

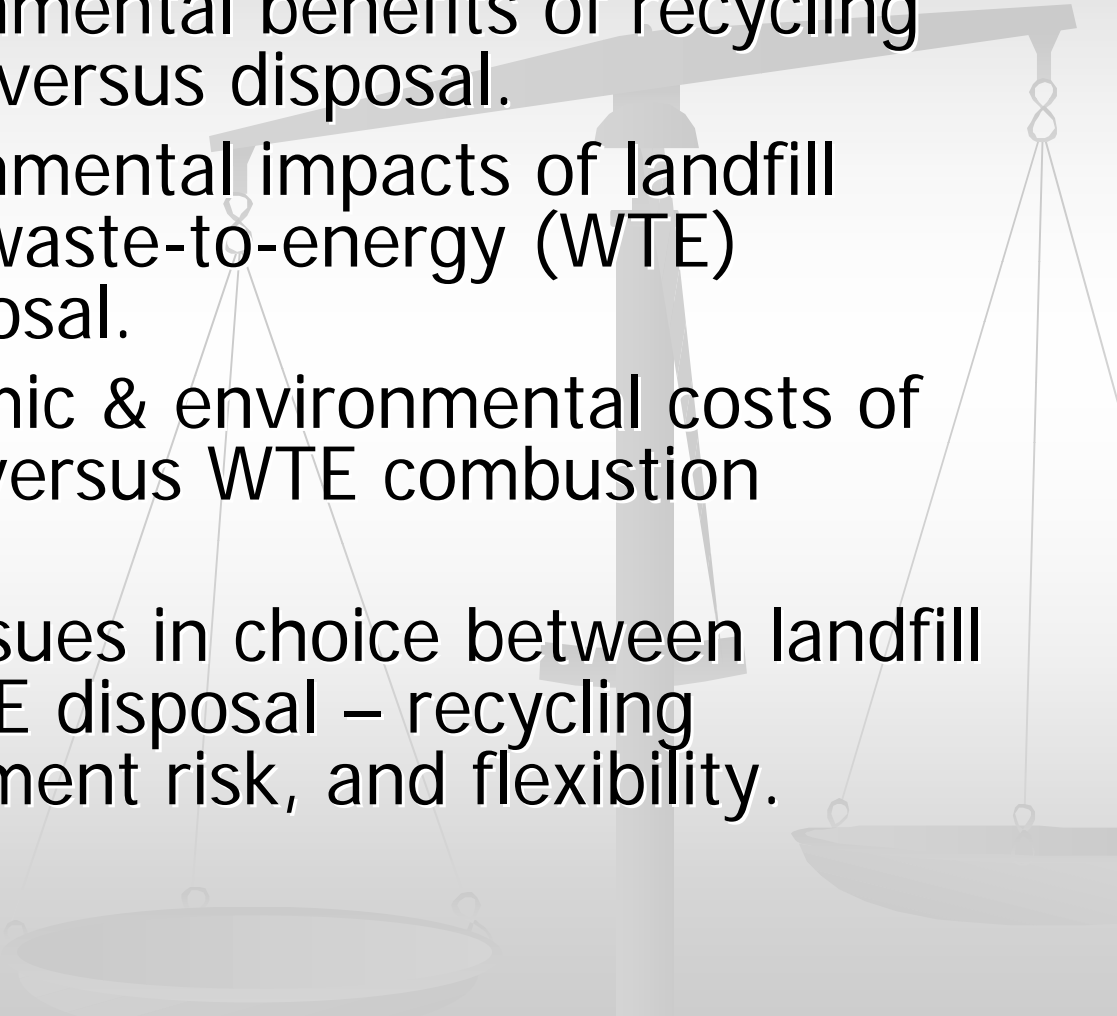
# Environmental Economics of Discards



Dr. Jeffrey Morris  
Sound Resource Management  
[jeff.morris@zerowaste.com](mailto:jeff.morris@zerowaste.com)


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# Presentation Outline

- 1) Compare environmental benefits of recycling and composting versus disposal.
  - 2) Compare environmental impacts of landfill disposal versus waste-to-energy (WTE) combustion disposal.
  - 3) Compare economic & environmental costs of landfill disposal versus WTE combustion disposal.
  - 4) Mention other issues in choice between landfill disposal and WTE disposal – recycling potential, investment risk, and flexibility.
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(1)

