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# Byproducts Transformation: from Waste to Resource to Energy

Ljupka Arsova  
Gershman, Brickner & Bratton, Inc.  
Fairfax, VA USA  
May 14, 2015




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## Outline

- Introduction
- Technology Review
- Plants in the US
- Trends, Expectations and Opportunities



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

**RENEWABLE Energy**  
FROM WASTE

INSIDE:  
Maximizing RDF Systems .....p. 25  
A Financial Source for WTE .....p. 29  
Boiler Emission Rules Update .....p. 32  
Biogas Heats Up in Wisconsin.....p. 35  
Fueling Fleets with Plastics.....p. 38

SERVING FUEL AND ENERGY PRODUCERS // SPRING 2012

A WORKING MODEL

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

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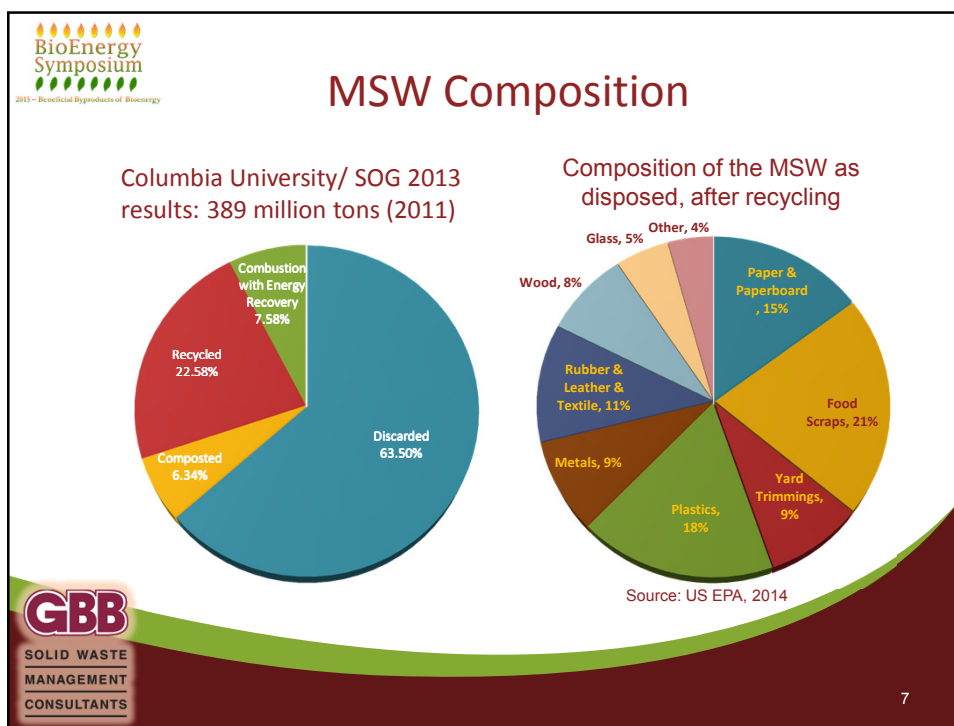
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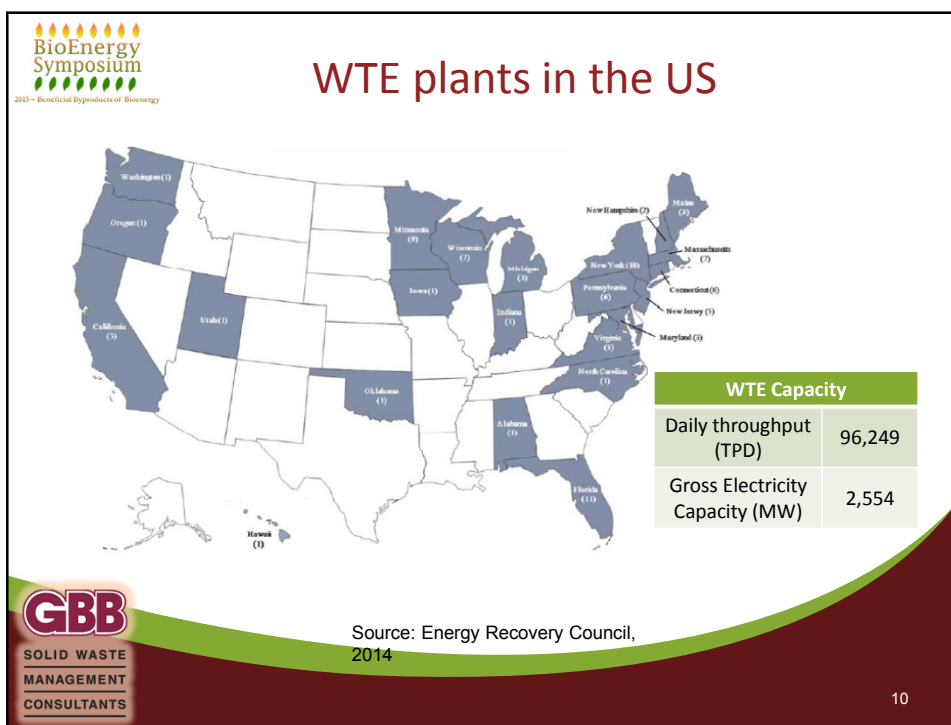
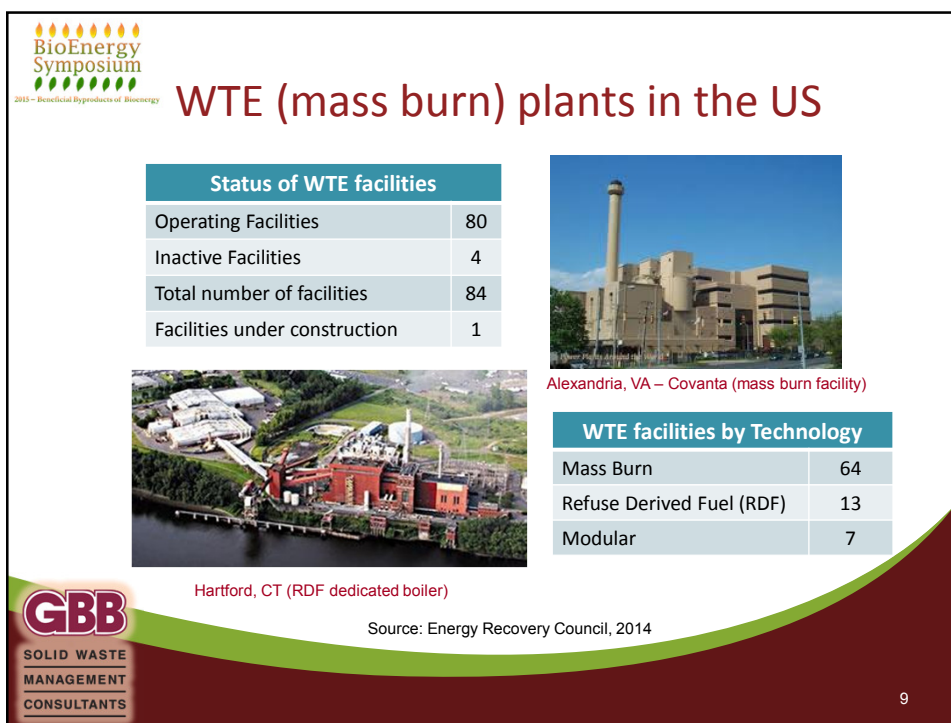


