Waste-to-Energy and Conversion Technologies in the U.S. with Alexandria/Arlington VA Case Study

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By

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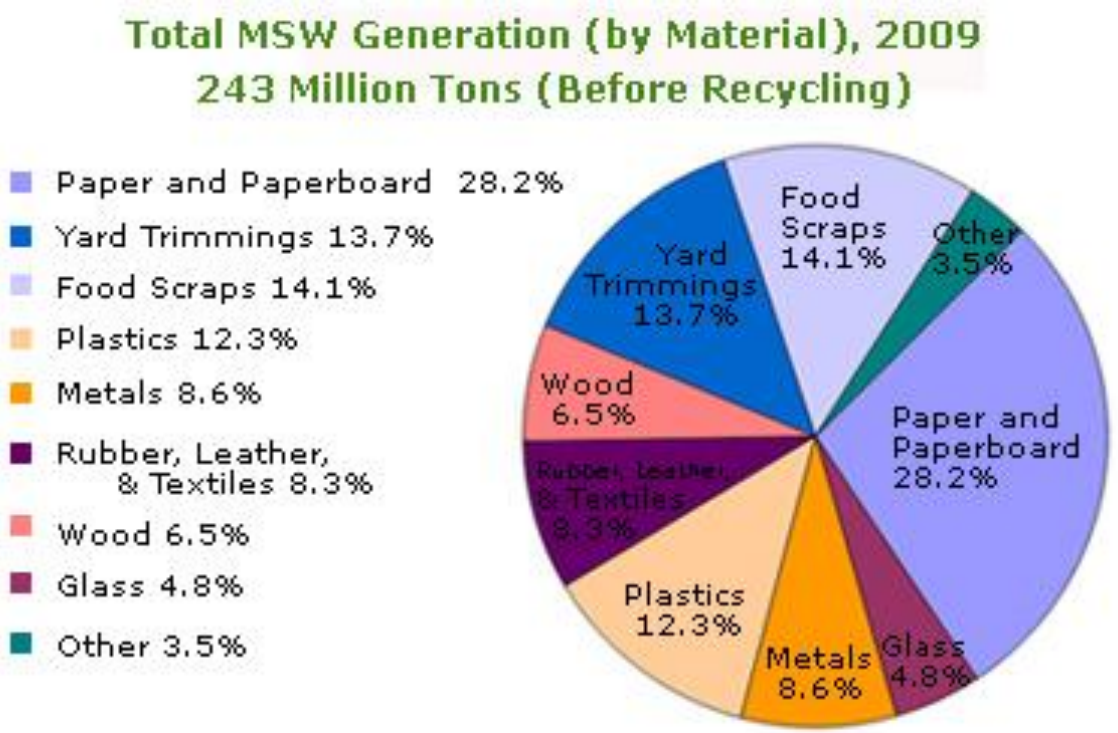
GBB
SOLID WASTE MANAGEMENT CONSULTANTS

Waste Facts
(Before Recycling)

Source: U.S. EPA 2009

http://www.epa.gov/wastes/nonhaz/municipal/

- In 2009, 243 million tons MSW generated
- In 2009, the per capita generation of waste was 4.34 pounds per person per day or approximately 1,584 lbs. per year
  - Estimated 1,752 lbs. per year by 2010



Selected Commodity Recycling Rates

- The EPA reports the following recycling rates of selected materials in 2009 [1]:
  - Auto Batteries: 95.7%
  - Office Type Papers: 74.2%
  - Steel Cans: 66.0%
  - Yard Trimmings: 59.9%
  - Aluminum Beer and Soft Drink Cans: 50.7%
  - Tires: 35.3%
  - Glass Containers: 31.1%
  - HDPE Natural (White Translucent) Bottles: 28.9%
  - PET Bottles and Jars: 28.0%

1 – Does not include combustion (with energy recovery).

What's in our waste… Zero Waste?