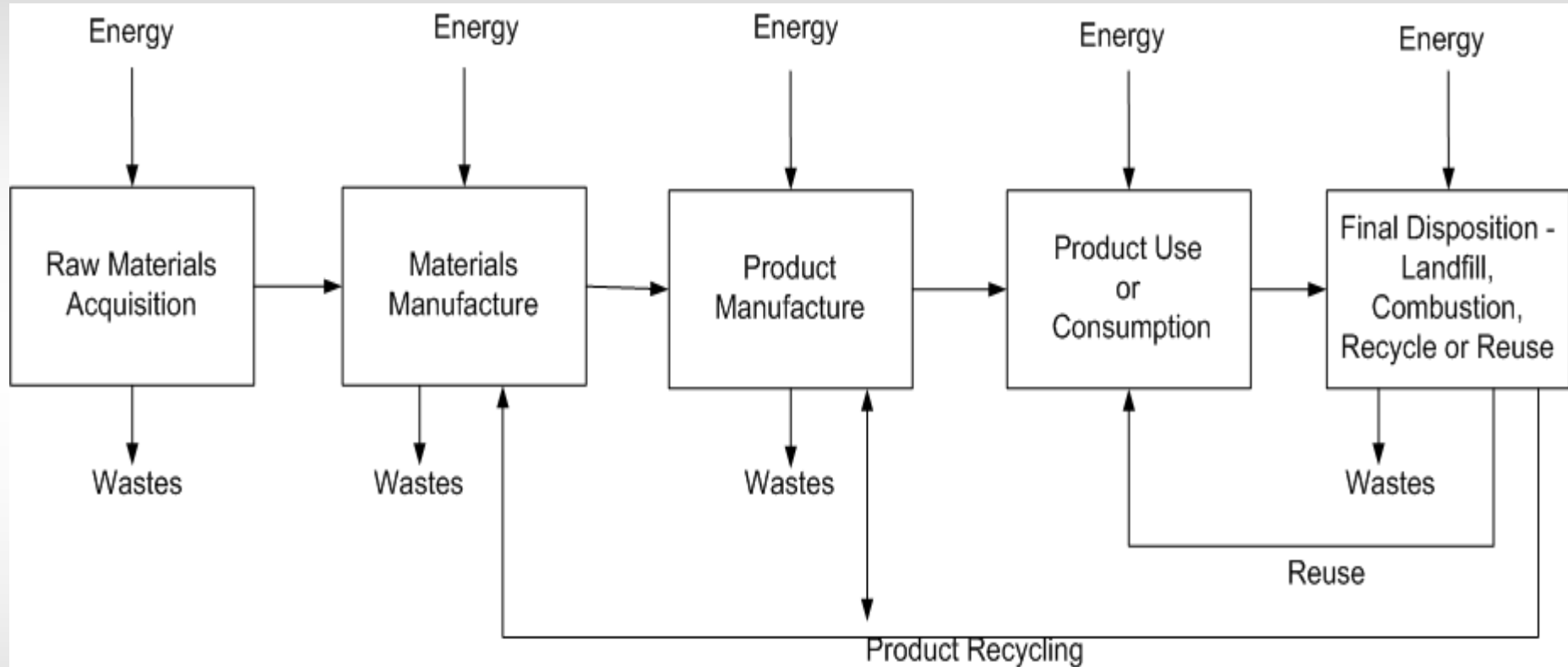
**Environmental Benefits of  
Recycling and Composting  
Versus  
Disposal of Discards**



# Economic Value Of Pollution Reductions From Recycling

	<u>Pollution Reduction</u>	<u>Units</u>	<u>Pollution Cost</u>	<u>Value of Reduction</u>
Global Warming	5,579.8	lbs eCO2	\$0.018	\$100.44
Acidification	18.1	lbs eSO2	\$0.345	\$6.23
Eutrophication	1.0E-01	lbs eN	\$0.002	\$0.00
Human Health - Particulates	2.7E-04	DALYs	\$46,586	\$12.68
Human Health - Toxics	1.7E-01	lbs eHg	\$2,350	\$390.31
Ecological Toxicity	4.9	lbs e2,4-D	\$1.64	<u>\$8.08</u>
<b>Economic Benefit of Reductions Per Ton Recycled</b>			=	<b>\$517.74</b>

