

# Working the Food Scrap Hierarchy

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## OBJECTIVES

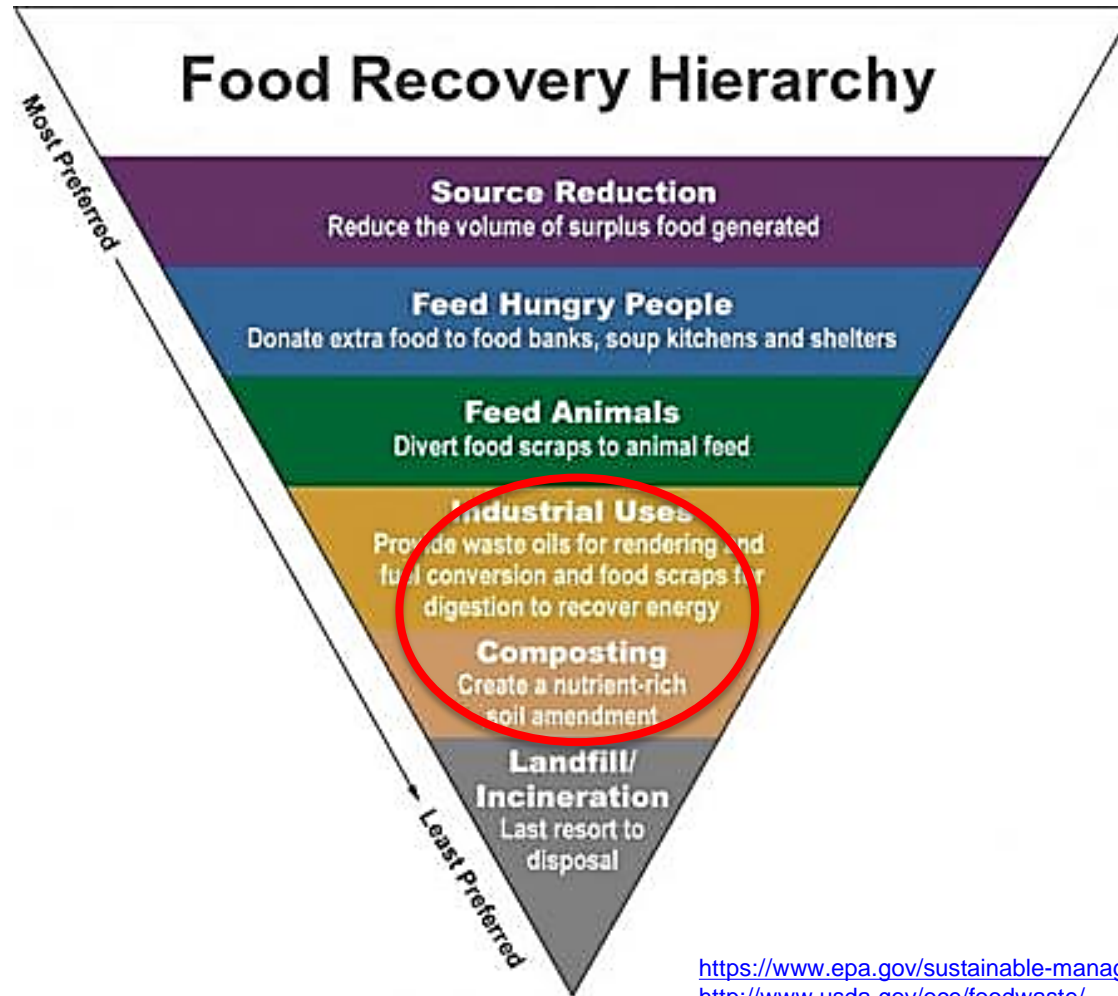
- Research and develop novel waste-to-resource technologies capable to convert organic wastes into value-added fuel and chemical products
- Fulfill commercialization and technology transfer of new waste-to-resource concepts
- Educate the next generation of engineers, scientists and policymakers on waste utilization design and practice





Approximately 40% of the food produced in the U.S. is wasted annually from farm to table

- Largest individual constituent of MSW at 21%
- 0.65 lb/person/day
- 37 million ton/yr (2013)
  - Only 5% beneficially reused
- Equivalent to \$165 billion in lost value
- Worldwide food waste is about 33%



