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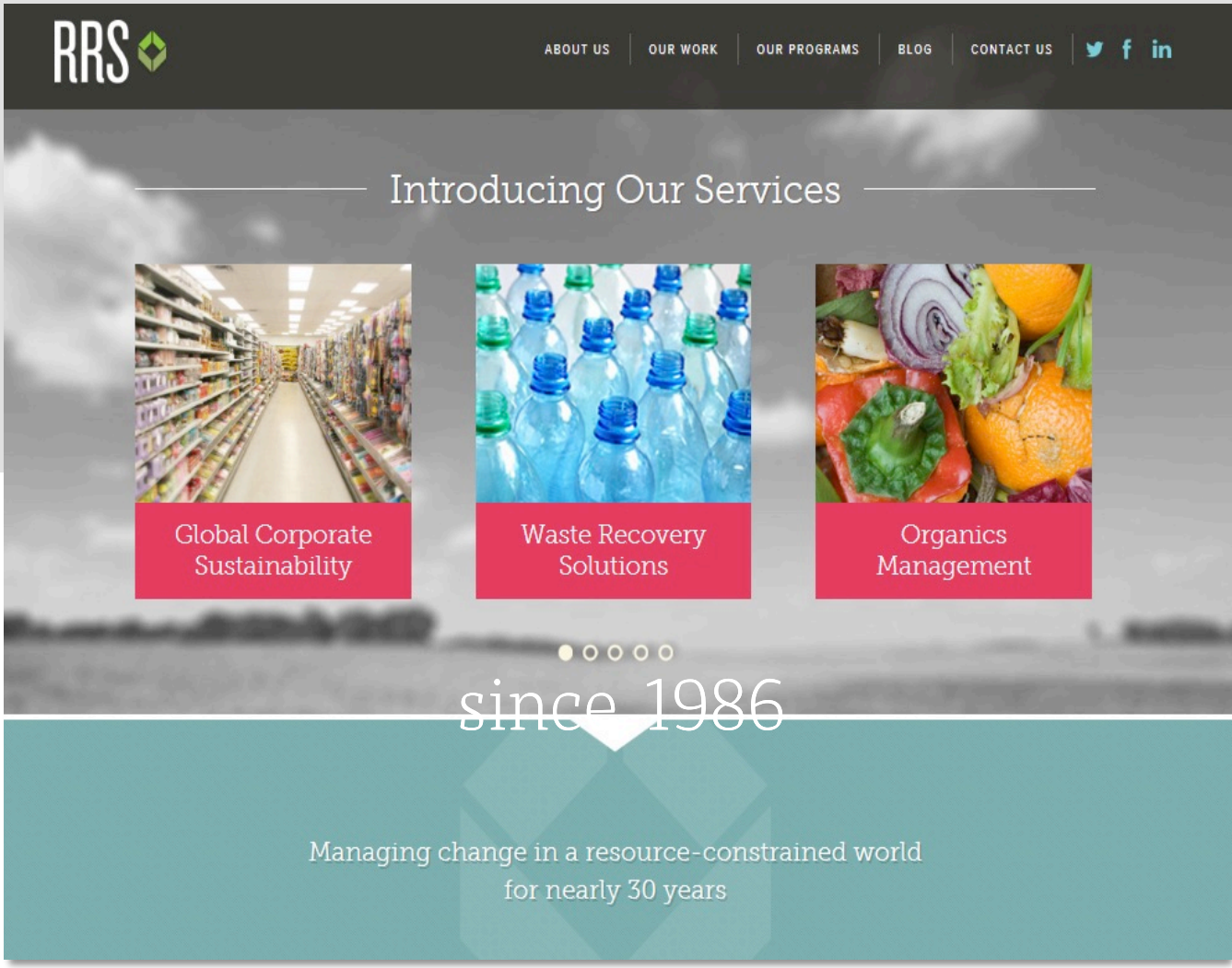
COSTS OF RECYCLING & DIVERSION

Michael R. Timpane
Vice President

National Waste & Recycling Association
Collect. Recycle. Innovate.

Cost of Recycling Webinar
May 14, 2015

Providing solutions in sustainability, resource management and waste recovery for clients and their supply chains



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managing change in a resource-constrained world.

TODAY'S AGENDA

01

Recycling Value Chain

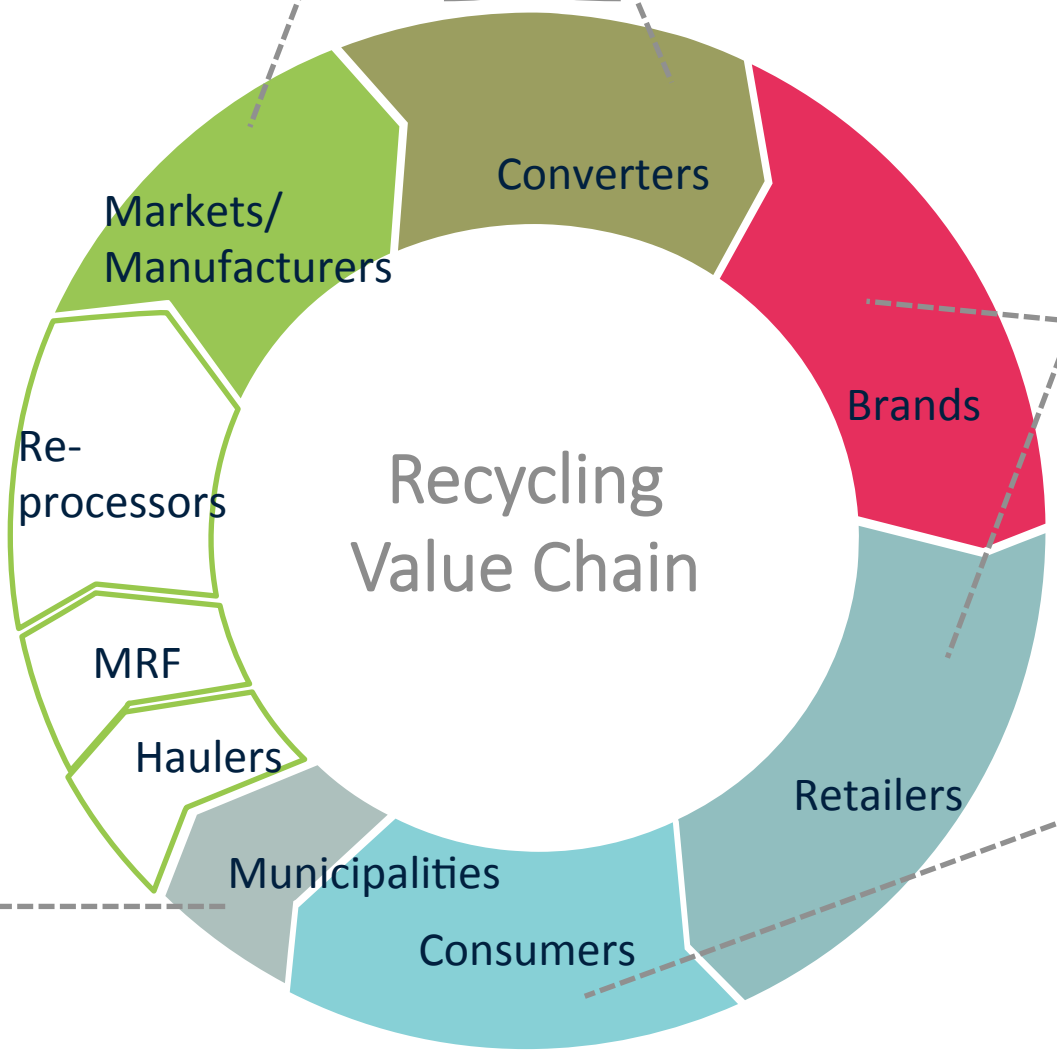
02

Concepts in Costs In Recycling

03

Other Topics

Demand Motivations



- Material cost savings
- Reliable Supply & Quality
- Customer Specification

- Material cost savings
- Supply & Quality
- Customer Specifications

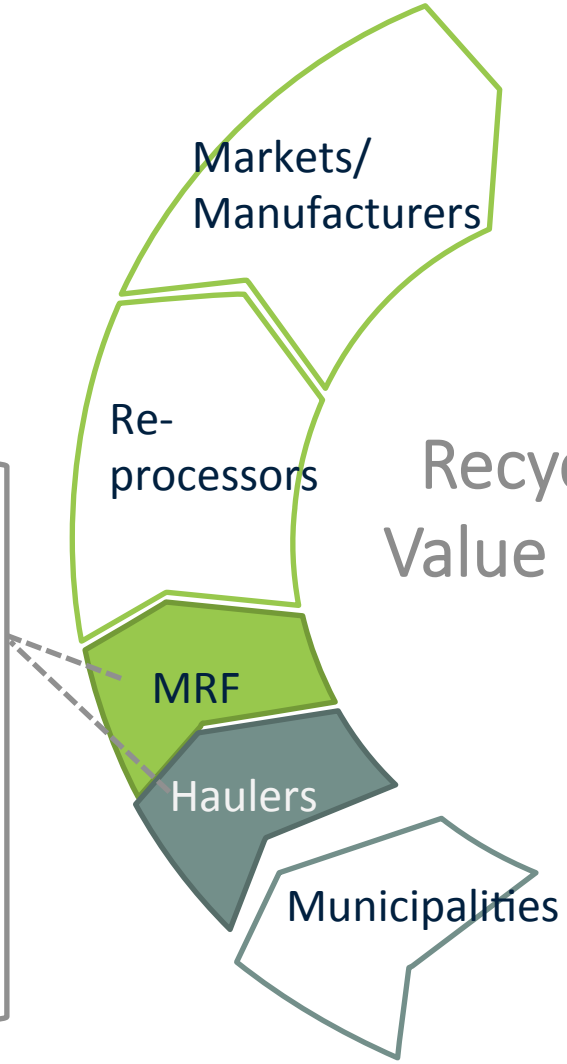
- Customer Demand/ competitive advantage
- Avoid Regulatory risk
- NGO pressure
- Sustainability Concerns
- Protect 1 way packaging

