
 Renewable Waste INTELLIGENCE

Renewable Energy from Waste Technologies and Projects

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

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December 3, 2013

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GBB -- Quality – Value – Ethics – Results



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

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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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RENEWABLE Energy FROM WASTE

INSIDE:

- Maximizing RDF Systemsp. 25
- A Financial Source for WTEp. 29
- Dollar Emission Rules Updatep. 32
- Bergas Heats Up in Wisconsinp. 35
- Fueling Plants with Plasticsp. 38

SERVING FUEL AND ENERGY PRODUCERS // SPRING 2013

A WORKING MODEL

Greenwood Energy is producing market-friendly fuel pellets from waste in America's heartland.

Food Waste or Fuel Source?

DEPARTMENTS - CRITICAL THINKING

Harvey Gershman
OCTOBER 16, 2013

Huh... take out the garbage. It stinks! my mom used to remind me of my household chore growing up in Pawtucket, R.I., in the 1960s. We had a 30-gallon can for food waste in the back corner of our lot waiting to be collected by the city and delivered to pig farmers for feed. Neighboring Providence did it a little differently. It had to be bundled in newspapers and set out for collection, eventually to find its way to pig farmers.

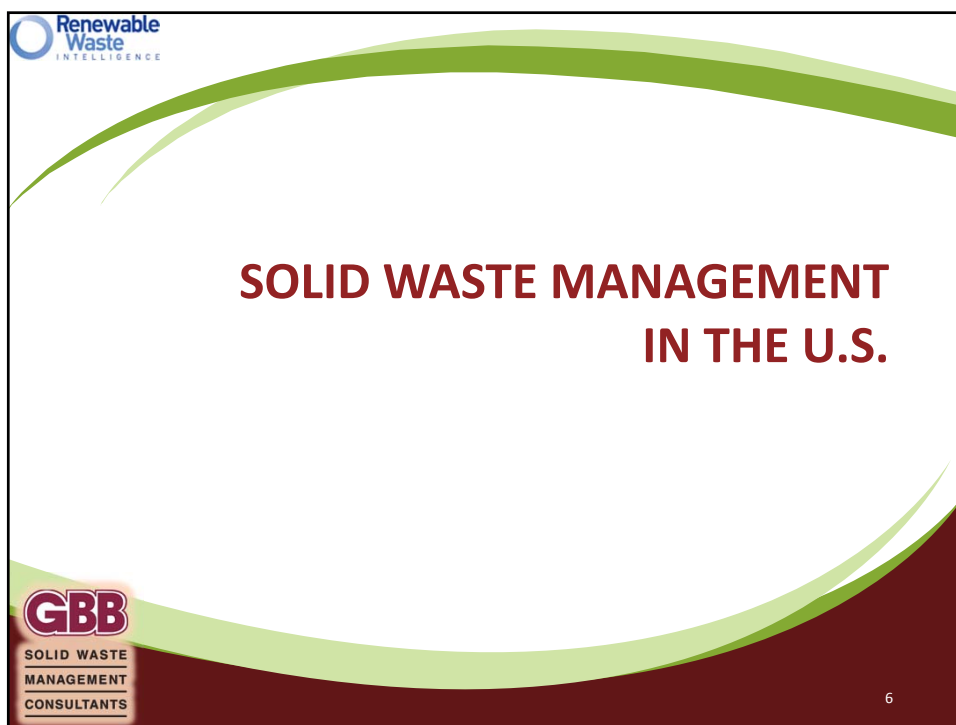
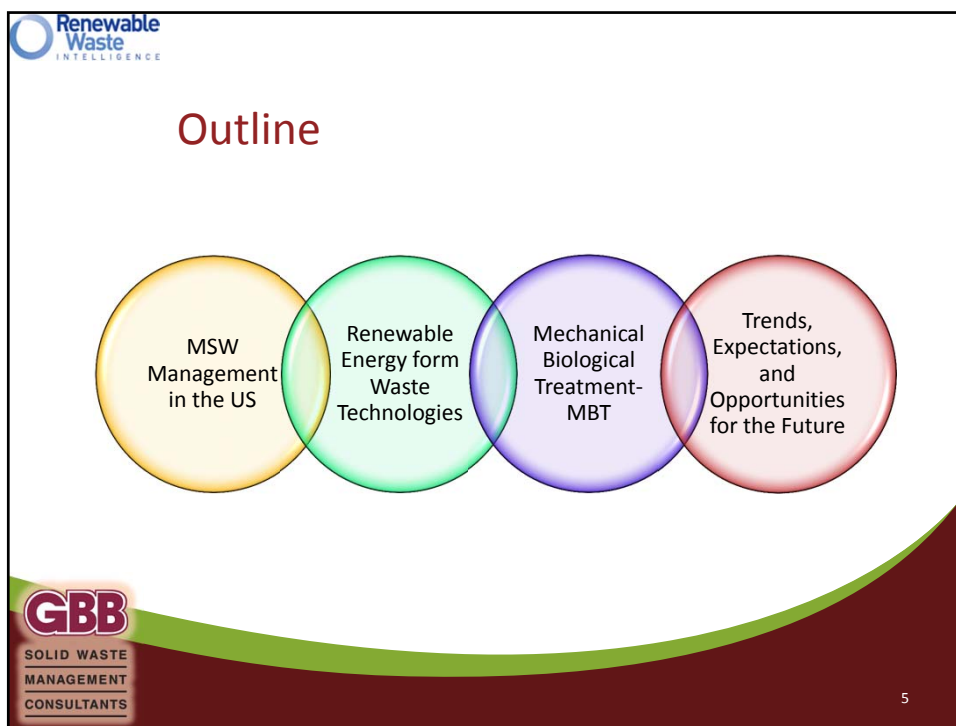
Fast-forward to the new millennium. We are serious about increasing recycling even more by going after organics. The U.S. Environmental Protection Agency reports that food waste accounts for approximately 21 percent of landfilled municipal solid waste (MSW), or around 35 million tons per year (TPY). This waste is a resource that can be used to produce bioogas, for power production or

