Organics Management
Waste Recovery
Global Corporate Sustainability
Managing change in a resource-constrained world.

since 1986
THE EVOLVING PACKAGING WASTE STREAM

DECREASING PREVALENCE

-8% NEWSPAPER
-3% GLASS CONTAINERS
-0.7% STEEL CONTAINERS
-1% TOTAL OTHER NONDURABLE GOODS
-0.4% OTHER PAPER & PAPERBOARD PACKAGING
-0.3% ALUMINUM CONTAINERS

INCREASING PREVALENCE

0.1% ALUMINUM FOIL, CLOSURES, ETC.
0.2% HOPE NATURAL BOTTLES
0.5% OTHER PLASTIC CONTAINERS
2% PLASTIC BAGS, SACKS, & WRAPS
3% PET BOTTLES & JARS
3% OTHER PLASTIC PACKAGING
7% CORRUGATED CARDBOARD

Evolving Material Stream

**Units Per Ton 2000**

**Units Per Ton Added to 2016**

**By 2030**

Lightweighting challenges for material recovery:
- Working harder for same ton
- Throughput is volumetric & based on geometry
- Screen openings, air flow, conveyor speeds, chemistry, dexterity
- 35 TPH throughput in 2010 is 26 TPH in 2018 - shows up in cost
RESIDUE COST HAS TRIPPLED — IMPACT OF SINGLE STREAM TRADE OFF- CONVENIENCE/VOLUME VS THE CART THAT DOES NOT GET INSPECTED

<table>
<thead>
<tr>
<th>Year</th>
<th>%Residue</th>
<th>Comparative $/T (Current LF $/T)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>8%</td>
<td>&lt;$4</td>
</tr>
<tr>
<td>2012</td>
<td>13%</td>
<td>$6.37</td>
</tr>
<tr>
<td>2014-2015</td>
<td>16%</td>
<td>$7.92</td>
</tr>
<tr>
<td>2020 Avg. Est.</td>
<td>22.2%</td>
<td>$13.25</td>
</tr>
</tbody>
</table>

331% INCREASE IN 15 YEARS
**AFTER RISING FOR A DECADE- MRF COSTS BEGIN STABILIZE SLIGHTLY LOWER IN 2020 AS REPORTED PUBLICLY**

### MATERIAL RECOVERY FACILITY COST CATEGORIES

<table>
<thead>
<tr>
<th>COST CATEGORY</th>
<th>2009</th>
<th>2015</th>
<th>2019</th>
<th>2020</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed</td>
<td>$12.00</td>
<td>$20.00</td>
<td>$25.00</td>
<td>$21.00</td>
<td>108%</td>
</tr>
<tr>
<td>O&amp;M</td>
<td>$46.00</td>
<td>$54.00</td>
<td>$56.00</td>
<td>$51.00</td>
<td>22%</td>
</tr>
<tr>
<td>Residue</td>
<td>$4.00</td>
<td>$8.00</td>
<td>$10.00</td>
<td>$11.00</td>
<td>150%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$62.00</td>
<td>$82.00</td>
<td>$91.00</td>
<td>$83.00</td>
<td>46%</td>
</tr>
</tbody>
</table>

### O&M
- Impacts of China - Slowing down the line
- Rise of film and clamshells
- More units per ton = less throughput
- Labor shortage
- Aging of the fleet-new growth 5-10 vs. 20/yr.

