State of Technology for MSW Processing:
Smart Technologies for Processing MSW

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By
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State of Technology

Gershman, Brickner & Bratton, Inc.
Innovative, Sustainable Solutions for Solid Waste Management

*We believe in a **world** where discarded materials are used as resources rather than wasted – for the benefit of communities and the environment.* ***both today and far into the future***.

ONE COMPRESSED BALE OF MILK JUGS CONTAINS
12,000

RECYCLING GI
SAVES ENOUGH
TO POWER A TE
FOR **20 MINU**

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U.S. Waste Management Infrastructure

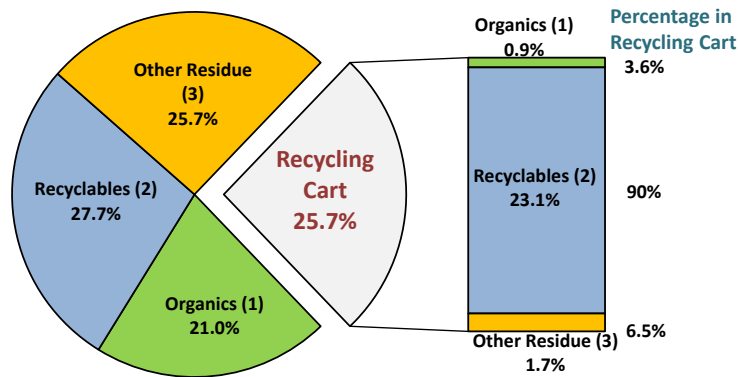| Technology	Number
Source Separation Collections	9,000
Material Recovery Facilities (MRF)	736
Composting	2,300
Mixed Waste Processing Facilities (MWPF)	51
Mass Burn WTE	65
Modular WTE	9
RDF -Processing &/ or Combustion	20
Anaerobic Digestion	19
Transfer Stations	3,350
Landfills	1,908

Sources: Most from Eileen Berenyi's Research ~ 2012-2015

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MSW Processing
Household Outputs

Source: GBB – Fayetteville, NC & Fort Worth, TX

Other Residue (3) 25.7%

Recyclables (2) 27.7%

Recycling Cart 25.7%

Organics (1) 21.0%

Percentage in Recycling Cart

Organics (1) 0.9% — 3.6%
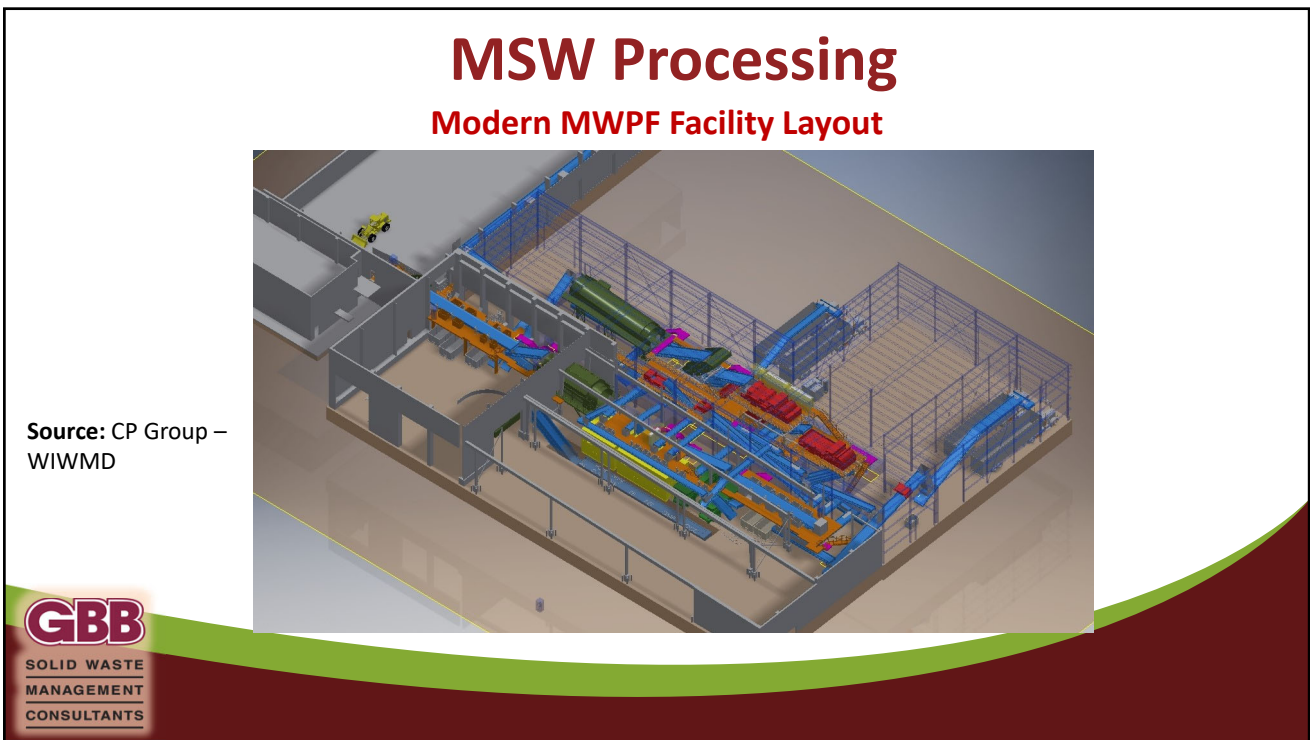
Recyclables (2) 23.1% — 90%