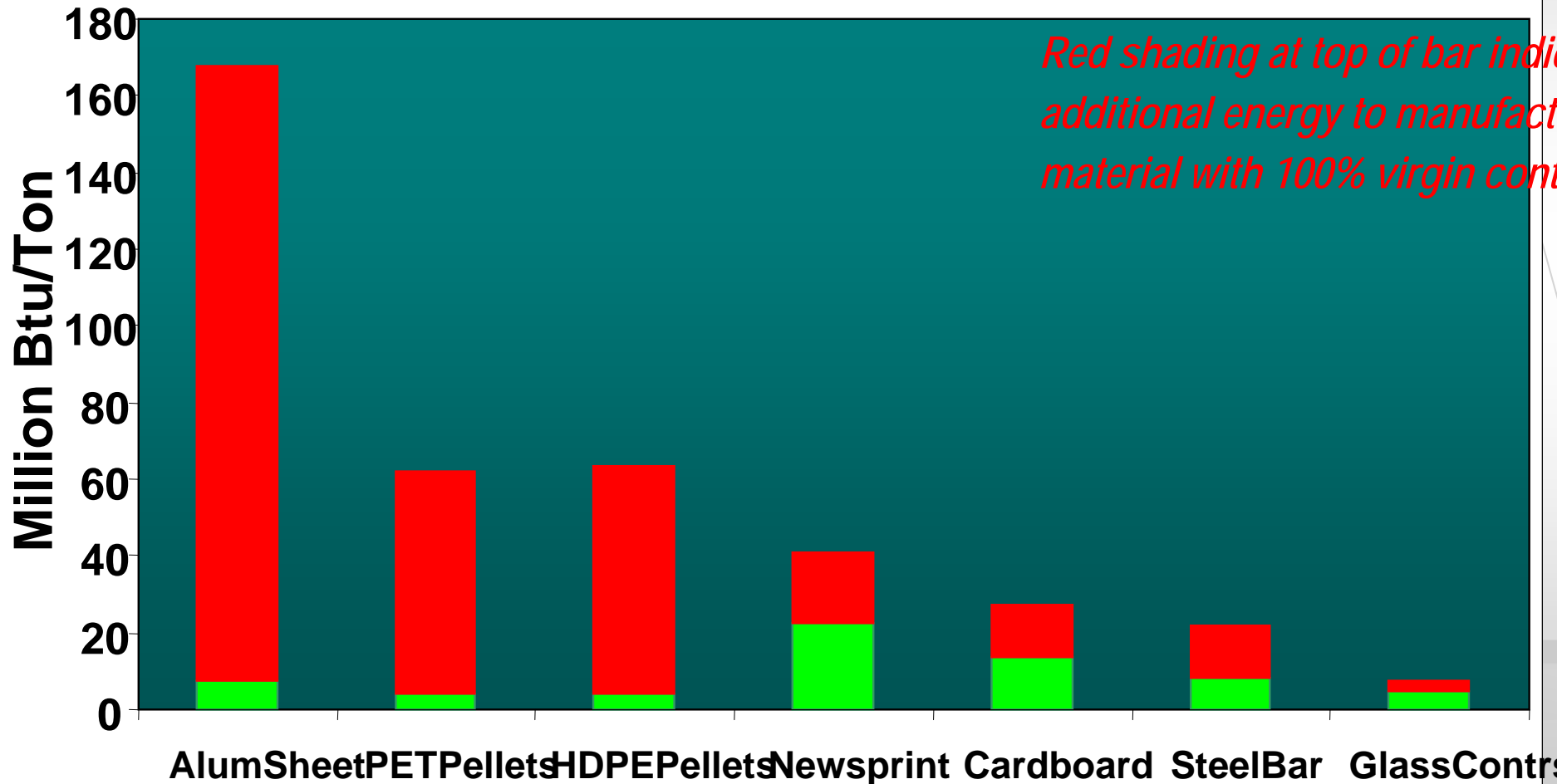
# Product Life Cycle Inventory



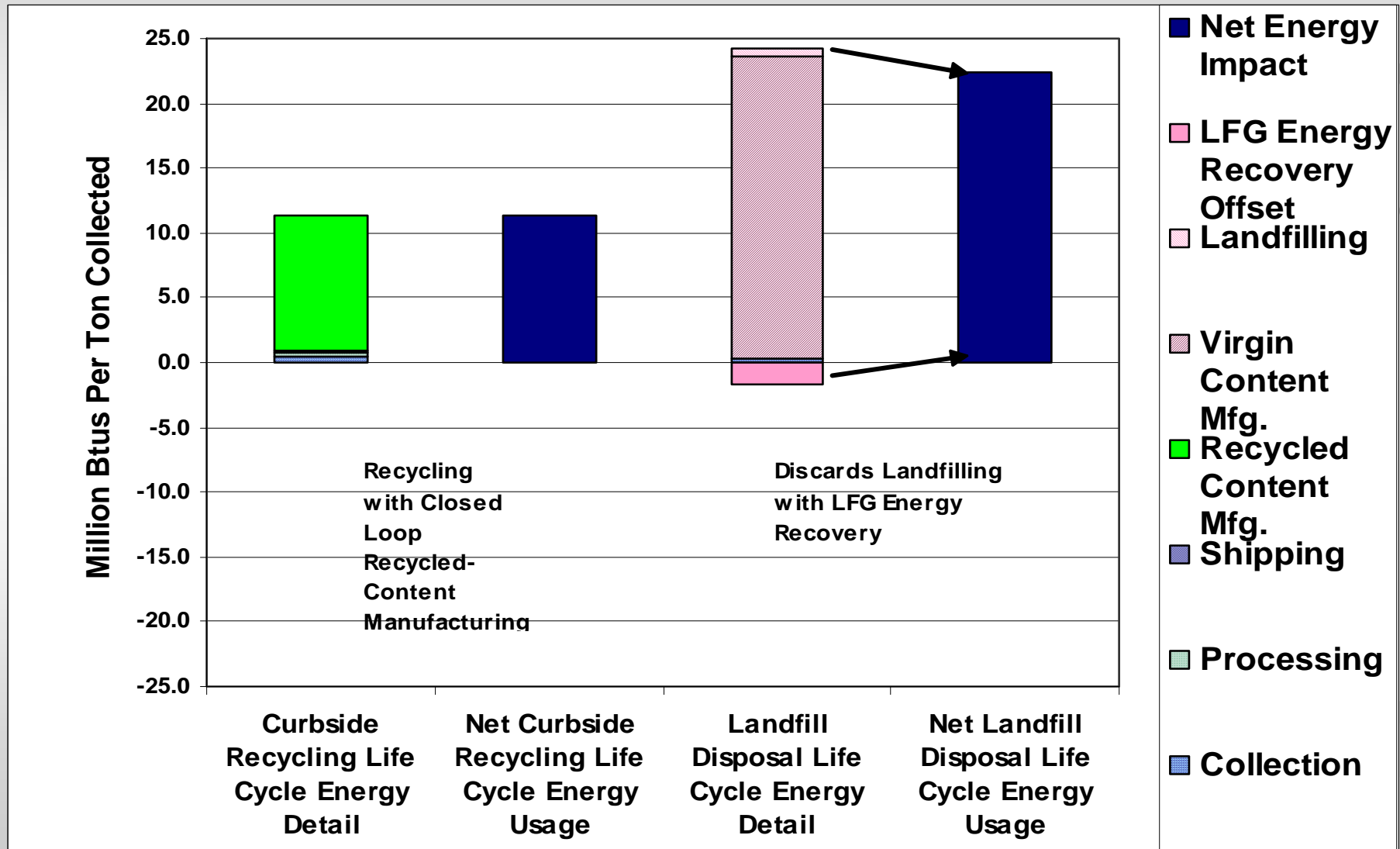
One or limited number of return cycles into product that is then disposed – open-loop recycling.  
Repeated recycling into same or similar product, keeping material from disposal - closed-loop recycling