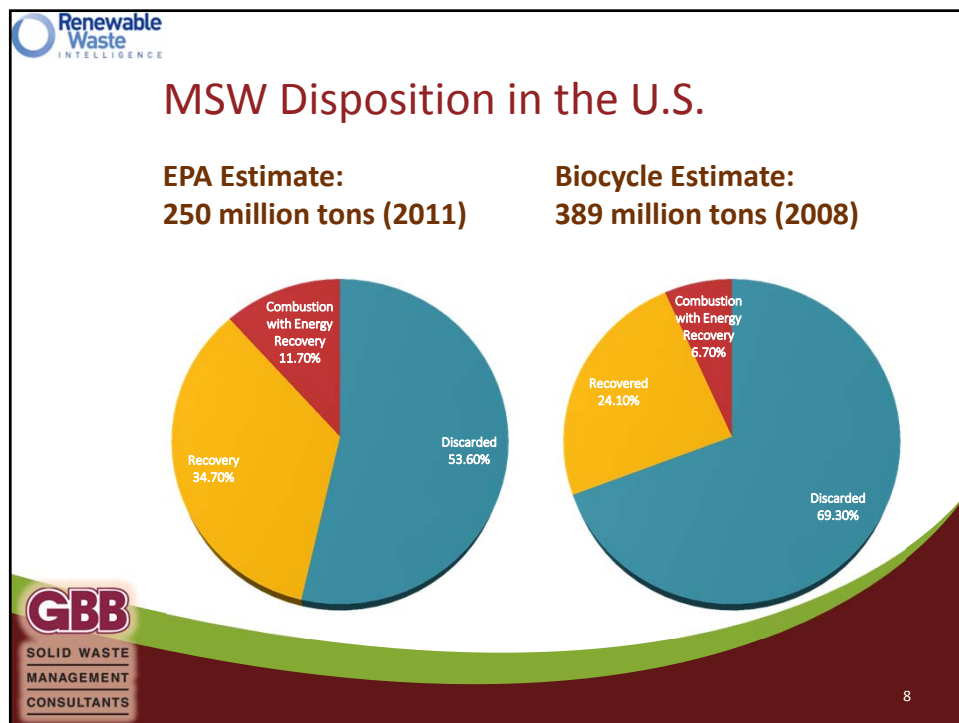
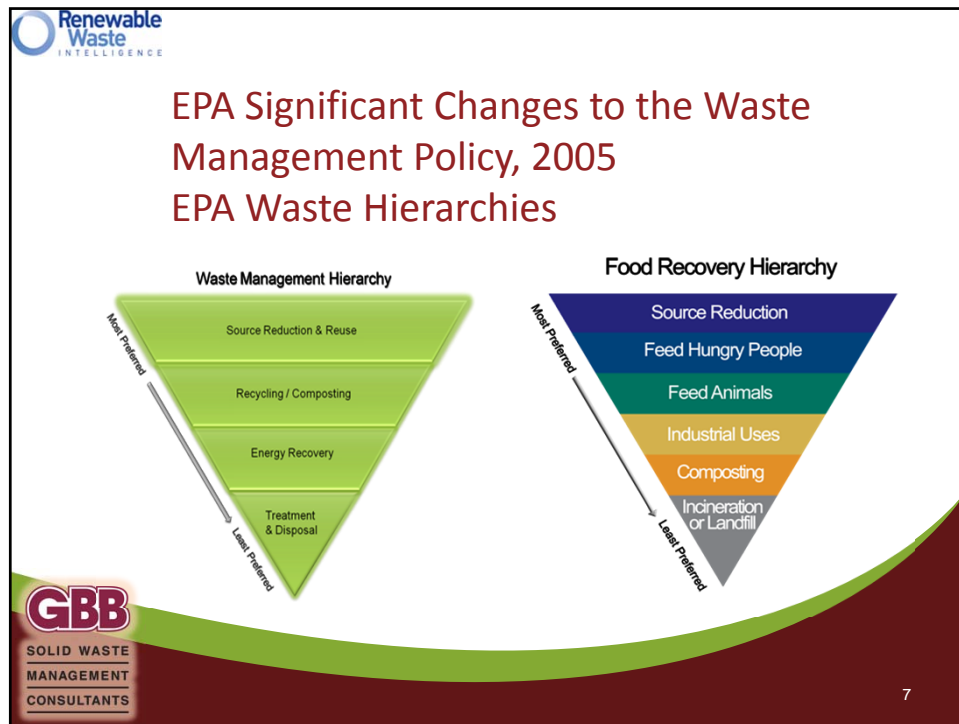


