

# ***RECYCLING CONTAMINATION STRATEGIES – SHORT & LONG RUN AND GRESHAM’S LAW***

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## ***RECYCLING PROGRAMS UNDER FIRE - Global Problems, Local Solutions***

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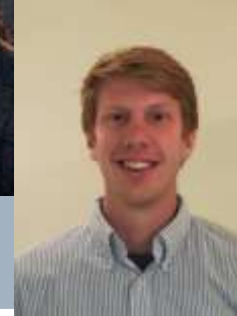
# About



**Estab. 1994  
Certified WBE**

*Research &  
Consulting in Solid  
Waste, Resource  
Economics, &  
Sustainability*

**Staff:**



## ***SERA By the Numbers...***

Projects: 325+

Articles:

- 140 SW
- 150 Resource Econ



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***Clients: Towns, Cities, Counties, Districts,  
States of all sizes across US & Canada***

**DATA &  
COLLECTION  
MODELS  
CASE STUDIES  
SWMP PLANS &  
EVALUATION  
PAYT & FUNDING  
Food / Organics**



**Awards / Honors:** *National Lifetime Achievement Awards from:*

- SWANA
- National Recycling Coalition
- Journal of SW & Technology
- State Award: CAFR

Boards: NRC, CAFR, CO-SWANA

Former Boards: WSRA, AESP



# DEFINITIONS...

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**COLLECTION**



**RECYCLING**

**DIVERSION**



**RECYCLING**



# DEFINITIONS...

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**20% TRASH +  
80% RECY**



**RECYCLING**



**SINGLE STREAM**



**DEVIL (☺)**



**SINGLE STREAM  
recycling**



**MRFS CAN CLEAN SINGLE  
STREAM TO SPEC TODAY**

# ***DEFINITIONS...***

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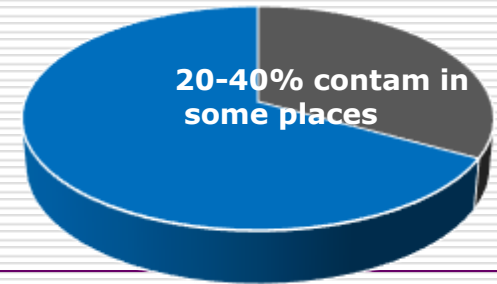
**RECYCLING** Does involve use of the commodity as a Resource

The definitions of materials developed by ISRI or mills are vital for for defining **"COMMODITY"** – an economic **INPUT OF PRODUCTION**

**What we're currently collecting isn't "it"**

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# QUALITY & CONTAMINATION PROBLEM...



- Problem NOT NEW
  - Pre-dates SS... but worsened / accelerated under SS.
  - Mills complained for years
- MRFs can sort (close to) specs now, but not with current incentives and input streams.
  - Management attention; processing speed / depth; steps; input quality-
  - No MRFs spec'd for 20% TRASH – and reports of contamination levels 20%, 25%, 30% and one CA article said a city had 40%!! in-bound
  - Industry standard outbound was often 3% (but not enforced)
- Enforced quality out drives what is delivered (SS or DS)
- China brought a long-standing problem to a head
- Nationally or internationally, what has been produced is NOT an economic input – how to fix problem & result?

**MEETING DEFINITION OF A REAL "COMMODITY" IS IMPORTANT.<sup>7</sup>  
THAT MEANS A USABLE, ACCEPTABLY "CLEAN-ISH" COMMODITY  
POSSIBLE WAYS....**



**And every MRF "pretties" the bales**

# Gresham's Law

8

## ***BAD BALES DRIVE OUT GOOD BALES***

*Bad bales flood the market; driving good bales out of circulation*

IFF

No quality control / enforcement

No reward for quality



## ***Race to the Bottom***

**Began first time "out of spec" bale not rejected**

**Irreversible as long as not regularly rejected**

Enforcement of a "commodity" is key to a functioning market

**SERA**



# Gresham's Law

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## Rational Actors

- MRFs – no \$ reward to slow down
- No one checking / rejecting

## Irrational Actors

- Mills pay more pre-cleaning – but not for cleaner material.
- Same \$! Pay those who are good at cleaning!

