TOPICS IN THE ECONOMICS OF MIXED WASTE PROCESSING & DIVERSION

Michael R. Timpane
Vice President
Mixed Waste Processing Facilities

- emotional responses
- loaded terms
- claims and counter-claims

We Take & Recover Everything MRF

Stop One Bin
Mixed Waste Processing Facilities

• Strip away the rhetoric and what is left is a waste processing strategy
  • Limited applications
  • Expensive
MWPF’S THE PROMISE THE RISK & THE PURPOSE
MWPF’S THE PROMISE THE RISK & THE PURPOSE

Promise- Next step where the entire stream is captured for economic re-use

Risk- Track record and other complexities

Purpose- Economics of mixed waste will be determined by its intended use
PROCESSING

1. Various combinations of new & tested technologies separate fiber from containers better
2. Scale has increased per unit recovery, allowing sizeable increases in capital investment (up to 80 TPH and higher) for larger regional urban areas
3. Recovery of fines to “manageable” organic % & inerts
4. Professional Processors/Track record- Herbert, Gross, Athens, WM commercial MRFs, Newby II, pipeline, foreign investment due to European approach
5. Models emerging in California that will be sustained; data baselines for improvement/approach established
THE PROMISE: RELIABLE MANUFACTURERS GETTING BETTER

Flats from Rounds, lights from heavies, smalls or “fines” capture

Advanced Air Knives: Nihot/WalAir/CP
- Closed system
- Positive/Negative
- Lights from heavies,
- Floating flat material from dimensional material (rounds)

Optical Sorters In-flight, TiTech, MSS
- Colors, Papers, individual containers
- 3 materials
- In-line up to 7 firing multiple materials
- Positive and negative sorts

Dimensional Trommels
- Dimensional layers and hole openings
- Air assisted
- Replaces high maintenance disk screens
- Captures organic sweet spot fraction (<-6”)

THE PROMISE: RELIABLE MANUFACTURERS GETTING BETTER

Flats from Rounds, lights from heavies, smalls or “fines” capture
THE PROMISE: TAPPING THE ENERGY POTENTIAL OF THE ORGANIC FRACTION

Issues are scale and throughput

- Enerkem
- Abengoa
- Fulcrum
- Fiberight
- Navitus
- Anaerobic Digestion
- Approved projects Hawaii to Maine
PROCESSING

1. Few operating as intended
2. Quality and quantity of recyclables - resultant available revenue offset
3. Human Factor Sorting MSW
4. Overstatement of recovery potential
5. Attempts to control wastes
6. Cheaper options
7. MRF/Landfill/Market watchdogs aligned against full MWPFs
Recycling Reviewed, part 2, Leslie Jones, WASTE AWAY BLOG
HISTORICAL ECONOMIC RISKS- Ceiling of Recovery

Residential: 100% Efficiency in Recovery
71% Diversion Potential

- Recyclables: 46%
- Organics: 25%
- Non Recyclables: 29%

Recyclables
Organics
Non Recyclables
Mixed Waste Processing Facilities (MWP)- Economics depends on the Purpose of its Deployment

**Primary Means of Recycling (Savings on collection costs)**
- Savings on collection costs
- Household maximization of utility
- Recovery rate

**Preparation of Fuels and energy feedstocks**
- Historical RDF
- Compacted Fuel Pellets
- Gasification, sacharrization, production of fuels and natural gas

**MRF of Last Resort**
- Residual MRF
- Multiple options deployed prior
- High tip fee, high diversion goals
ONE BIN VS. SINGLE STREAM:

Case: Primary Means of Recycling vs. Single Stream

• Ranges, not real numbers
• Assumptions must be local
• Best operating practices
• No green waste
• Costs applied to recycling tons only
• Costs include capital

Warning: Examples only
### One Bin vs. Two Bin $ Revenue Yield

**3 yr. Average $100 T through Nov 2014**

<table>
<thead>
<tr>
<th></th>
<th>One Bin (Recycling Portion)</th>
<th>Two Bin (Single Stream)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$/Inbound Ton</td>
<td>$60 T</td>
<td>$85 T</td>
</tr>
<tr>
<td></td>
<td>60% * $100</td>
<td>85% *$100</td>
</tr>
</tbody>
</table>

