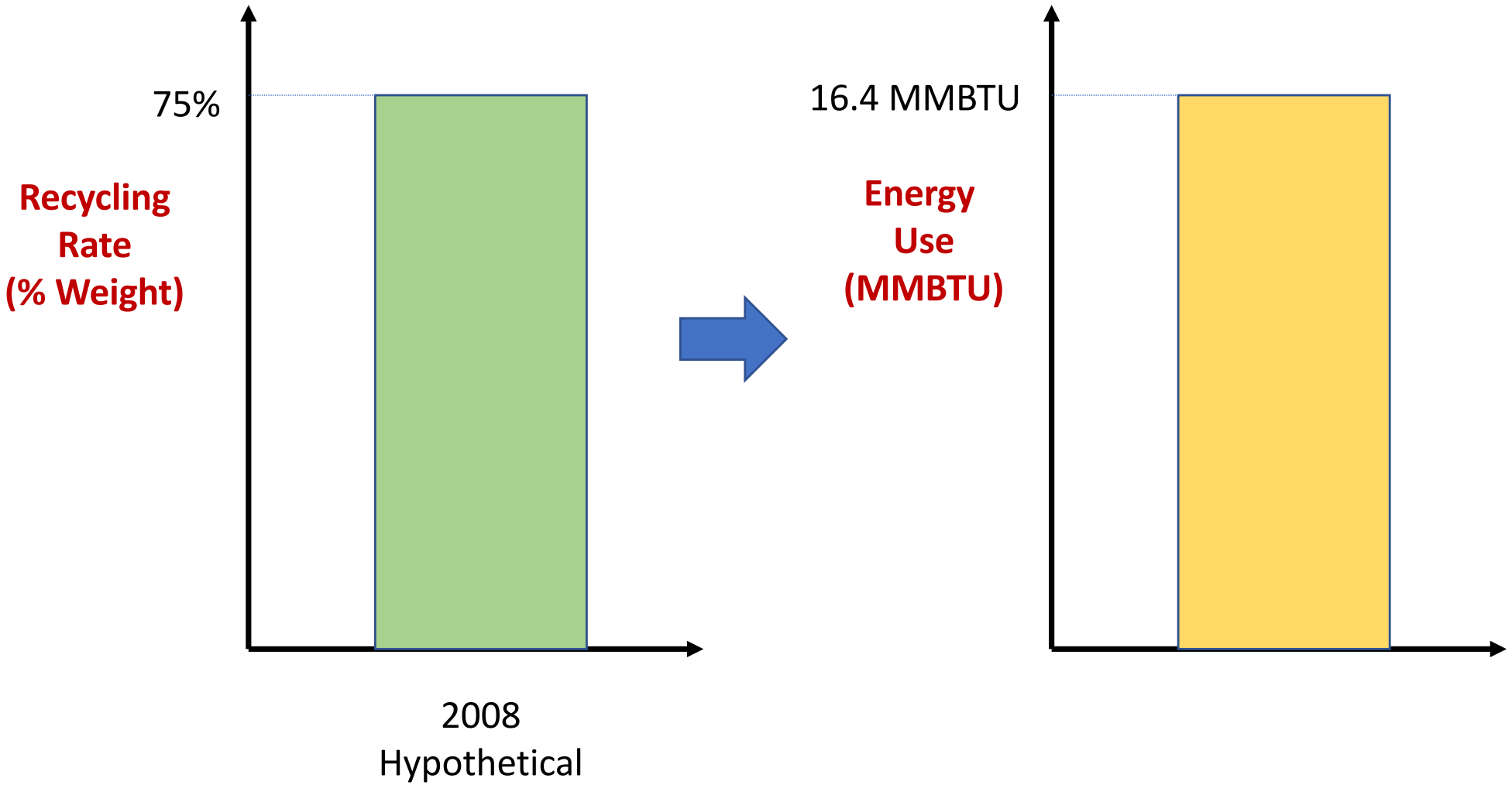
Approach

Use this hypothetical 75% recycling scenario, calculate a corresponding energy footprints (with WARM factors)