# COMMODITY DEFINITION IS IMPORTANT



**And every MRF "pretties" the bales**

Source: SERA research



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# NEAR TERM

# ***NEAR TERM STRATEGIES***

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- ❑ Education for in-bound contamination; contracts and incentives for out-bound
- ❑ Allocating and bounding financial risk
- ❑ Getting to marketable...

# WHAT TO DO LOCALLY / NEAR TERM



- ❑ Bag fee/ban NOW (80%); split glass? Bottle bill?
- ❑ Optimize / reduce costs of current programs
  - ❑ EOW for recycling; possible bans / mandates
  - ❑ PAYT (ordinance) more material & reduces cost/ton
  - ❑ Organized collection can help, depending
- ❑ Consider accepted material mix –LOCAL / complex
- ❑ INBOUND – Education (but not same old same old)
  - ❑ 20% problem, sorts to focus on local problems, dashboard
  - ❑ Self-efficacy, their values, social marketing, DTD if possible
- ❑ OUTBOUND - Contracts & incentives
  - ❑ One-side - Contracts direct to end-users, partners
  - ❑ MRF-side – Enforce, incentives, partner, bound risk

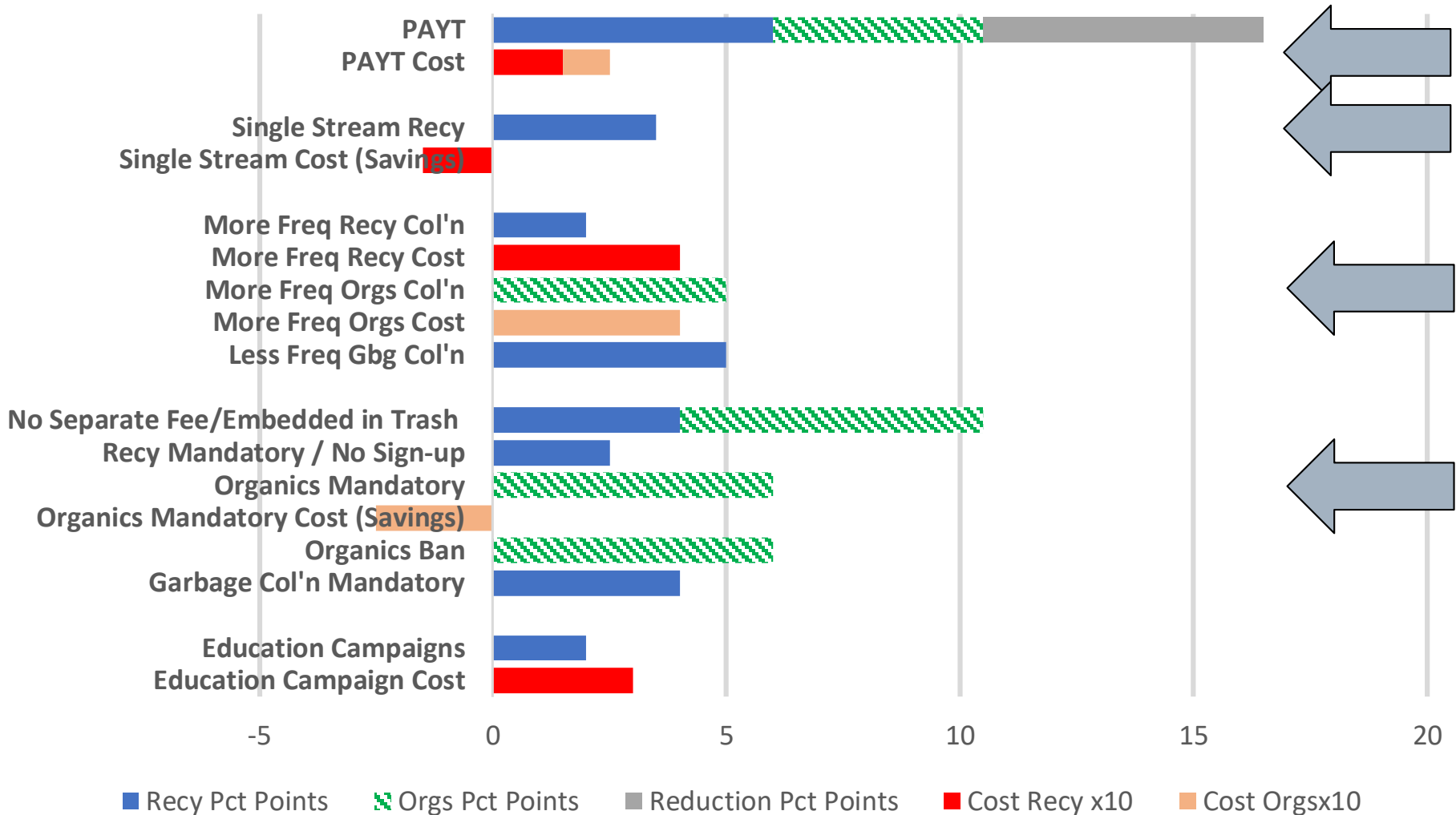
# WHAT TO DO LOCALLY / NEAR TERM



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# SERA STATISTICAL C/E RESEARCH

## Diversion & Cost Impacts of Residential Program Options-SERA



Source: SERA Statistical regression analysis of hundreds of cities across North America  
 Source: Skumatz, all rights reserved may be used with permission of author

# WHAT TO DO LOCALLY / NEAR TERM



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# MRF PROCESSING OPTIMIZATION RESULTS - LOCAL!

## BREAKEVEN ANALYSIS

Breakeven Analysis			MRF Covers all costs			Industry funds Densifier		
Model 1: Manual sort PS / densifier, Labor \$32K- MRF Type	TPY (thous)	Percent PS in Scenario	EPS Prices Required for Plant to Break Even with 0.9% PS Recov	Tons/yr of EPS Required for Plant to Break Even at \$160/Ton (thous)	Pct EPS Content for Plants to Break Even at \$160/Ton	EPS Prices Required for Plant to Break Even with 0.9% PS Recov	Tons/yr of EPS Required for Plant to Break Even at \$160/Ton (thous)	Pct EPS Content for Plants to Break Even at \$160/Ton
