

**RENEWABLE Energy**  
FROM WASTE  
CONFERENCE

# Update on Renewable Energy From Waste Technologies

West Palm Beach, FL

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

November 18, 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





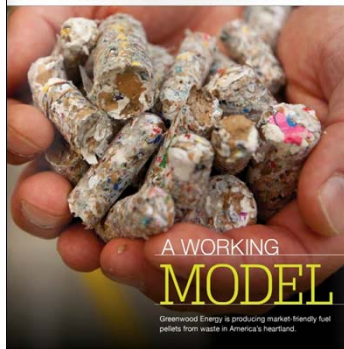
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- Fueling Plants with Plastics .....p. 38



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 Gorchman  
OCTOBER 16, 2013


Halfway. Take out the garbage. It stinks! My mom used to remind me of my household doing growing up in Providence, R.I., in the '50s. We had a 35-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 food. Neighboring Providence did it a little differently. It had to be handled 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 biogas, for power production or



[www.rewmag.com](http://www.rewmag.com)





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NOVEMBER 18-20 2013 )) WEST PALM BEACH, FLORIDA

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## Outline

MSW Management in the US

Renewable Energy form Waste Technologies

Federal and States Incentives and Support

Trends and Expectations for the Future

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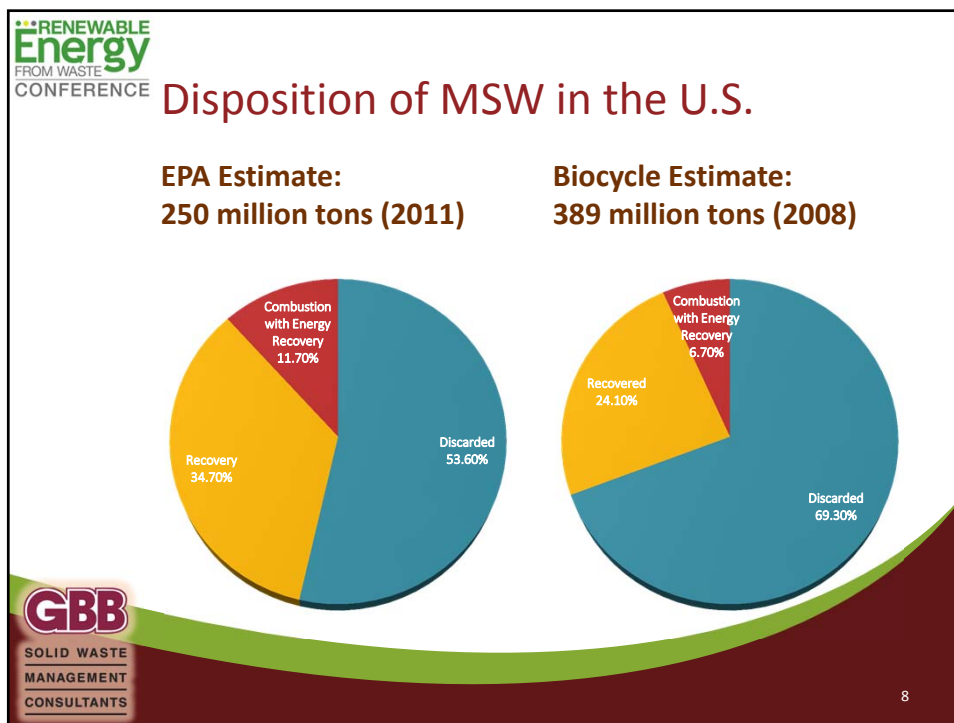
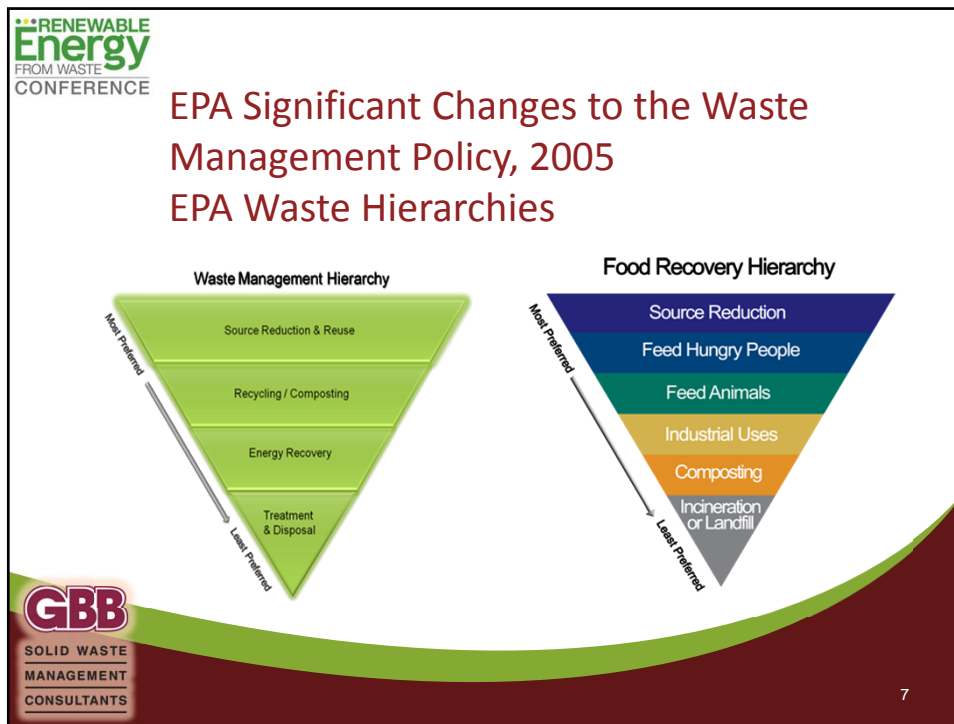
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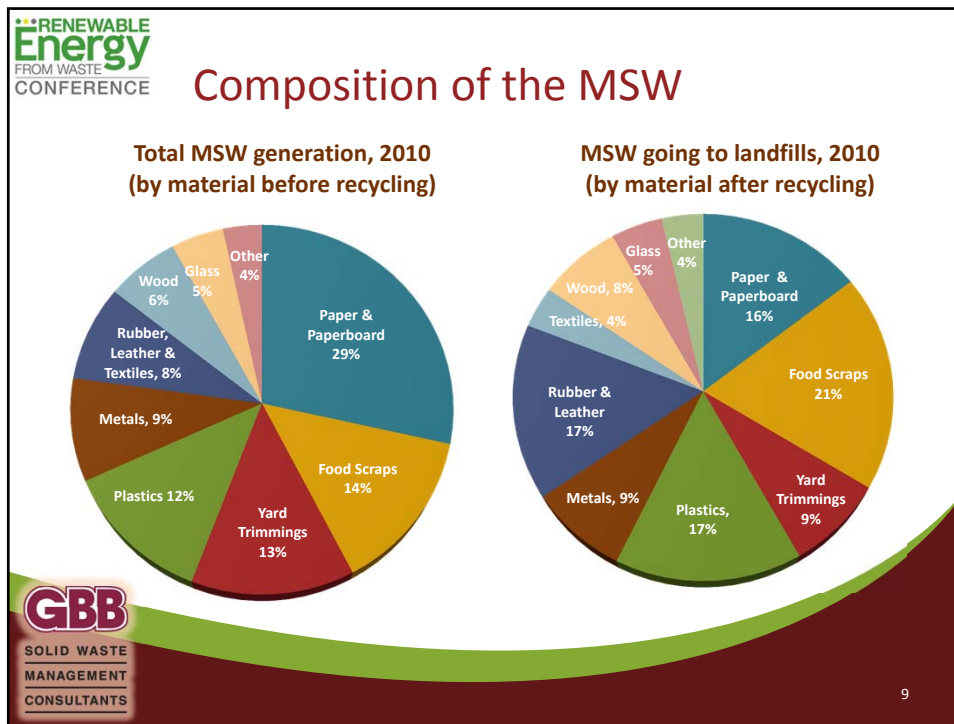
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# SOLID WASTE MANAGEMENT IN THE U.S.