### Fixed Cost
- Trend towards automation
- Oversupply of MP - need for better cleaning of paper
- Larger regional footprint
- More peripheries & technology
- Higher speeds

### Residue
- Aggressive MRF interpretation
- Impact of China - tighter quality standards
- Enforcement
- “Wish” Cycling
- PAYT/Recycling Free

---

**Inbound Processing $/Ton**
- **After rising for a decade, MRF costs begin stabilize slightly lower in 2020 as reported publicly.**

<table>
<thead>
<tr>
<th>COST CATEGORY</th>
<th>2009</th>
<th>2015</th>
<th>2019</th>
<th>2020</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed</td>
<td>$12.00</td>
<td>$20.00</td>
<td>$25.00</td>
<td>$21.00</td>
<td>108%</td>
</tr>
<tr>
<td>O&amp;M</td>
<td>$46.00</td>
<td>$54.00</td>
<td>$56.00</td>
<td>$51.00</td>
<td>22%</td>
</tr>
<tr>
<td>Residue</td>
<td>$4.00</td>
<td>$8.00</td>
<td>$10.00</td>
<td>$11.00</td>
<td>150%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$62.00</td>
<td>$82.00</td>
<td>$91.00</td>
<td>$83.00</td>
<td>46%</td>
</tr>
</tbody>
</table>
• **NERC STUDY** - $112 before Revenue Share


• **THE RECYCLING PARTNERSHIP STUDY** – $64 Net Charge


<table>
<thead>
<tr>
<th>COMPARISON</th>
<th>PROCESS FEE CHARGE</th>
<th>REVENUE CREDITS</th>
<th>NET PROCESS CHARGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>NERC Study</td>
<td>$112</td>
<td>$34.92</td>
<td>$77.08</td>
</tr>
<tr>
<td>Recycling Partnership</td>
<td>$107 (implied)</td>
<td>$43.37 (implied)</td>
<td>$64.08</td>
</tr>
<tr>
<td>RRS Rate Study</td>
<td>$122</td>
<td>$20.00</td>
<td>$102</td>
</tr>
</tbody>
</table>
Big Positive Movers in the Quarter
• Steel Cans from $106 to CAN$373 in < than 45 days
• Aluminum Cans 24.3%
• NHDPE 13.1%, maintains price advantage to AL cans for 4\textsuperscript{th} straight month by CAN$397 per ST
• Fiber up across the board over 8%
• Polypropylene bottle spikes over $1005

What a difference a year makes!!!
• 103\% increase, now over CAN$ 95 compared to CAN$ 42

Looks good for the next quarter for fiber and metal, plastic in flux and 2Good2B true
AVERAGE RESIDENTIAL SINGLE STREAM COMMODITY REVENUE

Current Single Stream Composition Average Commodity Revenue

- Mixed Paper (Grade #54)
- Sorted Residential Papers and News (SRPN Grade #56)
- Corrugated Containers (OCC Grade #11)
- Aseptic and Gable-top Cartons (Grade #52)
- Aluminum Cans (UBC)
- Steel Cans
- PET
- Natural HDPE
- Colored HDPE
- Mixed Plastic #3-7
- Residue (Shown as a cost)
- Glass 3 Mix (Shown as a cost)

$63.80 (with Residue)
1. Prices for ...curbside recyclables – OCC, UBCs, PET, HDPE and PP – surged over the past month...good news for MRFs” Resource Recycling

2. “Freight Container rates hit nine-year high Recycled commodities are having difficulty acquiring container...because of a shortage in Asia. Shipping lines since late 2020 prefer to send empty containers to speed their return to Asia rather than loaded with scrap. West Coast has “quadrupled” to over $40T per container since late November. ”- ISRI,, Argus

3. Shanyeng and Nine Dragons taking April downtime worldwide as “demand softens” and prices for OCC/mixed paper increase rapidly for export (it is almost certain, and the rumor mill confirms, North, Latin and South American container and paperboard mills will follow suit to slow price rises).
AFPA GUIDANCE FOR RECYCLING

- Bring clarity to how packaging works in paper mills
- Researched based findings on paper-based packaging performance
- 10 companies, Fiber Box Assn. technical group
- Survey in June 2020 from mills informed the Guidance
  - 86 mills, 75% responded to survey
  - Challenges slow pulping is a “challenge to recyclability”
  - Three materials out of 10- paper cups and aseptics/cartons did not return enough responses to the survey
    - 30 mills now accept polycoated paper cups due to innovation
corrugated packaging

Corrugated packaging is strong, convenient and sustainable. It is the single most recycled packaging material. In 2019, the U.S. recycling rate for corrugated packaging was 92%. Walls of corrugated packaging consist of two parts: linerboard (or facing) on the exterior and corrugated medium (fluted paper) between layers of facing. Various layers can be used to increase the packaging’s strength.

