Challenges of Glass Recycling in North America

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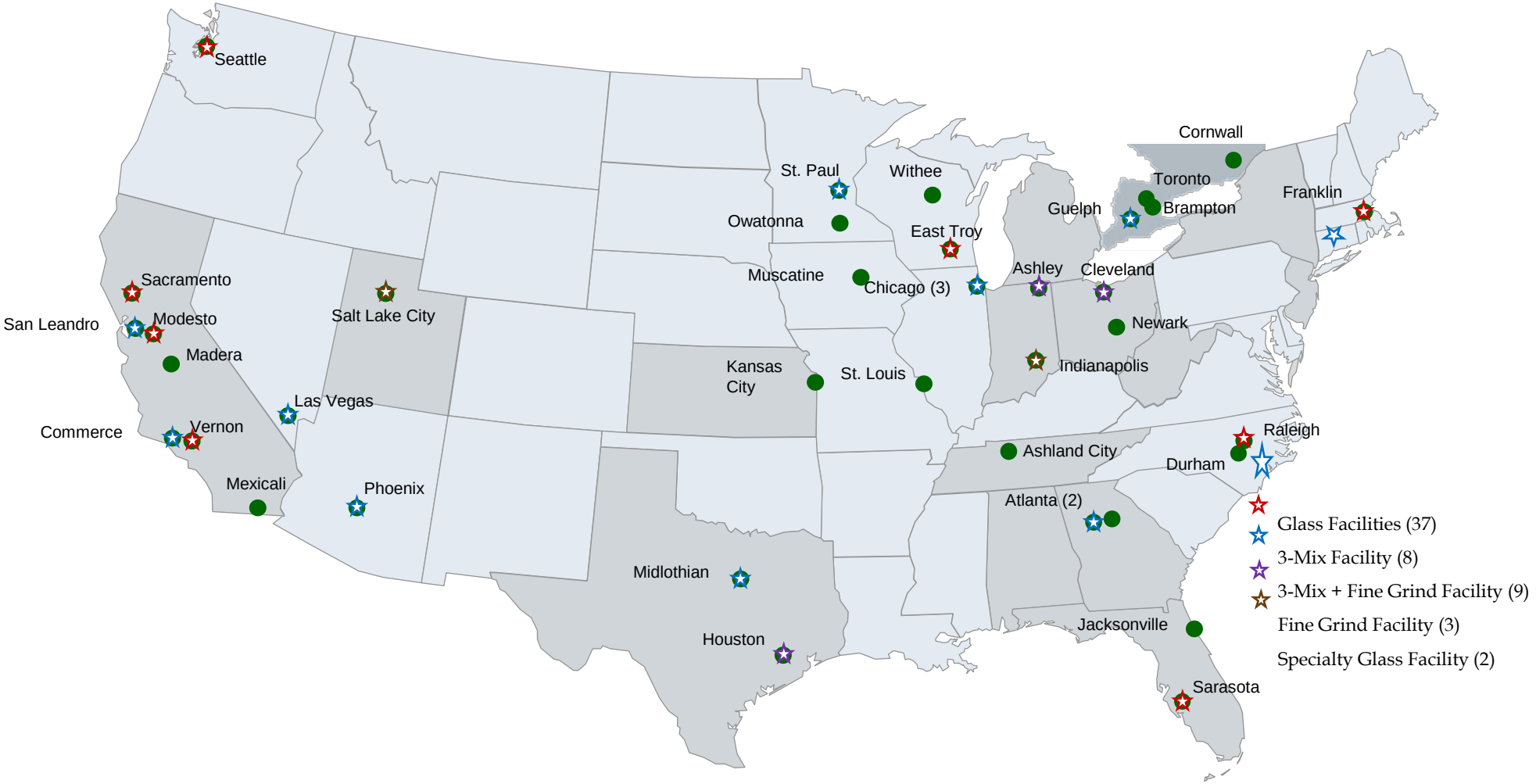
2016 SWANA Illinois Glass Markets Workshop

