

NAWTEC

***The Latest and Greatest on the
Resurgence of WTE and
Conversion Technologies***

**Presented at the
19th Annual
North American WTE Conference
Lancaster, Pennsylvania**

May 18, 2011

**By
Harvey W. Gershman, President
With Research Support by Tom Reardon and Neil Daniel
Gershman, Brickner & Bratton, Inc.**

GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

NAWTEC

GBB Overview

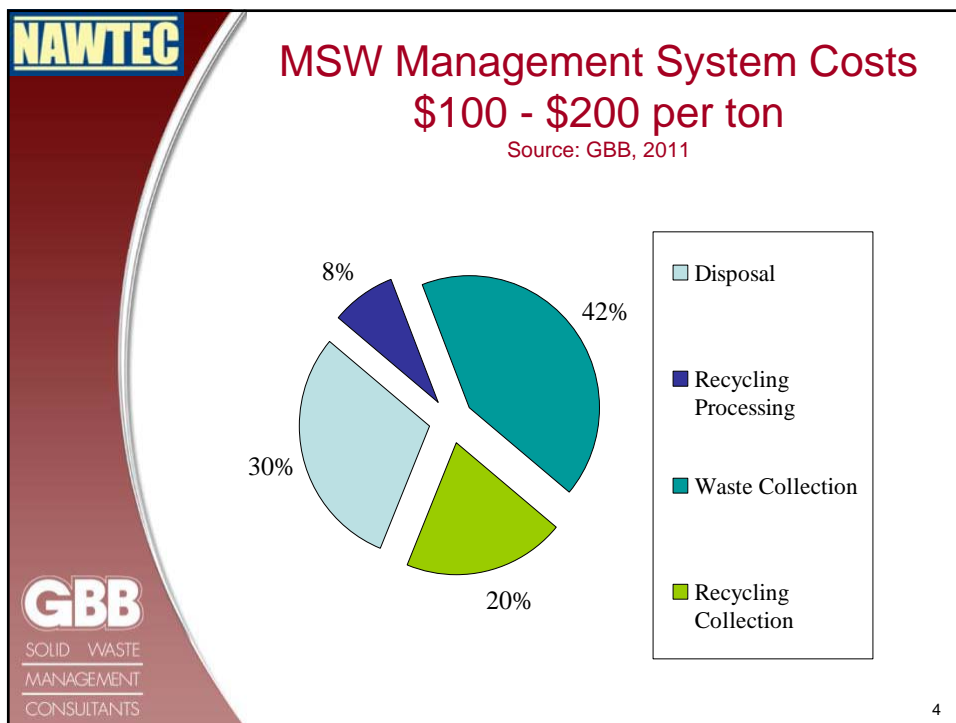
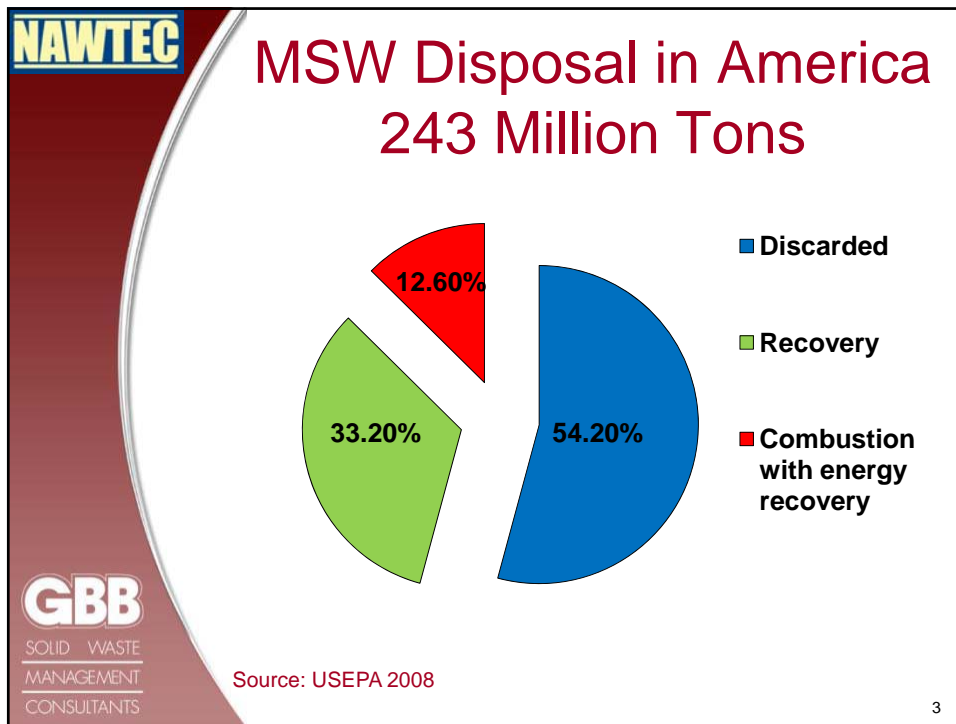


