Waste-to-Energy and Conversion Technologies under the Commercial Microscope

Including Projects Currently Under Development

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By
Harvey W. Gershman, President
Gershman, Brickner & Bratton, Inc.
With research support from Elizabeth Rice and Neil Daniel

Outline

- Introduction
- Waste-to-Energy and Waste Conversion Technologies --- Today and Tomorrow
- Review of Selected Waste Conversion Technology companies and their projects
- Summary and Trends for Future
- Q&A

Introduction

Intro - GBB Overview

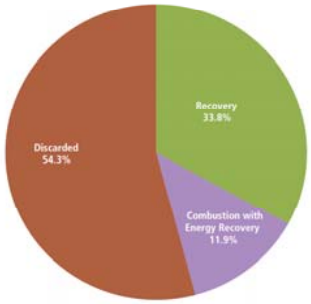
- Headquartered in Fairfax, VA
- Established in 1980 as an objective adviser to governments, institutions, and businesses
- 30+ years implementing innovative solutions for waste and recycling industry
- Dedicated and focused exclusively to solid waste management
- Owner's representative and feasibility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

GBB Recent Waste Conversion Technologies and Renewable Energy

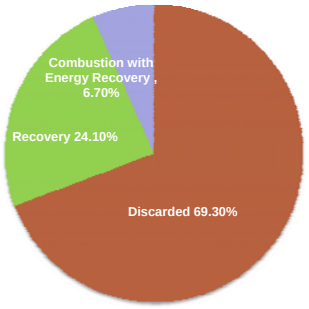
- Reviews addressing economic feasibility, technology effectiveness, environmental issues, and procurements for retrofits or new facilities:
  - County of Maui, HI
  - Orange County, NC
  - Rhode Island Resource Recovery Corporation
  - Marion County, OR
  - City of Annapolis, MD
  - Solid Waste Authority of Palm Beach County, FL
  - City of Allentown, PA
  - New Hanover County, NC
  - Prince William County, VA
  - City of Plano, TX
- 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
- Independent feasibility consultant

Waste-to-Energy (WTE) and Waste Conversion Technologies ...Today and Tomorrow

MSW Disposal in America



EPA 2009 Estimate:
243 million tons



Biocycle 2008 Estimate:
389 million tons

1 Ton of MSW

- Has 11 million BTU's
- Equivalent to:
  - 1 barrel of oil
  - ½ ton of coal
  - 11 Deca-therms of natural gas [a]
- Can make:
  - 5,500 lbs. of steam
  - 400 to 1,000 KWHrs of electricity
  - 80-90 gallons of ethanol

What if half of the waste landfilled went to WTE?

…that's 200,000 tons per day of new capacity needed!

Note: a – 1 "*Deca-therm*" = 10 therms or 1million Btu's

Additional Revenue Streams

- Green Tags (1MWh = 1 Tag)
  - Renewable Energy Certificate (RECs)
  - Green Certificates or Tradable Renewable Certificates
- White Tags (1MWh = 1 Tag)
  - Energy Efficiency Certificate
  - Represents the value of energy not used (conserved) at facilities
  - Created through the implementation of energy conservation projects - demand-side & Cogeneration
  - Principally electricity, but can be any energy supply
  - Mandated in CT, NV, PA, 9 other states evaluating
- Carbon Credits
  - Emissions off-set programs
  - Cap-and-trade

Source: U.S. Dept. of Energy

86 U.S. WTE Plants - $14 Billion in Assets generating approx. 2,700 MW's

Technology	Operating Plants	Daily Design Capacity (TPD)	Annual Capacity (1) (Million Tons)
Mass Burn	64	71,354	22.1
Modular	7	1,342	0.4
RDF - Processing & Combustion	13	16,928	5.3
RDF – Coal Combustion	2	4,592	1.4
Total U.S. Plants	86	94,216	29.2

(1) Annual Capacity equals daily tons per day (TPD) of design capacity multiplied by 365 (days/year) multiplied by 85 percent. Eighty-five percent of the design capacity is a typical system guarantee of annual facility throughput.

