

RENEWABLE Energy
FROM WASTE
CONFERENCE

Waste Conversion Market Update

Long Beach, CA

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

November 15, 2016

The slide features a dark red background with a green curved border at the top and bottom. The text is centered in white. The GBB logo is located in the bottom left corner.

RENEWABLE Energy
FROM WASTE
CONFERENCE

Session - Waste Conversion Market Update


- Harvey Gershman, Gershman, Brickner & Bratton, Inc.
- Ted Michaels, Energy Recovery Council
- Johannes Escudero, RNG Coalition
- Clark Ajwani, Los Angeles County DPW

2

The slide features a white background with a dark red curved border at the bottom. The text is in dark red and black. The GBB logo is in the bottom left corner. A vertical line of four white circles connects the speaker names.

RENEWABLE Energy
FROM WASTE
CONFERENCE

Harvey Gershman



"Earth Day 1970 first inspired my career to focus on helping do better things with waste. And, I have been able to do just that for the past 40+ years."

Harvey Gershman
President and Co-Founder

Specialties: Strategic thinking and planning; procurement and negotiation assistance; system administration; change management; and project financing coordination.

GBB Quality – Value – Ethics – Results
Founded 1980

GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

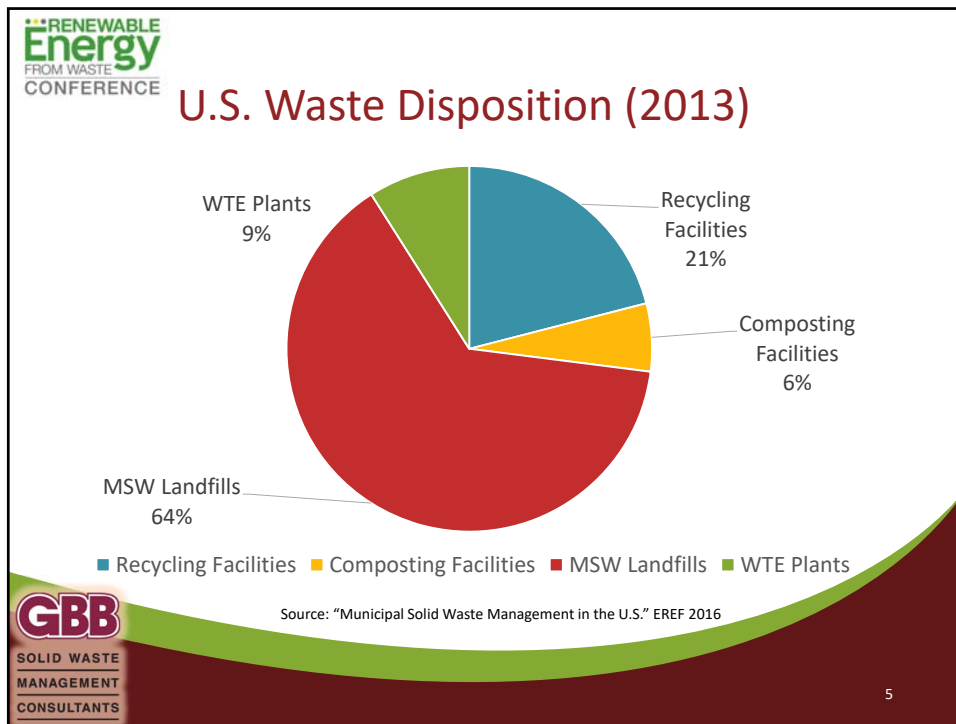
3

RENEWABLE Energy
FROM WASTE
CONFERENCE

WASTE MANAGEMENT IN THE U.S. – 2016 UPDATE

GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

4



RENEWABLE Energy FROM WASTE CONFERENCE

U.S. Waste Management Infrastructure

Technology	Number
Curbside Residential Recycling Programs	9,000+
Commercial Recycling Programs	Unknown
Material Recovery Facilities (MRF)	586
Transfer Stations	3,350
Mixed Waste Processing Facilities & Hybrid MRFs	70*
Composting	2,300
Anaerobic Digestion	21
WTE	77
Landfills	1,908