Small MRF	20	0.9%	\$196	0.22	1.1%	\$157	0.18	0.9%
Medium MRF	42	0.9%	\$149	0.35	0.8%	\$130	0.31	0.7%
Large MRF	72	0.9%	\$132	0.54	0.7%	\$118	0.48	0.7%
Mega MRF	144	0.9%	\$120	0.97	0.7%	\$109	0.88	0.6%

### Profit Per Ton Of Commodities Processed

	Alum- inum	Ferrous	OCC	ONP	ONP #2	Mix Paper	HDPE Colored	HDPE Natural	PET	2 - 7
<b>Profit per Ton - MEDIUM Prices</b>										
Very Small			\$71							
Manual Small	\$571	-\$262		-\$33			-\$52	\$329	\$159	
Small	\$1,411	\$52	\$45	\$36	\$29	\$1	\$279	\$404	\$327	
Medium	\$1,462	\$86	\$92	\$57	\$53	-\$23	\$376	\$348	\$395	
Large	\$1,471	\$90	\$93	\$54	\$51	\$1	\$412	\$381	\$401	-\$92 \$87 -\$95 -\$39
Mega	\$1,471	\$91	\$98	\$58	\$55	\$0	\$411	\$357	\$401	-\$87 \$85 -\$100 -\$39
<b>Profit per Ton - LOW Prices</b>										
Very Small			\$49							
Manual Small	\$296	-\$301		-\$44			-\$261	\$561	-\$58	
Small	\$1,136	\$12	\$23	\$25	\$18	-\$8	\$69	\$636	\$110	
Medium	\$1,187	\$47	\$70	\$46	\$42	-\$32	\$167	\$580	\$178	
Large	\$1,196	\$50	\$71	\$43	\$40	-\$8	\$203	\$613	\$184	-\$98 \$38 -\$126 -\$68
Mega	\$1,196	\$51	\$76	\$46	\$44	-\$9	\$201	\$589	\$185	-\$93 \$36 -\$131 -\$68
<b>Profit per Ton - HIGH Prices</b>										
Very Small			\$103							
Manual Small	\$1,096	-\$251		-\$26			\$179	\$989	\$562	
Small	\$1,936	\$62	\$77	\$44	\$36	\$13	\$509	\$1,064	\$730	
Medium	\$1,987	\$97	\$124	\$64	\$60	-\$11	\$607	\$1,008	\$798	
Large	\$1,996	\$100	\$125	\$61	\$58	\$12	\$643	\$1,041	\$804	-\$73 \$208 -\$71 -\$28
Mega	\$1,996	\$101	\$130	\$65	\$62	\$12	\$641	\$1,017	\$805	-\$68 \$206 -\$76 -\$28
<b>Assumptions:</b>										
Medium Prices	\$1,515	\$120	\$147	\$85	\$85	\$53	\$470	\$460	\$437	\$6 \$249 \$91 -\$11
Low Prices	\$1,240	\$80	\$125	\$74	\$74	\$44	\$260	\$692	\$220	\$0 \$200 \$60 -\$40
High Prices	\$2,040	\$130	\$179	\$92	\$92	\$64	\$700	\$1,120	\$840	\$25 \$370 \$115 \$0