Source: Energy Recovery Council), 2010 Directory

WTE Technology & Companies

Company	Technology		
	Mass Burn	RDF	Modular
Babcock & Wilcox	X	X	
Casella		X	
Covanta	X	X	X
Energy Answers*	X	X	X
Foster Wheeler	X		
Veolia*	X	X	
Wheelabrator (WMI)	X		
Xcel Energy		X	

* Covanta purchased Energy Answer's plants in 2008 and Veolia's plants in 2009.

Mass Burn Waste-to-Energy Facilities

North Broward County, FL
Wheelabrator

Alexandria/Arlington, VA
Covanta

Springfield, MA
Covanta

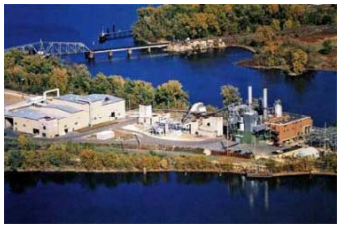
Baltimore, MD
Wheelabrator

RDF/Dedicated Boiler Facilities

Rochester, MA - Covanta SEMASS

Hartford, CT
Covanta

West Palm Beach, FL
Babcock & Wilcox



La Crosse, WI
Xcel

RDF Supplemental Burning in 1970s Coal-Fired Utility Boilers

Union Electric Co.
St. Louis, MO

Americology – WEPCO
Milwaukee, WI

St. Louis facility started with just shredded MSW less ferrous metals as the fuel which became problematic; Milwaukee facility was developed as a complete RDF processing facility w/Americology.

Material Recovery Facilities:
Clean MRF's vs. Dirty MRFs

- Dirty MRF processes MSW to recover recyclable materials through a both manual and mechanical sorting; sorted materials prepared to market specs
- Organics may be processed further for mulch, compost, RDF, or alternative daily cover (ADC)
- Good examples in California with recovery rates of 18 – 48 %
  - Many built or retrofitted to perform as dirty MRFs during 2002 and 2008
  - Capacities range from 1,400 TPD (Green Waste Recovery Facility, San Jose) to 6,000 TPD (Republic CVT MRF, Anaheim)
- Residuals from Dirty MRFs also provide good feed stocks for anaerobic/biological treatment technologies

Locations Advancing "Proven" Technologies

- Example of Mass burn WTE expansions
  - Completed:
    - Hillsborough County, FL - Covanta
    - Lee County, FL - Covanta
    - Olmsted County, MN – Olmsted County
  - Under construction: Honolulu, HI – Covanta
- Example of Locations advancing new facilities with 'proven' technologies:
  - Baltimore, MD – Energy Answers
  - Frederick County, MD (NMWDA) - Wheelabrator
  - Durham York (Ontario CN) - Covanta
  - City of Los Angeles, CA – Green Conversion Systems
  - Palm Beach County, FL (SWAPBC) – B&W
  - Puerto Rico – Energy Answers
  - U.S. Virgin Islands – Alpine Energy

Energy Answers Int'l – Baltimore, MD

- Developing the Fairfield Renewable Energy Power Plant on 90-acre "brownfield" site on the Fairfield Peninsula in Baltimore, MD
- 4,000 tons per day of Processed Refuse Fuel
- $1 Billion capital cost
- RDF preparation offsite; locations under development
- Received all major permits and approvals
- Outputs:
  - 160 MW combined heat and power plant;
  - 350 tons/day of recovered, recyclable metals; and
  - 800 TPD construction-ready aggregate and other building materials
- Schedule:
  - Construction to begin by the end of 2011
  - Power production expected to begin summer 2013
  - Commercial operation late 2013

Source: Energy Answers

Wheelabrator - Frederick County, MD (NMWDA)

- Owned by the Northeast Maryland Waste Disposal Authority and will serve Frederick and Carroll counties under a long-term service agreement between the Authority and the counties.

