Recycling: A Collector & Processor's Perspective

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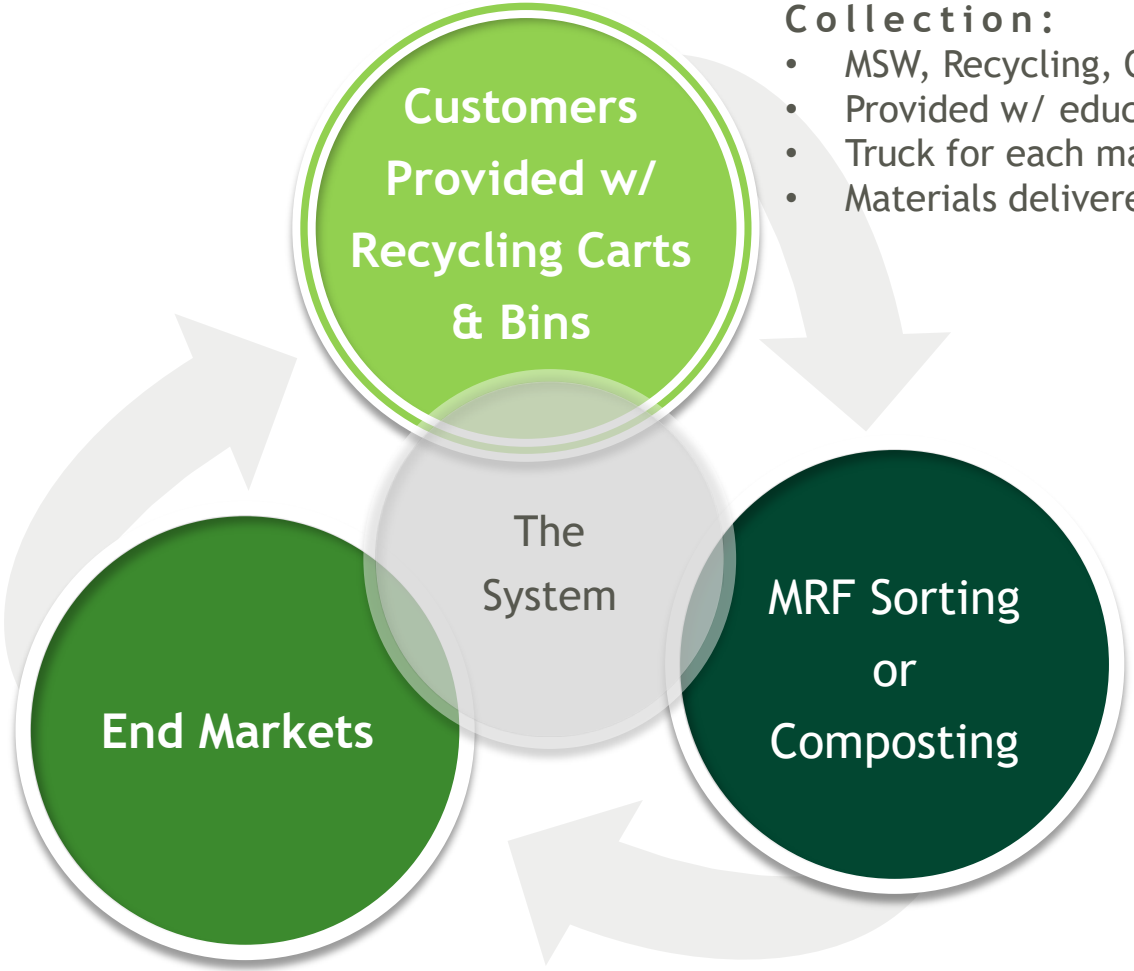
October 2019

Recycling Collection & Processing

It's Not Broken – It Works For Recyclables

An *Evolving System Since 1970's*

Recycling Collection & Processing System



Collection:

- MSW, Recycling, Organics (?) carts provided.
- Provided w/ education as to what goes in each
- Truck for each material type services each container
- Materials delivered to appropriate facility

Processing:

Material Recovery (MRF) Processing

- Mechanical & Manual Sorting
- Separate materials into categories by size & shape>>unique plastic type
- Contaminants removed
- Materials baled & Stored

Organics Processing

Sales & Marketing:

- Sold to stable end markets
- Each market requires a unique material type
- Contamination reduces yield/value

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How Recycling Works:

Unique Manufacturing Operation > Creating Feedstock for Other Manufacturing Processes

Material Delivered

Mechanical & Manual Separation

Size/Shape/2D v 3D

Storage

Acceptable Materials

- Paper
- Cardboard
- PET Plastic Bottles/Jars - #1
- HDPE Plastic Bottles/Containers #2
- PP Plastic Containers & Lids -#5
- Aluminum Cans (UBCs)
- Metal Cans
- Glass