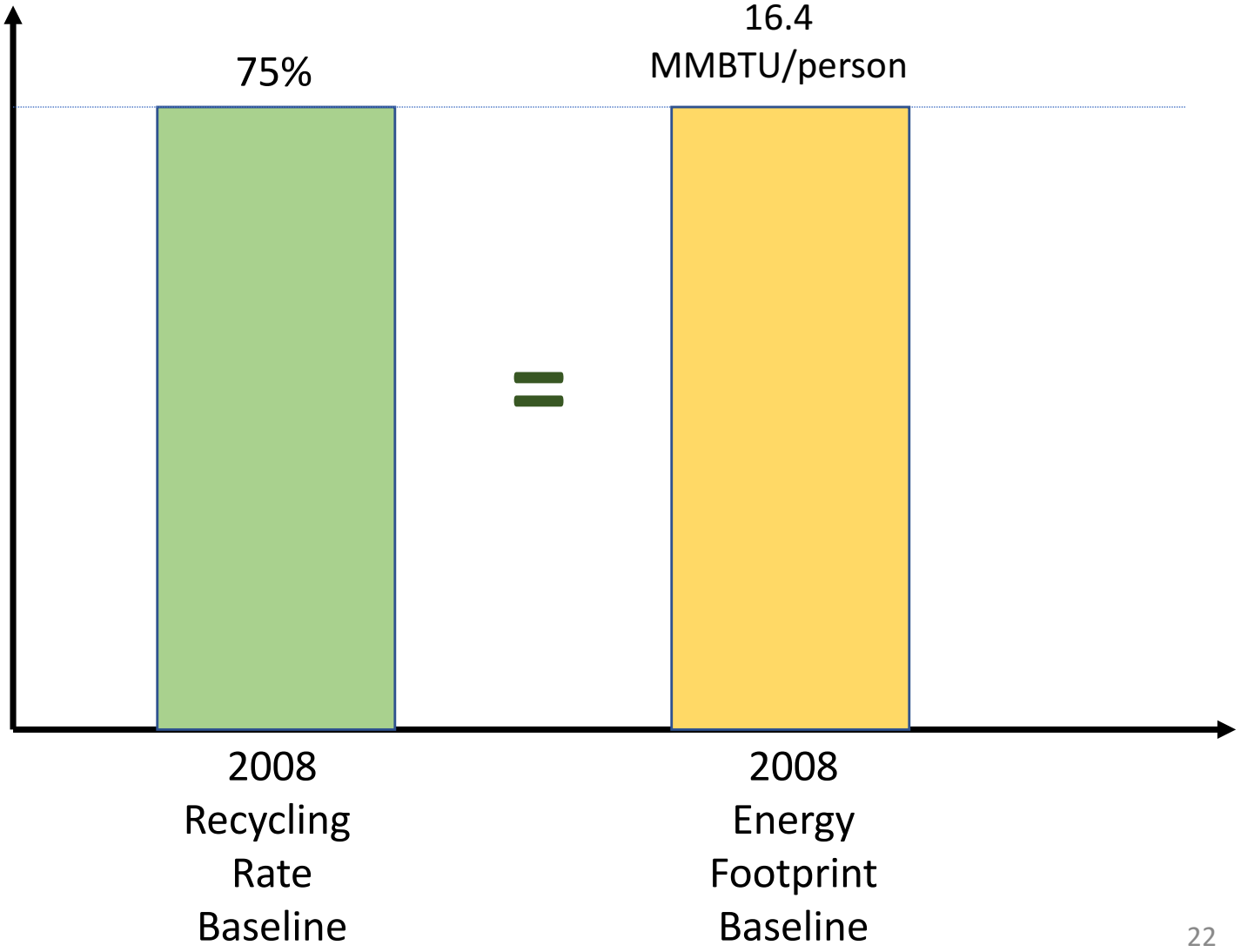
Approach

Calculate a “baseline” energy footprint

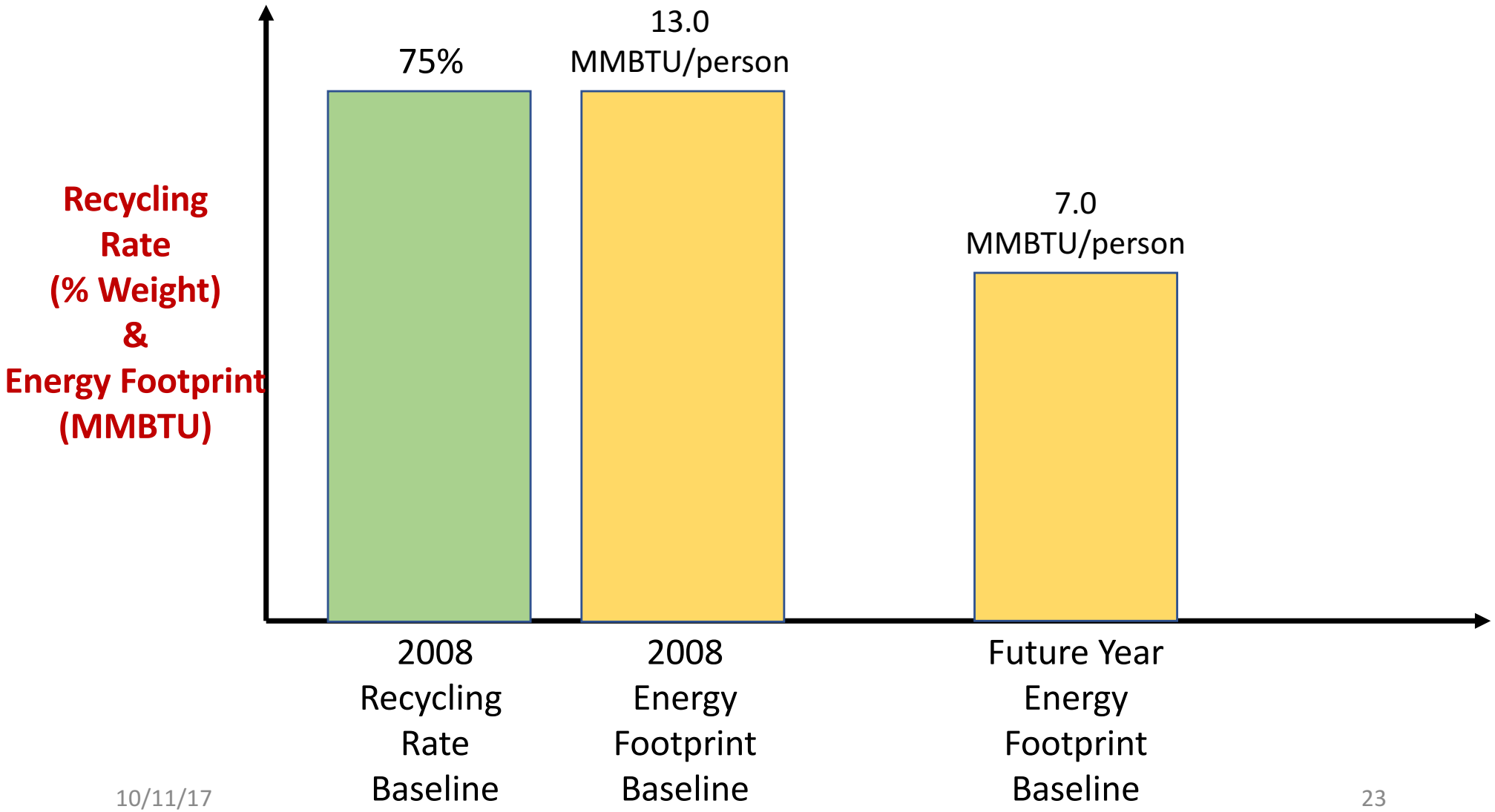


Approach

Recycling Rate (% Weight) & Energy Footprint (MMBTU)

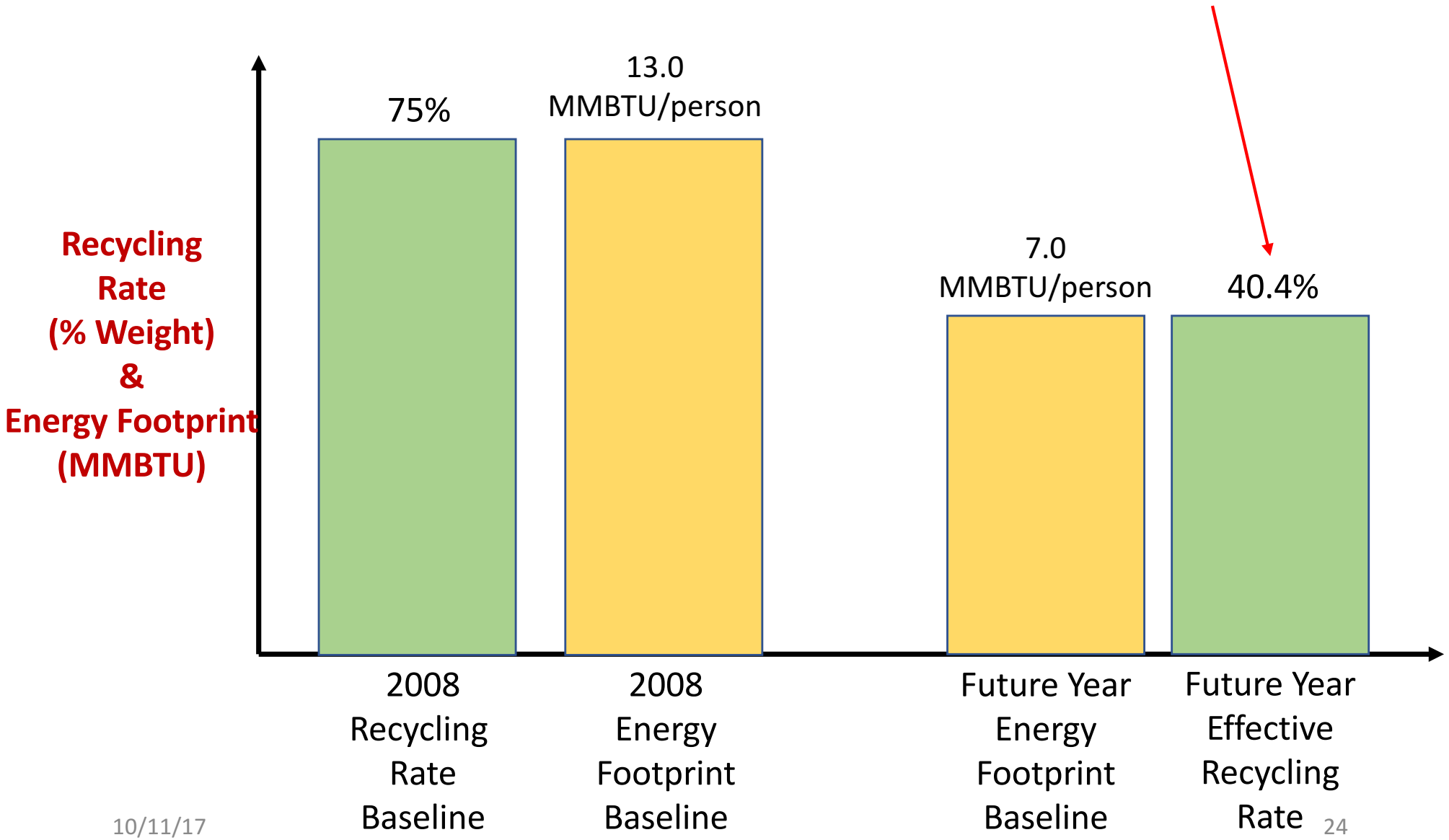


Approach


Recycling Rate (% Weight) & Energy Footprint (MMBTU)
75%
13.0 MMBTU/person
7.0 MMBTU/person
2008 Recycling Rate Baseline
2008 Energy Footprint Baseline
Future Year Energy Footprint Baseline