- Will process up to 1,500 tons per day of MSW with an electric generating capacity of 55 megawatts; the equivalent of supplying the electrical needs of 60,000 homes.
- 1,600 private sector jobs created during construction and 80 full-time private sector jobs during operation
- The Authority will finance the project's capital cost through the issuance of tax exempt and taxable revenue bonds. The total bond size is projected to be $527 million.
- Expected to be commissioned in 2014

Solid Waste Authority of Palm Beach County, FL

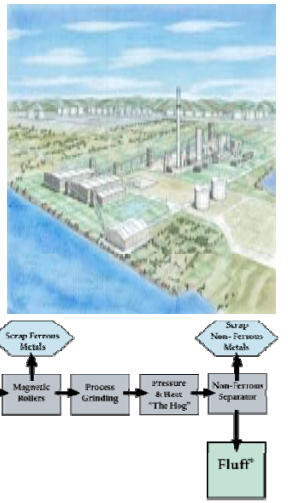
- New Facility - Notice of Award, April 2011
  - 3,000 TPD Mass Burn facility
  - 130 MW renewable power; enough for over 86,000 houses
  - $668 million construction price
  - $20.5 million first year O&M cost
  - To use advanced emissions control system
- Groundbreaking - April 2012

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

Alpine Energy Group, LLC

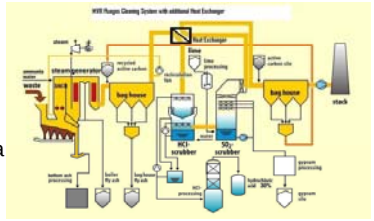
St. Croix, US Virgin Islands

- Will Use Bouldin WastAway refuse derived fuel ("RDF") processing and recycling facility that will convert 200 TPD MSW into approximately 150 TPD in PRDF
  - Annual pelletized RDF consumption expected to be at least 109,500 tons
- 16.5MW (net) power generating facility
  - To use a wide variety of alternative fuels, including biomass, energy crops, rum bottoms, sewage sludge and tire-derived fuel ; no petroleum coke
- Construction start estimated in Fall of 2011 - delayed



City of Los Angeles, CA – Green Conversion Systems

- 1,100 TPD post-recycled residential waste
- "Advanced Thermal Recycling"
- MRF recycling @ 29%
- Conversion Technology 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
- Landfill diversion rate @ **99%**



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

More Mixed Waste Processing in the Future...Again!

- Many conversion technologies require MSW pre-processing
- Electric utilities may become a player
  - 20 percent of demand met through renewable energy and efficiency measures by 2020
  - FYI: 10 percent of coal now used equates to 225 millions tons RDF per year (more than we could make!)

592 (and counting) Companies Offering Technology and/or Development Services

- 31 Aerobic Composting
- 110 Anaerobic Digestion
- 36 Ethanol Fermentation
- 175 Gasification
- 47 Plasma Gasification
- 52 Pyrolysis
- 63 WTE: mass burn, modular, dedicated boilers, and RDF
- 78 Others (agglomeration, autoclave, de-polymerization, thermal cracking, steam reforming, hydrolysis)

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

Issues to Consider in Technology Development

- Performance history and size
- Scaling uncertainties
- Environmental impacts
- Siting and permitting needs
- Cost uncertainties and their $ coverage
- Product market uncertainties
- Process guarantees
- Financial resources of developer and/or guarantor
- Community acceptance
- Other risks and unknowns

143 Conversion Companies Operating either Commercial or Demonstration facilities with MSW

- 64 Anaerobic Digestion
- 47 Gasification
- 13 Plasma Gasification
- 19 Pyrolysis

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

- Ada County, ID
- Baton Rouge, LA
- City of Allentown, PA
- City of Dallas, TX
- City of Glendale, CA
- City of Plano, TX
- City of San Antonio, TX
- City of Taunton, MA
- Columbia, SC
- Fulton, MS
- Gallatin County, KY
- Lake County, IN
- Los Angeles County, CA
- Mason City, IO
- Salinas Valley, CA
- San Bernardino County, CA
- Santa Barbara County, CA
- Story County, NV