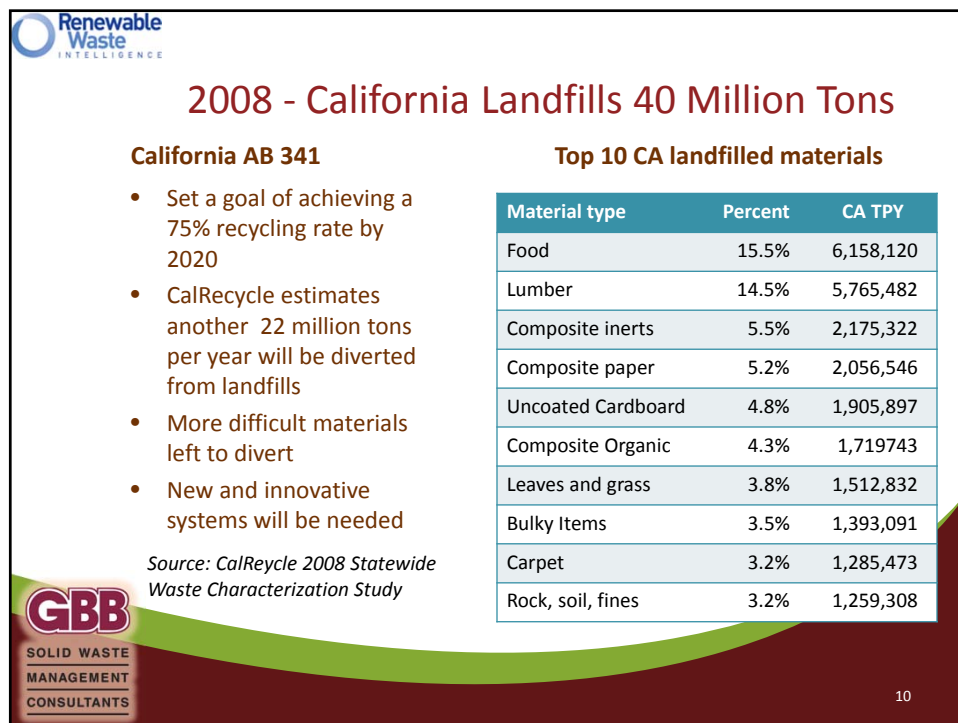
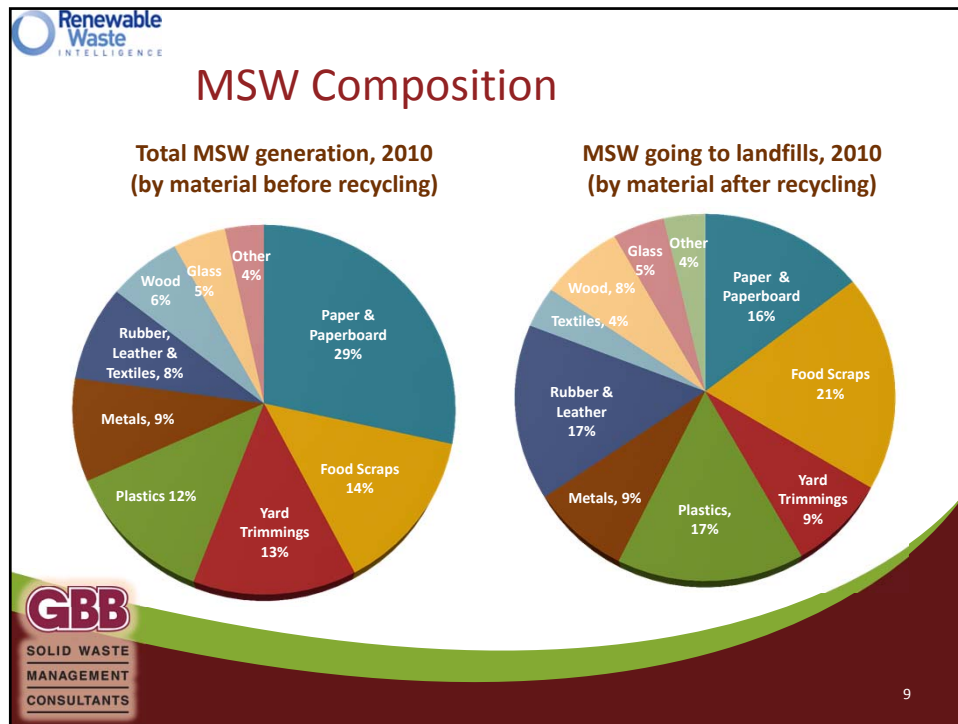
www.rewmag.com

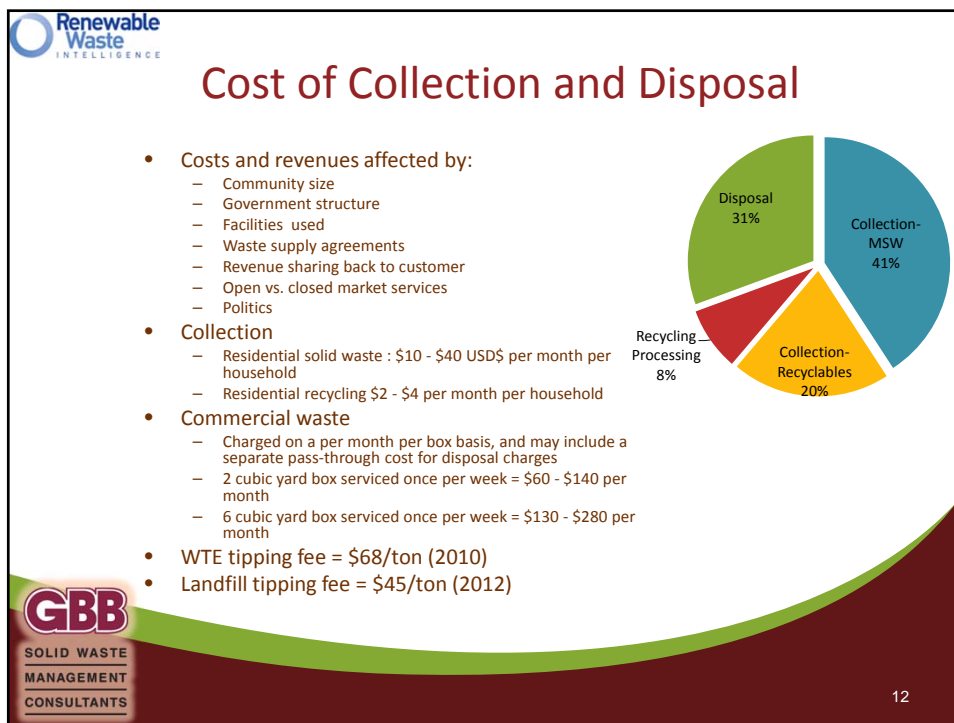
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Collection Needs to Match Up with Technologies