- Response to Environmental Concerns
- Price
- Thrifty/ Conservation
- Product Feature

- Voter Demand
- Environmental Mitigation
- Landfill cost
- Zero Waste/ Diversion mandates

Business Motivations

- **Service Providers**
- **Revenue from both inbound and outbound customers**
- **Pay for Play**
- **Less powerful position**



Recycling Value Chain

Recycling should be free	inelastic demand
Take more materials	More and tougher quality specs
Minimize my risk	Market risk on you
Long-term contracts	No long term contracts
dynamic material streams	Markets structure weak for new material
Competes with LF	Competes with Virgin Materials

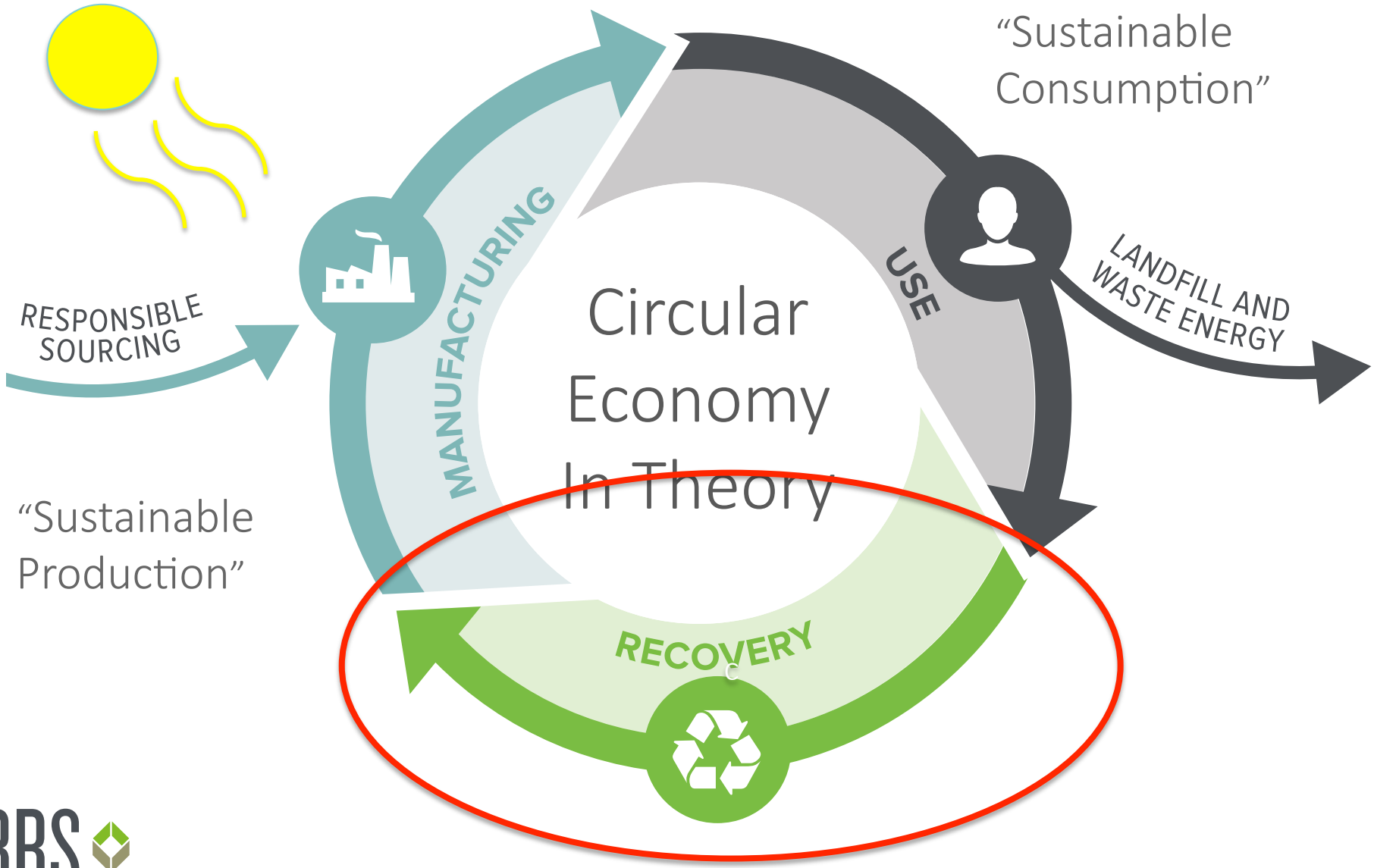
“Valuing” Single Stream Recycling Today

“(the) local curbside collection program is only the beginning of a recycling loop. At present, the cost of collecting and processing recyclable materials far outweighs their value as a commodity that can be sold back to industry.

“Valuing” Single Stream Recycling Today?

“(the) local curbside collection program is only the beginning of a recycling loop. At present, the cost of collecting and processing recyclable materials far outweighs their value as a commodity that can be sold back to industry. Unless consumers buy recycled products, the markets for the material they put out at the curb” will not grow.

HBR- 1993


"Sustainable Consumption"
RESPONSIBLE SOURCING
MANUFACTURING
USE
LANDFILL AND WASTE ENERGY
Circular Economy In Theory
"Sustainable Production"
RECOVERY

RRS

CONCEPTS, DEFINITIONS, TRENDS

Disclaimer

- *Examples only- to provide contrast. Your cost will be specific.*
- *Averages and available public Information- highest common denominator (fleet)*
- *Ranges rather than revealed numbers*
- *Non-public entities*
- *Studies, public proposals, presentations, literature, web*
- *Must do the math to get local program numbers- requires deep dive assessment*

Residential Single Stream Collection Costs

Pass-by's can also be minimized through proper periodicity

Average* Garbage vs. Single Stream Collection - $/T			
Garbage			
Collection			
Route Truck Cost	$850		($100 for 8.5 Hrs.)
Route Truck Yield	10	Tons	***Can be up to 13 Tons***
Cost Per Ton	$85		
Single Stream			
Collection			
Route Truck Cost	$850		($100 for 8.5 Hrs.)
Route Ratio	1.25		*25% More Routes*
Total Route Cost	$1,063		
Route Truck Yield	9	Tons	***Can be up to 11 tons***
Cost Per Ton	$118		

