Biomass Management: Ranking Management Options For Wood, Yard Debris & Food Scraps

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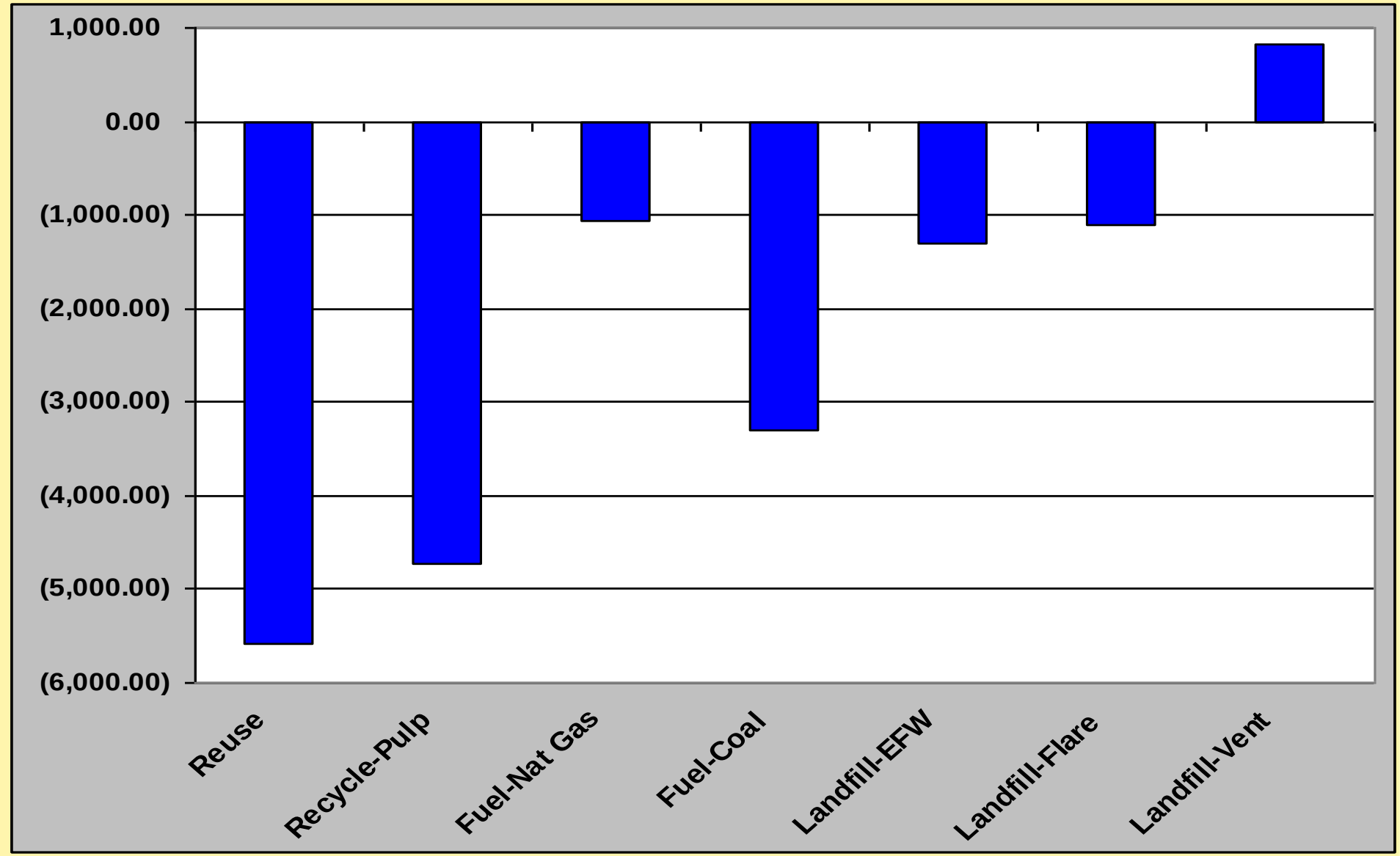
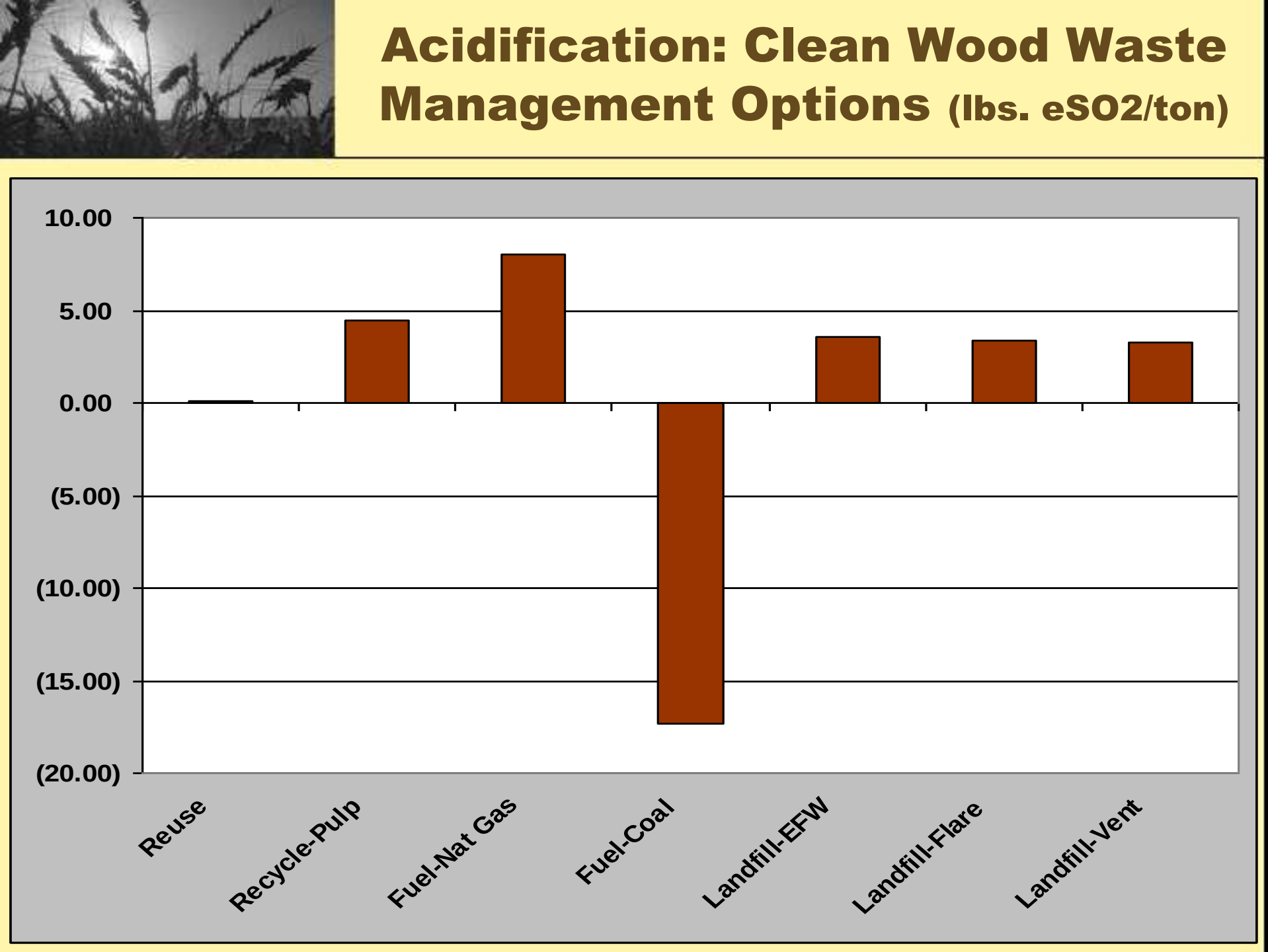
CO_2 Emissions: Clean Wood Waste Management Options (pounds/ton)