- *One bin – two bin – three bin - four?*
- *Which shall it be to be greener evermore?*



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California communities are changing their collection practices to further recycling

Residential Systems	Commercial Systems
1 Bin for All, like Newport Beach	Open market, most
3-cart system, like San Francisco	2-stream "wet/dry" system, like San Jose
1+1+1: Weekly recycling and composting, EOW trash, like in Portland, OR	City forces conduct collection, like Santa Monica
Dual pass 2-cart system, like Long Beach	Closed market, like San Francisco

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**RENEWABLE ENERGY FROM
WASTE TECHNOLOGIES**

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**Increased Interest in Renewable Energy
from Waste Technologies**

>579 Technology and/or
Project Development
Companies Worldwide

150 Commercial or
Demonstration Facilities
with MSW Worldwide


Contributing factors:

- Renewable energy policy
- Greater revenue potential
- Funding (grants/loans)
- Local governments desire to be greener
- GHG considerations
- Landfill waste diversion goals
- Local jobs
- Increasing collection/disposal fees


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Mass Burn Waste-to-Energy Facilities




North Broward County, FL - Wheelabrator



Alexandria/Arlington, VA - Covanta



Springfield, MA -Covanta



Baltimore, MD - Wheelabrator

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US has long-time RDF facility survivors with >20 years of operations, including RDF/Dedicated Boiler Facilities



Rochester, MA



Hartford, CT



West Palm Beach, FL



La Crosse, WI

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California Waste to Energy Facilities

Covanta Stanislaus

- Modesto, CA, began operation in 1989
- 800 TPD
- 22.5 MW sold to Pacific Gas and Electric



Commerce Refuse-to-Energy

- Commerce City, CA, began operation in 1987
- Owned/operated by Los Angeles County Sanitation District
- 360 TPD
- 10 MW sold to Southern California Edison



Southeast Resource Recovery

- Long Beach, CA, began operation in 1988
- Owned by City of Long Beach and LA County Sanitation District and operated by Covanta
- 1,380 TPD
- 36 MW sold to Southern CA Edison



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Energy Recovery and Recycling in the Pacific Northwest


Burnaby, B.C. (Greater Vancouver Regional District)

- 850 TPD since 1988
- 25 MW power
- 55 % recycling



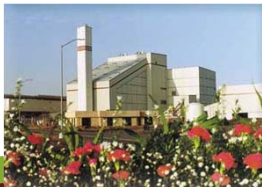
Marion County, OR

- 550 TPD since 1987
- 13 MW power
- 56.5 % recycling



City of Spokane, WA

- 800 TPD since 1991
- 26 MW power
- 47 % recycling



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Locations Advancing WTE 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
- Advancing new facilities
 - Allentown, PA – Delta Thermo Energy Inc.
 - Baltimore, MD – Energy Answers
 - City of Cleveland, OH – to be determined
 - City of Houston, TX – to be determined
 - City of Los Angeles, CA – Green Conversion Systems
 - County of Maui, HI - Anaergia
 - Frederick County, MD (NMWDA) - Wheelabrator
 - Iowa City, IO – to be determined
 - Metro Vancouver, CN – to be determined
 - Puerto Rico – Energy Answers
 - Region of Peel, Ontario, CN - Covanta

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Solid Waste Authority of Palm Beach County, FL

- New Facility - Notice of Award, April 2011
 - 3,000 TPD Mass Burn facility
 - 130 MW renewable power; enough for over 86,000 houses
 - \$668 million construction price
 - \$20.5 million first year O&M cost
 - To use advanced emissions control system
- Groundbreaking - April 2012
- Expected commercial operation 2015