**Easier to recycle**
- water-based inks
- water soluble dyes
- UV EB inks
- water soluble adhesives
- paper tape
- polymer tape
- pressure sensitive labels
- clay coatings
- varnish coatings
- polymer barriers
- polymer windows
- metalized foils
- non-tree fibers

Definitions for non-fiber elements appear in the appendix.

**THE BOTTOM LINE:**
- Water soluble inks, dyes and adhesives, UV EB inks, paper and polymer tapes, clay coatings and varnish cause few problems.

**Recycling challenges**
- hot melt adhesives
- wax coatings
- bioplastic barriers
- metals
- plastics
- laminated foils
- stamped foils
- wet strength resins

33% or more of respondents rated these non-fiber elements as a challenge in mills. Being a challenge does not make something not recyclable.
## BOARD & RY PULP MILL START UPS
### 1ST HALF 2021

<table>
<thead>
<tr>
<th>Name</th>
<th>City</th>
<th>NET Metric Tons(000)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green Bay Packaging</td>
<td>Green Bay, WI</td>
<td>680</td>
<td>Started up March 25, OCC and MP</td>
</tr>
<tr>
<td>Nine Dragons</td>
<td>Biron, Wisc.</td>
<td>240</td>
<td>First part of three-part RCP expansion, pulp mill ( will be followed by recycled medium and 2nd phase pulper expansion) altogether 600K TPY</td>
</tr>
<tr>
<td>Nine Dragons</td>
<td>Rumford, ME</td>
<td>200</td>
<td>Long planned pulper expansion</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>1,120</strong></td>
<td></td>
</tr>
</tbody>
</table>

### 2020 Capacity Increases

<table>
<thead>
<tr>
<th>Name</th>
<th>NET Metric Tons (000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 total facilities</td>
<td>964</td>
</tr>
</tbody>
</table>

2.7 MMT now on-line since 2019
## BOARD & RY PULP MILL NEW CONFIRMED ANNOUNCEMENTS
### 1ST QTR. 2022

<table>
<thead>
<tr>
<th>Name</th>
<th>City</th>
<th>NET Metric Tons(000)</th>
<th>Comment</th>
<th>Current Open Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlantic Packaging</td>
<td>Whitby, Ontario</td>
<td>400</td>
<td>October announcement</td>
<td>2022-2023</td>
</tr>
<tr>
<td>Cascades</td>
<td>Ashland, VA</td>
<td>240</td>
<td>First part of three-part RCP expansion, pulp mill (will be followed by recycled medium and 2nd phase pulper expansion) altogether 600K TPY</td>
<td>2022-2023</td>
</tr>
<tr>
<td>Kamine Celadon</td>
<td>Tampa, Fl Port</td>
<td>400</td>
<td>Signed financing last week</td>
<td>2022</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>1,040</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

New Start-Ups + New Announcements increases total capacity by over 5.4 MMT since 2018 if all these projects are built.
SINGLE STREAM RECYCLING SERVICE REMAINS POPULAR

# of Programs tripled in 15 years
• MRF capacity more than doubled and over 3,000 munis offer service
• Fastest growing new municipal service
• Still growing despite severe commodity quality problems using current cleaning

Persistent Record
• < handful Single Stream programs ever rescinded

Convenience, most popular municipal service
• Huge popularity after initial roll out pains
• surveys uniformly show >85% approval rating with consistent service