**Yield Difference**

- ($25) T
### One Bin vs. Two Bin Disposal

#### One Bin (Recycling Portion)

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
<th>T&amp;D Residuals ($45T x 40%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T&amp;D Residuals ($45T x 40%)</td>
<td>$18.50/Ton</td>
<td>/T Disposed $33-65 Range</td>
</tr>
</tbody>
</table>

#### Two Bin (Single Stream Recycling portion)

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
<th>T&amp;D Residuals ($45T x 15%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T&amp;D Residuals ($45T x 15%)</td>
<td>$6.75/Ton</td>
<td>$T Disposed $33-65 Range</td>
</tr>
</tbody>
</table>
### One Bin vs. Two Bin Recyclable Collection

<table>
<thead>
<tr>
<th>One Bin</th>
<th>Two Bin</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Collection</strong></td>
<td><strong>Collection</strong></td>
</tr>
<tr>
<td>Route Truck Cost</td>
<td>Route Truck Cost</td>
</tr>
<tr>
<td>$850</td>
<td>$850</td>
</tr>
<tr>
<td>Route Truck Yield</td>
<td>Route Truck Yield</td>
</tr>
<tr>
<td>10 Tons</td>
<td>9 Tons</td>
</tr>
<tr>
<td>Cost Per Ton</td>
<td>Cost Per Ton</td>
</tr>
<tr>
<td>$85</td>
<td>$118</td>
</tr>
</tbody>
</table>

**Route Ratio** | **1.25** Not 1 to 1 comparison

**Total Route Cost** | **Cost Per Ton** |
| $1,063 | $118 |
## One Bin vs. Two Bin Processing- $/T Received

### One Bin (Recycling Portion)

<table>
<thead>
<tr>
<th>Tons Recovered</th>
<th>$/Inbound Ton</th>
<th>$/Recovered Ton</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$45 Ton</td>
<td>$75 Ton</td>
</tr>
</tbody>
</table>

- $T Received $40-60 Range
- Cost per ton recovered at 60%

### Two Bin (Recycling portion)

<table>
<thead>
<tr>
<th>Tons Recovered</th>
<th>$/Recovered Ton</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$62 Ton</td>
</tr>
</tbody>
</table>

- $T Received $50-60 Range
# Recycling from One Bin vs. Single Stream

<table>
<thead>
<tr>
<th>Category</th>
<th>$/T Single Stream</th>
<th>$/T One Bin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rev. from Commodities</td>
<td>$85</td>
<td>$60</td>
</tr>
<tr>
<td>Disposal</td>
<td>($6.75)</td>
<td>($18.50)</td>
</tr>
<tr>
<td>Collection Cost</td>
<td>($118)</td>
<td>($85)</td>
</tr>
<tr>
<td>Processing Cost</td>
<td>($60)</td>
<td>($75)</td>
</tr>
<tr>
<td><strong>NET PROGRAM COST</strong></td>
<td><strong>$100</strong></td>
<td><strong>$119</strong></td>
</tr>
</tbody>
</table>

At 65% $107 for One Bin
## ECONOMICS: SINGLE STREAM COMPARES FAVORABLY WITH ONE BIN

<table>
<thead>
<tr>
<th>Considerations</th>
<th>Single Stream</th>
<th>One Bin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher Tonnages, Higher Quality</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Secondary Processing required for Organics- net cost</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Mixed Paper may not be available or marketable</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>More upside/less downside from Commodities</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
Mixed Waste as Diversion Strategy
MICRO-ECONOMIC FRAMEWORK
PROCESSING DIVERSION CURVE

2009 COUNCIL OF U.S. MAYORS

Requires add’l secondary processing

GOOD RECYCLABLES AND ORGANICS UNAVAILABLE WITH INCREASING COMPLEXITY; OR COLLECTION COSTS SOAR

COST TO EXTRACT INCREASES

MARKETS MORE MARGINAL
1. Multiple “stacking” of collection/processing technologies, i.e.
   - MWPF unders to Anaerobic Digester
   - Solid waste composting with pre-MRF
   - Food waste separation and processing