	Reuse	Recycle To Paper Pulp	Fuel Replace Nat. Gas	Fuel Replace Coal	Landfill Recover Energy	Landfill Flare LFG	Landfill Vent LFG
Emissions							
New Wood Production		.5*660 + .5*673 = 666	.5*660 + .5*673 = 666	.5*660 + .5*673 = 666	.5*660 + .5*673 = 666	.5*660 + .5*673 = 666	.5*660 + .5*673 = 666
Processing & Chipping		141	141	141			
Chip Storage		100	100	100			
Hauling	6	29	17	17	12	12	12
Combustion			68	68			
Biodegradation					647	647	2,587
Internal Combustion Engine for Electricity Generating Equipment					*0*		
Landfill Gas (LFG) Flare						*0*	
Landfill Operations					*66*	*66*	*66*
Offsets							
Carbon Storage	-2,878	-2,878			-2,506	-2,506	-2,506
Tree Harvest	-2,700	-2,700					
Pulping Wood Production		-92					
Natural Gas Production & Combustion			-2,066		-182		
Coal Production & Combustion				-4,299			
Net Emissions	-5,572	-4,733	-1,072	-3,306	-1,297	-1.115	825

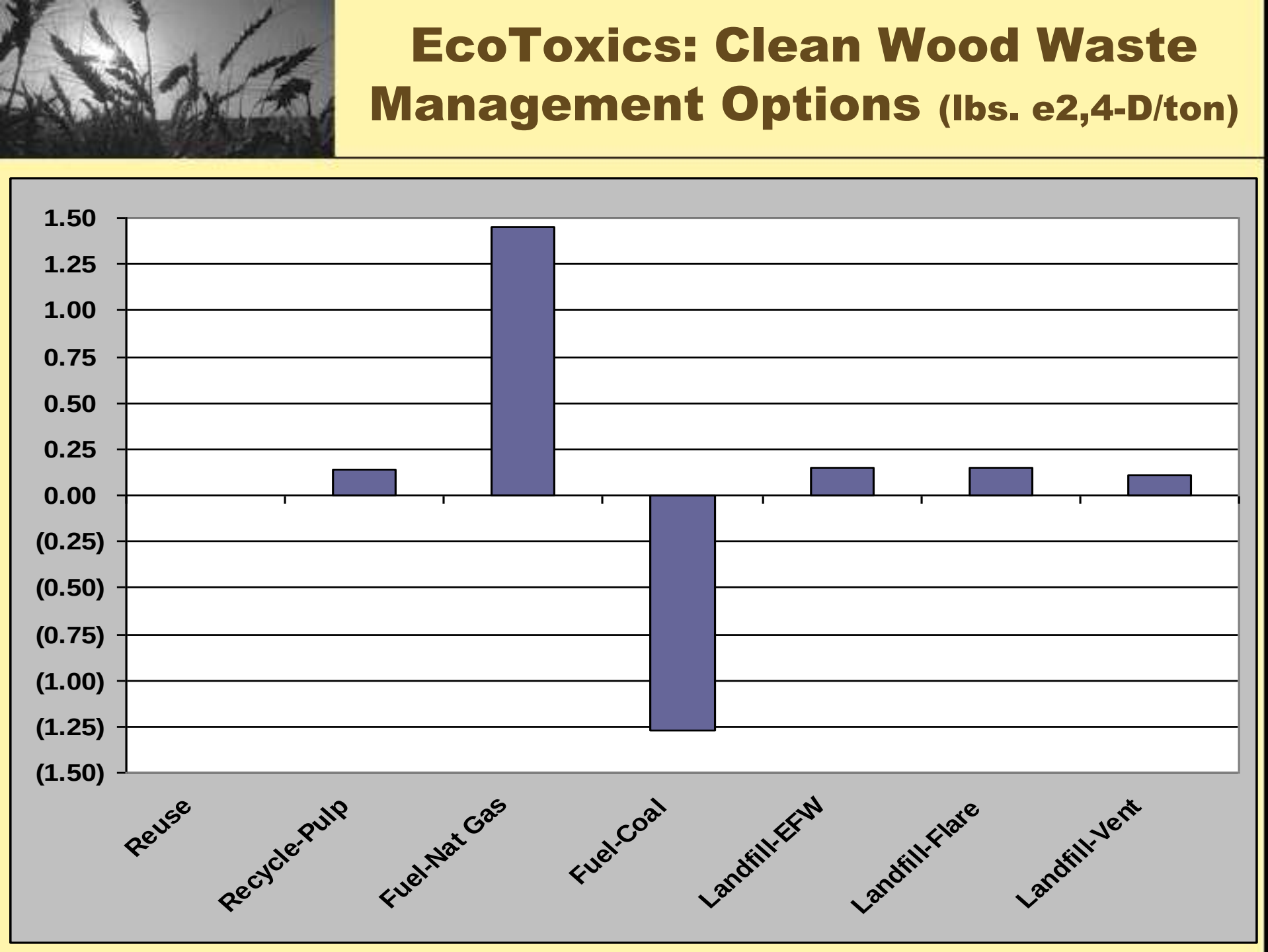
CO_2 Emissions: Clean Wood Waste Management Options (lbs. eCO_2/ton)