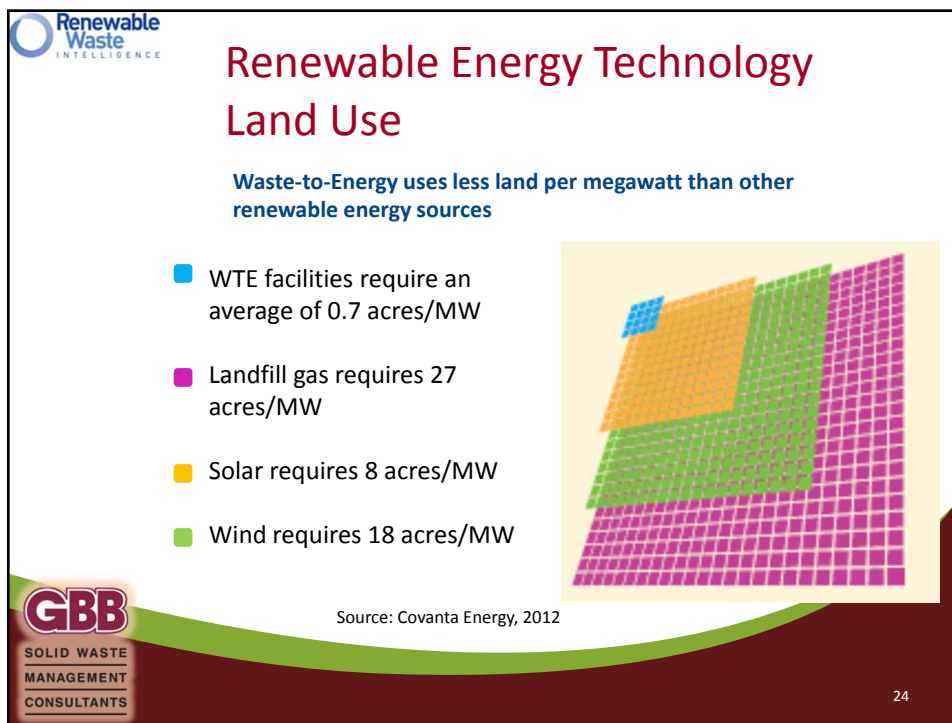
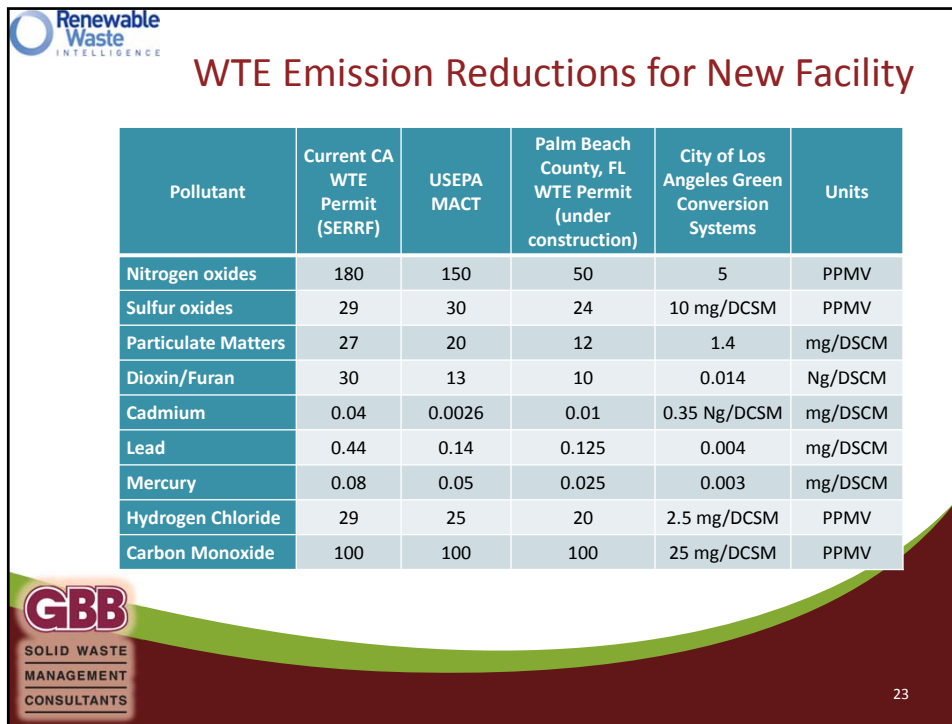


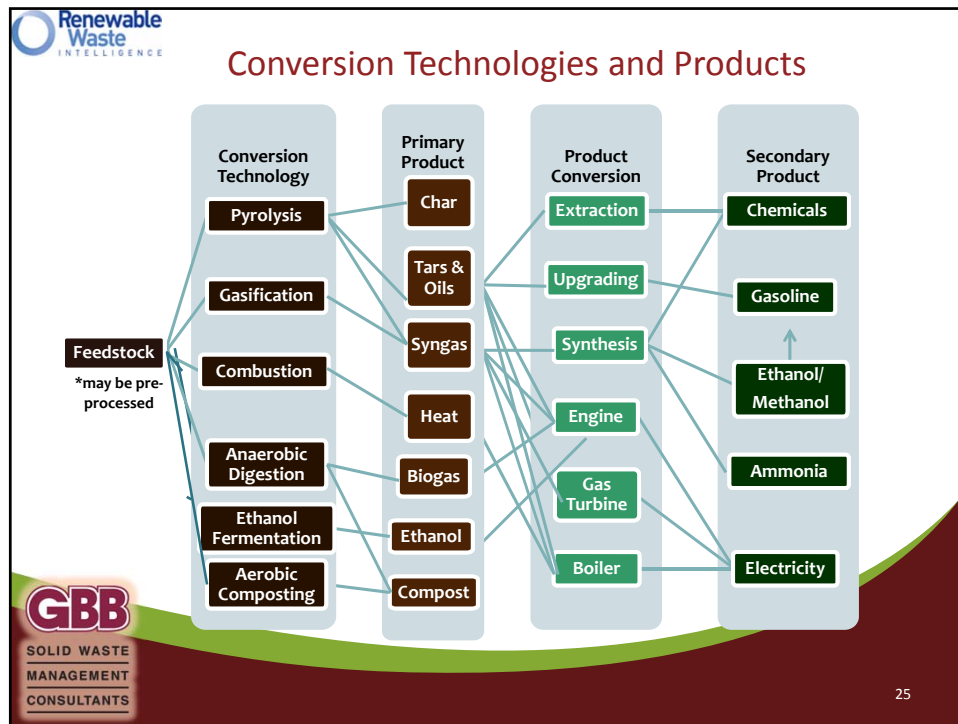
Source: Babcock & Wilcox; artist's rendering of proposed facility.