Selected Waste Conversion Technology Companies and Projects

Federal Grants and Loans

- In December 2009, 19 alternative technologies received a total of $564 million from DOE for pilot, demonstration and commercial Projects
  - $117 million in appropriations for conversion technologies in Biomass and Biorefinery Systems Research, Development & Demonstration program in 2012, up from $82 million in 2010
- *Federal Loan Guarantee Programs*
  - *U.S. Department of Agriculture (USDA) Renewable Energy loan guarantee programs*
  - *U.S. Department of Energy (DOE) Renewable Energy loan guarantee programs* **(In summer 2011, biofuels and biomass technologies received $240 million!)**

Agilyx

- Tigard, Oregon Facility has been operating for 18 months,
- Anaerobic thermal processing
- Processes 10 TPD of a dozen types of plastics, including #1-7, engineering grade resins
- Can handle a mix of rigids and films, loads up to 70% PVC
- Produces include crude oil, natural gas
- Conversion rate of 80% (depends on the waste plastic feedstock, but an average of 8.5-10 pounds of plastic can produce one gallon of synthetic crude oil)
- Has secured over $22 million in Series B funding, led by Kleiner Perkins Caufield & Byers, and joined by new strategic investors, Waste Management, Inc. and Total Energy Ventures International.

Tigard, OR facility

AlterNRG

- Plasma gasification technology developed in partnership with Westinghouse Plasma Corp.
- Produces clean syngas from a wide variety of feedstocks, including auto shredder residue, plastics, biomass, wood waste
  - Generates a SYNGAS for power generation or further conversion to ethanol
  - 80% of energy input converted to syngas
  - Plasma torches use 2%-5% of energy input
- 48 ton per day commercial demonstration facility in Madison, PA
- Commercially installed in facilities in Japan, Canada, India, and the U.S.
- Facilities under development 11 countries through partnerships with Coskata, SMSIL, and NRG Energy

AlterNRG gasifier

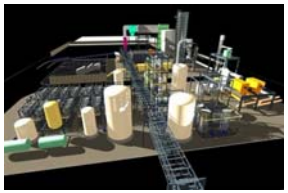
GeoPlasma St. Lucie LLC Renewable Waste-to-Energy Project

- Feedstock (Tons Per Day) : 525 MSW and 75 tires
- Capital cost: $125 million
- 9-acre site at County Landfill
- Energy output type(s): approx. 20 megawatts power and steam offload to Tropicana Products
- Owner: GeoPlasma, Atlanta, GA / Energy Resources Group
- Financing method: Private
- Construction Start: End of the year, 2011, subject to permits and financing
- Florida DEP Air Construction Permit obtained September 2010
- Operations Start: Mid 2013

Source: GeoPlasma-St. Lucie, LLC and Energy Resources Group, May 2010

BlueFire Ethanol

- Concentrated Acid Hydrolysis Technology Process converts cellulosic waste materials to ethanol, and other viable alternatives to petroleum derived fuels
- Have demonstrated production of ethanol and other petroleum displacing fuels from post-recycled MSW, rice and wheat straws, wood waste and other agricultural residues



Fulton, MS site prepared for construction, June 2011

- Lancaster, CA – 3.7 million gallon per year facility will use post-sorted MSW from landfills around the Los Angeles area. Anticipated start time is TBD
- Mecca, CA –17 million gallon per year facility will use post-sorted MSW and wood waste from all over southern California. Anticipated start time is TBD
- Fulton, MS – 19 million gallon per year facility will use woody biomass and mill wastes from Cooper Marine & Timberlands. BlueFire has received $88 million in DOE funding and has secured 15-year offtake agreements for products.