Breakeven Analysis			MRF Covers all costs			Industry covers Optical sort equipment		
Model 2: Optical Sorter / baling, Labor \$32K- MRF Type	TPY (thous)	Percent PS in Scenario	EPS Prices Required for Plant to Break Even with 1.2% PS Recov	Tons/yr of EPS Required for Plant to Break Even at \$160/Ton (thous)	Pct EPS Content for Plants to Break Even at \$160/Ton	EPS Prices Required for Plant to Break Even with 1.2% PS Recov	Tons/yr of EPS Required for Plant to Break Even at \$160/Ton (thous)	Pct EPS Content for Plants to Break Even at \$160/Ton
Large MRF	72	1.2%	\$130	0.70	1.0%	\$88	0.47	0.7%
Mega MRF	144	1.2%	\$96	1.04	0.7%	\$59	0.63	0.4%

Source: SERA analysis / may not be used / photographed

# WHAT TO DO LOCALLY / NEAR TERM



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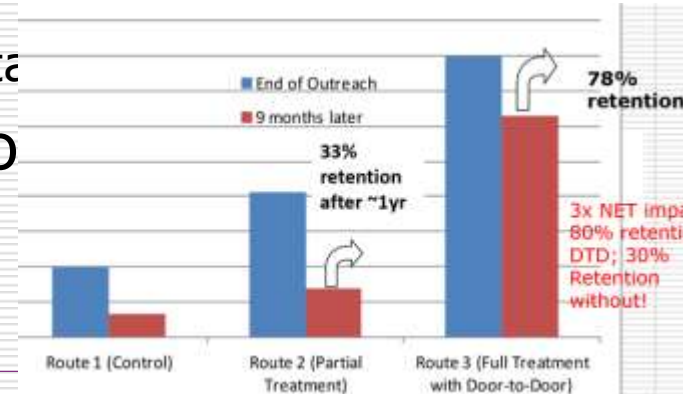
# GET THE MOST FROM EDUCATION / OUTREACH- NOT SAME OLD SAME OLD



- Information is not motivating
  - Self-efficacy - empowerment
  - Their values – multiple groups
  - Feedback
  - Social marketing
    - Motivations / barriers, messengers, connect
    - Target to next group, not your friends

## □ Effective Input

- Surveys, stakeholder techniques for target
- Measure, cost, retention, improve
- Improve inbound stream
  - Stop “wishful” recycling
  - Not spec'd for 20% contamination!



# WHAT TO DO LOCALLY / NEAR TERM



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# UNCERTAINTIES AND CHANGES CITIES & MRFS

## Typical, City –

- Increase \$21, then \$5 more
- Used to be \$10, now \$40
- Incr. \$2-11/hh/yr

- ❑ With China rejects, more examples of contracts & restructuring at renewal – with big increases
  - ❑ Thresholds, fees, payments for service
- ❑ Contract recommendations / calcs vary with:
  - ❑ Ownership / operating arrangement & responsible parties
  - ❑ Materials allowed / agreed, waste comp, evolving ton
- ❑ Rather than UNEXPECTED –
  - ❑ Get control, predictability
  - ❑ MUTUAL agreement

## Share of revenues

50% above threshold, 55%,  
70% above threshold, above \$65;  
80% city; 100% to city; other...