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Gasification/Fermentation

- Partial combustion in an air-controlled environment
- With fermentation, includes enzymatic digestion
- Product: Syngas for production of electricity, chemicals/ fuels (ethanol)
- Feedstocks: biomass, medical waste, demonstration-scale MSW
- Plasma gasification: a plasma arc is used as a heat source

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Logos of companies associated with Gasification/Fermentation:




- ALTER NRG
- COVANTA CLEERGAS™
- Enerkem
- Fiberight
- Fulcrum BIOENERGY
- INEOS Bio
- INT Interstate Waste Technologies
- PlascoEnergy GROUP
- SIERRA ENERGY




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Pyrolysis

- Thermal conversion in the absence of oxygen
- Non-recyclable plastics to oils, fuels


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Anaerobic Digestion



Biological degradation of organic material in absence of oxygen

- Biogas fuel for electricity and/or heat production; can be conditioned to pipeline quality
- Digestate for soil amendment, animal bedding, or rolled into a composting process



There are 13 AD plants accepting food waste in the U.S., including demonstration, pilot and commercial projects

Renewable Waste Intelligence, March 2013

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Companies in U.S. at Work with AD



OWS
Organic Waste Systems



entec
biogas USA



W2e
Organic Power



EISENMANN



BEKON
Energy Technologies GmbH & Co. KG



HARVEST
Power of We



CR&R



eci
Bio Energy



quasar
energy group



ZeroWaste
ENERGY, LLC.
Recovery and Energy with Zero Waste



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Locations Advancing Conversion Technologies

- Advancing new facilities with thermal technologies:
 - City of Taunton, MA – Interstate Waste Technologies, Inc.
 - Three Rivers Solid Waste Management. Authority - Pontotoc, MS – Enerkem
- Anaerobic digestion specific RFPs issued:
 - Humboldt Waste Management Authority, Eureka, CA
 - Montgomery, AL- under construction w/Zero Waste Energy
- Anaerobic Digestion plants under development :
 - 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 - W2E
 - City of Portland, OR - Columbia Biogas
 - Monticello, IN- Waste No Energy LLC
 - City of Charlotte, NC - Blue Sphere
 - Perris, CA - CR&R
 - Santa Barbara, CA – Mustang Renewable Power Ventures

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Technology Commercialization Examples

Location	Edmonton, Alberta, CA	Vero Beach, FL	Storey, NV
Technology	Gasification/ Catal.Conv. of Syngas	Gasification/ Ferment. of Syngas	Gasification/ Catalytic Conv. of Syngas
Developer	Energem	INEOS Bio	Fulcrum Bioenergy
Feedstock	Non-recycled MSW	Yard, vegetative, residential waste	Post-sorted MSW
Throughput (TPD)	300	450	400
Energy Products	Methanol; Ethanol	Ethanol	Ethanol; Propanol
Cost	\$80M	\$130M	\$120M
Federal Grants/Loan Guarantees	\$23.5M	\$125M	--
Start Date	2014	June 2012	2015

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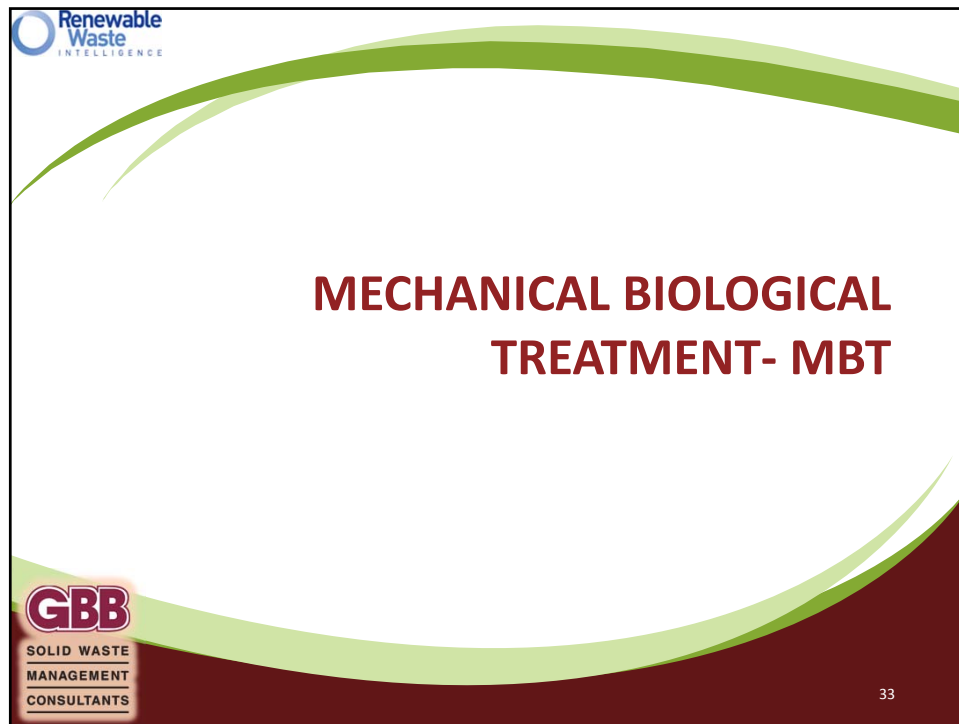
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Technology Commercialization Examples