Climax Global Energy

- Fairfax, South Carolina pilot facility processes 20 TPD of plastics # 1-7
- Feedstock is shredded and mixed with pulverized carbon
- Microwave pyrolysis process
- Products include transportation fuel, synthetic lubricants and commercial waxes, as well as gases that may be used on-site for energy
- Conversion rate of 80% (**0.8 tons of wax/oil product from one ton of plastic**)
- Utilization of gas product meets 70% of the microwave energy demand of the facility
- Nitrogen is supplied to the reactor to ensure an oxygen- depleted environment, and a catalyst is used to clean up the product from organic chlorides that may be produced from PVC.
- As of October 2011, CGE has raised $2.83 million from undisclosed investors in a private placement out of its planned $6 million offering of equity

Fairfax pilot plant

Chinook Energy, LLC

- Developer of energy plants utilizing Chinook Sciences' gasification and metals recycling technologies
- The RODECS ®, Chinook's patented gasification technology
  - World's only Industrial universal gasification system, can process universally any type of waste material without the need for extensive pre-processing
  - Transforms organic based material in waste stream into useful energy (steam, electricity, etc.), and/or useful clean fuel (like Methanol, Ethanol, Synthetic Diesel, Hydrogen, etc.)
  - Currently being used in nine countries in four continents

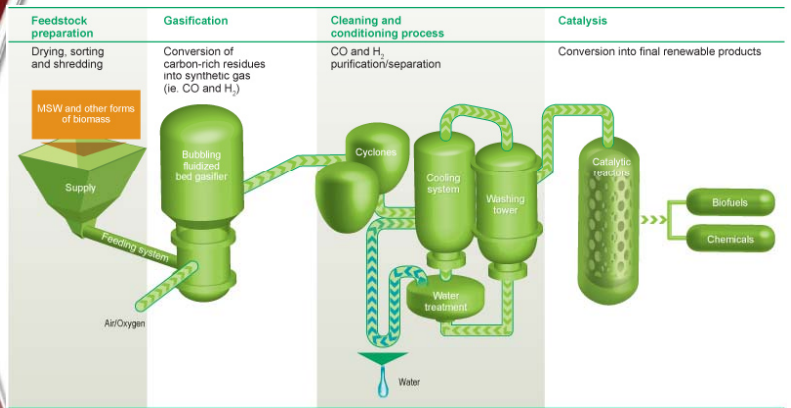
Two metals recycling and conversion to fuel projects under development in Europe and expect operations to commence at those facilities in 2011.
Environmental Solutions UK Ltd. - **120,000 metric TPY** of automobile shredder residue processed to generate approximately **30 MW** of renewable electricity, enough to power 21,000 homes

Enerkem

- Gasification and conversion to syngas, methanol, ethanol
- Feedstocks include municipal solid waste, wood chips, treated wood, sludge, petcoke, spent plastics and wheat straw
- Operates 2 plants in Quebec, Canada
  - Commercial demonstration facility in Westbury, operational since 2009, producing 1.3 million gallons/year
  - Pilot plant in Sherbrooke, operational since 2003, used to test over 25 different solid, slurried, and liquid feedstocks
- Full-scale commercial facilities currently under construction in Edmonton, Alberta and Pontotoc, Mississippi
  - will produce methanol and cellulosic ethanol.

Enerkem's Westbury facility

Enerkem Process



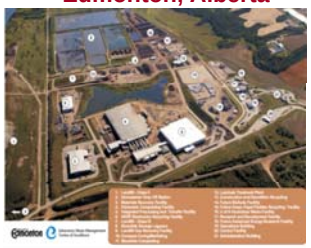
- Catalysis produces methanol, which can be sold as-is, converted to ethanol, or used as a chemical building block for the production of secondary chemicals, such as acrylic acid, n-Propanol, and n-Butanol

Enerkem Facilities

Pontotoc, Mississippi

- **Feedstock :** Sorted MSW and wood residues
  - 660 TPD to 330 TPD RDF for feedstock
- **Total Capacity :** 10 M gallons/year
- **Products:** syngas, methanol, ethanol
- **Start date:** 2012, Currently in permitting cycle
- In partnership with Three Rivers Solid Waste Management Authority
- Will help recycle and convert 60% of the waste crossing the area's landfill gate
- Awarded $50M funding from U.S. DOE Bio-Refinery Assistance Program, total $130 million in financial support from the U.S. Department of Agriculture and DOE