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## U.S. Waste Management Infrastructure

Technology	Operating Plants
Material Recovery Facilities (MRF)	586
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	No data
Landfills	1,908

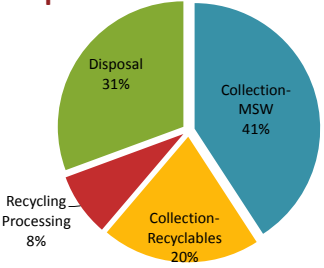
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## Cost of Collection and Disposal

- Costs and revenues affected by:
  - community size
  - government structure
  - politics
  - facilities used
  - waste supply agreements
  - Revenue sharing back to customer
- Collection
  - Residential solid waste : \$10 - \$40 USD\$ 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
- WTE tipping fee= \$68/ton (2010 data)
- Landfill tipping fee = \$45/ton (2012 data)



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## Future Collection System Changes

- Changes to residential services
- Changes to commercial services
- Adding food scraps




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## Collection Services – Many Choices

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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## Curbside Collection of Food Scraps in the U.S.

183 communities offer curbside collection of residential food scraps

18 states	2.55 million households	726,250 tons in 2012*
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\* 79% of programs reporting

Source: BioCycle Magazine, March 2013

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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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## 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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## 150 Conversion Companies Operating either Commercial or Demonstration Facilities with MSW Worldwide

- 67 Anaerobic Digestion
- 48 Gasification
- 19 Plasma Gasification
- 16 Pyrolysis

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

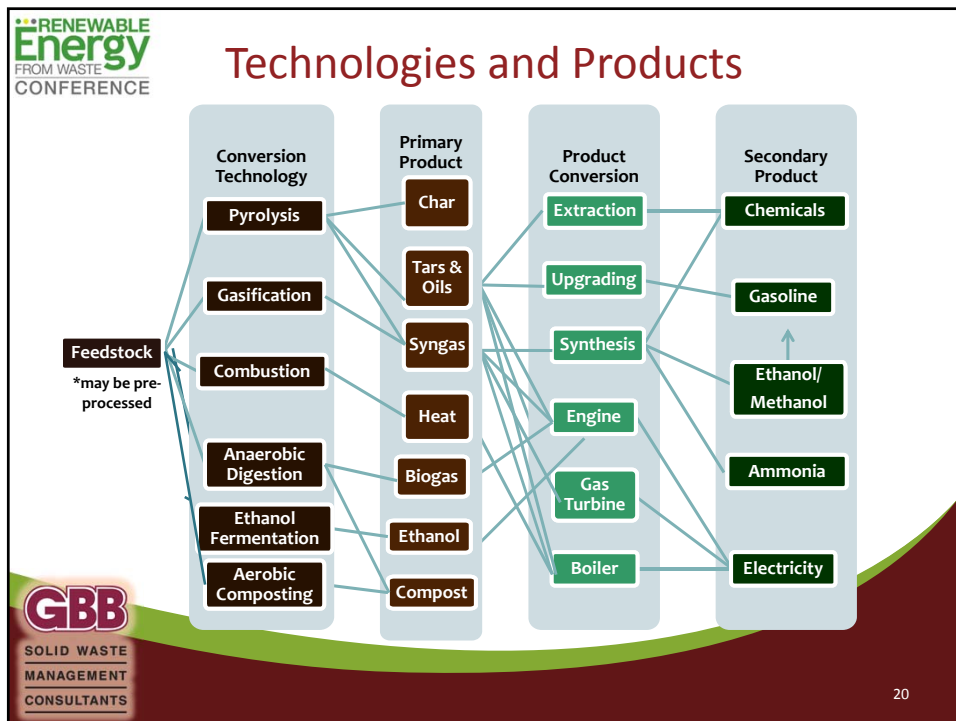
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# RENEWABLE ENERGY FROM WASTE TECHNOLOGIES

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## Technologies Processing Mixed MSW

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## WTE Plants in the U.S.

Technology	Operating Plants	Daily Design Capacity (TPD)	Annual Capacity <sup>(1)</sup> (Million Tons)
Mass Burn (see note)	65	71,354	22.1
Modular	9	1,342	0.4
RDF -Processing & Combustion	10	15,428	4.8
RDF -Processing Only	5	6,075	1.9
RDF -Combustion Only	5	4,592	1.4
Total U.S. Plants <sup>(2)</sup>	94	98,791	30.6
WTE Facilities	89	92,716	28.7


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**Note:** A few more WTE (mass-burn plants have recently announced closings, typically at end-of-term of initial 20-year debt and service term.


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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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## 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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## Gasification


- Partial combustion in an air-controlled environment
- 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

**COVANTA CLEERGAS™**

 Enerkem

 Fulcrum  
BIOENERGY

 INEOS Bio

 PlascoEnergy  
GROUP

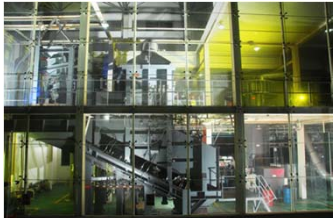
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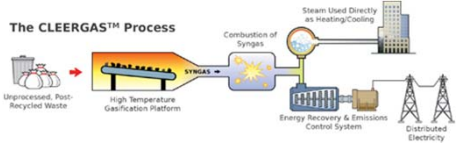
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# COVANTA CLEERGAS™

- Unprocessed, post-recycling waste
- Gasification with Syngas combustion
- Commercial Scale Demonstration Unit- Tulsa, Oklahoma (Unit 3 of their WTE plant)- 350 TPD, runs since July 2011
- Commercial system- 300 TPD modular units



**The CLEERGAS™ Process**



Unprocessed, Post-Recycled Waste → High Temperature Gasification Platform → SYNGAS → Combustion of Syngas → Steam Used Directly as Heating/Cooling → Energy Recovery & Emissions Control System → Distributed Electricity


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# INEOS Bio

- Gasification followed by biocatalyst fermentation and distillation
- MSW to Bioethanol (2014)
- 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 power