## Base processing fees

- \$65-75; \$50 escalating to \$81

*Inbound contam thresholds, extra fees*  
10-15% inbound; 10% thresh +  
\$100K /10% (2.50/hh);  
10% and at 8% over costs 25% more;  
Add \$40-70/T if over threshold  
26%; fines cost \$0.21-0.35/hh/yr/pct  
point of contam (\$5.50-\$9/hh/yr)

## Typical, MRF –

- 20-40% contamination!
- Higher contam costs us \$5.50/ton
- 26% contamination
- \$5.50-9/hh/yr contam

# ***ELEMENTS OF CONTRACTS – CITY & MRF***

## **Activity**

Goals, transparency, roles;  
Statistical sorts in-bound; clear protocols

Education on YES/NO materials

Feedback to residents; dashboard

Statistical sorts out-bound; clear protocols

Assess payments / true-up  
Fees in, incentives, revenue sharing

Contract revisions

Transparency

Review and discussion of costs, etc.

Source:  
SERA research

*Cities can often handle a little higher cost – if PREDICTABLE*

# ***HAVE SEEN ELEMENTS VARY ALL OVER THE MAP***

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- *Inbound contam thresholds, extra fees*
  - *10-15% inbound; 10% thresh + \$100K /10% (2.50/hh);*
  - *10% and at 8% over costs 25% more;*
  - *Add \$40-70/T if over threshold*
  - *26%; fines cost \$0.21-0.35/hh/yr/pct point of contam (\$5.50-\$9/hh/yr)*
- *Base processing fees*
  - *\$65-75; \$50 escalating to \$81;*
- *Outbound contam*
  - *- not as much info / need more as contracts proceed*
- *Extra costs for contamination / costs of contamination*
  - *\$3.50/hh; \$5.50+/ton*
- *Share of revenues*
  - *50% above threshold, 55%,*
  - *70% above threshold, above \$65;*
  - *80% city; 100% to city; other...*

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# LONGER TERM

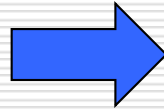


# WHAT TO DO BIGGER PICTURE / LONGER TERM

- ❑ Economic development
- ❑ State policies
  - ❑ PAYT, bottle bills, bag fees / bans, EPR
- ❑ Formal markets – Boards of Trade
  - ❑ Necessary - consistent, reliable product to trade
  - ❑ Benefit - Futures, options – mitigates price volatility
  - ❑ Benefit - More predictable program costs. More important than lowest cost in many cases.
- ❑ Most important of all - Carbon Tax / Cap and Trade legislation
  - ❑ Embedded energy in recyclables that virgin materials would have to pay, so price for virgin >> price for recyclables. Prefers recycling; helps demand & price.
  - ❑ Solves fundamental problems, importance (\$160-1K per ton adder)



# WHAT CAN BOARDS OF TRADE ACCOMPLISH? "COMMODITY" (IF ENFORCED) BENEFITS



## MARKET TRADING

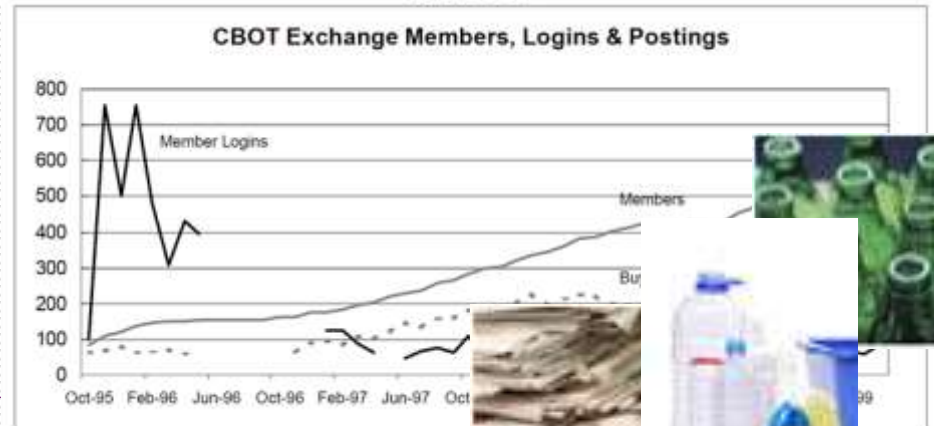
- ➔ Certainty in what is being sold ➔
- ➔ Market efficiencies, less risk, more predictable
- ➔ Futures, options, price stabilization
- ➔ Program costs more predictable, less price variation



