Costs: More or Less?

For the Maryland Recyclers Network
BWI Doubletree Hotel
Linthicum Heights, MD

Harvey W. Gershman
President
Gershman, Brickner & Bratton, Inc.

October 4, 2013

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About the Maryland Recycling Network

- **We support the 3 R's throughout Maryland**
  "sustainable reduction, reuse and recycling of materials otherwise destined for disposal."
- **Why Join?**
  - Networking
  - Knowledge
  - Business
  - Social
  - Personal
- MRN/SWANA-MidAtlantic Annual Conference Thursday, June 19, 2014 (All day) - Friday, June 20, 2014 (All day)
- www.marylandrecyclingnetwork.org

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GBB – Quality – Value – Ethics – Results

- Established in 1980
- Solid Waste Management and Technology Consultants
- Helping Clients Turn Problems into Opportunities
- www.gbbinc.com

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GBB Waste Technology Services

- Economic, technical, and environmental reviews
- Markets development
- Process planning and design
- Waste characterization and sourcing
- Procurement and negotiation assistance
- Independent feasibility consultant
- Technology due diligence
- Acceptance testing and operations monitoring

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GBB Clients in Maryland

- Annapolis
- Anne Arundel County
- Attorney General's Office
- City of Baltimore
- Baltimore County
- Calvert County
- Calvert Trash Service, Inc.
- Caroline County
- Charles County
- Clean Rock Industries
- Columbia County
- CSI Norfolk
- Easton Utilities Commission
- F&E Stokers
- Fort Meade
- Frederick County
- Gaithersburg
- Gatlinburg
- Geosyntec
- Harford County
- Howard County
- Johns Hopkins Medical Center
- Legg Mason Wood Walker, Inc.
- Leimbach Development
- Waste News
- Marriott Corporation

- Maryland Department of the Environment
- Maryland Environmental Service/Lower Shore
- Maryland Environmental Service/Prince George's County
- Maryland Reclamation LLC
- Maryland Recyclers Coalition
- Maryland Recycling Conference
- McCormick and Company
- McGuire, Woods, Battle & Booth
- Mitchell Petersen
- Montgomery County
- Northeast Maryland Waste Disposal Authority (NMWDA)
- Ocean City
- Office Paper Systems , Inc.
- OREG Site Work Services, LLC
- Prince George's County
- Queen Anne's County
- Recycling Inc.
- Reese & Carney, LLP
- Rogers Golden Halprin / NMWDA
- Somerset County
- St. Mary's County
- Stark & Keenan/Town of Bel Air
- State of Maryland
- SWANA
- SWANA (as GRCDA)
- Talbot County
- The Recycling Center
- Town of Easton
- URS/Maryland Environmental Service
- US Postal Service-Baltimore Division
- University of Maryland
- Washington County
- Wicomico County

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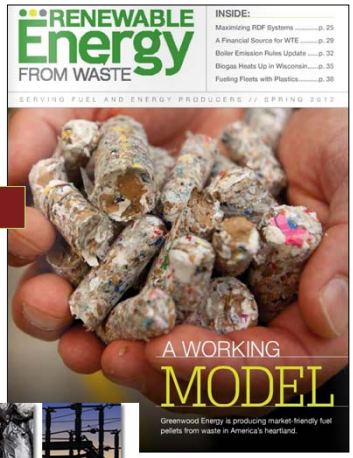
www.rewmag.com



RENEWABLE Energy FROM WASTE CONFERENCE

NOVEMBER 18-20 2013 WEST PALM BEACH, FLORIDA

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Today's Agenda

Solid Waste Management Costs	• What factors influence system costs?
Maryland – What's Ahead?	• Reaching for 70% diversion
What's on the Horizon?	• Conversion Technologies • New Projects • Mechanical Biological Treatment
China's Green Fence	• What does it mean for recycling in the U.S.?
Opinions and Trends	• Some crystal ball thoughts

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Solid Waste Management Costs

- What factors influence system costs?

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General Trends in the US

- Recognized value for materials and energy from waste
- Waste reduction and product stewardship efforts
- Reduce the environmental impact of products
- Implementation of integrated waste management related policy with recycling goals
- Increased interest in Zero waste and food recycling
- Public and financial support for better waste management

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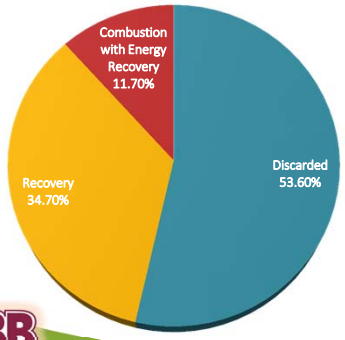
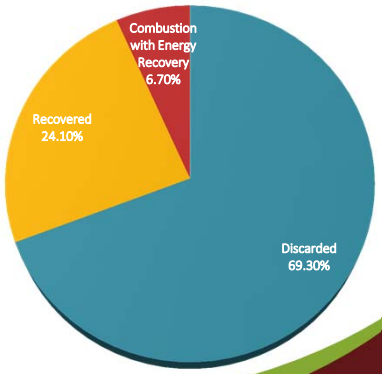
Disposition of MSW in the U.S.