Approach

$\frac{7.0}{13.0}$ x 75% = 40.4%

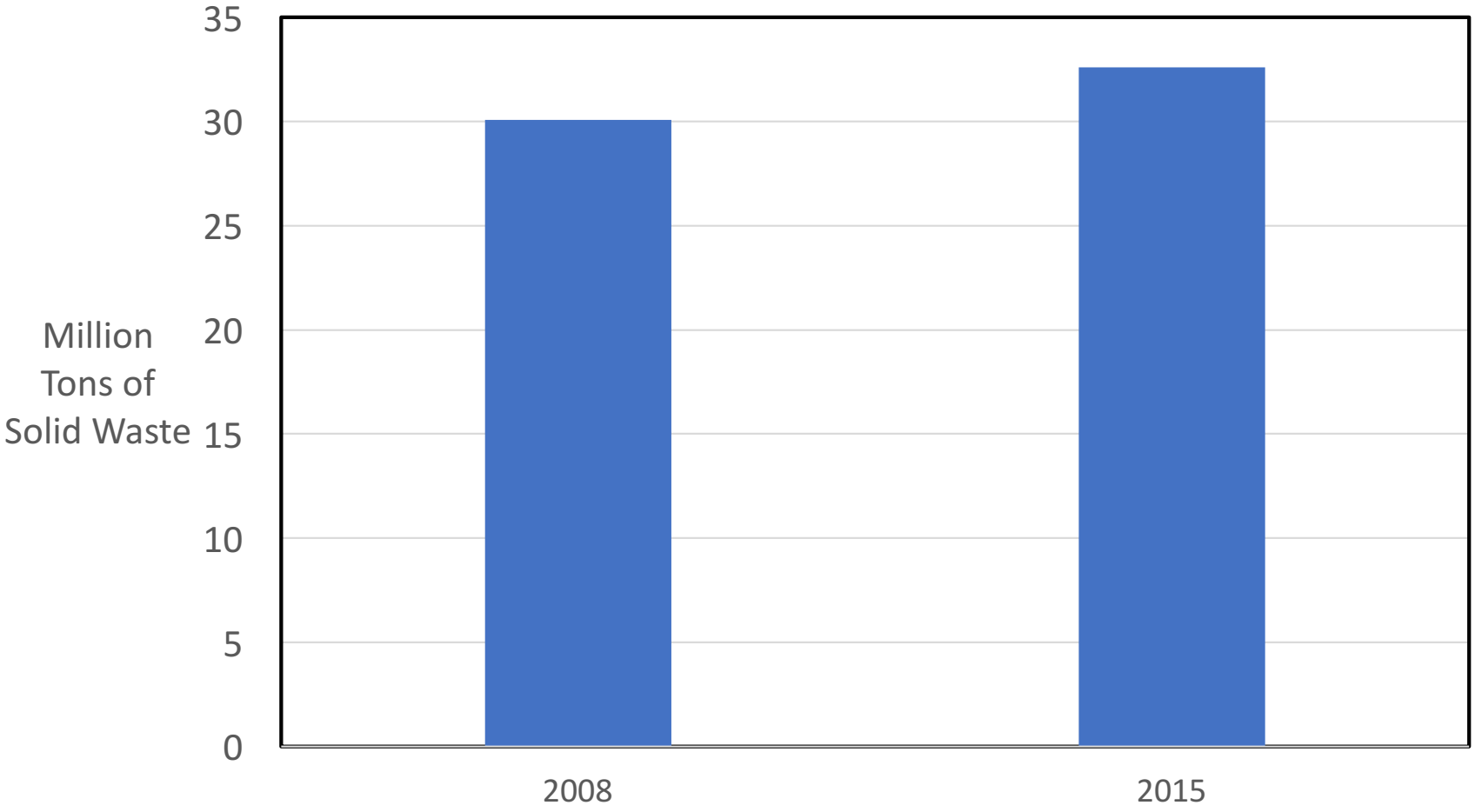


Integrating Source Reduction

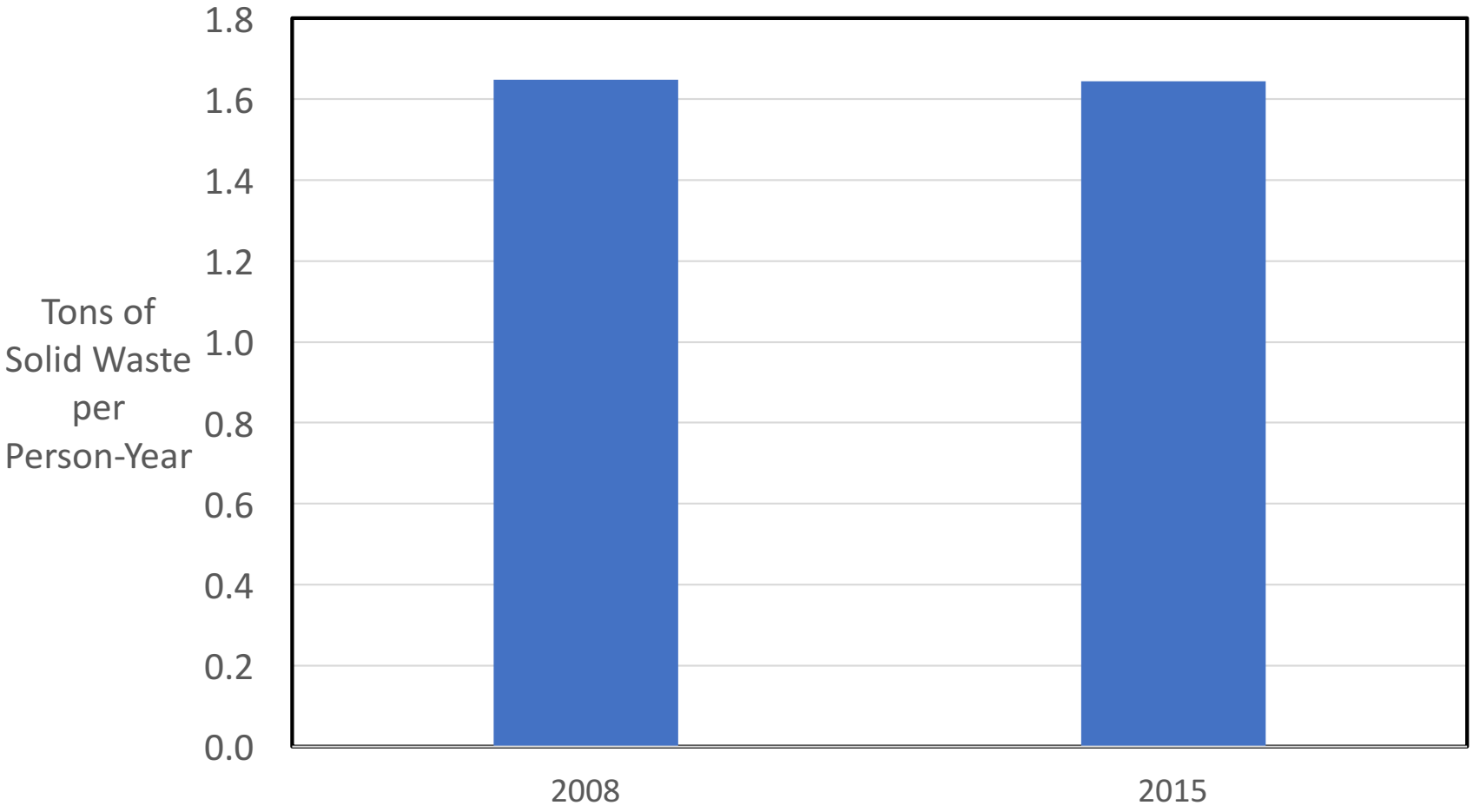
- By comparing the net energy footprint from recycling, landfilling, and WTE in any year to a target year, we can calculate an “energy equivalent recycling rate.”