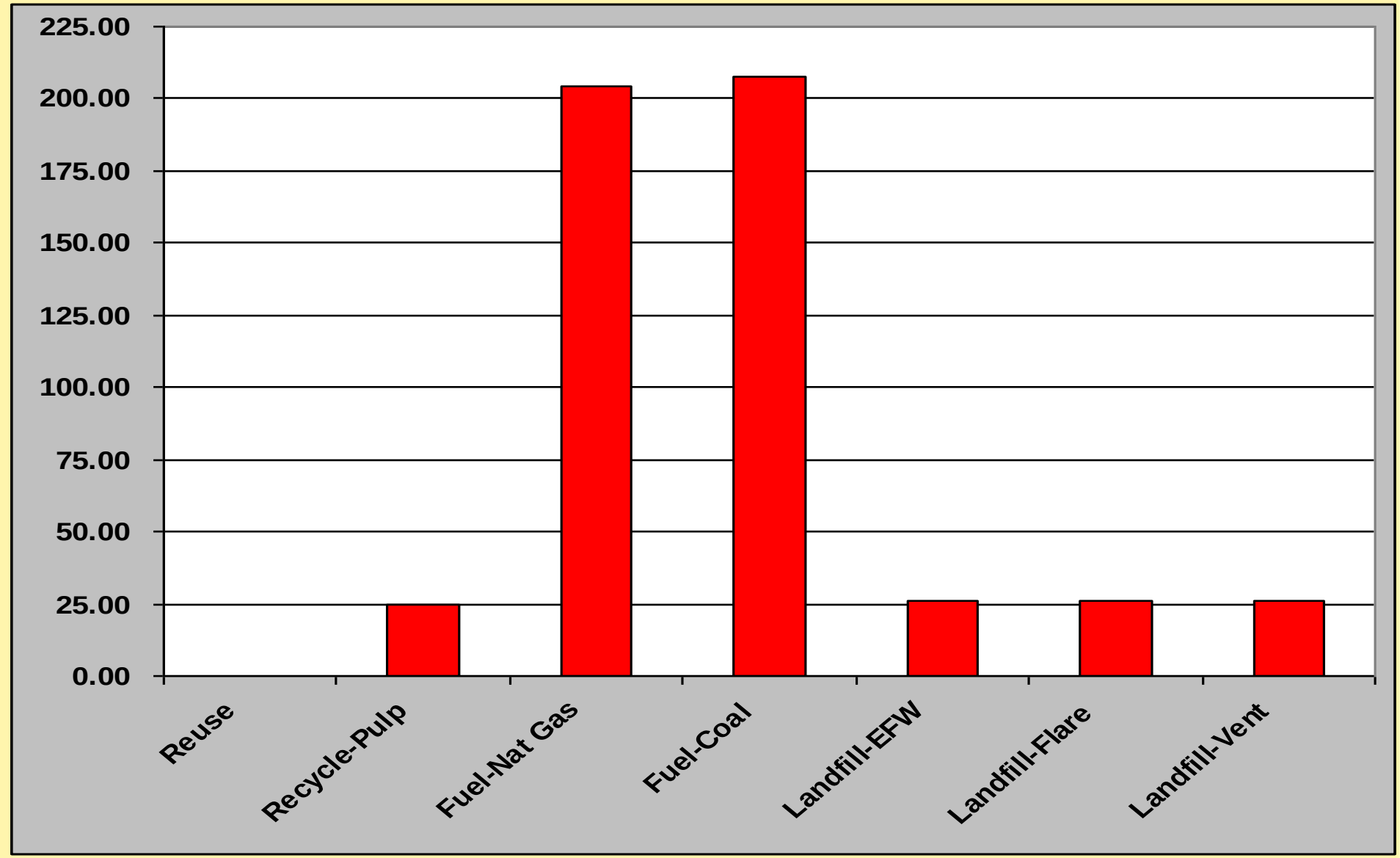
Acidification: Clean Wood Waste Management Options (lbs. eSO2/ton)



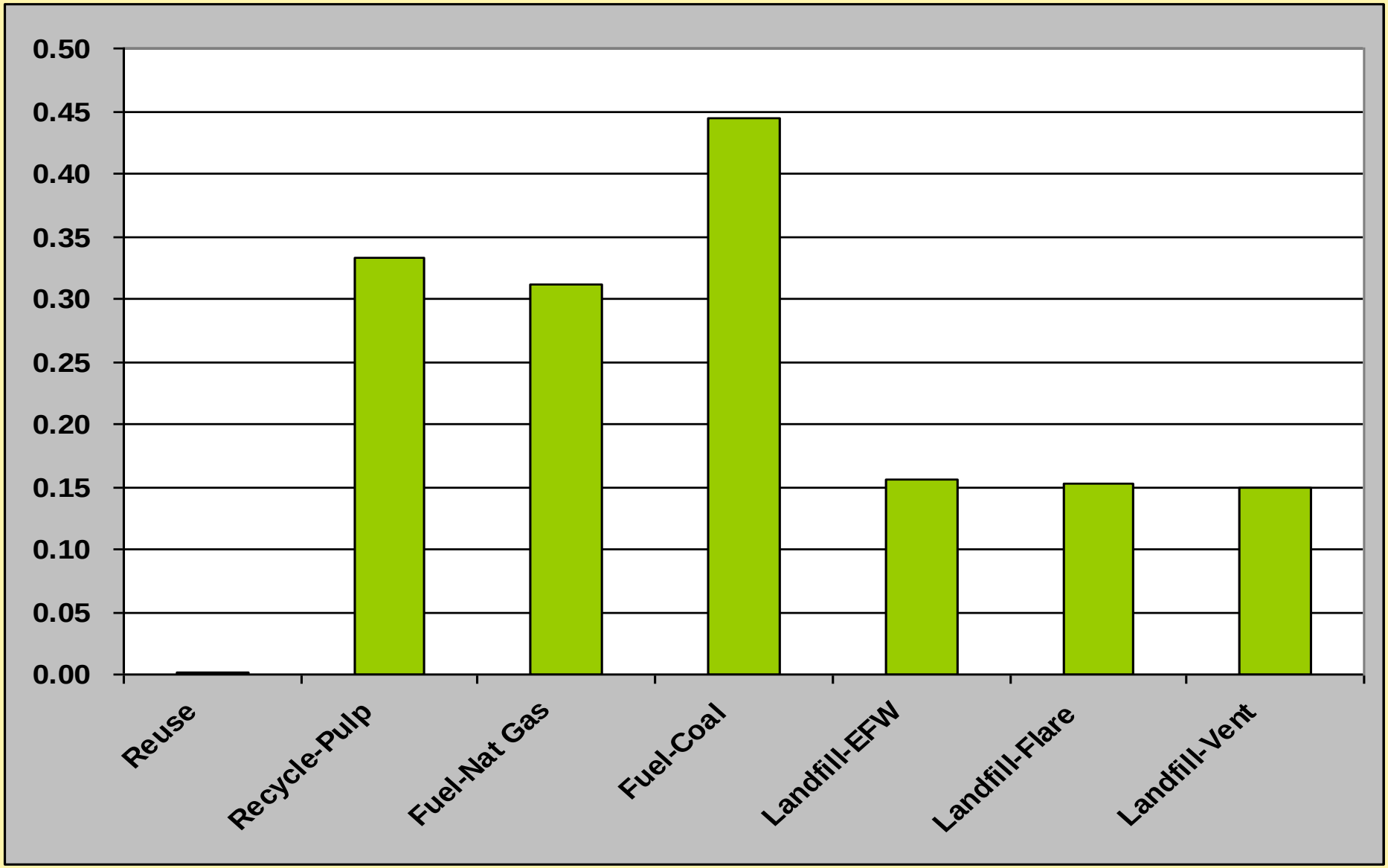
EcoToxics: Clean Wood Waste Management Options (lbs. e2,4-D/ton)