EPA Estimate:
250 million tons (2011)



Biocycle Estimate:
389 million tons (2008)



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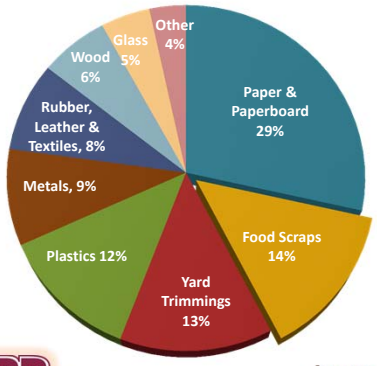
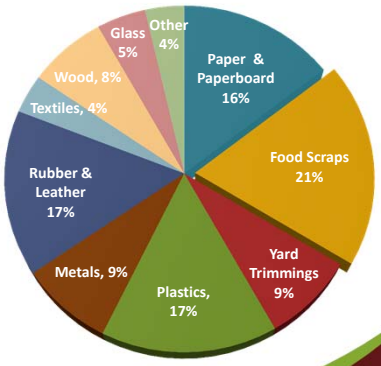
Food Waste in MSW

Total MSW generation, 2010 (by material before recycling)



MSW going to landfills, 2010 (by material after recycling)



Around 35 million tons of food waste

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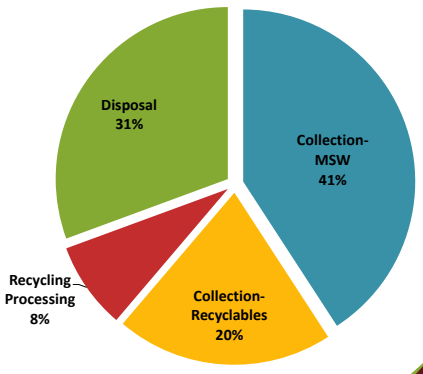
Cost of Collection and Disposal

- Collection
  - Residential solid waste : $10 - $40 per month per household
  - Residential recycling $2 - $4 per month per household
- Commercial waste
  - charged on a per month per box basis, and may include a separate pass-through cost for disposal charges.
  - 2 cubic yard box serviced once per week = $60 - $140 per month
  - 6 cubic yard box serviced once per week = $130 - $280 per month



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Factors Affecting System Costs

- Population and Demographics
- Laws and Regulations
- Markets
- Politics
- Sites
- Financing
- Hidden Costs
- Waste Supply Contracts
- Public Education and Enforcement

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Factors that Drive Cost Down

- Unbundling collection from processing
- Long-term contracts
- Automated collection
- Every other week collection for recyclables and yard waste
  - Even once per month for recyclables
  - Seasonal for yard waste
- Call in bulk service

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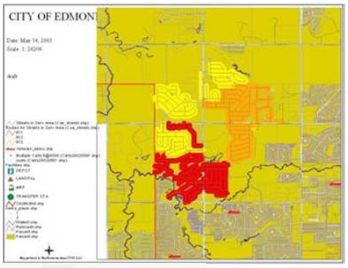
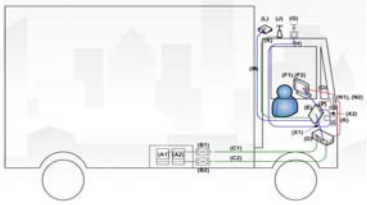
Factors that Drive Cost Down

- Software and services
  - Computerized Routing
  - GPS
  - Asset management
  - Customer service
  - Web site, text, app, and email reminders for customers
- Maintenance contracts
- Closed market contracting





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Value* of Recyclables in One Ton of Curbside Recycling Sorted and Sold to Markets

Year	$ per Ton Equivalent
1994	$40.00
1995	$104.00
1998	$48.00
2005	$85.00
2008	$150.00
2009	$60.00
2010	$145.00
2011	$140.00
2012	$145.00

*Does not include any redemption values some states rebate to processors.
Source: GBB internal database.