Truck Capital Cost for Capturing Single Stream

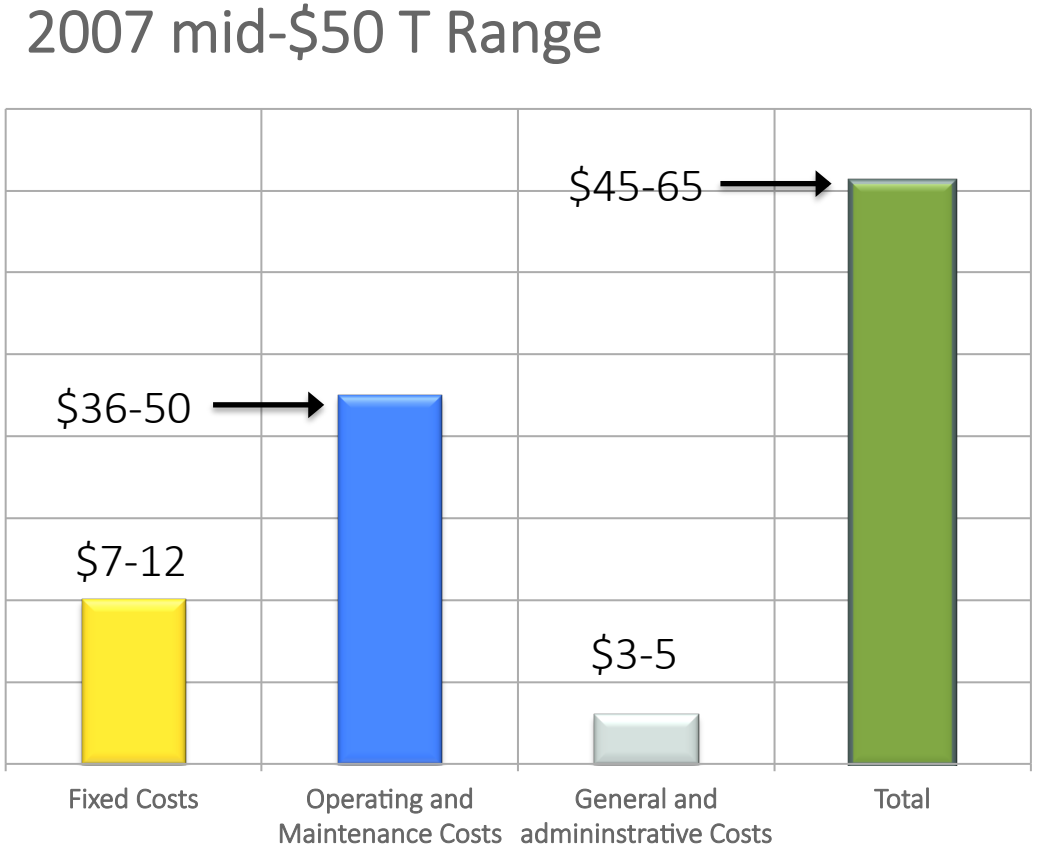
$ 2 Million for 100,000 HH

Container Capital for Capturing Single Stream

$40-60 per Cart
for 96 gallon

SINGLE STREAM PROCESSING
$/T Received

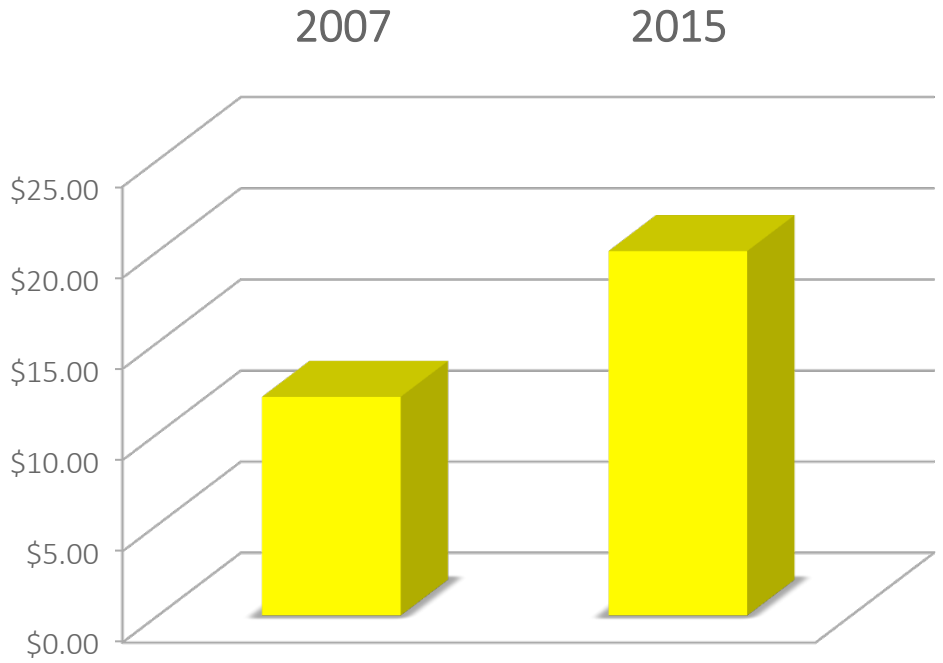
- Fixed Costs- Land (sunk), fixed equipment, mobile equipment, building and facilities.
- O&M- Out of pocket to run the plant
- G&A- Sales, management, administrative, education costs



SINGLE STREAM PROCESSING
$/T Received

Fixed Costs- Sort more types and sizes of material at higher volume

- Larger footprint
- Longer sort lines
- More peripheries
- More technology
- Higher speeds
- Regionalization
- Respond to Waste Stream
- Prime Mover & Capacity
- Competitive Retrofits



SINGLE STREAM PROCESSING
Plant Capital Costs (before land)

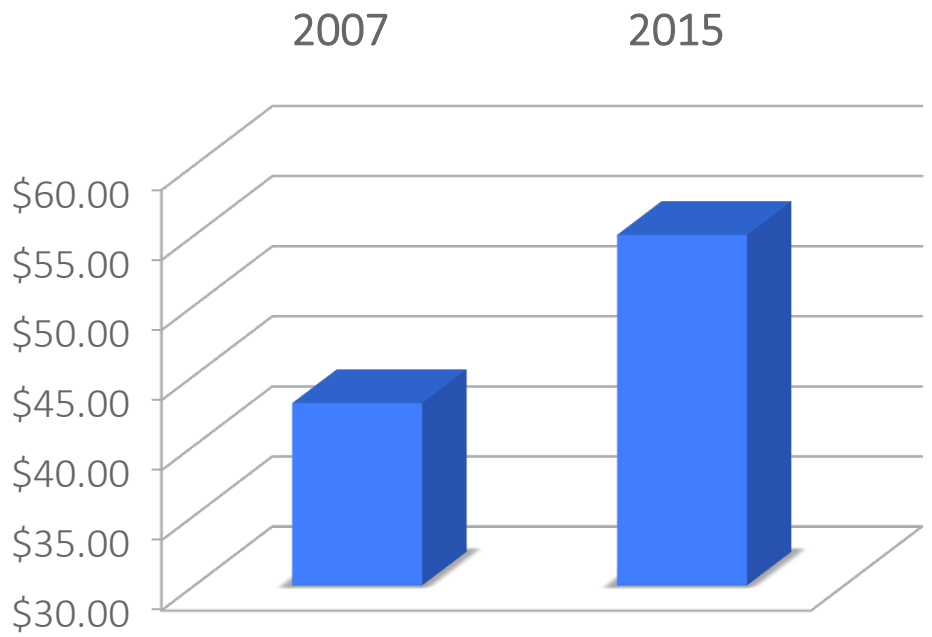
$8-12M

$20M

Bollegraaf Philadelphia
Waste Management World

SINGLE STREAM PROCESSING
$/T Received

Operations and Maintenance



SINGLE STREAM PROCESSING- O&M

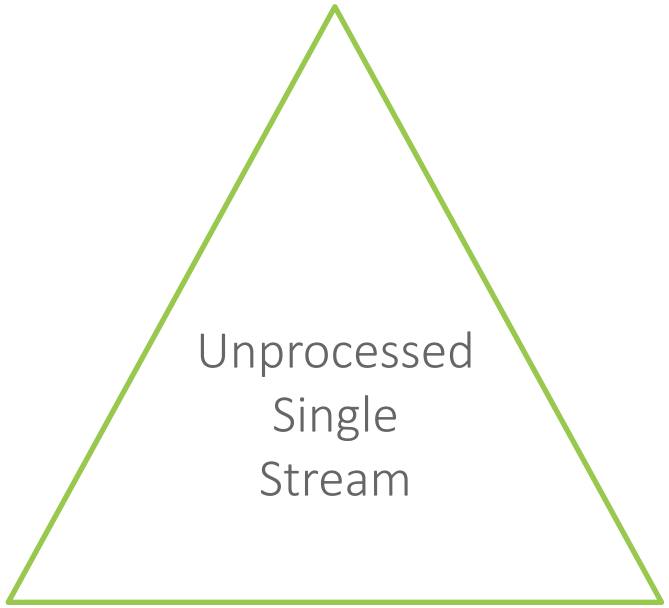
- More and lighter units
- More types of material
- More downtime & maintenance