# Energy Use -- Resource Extraction, Resource Refining & Product Manufacturing

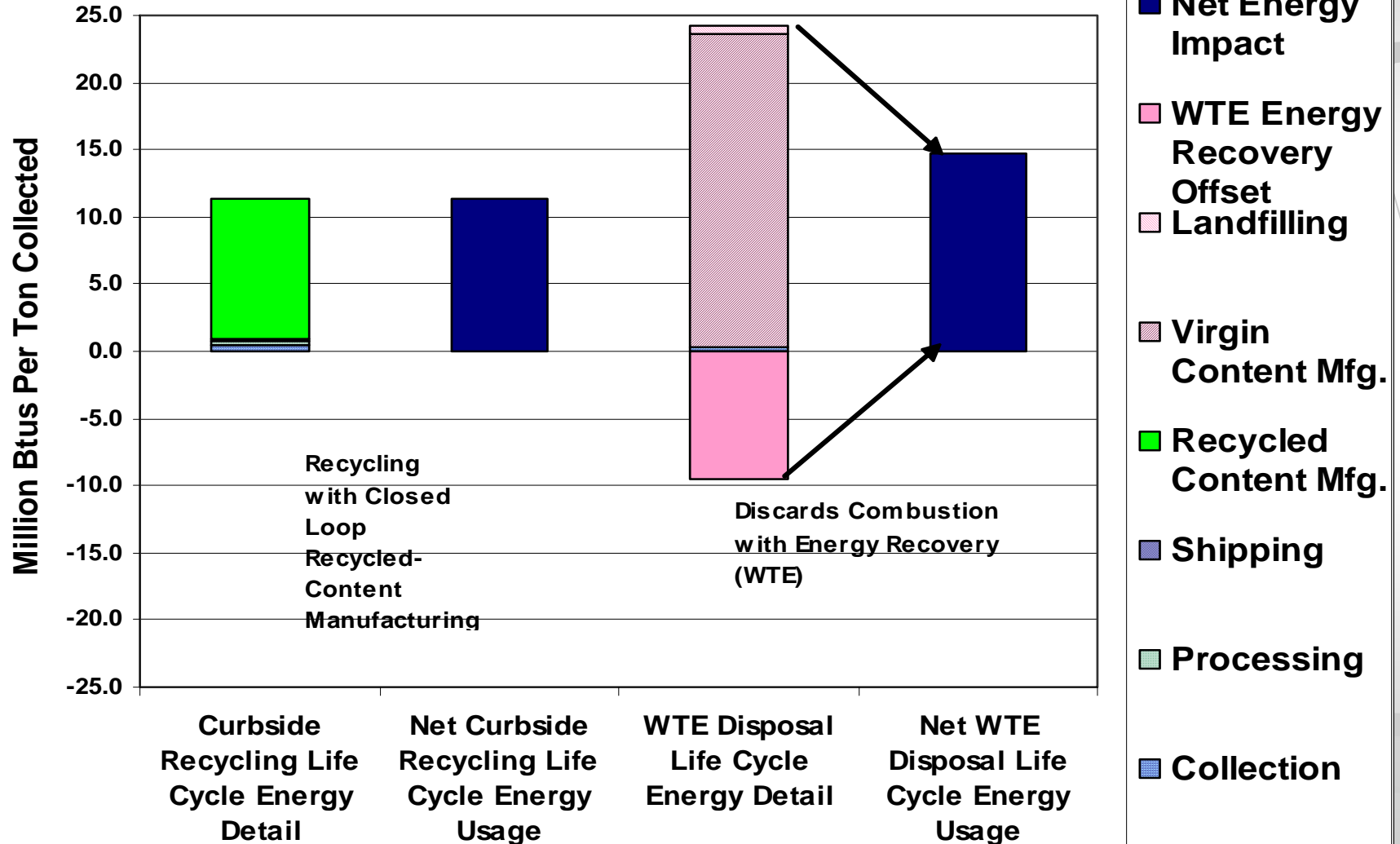
## Products Made with Virgin- vs. Recycled-Content