*Excludes facilities that solely produce RDF

GBB
SOLID WASTE MANAGEMENT CONSULTANTS

6

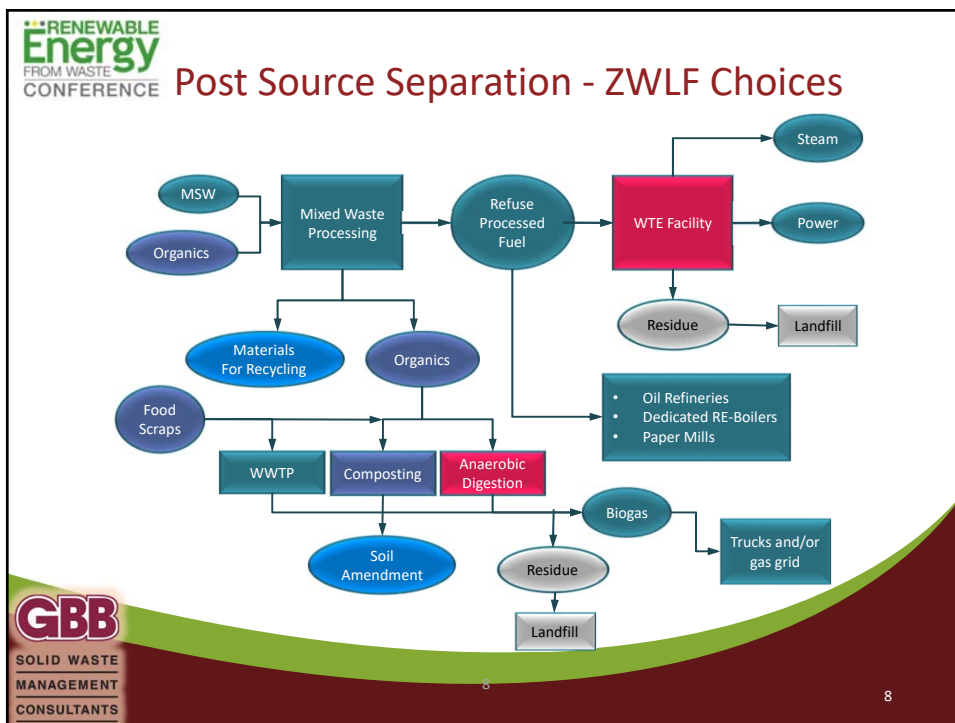
RENEWABLE Energy
FROM WASTE CONFERENCE

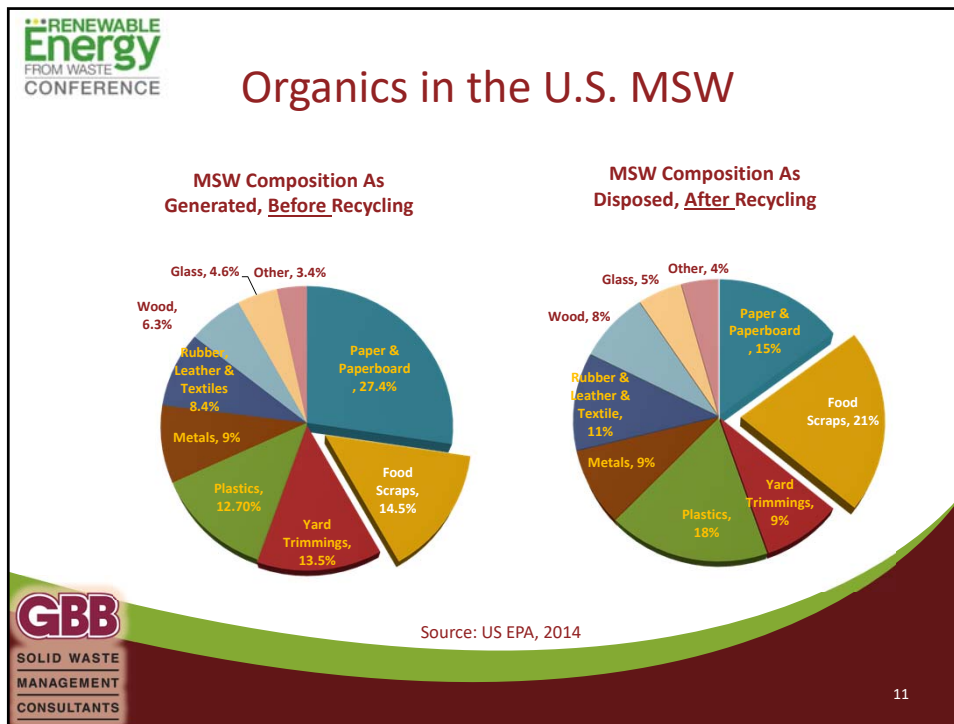
U.S. Waste Disposition Methodology (2013)