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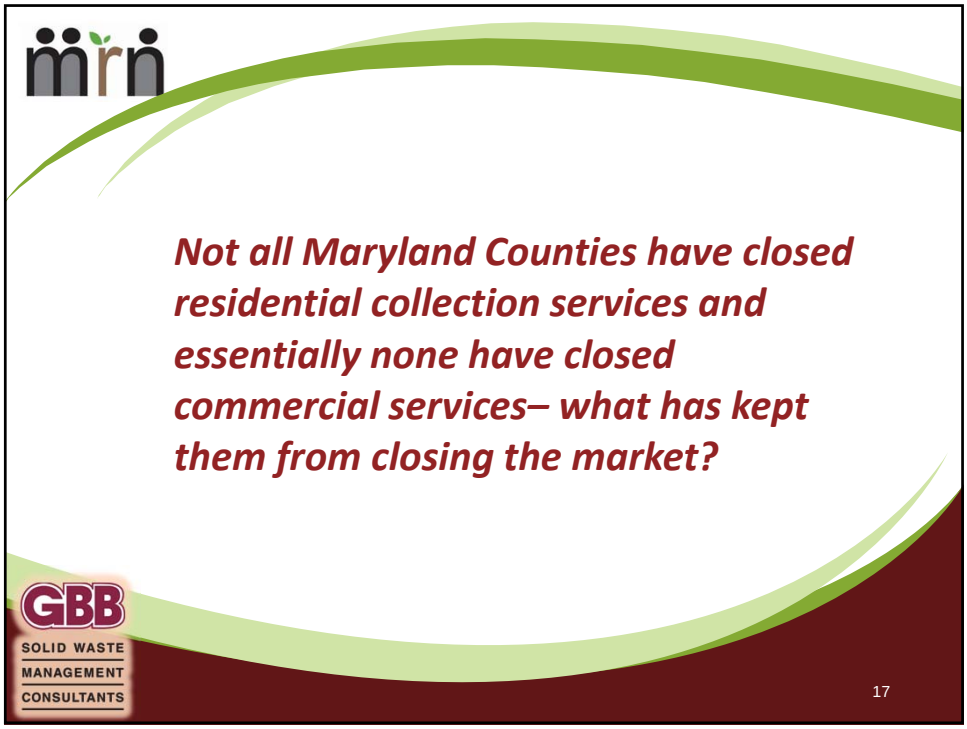
Not all Maryland Counties have closed residential collection services and essentially none have closed commercial services– what has kept them from closing the market?
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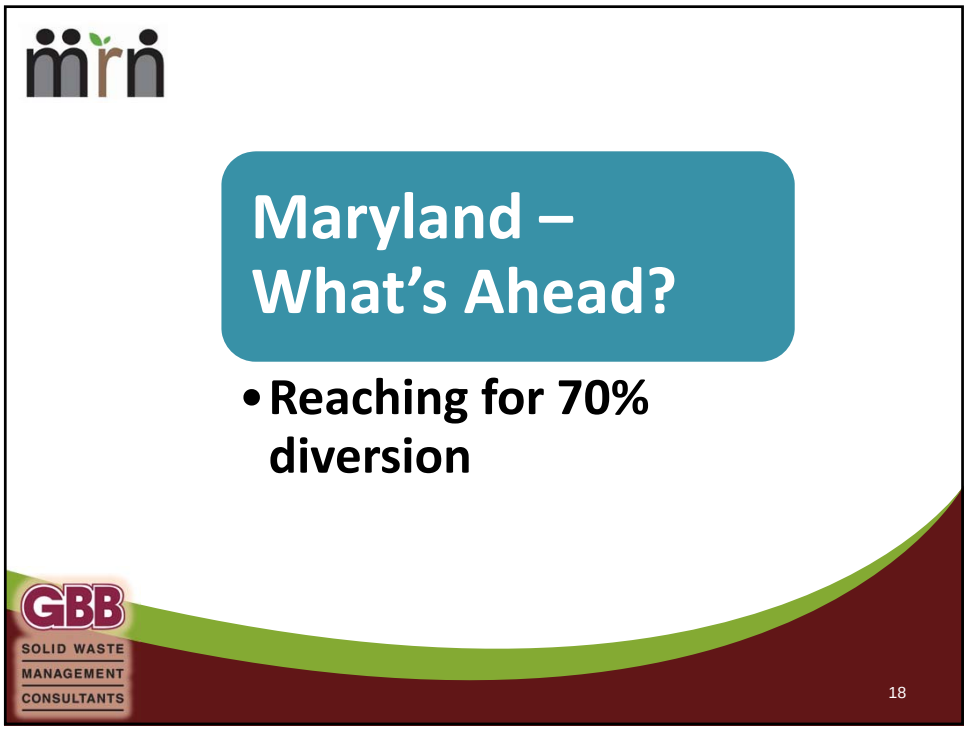
Maryland – What's Ahead?
• Reaching for 70% diversion
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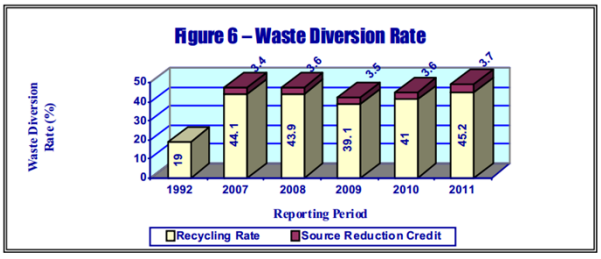
Maryland CY2011 Waste Diversion and Recycling