Human Toxics: Clean Wood Waste Management Options (#s eToluene/ton)



Eutrophication: Clean Wood Waste Management Options (lbs eN/ton)



Value of Pollution Reductions

LCA Impact	Economic Cost (US$/ton)
Climate Change	$36 eCO2
Human Health - Particulates	10,000 ePM2.5
Human Health - Toxins	118 eToluene
Human Health - Carcinogens	3,030 eBenzene
Ecosystems Toxics	3,280 e2,4D
Acidification	661 eSO2
Eutrophication	4 eNitrogen

Environmental Value for Wood Waste Management Options

	Pounds of Impact Category Emissions Released/(Reduced) Per Ton of Wood Waste						
Impact Category	Lumber Reuse	Recycling to Paper Pulp	Fuel Sub for Natural Gas	Fuel Sub for Coal	Landfill - LFG Energy	Landfill - LFG Flare	Landfill - LFG Vent
Climate Change (eCO2)	-5,572.18	-4,732.40	-1,072.24	-3,306.48	-1,296.94	-1,115.18	824.89
Acidification (eSO2)	0.05	4.42	8.04	(17.35)	3.58	3.35	3.30
Eutrophication (eN)	0.00	0.33	0.31	0.44	0.16	0.15	0.15
Particulates (ePM2.5)	0.01	3.10	6.72	0.49	3.09	3.03	3.02
Human Toxics (eT)	0.00	24.37	204.49	207.66	26.02	26.03	26.02
Human Carcinogens (eB)	0.00	0.00	0.16	0.15	0.00	0.00	0.00
Ecosystems Toxicity (e2,4-D)	0.00	0.14	1.45	(1.27)	0.14	0.15	0.11
Environmental Benefit/(Cost)	$100	$67	($32)	$52	$5	$2	($33)
-- with metals emissions	$100	$26	($699)	($563)	($39)	($41)	($75)

Definitions of Terms on Graphs

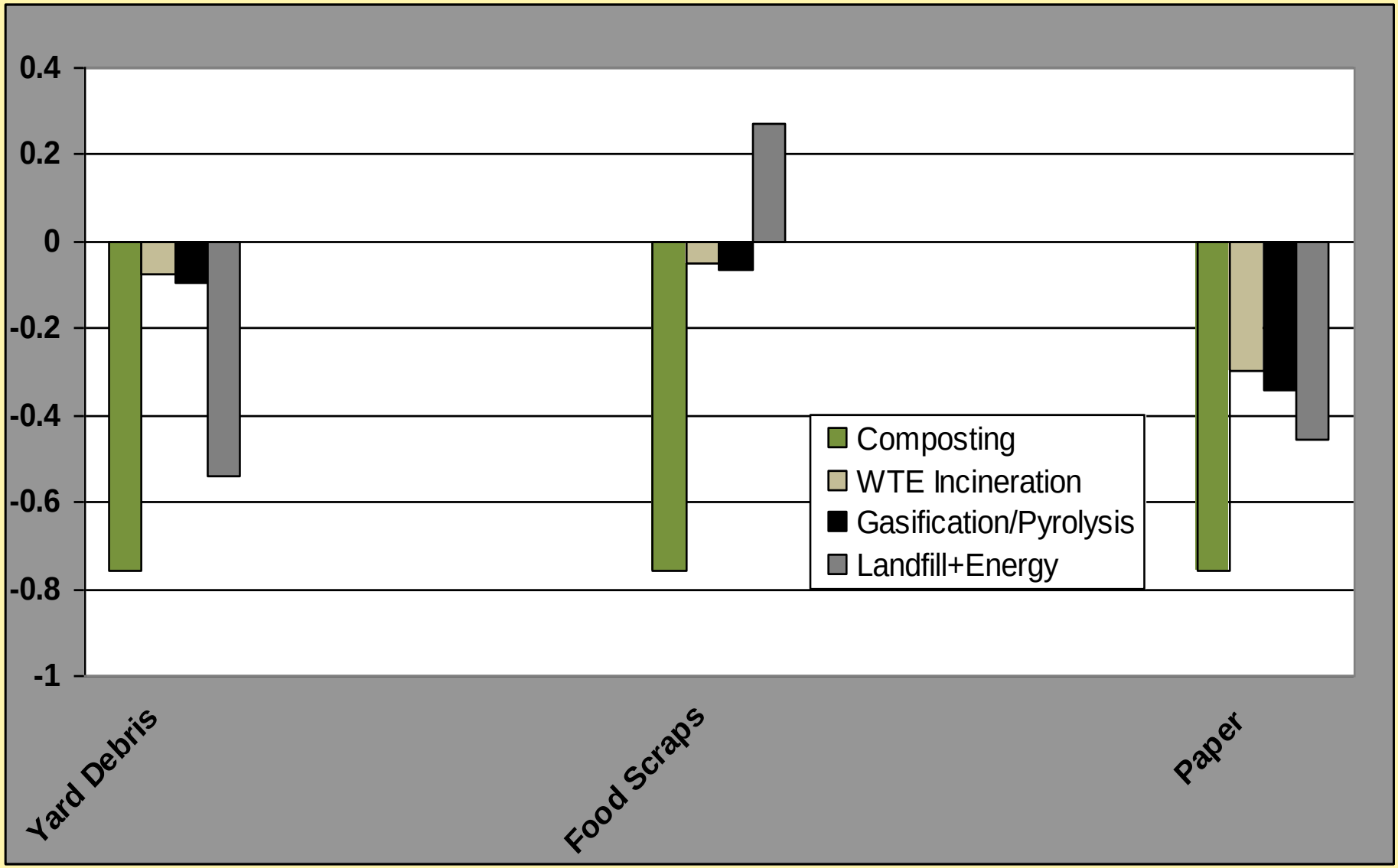
1. Composting: aerobic composting

2. WTE Incineration: mass burn thermal conversion/ advanced thermal recycling (offset to natural gas powered electricity generation)