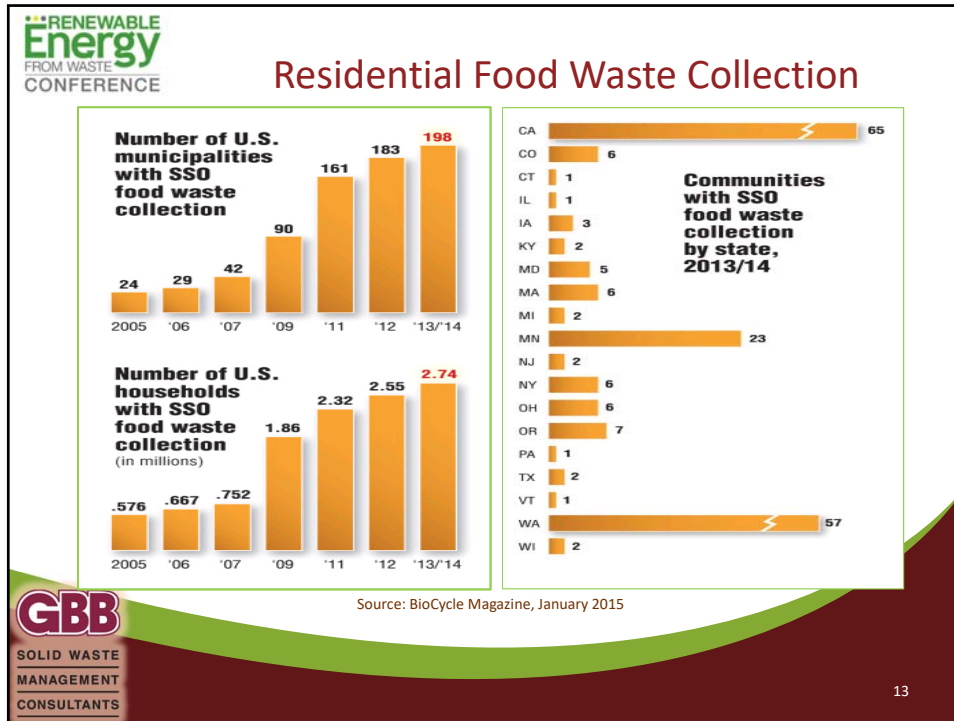
- EREF estimates 347 million tons MSW managed in 2013 using “bottom up” approach
- EPA estimates 254 million tons MSW in 2013 using “material balance” approach
- Approximately 220,000,000 total tons (~600,000 TPD) of MSW disposed at landfills in 2013... diverting this material would provide...
 - Nation-wide *investment opportunity of \$120 billion*
 - *50,000 jobs created* across the country