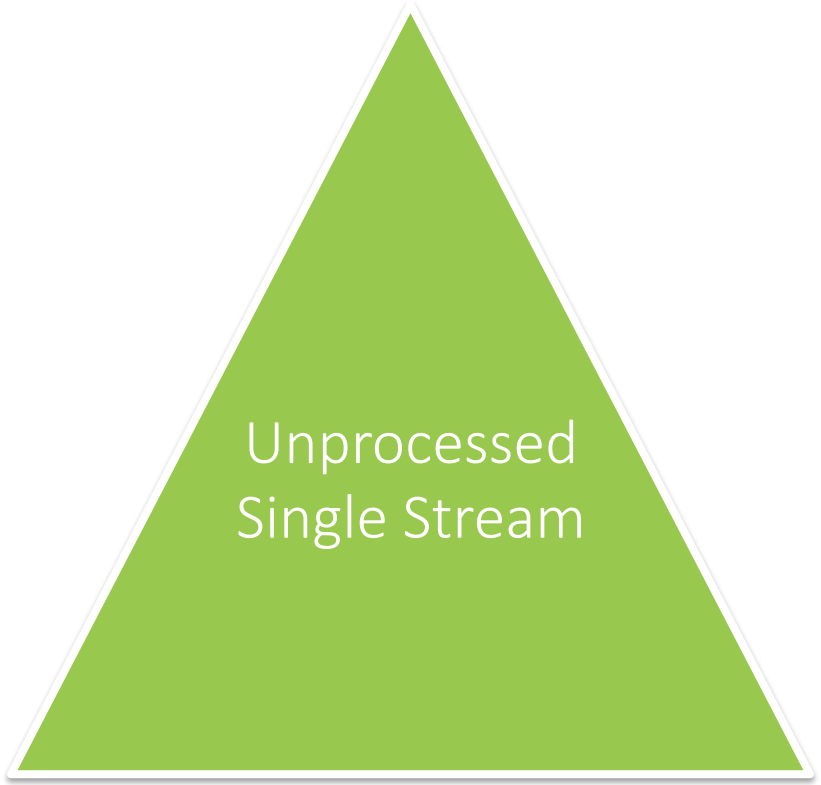
$12T

$43 T

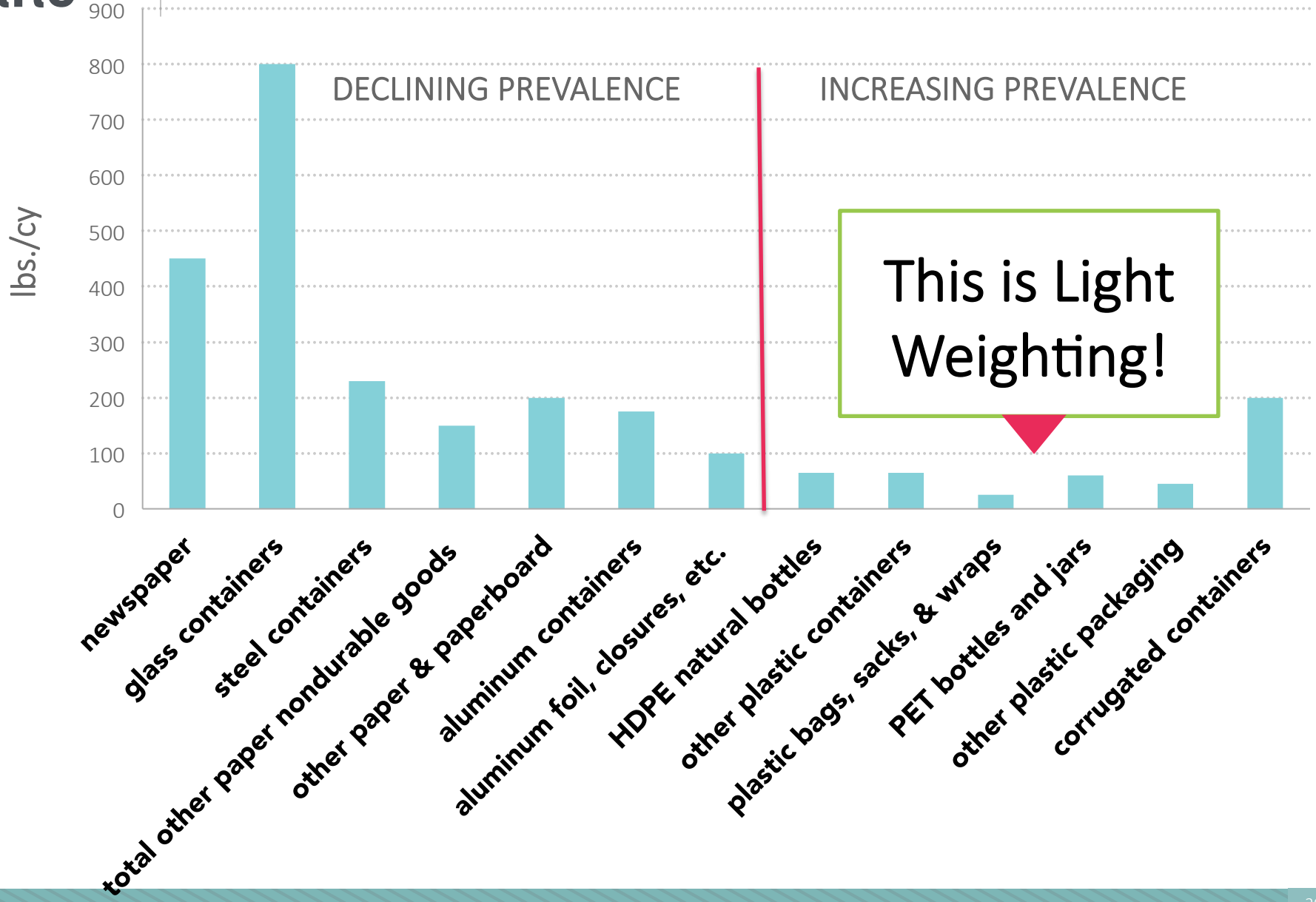
SINGLE STREAM PROCESSING

More and lighter units per ton





DENSITY RELATIONSHIP TO MATERIAL PREVALENCE



O&M: More Types of Material

Fiber	**Fiber**
Newspaper and inserts	Newspaper and inserts
Cardboard	Cardboard
Paperboard	Paperboard
Junk mail	Junk mail
Ledgers, files, computer paper	Ledgers, files or computer paper
Magazines, catalogs, directories	Magazines, catalogs, directories
Paperback & hardcover books	Paperback & hardcover books
	Other HH Fiber- Cups, containers, cleaned and washed
Containers	**Containers**
Aluminum cans and foil (clean)	Aluminum cans and foil (clean)
Steel cans	Steel cans
Aerosol cans (empty))	Aerosol cans (empty), except paint cans!
Glass bottles & jars	Glass bottles & jars
Six-pack ring carriers	Six-pack ring carriers
1 PETE): Soft drink & water bottles	1 PETE: Soft drink & water bottles; thermoform clamshells, ball holders
2 HDPE: Milk jugs, detergent bottles	2 Milk jugs, detergent bottles
	Beverage cartons
	Plastic Shopping bags bundled
	3 (PVC): Health & beauty aide, cooking oil bottles & household cleaners
	4 LDPE (LDPE): Margarine tubs & lids, dessert cups, six-pack rings
	5 (PP): Yogurt cups, syrup bottles, deli trays, and caps/lids. Clean Plant pots.
	6 PS: Rigid #6 plastics only, coffee lids, bakery containers; No Styrofoam or utensils
	7 OTHER : Microwaveable containers and narrow-neck bottles, flexible packaging
	Household Rigid Plastics

SINGLE STREAM PROCESSING MAINTENANCE COST TREND

$/T Received

- Aging of the Fleet- Most more than 5 years old
- More linear feet
- More peripheries and types of machinery
- Custom Equipment maintenance access
- From interviews and available studies