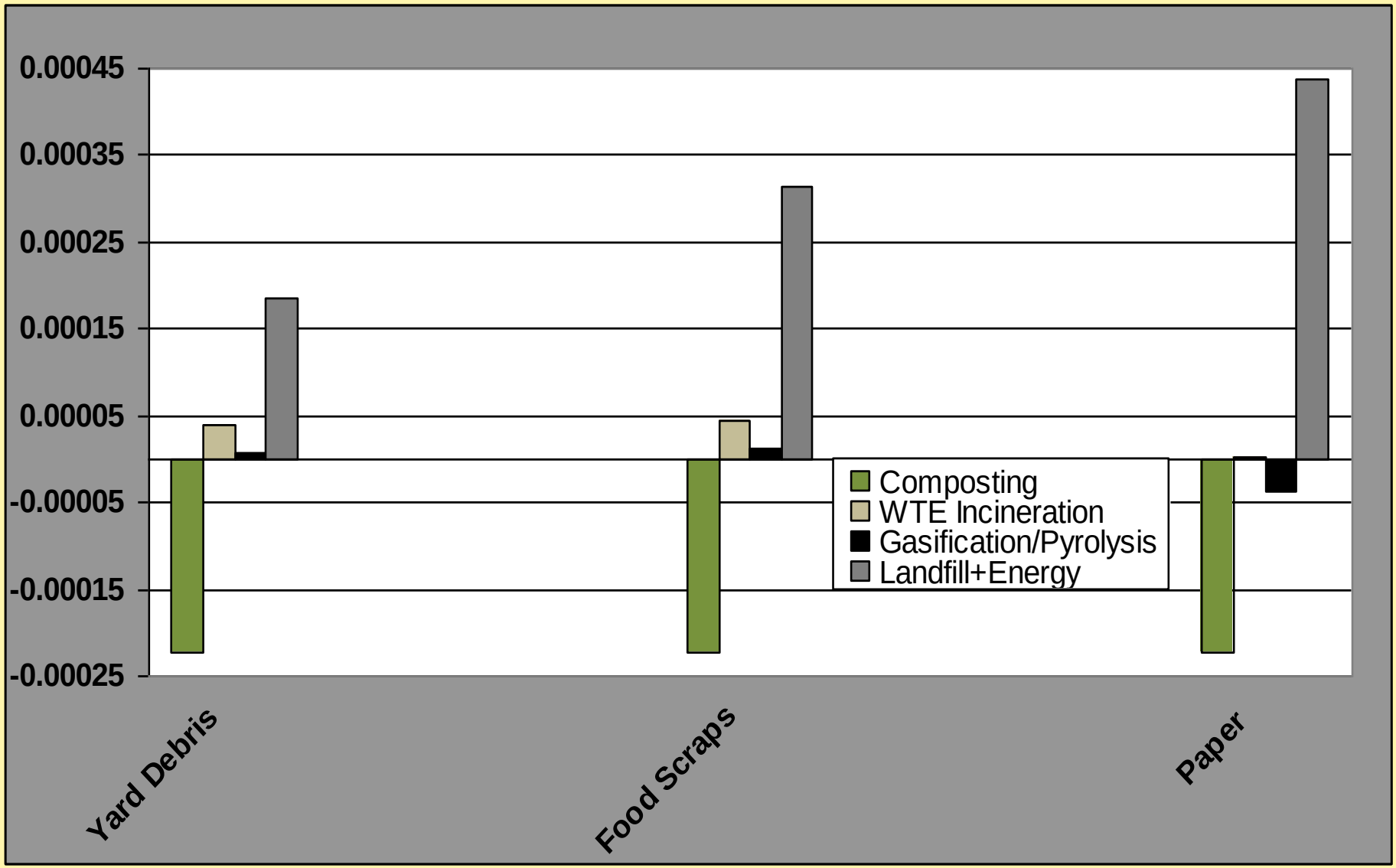
3. Gasification/Pyrolysis: averages for advanced thermal conversion technologies (offset to nat. gas electricity)

4. Landfill+Energy: 75% methane capture & conversion to electricity via an internal combustion engine (offset to natural gas electricity)

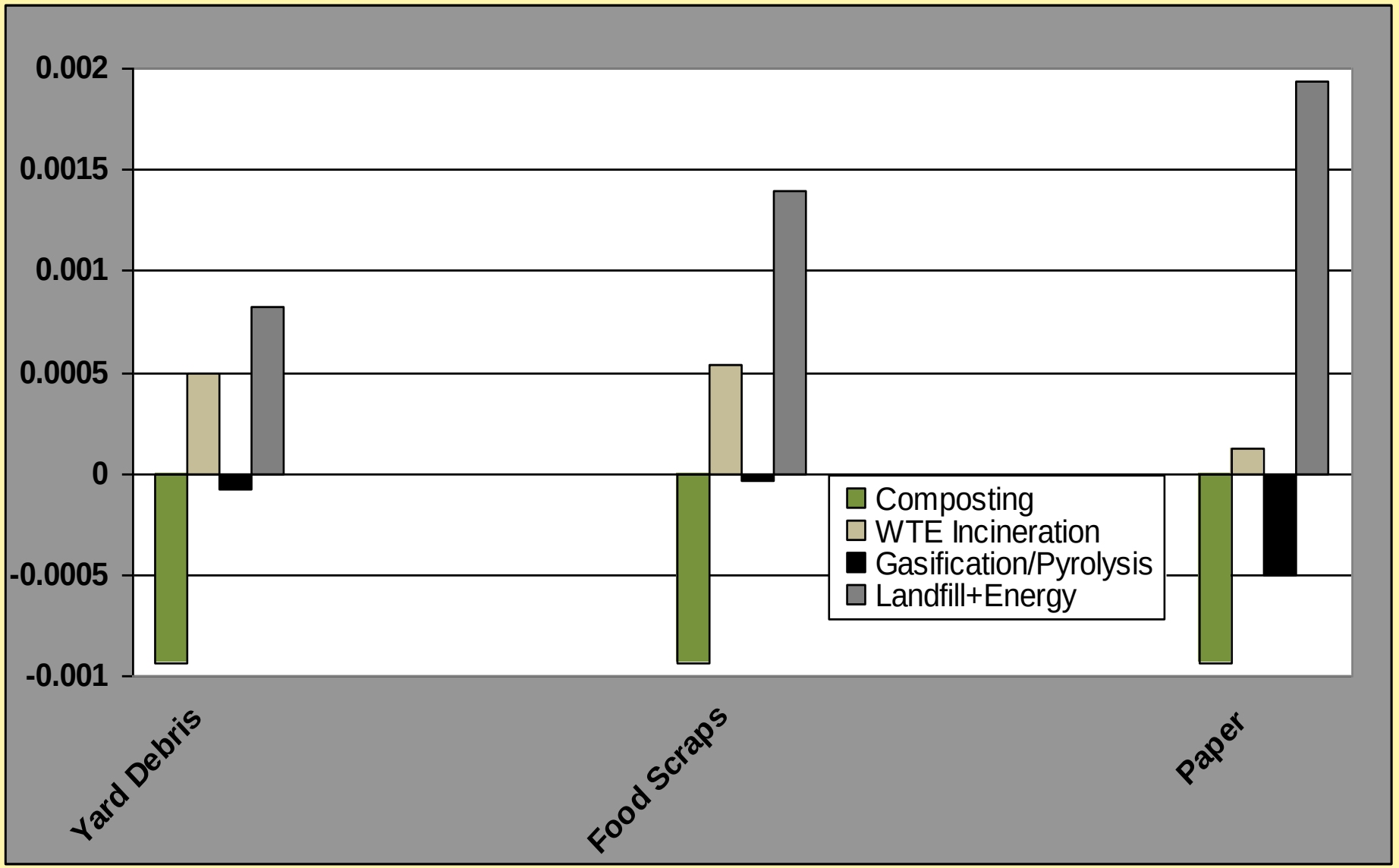
CO_2 Emissions: Composting vs. Disposal (tons eCO_2/ton)