& "Recycling Partnership"

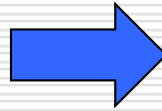


**10/18/95-12/31/99**



Source: SERA research

# ***ECONOMIST'S SOLUTION FOR RECYCLING MARKETS***



## **EMBEDDING EXTERNALITIES**

- ❑ Carbon tax (fee, assessment..) solves the recyclables / virgin materials issue
- ❑ How it works
- ❑ Why it helps us
  - Tremendous embedded energy in many recyclables
  - Valuing thru (carbon tax) provides huge benefit to recyclables relative to virgin materials-Recyclables win
  - Recyclables become the preferred (and cheaper) input immediately – and consistently
  - Current carbon market estimates: \$40, \$226/MTCO<sub>2</sub>e,
  - *OMG - Who would have thought Exxon would be a hero to our cause!!*  
(NPR 10/10/18)



# EMBEDDED ENERGY SHARES

## Energy Saved Recycled vs Virgin Material



Source: SERA research

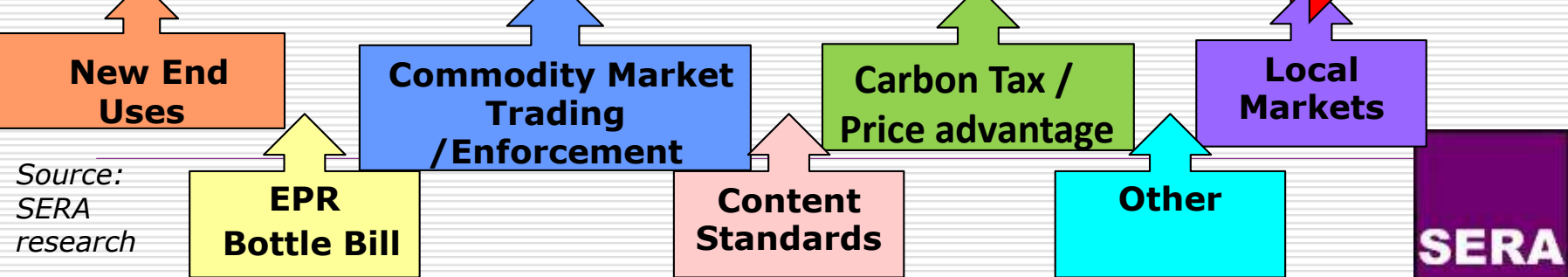
ISRI Fact Sheet 2011

SERA

# Nearer Term Options...



**Improve Longer Term market conditions with...**



Source: SERA research

# CHINA'S IMPACT AT US HOUSEHOLD LEVEL

- SERA surveys – National household, representative

CHINA	2018	2019
Not heard before reading	71%	66%

Given China, Should recycling continue?	2018	2019
Yes, recycle anyway	69%	68%
Yes, concerned whether recycling sensible	20%	22%
Yes another reason	4%	4%
No don't think items recycled	5%	4%
No Programs shouldn't continue	1%	1%
No another reason	2%	1%

# TAKEAWAYS



- China gave time – we wasted it
  - New countries; but harmed US mfg too
  - Waivers to allow landfilling & cancelled programs heartbreaking
  - Solution is NOT the rainbow – Econ 101 always wins
  - Enforcement is important to all
- Near term options presented
  - Bags, education, efficiencies, contracts; not killing single stream
- Longer term options presented
  - Markets, carbon tax; some econ / market development, policies
- Definitions / commodity & Quality matter and have consequences; higher dollars for better quality /MRFs can clean
- And enforce quality in high and low demand times – consistency is critical

# ***THANK YOU! – QUESTIONS?***

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***Also see Resource Recycling Article 8/2018***

*Others on cost-effectiveness & social marketing: RR Fall 2015, 11/13, 1/13, 4/10,  
Waste Adv 2/12*





# CONTAMINATION APPROACHES – GRESHAM'S LAW

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- Gresham's Law (applied to MRFs)

➔ **BAD BALES DRIVE OUT GOOD BALES**  
unless quality control / or quality rewarded...