Other Residue (3) 1.7% — 6.5%

(1) Contains Food Waste, Soiled Paper, and Yard Trimmings
(2) Contains OCC, Other Fibers, PET, HDPE, Mixed Plastics, Al, Fe, Film and Glass
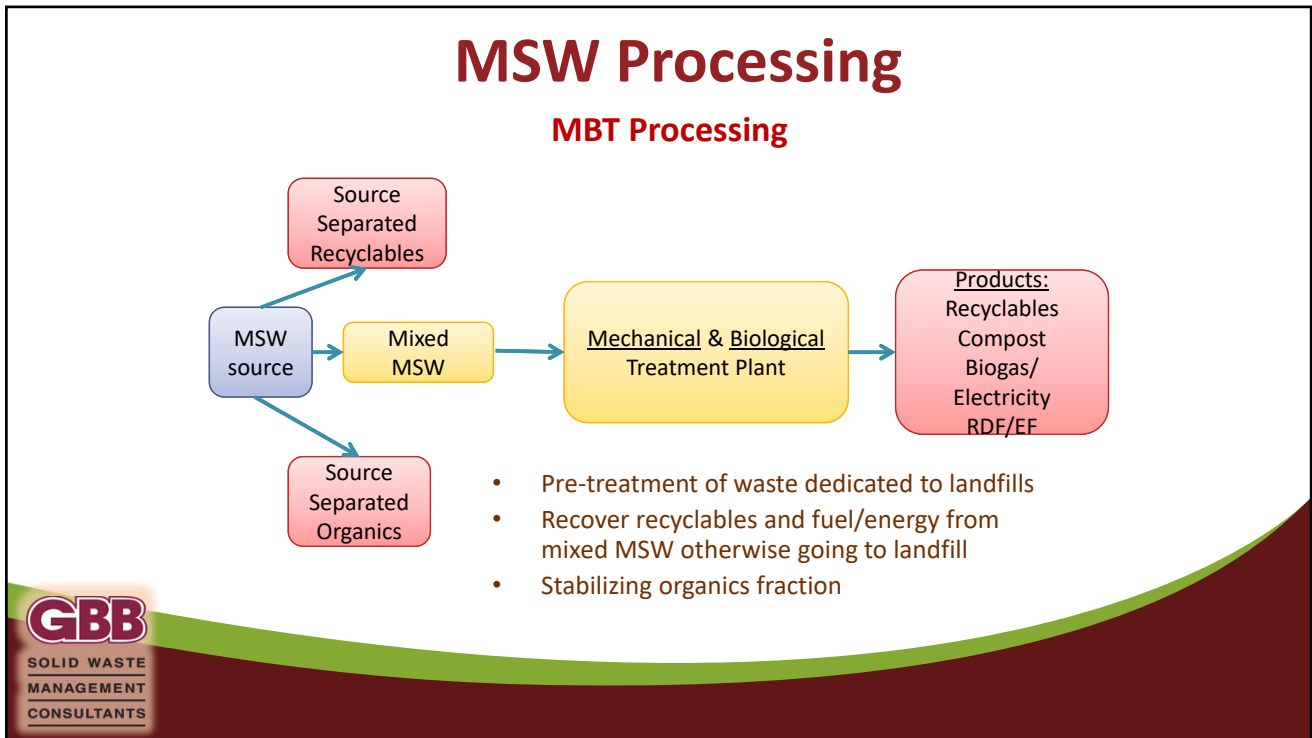(3) Includes C&D, Diapers, Textiles, Electronics and Other Residue