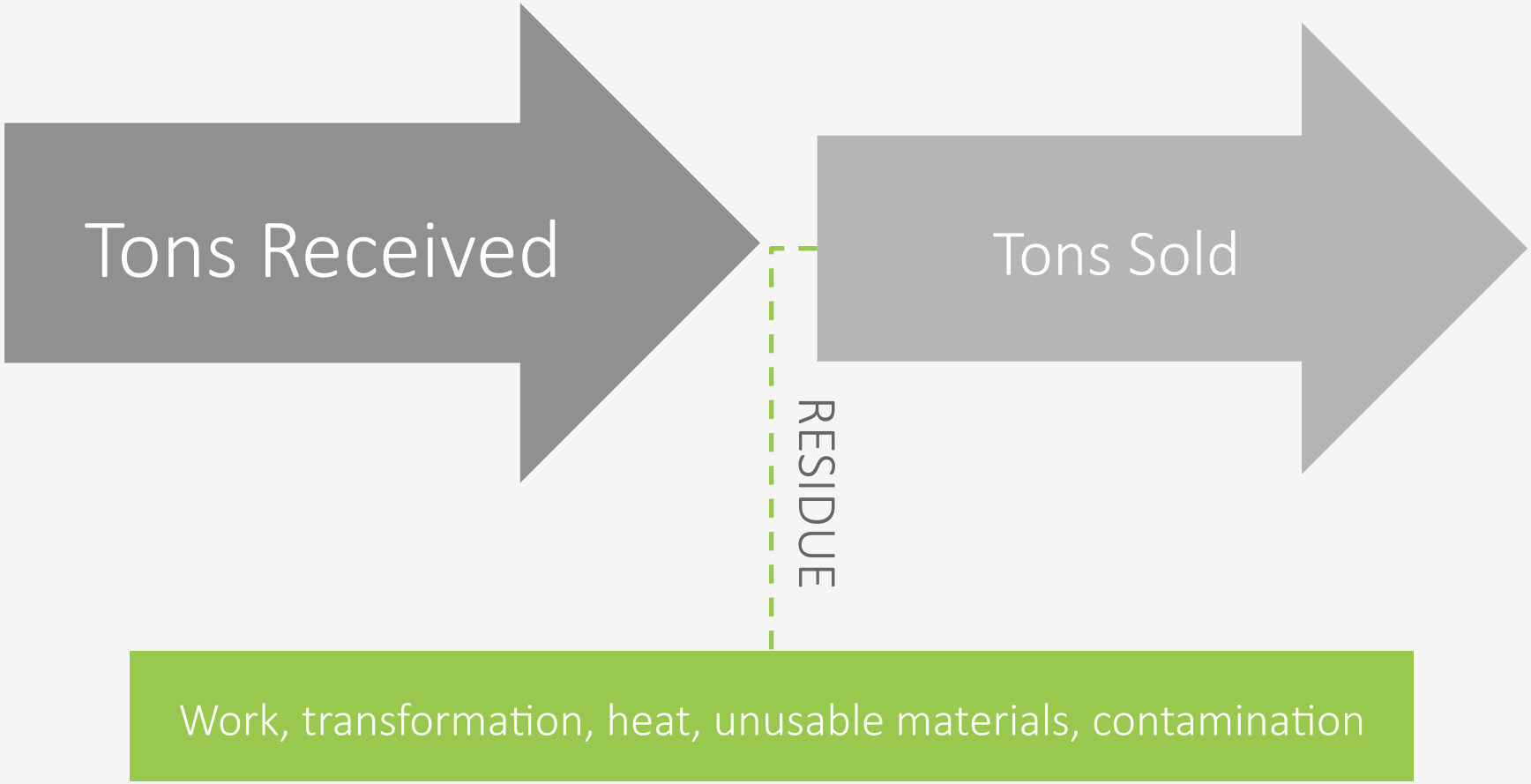
SINGLE STREAM PROCESSING TOTAL COSTS

From $45 - $65 to >$65 T to $77 T Received

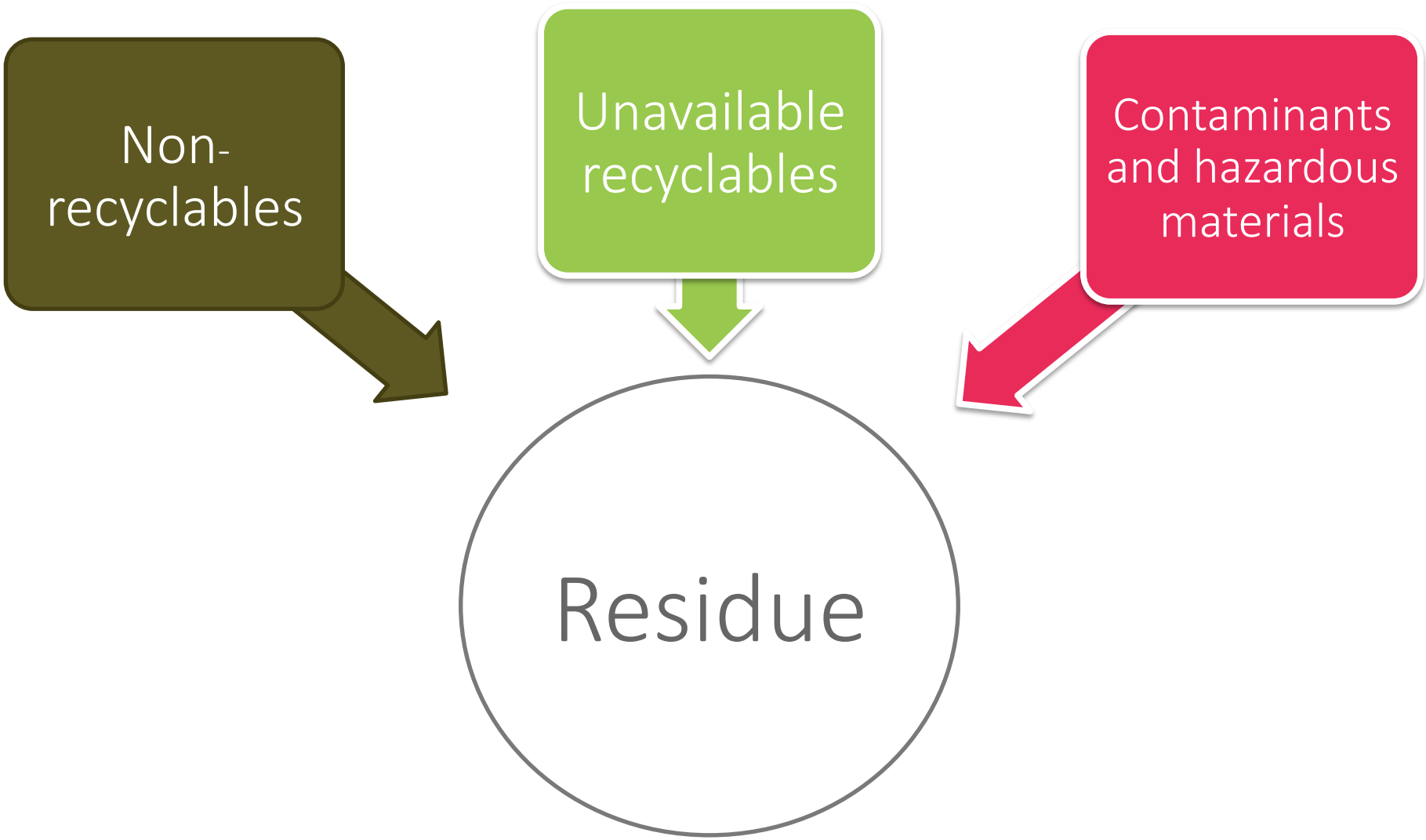
$20T

$57 T

CONCEPTS IN RECYCLING COST



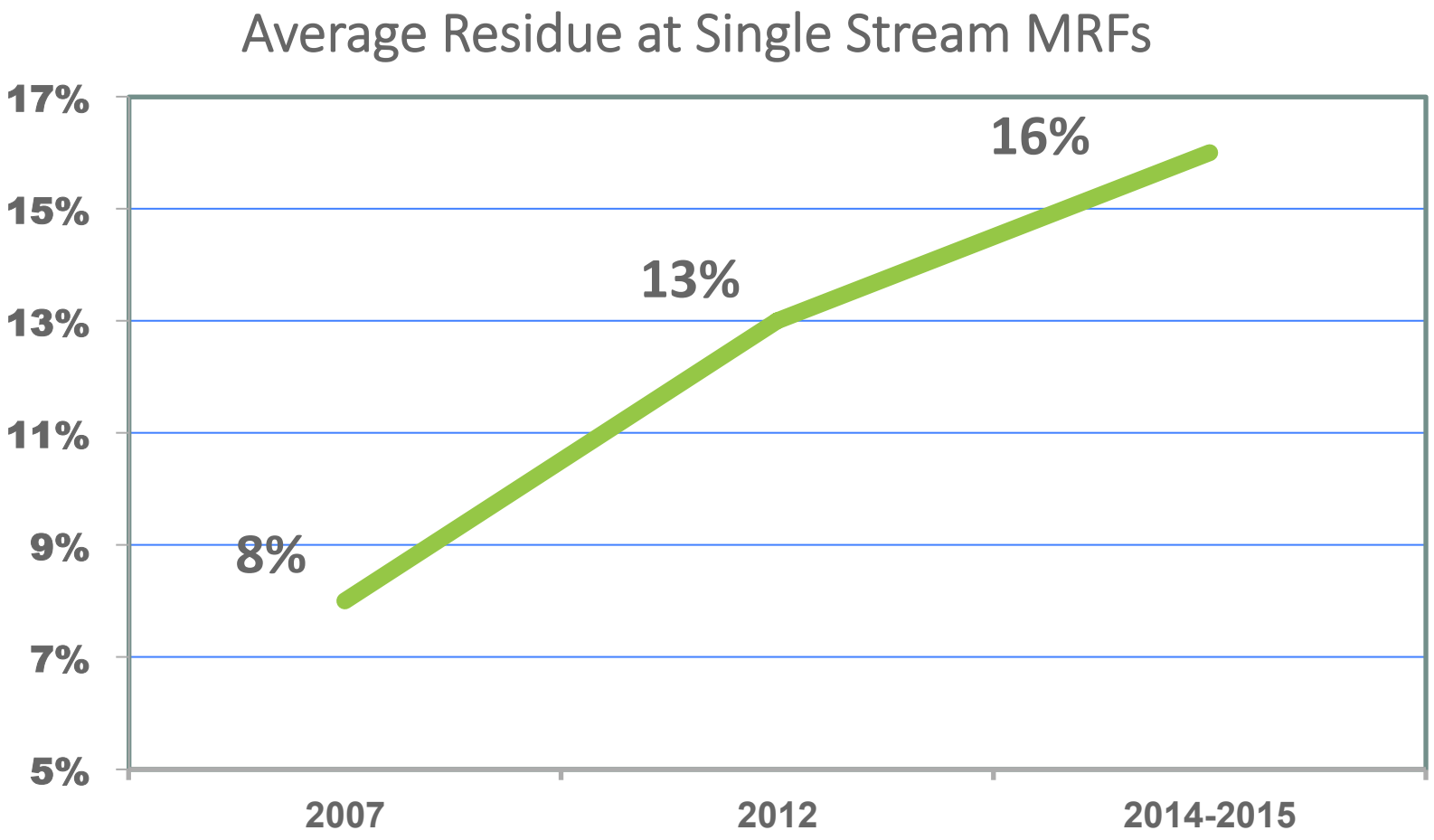
Costs for Recycling- Residue



Cost for Capturing Recyclables

4,800 TPM- 70% Participation	Single Stream			
	100,000 Households			
$/Tons Received	70% of 100%	80% of 100%	90% of 100%	95% of 100%
$55.00	70%	80%	90%	95%
Tons Sold	$78.57	$68.75	$61.11	$57.89
4800	$353,571	$309,375	$275,000	$260,526
Yield	3,360	3,840	4,320	4,560

CONCEPTS IN RECYCLING COST



Sources: 2007 Comparative Study on Public vs. Private MRFs, 2012 GAA study on Wisconsin-Area MRFs, ISRI Moore Presentation April 2015