Solid Waste Management Method	Tons	% of Total Solid Waste Managed
Exported	2,639,195	30%
Landfilled in MD	3,694,798	41%
Incinerated (WTE) in MD	1,403,523	16%
Recycled/Reused in MD	1,195,473	13%
TOTAL	8,932,989	100%



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Maryland CY2011 Recycling Rates

MD County	MDE Reported Recycling %	Recycling % Including Non-MRA Recyclables
Allegany	33.8%	71.4%
Anne Arundel	51.2%	47.5%
Baltimore City	27.9%	16.7%
Baltimore County	48.5%	59.5%
Calvert	53.4%	49.7%
Carroll	52.4%	80.8%
Cecil	43.1%	45.7%
Charles	58.6%	88.1%
Dorchester	22.2%	20.1%
Frederick	49.8%	39.4%
Garrett	51.9%	53.3%
Harford	59.5%	49.3%
Howard	52.5%	50.8%
Mid-Shore	50.8%	59.6%
Montgomery	62.7%	50.3%
Prince George's	49.1%	51.7%
Somerset	18.0%	42.2%
St. Mary's	34.6%	36.5%
Washington	47.8%	52.6%
Wicomico	26.9%	31.4%
Worcester	34.9%	40.4%

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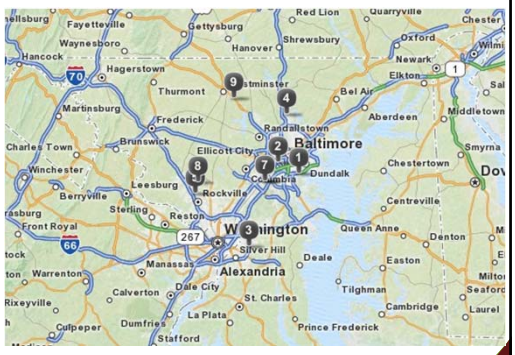
MRFs in Maryland

1. BFI Baltimore Processing Center, Baltimore
2. Weyerhaeuser Recycling Services, Baltimore
3. Prince George's County Recycling (Recycle America Alliance), Capitol Heights
4. Baltimore County Resource Recovery Facility, Cockeysville
5. Montgomery County Recycling Center, Deerwood
6. Recycle America Alliance-Dry Commercial Waste, Elkridge
7. Recycle America-Single Stream Facility, Elkridge
8. Office Paper Systems, Inc. Fiber MRF, Gaithersburg
9. Carroll County-Northern Landfill Processing Facility, Westminster



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Waste-to-Energy Facilities in Maryland

1. Harford Waste-to-Energy Facility, Joppa, MD
2. Baltimore Refuse Energy Systems Company (BRESCO), Baltimore, MD
3. Montgomery County Resource Recovery Facility, Dickerson, MD

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WTE – What's Coming in Maryland?

- Frederick/Carroll Counties WTE Facility
  - 1,500 TPD
  - Through NMWDA; Wheelabrator selected
  - Part of an integrated system with high diversion
  - MSW and biosolids from Frederick, looking for another party to take Carroll's place

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WTE – What's Coming in Maryland?

- Energy Answers – Baltimore
- 4,000 tons per day of Processed Refuse Fuel
- RDF preparation offsite; locations under development
- Received all major permits and approvals for dedicated boiler and recycling operations
- Outputs:
  - 160 MW combined heat and power plant;
  - 350 tons/day of recovered, recyclable metals; and
  - 800 TPD construction-ready aggregate and other building materials
- Schedule
  - Construction began in August 2013