Containers =
Bottles, Cans, Jars, Jugs

- Screens Separate by Size (Cardboard v Paper)
- Screens Separate by Shape (Fiber v Containers or 2D v 3D)
- Containers Separated by Mechanically or Manually

Plastics	Optical Sorters or Humans
UBCs	Eddy Current
Steel Cans	Magnet
Glass	Glass Breaker

- Each material must be stored in a unique Bunker so it can be baled
- Stored
- Moved to Market


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Plastics Accepted in Recycling Programs: Strong Markets Exist

PET Bottles, HDPE Bottles & Containers; PP Containers/Lids

PET #1 Bottles/Jars

(i.e. Drink Bottles)

Bottles vs Clam Shells
Injection Molded v Thermoform
Different Melting Points
Impacts Final Material

Flexible Film
Bottle: Injection Molded

Clamshell: Thermoform

Accepted Recyclable Plastics & Why

HDPE #2 Bottles/Containers

(i.e. HDPE-C = Laundry Detergent bottles, HDPE-N = Milk Jugs)

Established End Markets

Each Resin Type Must Be a Single Resin
"Shape" also Matters

Polypropylene #5 Containers/Lids

i.e. Yogurt Tubs, Butter Tubs, Deli Containers

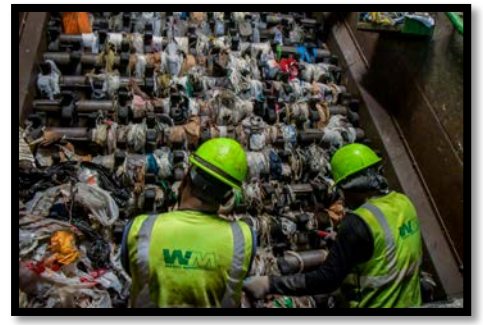
Containers = Bottles, Cans, Jars, Jugs

<u>All Other Plastics Contaminants</u>

- Impact Cost/Yield/Quality/Price
- Final Disposal Landfill

The Problem:

All the Other Plastics Received at MRFs; What Happens? Why?



People Think it's All Recyclable > And Put in the Bin!

- ✓ See a recycling symbol >> assume recyclable/acceptable in curbside bin
- ✓ Think all plastic is recyclable

The Biggest Offenders w/ Largest Impact or Cause Most Confusion

- ✓ Flexible Film Plastic
- ✓ All Other Plastics

What Happens at the MRF:

- ✓ Film plastic wraps equipment >prevents screens from working properly > contaminates paper
- ✓ Optical Sorters cannot differentiate by Shape so all PET/HDPE/PP 'recovered' if optically sorted
  - ❖ Can add more equipment/people to remove it
    - ➢ If removed no place to store it & too low quantity to economically recover (i.e. Aseptics)
    - ➢ If removed > goes to Landfill
  - ❖ Unwanted materials end up in plastic bales or in residue >> Landfill
- ✓ Flexible Film travels with paper and ends up in paper or in residue >> Landfill

What Happens at the Reclaimer & to these Plastics

- ✓PET thermoforms considered contaminants in PET bales >>Landfill
- ✓Non bottle/container grade HDPE contaminants in HDPE bales >> Landfill
- ✓Plastics contaminate paper bales >> US >> Landfill

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Education on Plastic Packaging often misleading, or absent, confusing consumers….

Other Forms of PET; HDPE & PP We & Our Buyers Receive >> In US >>> Landfill

Issues Undermining US Recycling Industry

1. Speed of Packaging Innovation Has Outpaced Capabilities of Recycling Infrastructure

Most plastic packaging is either not being collected for recycling or is simply not currently recyclable

2. US Recycling System Cannot Deliver Supply of Recycled Materials Demanded by the Global Commitment

New Plastics Economy Global Commitment target: 100% of plastic packaging be reusable, recyclable or compostable by 2025

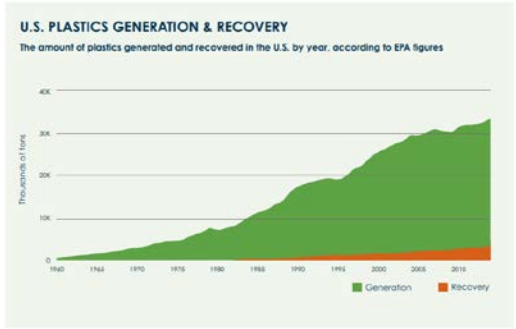
Example: PET Bottle Recycling - annual gap over 1B lbs. between US supply and demand for recycled PET in bottles