Edmonton, Alberta



- **Feedstock :** Sorted MSW
  - 660 TPD to 330 TPD RDF for feedstock
- **Total Capacity :** 10 M gallons/year
- **Products:** syngas, methanol, ethanol
- **Start date:** 2012
- **Approval:** Environmental permit granted
- Secured offtake agreement for sale of methanol produced with Methanex in September 2011

Entec Biogas USA

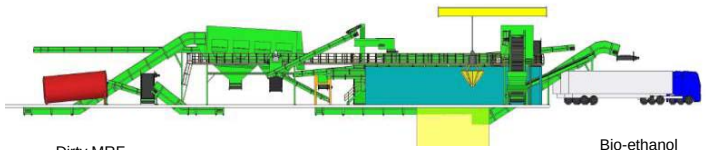
- Successfully designed, constructed, and commissioned more than 120 full scale biogas projects worldwide
  - Built the first MSW/food waste digesters in Japan and France
  - Currently in final design process for world's largest biogas plant for cow manure in El Paso, Texas
- Specializes in the anaerobic treatment of manure, food residues, municipal sludge, waste water from the food industry, and energy crops.

Malchin, Germany
500,000 MT/yr food waste→ 2 MW

- Offers five different Anaerobic Digester systems
  - Optimized process and highest biogas production yield for each application and project scale
- Options for product treatment include
  - Gas upgrading to natural gas quality and injection into pipeline
  - Solid – liquid separation for the digestate to produce a solid fertilizer for transport and a liquid used for fertilizer
  - Drying and pelletizing of the solid fraction to use as bio-fuel.

Fiberight

- Targeted Fuel Extraction (TFE) process cost effectively transforms MSW:
  - Dirty MRF separates, cleans and processes organic and hydrocarbon fractions
  - Converts organic fraction into cellulosic biofuel through hydrolysis, fermentation, and anaerobic digestion
  - Converts hydrocarbon fraction into plant energy and electricity
  - Utilizes byproducts for beneficial sale or energy production
- Cellulosic pulp can produce **90 gallons of ethanol per ton**
- End-to-end process operates on a 100% MSW input, robust system has been tested at scale



Fiberight (cont'd)

- Attained high yield conversion factors in 2009 at Lawrenceville, VA pilot plant
  - Developed robust enzyme catalysts and enzyme recycle process in partnership with Novozymes

Fiberight High-Solids Pulping

- Commenced production at Blairstown, Iowa plant, converted from corn ethanol plant into cellulosic ethanol plant in May 2010
  - Plant will be scaled to full commercial production capacity of 6 million gallons in 2012 with first production in 2011.
- Has site control for first commercial-scale biofuel plant in Elkridge, MD
- In 20-year partnership with TMO Renewables, UK, to build fifteen bio-refinery plants across the US in the next five years
  - Utilizing Fiberight digestion and fractionation process to produce "clean fiber" stream for TMO's bacterial fermentation process to produce ethanol