- This approach treats materials differently, but it still does not incorporate source reduction.

Florida Solid Waste Generation in 2008 and 2015

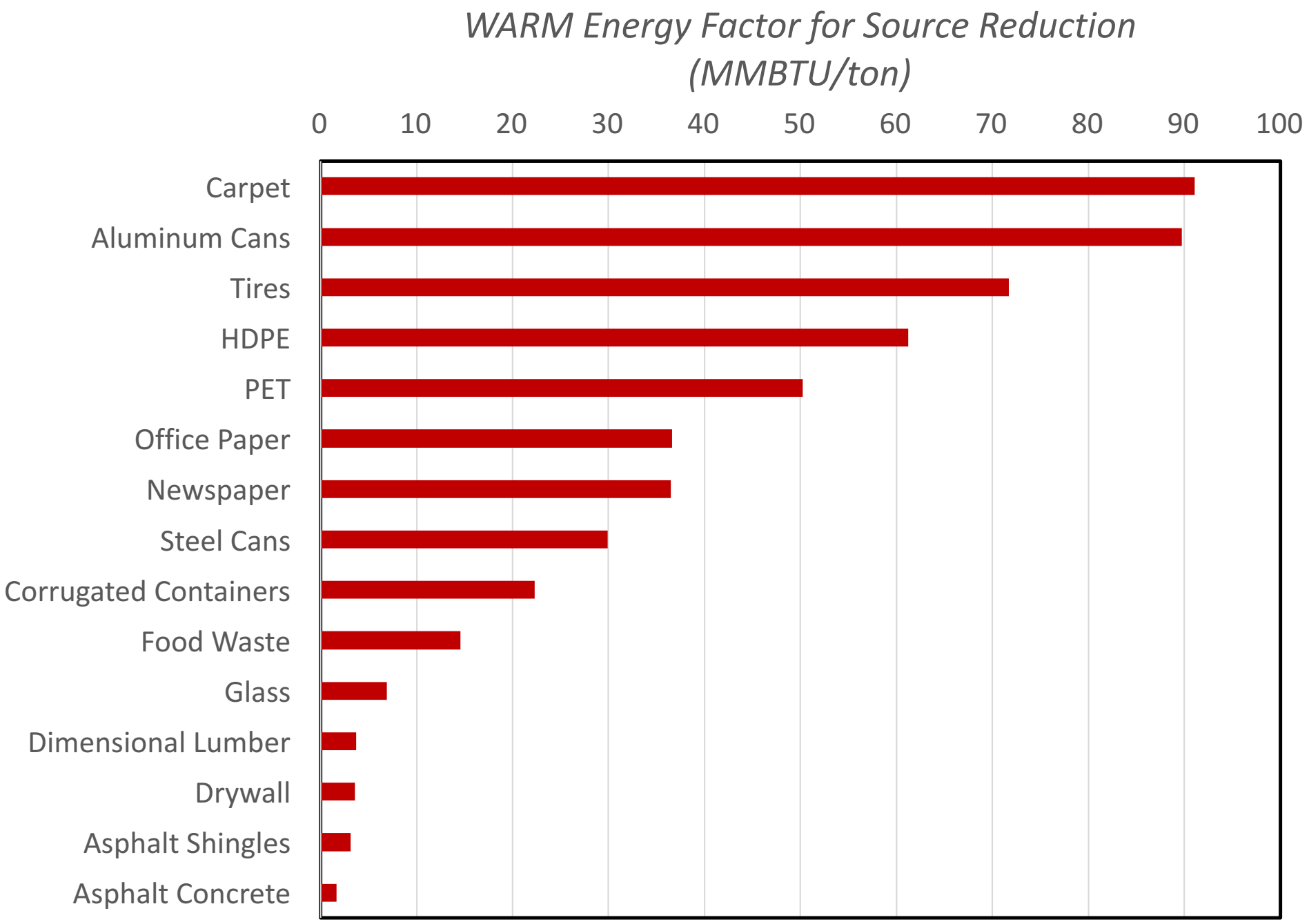


Per-Capita Florida Solid Waste Generation in 2008 and 2015



Florida's Per-Capita Waste Component Increase/Decrease
2008 → 2015

Material	Per Capita Generation (ton/person-year)		
	2008	2015	Difference
Aluminum Cans	0.012	0.010	-0.002
C&D Debris	0.400	0.487	0.087
Corrugated Paper	0.137	0.128	-0.009
Ferrous Metals	0.148	0.122	-0.026
Food	0.092	0.100	0.008
Glass	0.042	0.043	0.001
Newspaper	0.077	0.051	-0.026
Non Ferrous Metal	0.038	0.025	-0.013
Office Paper	0.043	0.031	-0.012
Other Paper	0.109	0.110	0.001
Other Plastics	0.061	0.073	0.012
Plastic Bottles	0.024	0.023	-0.001
Steel Cans	0.017	0.015	-0.002
Textiles	0.048	0.038	-0.010
Tires	0.020	0.012	-0.008
White Goods	0.029	0.018	-0.011
Miscellaneous	0.149	0.156	0.007
Process Fuel	0.032	0.027	-0.005
Yard Trash	0.170	0.177	0.007
Total	1.648	1.645	-0.004


WARM Energy Factor for Source Reduction
(MMBTU/ton)
0
10
20
30
40
50
60
70
80
90
100
Carpet
Aluminum Cans
Tires
HDPE
PET
Office Paper
Newspaper
Steel Cans
Corrugated Containers
Food Waste
Glass
Dimensional Lumber
Drywall
Asphalt Shingles
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Yard Trash	0.170	0.177	0.007
Total	1.648	1.645	-0.004