- Recyclables
  - Feasible to recycle 50-70 percent
- Energy Content of remainder
  - 5,500 BTUs per pound
    (coal at 9,000 BTUs per pound)

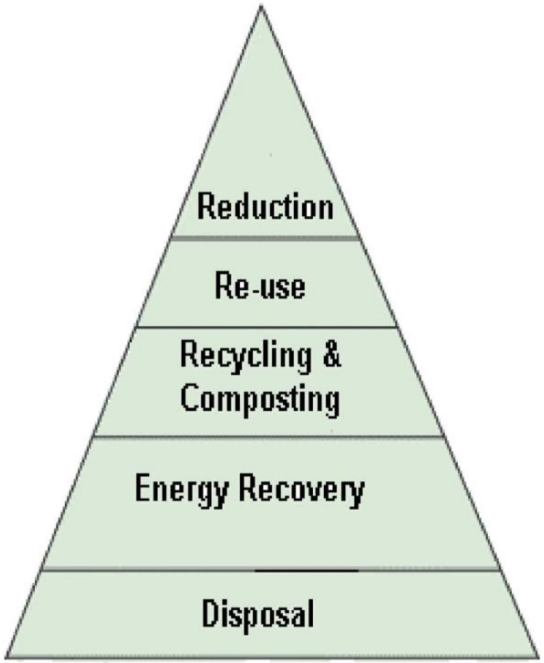
EPA's Waste Management Policy

Hierarchy Policy

- (Previous) Waste Management Hierarchy
  - Source Reduction
  - Recycling
  - Landfill and Incineration
- (Current) Waste Management Hierarchy
  - Source Reduction
  - Recycling
  - Incineration/Thermal Processing with energy recovery
  - Landfilling/Incineration without energy recovery

Source: Rick Brandes, U.S. EPA, 2009

Waste Management Hierarchy



Note: In 2005, EPA designated WTE energy as renewable energy and 35% recycling goal established!

What is Potential of Waste to Energy

- Potential Outputs of 1 Ton of MSW
  - Power - up to 750 kWh of electricity produced on 80 to 100 gallons of ethanol
  - Metals – up to 50 pounds of recovered ferrous & non-ferrous metals
  - Ash – 10% of the original volume; 25%-30% by weight

Alternative Technologies in the 1970s and Early 1980s

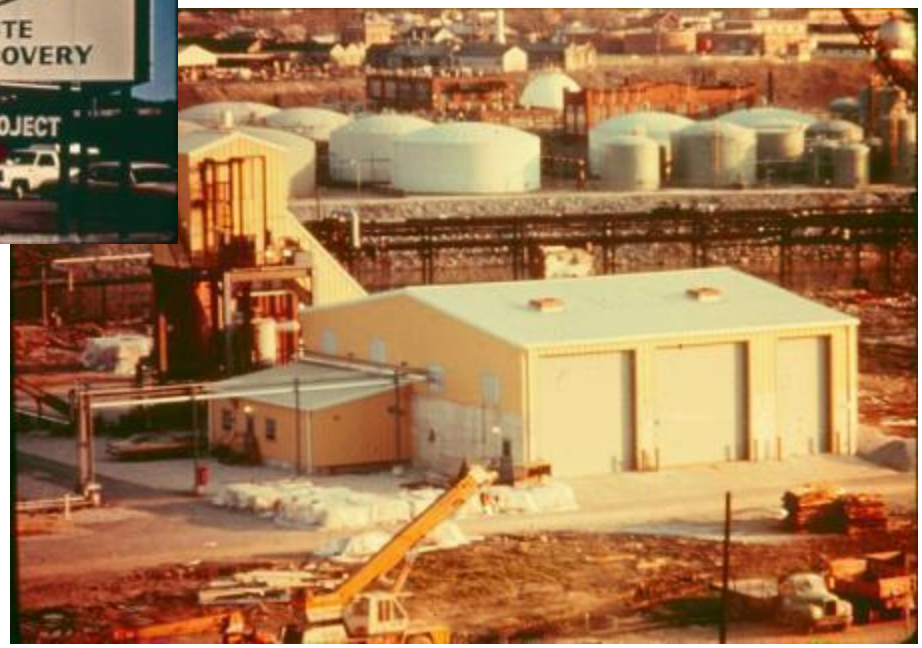
- Andco Torrax Gasifier in Niagara, NY
- Black Clawson Hydropulper in Franklin, OH
- CEA Eco-Fuel in Bridgeport, CT
- Columbus, Ohio RDF Burning Power Plant
- Occidental Petroleum, GarbOil in San Diego, CA
- Monsanto Pyrolysis in Baltimore, MD
- Recovery 1 in New Orleans, LA
- Union Carbide Oxygen Pyrolysis in Charleston, WVA
- RDF for Utility Boilers in St. Louis, MO; Milwaukee, WI; Rochester, NY; and Chicago, IL

Why did these projects fail or stop operating?

Monsanto Languard Pyrolysis Kiln Baltimore, MD (1,000 TPD)

(Late 1970s, low quality gas)

Union Carbide Purox System Charleston, WV (300 TPD)



NCRR Recovery I Facility New Orleans, LA (750 TPD)

Primary goal was shredding and extensive materials recovery prior to landfill

RDF 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.