Strategic Materials footprint

- **Established in 1896, SMI is the largest glass recycler in the U.S.**
- **Operates 39 glass recycling plants across North America; 18 plants receive MRF mixed glass**
- **Recycling over 2.75 million inbound tons of glass each year**
- **A top ten plastics processor**



SMI Process

Supply

Container Deposit Material

Plate Glass

Curbside Collection

Source

Inventory

Process

SMI Processing Facility

Color Sorter

Clean

Sort

Size

Customers

Container Glass

Fiberglass

Highway Bead

Specialty

SMI Final Product

Curbside supply has **up to**

50% organics,

30,000 PPM ceramic ,

and is of mixed color

Final product must meet

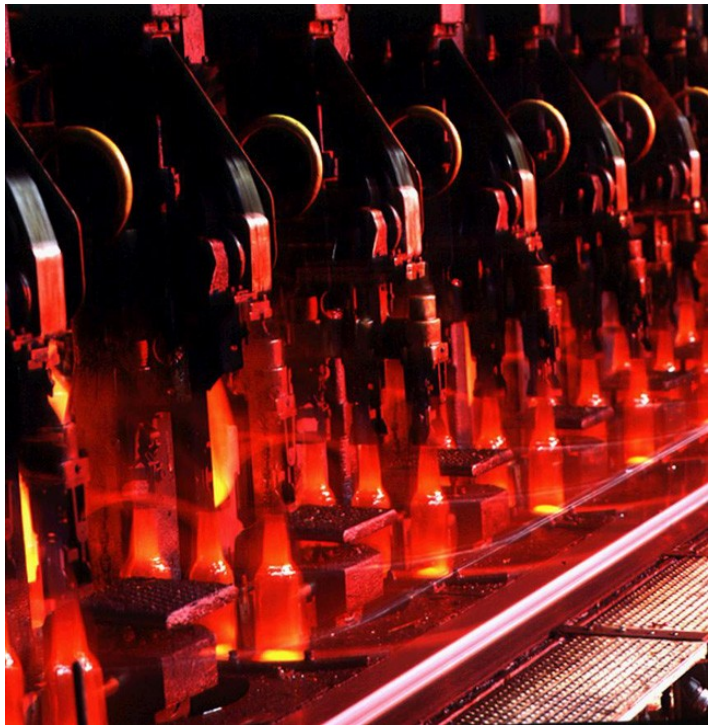
.15% -.25% organics,

< 50 PPM of ceramic,

and within color specifications

Growth of single stream recycling

Container Review



- Demand is off YOY slightly
- Industry currently at 30% an they want to increase to 50-60% min

Why Use Cullet

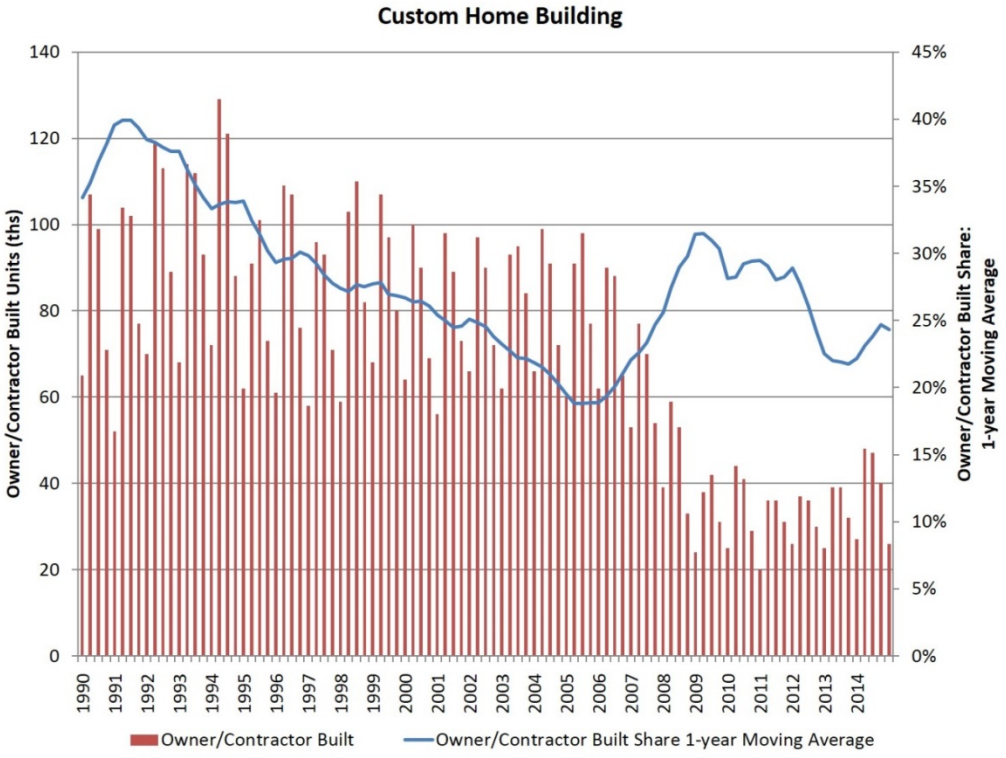
- **20% less air**
- **50% less water pollution**
- **Saves approx. 30% energy**
- **Speeds up production**