Indian River BioEnergy Center

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**Enerkem**

- Commercial scale demonstration facility in Westbury, CA (since 2009, 1.3 million gallons/year)
- Pilot plant in Sherbrooke, CA (since 2003)
- On going work on commercial facilities:
  - Edmonton, Alberta- 10 million gal/year, start-up 2013
  - Pontotoc, Mississippi & Varennes, Québec, each 10 million gal/year (MRF construction in 2015)



Edmonton facility under construction-  
September 2013

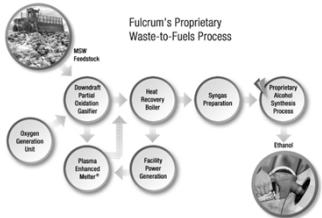

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**Fulcrum BIOENERGY** **InEneC** Technology partner


- Sierra BioFuels- commercial plant under construction in City of McCarran, NV
  - 10.5 million gal/year
  - Permitting completed
  - Feedstock and off-take agreements completed
  - USDA \$105 million loan guarantee in August 2012
  - Secured \$175 million for construction as of Nov 2012
  - Expected startup in 2015


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- Gasification followed by plasma torches to refine the syngas product
- Plants:
  - Commercial-scale demonstration, 94 TPD- Train Road, Ottawa, CA
  - Recently signed contract with the City of Ottawa to build new 3-line plant to process 109,500 t/year of the city MSW



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## Fermentation

- Significant pre-processing requirements
- Chemical reaction of decomposition of complex organic molecules to simple sugars coupled with fermentation and distillation
- Feedstock: organic fraction of the MSW
- Products: methanol and ethanol

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Fiberight

novozymes Rethink Tomorrow



Fiberight High-Solids Pulping



Ethanol fermentation Feedstock- MSW

- Demonstration plant in Lawrenceville, VA- opened October 2012
- Blairstown, IA- 6 mill gal/year, expected to be fully operational in summer 2014.
- Has site control for first commercial-scale biofuel plant in Elkridge, MD
- Recent contract with City of Marion, Iowa

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TMO Blairstown, Iowa Layout 33

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## Technologies Processing Mixed Non-Recyclable Plastics


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## Pyrolysis


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




**agilyx**



**Plastic2Oil**



**CLIMAX**  
GLOBAL ENERGY







**VADXX ENERGY**

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## Technologies Processing Mixed Non-recyclable Plastics

Company	Technology	Product	Status	Featured plants in N. America	No. of commercial plants
 agilyx	Pyrolysis	Crude oil & combustible gas	commercial	Demo: Tigard, OR, 10 TPD Commercial: Hennepin County, MN; Lithia Springs, GA, Manatee County, FL	3
 CLIMAX	Microwave Pyrolysis	Crude wax & combustible gas	demo	Under construction: Blackville, SC 20 TPD	1 under construction
 Plastic2Oil	Catalytic Pyrolysis	Crude oil & combustible gas	demo	demo: Niagara Falls, NY (45TPD)	none
 VADXX	Pyrolysis	Crude oil & combustible gas	Pilot	Pilot and commercial under development: Akron, Ohio	none

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## Technologies Processing Organics


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## Anaerobic Digestion (AD)

- Biological degradation of organic material in absence of oxygen
- Results are biogas and digestate:
  - Biogas can be used to produce electricity and/or heat or can be conditioned to pipeline quality
  - Digestate can be used as a soil amendment, animal bedding, or feedstock for composting



Kroger AD plant, California

There are 19 AD plants accepting food waste from commercial, institutional and industrial sources in the U.S., including demonstration, pilot and commercial projects.

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GBB, June 2013

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**Anaergia**  
*Redefining Recovery*

- International AD company (North America, Europe and Asia)
- Offer technology and serve as project developer
- Proprietary AD technologies:
  - TRITON™ Two stage AD;
  - OMNIVORE™ retrofit for co-digestion-
- Approx. 1600 biogas projects with most of them at WWTP worldwide
- Projects in the US:
  - Michigan State University- under construction 16,800 TPY capacity of commercial food scraps and manure;
  - County of Maui, HI- under development, mixed waste processing with AD unit system



AD plant in Hungary

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**Clean World Partners**

**clean world PARTNERS**

- Founded in 2009 in Gold River, CA
- Three proprietary anaerobic digestion systems developed at UC Davis:
  - Anaerobic Phased Solids (APS) Digester System
  - Dynamic Biofilm Reactor (DBR)
  - High Rate Digestion (HRD)
- Projects:
  - American River Packaging- 2,900 TPY of food Processors Waste
  - Sacramento's South Area Transfer Station (with Atlas Disposal)- 10,000 TPY currently upgrading to 40,000 TPY of commercial food waste
  - UC Davis (demonstration plant since 2002)- 20,000 TPY of food waste



Sacramento plant



US Davis Demo Plant


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## FEED Resource Recovery Inc.