- "When a government overvalues one type of money and undervalues another, the undervalued money will leave the country or disappear from circulation into hoards, while the overvalued money will flood into circulation."
- ==> **Bad money drives out good**
- ... but only if authorities have chosen to enforce a fixed exchange rate.

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\*Some options with trust and long-term arrangements, but mutual benefit...

Source: SERA research

# OPTIMIZING COLLECTIONS – HOW FAR CAN YOU GO?

LOWER COST/MONTH



M  
O  
R  
E

D  
I  
V  
E  
R  
S  
I  
O  
N

**3 stops / week –**  
old style!  
(Trash 2x/wk)  
Recy wkly

**2 stops / week**  
Trash wkly  
Recy wkly

**1 stop/wk?**  
Trash wkly to  
MWP???

**3 stops / week**  
Trash wkly  
Recy wkly  
Org wkly

**2 stops / week**  
Trash wkly  
Orgs & Recy Alt

**1.5 stops / week**  
Trash EOW  
Recy & Org Alt  
Wet wkly/dry EOW

**2 stops / week**  
Orgs Wkly  
Trash & Recy Alt  
Wet/dry wkly

**Integrated coll'n**  
(city or hauler)

See SERA article in Resource Recycling

# HOW MUCH DO YOU SAVE? AND GET?

Coll'ns/hr;  
Bans&Mandates

Coll'ns - 20% worse → 10-15% more cost

Bans / Mandates – 11-30x more tons for same City budget

Wkly vs. EOW recycling; PAYT

20-40% recy costs; lose 1-3% points

PAYT – 17% diversion from new billing system

Reduce trash & recy freq/ add organics?

Trash & recycling EOW 20-25%+

Organics 20%+ tons, same stops

MONTHLY CHANGE IN TIPPING PORTION - Moving to Organics from disposal - positive (red) means increase in costs

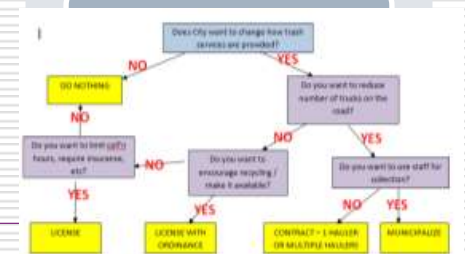
MONTHLY incremental tipping portion of cost assuming 70 lbs of organics collected per MONTH, whether collected weekly, every other week, or... Bold lines are range for common tip fees for organics processing

LF Tip across YW up/down	\$10	\$20	\$30	\$40	\$50	\$60	\$70	\$80	\$90	\$100
Organics	\$0.00	-\$0.35	-\$0.70	-\$1.05	-\$1.40	-\$1.75	-\$2.10	-\$2.45	-\$2.80	-\$3.15
\$20	\$0.35	\$0.00	-\$0.35	-\$0.70	-\$1.05	-\$1.40	-\$1.75	-\$2.10	-\$2.45	-\$2.80
\$30	\$0.70	\$0.35	\$0.00	-\$0.35	-\$0.70	-\$1.05	-\$1.40	-\$1.75	-\$2.10	-\$2.45
\$40	\$1.05	\$0.70	\$0.35	\$0.00	-\$0.35	-\$0.70	-\$1.05	-\$1.40	-\$1.75	-\$2.10
\$50	\$1.40	\$1.05	\$0.70	\$0.35	\$0.00	-\$0.35	-\$0.70	-\$1.05	-\$1.40	-\$1.75
\$60	\$1.75	\$1.40	\$1.05	\$0.70	\$0.35	\$0.00	-\$0.35	-\$0.70	-\$1.05	-\$1.40
\$70	\$2.10	\$1.75	\$1.40	\$1.05	\$0.70	\$0.35	\$0.00	-\$0.35	-\$0.70	-\$1.05
\$80	\$2.45	\$2.10	\$1.75	\$1.40	\$1.05	\$0.70	\$0.35	\$0.00	-\$0.35	-\$0.70
\$90	\$2.80	\$2.45	\$2.10	\$1.75	\$1.40	\$1.05	\$0.70	\$0.35	\$0.00	-\$0.35
\$100	\$3.15	\$2.80	\$2.45	\$2.10	\$1.75	\$1.40	\$1.05	\$0.70	\$0.35	\$0.00