Closed Loop …

Glass Containers can be used over and over again endlessly.

Can be used at 95% recycled content. Lots of room for growth.

Fiberglass Review



- Tied to Housing starts. Still recovering from 2009 housing collapse (2,000,000 starts to 500,000).
- During collapse volumes were relatively stable. Industry decided to support recycling community boosted recycled content levels rather than shut off receipts.

Why Use Cullet

- **20% less air emissions**
- **50% less water pollution**
- **Saves approx. 30% energy**

Not Closed Loop but Saves energy continuously

- **One six pack** produces enough fiberglass insulation to fill a standard wall cavity.
- **Boosting insulation by R-30 saves approx. $600 per year every year**

Challenges…

STRATEGIC MATERIALS
Recycling Earth's Resources

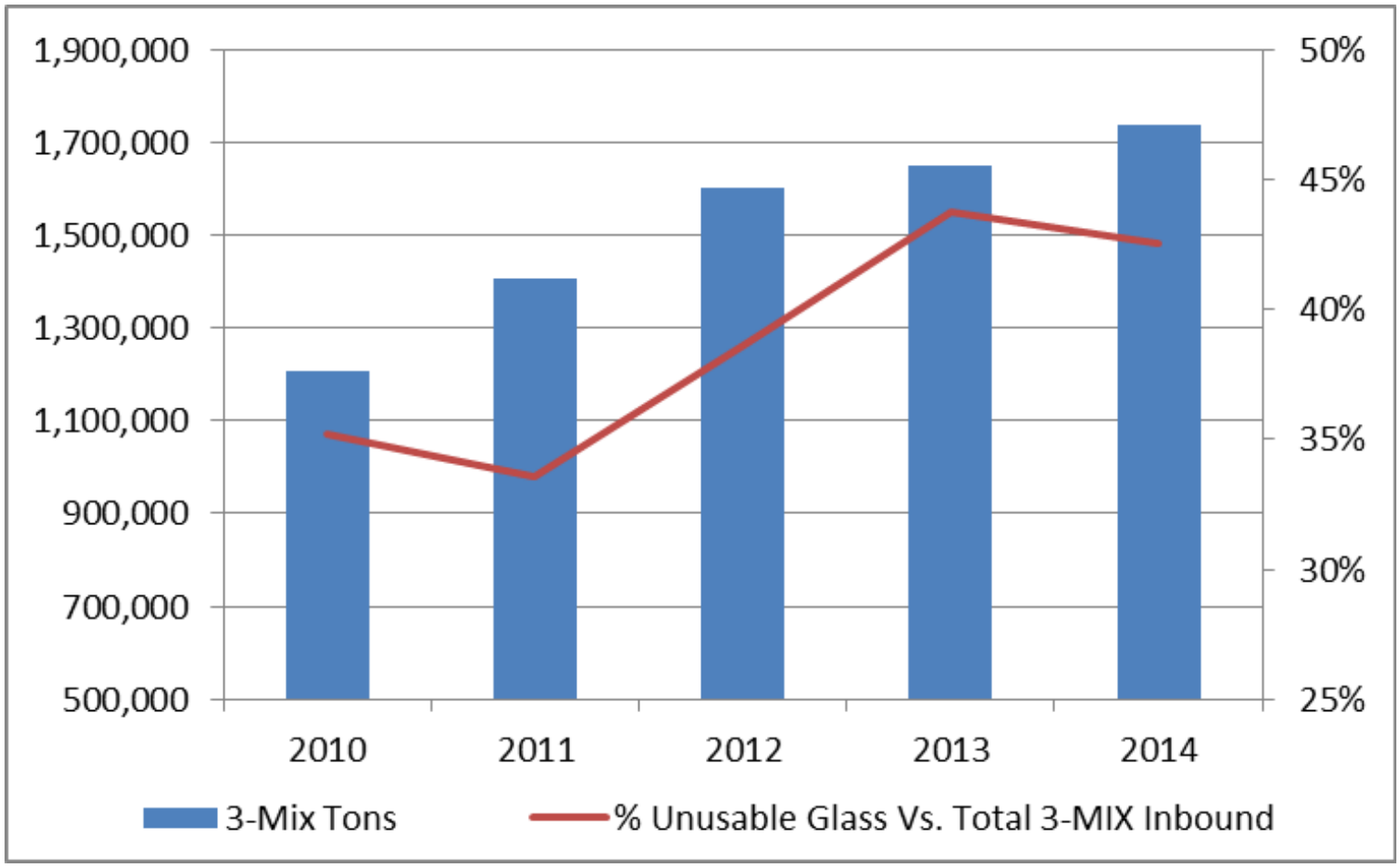
Before

Today

- Evolving ton?
- Blender
- 50% at mrf
- unprofitable

- Percentage of 3mix to straight color continues to increase.
- Quality of inbound single-stream supply has deteriorated rapidly.
- Costs have risen steadily to handle the lower quality single-stream glass.

3-MIX Quality Trends



3-MIX Quantity is increasing while Quality is Deteriorating