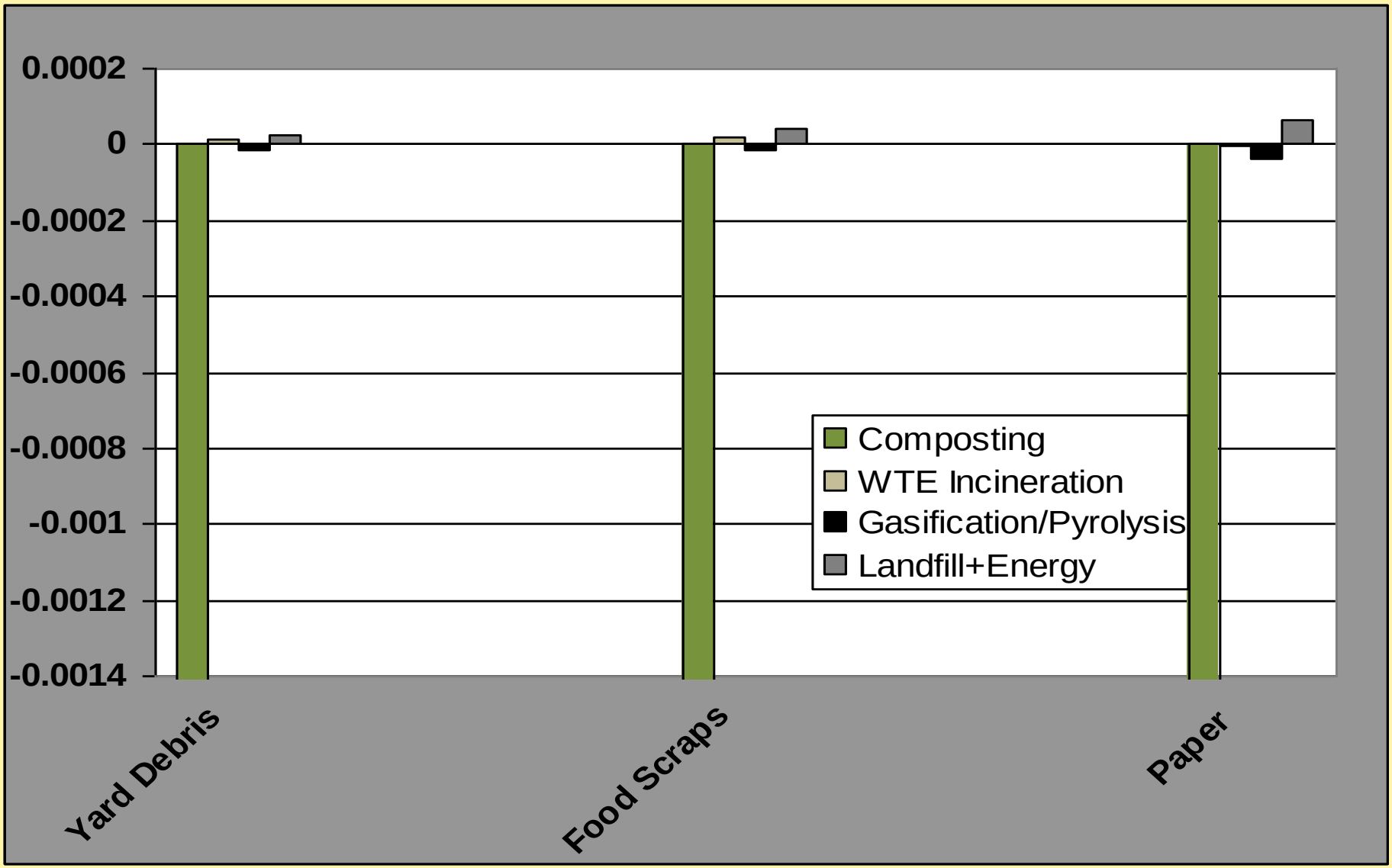
Particulate Emissions: Composting vs. Disposal (tons ePM2.5/ton)