- Headquartered in Fairfax, VA
- Established in 1980 as an objective adviser to governments, institutions, and businesses
- 30 years implementing innovative solutions for waste and recycling industry
- Dedicated exclusively to solid waste management; more focused than broad-based firms
- "Change Agents" to produce better services and facilities

GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

**Celebrating our 30th
Anniversary**

2



NAWTEC

86 U.S. WTE Plants - \$14 Billion in Assets Generating approx. 2,700 MWs

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: IWSA (now Energy Recovery Council), 2010 Directory


GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

5

NAWTEC

1 Ton of MSW

- Has 11 million BTUs with 30% moisture
- Equivalent to:
 - 1 barrel of oil
 - ½ ton of coal
 - 11 DT natural gas
- Can make:
 - 5,500 lbs. of steam
 - 400 to 600 KWHrs of electricity
 - 48 gallons of ethanol



What if half of the waste landfilled went to WTE?

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

GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

6

NAWTEC

Locations Advancing "Proven" Technologies in the U.S.


- Mass burn expansions
 - Completed:
 - Hillsborough County, FL - Covanta
 - Lee County, FL - Covanta
 - Olmsted County, MN – Olmsted County
 - Under construction: Honolulu, HI – Covanta
- Locations advancing new facilities with 'proven' technologies:
 - Baltimore, MD – Energy Answers
 - Frederick County, MD (NMWDA) - Wheelabrator
 - Harford County, MD (NMWDA) - Wheelabrator
 - Palm Beach County, FL (SWAPBC) – B&W
 - Puerto Rico – Energy Answers
 - U.S. Virgin Islands – Alpine Energy/EPI

GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

7

NAWTEC

Energy Answers – 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
- RDF preparation offsite; locations under development
- Received all major permits and approvals for dedicated boiler and recycling operations
- 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 expected to begin spring 2011
 - Power production expected to begin spring 2013
 - Commercial operation late 2013


Source: Energy Answers

GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

8

NAWTEC

Energy Answers - Puerto Rico



- Puerto Rico Resource Recovery and Renewable Energy Project I
- 2,100 TPD, 80MW Renewable Energy Power Plant
- Private initiative not requiring a commitment of government financial resources to its construction, operation or long-term performance
- \$500 million private investment in renewable energy and solid waste management
- Expected to be in service in the next 3 years
- Site size is approximately 40 acres

GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

9

NAWTEC

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



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


GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

10


NAWTEC

Overcoming Procurement and Contracting “Potential Interruptions”

GBB Reports for the Solid Waste Authority of Palm Beach County



- “Meeting the Future: Evaluating the Potential of Waste Processing Technologies to Contribute to the Solid Waste Authority’s System (A White Paper)” – September 12, 2009
- “Response to the Florida Chapter of the Sierra Club” – May 3, 2011
- See: www.swa.org ‘Agendas & Minutes’