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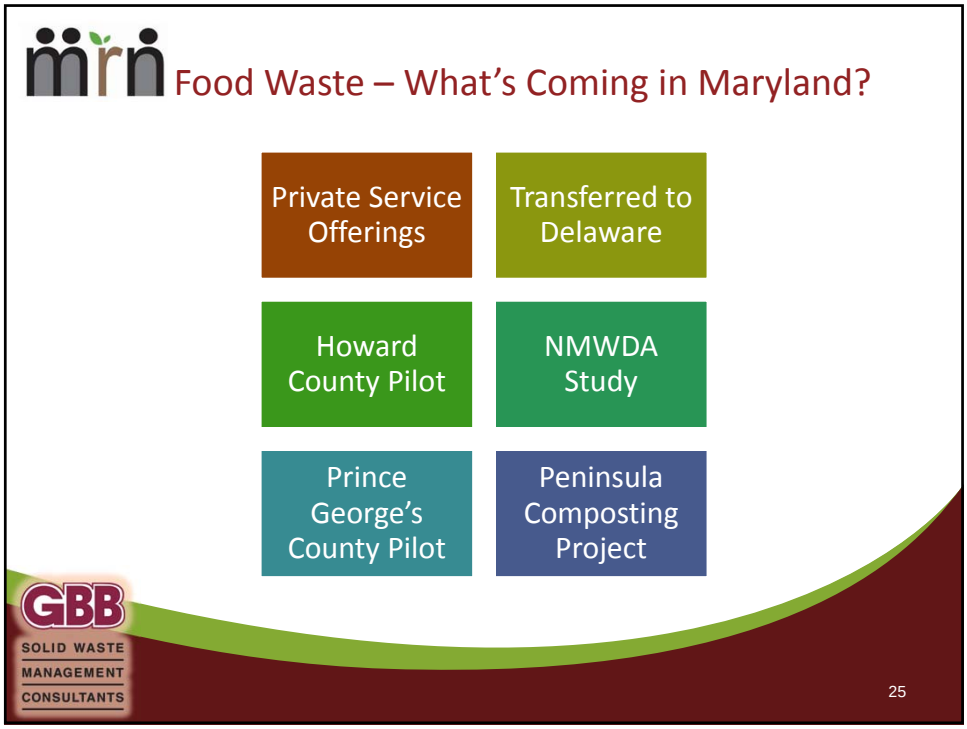
Food Waste – What's Coming in Maryland?
Private Service Offerings
Transferred to Delaware
Howard County Pilot
NMWDA Study
Prince George's County Pilot
Peninsula Composting Project
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How is your jurisdiction planning to get to 70% recycling?
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What's on the Horizon?

- **Conversion Technologies**
- **New Projects**
- **Mechanical Biological Treatment**

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Technology and Project Developers – 579 and Counting

- 34 Aerobic Composting
- 100 Anaerobic Digestion
- 30 Ethanol Fermentation
- 174 Gasification
- 49 Plasma Gasification
- 69 Pyrolysis
- 59 WTE: mass burn, modular, dedicated boilers, and RDF
- 64 Others (agglomeration, autoclave, de-polymerization, thermal cracking, steam reforming, hydrolysis)

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Source: Gershman, Brickner & Bratton, Inc., June 2013

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Gasification Technology Offerors

ALTER NRG
Enerkem
BlueFire ETHANOL
ENTECH RENEWABLE ENERGY SOLUTIONS
Chinook Energy THE END-STAGE RECYCLING COMPANY®
Fulcrum BIOENERGY
COVANTA ENERGY
InEnTec
PlascoEnergy GROUP
INEOS Bio

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Technologies Processing Mixed Non-recyclable Plastics

agilyx
envion
CLIMAX GLOBAL ENERGY
Plastic2Oil
VADXX ENERGY™

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Technologies Processing Organic Waste

Anaergia
HARVEST Power of We
eci Bio Energy
OWS Organic Waste Systems
biogas USA entec
quasar energy group
EISENMANN
ZeroWaste ENERGY, LLC. Recovery and Energy with Zero Waste
Fiberight

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Technology Commercialization Examples

Location	Edmonton, Alberta, CA	Vero Beach, FL	Storey, NV	Monterey, CA	Sacramento, CA
Technology	Gasification/ Catal.Conv. of Syngas	Gasification/ Ferment. of Syngas	Gasification/ Catalytic Conv. of Syngas	Anaerobic Digestion	Anaerobic Digestion
Developer	Enerkem	INEOS Bio	Fulcrum Bioenergy	Zero Waste Energy	Clean World Partners
Feedstock	Non-recycled MSW	Yard, vegetative, residential waste	Post-sorted MSW	SSO (food and yard waste)	Commercial food waste
Throughput (TPD)	300	450	400	15	100
Energy Products	Methanol; Ethanol	Ethanol	Ethanol; Propanol	Biogas; Electricity	Biogas; Electricity
Cost	$80M	$130M	$120M	$1.6M	$12M
Federal Grants/Loan Guarantees	$23.5M	$125M	--	--	$1.8M
Start Date	2014	June 2012	2015	Jan 2013	2014

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Locations Advancing "Proven" Technologies

- Mass burn WTE expansions completed
  - Hillsborough County, FL - Covanta
  - Lee County, FL - Covanta
  - Olmsted County, MN – Olmsted County
  - Honolulu, HI – Covanta
- Mass burn WTE facilities under construction
  - Durham York (Ontario CN) - Covanta
  - Palm Beach County, FL (SWAPBC) – B&W
- Example of Locations advancing new facilities with 'proven' technologies:
  - Baltimore, MD – Energy Answers
  - Frederick County, MD (NMWDA) - Wheelabrator
  - City of Los Angeles, CA – Green Conversion Systems
  - Region of Peel, Ontario, CN - Covanta
  - Puerto Rico – Energy Answers
  - Metro Vancouver, CN – To be determined