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MSW Processing
Map of Modern MWPF Locations

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MSW Processing
Modern MWPF Facility Layout

Source: CP Group – WIWMD

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MSW Processing

MBT Processing

- Pre-treatment of waste dedicated to landfills
- Recover recyclables and fuel/energy from mixed MSW otherwise going to landfill
- Stabilizing organics fraction

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MSW Processing

MBT Processing

Source: GBB – Entsorga

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Processing Systems of the Future

- The Future of Material Recovery Facilities (MRF):
  New Processing Systems will Consist of More of the Following:

  o **Combined Systems**
    - Systems will be capable of processing more than one type of stream, with some equipment processing multiple streams
  o **More Optical Units, less Screens**
    - Optical units will be utilized to recover more materials including fiber
    - Streams need only be divided by size/density prior to optical units (instead of by shape)
  o **Robotic Sorters**
    - Both for QC and for Pre-Sort – can positively pic multiple materials

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Processing Systems of the Future
Combined Systems

**Materials Recovery Facility
Improvement Project**

Source: MRWMD/BHS – Monterey, CA

Line processes Mixed Waste
OR
Single Stream Recyclables

C&D Processing Line

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Optical Units

If you can see it, you can collect it....

Source: CP Group / BHS

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Optical Units

1. Feeding of unsorted material
2. Spektrometer scanner
3. Separation chamber
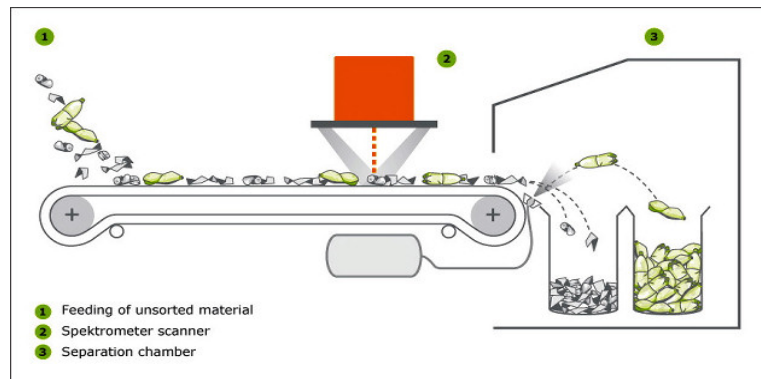
Source: TiTech/Tomra

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Smart Technologies for MRFs
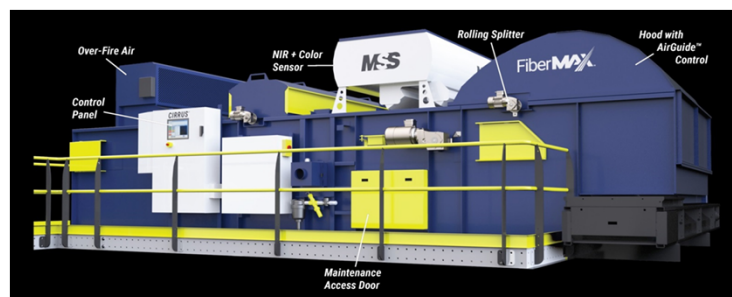
Improved Optical Units

- With improvements in algorithms, shape recognition and attention to air flow characteristics, optical units can now better recover:

  - **Types of Fiber**
  - **Clean Wood**
  - **Film**
  - **Flexible Packaging**
  - **Cartons**
  - **Other potential target materials (i.e. Black Plastics)**

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Smart Technologies for MRFs

CP Groups CIRRUS® FiberMax™

- Utilizes air flow to keep light-weight items from flying off the belt and improve trajectory
- Positive eject on plastics, other materials

