Environmental and Economic Benefits of Food Waste Management

March 2nd, 2017

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Agenda

EPA's Waste Reduction Model

- Organic materials and management practices in WARM
- Results comparison – organics management practices
  - Source reduction
  - Composting
  - Landfilling
  - Anaerobic Digestion

Commercial Food Waste Ban Economic Impact Analysis

- Methodology
- Results

Food Waste Management in U.S. EPA's Waste Reduction Model

What is WARM?

- Waste Reduction Model (WARM)
- Developed by U.S. Environmental Protection Agency with support from ICF since 1998
- WARM calculates life cycle energy and GHG emissions of baseline and alternative waste management practices—source reduction, recycling, combustion, composting, and landfilling—for 50 common MSW and C&D materials types
- Available as an Excel spreadsheet and openLCA (coming soon!)

1. Describe the baseline generation and management for the waste materials listed below.
If the material is not generated in your community or you do not want to analyze it, leave it blank or enter 0. Make sure that the total quantity generated equals the total quantity managed.

Material	Tons Recycled	Tons Landfilled	Tons Combusted	Tons Composted	Tons Anaerobically Digested	Tons Generated
Aluminum Cans				NA	NA	0.0
Aluminum Ingot				NA	NA	0.0
Steel Cans				NA	NA	0.0
Copper Wire				NA	NA	0.0
Glass				NA	NA	0.0
HDPE				NA	NA	0.0
LDPE	NA			NA	NA	0.0
PET				NA	NA	0.0
LLDPE	NA			NA	NA	0.0
PP	NA			NA	NA	0.0
PS	NA			NA	NA	0.0

2. Describe the alternative management scenario for the waste materials generated in the baseline.
Any decrease in generation should be entered in the Source Reduction column.
Any increase in generation should be entered in the Source Reduction column as a negative value.
Make sure that the total quantity generated equals the total quantity managed.

Tons Source Reduced	Tons Recycled	Tons Landfilled	Tons Combusted	Tons Composted	Tons Anaerobically Digested
				NA	NA
				NA	NA
				NA	NA
				NA	NA
				NA	NA
				NA	NA
	NA			NA	NA
				NA	NA
	NA			NA	NA
	NA			NA	NA
	NA			NA	NA

Organic Materials in WARM

Material Name	Assumptions
Food Waste	Weighted average of beef, poultry, grains, bread, fruits and vegetables, and dairy products
Food Waste (non-meat)	Weighted average of grains, fruits and vegetables, and dairy products
Food Waste (meat only)	Weighted average of beef and poultry
Beef	
Poultry	Assumes broiler chicken
Grains	Weighted average of corn, wheat, and rice
Bread	Assumes wheat grain
Fruits and Vegetables	Weighted average of potatoes, tomatoes, citrus, melons, apples and bananas
Dairy Products	Weighted average of dairy products
Yard Trimmings	Weighted average of grass, leaves, and branches
Grass	
Leaves	
Branches	
Mixed Organics	Weighted average of food waste and yard trimmings