Economic Impacts of Dirtier Supply

STRATEGIC MATERIALS
Recycling Earth's Resources

Effects of Dirtier Supply	Cost Impacts					Countermeasures	
	Labor	Utility	Other	R&M	CapEx	Process Improvement	Equipment
More Inbound Testing						Yes, Complete	n/a
Improved Storage						Yes, Ongoing	Upgrade
Increased Loader Activity						n/a	n/a
Increased Labor to Reduce Contamination						Yes, Ongoing	New
Slower Line Speeds (throughput)						Yes, Lean Implementation	Upgrade
Decreased Sorter Performance						Yes, Lean Implementation	Upgrade
Decreased Air Efficiency						Yes, Lean Implementation	Upgrade
Lower Yields & Increased Landfill						Yes, Lean & Inspection	n/a
Plant Design Capabilities Eroded						Yes, Ongoing	New
Increased Failures						Yes, Lean Implementation	Upgrade
Increased Re-work						n/a	Upgrade
Shorter Equipment Life						Yes, Mpulse, Lean	Upgrade
Increased Maintenance Frequency						Yes, Mpulse, Lean	n/a
Greater Outbound Testing						Yes, Complete	n/a
Increased EH&S Exposure						Yes, Ongoing	Upgrade

Dirtier supply is having a severe economic impact

3-MIX Single Stream Inbound Inspection

Inspection Table (Tool)

Quality Reports (Tools)