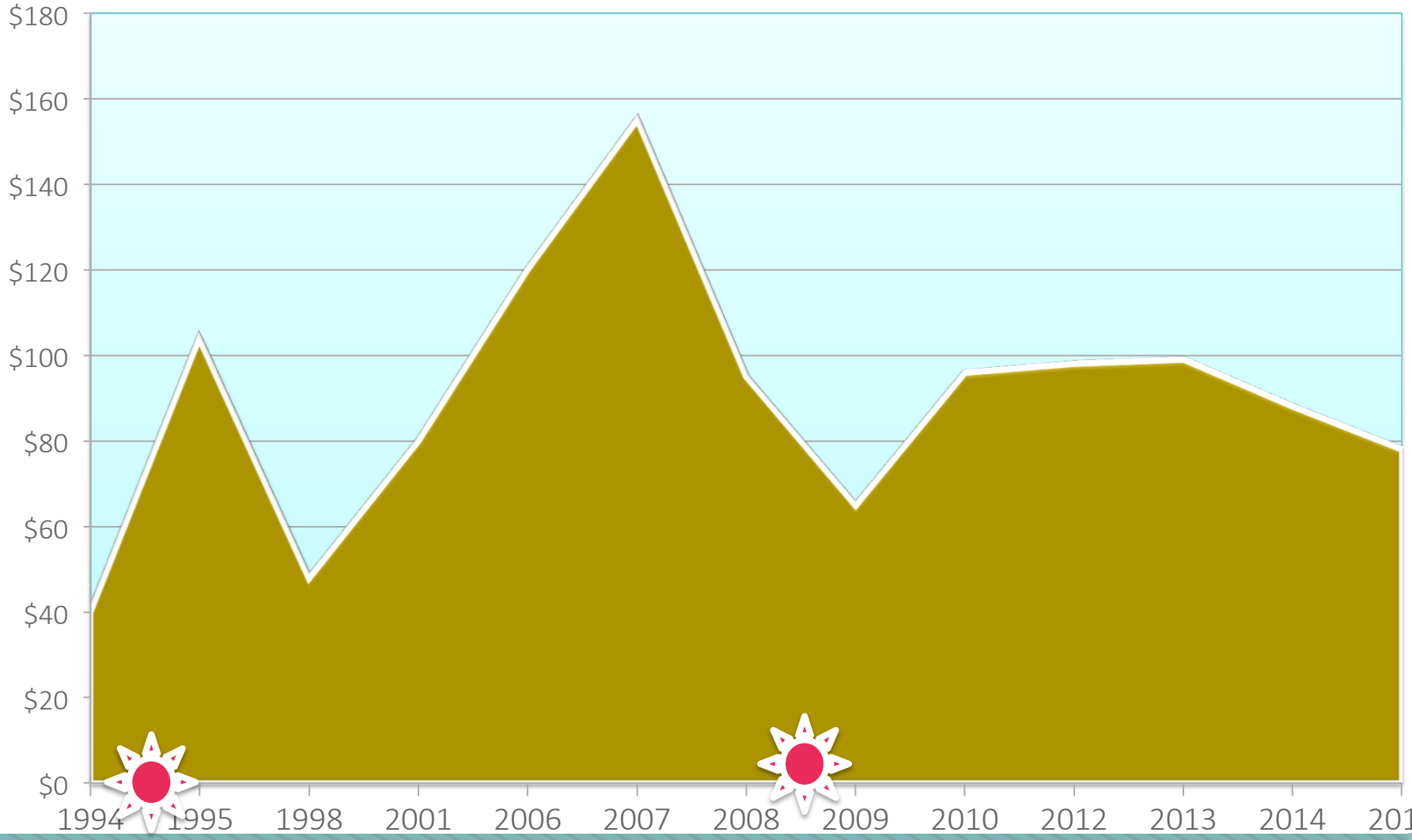
CONCEPTS IN RECYCLING COST

Year	Percent Residue	Total Impact	Comparative $/T (Current LF $/T)	Avg. MRF/Yr.
2007	8%	$82,320,000	$3.92	$131,292
2012	13%	$133,770,000	$6.37	$213,349
2014-2015	16%	$164,640,000	$7.84	$262,584

GAA Wisconsin, Moore, ISRI- 85 MRFs

RECYCLING REVENUE (TS)

System-wide Annual Blended Value, Average Value, Average Commodity Value, Average Market Value



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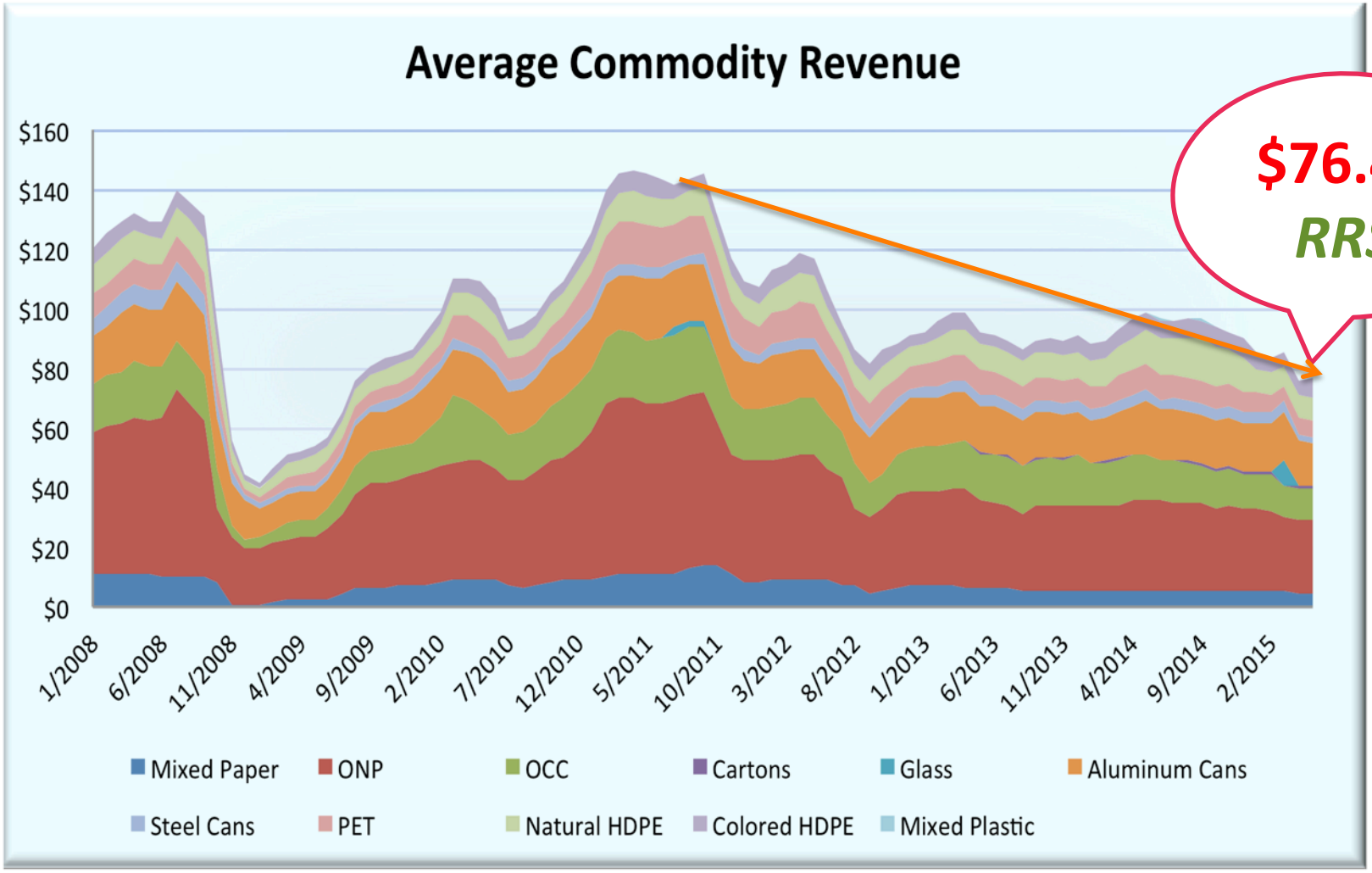


Material Revenue: Audit Your Material to Understand

- Compositions will determine blended value
- $66.50 in this real life Florida example

Material	% of Ton Volume	%of Ton Value
Mixed Paper	14.6%	12.8%
Newspaper (ONP) & Acceptable Fiber	29%	26%
Cardboard (OCC)	13.10%	16.32%
Aseptic Cartons	0.60%	0.60%
Mixed Glass	27.10%	(-)13%
Aluminum Cans	0.90%	16.00%
Steel Cans	1.70%	3.10%
PET #1	3.20%	5.50%
Natural HDPE #2	3.30%	12.90%
Colored HDPE #2	3.80%	6.40%
#3-7 Mixed Plastic	2.70%	0.38%
TOTAL	**100.00%**	**100.00%**