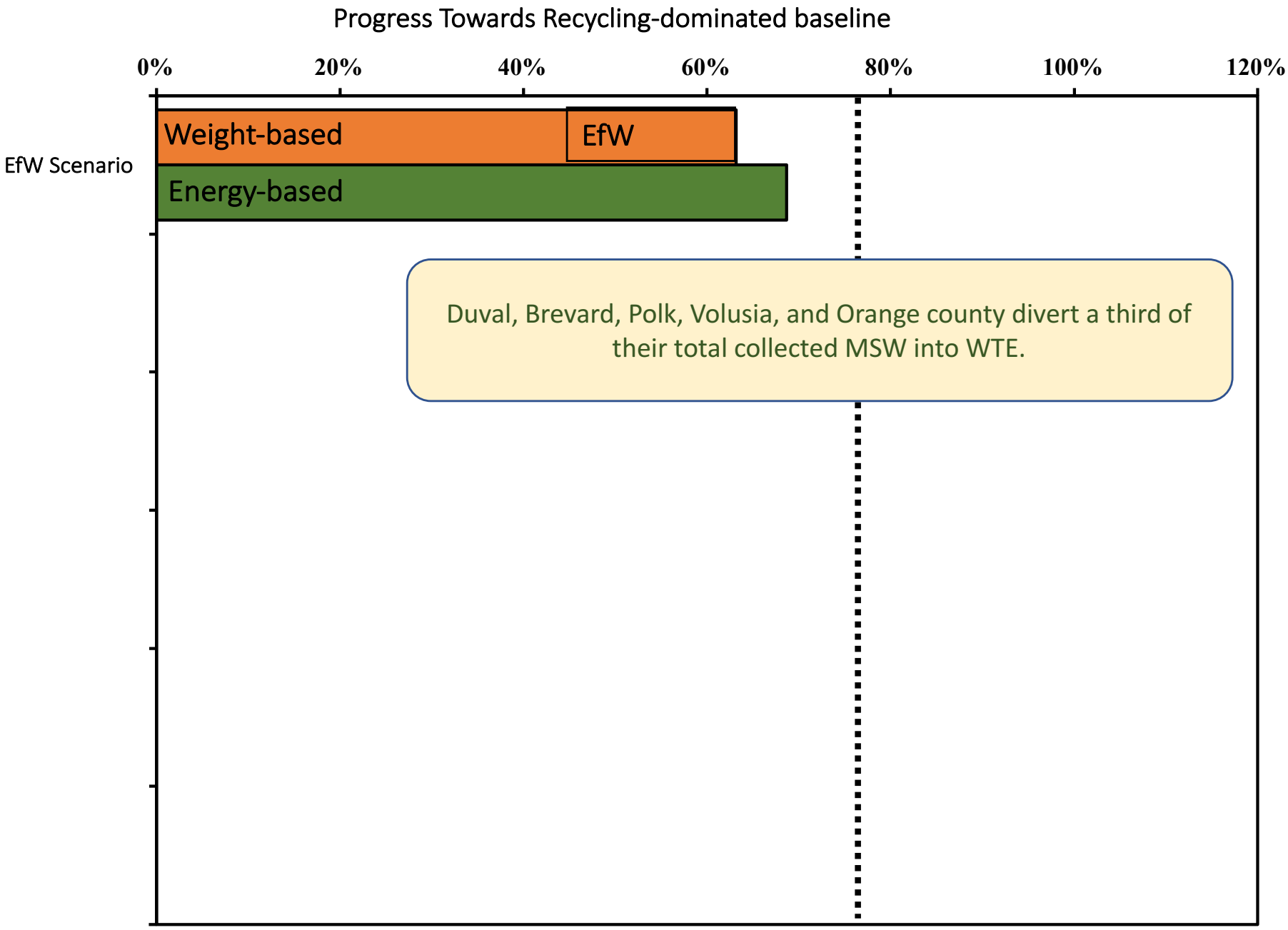
Incorporating Source Reduction

- If we establish a baseline year (e.g., 2008), we can compare component generation in any future year.
- When source reduction occurs, this adds to the savings footprint, and thus increases the recycling rate.
- When source increase occurs, this lowers the savings footprint, and thus decreases the recycling rate.

Example

- Let's examine the effect of several different SMM approaches on mass-based and energy-based recycling rates.
  - Increase WTE
  - More collection of major recyclables from residential stream
  - Source segregate organics
  - Increase C&D and yard trash recycling
  - Combination

