

***The Latest Updates on
Waste-to-Energy
and Conversion Technologies;
Plus Projects Under Development***

**WTE Development and Finance Summit
January 2013**

By

**Stephen Simmons, Principal Associate
Gershman, Brickner & Bratton, Inc.**



Outline*

- Introduction
- Selected Waste Conversion Technology companies and their projects
 - Technologies processing MSW
 - Technologies processing mixed non-recyclable plastics
 - Technologies processing organic waste
- Ongoing and future project developments
- Summary and Trends for Future
- Q&A

*Research support from Ljupka Arsova and Elizabeth Rice



Intro - GBB Overview



- Headquartered in Fairfax, VA
- Established in 1980 as an objective adviser to governments, institutions, and businesses
- 30+ years implementing innovative solutions for waste and recycling industry
- Dedicated and focused exclusively to solid waste management
- Owner's representative and feasibility reports for financings
- "Change Agents" to produce better services and facilities

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GBB Waste to Energy and Conversion Technology Services

- Reviews addressing economic feasibility, technology effectiveness, environmental issues, and procurements, and project development support for retrofits or new facilities:
 - City of Allentown, PA
 - City of Annapolis, MD
 - Marion County, OR
 - County of Maui, HI
 - New Hanover County, NC
 - Orange County, NC
 - City of Plano, TX
 - Prince William County, VA
 - Rhode Island Resource Recovery Corporation
 - Solid Waste Authority of Palm Beach County, FL
- Due diligence reviews and business planning for private companies considering purchasing technologies or investing in projects
- Waste characterization and sourcing; processing conceptual design and cost estimating



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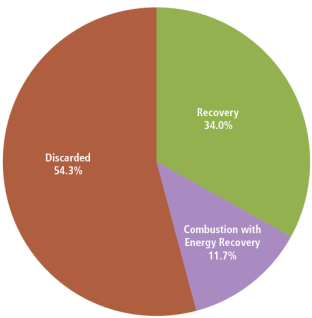
Introduction



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MSW Management in the U.S.