GBB
SOLID WASTE MANAGEMENT CONSULTANTS

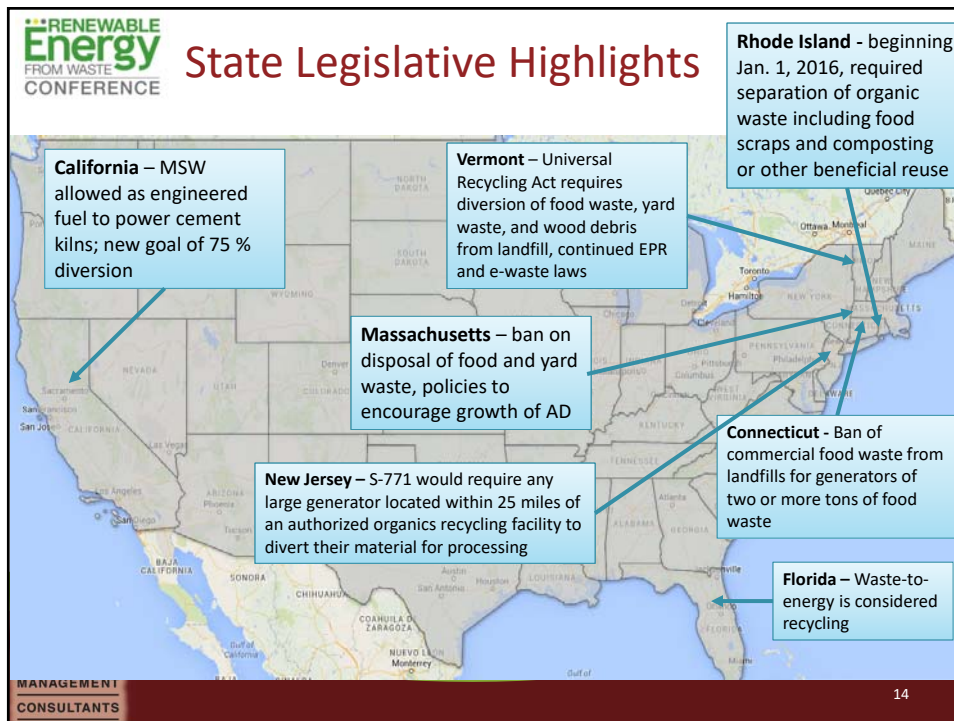
7







13



14

RENEWABLE Energy
FROM WASTE
CONFERENCE

WASTE CONVERSION MARKET UPDATE

GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

15

RENEWABLE Energy
FROM WASTE
CONFERENCE

Mass Burn/Dedicated Boilers

- Feedstocks
 - MSW
 - Special wastes
 - Biosolids
- Excess air for complete combustion
 - Starved air in some modular systems
 - Less excess air in Dedicated Boilers
- Products: steam, power, hot water, and/or chilled water; metals, aggregates, and ADC

B&W Babcock & Wilcox

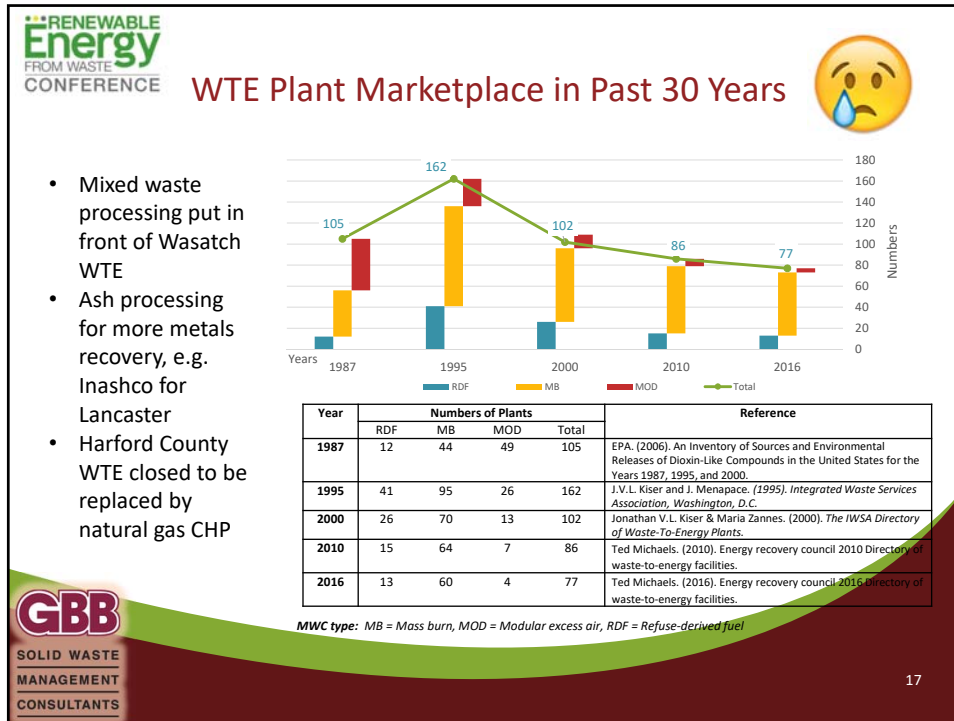
COVANTA
Powering Today. Protecting Tomorrow.