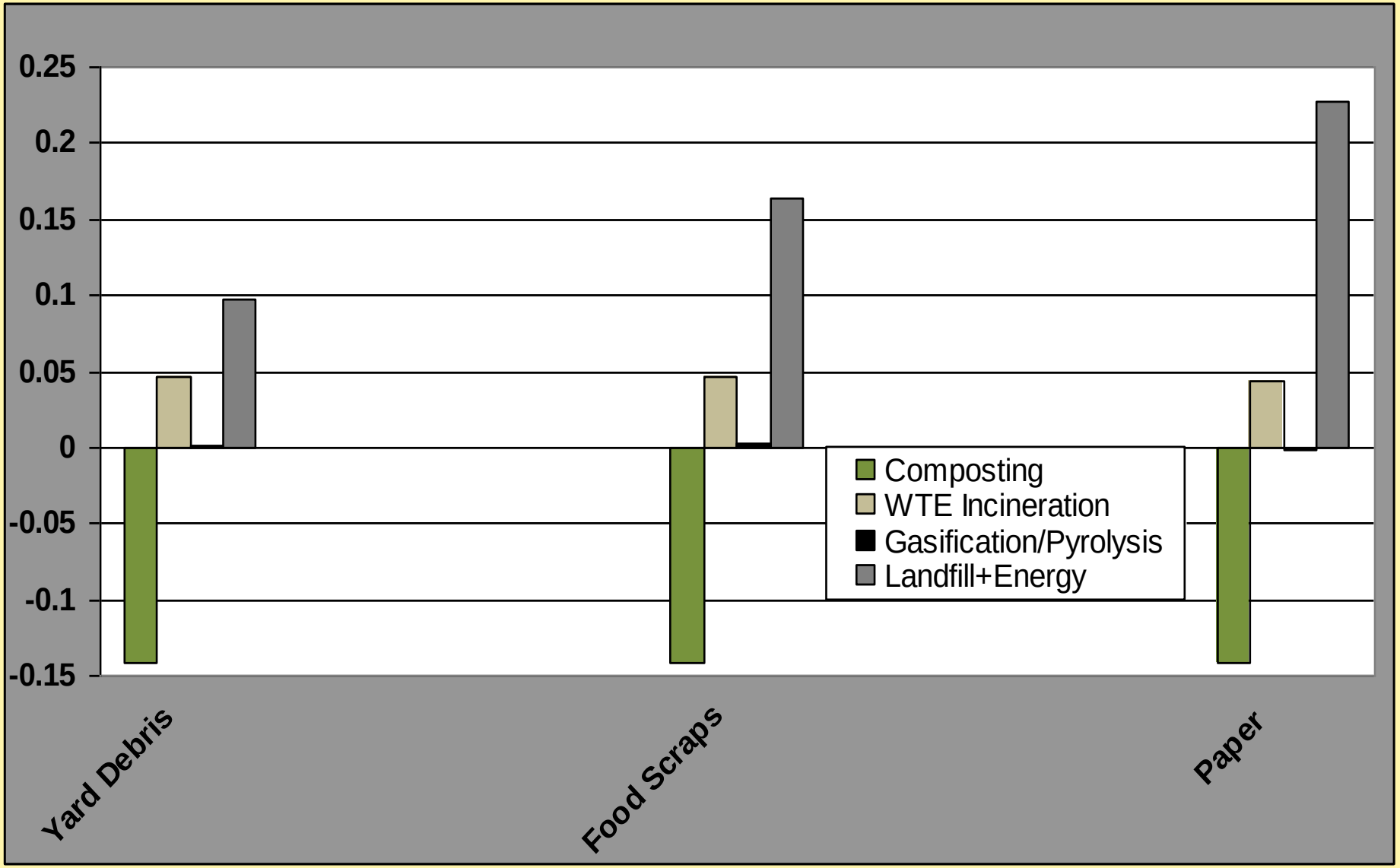
Acidifying Emissions: Composting vs. Disposal (tons eSO2/ton)



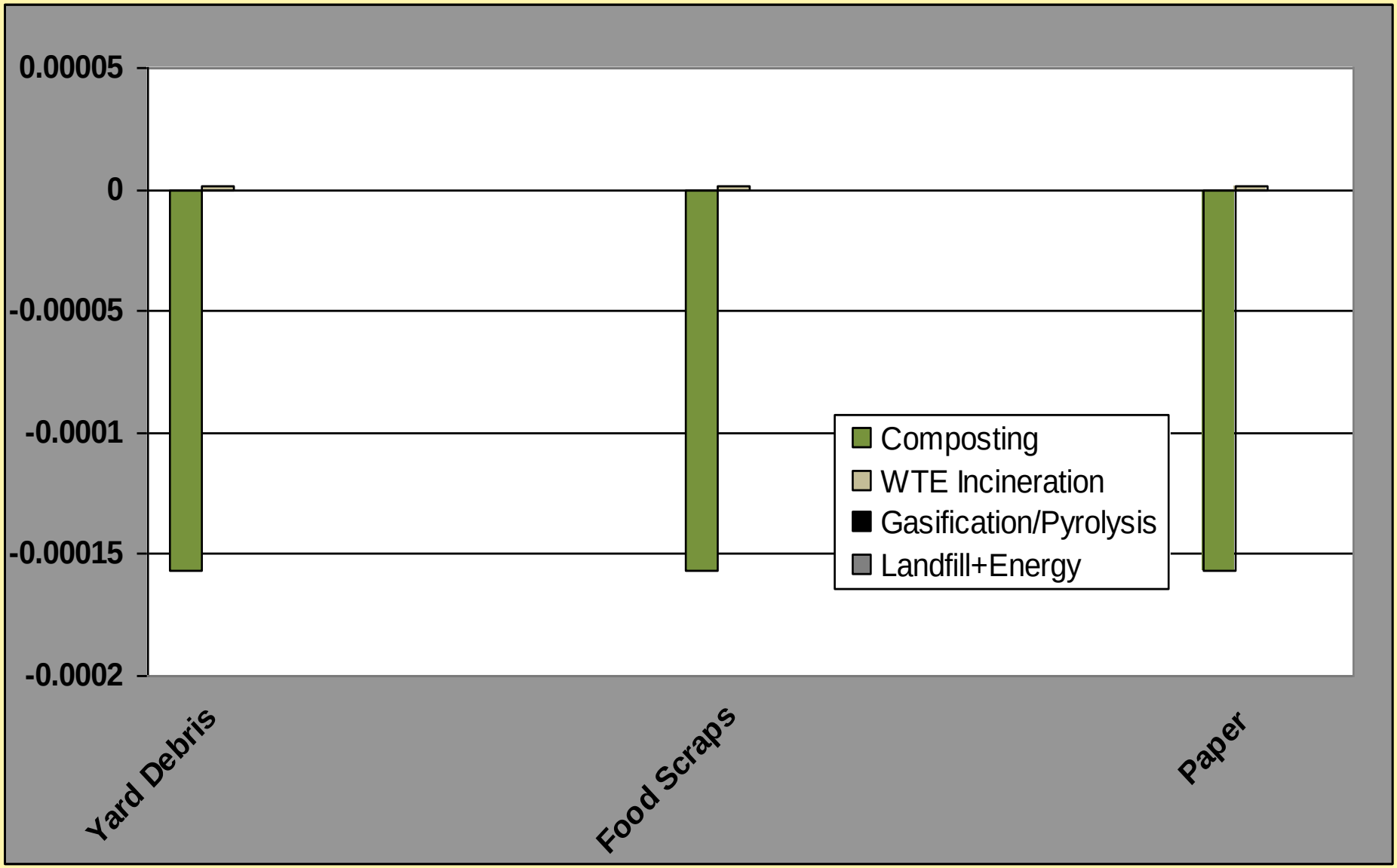
Eutrophying Emissions: Composting vs. Disposal (tons eN/ton)