- US company founded in Boston 2007
- AD for Food Processing Industry
- Kroger Project at Ralphs/Food 4 Less distribution facility in Compton, CA- operating
  - 55,000 TPY (150 TPD)
  - Food waste from Kroger distribution center



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## HARVEST™ Power of We™

- US company founded in 2008 in Waltham, MA
- Licensed European AD technologies
- More than 10 composting plants
- Three AD plants
  - Richmond Energy Garden, Canada- 40,000 TPY of food and yard waste
  - London Ontario Energy Garden, Canada- 65,000 TPY of mixed organic waste
  - Energy Garden in Bay Lake, FL- under construction- 100,000 TPY of Mixed organic waste



Richmond Energy Garden



London Energy Garden

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**quasar**  
energy group

- Cleveland, OH based; est. 2006
- Initially European technology; now, more than 98% of components purchased from US and more than 76% of those from Ohio
- Integrated Anaerobic Digestion System (iADs) is patent pending technology developed at Ohio State University
- Projects:
  - 8 operating commercial AD projects in the US
  - 3 commercial projects under construction

Cleveland, Ohio- 42,600 TPY of Biosolids, FOG and food waste



Wooster, OH- 20,000 TPY, Pumpable and high solids organic biomass



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**ZeroWaste™**  
ENERGY, LLC.  
*Recovery and Energy with Zero Waste*

- US company based in Lafayette, CA
- Dry Anaerobic Digestion licensee for:
  - KompoFERM
  - SmartFERM
- Plants:
  - Monterey Regional Waste Management District- 5,000 TPY of food and green waste
  - City of San Jose (start-up Dec. 2013)- 90,000 TPY of commercial food waste
  - 3 plants under construction and development

Monterey, CA



San Jose, CA



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## Landfill Gas

- Landfill gas (LFG) is a by-product of the decomposition of MSW:
  - ~ 50% methane (CH<sub>4</sub>)
  - ~ 50% carbon dioxide (CO<sub>2</sub>)
  - <1% non-methane organic compounds (NMOCs)
- For every 1 million tons of MSW:
  - ~ 0.8 MW of electricity
  - ~ 432,000 cubic feet per day of LFG
- MSW landfills are the third-largest source of human-related methane emissions in the U. S.


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## 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
- As of July 2013, there are 621 operational LFG energy projects in the U.S.
- EPA estimates an additional 450 MSW landfills could turn their gas into energy
  - Enough to power 500,000 homes



Maui, HI LFG System

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## Locations Advancing Technologies

- Example of Locations advancing new facilities with thermal technologies:
  - City of Taunton, MA – Interstate Waste Technologies, Inc.
  - Three Rivers Solid Waste Management Authority - Pontotoc, MS – Enerkem
  - City of Los Angeles, CA – Green Conversion Systems
- 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

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## Locations Advancing LFG to Fuels Projects

- City of Denton, TX uses LFG to fuel a 3 million gal/year biodiesel production facility
- Los Angeles, CA converts LFG into CNG to fuel landfill equipment (Puente Hills LF)
- Orange Co, CA – first commercial LFG-to-LNG facility online Jan. '07 – used in county waste trucks (Frank R. Bowerman LF)
- Central LF, CA plans to convert LFG to CNG to fuel Sonoma County school buses
- Franklin Co, OH uses LFG to produce methanol as a feedstock for biodiesel and a separate CNG plant
- Waste Management, Inc. in CA produces 10-20K gal LNG per day for garbage trucks

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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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## MECHANICAL BIOLOGICAL TREATMENT- MBT EUROPEAN EXPERIENCE

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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
- Includes:
  - 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 is the key to MBT, with 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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## The EU Market for MBT Plants?

- The EU Landfill Directive especially restricts the landfilling of biodegradable waste and stipulates a pre-treatment of municipal wastes
- In terms of this type of treatment, MBT technology is currently the only alternative to waste incineration, which in many cases is not favored politically
- At the same time, MBT plants benefit from the growing demand for the high-grade refuse-derived fuel they produce
- in times of increasing energy prices, it has become an in demand fuel for cement mills, RDF power plants or even coal-fired power plants

Source: by [ecoprog GmbH](#)...December 1, 2011

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## Example of the MBT Plants in Europe