Location	Monterey, CA	San Diego, CA	South San Francisco, CA	Sacramento, CA
Technology	Anaerobic Digestion			Anaerobic Digestion
Developer	Zero Waste Energy			Clean World Partners
Feedstock	SSO (food and yard waste)			Commercial food waste
Throughput (TPY)	~5,000	90,000	11,200	100
Energy Products	Biogas; Electricity	Electricity	CNG, Compost	Biogas; Electricity
Cost	\$1.6M	\$11.8M	-	\$12M
Federal Grants/Loan Guarantees	--			\$1.8M
Start Date	Jan 2013	Fall 2013	Q2 2014	2014

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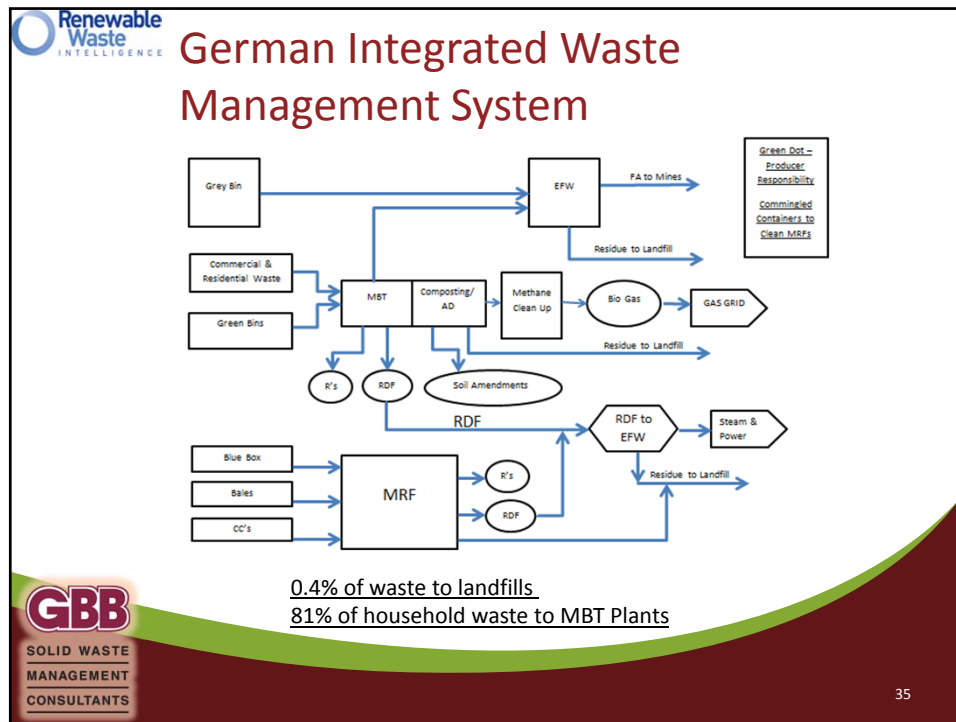
Mechanical Biological Treatment (MBT)

- Originated in Germany in 1999 (now 36 operating MBTs)
- 330 plants in EU most of them in: Germany, Austria, Italy, Switzerland and the Netherlands, while UK is catching up
- MBT scope:
 - Mechanical Sorting of recyclables and organics
 - Food scraps and green waste are processed through anaerobic digestion and composting units
 - Dry materials into a high BTU fuel fraction as RDF
- RDF key: 54% to dedicated boilers, 16% to coal plants, 11% to cement kilns and 19% to other users

Source: Mechanical Biological Treatment of Municipal Solid Waste, UK Department for Environment Food & Rural Affairs (DEFRA), February 2013


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Hannover Energy from Waste Facility... on the Way to the Airport



...where the rest of the waste goes!!
<http://www.eew-energyfromwaste.com/en/unsere-standorte/hanover.html>

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TRENDS, EXPECTATIONS, AND OPPORTUNITIES FOR THE FUTURE

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What is coming to America for the 60% Going to Landfills?

- Organics treated as recyclables
 - Co-composting and anaerobic digestion ready for prime time
- Engineered fuels (EF) to non-renewable fuels
 - Sourced from MSW and industrial waste streams
- MBT
- Conversion technologies for higher valued liquid fuels and chemicals
 - MSW -- watch what is coming on line closely
 - Mixed plastics – almost ready for prime time
- Proven WTE; but depends on:
 - Energy economics
 - Political will

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Project Building Blocks

Regulatory impetus and incentives	Limited or high disposal costs	Waste Supply	Markets
Site with good logistics that can be permitted	Landfill for ash and by-pass	Contractor with resources and proven technology	Capital
Ability to pay service fees	Financeability	Compatibility with High Level of Recycling	Political Will


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Project Development

- Address the “building blocks” with resources
- Match collection with processing/recovery
- Decide on ownership and risk posture
- Select contractor and technology
 - Procurement process vs. developer “Valley of Death”
- Developing public knowledge and acknowledgement of need
- Have patience....these projects may take years to get to project financing



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Engaging the Public

Fighting emotion and bias with logic and science


- Engage public relations support
- Conduct focus groups
- Be ready for anti-environmental terrorism

Solid Waste Authority of Palm Beach County response to the Florida Sierra Club

- http://www.swa.org/pdf/SWAPBC_GBB_Final_Report_050311_w-Atchs.pdf




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Legislation and Regulations

- *Will more states ban food scraps from disposal?*
- *Will U.S. landfill disposal ever be as expensive as in EU and UK?*
- Permitting needs to be streamlined/rational
- Several states stepping up recycling/diversion goals and Producer Responsibility (EPR)
- EPA needs to help lead the way with RFS and EF rules
- ***Waste is very recyclable and it is also very renewable!***