Source: CP Group

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Smart Technologies for MRFs

Video of CIRRUS® FiberMax™

http://www.mssoptical.com/
cirrus-maxselect/fibermax//

Source: CP Group

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Smart Technologies for MRFs

Other Optical Advancements – Additional Spectrum and Lasers

Steinert Unisort Black

Tomra LOD

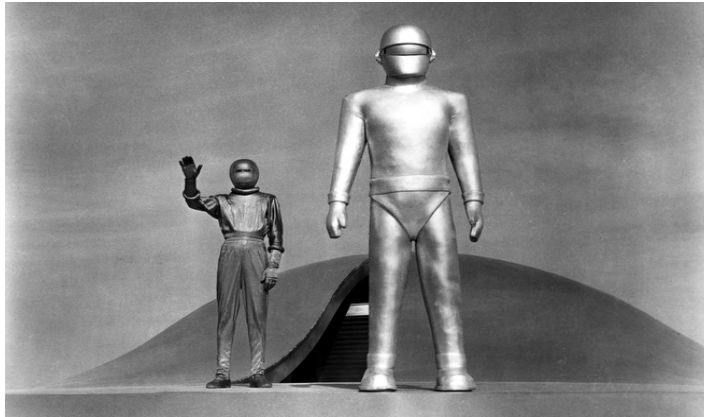**Source:** Steinert

Source: Tomra

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Processing Systems of the Future

The Rise of the Robots

Source: "The Day the Earth Stood Still" 1951

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Smart Technologies for MRFs

Robot Sorters SamurAI™ and Max-AI®

Source: Machinex / BHS

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Smart Technologies for MRFs
Robotic Sorters

AMP Cortex

RoBB-AQC

Source: AMP / Van Dyk

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Smart Technologies for MRFs
Video of QC Robotic Sorter – Max AI®

http://www.max-ai.com/

Source: BHS

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Smart Technologies for MRFs

QC Robotic Sorters – Advantages and Disadvantages

- **Advantages**
  - Better Speed and Accuracy (*for most items*) than Manual QC *(Most will achieve 98% purity (or more) after an optical unit for PET or HDPE)*
  - No Pee Breaks!
  - Decent ROI
- **Disadvantages**
  - Expensive (not right for all situations)
  - New, difficult to know lifespan and maintenance needs
  - Still susceptible to items that aren't "seen"
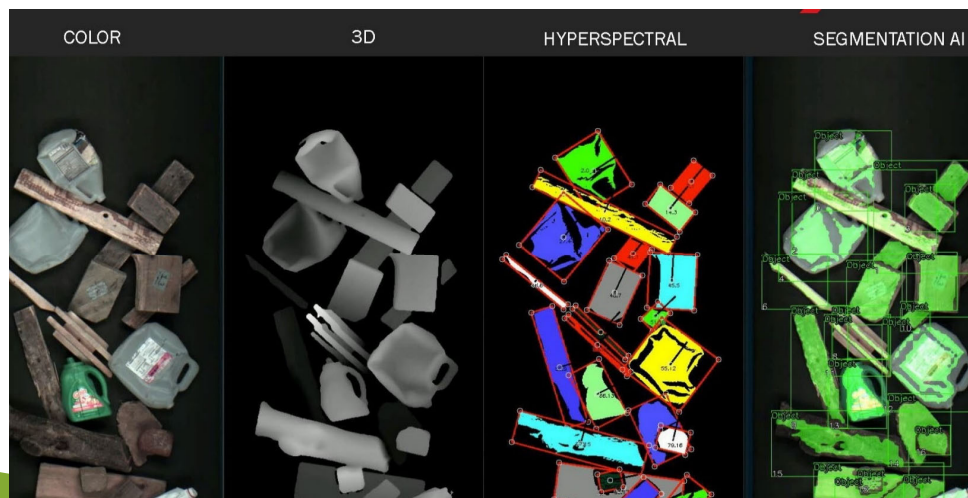 - Limited belt sizes and throughput (for now)
  - Don't believe all the hype....

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Robotic Sensors with AI

**Source:
Waste
Robotics**

COLOR | 3D | HYPERSPECTRAL | SEGMENTATION AI

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Processing Conclusions

**The lines between processing Single Stream,
MSW and C&D will become blurred**

- Systems will be capable of processing multiple material streams
- Opticals and robotics will be able to easily target multiple materials not traditionally recovered
- AI and sensors will increase the knowledge regarding what is in both inputs and outputs from processing systems
- The very nature of the processing systems will create new commodity streams that without a market will become residue
- The processing facilities will need to be part of a larger recovery system to be successful (SBP or MMC's)

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Additional Info

Technology and Equipment Guide

Supplemental Report: *The Evolution of Mixed Waste Processing Facilities* – Technology and Equipment Guide (2015)
- Prepared for the American Chemistry Council

- https://plastics.americanchemistry.com/Education-Resources/Publications/The-Evolution-of-Mixed-Waste-Processing-Facilities-Technology-and-Equipment-Guide.pdf

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Thank you!

Questions and Comments?

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