DB Report #104
Mixed Glass - Summary by Supplier by Plant

STRATEGIC MATERIALS
Recycling Earth's Resources

Date Range: 2013-06-01 - 2014-05-31

1002 Atlanta-CP 1002

		RATING	%+3/8	%-3/8	%NGR	Load Tons	Usable Tons
	Supplier#1	77	77%	8%	15%	11750.64	9047.99
	Supplier#2	77	77%	17%	6%	2627.90	2023.48
	Supplier#3	77	77%	12%	11%	1615.80	1244.17
MIX3SS	Supplier#4	74	74%	12%	13%	6833.37	5056.69
MIXCOLR	Supplier#5	71	74%	20%	7%	6593.42	4879.13
	Supplier#6	71	72%	19%	9%	5214.85	3754.69
	Supplier#7	72	72%	16%	11%	4446.45	3201.44
	Supplier#8	71	71%	10%	19%	4681.33	3323.74
	Supplier#9	69	70%	20%	10%	3145.73	2202.01
MIX3SS	Supplier#10	70	68%	21%	11%	15591.48	10602.21
	Supplier#11	68	68%	16%	16%	4947.63	3364.39
MIX3SS	Supplier#12	68	68%	16%	16%	3705.97	1161.26
MIXCOLR	Supplier#13	74	68%	1798%	-1767%	2346.34	1595.51

- Created incoming inspection program 2012 and implemented beta testing
- Rolled out internal testing in 2013 and started to share data with suppliers
- Tied pricing to incoming quality in 2014
- Started to install testing tables at suppliers who want to test prior to shipping to SMI

DB Report #101
Mixed Glass - Detail by Supplier by Plant

STRATEGIC MATERIALS
Recycling Earth's Resources

Unverified-Test Report

Plant: 1066 Seattle
Supplier: #12345
Date Range: 2015-01-01 - 2015-01-31

Product Group: MIX3SS

									Weight in Grams				
Date	WT#	Sample ID #	Tons	RATING	Usable %	Undersize	Non-Glass		Weight	UNDER 3/8"	Usable Glass	Non-Glass	Other
1/2/2015	1066-15-08425	1066-IB-001006	34.19	90	90%	7%	3%		2882	191	2698	93	0
1/5/2015	1066-15-08473	1066-IB-001026	32.1	75	75%	7%	18%		2558	176	1924	458	0
1/5/2015	1066-15-08474	1066-IB-001028	33.52	79	79%	7%	14%		2089	152	1650	287	0
1/5/2015	1066-15-08497	1066-IB-001035	32.69	74	74%	14%	11%		2729	391	2026	312	0
1/6/2015	1066-15-08538	1066-IB-001043	32.01	70	70%	15%	15%		2300	354	1608	338	0
1/6/2015	1066-15-08555	1066-IB-001047	32.83	76	76%	6%	18%		2227	128	1693	406	0
1/6/2015	1066-15-08587	1066-IB-001063	33.02	77	77%	14%	8%		2687	379	2081	227	0
1/7/2015	1066-15-08592	1066-IB-001074	34	78	78%	16%	7%		2553	400	1984	169	0
1/12/2015	1066-15-08635	1066-IB-001075	30.85	80	80%	7%	13%		2682	185	2152	345	0
1/12/2015	1066-15-08643	1066-IB-001076	34.53	79	79%	13%	8%		2461	317	1938	206	0
1/7/2015	1066-15-08790	1066-IB-001095	33.18	82	82%	9%	9%		2555	235	2101	219	0
1/7/2015	1066-15-08798	1066-IB-001112	31.09	81	81%	5%	14%		1557	83	1260	214	0
1/8/2015	1066-15-08763	1066-IB-001119	-1	73	73%	8%	19%		2541	214	1847	480	0
1/9/2015	1066-15-08731	1066-IB-001130	34.43	79	79%	13%	9%		3024	380	2385	259	0
1/9/2015	1066-15-08748	1066-IB-001131	33.32	87	87%	4%	9%		2963	116	2587	260	0
1/9/2015	1066-15-08762	1066-IB-001133	35.29	82	82%	5%	13%		2502	127	2062	313	0
1/9/2015	1066-15-08710	1066-IB-001134	31.76	82	82%	5%	13%		2502	127	2062	313	0