TMO Blairstown, Iowa Layout

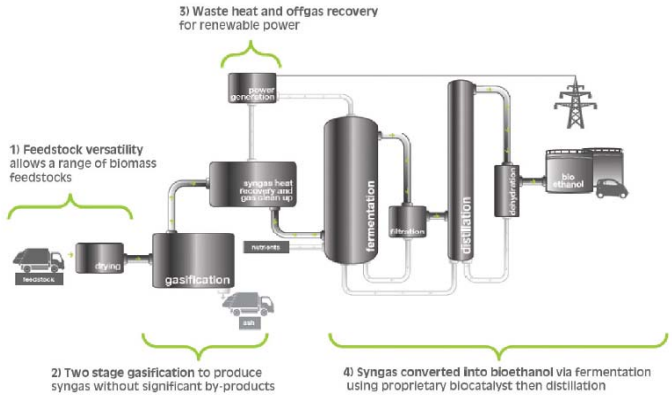
Harvest Power

- Advanced aerobic composting
  - Produces high quality compost
- Anaerobic digestion and gasification
  - For food and yard waste for power and heat
  - Produces biogas with 15-20% higher methane content than comparable single-stage system
- Founded in 2008; $150 million capitalization
- Acquired 100% of Coastal Supply Company, Inc, a Delaware-based soil and mulch manufacturer in September 2011
- Have facilities currently processing over 560,000 TPY of organic waste in PA, BC, and CA
- Facilities in development:
  - London, Ontario (under construction) – 65,000 TPY anaerobic digester to produce 22,000 kWh of energy and 4,000 tons of fertilizer annually
  - Vancouver- partnership with GICON Bioenergie GmbH to construct digestion facility

Fraser Richmond Soil & Fibre Richmond, BC

Harvest Bioenergy Centre London, Ontario

INEOS Bio



Feed Handling → Gasification → Fermentation → Ethanol Purification

INEOS New Planet Bio Energy Indian River County, FL

Pilot facility in Fayetteville, AR

- Facility to be constructed in Vero Beach, Indian River County, FL as a joint venture with NPE Florida
- Will process150,000 tons annually of waste materials from landfills to produce **8 million gallons of fuel-grade ethanol and 6 megawatts (gross) of electric power**
- **80-100 gallons of ethanol produced per dry ton of waste**
- Received and closed on DOE grant and $75M in USDA backed private financing, Total project investment will be more than $130M
- Project ground breaking was Feb. 2011; construction to be complete w/operations in April 2012
- Will create an estimated 380 direct and indirect jobs (including 175 construction jobs) over the next two years, and 50 full time jobs once the BioEnergy Center becomes operational

Lake County (IN) Solid Waste Management District Waste-to-Ethanol Project

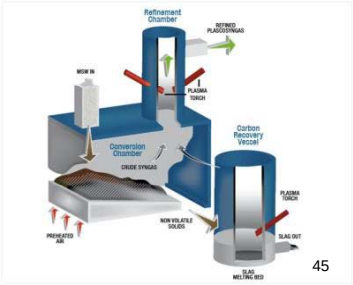
- Powers Energy One of Indiana LLC (developer) to use **INEOS** technology
- 2,000 TPD facility with multiple lines @ 125 TPD (16 lines)
- Capital cost: $256 million, awaiting confirmation of financing
- Plans include expanding to as much as 10,000 TPD
- INEOS guaranteeing 90 gallons ethanol per ton MSW input
- Tipping fee projected to be $17.25 per ton after 3 cents per gallon ethanol payment to municipalities participating and $2.50 per ton host community fee to the District
- Service agreements needed with most municipalities in Lake County; many executed
- Project stalled for site acquisition and financing partners; moving forward not

Source: Jeffrey Langbehn, Executive Director; November 2011

PlascoEnergy GROUP

- Shreds/processes MSW for introduction into conversion chamber
- Produces syngas (for electrical generation), recyclable slag, water, and recovered metals through gasification
- Uses plasma torches to refine the syngas produced
  - Limited use of torches = reduced electricity demand
- 94 ton-per-day capacity, 4MW commercial-scale Train Road facility in Ottawa, Canada
  - Partnership since 2006 with the City of Ottawa, facility has a small footprint (3 acres) and was built on existing landfill space
- Selected by the Salinas Valley Solid Waste Authority (CA) as a viable technology for planned Resource Management Park, Environmental Impact Study currently underway
- Shortlisted in Santa Barbara, CA

Plasco Trail Road



Taylor Biomass Energy LLC
Town of Montgomery, NY



- Expands the Taylor Sorting and Separating Process to accept mixed solid waste, in addition to wood waste, and waste from construction and demolition debris ("C&D") as inputs
- Converts the organic biomass portion of mixed solid waste to electric power, through gasification; 20 MW power
- Location: 95-acre site in Montgomery, Orange County, NY
- Plans to expand from 307 TPD of C&D waste and 100 TPD of wood waste to 450 TPD of C&D waste, 100 TPD of wood waste, and 500 TPD of MSW
- Construction started in January 2011, completion expected by early 2012
- $145 million construction cost - financed by $100 million in U.S. DOE grants, $20 million in private investment, and tax credits