# Total Energy Usage: Recycling Versus Landfill Disposal with Energy Recovery

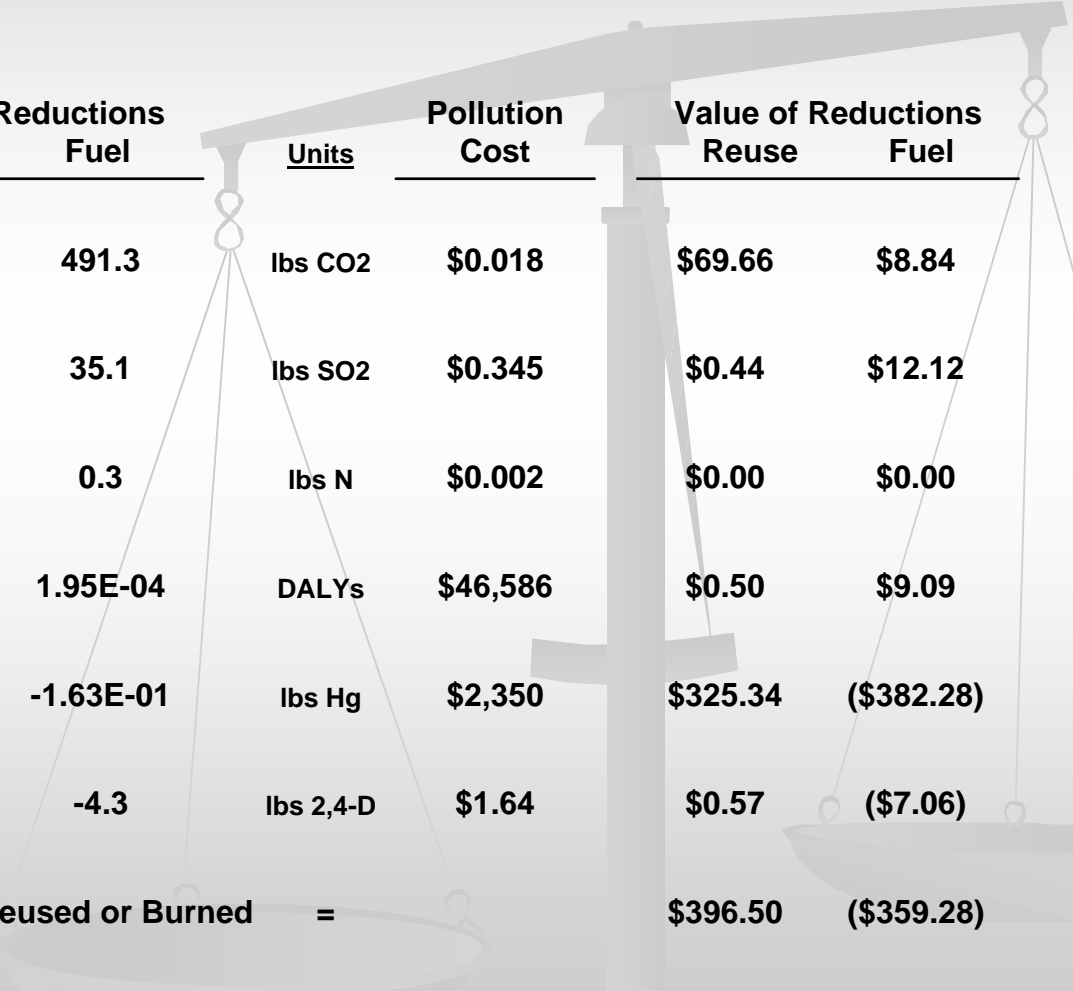


# Total Energy Usage: Recycling Versus WTE Combustion Disposal



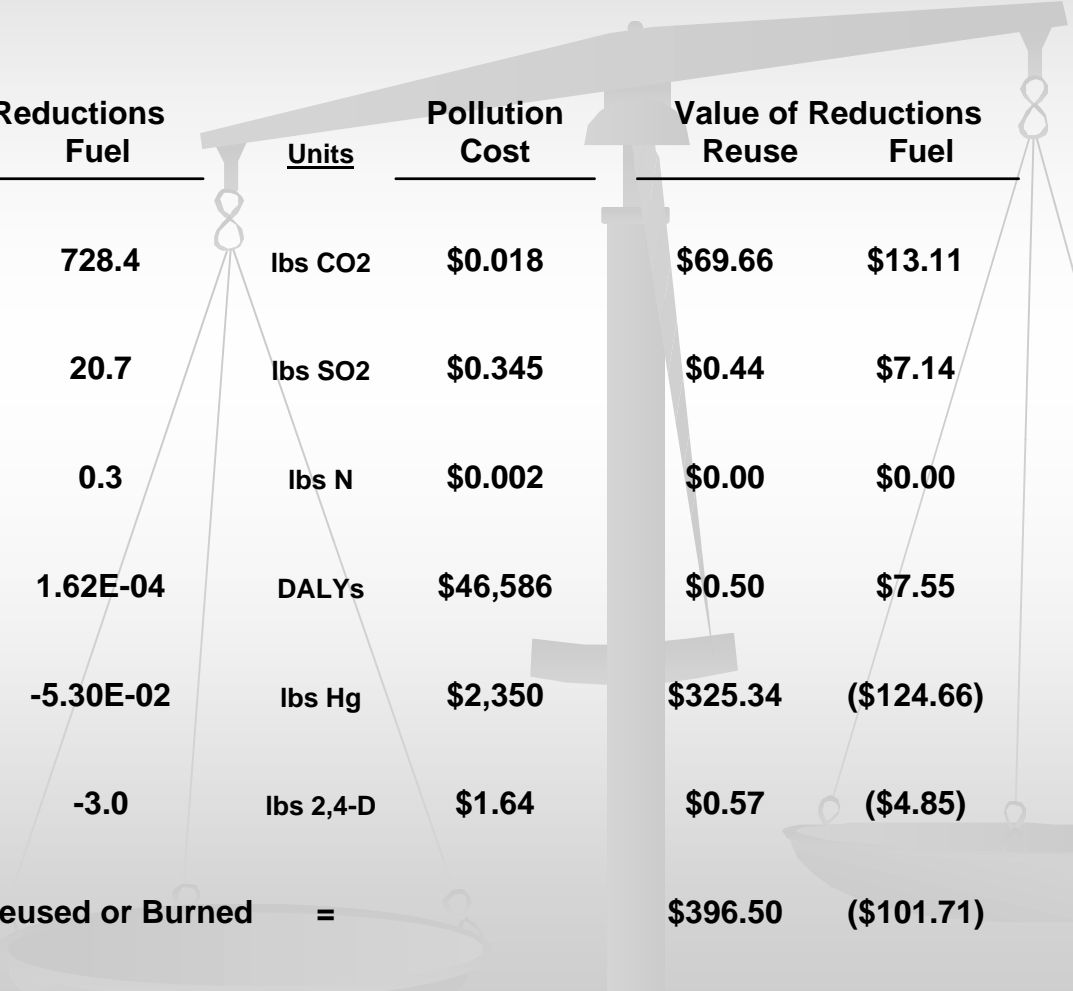


# Economic Value Of Pollution Reductions From Wood Reuse Or Use as Fuel Substitute for Natural Gas



	Pollution Reductions		Units	Pollution Cost	Value of Reductions	
	Reuse	Fuel			Reuse	Fuel
Global Warming	3,869.8	491.3	lbs CO2	\$0.018	\$69.66	\$8.84
Acidification	1.3	35.1	lbs SO2	\$0.345	\$0.44	\$12.12
Eutrophication	0.1	0.3	lbs N	\$0.002	\$0.00	\$0.00
Human Health - Particulates	1.07E-05	1.95E-04	DALYs	\$46,586	\$0.50	\$9.09
Human Health - Toxics	1.38E-01	-1.63E-01	lbs Hg	\$2,350	\$325.34	(\$382.28)
Ecological Toxicity	0.3	-4.3	lbs 2,4-D	\$1.64	\$0.57	(\$7.06)