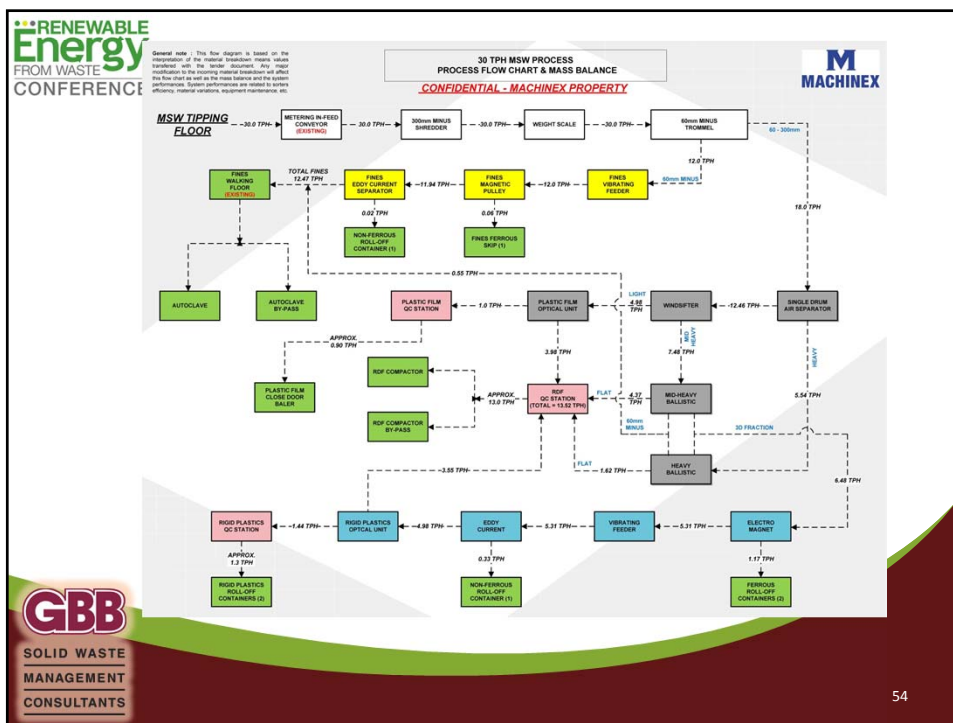
Avonmouth, UK

Veolia - Southwark UK

Hanover, Germany

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## MBT Equipment

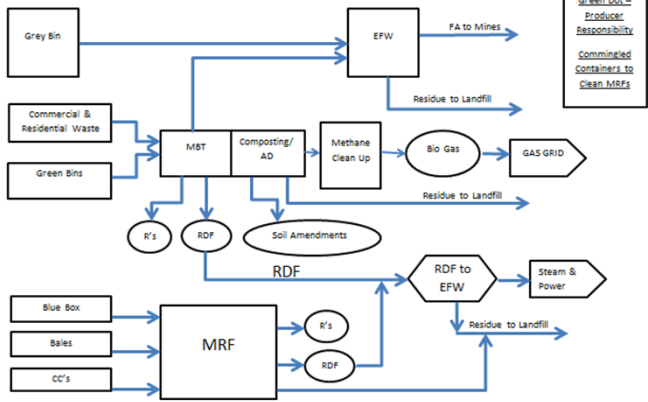


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## German Integrated Waste Management System



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0.4% of waste to landfills  
81% of household waste to MBT Plants

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## Facilities Tour – June 14, 2013

- **Waste Management Centre - Pohlsche Heide**
  - MBT with partial flow anaerobic dry digestion and composting and tunnel anaerobic dry digestion plant for organic waste
  - See: <http://www.pohlsche-heide.de/english/index.php?head=home&nav=company&um=home&cont=company>
  - Demonstration site for CREED
- **Small sized industrial RDF combined heat and power (CHP) plant - Minden**



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## Waste Management Centre – Pohlsche Heide

- Some facts:
  - Convenience Center
  - Mixed waste processing facility for materials and RDF
  - Yard waste processing for mulch and composting
  - Anaerobic digestion for wetter organics for CHP and biogas
  - Landfill
  - Approximately 200,000 tons per year handled here



Scale House Entrance

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## Waste Management Centre – Pohlsche Heide



Mixed waste processing  
equipment inside

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The slide features two photographs. The left photograph shows the exterior of a large industrial building with green and grey corrugated metal siding and a large open bay door. The right photograph shows the interior of the facility, which is a complex, multi-level structure with various pieces of machinery, including conveyor belts and large processing units, illuminated by bright overhead lights.

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## Waste Management Centre - Pohlsche Heide



More Mixed Waste Processing  
Facility Equipment

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This slide contains two photographs showing detailed views of the waste processing equipment. The left photograph is a close-up of a large green hopper or feeder system supported by a metal frame. The right photograph shows a worker in an orange safety vest and a white hard hat standing in a walkway between levels of the facility, looking at a mobile device. The background shows more of the complex machinery and structural steel.

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## Waste Management Centre - Pohlsche Heide



And, more mixed waste processing; RDF load in the middle; and outside storage

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## Waste Management Centre - Pohlsche Heide



Inside composting areas for organics

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## Waste Management Centre - Pohlsche Heide




AD Mixer "Concrete" Pump and Mixer Room




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## Waste Management Centre - Pohlsche Heide



AD chamber discharge; think of this as the bottom of the vats that make beer!



