Zero Waste Composting:

How Food Waste Can Help Conquer Climate Change and Prevent Disease

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Eureka Recycling's mission is to demonstrate that waste is preventable, not inevitable.

What is Zero Waste?

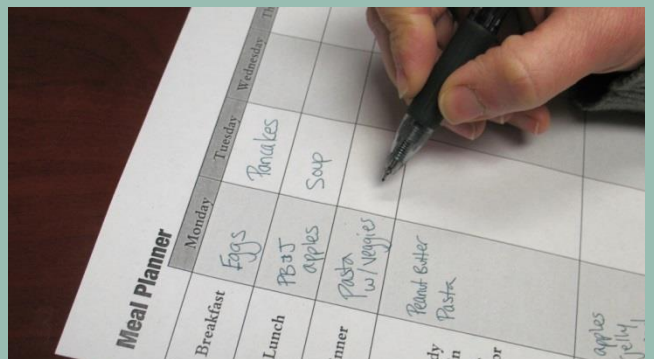
Zero-Waste Composting

1. Preventing wasted food

2. Backyard or worm composting

3. Collection of what's left

Preventing Wasted Food



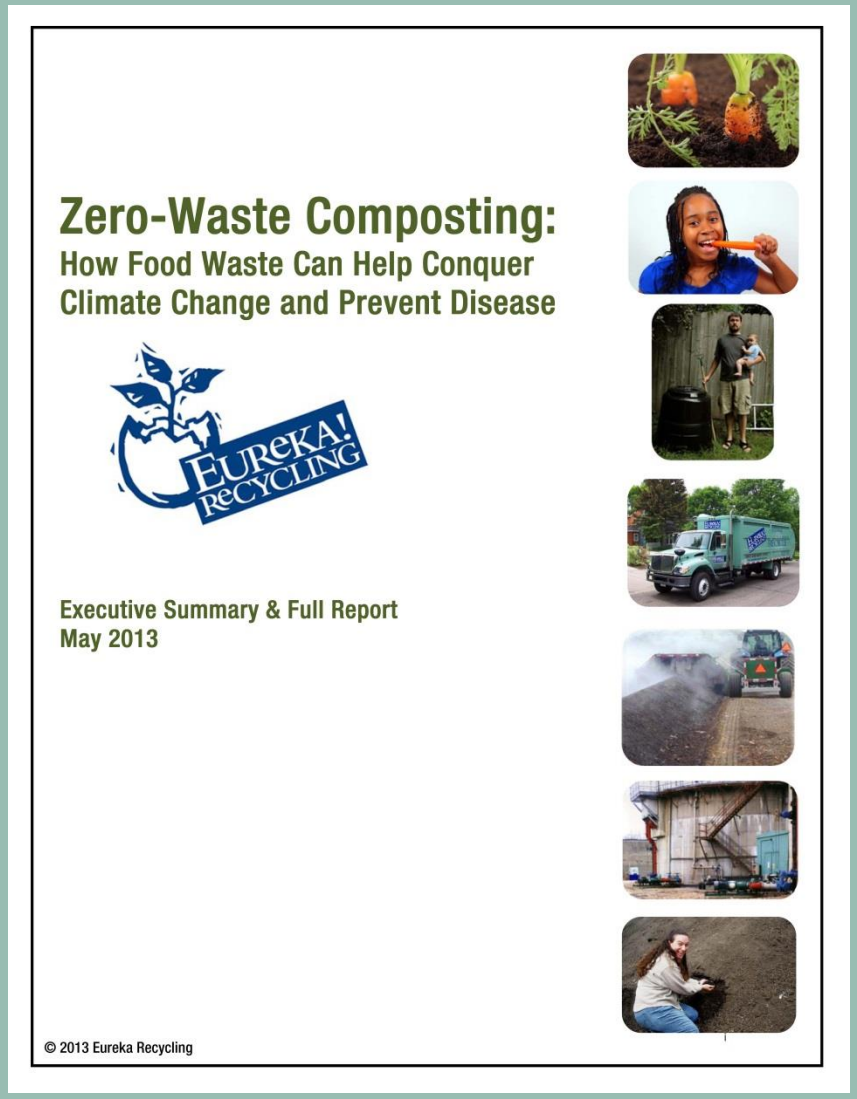
Food Storage Tips—Quick Reference

EUREKA! RECYCLING

	Counter/Room Temp	Fridge	Freezer	Exceptions
Apples, pears	Ripen **pears** on counter.	Keep in the fridge; remove bad apples/pears.		For longer storage: keep in cool place in a cardboard box with damp towel over them.
	Last longer in fridge.	Store single layer, unwashed, airtight container.	Freeze in single layer on cookie sheet. Store airtight.	If you need to wash ahead, a little vinegar in water.
		in open container in	Freeze juice in ice cube trays. Store peels and cubes airtight.	
			melon and	