<b>Economic Benefit of Reductions Per Ton Reused or Burned</b>				<b>=</b>	<b>\$396.50</b>	<b>(\$359.28)</b>

# Economic Value Of Pollution Reductions From Wood Reuse Or Use as Fuel Substitute for Coal



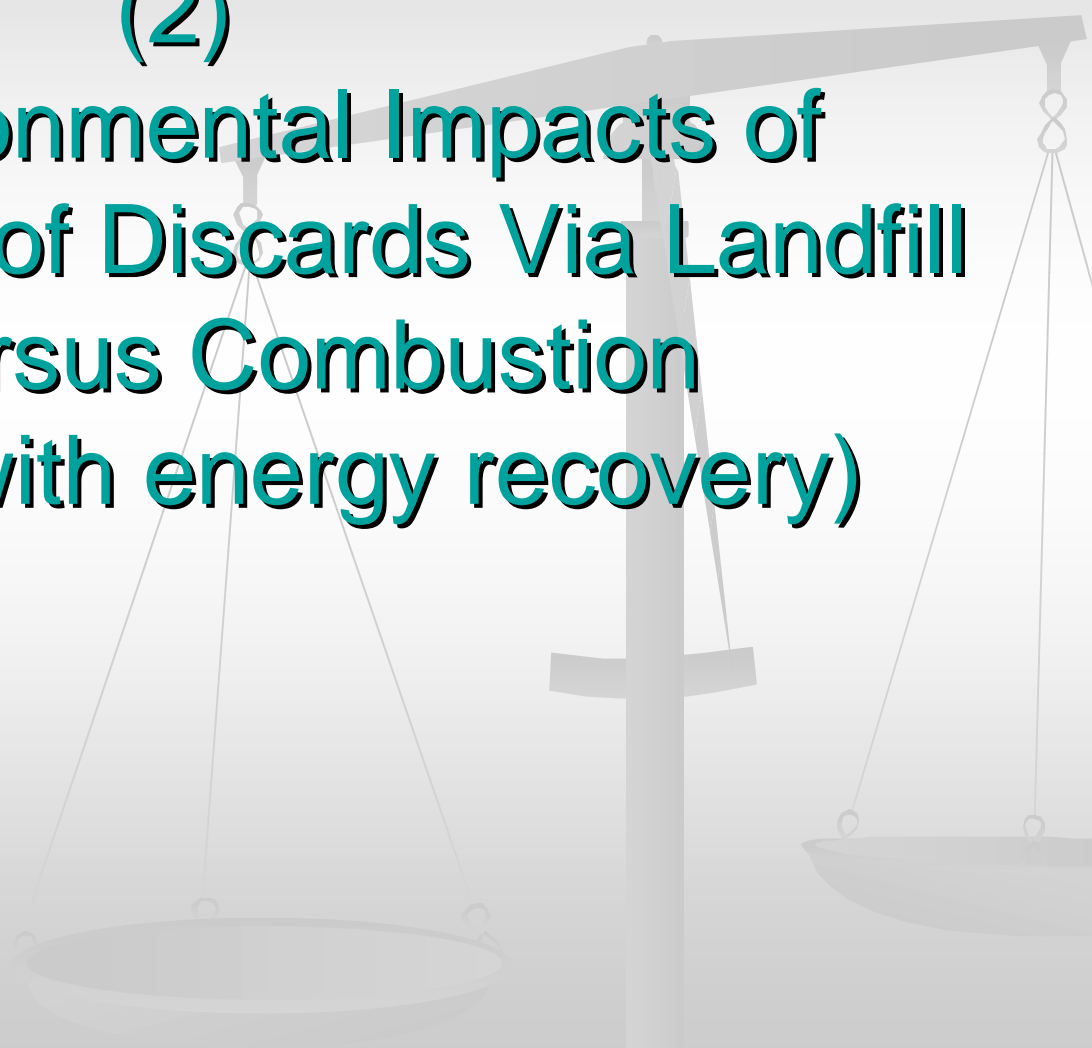
	Pollution Reductions		Units	Pollution Cost	Value of Reductions	
	Reuse	Fuel			Reuse	Fuel
Global Warming	3,869.8	728.4	lbs CO2	\$0.018	\$69.66	\$13.11
Acidification	1.3	20.7	lbs SO2	\$0.345	\$0.44	\$7.14
Eutrophication	0.1	0.3	lbs N	\$0.002	\$0.00	\$0.00
Human Health - Particulates	1.07E-05	1.62E-04	DALYs	\$46,586	\$0.50	\$7.55
Human Health - Toxics	1.38E-01	-5.30E-02	lbs Hg	\$2,350	\$325.34	(\$124.66)
Ecological Toxicity	0.3	-3.0	lbs 2,4-D	\$1.64	\$0.57	(\$4.85)
<b>Economic Benefit of Reductions Per Ton Reused or Burned</b>				<b>=</b>	<b>\$396.50</b>	<b>(\$101.71)</b>