\*=Per Month

Coll'n Integration /contracting /franchising

10-25% from not splitting collections



# ***ELEMENTS OF CONTRACTS – CITY & MRF***

<b>Element</b>
Clear goals, metrics, <b><i>transparency, clarity of risk &amp; responsibilities</i></b>
Statistical sorts in-bound; clear protocols
Decision process YES/NO materials; Decision process on responsibilities for upgrades / responsible parties for equipment (varies with ownership) Responsibility for education
Feedback to residents; dashboard
Statistical sorts out-bound; clear protocols
Financial: Processing costs, escalations Clear fees for exceeding thresholds in & out; Revenue sharing agreements
Assess payments / true-up
Contract revisions Review and discussion of performance, costs, etc.

***Cities need predictability & MRFs need reimbursement for "excess costs" and BOTH need incentives & accountability***

# CONTRACTS – CITY & MRF – FINANCIAL FORM, ELEMENTS

Thresholds / Values	Sample
<b>GOAL for in-bound contamination (w/penalty)</b>	X-y%
For every X% more, city pays to MRF → (calc to cover landfill costs, slower sorting, value reduction, mat'ls, eqpt)	\$X/ton
<b>GOAL for out-bound contamination (w/penalty)</b>	XX%
For every X% more, MRF pays city →	\$X/ton
<b>Processing costs service fee paid by City</b> at fixed costs per ton inbound (adjustments for quality in/out above)	e.g. \$XX/ton
<b>Revenue sharing arrangement</b> – all positive revenues shared at → (some percent to each to provide incentives to beat outbound threshold; actual sales vs. posted / transp; zero floor uncommon) – after risks assigned	e.g. 50/50, etc.

**Cities need predictability & MRFs need reimbursement for "excess costs" and BOTH need incentives & accountability**

Source:

SERA research

**SERA**

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# DETAIL ON CONTRACTS

# CONTRACTS TO IMPROVE PREDICTABILITY

## Typical, MRF –

- 20-40% contamination!
- Higher contam costs us \$5.50/ton
- 26% contamination
- \$5.50-9/hh/yr contam

## Typical, City –

- Increase \$21, then \$5 more
- Used to be \$10, now \$40
- Incr. \$2-11/hh/yr

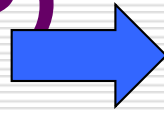
- ❑ Contracts for collection efficiencies
- ❑ Contracts directly with end-users
- ❑ Contracts and incentives for in & outbound
  - ❑ With China rejects, more examples of contracts & restructuring at renewal – with big increases
  - ❑ Changes in thresholds, fees, payments for service
  - ❑ MRF-side - Allocating and bounding financial risk
  - ❑ Getting to marketable...
- ❑ Contract recommendations & computations will vary with:
  - ❑ Ownership / operating arrangement & responsible parties
  - ❑ Materials allowed / agreed, waste comp, evolving ton
- ❑ Rather than UNEXPECTED –
  - ❑ Get control, predictability
  - ❑ MUTUAL agreement



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# DETAIL ON MARKETS & CARBON TAX

# KEY OTHER (LT?) STRATEGIES



## MARKET TRADING

- Qualifying to trade on Boards of Trade (require well-defined, enforced commodities) mutes price fluctuations (options, futures). Program costs become more predictable
- Most desirable from economics point of view – Carbon tax – embedded energy in recycling will make prices much lower than “virgin” and recyclables become the desired input. Big benefits.