EPA/USDA – National Food Waste Reduction Goal of 50% by 2030

- Greenhouse gas emission reductions
- Energy
- Nutrient value
- Soil structure
- Economics – jobs, production, fees, flexibility
- Water strategy
- Landfill capacity
- Societal



Consumers want safe, wholesome, nutritious, inexpensive, sustainable food



Corporate Sustainability Requirements



- Clean Energy
- Renewables
- Efficiency/Savings



# State by State organic regulation

State <sup>1</sup>	Disposal Ban- Yard Waste	Disposal Ban- Food Waste <sup>3</sup>	Landfill Diversion Target	Renewable Energy Portfolio Requirement
Arizona				✓
Arkansas	✓ <sup>2</sup>			
California		✓ <sup>4</sup> (2016)	✓	✓
Colorado				✓
Connecticut		✓ <sup>4</sup>	✓	✓
Delaware	✓		✓	✓
Florida	✓ <sup>2</sup>		✓	
Georgia	✓ <sup>2</sup>			
Hawaii				✓
Illinois	✓			✓
Indiana	✓			✓
Iowa	✓ <sup>2</sup>			✓
Kansas				✓
Maine				✓
Maryland	✓			✓
Massachusetts	✓	✓ <sup>4</sup>	✓	✓
Michigan	✓		✓	✓
Minnesota	✓			✓
Missouri	✓			✓
Montana				✓
Nebraska	✓ <sup>2</sup>			
Nevada				✓
New Hampshire	✓			✓
New Jersey	✓			✓
New Mexico				✓
New York			✓	✓
North Carolina	✓			✓
North Dakota				✓
Ohio	✓			✓
Oklahoma				✓
Oregon				✓
Pennsylvania	✓			✓
Rhode Island	✓	✓ <sup>4</sup> (2016)		✓
South Carolina	✓			✓
South Dakota	✓			✓
Texas				✓
Utah				✓
Vermont	✓	✓ <sup>5</sup> (2017/2020)		✓
Virginia				✓
Washington				✓
West Virginia	✓			
Wisconsin	✓			✓
<b>TOTAL</b>	<b>24</b>	<b>5</b>	<b>7</b>	<b>37</b>



- Massachusetts (2014)
- Vermont (2014) – commercial food waste, 104 ton/yr
- Connecticut (2014) – commercial food waste, 104 ton/yr
- Rhode Island (2016) – commercial food waste, 104 ton/yr
- New York City (2015) – based on business size
- California (2016) – commercial food waste, 8 yd/wk
- San Francisco (EBMUD) – 120 tpd, 4.5 MW CHP
- Ann Arbor – summer time collection, ongoing study

- Wastewater
  - Treatment digester  $\approx$  60
  - Accepting outside substrate – 2 active, several evaluating
    - Bioworks (Flint)
    - Lowell Energy AD (Spart, Lowell Light & Power)
- Commercial (food processors)  $\approx$  10
- Agricultural – 7 operating, 1 planning
  - 4 accepting outside substrate (FOG, processing waste)
  - Energy generation capacity – 3.2 to 3.6 MW
  - Methane emission reduction – 49,000 mton CO<sub>2</sub>/yr
- Community system – 1

# Michigan food waste generation

Source	Number	Population	Assumed Daily Waste		Generation Days	Potential Mass of Food Waste	
			Min. (lb/d)	Max. (lb/d)		Min. (ton/yr)	Max. (ton/yr)
Food Processors							
Large	60		2,000	25,000	350	21,000	262,500
Medium	300		1,000	5,000	250	37,500	187,500
Small	200		50	999	250	1,250	24,975
Retail	300		200	600	360	10,800	32,400
Hospitals	107	16,057	0.4	0.6	365	1,172	1,758
Correctional facilities	31	43,570	0.4	0.6	365	3,181	4,771
Universities	105	684,965	0.4	0.6	303	41,509	62,263
Schools	927	1,548,835	0.4	0.6	170	52,660	78,991
Food Service	35,058		0.4	0.6	365		
<b>Commercial Total</b>						<b>169,072</b>	<b>655,158</b>
Residential	4,539,871	9,922,576		0.6	365		1,086,522

- Innovative organics waste management options exist
- Technologies are commercially available
- Multiple benefits can be realized
  - GHG reductions
  - Energy
  - Nutrients
- Social pressures
- Markets need to be developed for products
- Support network needs to be developed

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