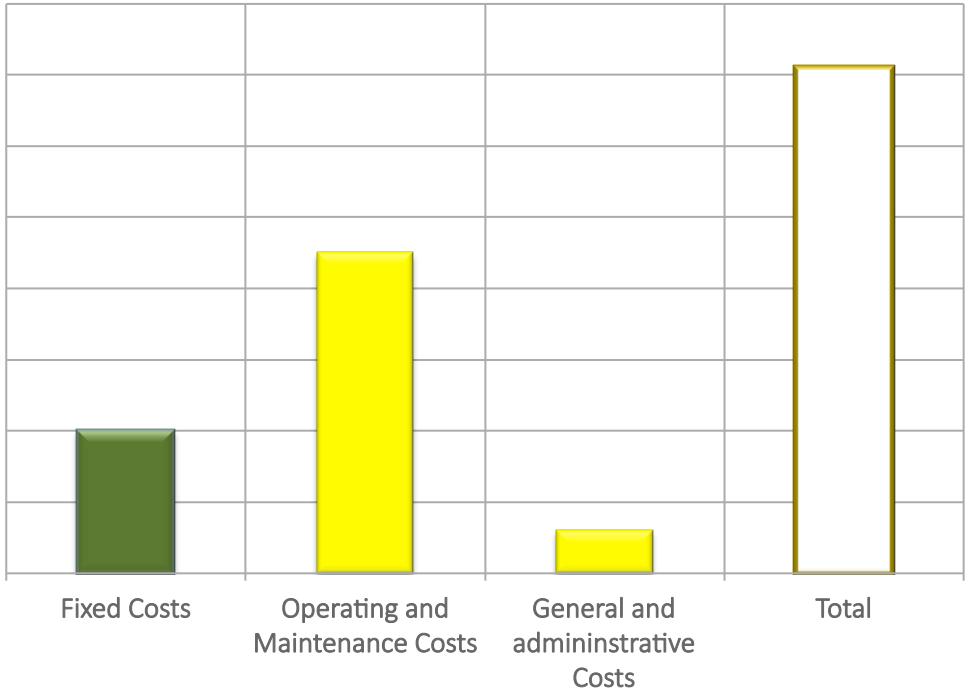
Single Stream- Net Change in Costs (from examples-*)

Category	2007	2015	Change
Revenue	$125	$76	-83%
Disposal	-$3.92	-$8	-7%
Collection	-$140	-$118	37%
MRF Processing	-$59	-$71	-20%
Subtotal	-$203	-$197	3.2%
Net Costs	-$78	-$121	-73%

Support is Needed
Service Providers Must Be Paid for Providing More Recycling & More Convenience

Considerations to Guarantee Survival

- Cover Out of Pocket costs in any arrangement with low risk, preferably fixed fee
- Insure further investment by having enough profit for an appropriate return
  - Private: Annual or longer
  - Public: Quarterly (Conundrum)



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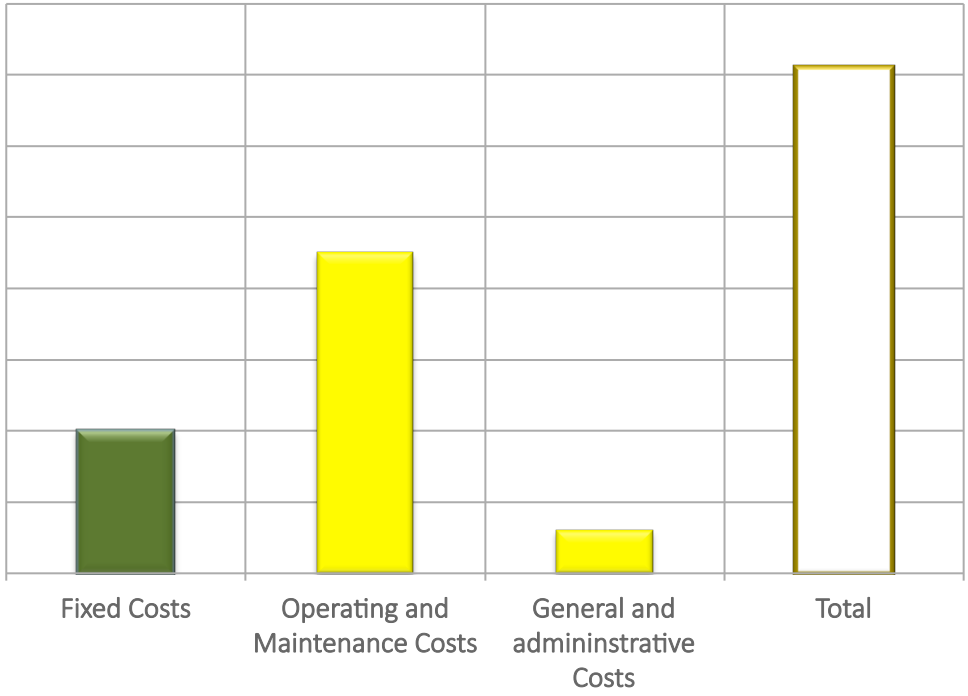
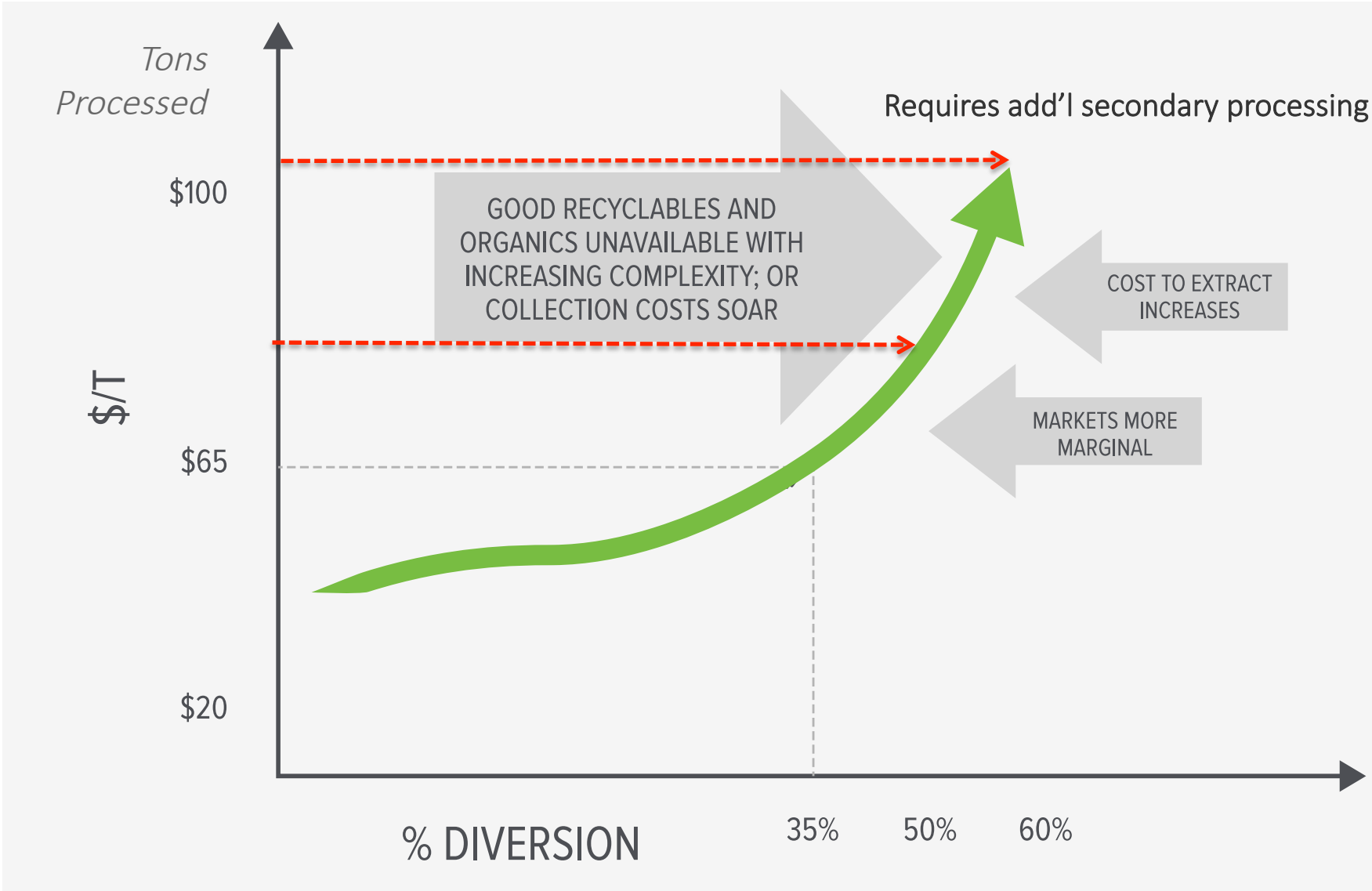