SMI Developed a "Tool" to Measure Quality for Single Stream Supply

3-MIX Single Stream Matrix (market specific)

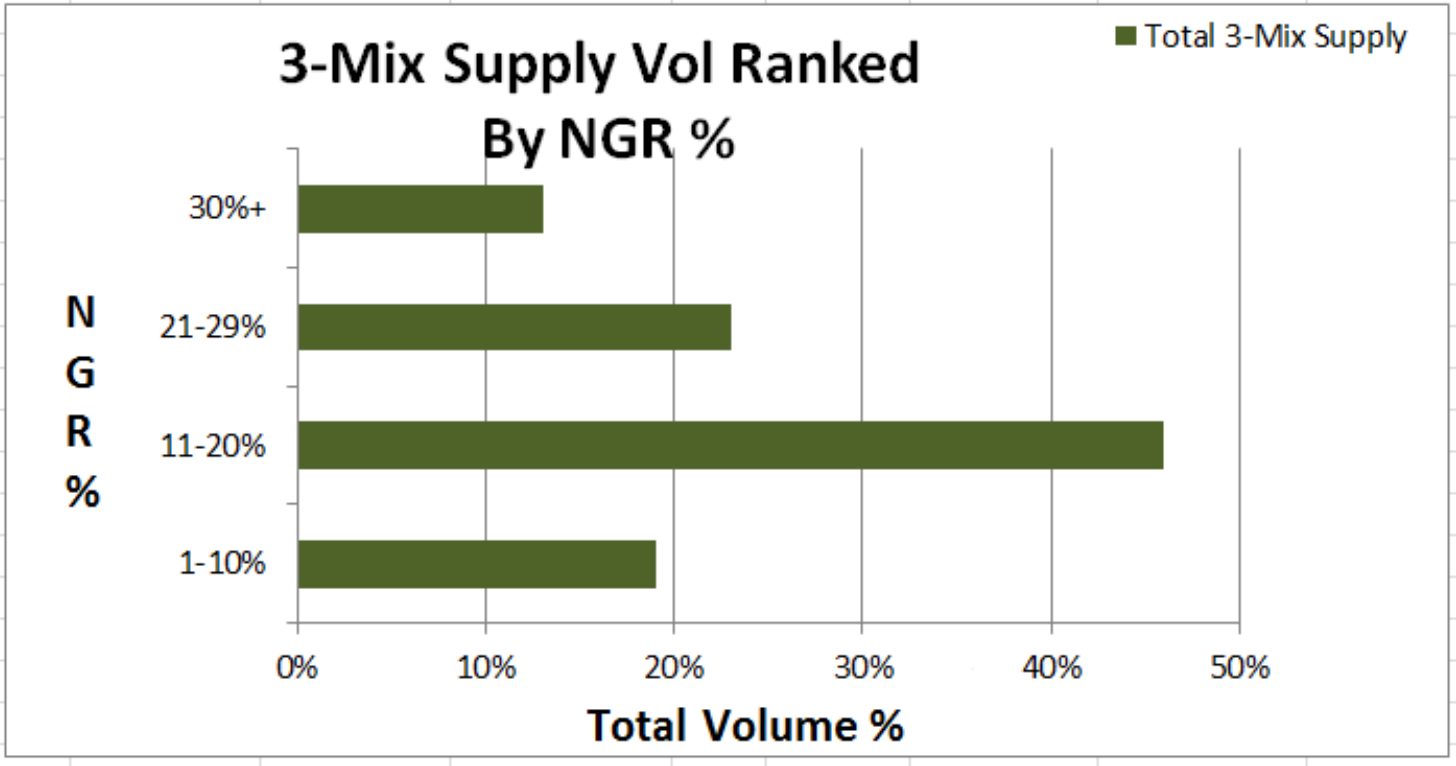
STRATEGIC MATERIALS
Recycling Earth's Resources