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### Waste Management Centre - Pohlsche Heide



Biogas clean up and storage

Biogas product storage prior to discharge into the gas grid

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### Small sized industrial RDF CHP plant - Minden



Receiving doors, office, furnace area, and ash boxes – left to right.


RDF being delivered.

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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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## LEGISLATION UPDATE

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## Government support programs

- USDA Rural Development- grants and loan guaranteed through BioRefinery Assistance Program
- Energy Policy Act of 2005- DoE's Loan Guarantee Program
- Near Term Energy Efficient Technologies (NTEET) Program- DoD program
- Rural Energy for America Program (REAP)- Renewable Energy System and Energy Efficiency Improvement Guaranteed Loan and Grant Program

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## Renewable Energy Incentives

- Federal
  - Renewable Electricity Production Tax Credit (PTC)
    - Corporate Tax Credit for commercial and industrial sector
  - Business Energy Investment Tax Credit (ITC)
    - Corporate Tax credit for commercial, industrial, utility and agricultural sectors
- State
  - Feed-In-Tariff
  - Renewable Energy Portfolio Standards (30 states and DC have mandated RPS; 7 states have voluntary - January 2012 data)
  - Potential for Municipal grants and loans

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## Examples of State Regulatory Initiatives

**State goals to drive action:**

- 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;

**States with bans on food waste from commercial generators:**

- MA 2014
- VT 2014 (large generators); 2020 (all generators)
- CT 2014 (large generators); 2020 (all generators)

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# RENEWABLE ENERGY FROM WASTE PROJECT DEVELOPMENT

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### Summary of Technologies and Risks/Liabilities

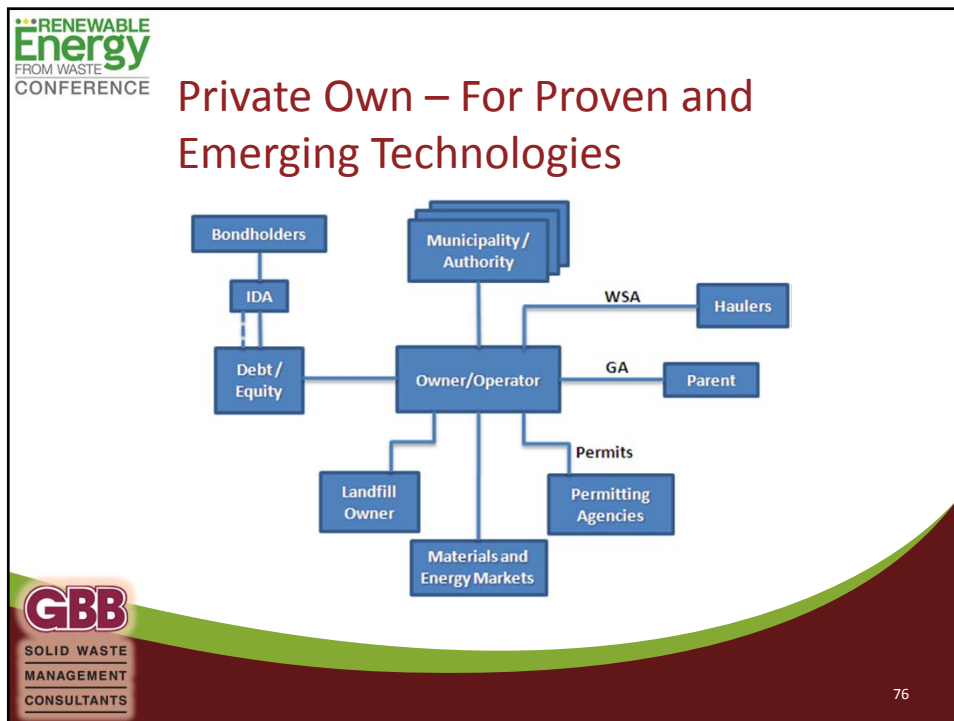
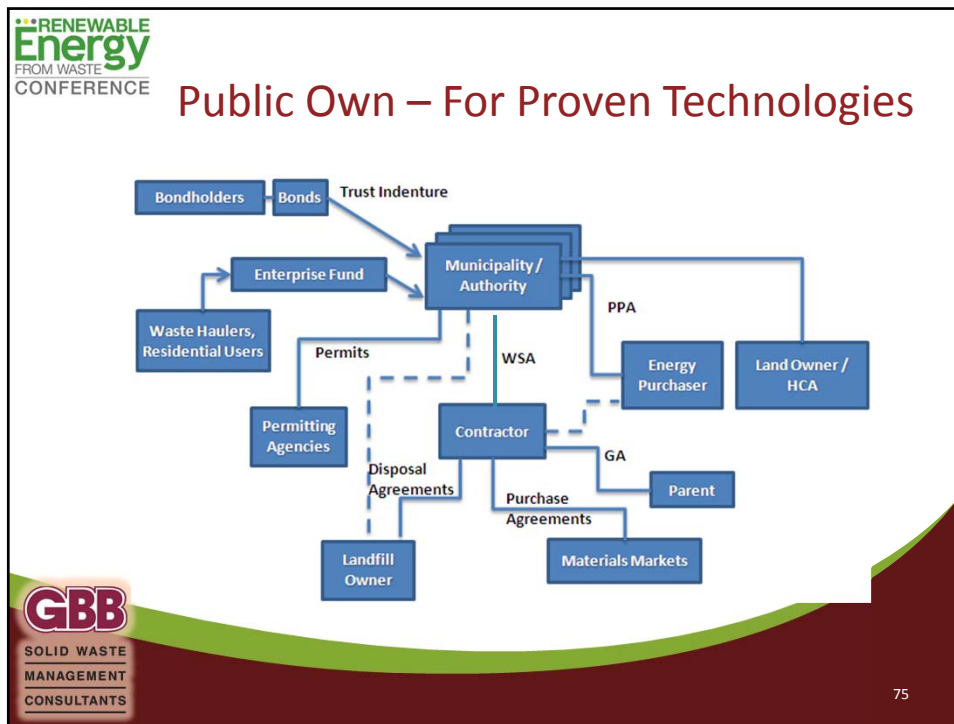
Source: Gershman, Brickner & Bratton, Inc. August 2012