Waste to Energy:
$14 Billion of Productive Assets Servicing the U.S.

North Broward County, FL

Alexandria/Arlington, VA

Springfield, MA

Today's WTE and Conversion Technologies

- Energy Recovery Council represents companies and local governments engaged in the waste-to-energy sector
- Base load electric generation capacity of Approx. 2,700 MWs
- Process more than 28 million tons of trash per year

Source: Energy Recovery Council

U.S. WTE Plants by Technology

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	12	15,428	4.8
RDF - Processing Only	2	6,075	1.9
RDF – Coal Combustion	2	4,592	1.4
Total U.S. Plants (2)	87	98,791	30.6
WTE Facilities	83	92,716	28.7

(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.

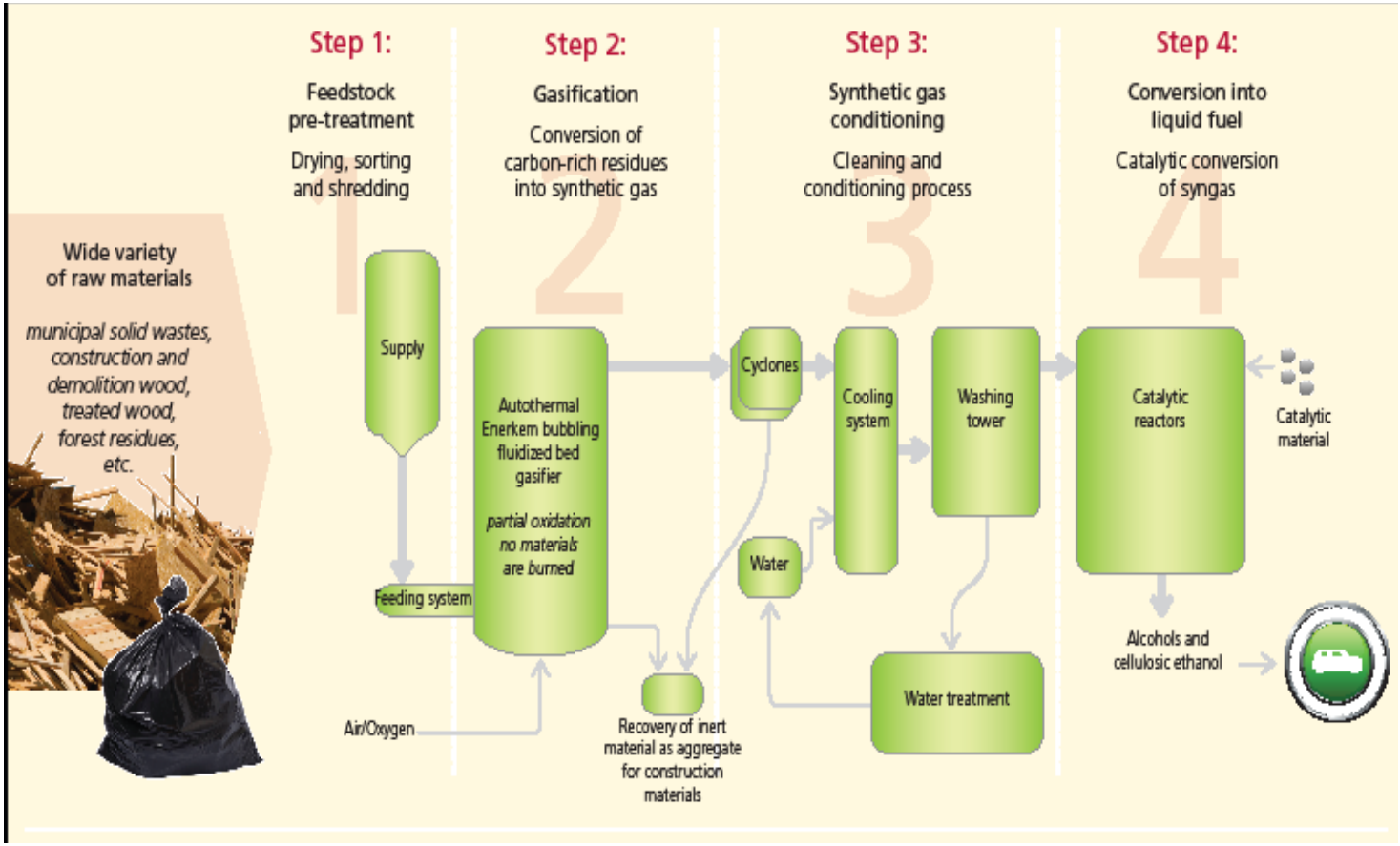
(2) Total Plants includes RDF Processing facilities that do not generate power on site.