3. Limited Investment in US Recycling System
No Universal Access
Underfinanced Public Service

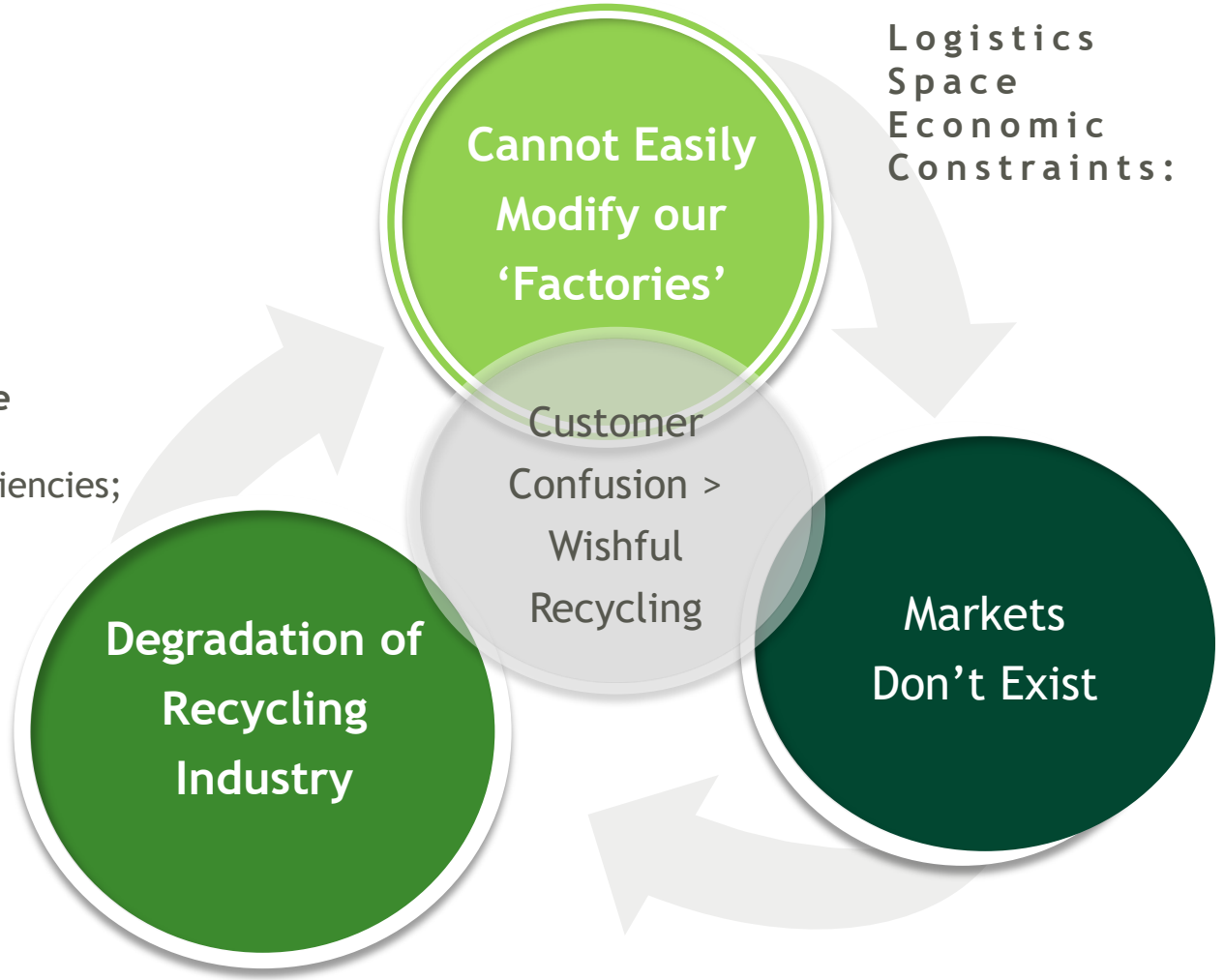
Challenges with an Ever Evolving Plastics Stream

New & Different Plastics

Speed of packaging innovation has outpaced the capabilities of our recycling infrastructure



Today We Can Only Recycle A Defined Subset of Plastics



Most plastic packaging is either not being collected for recycling or is not currently recyclable.

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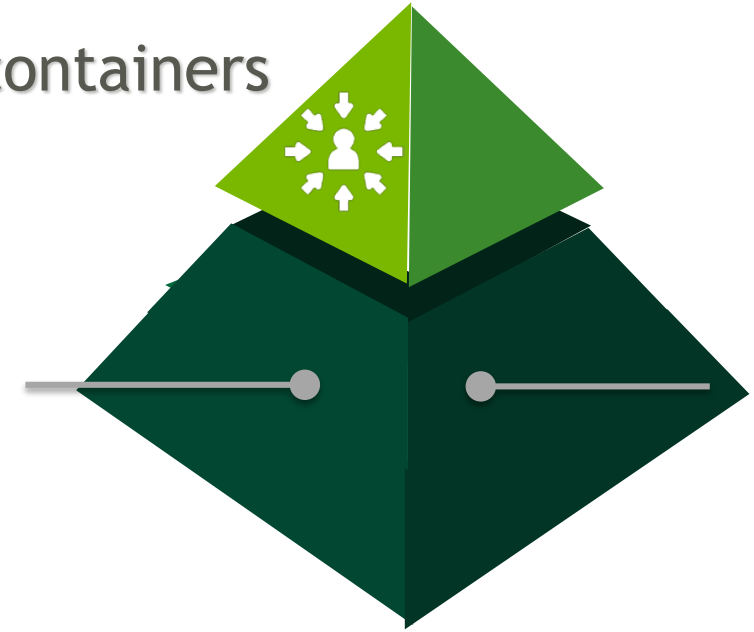
The Real Problem:
Plastics Ending up in the Environment