11

NAWTEC

Alpine Energy Group, LLC

St. Croix, US Virgin Islands

- Uses Bouldin WasteAway Refuse Derived Fuel (“RDF”) processing and recycling facility that will convert 200 tons-per-day of Municipal Solid Waste (“MSW”) into approximately 150 tons-per-day of RDF
 - 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 Summer of 2011
- Public hearing before the St. Croix Coastal Zone Management Commission in late April 2011



12

NAWTEC

Bouldin Corp. "WastAway" Process


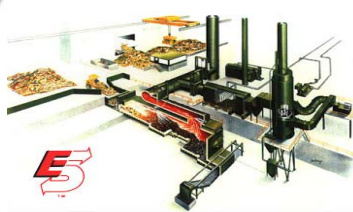
- Processes MSW into RDF; then steam heated and hydrolyzed to make RDF into a "Fluff" product
- First commercial plant in Morrison, TN began operations in 2003
- Commercial plant in Aruba; operational July 2009
- Selected by Alpine for projects in the U.S. Virgin Islands

GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS


13

NAWTEC


Enercon Systems



Pittsfield, MA



Agawam, MA



Wallingford, CT

- MSW WTE systems - up to 560 TPD (up to 15 MW)
- MSW "step-hearth" combustors- From 5 to 140 TPD
- Gas cleaning systems - baghouses, scrubbers, etc.; dioxin/furan levels well below latest EPA Regulations
- Three operating facilities in U.S. operating since 1980s
- Also engineer and manufacture:
 - Various incinerators, pyrolysis, dampers, special waste-heat boilers, vitrification systems, and industrial drying systems

GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS



Recent Activities Investigating Conversion Technologies in the U.S.

- Some locations that have investigated technology:
 - Broward County, FL
 - City of Los Angeles, CA
 - City of Sacramento, CA
 - King County, WA
 - Los Angeles County, CA
 - New York, NY
 - Tallahassee, FL
- Some locations that are currently investigating technologies:
 - City of Allentown, PA
 - City of Glendale, CA
 - City of Plano, TX
 - City of San Antonio, TX
 - Santa Barbara County, CA
 - San Bernardino County, CA

15



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

- 30 Aerobic Composting
- 106 Anaerobic Digestion
- 34 Ethanol Fermentation
- 170 Gasification
- 47 Plasma Gasification
- 47 Pyrolysis
- 61 WTE: mass burn, modular, dedicated boilers, and RDF
- 68 Others (agglomeration, autoclave, depolymerization, thermal cracking, steam reforming, hydrolysis)

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

16

NAWTEC

58 Conversion Locations Claimed to be Operating Commercially with MSW

- 31 Anaerobic Digestion
- 17 Gasification
- 2 Plasma Gasification
- 6 Pyrolysis
- 2 Other (Agglomeration, autoclave, depolymerization, Thermal Cracking, Steam reforming, hydrolysis)

GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

17



NAWTEC

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

GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

18



Grants and Loans



Federal

- In December 2009, 19 alternative technologies received a total of \$564 million from DOE for Pilot, Demonstration and Commercial Projects
- *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*

States


- California and Pennsylvania as examples


19




Selected Alternative Technology Companies and Projects

20

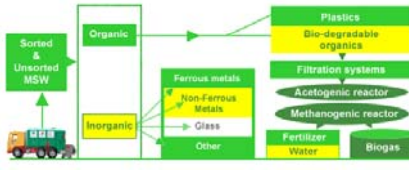




SOLID WASTE
MANAGEMENT
CONSULTANTS




ARROWECOLOGY
THE WAY TO ZERO WASTE





Hidra, Israel Pilot Plant

- 100,000 tons per year of MSW
- 320 TPD on a 6 days per week basis
- Initial separation of recyclables using water slurry
- 23,000 tons of compost product
- 19,000 tons of residue
- Capital cost \$70K +/- per daily installed ton




21






SOLID WASTE
MANAGEMENT
CONSULTANTS

ArrowBio – Sydney, Australia




WSN Facility – 300 TPD
Jacks Gully Tank Farm
Fall 2008

22




CR&R Inc. – Perris, CA


- Selected as one of four by Los Angeles County alternative technology projects
- 150 TPD from CR&R dirty-MRF post-recycled residual output to Arrow Bio anaerobic digestion system; convert the biogas generated into biomethane for their truck fleet
- In January 2011, received a \$4.5 million California Energy Commission Alternative and Renewable Fuel and Vehicle Technology Program grant
- Advancing permit approvals