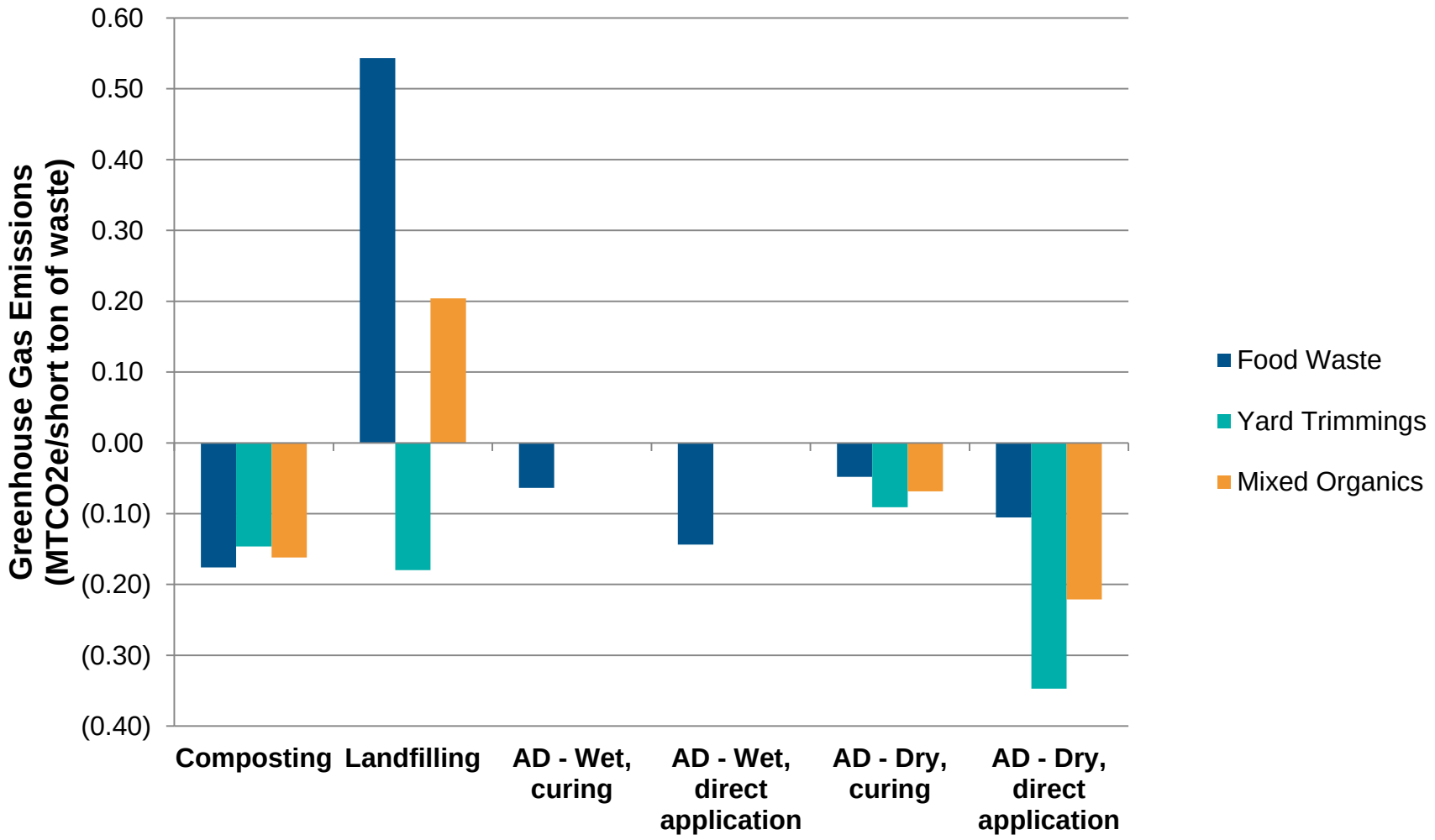
Organics Management Practices in WARM

<table>
<tr><th>Management Practice</th><th>Food Waste</th><th>Yard Trimmings</th><th>Mixed Organics</th></tr>
<tr><td>Source Reduction</td><td>Modeled specifically for all food waste types</td><td colspan="2">Not modeled – does not apply for yard trimmings</td></tr>
<tr><td>Anaerobic Digestion</td><td rowspan="4">Assuming weighted average food waste properties for all food types</td><td>Modeled based on specific properties for grass, leaves, and branches</td><td rowspan="4">Weighted average of food waste, grass, leaves, and branches</td></tr>
<tr><td>Composting</td><td>Assuming weighted average green waste properties</td></tr>
<tr><td>Combustion</td><td>Assuming weighted average green waste properties</td></tr>
<tr><td>Landfilling</td><td>Modeled based on specific properties for grass, leaves, and branches</td></tr>
<tr><td>Donation</td><td>In development; guidance available to estimate avoided landfilling</td><td colspan="2">Not modeled – does not apply for yard trimmings</td></tr>
</table>