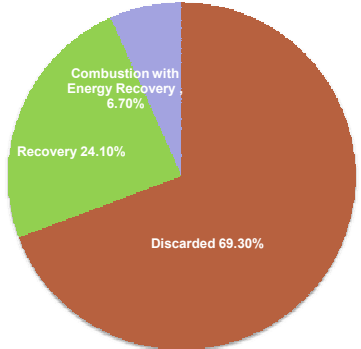
Discarded 54.3%

Recovery 34.0%

Combustion with Energy Recovery 11.7%

EPA Estimate: 250 million tons

2010




Combustion with Energy Recovery 6.70%

Recovery 24.10%

Discarded 69.30%

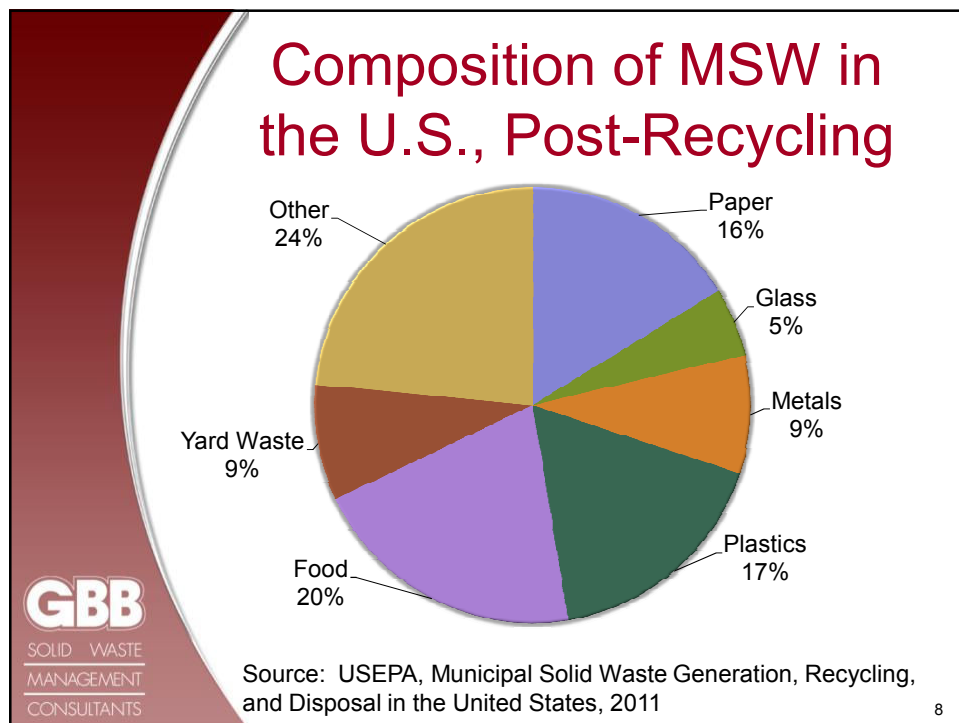
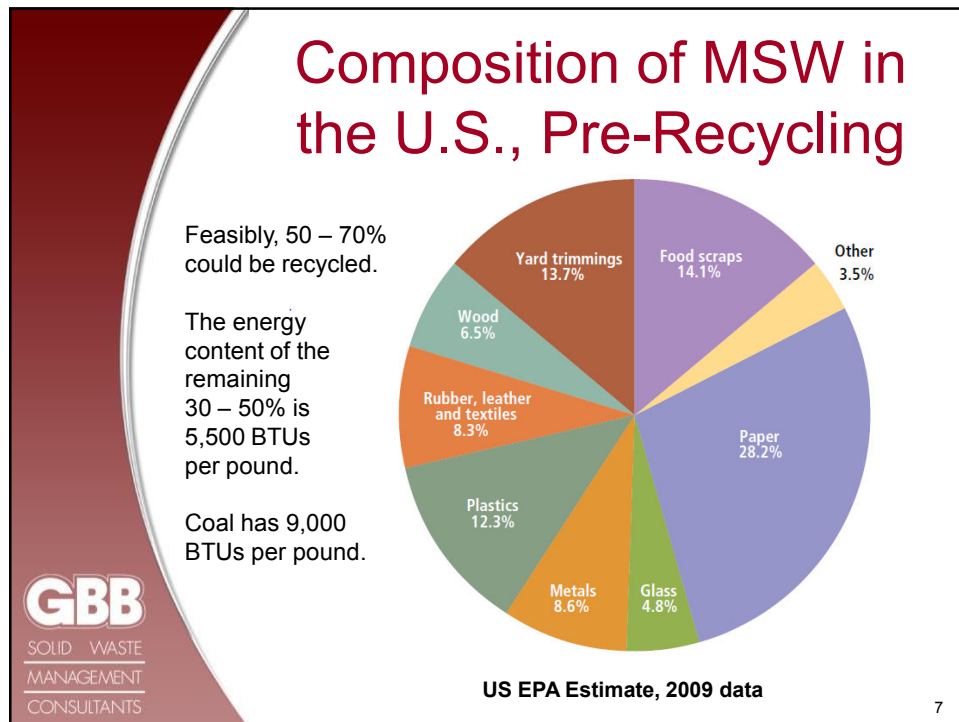
Biocycle Estimate: 389 million tons