SOLID WASTE
MANAGEMENT
CONSULTANTS

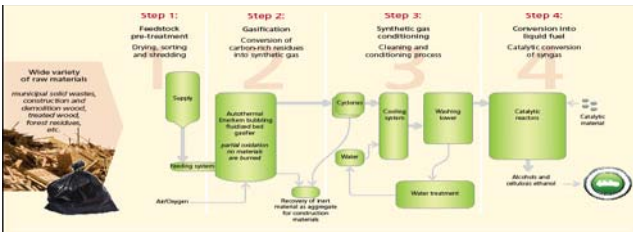
23






- Gasification and conversion to ethanol biofuel
- Pilot plant in Westbury, Quebec
- Catalyst conversion system proven and operational
- Feedstock flexibility







SOLID WASTE
MANAGEMENT
CONSULTANTS

24




Enerkem Edmonton, Alberta



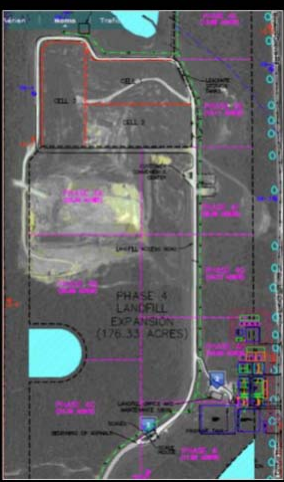
- **Feedstock** : Sorted Municipal Solid Waste
 - 660 TPD to 330 TPD RDF for feedstock
- **Total Capacity** : 10 M gallons per year (initially)
- **Product** : Syngas, Methanol, Ethanol
- **Start date**: 2012
- **Approval**: Environmental permit granted
- Good support during public consultation process
- See: www.edmontonbiofuels.ca




25



Enerkem – Three Rivers Solid Waste Management Authority (Pontotoc, MS)



- **Feedstock** : Sorted Municipal Solid Waste and wood residues
 - 660 TPD to 330 TPD RDF for feedstock
- **Total Capacity** : 10 M gallons per year (initially)
- **Product** : Syngas, Methanol, Ethanol
- **Start date**: 2012
- LOI signed with the Three Rivers Planning and Development District for MSW feedstock
- Currently in permitting cycle
- Will help recycle and convert 60% of the waste crossing the area's landfill gate
- Awarded \$50M funding from U.S. DOE advanced bio-refineries program



26

NAWTEC

Entech Typical Arrangement Advanced Conversion Technology

THERMAL REACTOR ENERGY FILTRATION HEAT EXCHANGER AIR QUALITY CONTROL SYSTEMS
PYROLYTIC GASIFICATION CHAMBER OPTIONAL TURBINE GENERATOR
TYPICAL ENTECH RENEWABLE ENERGY SYSTEM FOR MSW-BIOMASS

ENTECH
RENEWABLE ENERGY SOLUTIONS

GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

April 2010: Los Angeles County advances negotiations for a facility at Rainbow Disposal in Huntington Beach, CA

27

NAWTEC

Geoplasma

Jacoby Energy

Plasma Converter System Process

The Five (5) Step PCS Process

Feedstock Material In → Plasma Converter Feed System → Plasma Vessel → Plasma Converted Gas (PCG) → Cool And Neutralize → PCG Filter → PCG Storage Tank → For Use

Molten Silicate and Metal (byproduct from Plasma Vessel)


Step 1 Feed **Step 2 Dissociate** **Step 3 Cool** **Step 4 Neutralize** **Step 5 Filter**

- Generates a SYNGAS for power generation
- Plasma vessel based on Westinghouse (Alter NRG) Plasma furnace

GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS


ALTER NRG

28




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: First Quarter 2011, subject to permits and financing
- Florida DEP Air Construction Permit Application obtained September 2010
- Operations Start: Mid 2013



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



SOLID WASTE
MANAGEMENT
CONSULTANTS

29



INEOS New Planet Bio Energy, LLC Indian River County, FL

- Vero Beach, Indian River County, FL
- In Dec. 2009, received \$50 million DOE grant
- Feedstock: wood, vegetative residues, and C&D materials into ethanol
- 80-100 gallons of ethanol per dry ton of biomass
- The project ground breaking February 2011
- 150,000 tons annually of waste materials from landfills to produce 8 million gallons of fuel-grade ethanol and 6 megawatts of electric power










SOLID WASTE
MANAGEMENT
CONSULTANTS

30

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
- Plans include expanding to as 10,000 tons per day
- INEOS guaranteeing 90 gallons ethanol per ton MSW input
- Tipping Fee projected to be \$17.25 per ton after 3 cent 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

Source: Jeffrey Langbehn, Executive Director; June 2010

31





- Headquartered in Ottawa, Canada
- Shreds/processes post recycled MSW for introduction into conversion chamber
- Produces Syngas for electrical generation
- Two operating facilities
 - 94 ton-per-day capacity plant in Ottawa, Canada
 - 5 ton-per-day research and development facility in Castellgali, Spain
- Shortlisted in Santa Barbara, CA
- Selected by the Salinas Valley Solid Waste Authority (CA)
- Other plans to build facilities in Canada and China




32

NAWTEC

City of San Jose, CA







City of San Jose signs new contract to boost recycling

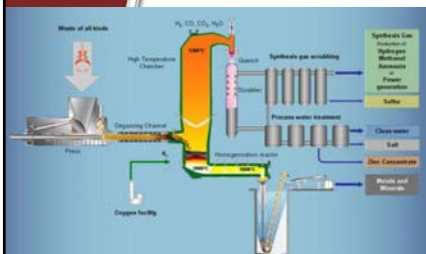
- Negotiating new 15-year contracts with two private waste management companies (Allied Waste Services of North America and Zero Waste Energy)
- Technology: dry fermentation anaerobic digestion
- Objective to bring the commercial recycling rate to 80 percent by 2014 from current level of 22 percent

GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

33

NAWTEC

Thermoselect SA - Pyrolysis



- Swiss pyrolysis/gasification technology
- No waste preparation or RDF production required
- Offered in U.S. by Interstate Waste Technologies, the North American licensee
- Seven facilities with this technology in Japan (with variety of fuels)
- Actively marketing system in U.S.
- Qualified for a project with Los Angeles County, CA and Puerto Rico

GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

34

NAWTEC



GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

City of Taunton, MA Solid Waste Management Facility



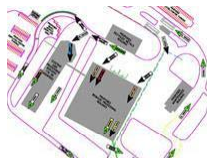
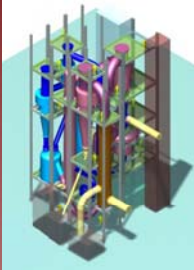
- Awarded through public procurement for non-mass burn incineration technologies
- Design capacity: 1,770 tons per day
- Guaranteed availability: 85.6% or 552,750 tons per year
- Construction cost: \$420 million
- Operating costs: \$55 million
- Estimated Start-up date: Third Quarter 2013
- Electricity Output (initially): sell net 54 Mw; 733 Kwhr per ton
- Ethanol Output (current): 34 million gallons per year; 61.3 gallons per ton
- Other Outputs (Per Input Ton): approx. 20 percent (Aggregate, Metal, Sulfur, Salt, and Zinc Concentrate)
- 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