Applying SMM for Florida SWM in 2020



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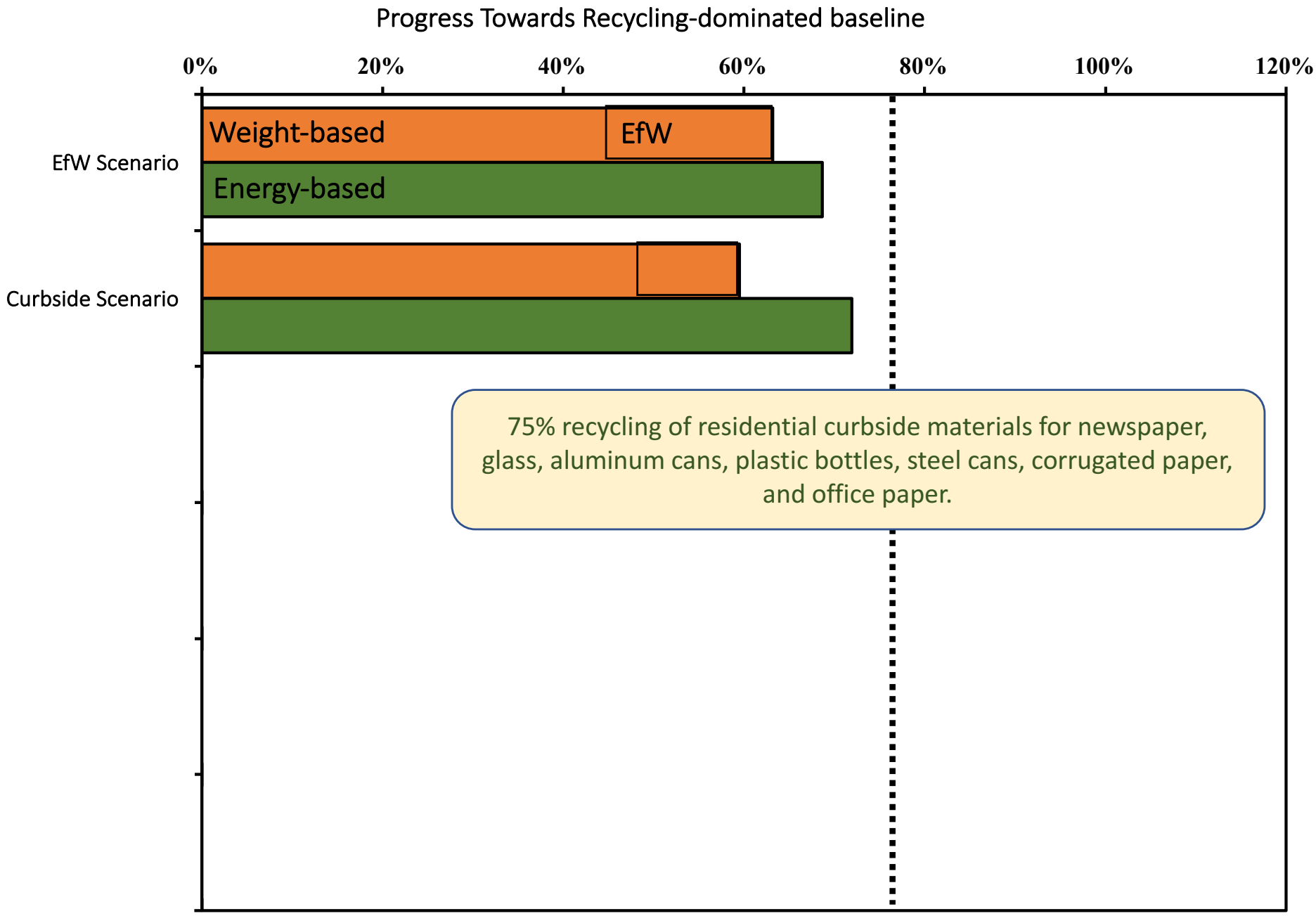
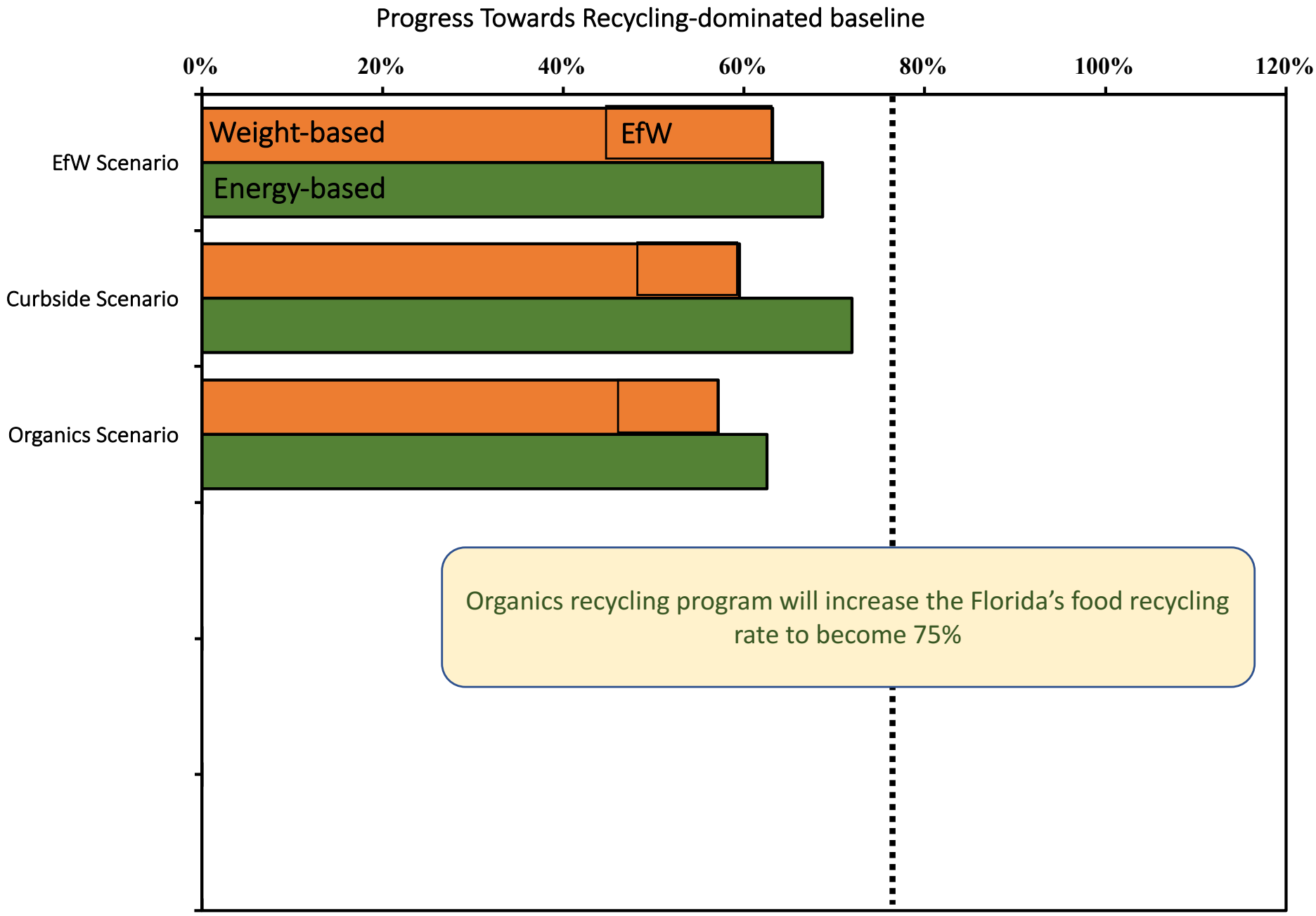
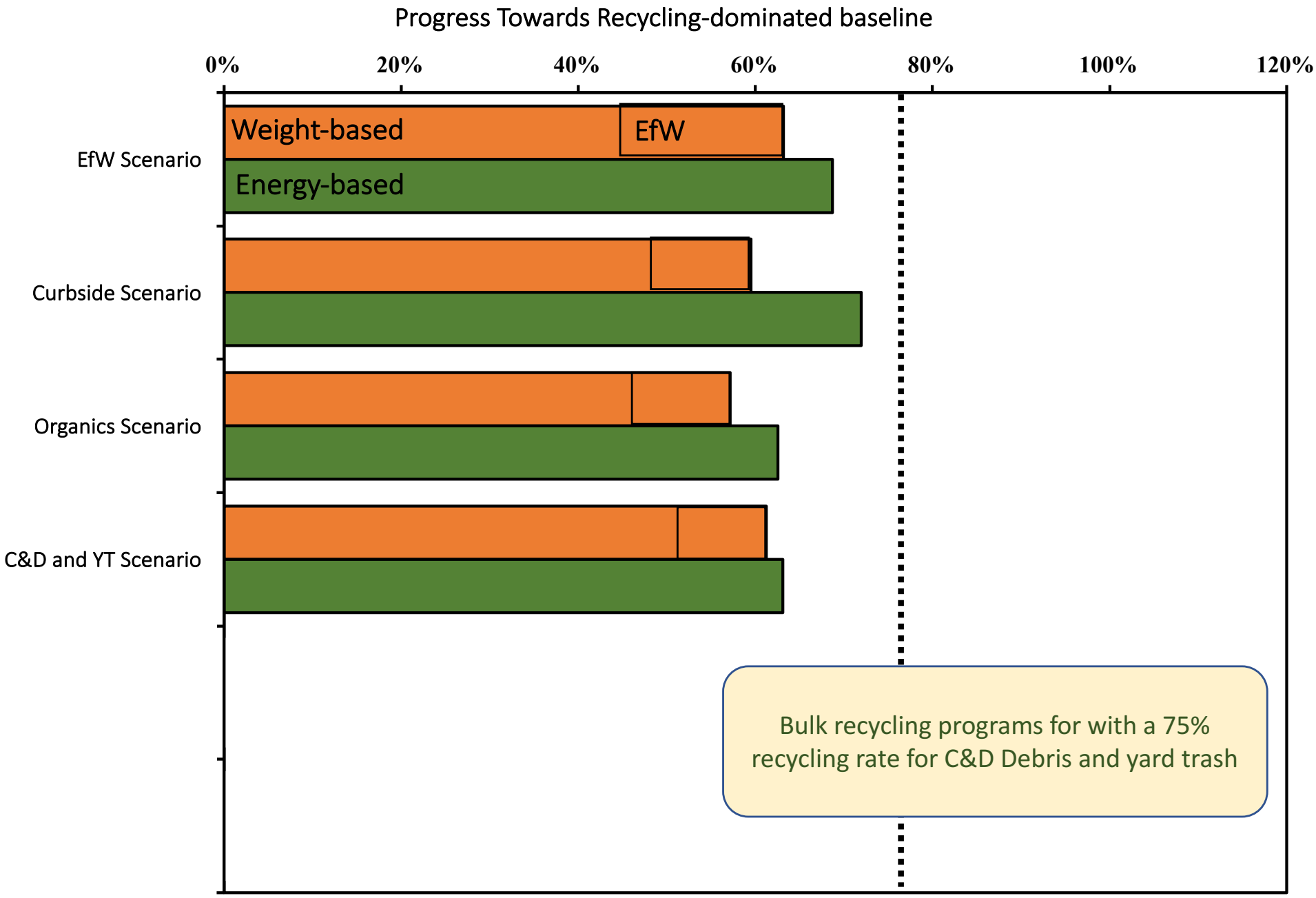