What our Industry Would Like to See:

1. Better Consumer Education
    a. Correct labeling for proper disposal
    b. Transparency >> Truth in Marketing
2. Better 2D vs 3D Separation
    a) Improved Processing technology to better separate containers from paper
3. More Demand for Recycled Content
    a. Technology to enable use of more recycled content
        I. Focus on Improved Compatibilizers



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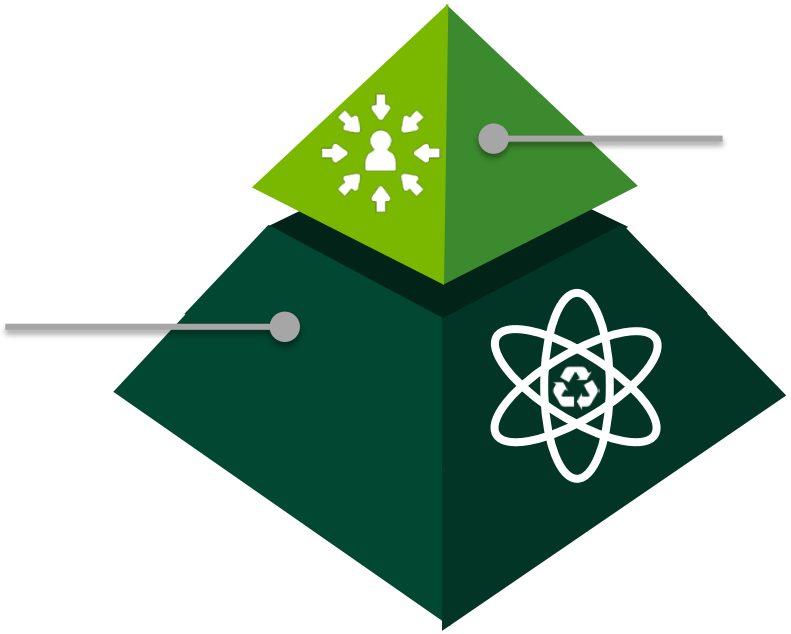
What our Industry Does Not Want to See:

Introduction of New Plastics or Programs that Degrade Recycling:



New Plastic Development:

- Superior qualities but not interfere w/ Recycling or Composting
- If not compatible w/ Recycling or Composting >> destination landfill >>clear labeling >> should break down safely in environment & be non-toxic

Chemical Recycling:

- Have to consider how material is collected (how to obtain feedstock)..
  - Buying MRF Bales?
  - Buying Mill residue?

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The Scale of Plastic Production vs Recycling

Closing Thought:
Adding New Plastics to the Mix Just Might Mean More Problems if Collection & 'Processing' Not Seriously Thought Through

Table 10.1. Current Estimates of Plastics Production and Recycling

		Global	Total U.S.			U.S. Plastic Containers & Packaging		
RIC	Polymer	Virgin Production	Generation	Recycled	Recycling Rate	Generated	Recycled	Recycling Rate
1	PET	23.5	5.1	0.94	18%	3.0	0.89	30%
2	HDPE	51.3	6.0	0.62	10%	3.0	0.61	20%
3	PVC	61.0	0.9	Neg	N/A	0.1	Neg	N/A
4	LDPE	20.9	7.9	0.49	6%	2.7	0.49	18%
5	PP	56.0	7.7	0.07	1%	0.8	0.02	2%
6	PS	14.7	2.4	0.03	1%	0.2	0.03	N/A
7	Other		4.4	0.99	23%	0.4	Neg.	N/A

Global Virgin Polymer production from plasticinsights.com
U.S. Generated & Recycled figures from EPA
Figures in millions tons/year

Typical MRF- Recycling Recovery

- Receives 100,000 Inbound Tons Annually
- Processes 4,400 Tons of Plastic Annually (4.4%)
- Plastic Reclaimers require feed from 10-13 MRFs

The Other Plastics Generated

A lot of plastics made are not used in the container/packaging space
But the plastics recycling focus is typically in the container/packaging space

Questions

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