Source: Interstate Waste Technologies, May 2010

IWT
INTERSTATE WASTE TECHNOLOGIES

35

NAWTEC







GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

Taylor Biomass Energy LLC Town of Montgomery, NY

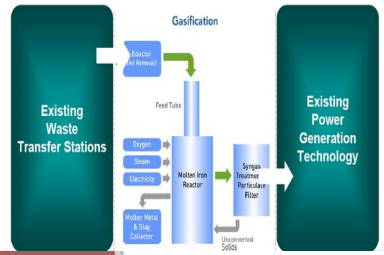
- Expands the Taylor Sorting and Separating Process to accept mixed solid waste ("MSW"), in addition to wood waste, and waste from construction and demolition debris ("C&D") as inputs
- Converts the organic biomass portion of mixed solid waste (MSW) to electric power, through gasification; 20 MW power
- Location: 95 acre site at 350 Neelytown Road, Montgomery, in 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
- \$145 million construction cost

36




Ze-gen

Attleboro (MA) Clean Energy Project



- Proposed \$20 million facility to be located within the existing Attleboro Corporate Campus
- The technology will be used to convert approximately 75 tons per day of waste material into synthesis gas
- Obtaining permits and approvals
- Impacted by the Massachusetts incinerator ban policy
- Construction expected to take one year
- Intends to be online in the first quarter of 2012



SOLID WASTE
MANAGEMENT
CONSULTANTS

37



Some Others To Watch Also...



Chinook Energy
THE END-STAGE
RECYCLING COMPANY®



COVANTA
ENERGY
for a cleaner world



R3 ENVIRONMENTAL
RECLAIM. RECYCLE. REUSE.




Wheelabrator Technologies Inc.
A Waste Management Company




SOLID WASTE
MANAGEMENT
CONSULTANTS

38




Summary Points



SOLID WASTE
MANAGEMENT
CONSULTANTS


39



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



SOLID WASTE
MANAGEMENT
CONSULTANTS

40

NAWTEC

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!)

GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

41


NAWTEC

Economics Holding Back WTE

- Landfill disposal abundant and relatively cheap
 - *Why don't we tax landfill use more like they do in Europe?*
- Recyclables worth a lot
- Energy revenues not high enough
 - Power alone not enough
 - Cogeneration/CHP applications necessary with power
 - Liquid fuel products have much higher value
- Create funds for higher cost WTE by making collection more efficient

GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS


42



**STATEMENT FROM GOVERNOR
MARTIN O'MALLEY ON HIS DECISION
TO SIGN SENATE BILL 690**

ANNAPOLIS, MD (May 17, 2011) – Governor Martin O'Malley issued this statement today regarding Senate Bill 690 - Renewable Energy Portfolio - Waste-to-Energy and Refuse-Derived Fuel:

“After careful deliberation, I have decided to sign Senate Bill 690. Our State has an aggressive goal of generating 20% of our energy from Tier I renewable sources by 2022 and we intend to achieve that goal through as much in-state energy generation as possible. This will require a diverse fuel mix including onshore and offshore wind, solar, biomass including poultry litter, and now waste-to-energy if we are to realize our 20% goal. ...”




SOLID WASTE
MANAGEMENT
CONSULTANTS

43



Trend for Future

- New technologies will need 4-6 years to learn if they work and their economics
- Added economic benefit of placing value on carbon credits and power from waste as 'renewable energy'
 - Possible impetus for more proven technologies that are now deemed too expensive
- Renewable fuel standards from EPA and added recycling requirements



SOLID WASTE
MANAGEMENT
CONSULTANTS

44

NAWTEC

Trend for Future (Cont'd)

- Low risk assumption by public sector until new technologies proven
- Continued demand for recyclables; industry wants more paper, aluminum, and plastics
- 'Environmentalists' and 'Zero Waste' proponents will continue to fight WTE and alternative technologies calling them all "incineration"

GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

45

NAWTEC

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
- Development Team Committed with Resources
- Political Will

GBB
SOLID WASTE
MANAGEMENT
CONSULTANTS

46




The Ultimate Goal:

Fully Integrated and Efficient Waste Management System with Significant Diversion and WTE ...in a 50-50 partnership!

...for more jobs, better environment, and energy independence!



47




Thank you!!

Harvey Gershman

hgershman@gbbinc.com

1-800-573-5801
1-703-663-2424 (office)
1-703-698-1306 (fax)

www.gbbinc.com



48