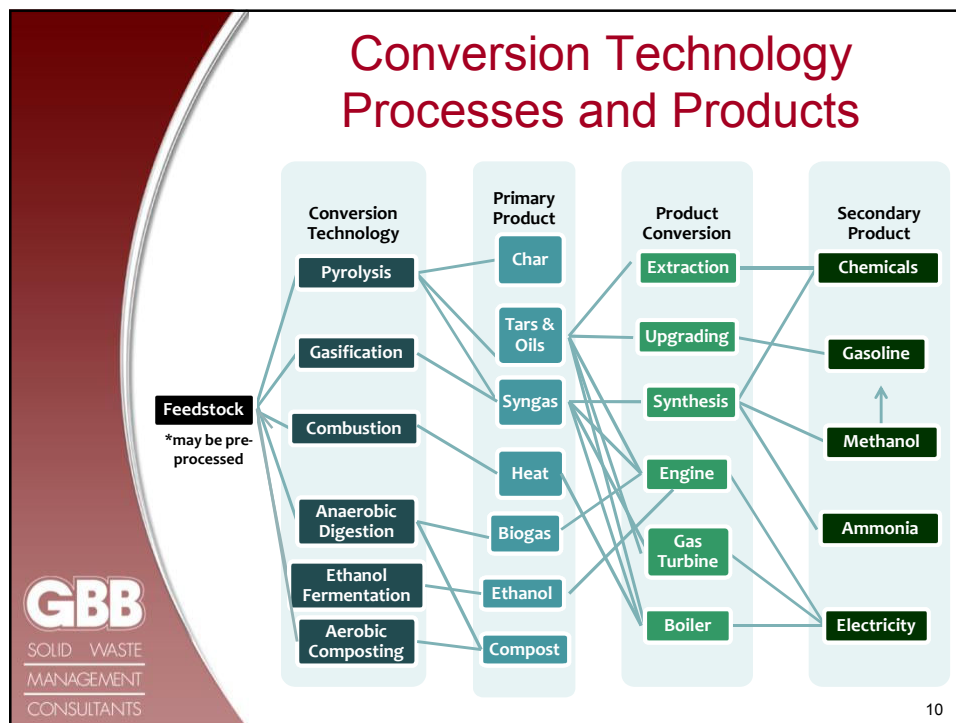
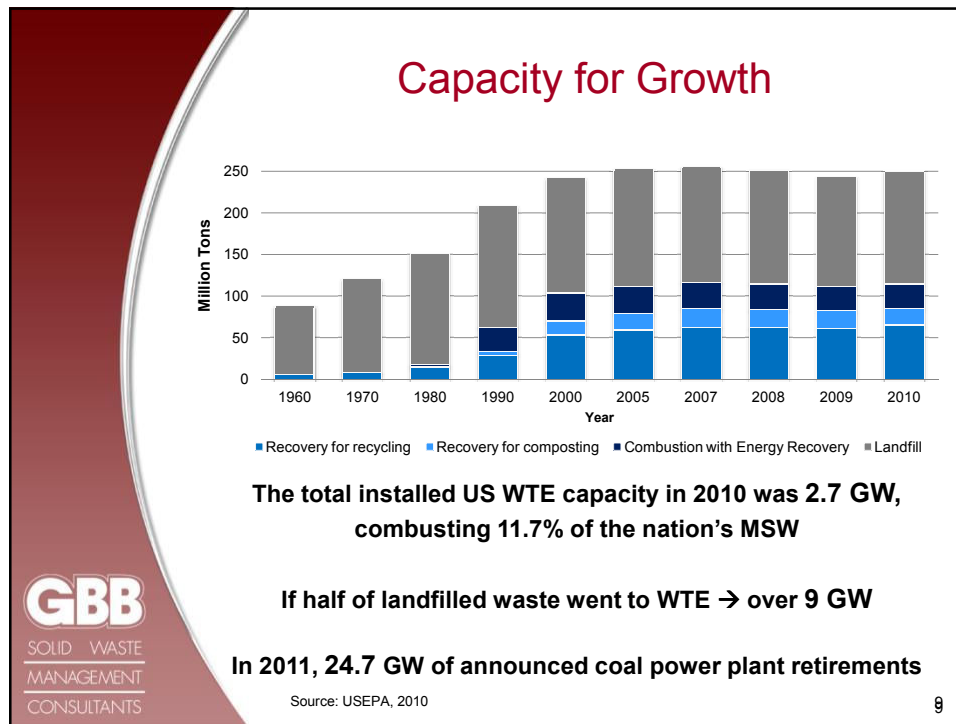
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Increased Interest in WTE and Conversion Technologies

>591 Technology and/or Project Development Companies Worldwide

150 Commercial or Demonstration Facilities with MSW Worldwide

Contributing factors:

- Renewable energy policy
- Funding
- Local governments desire to be greener
- Waste diversion from landfills
- Local jobs
- Disposal fees increase
- Transportation costs increase



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591 (and counting) Companies Offering Technology and/or Development Services Worldwide

- 34 Aerobic Composting
- 109 Anaerobic Digestion
- 37 Ethanol Fermentation
- 169 Gasification
- 45 Plasma Gasification
- 52 Pyrolysis
- 60 WTE: mass burn, modular, dedicated boilers, and RDF
- 81 Others (agglomeration, autoclave, de-polymerization, thermal cracking, steam reforming, hydrolysis)



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

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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



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

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Technologies Processing Mixed MSW



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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, test runs since July 2011
- Start-up April 2012
- Commercial system- 300 TPD modular units
- Selected by St. Lucie County, FL