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Locations Advancing "Proven" Technologies (cont'd)

- Anaerobic digestion specific RFPs issued:
  - Humboldt Waste Management Authority, Eureka, CA
  - Montgomery, AL- under construction w/Zero Waste Energy
- Anaerobic Digestion plants under development based on private companies initiatives:
  - City of Newport News, VA- quasar
  - Town of Bourne, MA- Harvest Power
  - Town of Brunswick, ME-quasar and Village Green Ventures
  - City of Columbia, SC- w/W2E
  - City of Portland, OR- w/Columbia Biogas
  - Monticello, IN- w/ Waste No Energy LLC
  - City of Charlotte, NC- w/Blue Sphere

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Featured Ongoing Projects in North America

- City of Cleveland- Long-Term Waste Recycling and Disposal *Project*
- City of Houston- *One Bin for all*
- Prince William County- *Demonstration plant of an emerging MSW WTE conversion technology*
- County of Maui- *Integrated Waste Conversion and Energy Project*
- Iowa City- Conversion technology as part of the solid waste management system

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Europe's Waste Management Situation

- **High standards for construction and operation of landfills**
  - **Waste must be treated prior to disposal**
- **Treatment Methods considered:**

Mechanical Biological Treatment	• Recovery of organics and recyclables, fuel production
Biological treatment	• Anaerobic Digestion • Biogas and compost production • Aerobic Composting • Compost production
Waste to Energy	• Energy production, High mass reduction