EnergyAnswers International

Wheelabrator TECHNOLOGIES

GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

16



RENEWABLE Energy FROM WASTE CONFERENCE

Newest Traditional WTE: Solid Waste Authority of Palm Beach County, FL

- Notice of Award – April 2011
- Groundbreaking – April 2012
- First Fire – February 2015
- Commercial operation – June 2015
- 3,000 TPD Mass Burn facility (1,040,000 TPY)
 - ✓ Babcock & Wilcox
 - ✓ 130 MW renewable power; enough for over 86,000 houses
 - ✓ \$668 million construction price
 - ✓ \$20.5 million first year O&M cost
 - ✓ Advanced emissions controls, ferrous and non-ferrous metals recovery

Source: SWA of Palm Beach County

GBB
SOLID WASTE MANAGEMENT CONSULTANTS

18

RENEWABLE Energy
FROM WASTE
CONFERENCE

Anaerobic Digestion/Composting

- Biological decomposition of the organic material in absence of oxygen
- >20 commercial plants that take source separated organics
- Feedstock: Commercial food waste, residential SSO, co-digestion at WWTP and farms
- Two main type: high solids AD and low solids AD

Anaergia

OIWSI
Organic Waste Systems

EISENMANN

HARVEST
Power of We™

quasar
energy group

Hitachi Zosen INOVA

ZeroWaste
ENERGY, L.L.C.
Recovery and Energy with Zero Waste


NATURAL SYSTEMS UTILITIES
A BETTER WAY

GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

19

RENEWABLE Energy
FROM WASTE
CONFERENCE

Perris, CA CR&R Anaerobic Digestion Facility



- CR&R completed \$100 million facility
 - 84,000 TPY capacity
 - High solids anaerobic digestion system
 - Feedstock includes food scraps and yard waste
 - Generating CNG to fuel truck fleet

Source: Biocycle 2015


GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

20

RENEWABLE Energy FROM WASTE CONFERENCE

Gasification


- Partial combustion in an air-controlled environment
- Product: Syngas for production of electricity, chemicals/ fuels (ethanol)
- Feedstocks
 - Engineered fuel from MSW
 - Biomass
 - Agricultural waste




GBB
SOLID WASTE MANAGEMENT CONSULTANTS

21

RENEWABLE Energy FROM WASTE CONFERENCE



Fulcrum Bioenergy Sierra Biofuels Plant



- First commercial plant under construction in Reno, NV
 - Gasification followed by synthesis
 - 200,000 TPY MSW into 10 million gallons of jet fuel per year
 - EPC Contractor- Abengoa
 - Commercial operation expected 3rd quarter of 2017
 - Fuel off take agreement with Cathay Pacific Airways
- \$30 million dollar investment into Fulcrum Bioenergy by BP to provide biofuels made from waste materials
 - BP to purchase 500 million gallons of biofuel over 10 years
 - Airlines signed accord in Montreal 11/10/16 to fund environmental initiatives that offset airline pollution

Source: <http://www.bloomberg.com/news/articles/2016-11-08/bp-buys-jet-fuel-made-from-garbage-to-curb-airline-pollution> ; fulcrum-bioenergy.com

GBB
SOLID WASTE MANAGEMENT CONSULTANTS

22

RENEWABLE Energy FROM WASTE CONFERENCE

INEOS Bio

- Gasification followed by biocatalyst fermentation and distillation
- Plant:
 - Vero Beach, Indian River County, FL-commercial demonstration facility
 - process ~150,000 TPY of yard, wood and vegetative wastes
 - produce 8 million gal/year ethanol and 6 MW (gross) of electric