2. High regulatory costs including mandatory separation, heavy outreach, and local enforcement
<table>
<thead>
<tr>
<th></th>
<th>Altamonte Springs</th>
<th>Thurston, WA</th>
<th>Montgomery Co, MD</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Paper</strong></td>
<td>29%</td>
<td>17%</td>
<td>26%</td>
<td>24%</td>
</tr>
<tr>
<td><strong>Film</strong></td>
<td>7%</td>
<td>6%</td>
<td>8%</td>
<td>7%</td>
</tr>
<tr>
<td><strong>Plastic</strong></td>
<td>9%</td>
<td>7%</td>
<td>7%</td>
<td>8%</td>
</tr>
<tr>
<td><strong>Metal</strong></td>
<td>3%</td>
<td>5%</td>
<td>4%</td>
<td>4%</td>
</tr>
<tr>
<td><strong>Glass</strong></td>
<td>3%</td>
<td>4%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td><strong>Recyclables</strong></td>
<td><strong>51%</strong></td>
<td><strong>39%</strong></td>
<td><strong>47%</strong></td>
<td><strong>46%</strong></td>
</tr>
<tr>
<td><strong>Food</strong></td>
<td>7%</td>
<td>24%</td>
<td>21%</td>
<td>17%</td>
</tr>
<tr>
<td><strong>Wood</strong></td>
<td>3%</td>
<td>2%</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td><strong>Other Organics</strong></td>
<td>8%</td>
<td>6%</td>
<td>2%</td>
<td>5%</td>
</tr>
<tr>
<td><strong>Organics</strong></td>
<td><strong>17%</strong></td>
<td><strong>32%</strong></td>
<td><strong>26%</strong></td>
<td><strong>25%</strong></td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>29%</td>
<td>24%</td>
<td>25%</td>
<td>26%</td>
</tr>
<tr>
<td><strong>Special Wastes</strong></td>
<td>3%</td>
<td>5%</td>
<td>3%</td>
<td>4%</td>
</tr>
<tr>
<td><strong>Non-Recyclables</strong></td>
<td><strong>32%</strong></td>
<td><strong>29%</strong></td>
<td><strong>27%</strong></td>
<td><strong>29%</strong></td>
</tr>
</tbody>
</table>
LIMITS TO RECOVERY

Residential: 100% Efficiency in Recovery
71% Diversion Potential

- Recyclables: 46%
- Organics: 25%
- Non Recyclables: 29%

- Recyclables
- Organics
- Non Recyclables
PHYSICS 101

LIMITS TO RECOVERY: MRFS & MWPFS DILEMMA

Work, transformation, heat unusable materials, contamination
LIMITS TO RECOVERY: MRFS & MWPFS DILEMMA

PHYSICS 101

Amount in the Inbound Stream

Amount Available for Recovery

Contamination with Non-recyclables
Cross contamination
Loss-breakage, fines

Discovery, Yield, Efficiency

Efficiency of Facility
LIMITS TO RECOVERY: MRFS & MWPFS DILEMMA

<table>
<thead>
<tr>
<th>Material</th>
<th>15% Availability Loss</th>
<th>15% Efficiency Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recyclables</td>
<td>46%</td>
<td>39%</td>
</tr>
<tr>
<td>Organics</td>
<td>25%</td>
<td>21%</td>
</tr>
</tbody>
</table>

71% | 51.3%
MACRO VIEW

IF THE PURPOSE IS LANDFILL DIVERSION WHERE IS IT COUNTED?

1. EPA- Recycling rate vs. Diversion rate
2. California 75% - Utilizes base year of 1990 and landfill reduction per capita vs. base year
3. Florida- Includes WTE and has small county exemptions
4. New Jersey- two rates, larger number includes asphalt and concrete.

Source- Dept. of Ecology, WA
WHERE IS DIVERSION COUNTED?

DEEPER MICRO VIEW

ORGANICS 18% <15%

20-40% Screened Residue in secondary processing MSW Compost
POSSIBLE ROLES (NO SOURCE SEPARATED PROGRAMS OVER 50%)?

- Wet/dry to hone resource capture and automation
- Facility of last resort in high tip fee, high regulatory, stacking collection/processing environments: Up to 5 MRFs, food waste recovery, commercial and residential recycling in San Jose, San Francisco, South Bay, Oakland
- One bin collection savings?