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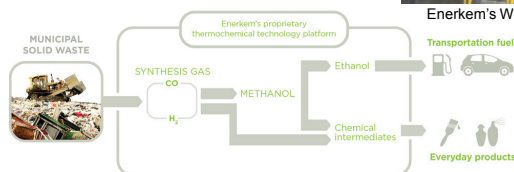
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Enerkem

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






Enerkem's Westbury facility



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Fiberight High-Solids Pulping

Ethanol fermentation
Feedstock- MSW





- Plants:
 - Demonstration plant in Lawrenceville, VA- opened October 2012
 - Blairstown, IA- 6 mill gal/year, expected to be fully operational in the first half of 2013.
 - Has site control for first commercial-scale biofuel plant in Elkridge, MD
 - 4 plants under development




TMO Blairstown, Iowa Layout

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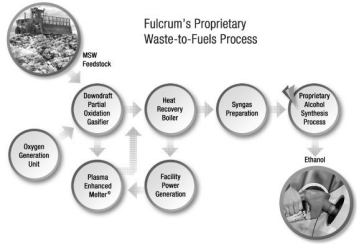

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Fulcrum BioEnergy





- 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
 - Construction expected to start in middle of 2013



InEnTec Technology partner

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- Gasification followed by biocatalyst fermentation and distillation
- MSW to Bioethanol

Plants:


- Fayetteville, AR- pilot plant
- Vero Beach, Indian River County, FL- commercial
 - process 150,000 TPA MSW
 - produce 8 million gal/year ethanol and 6 MW (gross) of electric power
- Lake County (IN) Solid Waste Management District- under development



Indian River BioEnergy Center August 2012



Pilot facility in Fayetteville, AR



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- Gasification followed by plasma torches to refine the syngas product
- Plants:
 - Commercial-scale demonstrational, 94 TPD- Train Road, Ottawa, CA
 - R&D, 5TPD, Castellgali, Spain
- Signed a deal with the City of Ottawa to process 109,500 t/year of the city MSW, December 2012
- Selected by the Salinas Valley Solid Waste Authority (CA) & Shortlisted in Santa Barbara, CA
- Other plans to build facilities in Canada and China







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Additional Gasification Technologies

ALTER^NRG

DYNAMIS
ENERGY

BlueFire
ETHANOL

ENTECH
RENEWABLE
ENERGY
SOLUTIONS

Chinoek - Energy
THE END-STAGE
RECYCLING COMPANY™

InEnTec

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Technologies Processing Mixed Non-Recyclable Plastics

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Technologies Processing Mixed Non-recyclable Plastics

Company	Technology	Product	Status	Featured plants in N. America	No. of commercial plants
	Pyrolysis	Crude oil & combustible gas	commercial	Demo: Tigard, OR, 10 TPD Commercial: Hennepin County, MN Under development: Manatee County, FL	1
	Microwave Pyrolysis	Crude wax & combustible gas	demo	Under construction: Blackville, SC 20 TPD	1 under construction
	Far Infrared Pyrolysis	Crude oil & combustible gas	demo	Demo: Montgomery County, MD, closed 2011	N/A
	Catalytic Pyrolysis	Crude oil & combustible gas	Pilot	Pilot: Niagara Falls, NY (45TPD)	none
	Pyrolysis	Crude oil & combustible gas	Pilot	Pilot: Akron, Ohio	none

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Technologies Processing Organics

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CR&R Inc. – Perris, CA



- Selected in Los Angeles County
- 150 TPD from CR&R dirty-MRF,
- DRANCO anaerobic digestion system;
- Convert the biogas generated into biomethane for their truck fleet
- \$4.5 million California Energy Commission Alternative and Renewable Fuel and Vehicle Technology Program grant
- Construction is expected to commence in 2012 and be completed in 2014



Dranco AD plant in Hotaka, Japan



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EISENMANN

- Wet anaerobic digestion technology
- Product: biogas, compost
- Plants:
 - Partnership with W2e Organic Power
 - Columbia, SC-* commercial scale prototype under construction
 - 48,000 tons per year; 3.2 MW
 - Start-up expected 2012
 - Gastonia, NC & Baton Rouge, LA-* under development
 - Chicago, IL- part of “the Plant” project
 - 5,000 tons per year capacity