Technology	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
Mixed-Waste Composting	Previous large failures; No large-scale commercially viable plants in operation; subject to scale-up issues	Moderate to high
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
Chemical Decomposition/	Technology under development; not a commercial option at this time	High

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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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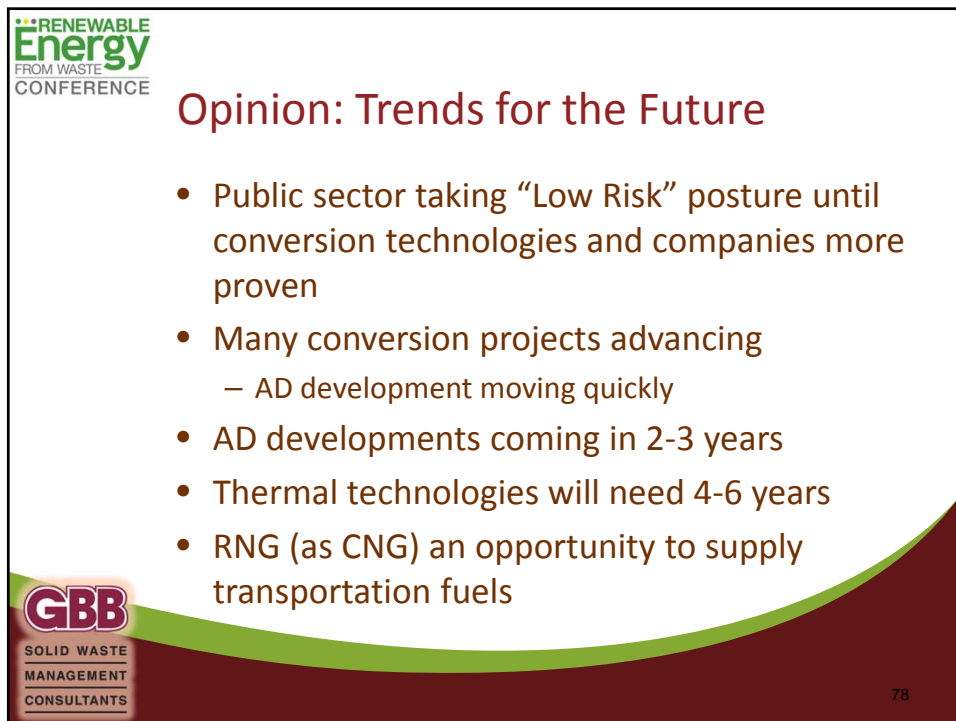


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## SUMMARY AND TRENDS FOR FUTURE

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### Opinion: Trends for the Future

- Public sector taking “Low Risk” posture until conversion technologies and companies more proven
- Many conversion projects advancing
  - AD development moving quickly
- AD developments coming in 2-3 years
- Thermal technologies will need 4-6 years
- RNG (as CNG) an opportunity to supply transportation fuels

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## Opinion of Trends for Future (Cont'd)

- Continued recycling industry demand for materials
- More mixed waste processing (MBT is on the go!)
  - Added recycling side-benefit
  - Most conversion technologies require pre-processing for feedstock preparation
  - Electric utilities may become a player for RDF
  - CNG from AD projects and municipal fleet use (Montgomery, AI)
- '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 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@gbbinc.com](mailto:hgershman@gbbinc.com)  
[www.gbbinc.com](http://www.gbbinc.com)

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