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Examples of State Regulatory Initiatives

<p>State goals to drive action:</p> <ul style="list-style-type: none"> • CA- 75% of MSW & 50% organic waste by 2020 • WA- 50% recycling met in 2011; eliminate yard waste from landfills by 2012; • OR- 50% recovery goal met in 2010; Material management 2050 Vision; 	<p>States with bans on food waste from commercial generators:</p> <ul style="list-style-type: none"> • MA 2014 • VT 2014 (large generators); 2020 (all generators) • CT 2014 (large generators); 2020 (all generators)
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Merging Waste Management and Climate Change Policies in California

- CARB & CalRecycle formed a joint task force to coordinate solid waste and climate change initiatives
- Waste Management Sector Implementation Plan goals
 - 20-30 MM TPY CO₂e reduction by 2020
 - GHG emissions to net zero by 2035
- Energy recovery of non-recyclable waste seen as a viable greenhouse gas reduction tool






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Select California Waste Management Policies Under Consideration

Category	Action	Timeframe
Funding & Incentives	Establish feed-in-tariffs for in-state renewable energy	2013-2020
Funding & Incentives	Evaluate MSW thermal technologies to receive renewable energy credits	2014-2015
Funding & Incentives	Obtain cap & trade funding for compost and anaerobic digestion projects, recycling and remanufacturing facilities	2013-2020
Research	Research for safe and beneficial uses of MSW conversion ash	Through 2025
Cap and trade	Determine status of MSW thermal facilities in cap and trade	Late 2015
Cap and trade	Review landfills for inclusion in cap and trade	Late 2014
Regulatory / Statutory	Consider actions moving toward inert only landfilling practices	Through 2020

Source: September 17, 2013 Waste Management Sector Implementation Plan



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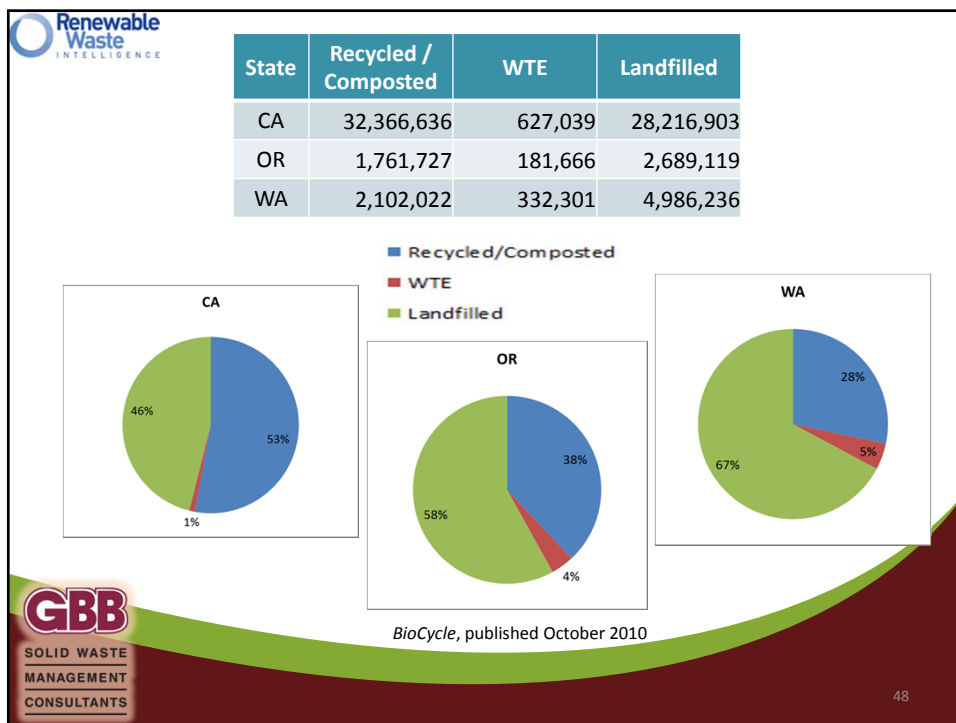
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Engineered Fuel for Significant Landfill Diversion in California

- In California, 139 “intermediate processing” facilities accept “aggregated materials” of some kind for “material recovery”
- Of the 139 facilities:
 - 56 (or 40 %) process “mixed solid waste”
 - 54 (or 39 %) process “mixed inerts/C&D”
- These facilities can be retrofitted to produce Engineered Fuel
- Use Engineered Fuel in:
 - Existing Cement Kilns
 - Existing Biomass and Coal Boilers
 - New Dedicated Boilers/WTE facilities permitted with MACT

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Recycling and Power or Fuel Production Potential from Landfilled Waste

- Additional recyclables recovered @ 10 percent of tons
- 1,000 TPD of MSW (340,000 TPY) = 20 MW
- 1 Ton of MSW = 60 gallons ethanol

State	Landfilled (Tons)	Potential			
		Materials Recovery (Tons)	Electricity (MW)	or	Ethanol (MG)
CA	28,216,903	2,821,690	1,660	or	1,693
OR	2,689,119	268,912	158	or	161
WA	4,986,236	498,624	293	or	299

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A Realistic & Ultimate Goal:

- Fully Integrated and Efficient Waste Management System with Significant Diversion (Recycling) and WTE-WCT
- ...in public-private partnerships!
- *...for more jobs, better environment, and energy independence for America!*

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Questions and comments?

Thank you!

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

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