- **Trying to be open and transparent on pricing.**
- **Key drivers for our pricing is**
  - Non-Glass Residue % and local landfill rates
  - Undersize %, plant capabilities and local disposal options
  - Local vs Export markets
- **Allows MRF's to evaluate economic value to improving / deteriorating quality**

		Undersize									
		0.0%	1.0%	5.0%	10.0%	15.0%	20.0%	25.0%	30.0%	35.0%	40.0%
NGR	0.0%	$ 20.80	$ 20.56	$ 19.60	$ 18.40	$ 17.20	$ 16.00	$ 14.80	$ 13.60	$ 12.40	$ 11.20
	1.0%	$ 19.60	$ 19.36	$ 18.40	$ 17.20	$ 16.00	$ 14.80	$ 13.60	$ 12.40	$ 11.20	$ 10.00
	5.0%	$ 14.80	$ 14.56	$ 13.60	$ 12.40	$ 11.20	$ 10.00	$ 8.80	$ 7.60	$ 6.40	$ 5.20
	10.0%	$ 6.80	$ 6.56	$ 5.60	$ 4.40	$ 3.20	$ 2.00	$ 0.80	$ (0.40)	$ (1.60)	$ (2.80)
	15.0%	$ 2.80	$ 2.56	$ 1.60	$ 0.40	$ (0.80)	$ (2.00)	$ (3.20)	$ (4.40)	$ (5.60)	$ (6.80)
	20.0%	$ (3.20)	$ (3.44)	$ (4.40)	$ (5.60)	$ (6.80)	$ (8.00)	$ (9.20)	$ (10.40)	$ (11.60)	$ (12.80)
	25.0%	$ (9.20)	$ (9.44)	$ (10.40)	$ (11.60)	$ (12.80)	$ (14.00)	$ (15.20)	$ (16.40)	$ (17.60)	$ (18.80)
	30.0%	$ (16.20)	$ (16.44)	$ (17.40)	$ (18.60)	$ (19.80)	$ (21.00)	$ (22.20)	$ (23.40)	$ (24.60)	$ (25.80)
	35.0%	$ (23.40)	$ (23.64)	$ (24.60)	$ (25.80)	$ (27.00)	$ (28.20)	$ (29.40)	$ (30.60)	$ (31.80)	$ (33.00)
	40.0%	$ (31.40)	$ (31.64)	$ (32.60)	$ (33.80)	$ (35.00)	$ (36.20)	$ (37.40)	$ (38.60)	$ (39.80)	$ (41.00)
	45.0%	$ (37.00)	$ (37.24)	$ (38.20)	$ (39.40)	$ (40.60)	$ (41.80)	$ (43.00)	$ (44.20)	$ (45.40)	$ (46.60)