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Harvest Power




- Anaerobic digestion and composting
- Product; biogas, electricity and compost

- Plants:
 - >10 composting plants
 - Anaerobic plants under construction: London, ON & Richmond, BC




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Quasar Energy Group



quasar's F825 system in Zanesville, Ohio

- Anaerobic digestion
- Product; Compressed natural gas, soil conditioner
- 5 commercial operating plant in Ohio



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Zero Waste Energy LLC



- Kompoferm Dry anaerobic digestion system
- Plants:
 - San Jose, CA- 270,000 TPY, operations beginning April-May, 2013
 - Marina- Monterey, CA- 5,000 TPY SmartFerm system (under development)
 - South San Francisco Scavengers- 9,000 TPY (under development)



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Technologies Processing Organic Waste



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Ongoing and Future Project Developments



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Locations Advancing “Proven” Technologies

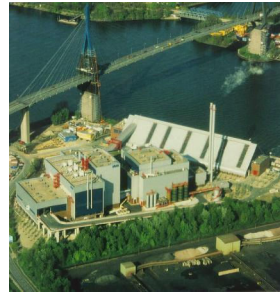
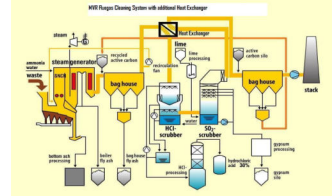
- Mass burn WTE expansions
 - Completed:
 - Hillsborough County, FL - Covanta
 - Lee County, FL – Covanta
 - Olmsted County, MN – Olmsted County
 - Under construction: Honolulu, HI – Covanta
- Mass burn under construction
 - Durham York (Ontario CN) – Covanta
 - Palm Beach County, FL (SWAPBC) – B&W
- Advancing new facilities with ‘proven’ technologies:
 - Baltimore, MD – Energy Answers
 - Frederick County, MD (NMWDA) - Wheelabrator
 - City of Los Angeles, CA – Green Conversion Systems
 - Puerto Rico – Energy Answers
 - Vancouver, British Columbia, CA
- Existing facilities being sold/upgraded/
 - Harrisburg, PA
 - New Hanover County, NC



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City of Los Angeles, CA – Green Conversion Systems

- 365,000 TPY post-recycled residential waste
- “Advanced Thermal Recycling” system by Fisia Babcock Environment GmbH (formerly Steinmueller)
- Reference facility: Hamburg, Germany
- Air emissions to be well below permit limits and real time air emission readings to be public
- Emphasis on aesthetics
- Ash processed for aggregates



Source: http://www.ecoling.ch/englisch/refmva_eng1.htm

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Durham/ York (Ontario CN) Covanta



- Design, construction and operation by Covanta
- \$260 million financed by Durham and York regions
- 140,000 TPY of waste
- 17.5 MW power and steam
- Recovered ferrous (e.g. steel) and non-ferrous (e.g. aluminum etc.) metals for recycling
- Under construction with target operation date late 2014

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New Hanover County, NC- Covanta



- Retrofit and operation of the existing WTE plant
- 500 TPD
- Facility first opened in 1984, and shutdown in April 2011
- 10MW electrical power
- Covanta has been chosen and the contract is awaiting board approval at this moment
- GBB is the technical consultant for the County



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Solid Waste Authority of Palm Beach County, FL

- **Babcock & Wilcox Power Generation Group, Inc. (B&W PGG)**, and its partner, **KBR, Inc.** were selected to build the plant in April 2011.
- B&W PGG to operate and provide maintenance services once the plant is operational



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

- \$668 million construction cost
- 3,000 tons per day of MSW capacity
- 325 full-time construction jobs (900 including all part time), 64 permanent, full-time operation jobs.
- 2009
 - Authority two-stage contractor procurement included due diligence review of new technology offerings
 - GBB hired to review potential alternative technologies and present its findings to Authority Governing Board
 - Authority authorized to continue its two-stage procurement process with mass burn technology



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Solid Waste Authority of Palm Beach County, FL (Cont'd)