Backyard & Worm Composting

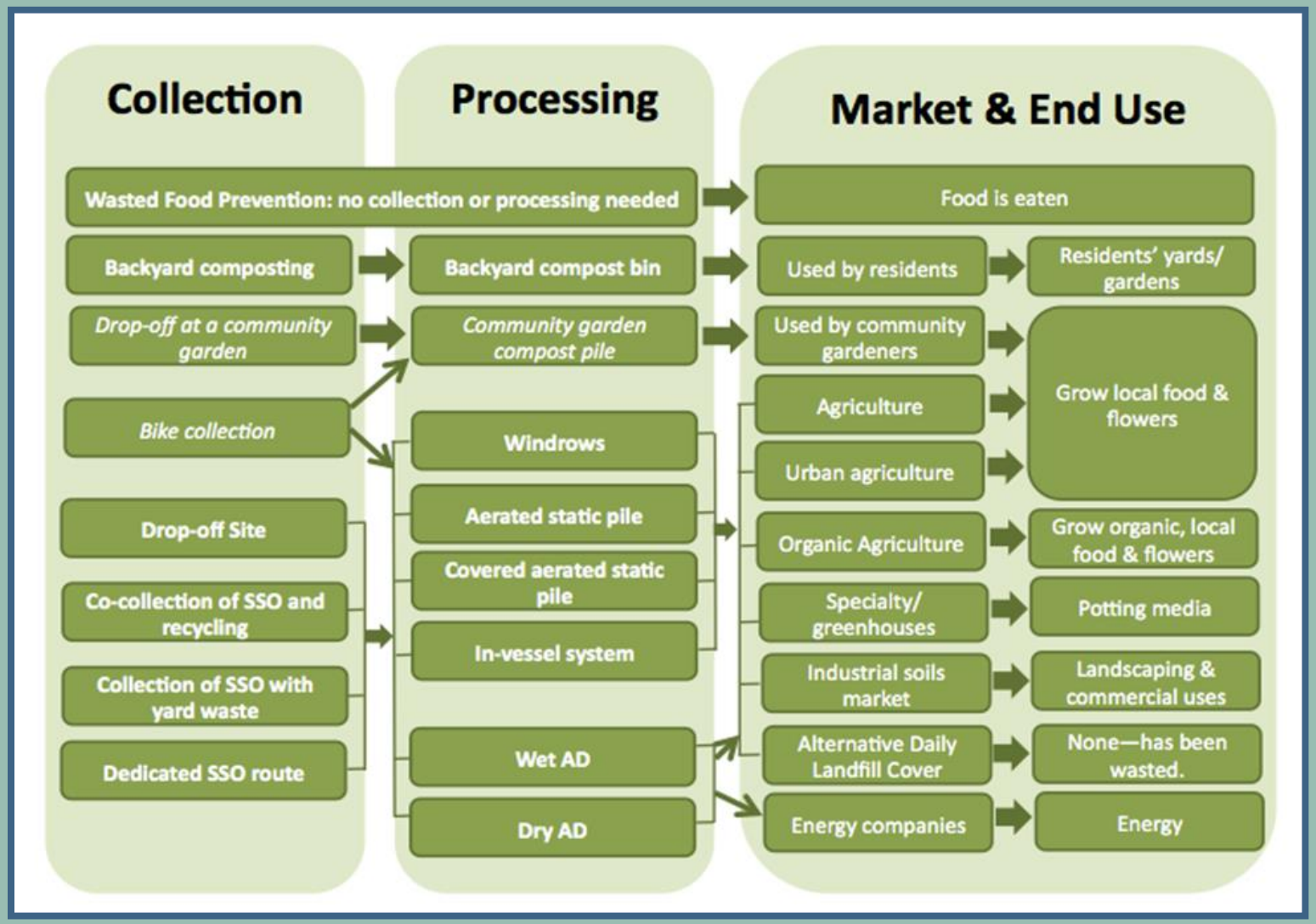
Zero-Waste Composting Report



Eureka Recycling's Research Partners:

- Nothing Left to Waste
- Sound Resource Management Group (SRMG)
- R. Alexander Associates, Inc. (RAA)
- Short Eliot Hendrickson (SEH)
- Resource Recycling Systems (RRS)
- Woods End Laboratories
- Specialized Environmental Technologies, Inc. / The Mulch Store
- Carver County Environmental Services

Options and Pathways for the Prevention & Management of Residential SSO

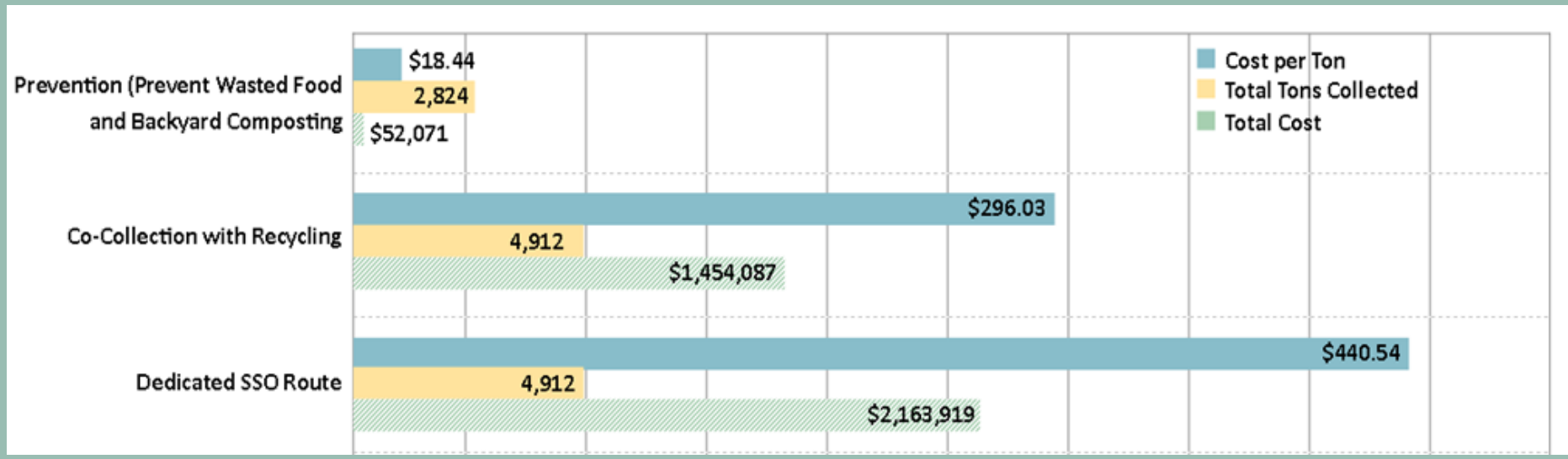


Triple Bottom Line

Economic	Environmental	Social
Program Costs	Climate Change*	
	Human Health—Particulates*	Human Health—Particulates*
	Human Health—Toxics*	Human Health—Toxics*
	Human Health—Carcinogens*	Human Health—Carcinogens*
	Eutrophication*	Job Creation
	Acidification*	Direct Benefits to Residents
	Ecosystems Toxicity*	