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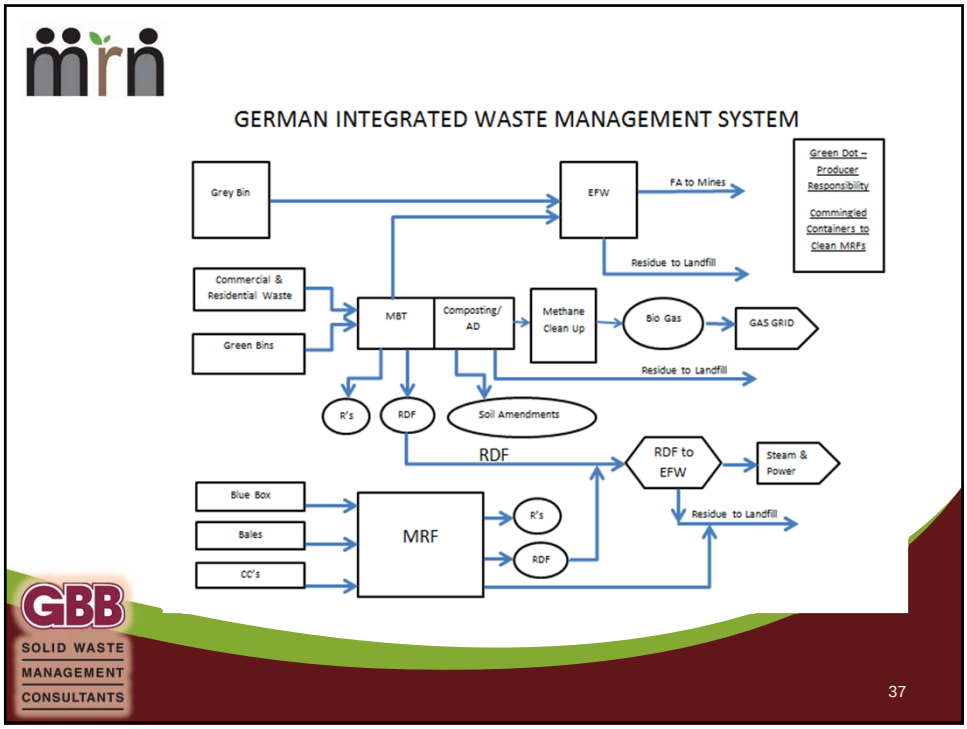
GERMAN INTEGRATED WASTE MANAGEMENT SYSTEM
Grey Bin
EFW
FA to Mines
Green Dot – Producer Responsibility
Commingled Containers to Clean MRFs
Residue to Landfill
Commercial & Residential Waste
Green Bins
MBT
Composting/ AD
Methane Clean Up
Bio Gas
GAS GRID
Residue to Landfill
R's
RDF
Soil Amendments
RDF
RDF to EFW
Steam & Power
Residue to Landfill
Blue Box
Bales
CC's
MRF
R's
RDF
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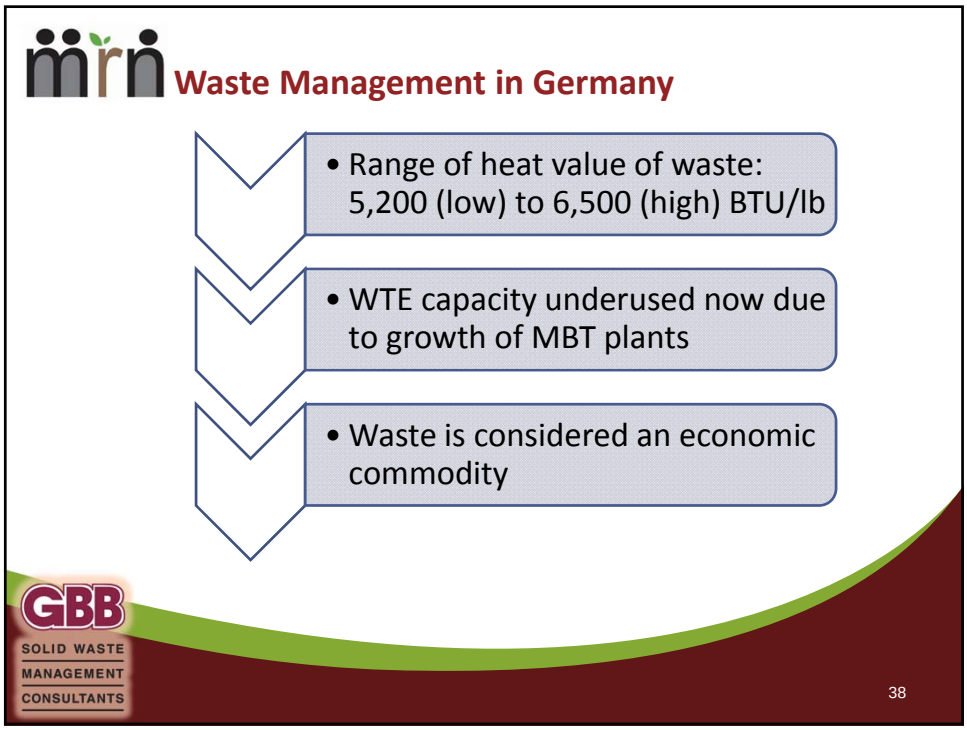
Waste Management in Germany
• Range of heat value of waste: 5,200 (low) to 6,500 (high) BTU/lb
• WTE capacity underused now due to growth of MBT plants
• Waste is considered an economic commodity
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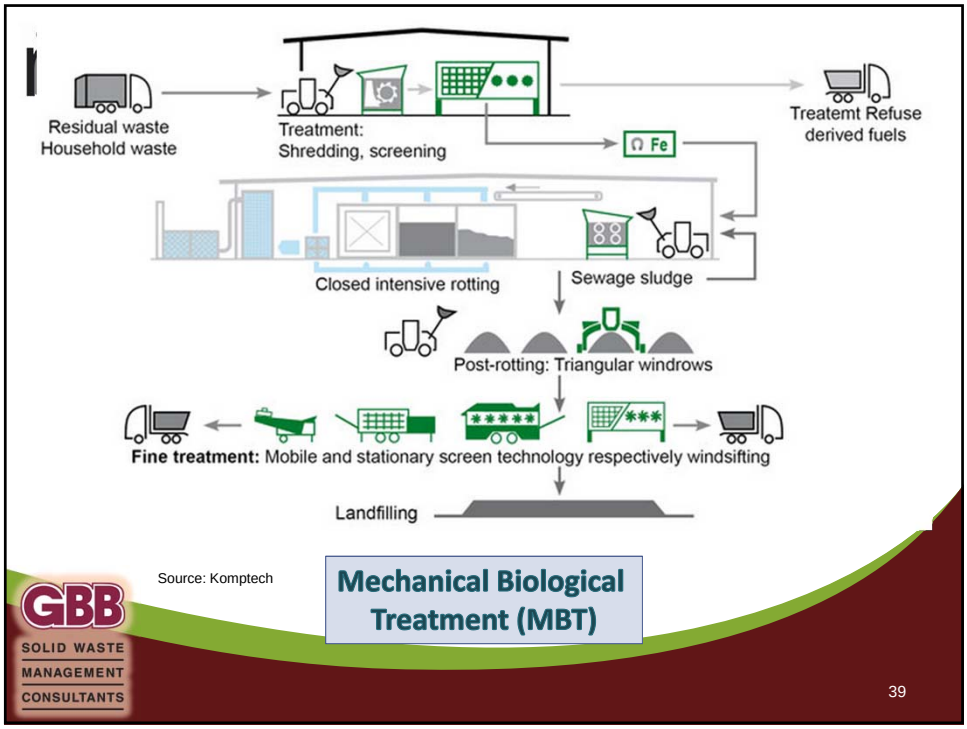
Residual waste
Household waste
Treatment:
Shredding, screening
Fe
Treatemt Refuse
derived fuels
Closed intensive rotting
Sewage sludge
Post-rotting: Triangular windrows
Fine treatment: Mobile and stationary screen technology respectively windsifting
Landfilling
Source: Komptech
Mechanical Biological Treatment (MBT)
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Site Visit #1: Waste Management Centre Pohlsche Heide
MBT with partial flow anaerobic dry digestion
• Publicly owned, privately operated
• The complex has MBT, landfill, WWTP, composting and tunnel anaerobic dry digestion plant for organic waste, and convenience center
– mixed waste sorting for materials and RDF (double grind)
– biogas with CHP and biogas to gas grid
– composting that produces soil amendment and fertilizer products
residue to landfill
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Site Visit #2: Minden