Other Considerations

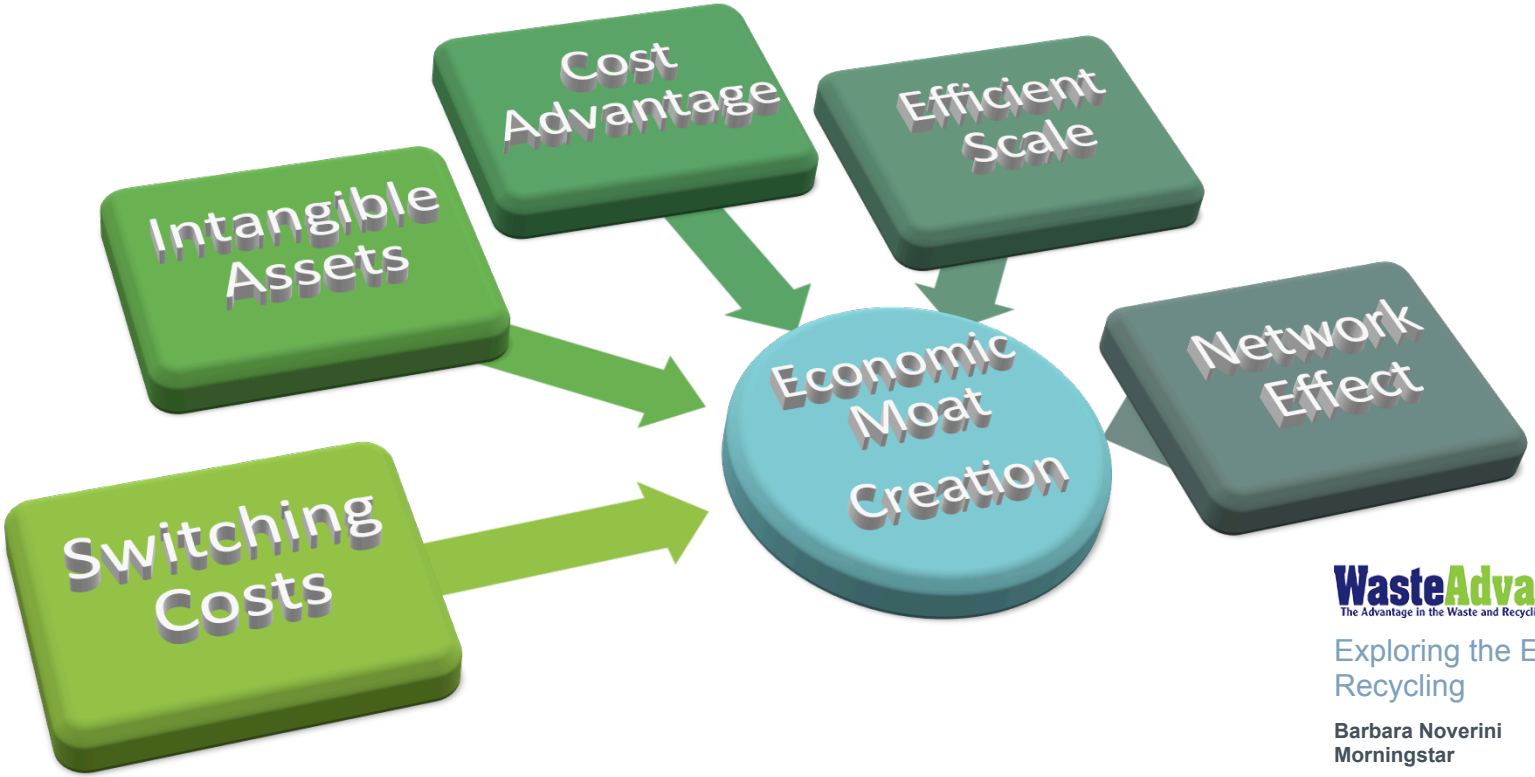
PROCESSING DIVERSION CURVE

2009 COUNCIL OF U.S. MAYORS



An Investor's View of Recycling Cost/Benefits

"As demand for recycling grows, a waste company must demonstrate economic profits throughout a commodity cycle before it can claim recycling as a true moat-building competitive advantage."



WasteAdvantage magazine
The Advantage in the Waste and Recycling Industry

Exploring the Economics of Recycling

Barbara Noverini
Morningstar

Investor's View of Recycling Cost/Benefits to an Integrated Waste Company

"Growth in recycling has not enhanced industry-wide profitability"

"Moat" -access and control landfill of the disposal asset diminished
- No competitive advantage
- Loss of pricing power, lack of pricing discipline
- Recycling actually increases the cost of overall system execution

WasteAdvantage magazine
The Advantage in the Waste and Recycling Industry

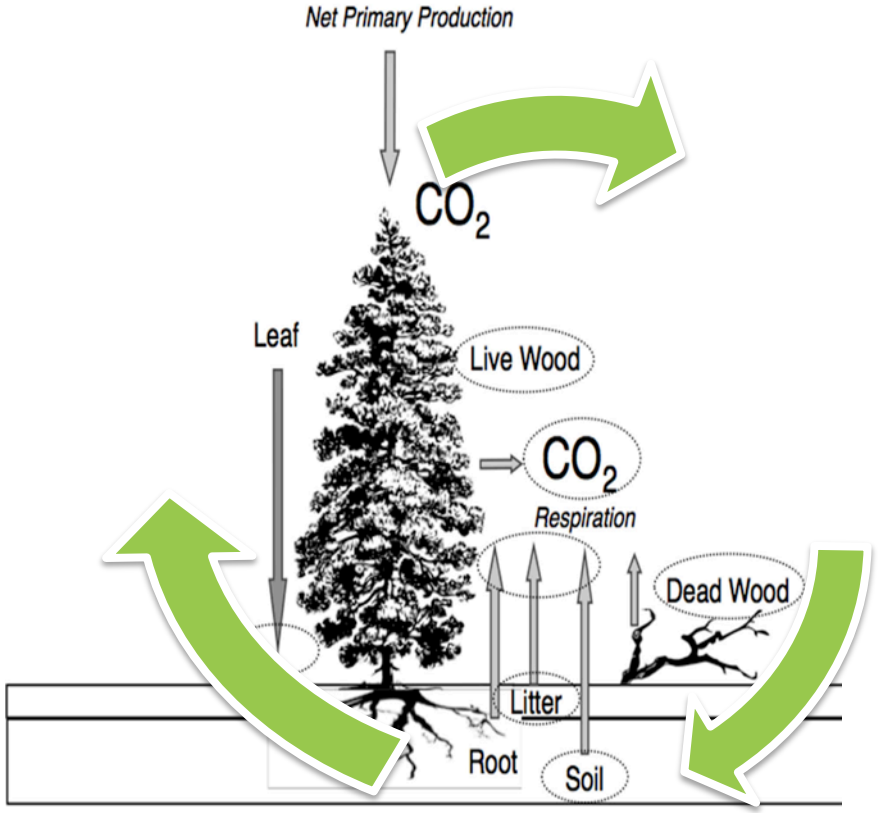
Exploring the Economics of Recycling

Barbara Noverini
Morningstar, September 23, 2014

Investor's View of Current Recycling

- Pipeline of Greenfield conventional MRF "lowest in years"
- Expectation is more closures this year with consolidation and unprofitability (up to 10%)
- No new large providers or consolidators on
- Recyclable volume reported by public companies is down in the first quarter

Externalities: Recycling Value Chain - Critical Link in the Circular Economy



Lyle, McDonough, Braungart, et. al – '*Cradle to Cradle, Industrial Ecology, Biomimicry, Blue Economy, Natural Capitalism…"*

- U.S. one-way consumption not sustainable - >4#/day
- Modeled on nature. When materials are recycled, energy consumption lowers, productivity optimizes, and stability accrues
- Keep products, components and materials at their highest utility at all times.
- Putting monetary value and costs for execution difficult. Today they are absorbed as social costs.

Managing Externalities: Policy-Maker's View of Cost/Value of Recycling

*""Avg. ton of material diverted to recycling …from region solid wastes has an estimated environmental value of $220T."- **Metro Portland, 2009***
."

- Properly engineered residential recycling programs costs(collection, disposal and administration) = net cost to C+LF
- True value of recycling has tangible benefits to the environment today
- Other models have pointed out recently (advanced LCA's) that there may be some corrections to some of the premises used.

A Policy-Maker's View of Cost/Value of Recycling

Table 1: 2007 Environmental Benefit Results by Diverted Material Type and End Use Market

	Metro 2007 Quantities Recovered	Environmental Benefits		Value of Specific Environmental Impacts Reductions Per Ton Recycled/Composted						
		Total	Per Ton Recycled	Climate Change	Human Health - Respiratory	Human Health - Toxics	Human Health - Carcinogens	Eutrophication	Acidification	Ecosystems Toxicity
Material & Market	(tons)	(million $)								
Cardboard	237,962	$112.6	$473	$104	$75	$274	$1	$0	$6	$13
Newsprint	96,105	29.5	307	82	25	180	1	0	7	12
Office Paper	99,608	17.2	173	155	17	-1	0	0	1	0
Metro Mixed Paper	23,205	4.6	199	101	19	71	0	0	6	2
PET	6,273	0.6	98	69	22	-10	0	0	15	1
HDPE	12,033	0.7	60	56	10	-11	0	0	4	0
LDPE Plastic Film	5,254	0.5	90	74	16	-7	0	0	6	1
Glass Packaging										
Glass containers	44,087	1.4	33	9	11	11	0	0	1	1
Fiberglass insulation	1,473	0.1	66	16	27	19	0	0	1	3
Aggregate	8,107	0.0	2	1	0	-1	0	0	0	2
Aluminum	11,743	17.3	1,469	402	189	687	8	0	54	129

A Policy-Maker's View of Cost/Value of Recycling