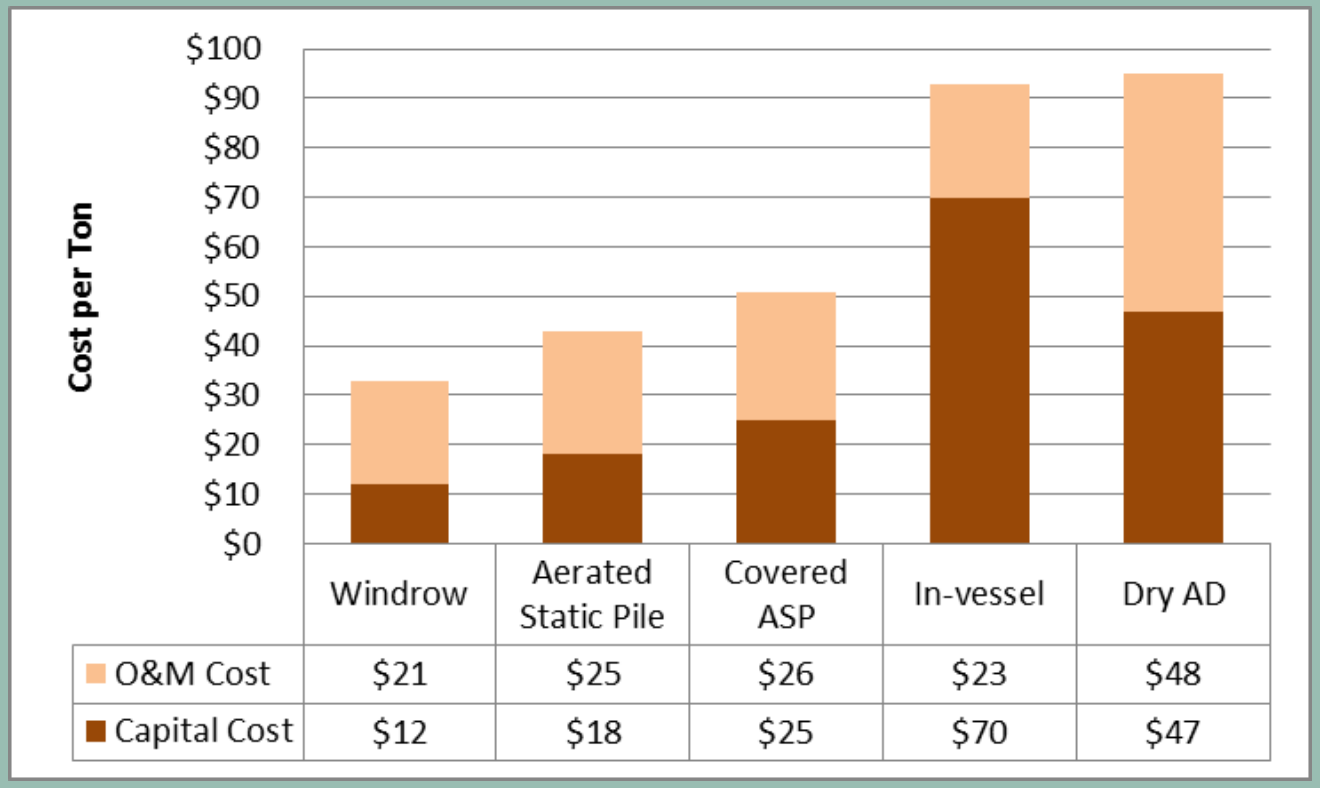
** Indicators calculated using MEBCalc™ Life Cycle Analysis Calculator*

Prevention and Collection Options: Costs and Tons Collected

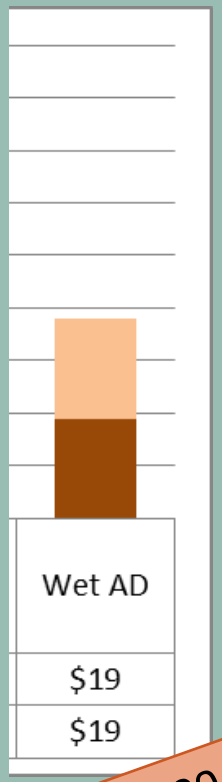


For St. Paul, a program that includes prevention & co-collection with recycling would cost $100 per ton ***less*** than co-collection alone.

Comparison of Processing Costs per Ton of Total Organics



6,000 tons per year



25,000 tons per year

Residential SSO as Primary Feedstock of AD?

- Analysis by Woods End Laboratory found that Residential SSO in comparison to Commercial SSO
  - C:N ratio ranges (due to long detention times C:N ration evens out)
    - Residential range of 24.6 to 32.7
    - Commercial range of 9.2 to 22.9
  - Biogas output
    - Residential = 1.8 million BTU/Ton
    - Commercial = 5.2 million BTU/Ton (3 times as much output)

What MEBCalc™ Does

- Inventories pollutants (100s) from solid waste management activities that are released at no cost to their generators
- Aggregates pollutant impacts into 7 types of environmental and human health effects
- Aggregates 7 impacts into overall estimate of solid waste system externalized costs
- Compares external costs for diversion scenarios to disposal scenarios

MEBCalc™ LCA Impact Categories

- **Climate change** – carbon dioxide equivalents (eCO_2)
- **Human health - respiratory diseases** – particulate matter no more than 2.5 microns equivalents ($ePM_{2.5}$)
- **Human health - non-cancers** – toluene equivalents (eToluene)
- **Human health - cancers** – benzene equivalents (eBenzene)
- **Eutrophication** – nitrogen equivalents (eN)
- **Acidification** – sulfur dioxide equivalents (eSO_2)
- **Ecosystems toxicity** – herbicide 2,4-D equivalents (e2,4-D)