Cheapest home-delivered service by far
TOP RECYCLING TRENDS NEXT TEN YEARS

1. Regulatory Strategies push packaging in N. America
   a) Recycled Content- will help pricing
   b) EPR expansion for traditional and non-tradition
   c) Bans- landfill and outright
   d) Deposit interest returns
2. Big Garbage, CPGs warm up to regulatory aids
3. Evolving ton continues, MRF cost rises
4. MRF automation- AI, robots, OS, autonomous vehicles
5. WfH permanent- 5-12% more blue bin paper volume; loss of AfH paper keeps pricing on writing paper grades high
6. China fiber needs still dominate the market. Mainland consumption/material insufficient, poorer quality
7. Europe, Latin America, Australia, & S. America recyclables consumption up
8. Chemical recycling Chimera
9. Pressure on plastics grows
10. Reuse comes back into focus
• Ellen MacArthur Foundation
• Shared vision across industry, NGOs, govt’s
• New Plastic Economy
• Global Commitment and Plastic Pacts
  o Reuse
  o All plastic packaging 100% reusable, recyclable, compostable
• Commitments translating into goals, targets, and action across stakeholders.
GLOBAL WASTE CRISSES LINKED TO OCEAN PLASTICS

- Global waste to grow 70% by 2050 and fastest in regions with weakest waste management and recycling infrastructure
- Influence of climate change on vulnerable geographies exacerbating mismanaged waste
- Ocean plastics crises highlighting infrastructure deficits

40% of Jakarta a city of more than 10 million is below sea level

Source: Trambogor.co, Jan 22, 2016
Globally plastics have a long way to go to achieve circularity and are widely mismanaged. Regulatory response is growing.
SINGLE USE PLASTIC - A REGULATORY TARGET

- **127 Countries** have adopted some form of regulation for plastics bags.

- **27 Countries** have enacted through law some type of ban on single-use plastics – product or material
  - EU Directive on SUP - ban selected single use plastics to be implemented by member states
  - United Kingdom – will ban selected single use plastics (Oct 2020) and tax selected packaging w/o 30% recycled content by 2022.
  - Bali, Indonesia – Ban on single use plastics

Source: UNEP, Single-Use Plastics Roadmap to Sustainability, 2018
UPDATE - PET

- Best prices in two years but still low
- Virgin overproduction
- Companies still supportive of rPET in packaging
- Haulers and brands warm to regulatory prodding
## PET PLASTIC (#1)
### THERMOFORM ISSUE AND BTB WILL BE CONTROVERSIAL

### PAST MARKET BEHAVIOR
- Low-cost virgin resin historically had capped pricing on recycled PET
- PET recycling rate had been flat for the past 10 years at around 30%
- Oversupply of virgin material

### RRS FORECAST AND RECOMMENDATIONS

#### SHORT TERM
- Best pricing since 2019, breaks $.10 per pound and is at pre-Covid levels. Volatile soft oil market and virgin PET oversupply- offset by loss of deposit system PET bales in 2020, now helped by rising resin and oil pricing
- Global warming and fire events have stabilized pricing and rPET demand. Pricing is uncertain given volatility in the energy sector
- Thermoform removal being pushed to MRFs- **NOT THE RIGHT SCALE**

#### LONG TERM
Low-cost virgin PE oversupply will push market down but will see demand driven increase in rPET (recycled PET)
U.S. STATE POLICIES FOR BAGS, PREEMPTION, EPS, SUP, AND EPR

State Bag Policy
- State bag ban
- Local fees or taxes enabled
- Preemption (Ban on Bans)
- Fees or taxes

State EPS Policy Type
- Government
- Pending Restaurant
- Pending Retail
- Pending Restaurant, Government, Retail

State SUP Policy Type
- Enacted/Adopted 2019 – bags, EPS, straws, stirrers.
- 2019 Legislation pending

State EPR Policy
- EPR study bills
- Beverage container deposits

Disclaimer: Map illustrates recent activity & trends and not intended to be a complete representation of all existing policy.