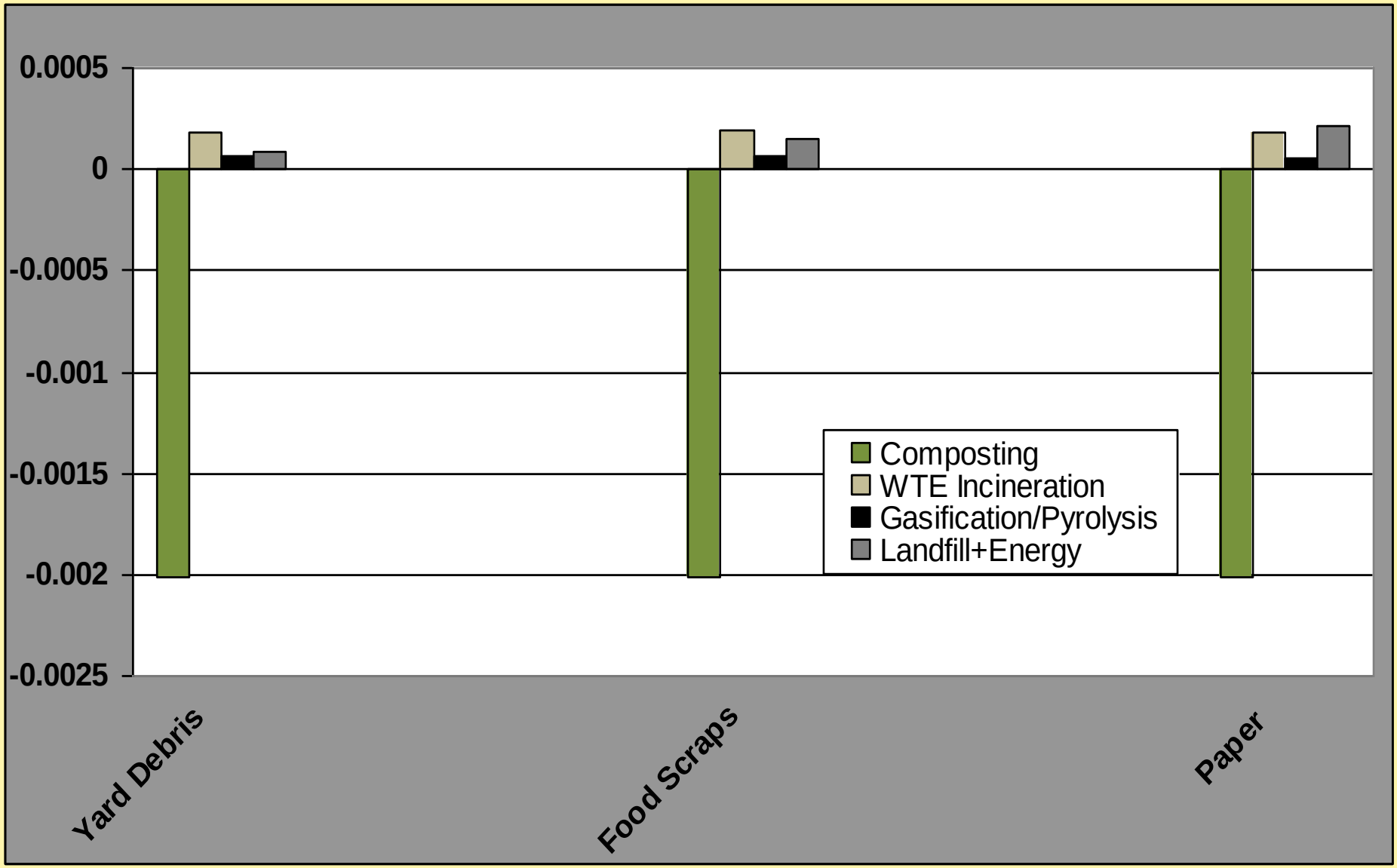
Toxics Emissions: Composting vs. Disposal (tons eToluene/ton)



Carcinogenic Emissions: Composting vs. Disposal (tons eBenzene/ton)



EcoToxics Emissions: Composting vs. Disposal (tons e2,4-D/ton)



Climate Cooling Benefits of Composting (from WA CEI)

- **Gasoline & Diesel:** capturing 100% of household compostable materials equivalent to 30% cut in household vehicle fuel & oil use.

- **Electricity:** capturing 100% of household compostable materials equivalent to 5% cut in household electricity use.

- **Meat & Dairy:** capturing 100% of household compostable materials equivalent to 50% cut in household meat and dairy consumption.

Value of Pollution Reductions from Recycling & Composting

Discard Type	Environmental Value (US$/ton)
Newspapers	$328-332
Cardboard	424-449
Mixed Paper	156-178
Glass Containers	53-54
PET Plastics	578-646
HDPE Plastics	202-279
Other Plastics	202-279
Aluminum Cans	1,456
Ferrous Cans & Scrap	14-63
Food Scraps	59-97
Yard & Garden Debris	58-67
Compostable Paper	49-71

Available Models

1. **ICLEI Clean Air Climate Protection (CACP)** (www.iclei-usa.org/action-center/tools/cacp-software)
2. **U.S. EPA Waste Reduction Model (WARM)** (www.epa.gov/climatechange/wycd/waste/calculators/Warm_home.html)
3. **Municipal Solid Waste Decision Support Tool (MSW-DST)** (Research Triangle Institute)
4. **Carnegie Mellon Economic Input-Output Life Cycle Assessment (EIO-LCA)** (www.eiolca.net)
5. **National Institute of Standard and Technology Building for Environmental and Economic Sustainability (BEES)** (www.bfri.nist.gov/oae/software/bees/model.html)
6. **U.S. EPA Tool for the Reduction and Assessment of Chemical and other Environmental Impacts (TRACI)** (www.epa.gov/nrmrl/std/sab/traci/)
7. **Morris Environmental Benefits Calculator (MEBCALC)** (Sound Resource Management)
8. **National Recycling Coalition (NRC) Calculator** (www.nrc-recycle.org)
9. **Northeast Recycling Council (NERC) Calculator** (www.nerc.org)
10. **Consumer Environmental Index (CEI)** (www.zerowaste.com)

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The End

Thank you.