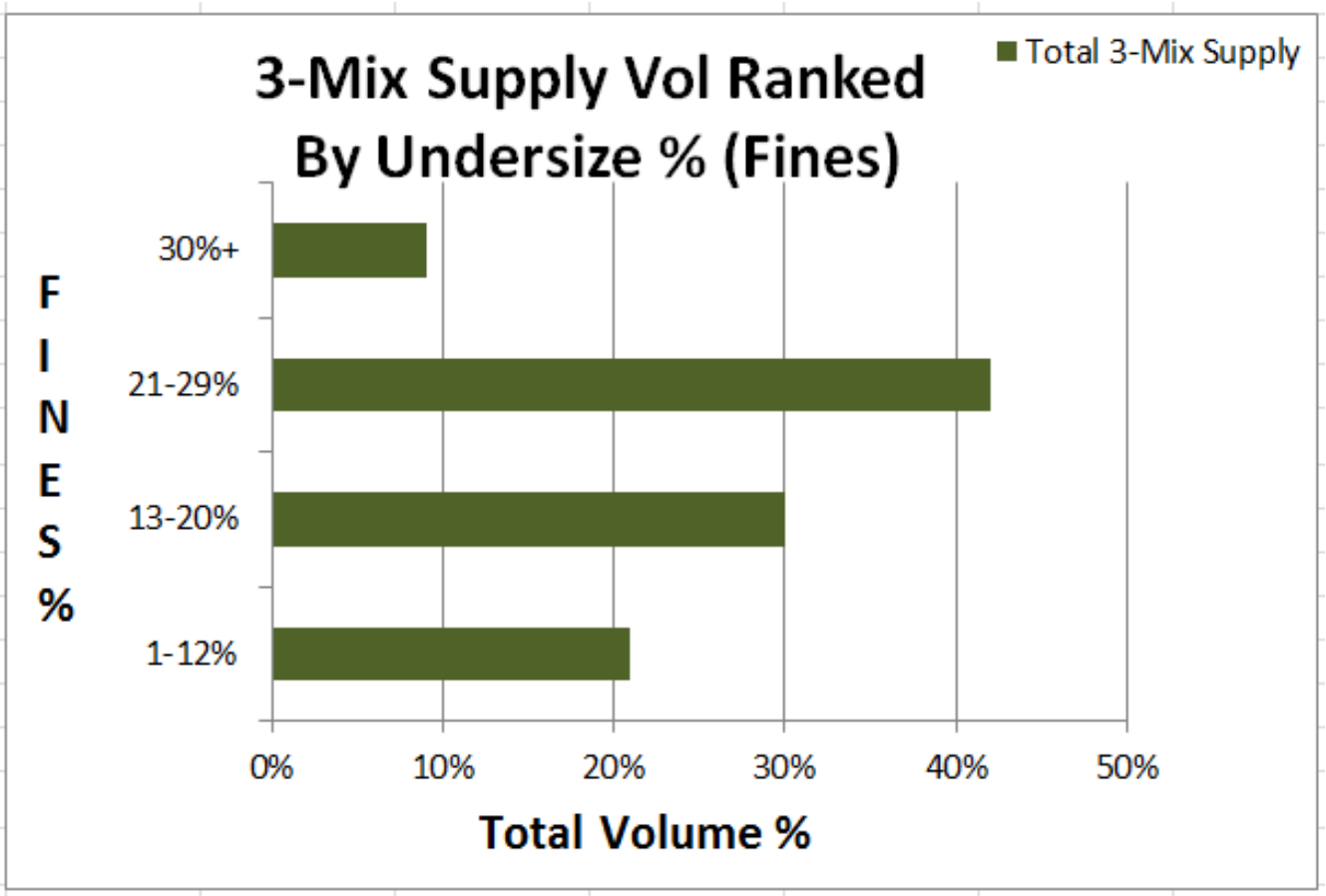
Creating a roadmap on economic value

3-Mix Single Stream – NGR % in Tot Supply



Over 2 years of Quality Inspection Data

3-Mix Single Stream–Undersize % in Tot Supply



Over 3 years of Quality Inspection Data

3-MIX Single Stream Specification

3-MIX Single Steam Specification			
Criteria	**Description**	**Examples**	**Target**
NGR	Non-Glass-Residual found in municipal recycling program	Paper, Plastic, Aluminum, steel	**10% Maximum**
U/S	Undersize Glass particles < 3/8" (or < 1/8" *)	Mixed color glass particles	**12% Maximum**
Other Criteria			**Target**
Ceramics	Broken bits of household ceramic	Dinner plates, mugs, cups	**.01% Maximum**
Color	Flint, Amber, Green(s) & other	Food containers, beer bottles, wine/ soda bottles	**See above table in Definition**
Moisture	Excessive water mixed with glass**	Rain, snow, ice	**5% Maximum**
Excluded Waste	Other, possibly hazardous waste	CRT, radioactive, medical waste, heavy metals, etc.	**0% (Zero) see 'Excluded Waste' Definition**

Publishing a new nationwide target specification for 3mix which

- Sets an achievable target for MRF operators
- Should help Cities & Mrf operators to establish target specification and economic formulas

All Incoming glass is not created equal