Small Sized Industrial RDF With Combined Heat and Power Plant

- Facility takes 35,000 tons of RDF per year from MBT
- BASF, chemical company, next door, uses for process steam
- RDF pays to be combusted as a fuel
  - 35 - 65 Euro per ton

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Technologies Working Together → Less Waste Landfilled

Mechanical Recycling	Chemical Recycling	Energy Recovery
Post-consumer source separated recyclables and industrial scrap	MRF residue, mechanically non-recyclable waste (organics, mixed plastics, etc)	MRF & processing residues, mixed MSW, alternative to disposal
Separated at the MRFs and sent to recyclers	Processed at anaerobic digestion, gasification or pyrolysis plants	Waste is used as a fuel at Waste-to-Energy plant
New things are made from the recovered materials	Fuels and chemicals are produced from the processed materials	Energy is produced from the non-recyclable waste

→ Treating waste as a commodity
→ Using technology (like MBT) to recover as much value as possible
→ Opportunity to work with other industries (like cement kilns) to reduce landfilling

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Technologies and Risk

Source: Gershman, Brickner & Bratton, Inc. March 2013

Alternative	Risks/Liability	Risk Summary
Mass Burn/WaterWall	Proven commercial technology	Very Low
Mass Burn/Modular	Proven commercial technology	Low
RDF/ Dedicated Boiler	Proven commercial technology	Low
RDF/Fluid Bed	Proven technology; limited U.S. commercial experience	Moderate to Low
Anaerobic Digestion	Proven technology; limited U.S. commercial experience	Moderate to Low
Pyrolysis	Previous failures at scale, uncertain commercial potential; no operating experience with large -scale operations	High
Gasification	Limited operating experience at only small scale; subject to scale-up issues	High
Mixed-Waste Composting	Previous large failures; No large-scale commercially viable plants in operation; subject to scale-up issues	Moderate to High
Chemical Decomposition	Technology under development; not a commercial option at this time	High

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China's Green Fence

- **What does it mean for recycling in the U.S.?**

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China's Green Fence

- China has been a prime market for recycled raw materials from the US
- China has announced that it will be stricter in terms of what contaminants it allows in shipments
- Any shipment of recyclables that has a single contaminant could be turned away
- During the first three months, ~7,600 tons of material from the U.S. was rejected
- Since the campaign began, an estimated 800,000 tons of recyclable waste total has been rejected

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China's Green Fence

- Could lead to increased exporting costs
- Concern over what the U.S. will do with its waste if it can't be sent to China
- Cities may be forced to take a hard look at what kind of recycling is offered and/or find a way to produce less contaminated waste
- America has to rethink its current mindset toward recycling and create solutions that are no longer dependent on sending trash abroad

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How can we adapt to the Green Fence?

Divert Cleaner Streams of Recyclables	• Public education and outreach • Enforce proper collection practices and equipment
Utilize More Advanced Technologies	• Upgrade MRF Technologies • Incorporate MBT elements
Process and Convert Recyclables in the US	• Produce RDF • Conversion Technology Feedstock • Remanufacturing in US

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What can be done to have recyclables stay in Maryland and be remanufactured here?

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Opinions and Trends

- Some crystal ball thoughts

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Opinion: Trends for the Future

- Many conversion projects advancing
- Will need 4-6 years to learn what works and their economics
- Continuation of public sector taking "Low Risk" attitude until "proven"
- Demand for more recyclables expected to continue at attractive pricing
- More mixed waste processing systems…again!
  - Many conversion technologies require MSW pre-processing… for feedstock sizing and inerts removal
  - Electric utilities may become a player for RDF
- 'Environmentalists' and 'Zero Waste' proponents will continue to fight WTE and Waste Conversion Technologies calling them all "incineration"

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A Realistic & Ultimate Goal:

- Fully Integrated and Efficient Waste Management System with Significant Diversion (Recycling) and WTE-WCT
- …in a 50-50 partnership!
- *…for more jobs, better environment, and energy independence in Maryland!*

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Thank you!!

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