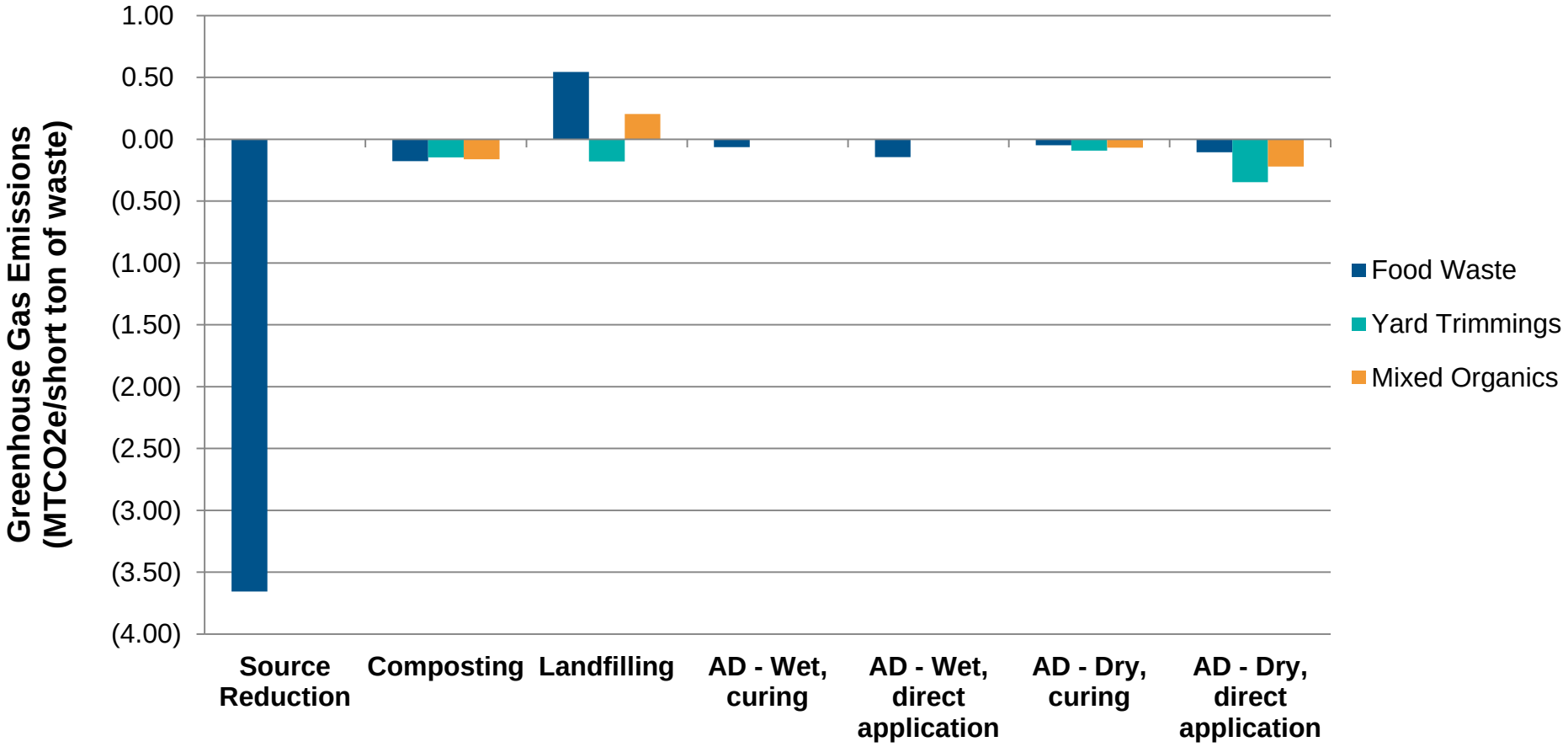
Management Pathways in WARM

	Energy and Emission Sources	Emission Offsets
Source Reduction	N/A	• Energy from raw material acquisition and manufacturing processes • Transportation energy • Non-energy emissions (e.g., refrigerants, enteric fermentation from livestock)
Composting	• Transport to composting facility • Equipment use • Fugitive CH4 and N2O emissions	• Soil carbon storage after land application
Landfilling	• Transport to landfill • Equipment use • Landfill CH4 emissions	• Landfill carbon storage • Net electricity offsets (adjustable for regional electricity grid)
Anaerobic Digestion (Wet and Dry)	• Transport of materials • Preprocessing and digester operations • Biogas collection and utilization • Curing and land application • Fugitive CH4 and N2O emissions	• Carbon storage after land application • Avoided fertilizer offsets • Net electricity offsets (adjustable for regional electricity grid)

Organics Results - Comparison



Organics Results – With Source Reduction



WARM Potential Options

Organics Module

- Separate, stand-alone tool that will only include organic materials and relevant pathways
- Redesigned interface focused on organic materials
- Food donation explicitly modeled
- Additional user inputs for AD and other management practices

Food Donation

- Differs from source reduction – management of existing food materials rather than avoiding food production
- EPA has prepared a guidance document: "Modeling Food Donation Benefits in EPA's Waste Reduction Model"
- Document provides a method for estimating avoided landfilling impacts from food donation
- Accounts for losses during food donation process

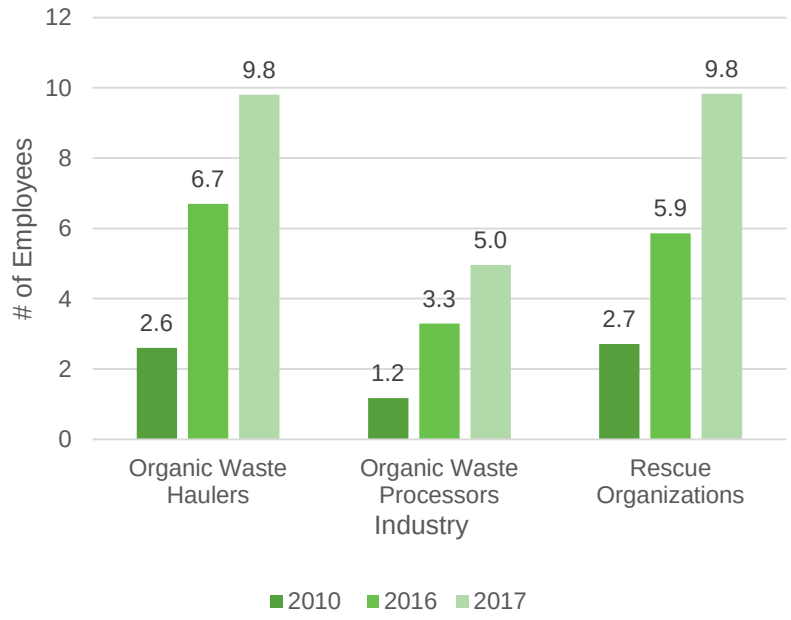
Commercial Food Waste Ban Economic Impact Analysis