Thermoselect SA - Pyrolysis

Chiba, Japan facility

- Applied gasification technology to MSW beginning in 1985
- Combined four proven technologies - compaction, pyrolysis, gasification and gas cleaning
- No waste preparation or RDF production required
- Can process a variety of feedstocks
  - Between 3,500 and 8,000 Btu/lb (HHV)
- Actively marketing system in U.S. - Qualified for a project with Los Angeles County, CA and Puerto Rico
- Has operated successfully in nine facilities, the first beginning in 1992 as a 110 tpd Demonstration Facility in Fondotoce, Italy
- Offered in U.S. by Interstate Waste Technologies, the North American licensee

City of Taunton, MA
Solid Waste Management Facility

IWT Interstate Waste Technologies

- Awarded through public procurement for non-mass burn incineration technologies
- Design capacity: 1,770 tons per day
- Guaranteed availability: 85.6% or 552,750 tpy
- Construction cost: estimate: $420 million
- Annual Operating costs: $55 million
- Estimated Start-up date: Late 2013
- Output (current): Gasification process with Syngas to methanol and then into Gasoline
- Est. of Net Service Fee: Approximately $50 per ton
- Owner is IWT Taunton Renewable Energy LLC.
- Financing: debt and equity; to apply for loan under DOE Loan Guarantee Program
- **Notified that this technical process (the 4th considered) is now within the MA ban on MSW combustion.**

Source: Multiple sources including Interstate Waste Technologies, May 2010

San Jose, CA

new contract to boost recycling

San Jose signs new contract to boost recycling

- The City of San Jose selected Zero Waste Energy Development for a 15 year contract to process all of the City's commercial organics under a new city-wide, collection system
- Technology: dry fermentation anaerobic digestion
- Objective to bring the commercial recycling rate to 80 percent by 2014 from current level of 22 percent
- Will be processing over 270,000 tons per year of waste that would otherwise be disposed in a landfill
- High quality compost and biogas will be produced
- Site development has started with operations planned to begin in in July, 2012

Summary Points

Technologies and Risk

Source: Gershman, Brickner & Bratton, Inc. September 2010

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

EPA Waste Reduction Model (WARM) Model Comparisons

Baseline Description	Alternative	Total GHG Emissions (MTCO2E/day) from:			
		Baseline MSW Generation and Management	Alternative MSW Generation and Management	GHG Emission or Reduction Difference	Barrels of Oil Saved (bbls/day)
Waste landfilled	20% Recycling	110	(310)*	(420)	523
Waste landfilled	50% Recycling	110	(543)	(653)	907
Waste landfilled	50% Recycling and Rest to Composting	110	(597)	(707)	904
Waste landfilled	50% Recycling and Rest to Waste To Energy	110	(661)	(771)	1,047

*Note: numbers in parenthesis are negative showing reductions in CO2 emissions.

Economic Factors

- Landfill disposal abundant and generally less expensive than WTE in the U.S.
  - *In Europe, landfilling unprocessed waste banned and/or taxed heavily*
- Recyclables worth a lot
- Energy revenues need to be high to compete with landfilling
  - Power alone not enough
    - Cogeneration and or combined heat and power applications help
    - MSW not always a renewable fuel
  - Liquid fuel products have much higher value
- Making collection more efficient can create funds for more recycling and waste conversion

Opinion: Trends for the Future

- Many conversion projects advancing
- Will need 4-6 years to learn what works and their economics
- Continuation of public sector taking “Low Risk” attitude until “proven”
- Demand for more recyclables expected to continue at attractive pricing
- More mixed waste processing systems [again]
  - Many conversion technologies require MSW pre-processing... for feedstock sizing and inerts removal
  - 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”

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!

Thank you!!

Harvey Gershman
HGershman@gbbinc.com

1-703-573-5800
1-800-573-5801
1-703-698-1306 (fax)

www.gbbinc.com