# Economic Value Of Pollution Reductions From Lawn & Garden Composting

	<u>Pollution Reduction</u>	<u>Units</u>	<u>Pollution Cost</u>	<u>Value of Reduction</u>
<b>Global Warming</b>	1,030.6	lbs CO2	\$0.018	\$18.55
<b>Acidification</b>	4.4	lbs SO2	\$0.345	\$1.52
<b>Eutrophication</b>	17.8	lbs N	\$0.002	\$0.04
<b>Human Health - Particulates</b>	3.4E-05	DALYs	\$46,586	\$1.57
<b>Human Health - Toxics</b>	1.0E-02	lbs Hg	\$2,350	\$23.95
<b>Ecological Toxicity</b>	34.5	lbs 2,4-D	\$1.64	<u>\$56.56</u>
<b>Economic Benefit of Reductions Per Ton Composted</b>			=	\$102.18
<b>Memo: Cost Savings from Reduced Irrigation</b>			=	\$228.52

(2)

**Environmental Impacts of  
Disposal of Discards Via Landfill  
Versus Combustion  
(both with energy recovery)**



# Economic Value Of Pollution Reductions From Combustion Versus Landfill for Post-Recycling Discards

	<u>Pollution Reduction</u>	<u>Units</u>	<u>Pollution Cost</u>	<u>Value of Reduction</u>
Global Warming	-30.2	lbs eCO <sub>2</sub>	\$0.018	(\$0.54)
Acidification	8.7	lbs eSO <sub>2</sub>	\$0.345	\$2.98
Eutrophication	2.3E-02	lbs eN	\$0.002	\$0.00
Human Health - Particulates	6.2E-05	DALYs	\$46,586	\$2.90
Human Health - Toxics	1.5E-04	lbs eHg	\$2,350	\$0.36
Ecological Toxicity	0.1	lbs e2,4-D	\$1.64	<u>\$0.15</u>
<b>Economic Benefit of Reductions Per Ton Combusted</b>			<b>=</b>	<b>\$5.85</b>

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**Economic & Environmental Costs of  
Disposal of Discards Via Landfill  
Versus Combustion  
(both with energy recovery)**