- 2011
 - Authority received competitive proposals and made selection recommendation to the Authority Governing Board
 - Comments from the Florida Sierra Club and Institute for Local Self Reliance were received suggesting approval to be postponed, alternative waste disposal methods to be studied, especially more recycling
 - GBB again hired to review and fact check the accuracy of the statements and claims made by Florida Sierra Club and ILSR
 - Summary of GBB analysis:
 - WTE is fully compatible with recycling and integral to well-managed solid waste systems
 - WTE reduces GHG emissions
 - Management and financial difficulties were contributing factors to WTE plants that have issues; the issues were not operational issues
 - Resurgence of interest in WTE technologies
 - Solid waste systems cost money
- See: <http://www.gbbinc.com/WTE-PB.shtml> for white papers
- Authority Governing Board approves awarding contract in April 2011
- **GROUND BREAKING CEREMONY was APRIL 4, 2012!**




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Some U.S. Locations Currently Investigating/Advancing Waste Conversion Technologies

- | | |
|---------------------------|-----------------------------|
| • Ada County, ID | • County of Maui, HI |
| • Baton Rouge, LA | • Fulton, MS |
| • City of Allentown, PA | • Gallatin County, KY |
| • City of Cleveland, OH | • Hennepin County, MN |
| • City of Dallas, TX | • Lake County, IN |
| • City of Glendale, CA | • Los Angeles County, CA |
| • City of Green Bay, WI | • New York City, NY |
| • City of Plano, TX | • Prince William County, VA |
| • City of San Antonio, TX | • Salinas Valley, CA |
| • City of Taunton, MA | • San Bernardino County, CA |
| • Columbia, SC | • Santa Barbara County, CA |




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PRINCE WILLIAM COUNTY, VIRGINIA

- County wants to create the Prince William Renewable Energy Park (PWREP) at the landfill (currently receiving 875 TPD MSW)
- County seeking to host a waste conversion technology demonstration facility on the County's landfill or composting sites
- Issuing RFP to identify qualified technology companies to design, build, finance, own and operate their demonstration
- Looking for technologies proven at throughputs of 50 to 200 TPD on a continuous basis
- Eligible technologies include pyrolysis, gasification, anaerobic digestion, plasma torch or other conversion method producing a fuel or energy product, such as electricity, syngas, steam, useable heat and/or other industrial outputs
- Issued in June 2012, due October 17, 2012
- Check status on the County's e-procurement web page under solicitations: <https://www2.pwcgov.org/e-proc/default.asp>



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Summary and Trends for Future



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Technologies and Risk

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

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
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/ Depolymerization	Technology under development; not a commercial option at this time	High

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Opinion of Trends for the Future...

- New technologies will need 3-5 years to learn if they work and their economics (permits, financing, construction and initial operating time)
- Added economic benefit of placing value on carbon credits and power from waste as 'renewable energy'
 - Possible impetus for growth of more proven technologies that are now deemed too expensive
- Renewable fuel standards from EPA and added recycling requirements (e.g. ethanol)

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Opinion of Trends for Future (Cont'd)

- Continuation of public sector taking “Low Risk” attitude until conversion technologies and companies more proven
- Continued recycling industry demand for more paper, aluminum, and plastics
- More mixed waste processing
 - Added recycling side-benefit
 - Most conversion technologies require pre-processing for feedstock preparation
 - 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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U.S. Plants Past, Present, and Future

YEAR	WTE/ RDF	Pyrolysis and Gasification	MRF	Recovered (million tons)
2001	83/26	0	523	104.3
2011	71/15	1	565	114.5
2021	74/17	26	615	129.6



Source: Gershman, Brickner & Bratton, Inc., 2011

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Canada Plants Past, Present, and Future

YEAR	WTE/ RDF	Pyrolysis/ Gasification	MRF/MBT	Recovered (million tons)
2001	8/0	0/0	-/-	7.7
2011	7/1	0/2	66/0	9.3
2021	8/1	0/4	75/0	11.9



Project Building Blocks

- ☐ Limited and High Alternative Disposal Costs
- ☐ Waste Supply
- ☐ Energy and Materials Market(s)
- ☐ Site for Facility
 - ☐ Good logistics for waste receipt, energy market(s), and residue disposal
 - ☐ Can be permitted
 - ☐ Accepted by neighbors
- ☐ Landfill for ash and by-pass
- ☐ Contractor with resources and proven technology or willingness to take technology risk
- ☐ Capital
- ☐ Financeability
- ☐ Compatibility with High Level of Recycling
- ☐ Political Will

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!*



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Thank you!!

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