Cost of LCA Impacts

- **Climate change**
  - $40/ton eCO_2
- **Human health - respiratory diseases**
  - $10,000/ton $ePM_{2.5}$
- **Human health - non-cancers**
  - $118/ton eToluene
- **Human health - cancers**
  - $3,030/ton eBenzene
- **Eutrophication**
  - $4/ton eN
- **Acidification**
  - $410/ton eSO_2
- **Ecosystems toxicity**
  - $3280/ton e2,4-D

LCA Emissions Summary

(pounds/ton food waste)

	Climate Change	Human Health-Particulates	Human Health-Toxics	Human Health-Carcinogens	Eutrophication	Acidification	Ecosystems Toxicity
	eCO_2	*e$PM_{2.5}$*	*eToluene*	*eBenzene*	*eN*	*eSO_2*	*e2,4-D*
Prevention							
Preventing Wasted Food	-1,259.98	-2.45	-374.23	-0.16	-0.61	-11.56	-0.04
Backyard Composting	-296.03	-2.096	-221.55	-0.32261	-0.1702	-4.8987	-0.0377
Collection							
Co-Collection w/ Recycling	63.09	0.0041	1.24	0.0008	0.0012	0.0462	0.0001
Dedicated SSO Route	378.54	0.0248	7.46	0.0047	0.0074	0.2774	0.0008
Processing							
Aerobic Composting	-368.88	-2.0607	-220.22	-0.3226	-0.0318	-4.7007	-0.0326
Wet AD	-137.37	1.4347	-64.55	4.1349	-0.02	-3.2542	-0.0187
Dry AD	-239.13	-1.8488	-126.51	3.1983	-0.027	-4.2064	-0.026

Environmental, Human Health & Avoided Disposal Costs/Ton FW

	Climate Change	Human Health-Particulates	Human Health-Toxics	Human Health-Carcinogens	Eutrophication	Acidification	Ecosystems Toxicity	Total Cost	Current Disposal Method for Saint Paul	Total Cost (Benefits)
unit	*eCO_2*	*$ePM_{2.5}$*	*eToluene*	*eBenzene*	*eN*	*eSO_2*	*e2,4-D*			
Prevention										
Preventing Wasted Food	($25.20)	($12.25)	($22.08)	($0.24)	$0.00	($2.37)	($0.07)	($62.21)	$50.66	**($112.87)**
Backyard Composting	($5.92)	($10.48)	($13.07)	($0.49)	$0.00	($1.00)	($0.06)	($31.03)	$50.66	**($81.69)**
Collection										
Co-Collection w/ Recycling	$1.26	$0.02	$0.07	$0.00	$0.00	$0.01	$0.00	$1.37	*NA*	**$2.73**
Dedicated SSO Route	$7.57	$0.12	$0.44	$0.01	$0.00	$0.06	$0.00	$8.20	*NA*	**$16.40**
Processing										
Aerobic Composting	($7.38)	($10.30)	($12.99)	($0.49)	$0.00	($0.96)	($0.05)	($32.18)	$50.66	**($82.84)**
Wet AD	($2.52)	($7.17)	($3.81)	$6.26	$0.00	($0.66)	($0.03)	($7.93)	$50.66	**($58.59)**
Dry AD	($4.56)	($9.24)	($7.46)	$4.85	$0.00	($0.86)	($0.04)	($17.32)	$50.66	**($67.98)**

Zero-Waste Composting for St. Paul, MN

Impact of Zero-Waste Composting for Three Years in Saint Paul

Human Health and Environmental Cost Savings			
	Prevention	**Collection & Processing**	**Total**
Tonnage	***8,896***	***15,473***	***24,368***
Climate Change (eCO2)	($322,398)	($458,479)	**($780,877)**
Human Health - Particulates (ePM2.5)	($100,543)	($162,156)	**($262,699)**
Human Health - Toxics (eToluene)	($356,107)	($567,848)	**($923,954)**
Human Health- Carcinogens (eBenzene)	($28,261)	($50,484)	**($78,745)**
Eutrophication (eN)	($7)	($3)	**($10)**
Acidification (eSO2)	($16,584)	($20,613)	**($37,197)**
Ecosystems Toxicity (e2,4-D)	($659)	($993)	**($1,652)**
	($824,558)	**($1,260,576)**	**($2,085,133)**

Zero-Waste Composting for St. Paul, MN

The full report is available on Eureka Recycling's composting website:

www.MakeDirtNotWaste.org

Additional Resources:

- **Eureka Recycling: www.eurekarecycling.org**
- **Sound Resource Management Group: www.zerowaste.com**