**MSW in the US**

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## Solid Waste Authority of Palm Beach County, FL




Source: SWA of Palm Beach Facebook page


- 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
- Advanced emissions control system
- Groundbreaking - April 2012
- Expected commercial operation 2015

  
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## WTE Expansions




Hillsborough County, FL- Covanta Energy




Lee County, FL- Covanta Energy



Honolulu, HI- Covanta



Olmsted County, MN

  
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## AD- Facilities and Market Leaders

- ~ 20 facilities operating in the U.S. (Source: GBB, 2015)
- 244 AD plants in Europe
- Privately financed, owned and operated
- Commercial food waste
- Organics from MSW
- Mixed with yard waste









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- US company founded in 2008 in Waltham, MA
- Licensed European AD technologies
- More than 10 composting plants
- Three commercial 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 (Disney World) - 100,000 TPY of Mixed organic waste



Richmond Energy Garden



London Energy Garden



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- US company established in 2006 in Cleveland, OH
- Initially European technology, now, more than 98% of the components are purchased in the U.S. and more than 76% of those are from Ohio-based companies
- Integrated Anaerobic Digestion System (iADs) is patent pending technology developed at Ohio State University
- Projects:
  - 11 operating commercial AD projects in the US
  - 2 commercial projects under development




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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- 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 November 2013)- 90,000 TPY of commercial food waste
  - Operator for Infinitus in Montgomery, AL
  - 6 plants under construction and development



Monterey, CA



San Jose, CA



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## Projects Under Development

- AD plants currently under development:

- GBB has been currently involved in City of Cleveland, Prince William County and Prince George's County

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## Gasification

- Emerging technology
- Partial combustion in an air-controlled environment
- Product: Syngas for production of electricity, chemicals/ fuels (ethanol)
- Feedstocks: MSW, biomass, medical waste,


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- Commercial plant in Edmonton, Alberta- 10 million gal/year, start-up June 2014
  - City MSW Processing Facility with Vecoplan equipment prepares feedstock
- Commercial scale demonstration facility in Westbury, CA (since 2009, 1.3 million gallons/year)
- Pilot plant in Sherbrooke, CA (since 2003)
- Under development: Pontotoc, Mississippi and Varennes, Québec, each 10 million gal/year (MRF construction in 2015)



Edmonton Transfer conveyor between MSW processing and Enerkem Facility



Enerkem Edmonton Facility June 2014



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- Gasification followed by synthesis
- Sierra BioFuels- first commercial plant under construction in Reno, NV
  - 200,000 MSW into 10 million gallons of jet fuel per year
  - EPC Contractor- Abengoa
  - Commercial operation 3<sup>rd</sup> quarter of 2017
  - Fuel off take agreement with Cathay Pacific Airways




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- Gasification followed by biocatalyst fermentation and distillation
- Biomass to Bioethanol operating now; MSW to Bioethanol yet to be proven
- 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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## Pyrolysis


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

















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## TRENDS, EXPECTATIONS, AND OPPORTUNITIES FOR THE FUTURE



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## Current Trends

- Conversion technologies are advancing
- Mixed waste processing and MBT for RDF production
- Material and fuel recovery from clean waste fractions
- Sustainability and zero waste
- Circular Economy




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Opinion of Trends for Future

More mixed waste processing (MBT is gaining interest)	"One-bin" approaches will be considered
Easier or cleaner recycling	Organics and AD



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Questions and comments?

***Thank you!!***

Ljupka Arsova  
1-800-573-5801  
[larsova@gbbinc.com](mailto:larsova@gbbinc.com)  
[www.gbbinc.com](http://www.gbbinc.com)