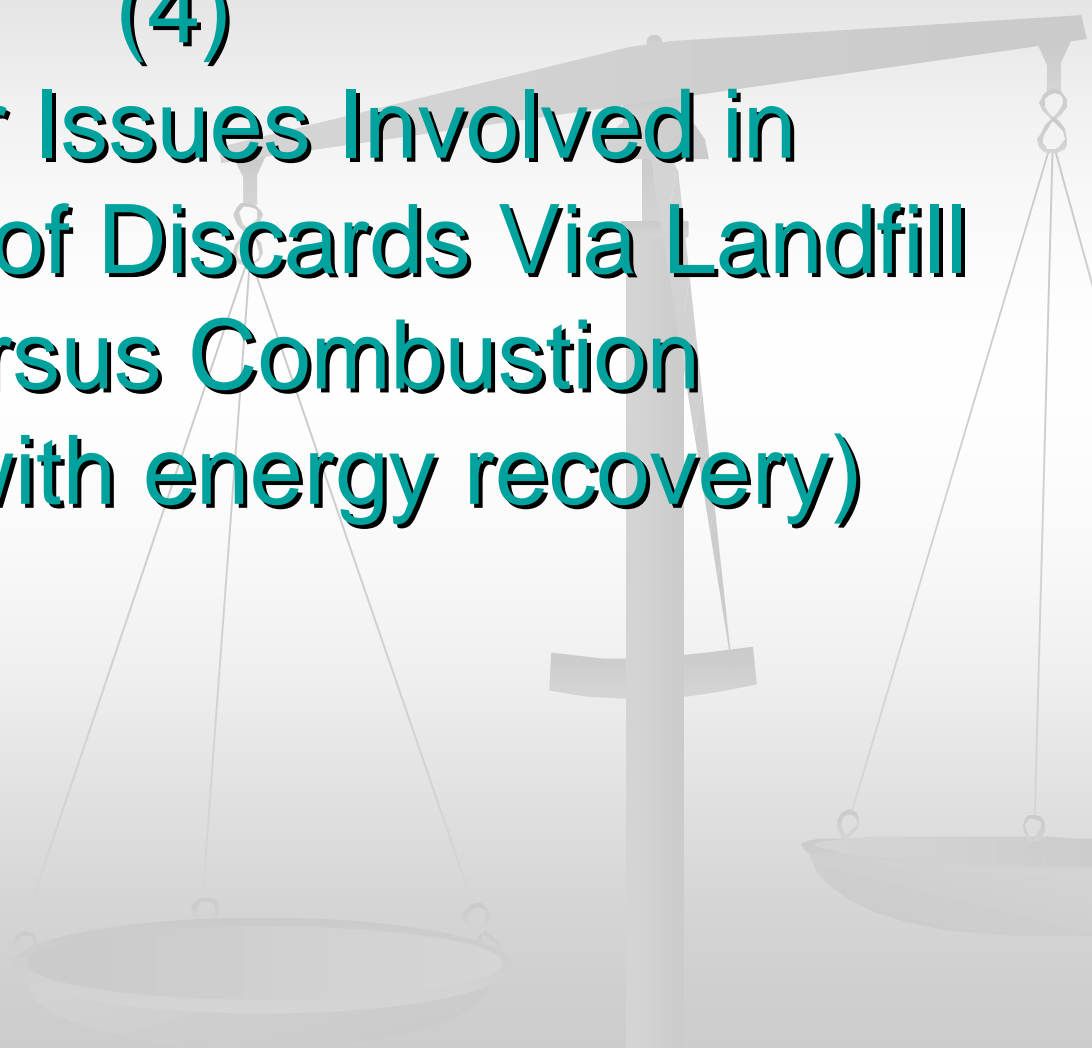


# Net Social Costs for Landfill & Incineration

<u>Per Tonne Costs</u>	<u>Netherlands (Euros)</u>			<u>Northwest US (US\$)</u>		
	<u>Landfill</u>	<u>Incineration</u>	<u>Inc +/-) Lnd</u>	<u>Landfill</u>	<u>Incineration</u>	<u>Inc +/-) Lnd</u>
Gross private costs	40	103	63			
Energy recovery revenue	(4)	(21)	(17)			
Material recovery revenue	<u>0</u>	<u>(3)</u>	<u>(3)</u>			
Net private costs	<u>36</u>	<u>79</u>	<u>43</u>	<u>20 - 23</u>	<u>80 - 111</u>	<u>57 - 91</u>
Gross Environmental Costs	26	46	20			
Energy recovery offset	(4)	(22)	(18)			
Material recovery offset	<u>0</u>	<u>(6)</u>	<u>(6)</u>			
Net Environmental Costs	<u>22</u>	<u>18</u>	<u>(4)</u>			<u>(6)</u>
Net Social Costs	58	97	39			51 - 85

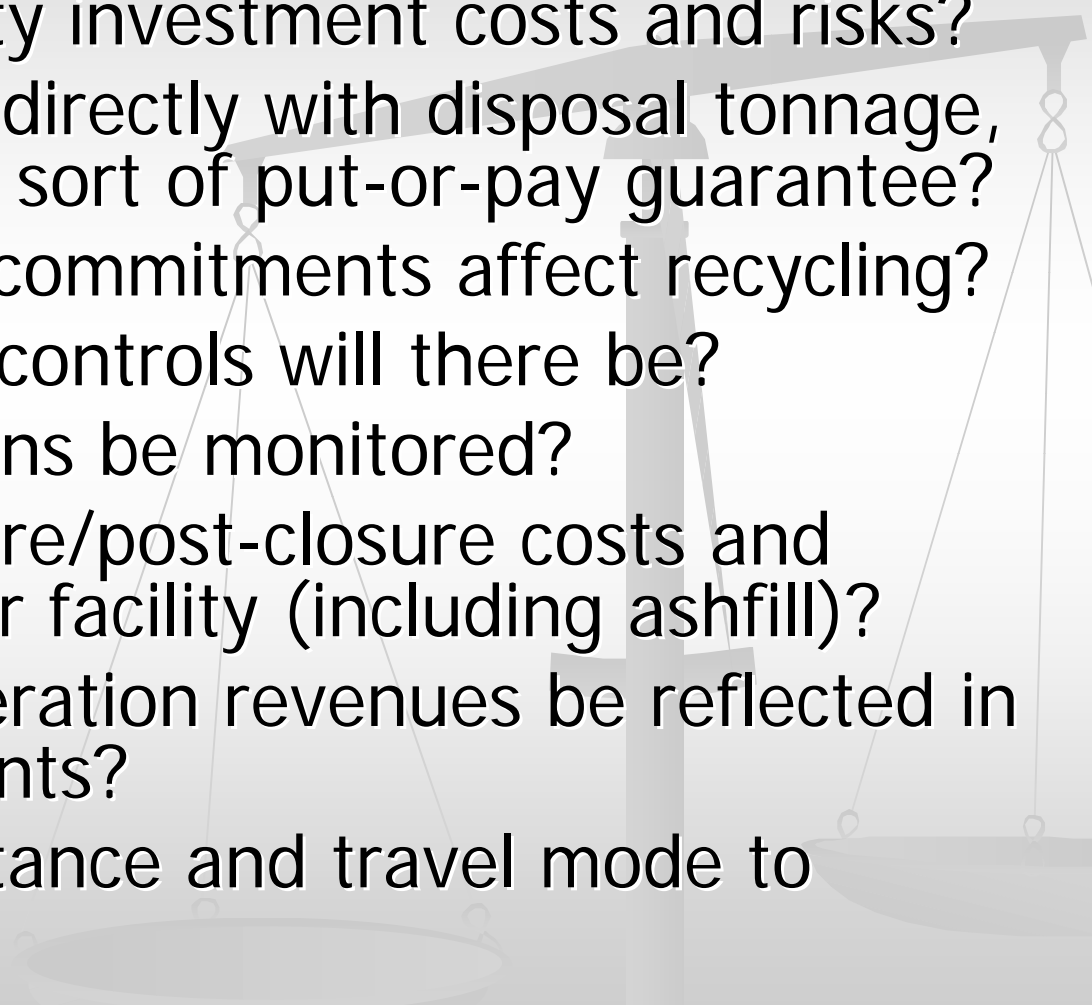
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**Other Issues Involved in  
Disposal of Discards Via Landfill  
Versus Combustion  
(both with energy recovery)**





# Important Questions

- 1) Who bears facility investment costs and risks?
  - 2) Do tip fees vary directly with disposal tonnage, or is there some sort of put-or-pay guarantee?
  - 3) How will tip fee commitments affect recycling?
  - 4) What emissions controls will there be?
  - 5) How will emissions be monitored?
  - 6) Who bears closure/post-closure costs and pollution risks for facility (including ashfill)?
  - 7) Will energy generation revenues be reflected in tip fee adjustments?
  - 8) What is haul distance and travel mode to facility?
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