Indian River BioEnergy Center

Problem-plagued INEOS closing down; plant for sale



GBB
SOLID WASTE MANAGEMENT CONSULTANTS

23

RENEWABLE Energy FROM WASTE CONFERENCE

Plastic to Oil Technologies

- Thermal conversion in the absence of oxygen
- Non-recyclable plastics to oils, fuels
- Plastics-to-Oil Technologies Alliance formed by ACC

Source: RES Polyflow












GBB
SOLID WASTE MANAGEMENT CONSULTANTS

24

RENEWABLE Energy
FROM WASTE
CONFERENCE

Processing Technology Vendors



GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

25

RENEWABLE Energy
FROM WASTE
CONFERENCE

ENTSORGA
West Virginia

BioHiTech
Global

Berkeley County, WV MBT Facility

- Uses High Efficiency Mechanical Biological Treatment (HEBioT) process
 - ~ 100,000 tons per year
 - Front end sorting of MSW to remove high value recyclables
 - Remaining material is processed by mixed waste composting to create Solid Recovered Fuel (SRF)
- SRF marketed to cement kilns valued at ~\$30/ton
 - EPA approved alternative to coal to reduce emissions

GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

26

RENEWABLE Energy
FROM WASTE
CONFERENCE

Fiberight

Hampden, ME Anaerobic Digestion/Enzymatic Hydrolysis Plant

- Mechanically separates MSW for processing into various bio-fuels
 - Front end separation of high valuable recyclables
 - Anaerobic digestion of soluble organics produces biogas
 - Enzymatic hydrolysis of cellulose organics produces high value sugars
- Groundbreaking October 27, 2016
 - Contracting with Municipal Review Committee (representing 187 local communities) for MSW feedstock


GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

27

RENEWABLE Energy
FROM WASTE
CONFERENCE

Montgomery, AL – Infinitus

- High-tech 80,000 square feet “state-of-the-art” Mixed Waste Processing Facility
- \$35 Million capital cost
- First “One Bin for All” in 21st Century in the U.S.
- Bulk Handling Systems Process
 - One-line, 40 ton per hour input for 100,000 tons per year
 - 60 % material recovery guarantee (including organics)
- Commercial operations began April 2014
- Temporarily closed October 2015
- City of Montgomery, AL purchasing for \$625,000



Source: GBB 2014


GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

28

RENEWABLE Energy
FROM WASTE
CONFERENCE

State of the U.S. LFG Industry

- LFG is extracted from landfills using a series of wells and a blower/flare system
- Collected gas goes to a central point for treatment and conversion/sale
- 636 operational LFG energy projects in the U.S. (July 2014)
 - 1,978 MW and 305 mmscfd
- EPA estimates an additional 440 MSW landfills could turn their gas into energy
 - Enough to power 500,000 homes



Maui, HI LFG System

GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

29

RENEWABLE Energy
FROM WASTE
CONFERENCE

TRENDS, EXPECTATIONS, AND OPPORTUNITIES FOR THE FUTURE

GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

30

RENEWABLE Energy
FROM WASTE
CONFERENCE

Trends Ahead

- MSW composition is getting less recyclable
 - “If waste isn’t recyclable, and not for AD/composting, what is it? ... *It’s fuel!*”
- More mixed waste processing
 - Added recycling side-benefit
- New conversion technology facilities and “One-bin” key to watch
- ‘Environmentalists’ and ‘Zero Waste’ proponents fight non-recycling alternatives
- Questions to consider:
 - *Will higher diversion goals be the norm?*
 - *Will more states ban food scraps from disposal?*
 - *Can the public procure better and include sites?*
 - *Will customers be willing to pay more for higher diversion?*

GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

31

RENEWABLE Energy
FROM WASTE
CONFERENCE

Thank you!

Harvey Gershman
President
1-800-573-5801
hgershman@gbbinc.com
www.gbbinc.com

GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

32