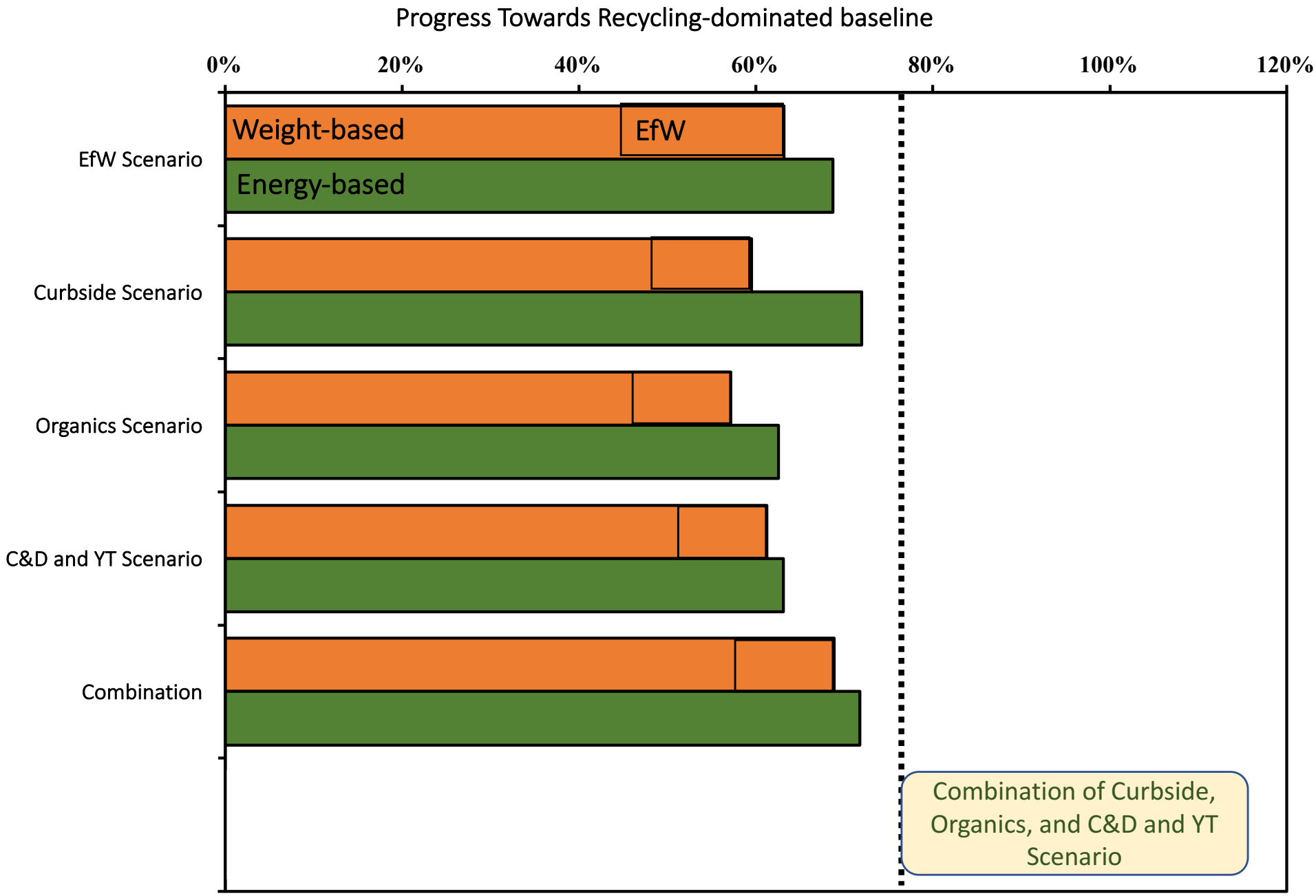
Applying SMM for Florida SWM in 2020



Applying SMM for Florida SWM in 2020



Applying SMM for Florida SWM in 2020



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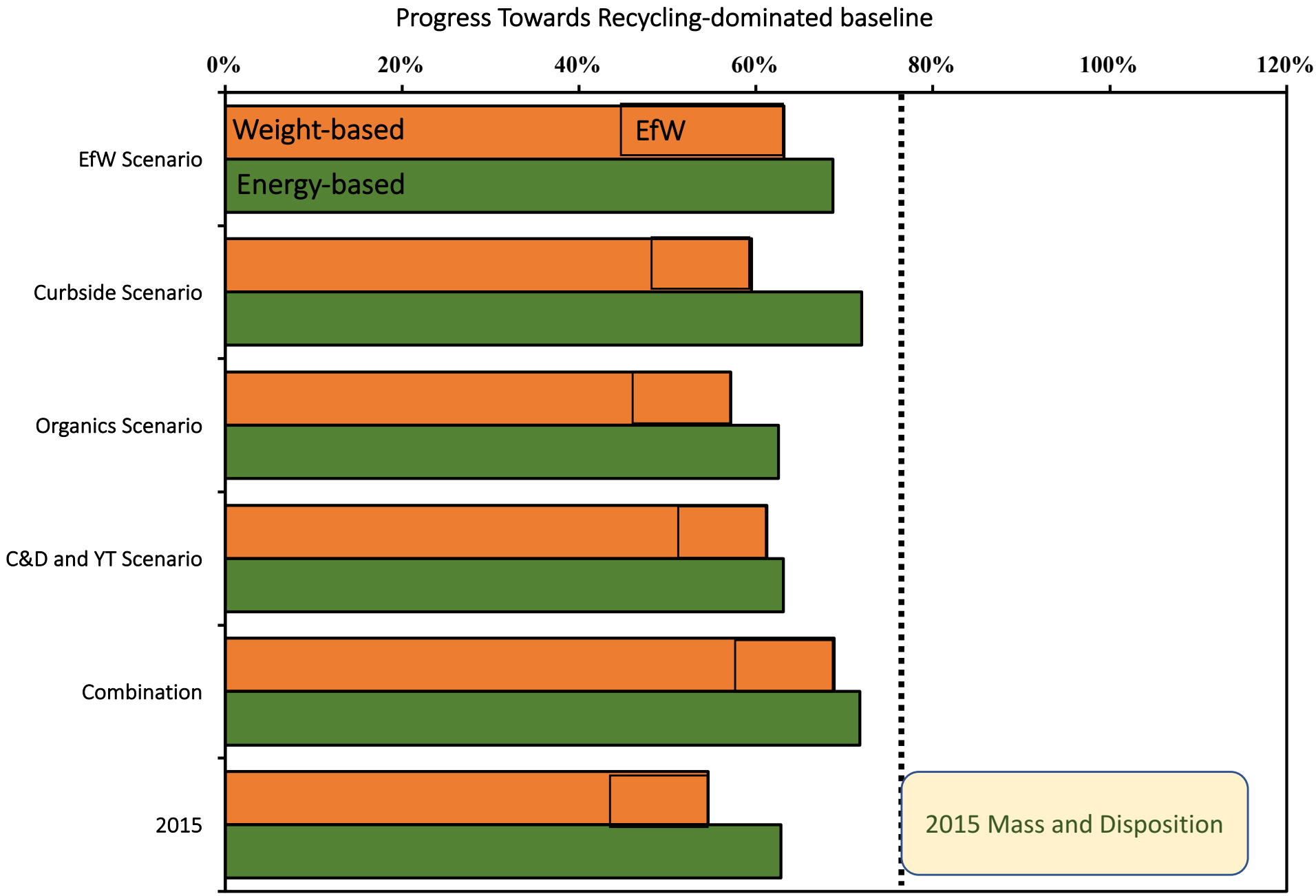
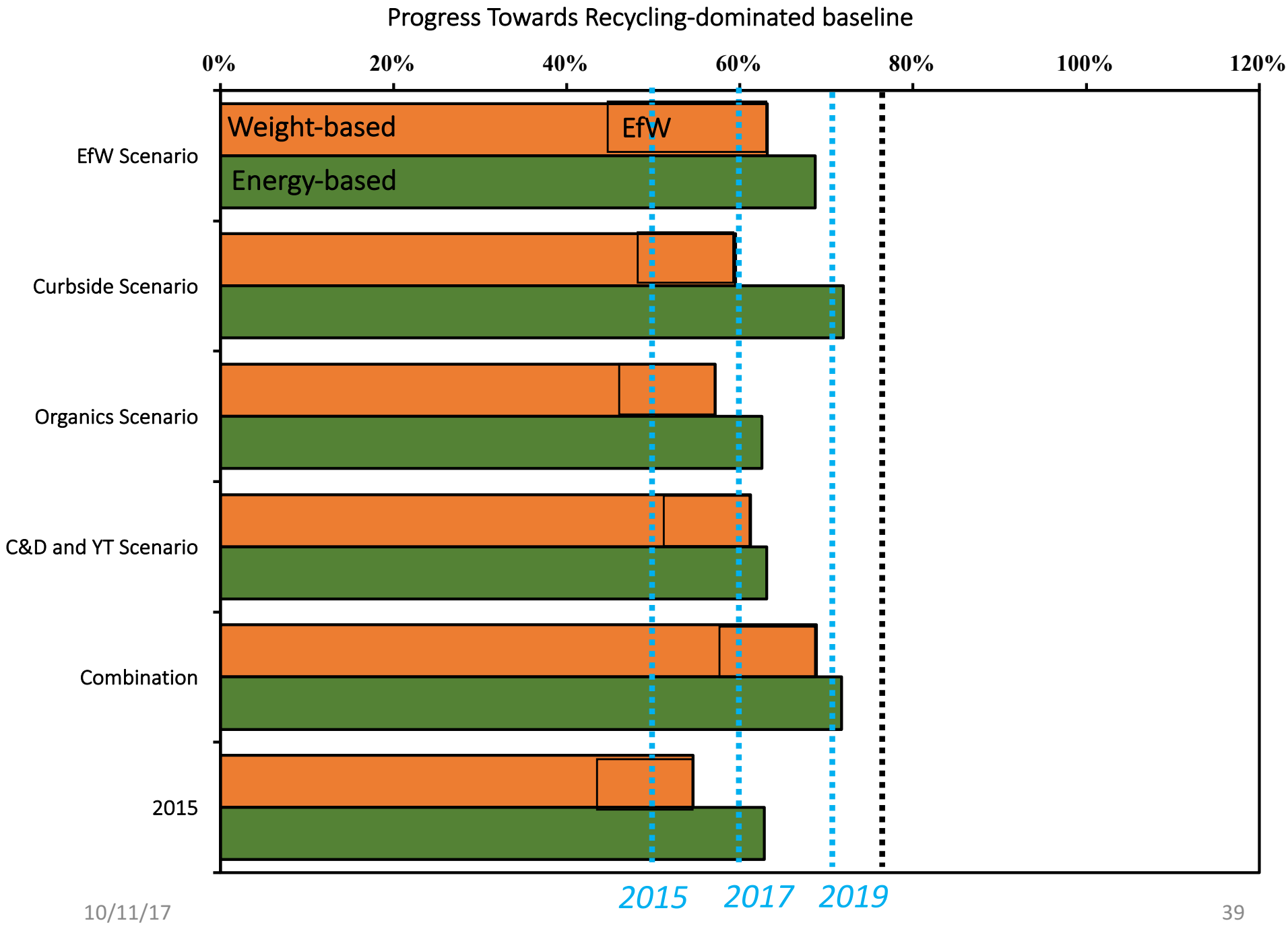
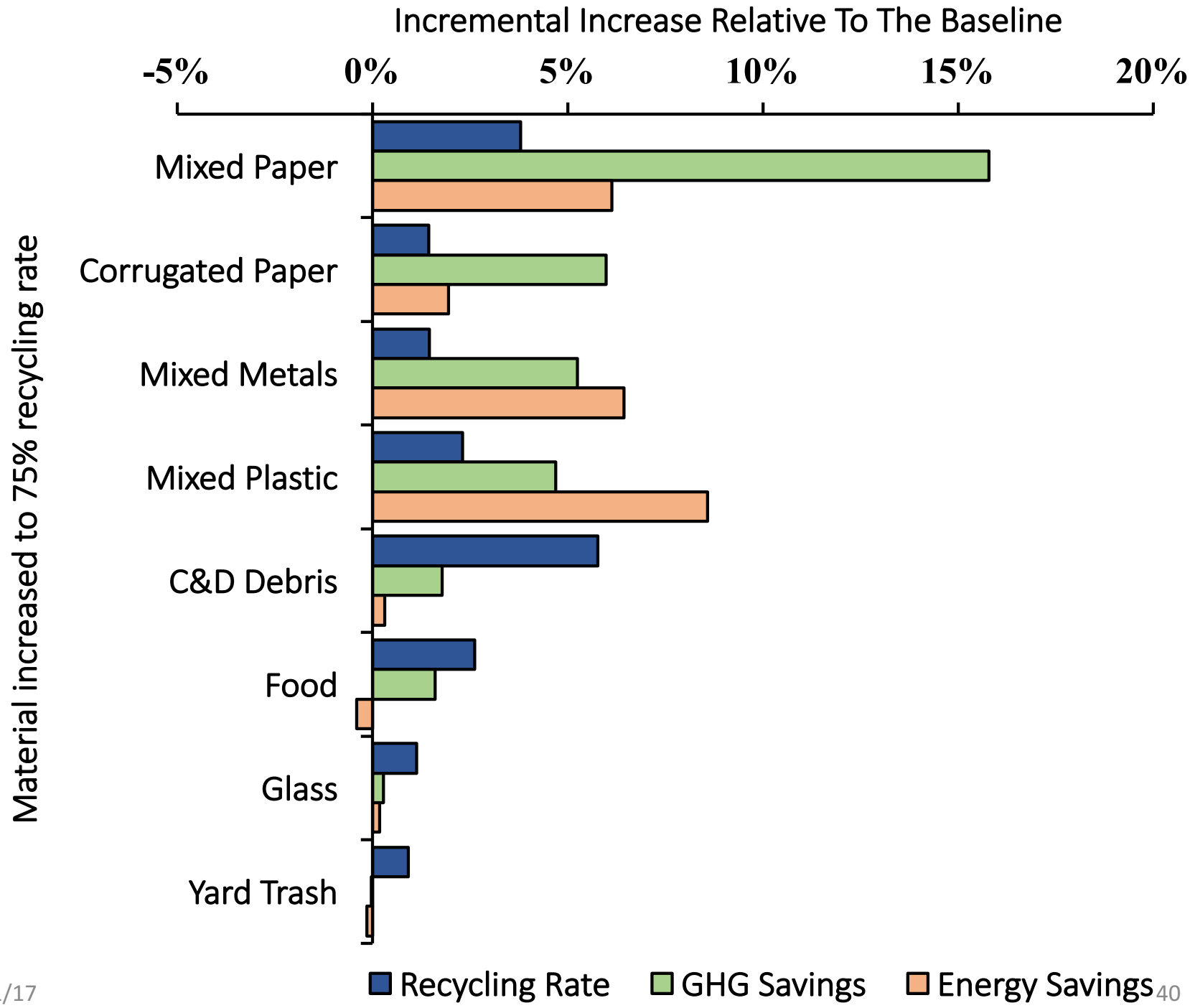


Applying SMM for Florida SWM in 2020




Incremental Increase Relative To The Baseline
-5%
0%
5%
10%
15%
20%
Material increased to 75% recycling rate
Mixed Paper
Corrugated Paper
Mixed Metals
Mixed Plastic
C&D Debris
Food
Glass
Yard Trash
Recycling Rate
GHG Savings
Energy Savings

Summary

- The approach of using lifecycle metrics as an alternative to weight-based recycling rates is of growing interest (e.g., Oregon).
- An approach was developed in Florida to use life cycle metrics (illustrated with energy savings) in a manner to compliment the current statutory requirement. This approach considers source reduction and differences among materials.
- Discussion points:
  - Which baseline to use?
  - Which sustainable consequence to use?