Study Methods

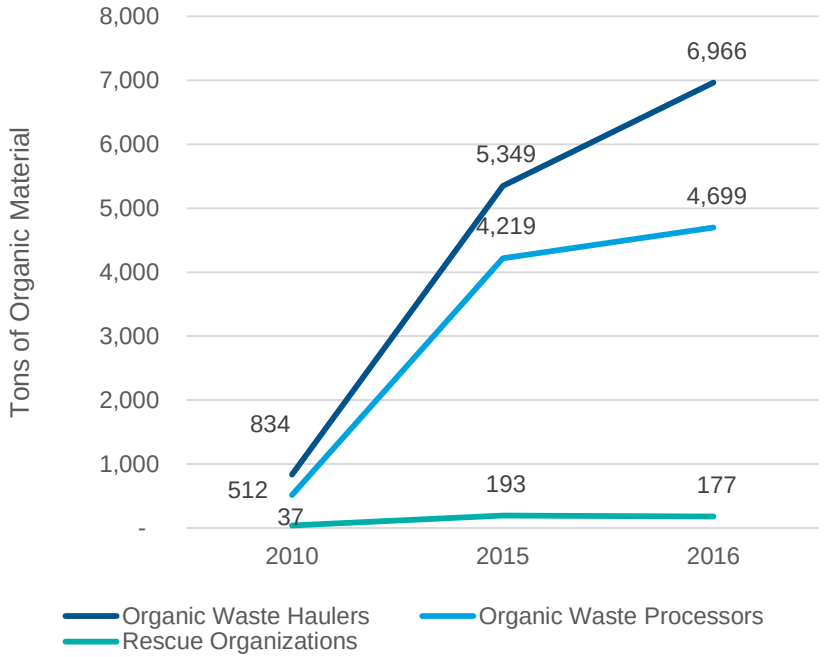
- **Project commissioned by the Massachusetts Department of Environmental Protection**
- **Survey**
  - ICF conducted a survey reaching out to 98 organizations including organic waste haulers, organic waste processors (e.g. composters), and food rescue organizations
  - Survey focused on:
    - Revenue
    - Employment
    - Capital facility and equipment expenditures
    - Plans for future business activities
    - Experience with the ban
- **IMPLAN**
  - IMPLAN (IMpacts for PLANning) is an input-output model economic model
  - ICF ran IMPLAN to calculate the indirect and induced impacts associated with food waste industry activity in Massachusetts

Snapshot of Industry Trends

EMPLOYMENT GROWTH 2010-2016



AVERAGE FOOD TONS PER ORGANIZATION 2010-2016



All segments reported a significant growth in employment from 2010 to 2016, with additional growth expected for 2017.

Based on the average employee per organization in each segment, ICF estimated the total employment across all segments to be roughly 490 in 2015, a 150% increase from 2010.

Haulers and processors handled between six and eight times as much material in 2015 as they did in 2010

The food rescue segment saw gains between 2010 and 2016, but reported less tonnage in 2016 compared to their 2015 high of 193 tons

Source: Data from survey, compiled by ICF.

IMPLAN Results

SUMMARY RESULTS BY SEGMENT, 2016

Impact Type	Haulers	Processors	Rescue Organizations	Total Impact
Employment	500	290	130	910
Labor Income ($ millions)	$25.6	$15.8	$ 5.4	$46.8
Value Added ($ millions)	$42.9	$25.8	$8.1	$76.8
Industry Activity ($ millions)	$101.5	$58.0	$15.1	$174.6
State & Local Taxes ($ millions)	$3.1	$1.8	$0.5	$5.4

Combined, the three industry segments supported over **900 total jobs**, representing a **150% increase** over the estimated 360 total jobs supported in 2010.

Source: IMPLAN Analysis, compiled by ICF. Note: Numbers may not sum due to rounding.

Conclusions

- Commercial Food Waste Disposal Ban has supported the **growth of the industry** and **increased cultural mindset** oriented towards organics waste diversion and broader waste management innovation.
- Across all segments growth in employment, investments, and tonnage of material.
- Combined, the three industry segments generated:
  - 900 jobs
  - $46 million in labor income
  - $77 million to gross state product
  - $175 million in industry activity
  - $5 million in state and local tax revenue

Q&A

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