Source: IWSA (now Energy Recovery Council)

FED Grants Announced

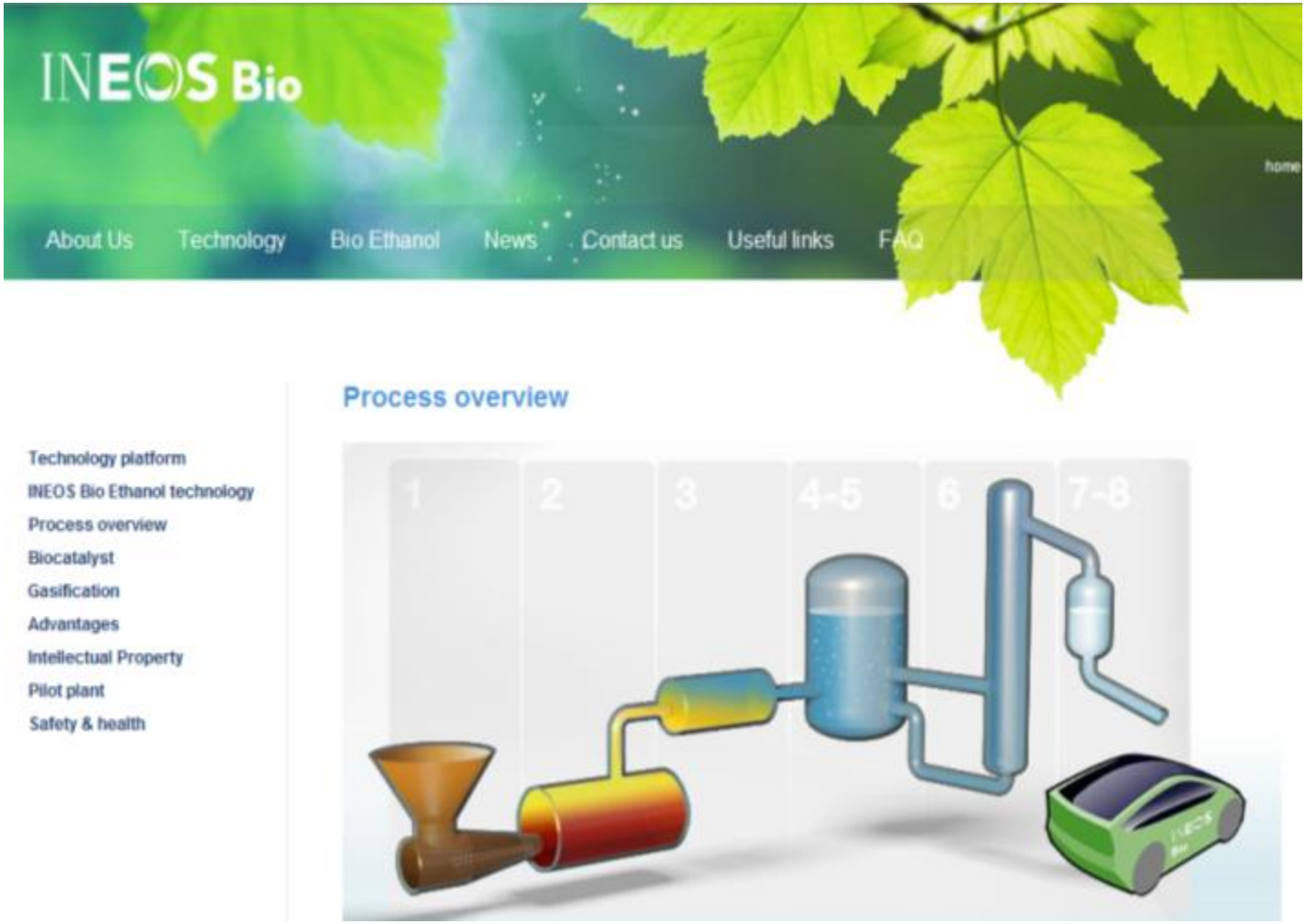
- GBB is tracking over 500 different “Alternative Technology” companies with various solid waste industry offerings
- In December 2009, 19 alternative technologies received a total of $564 million from DOE for Pilot, Demonstration and Commercial Projects
- USDA providing loan guarantees

Biofuel from Thermal Gasification Enerkem Technology



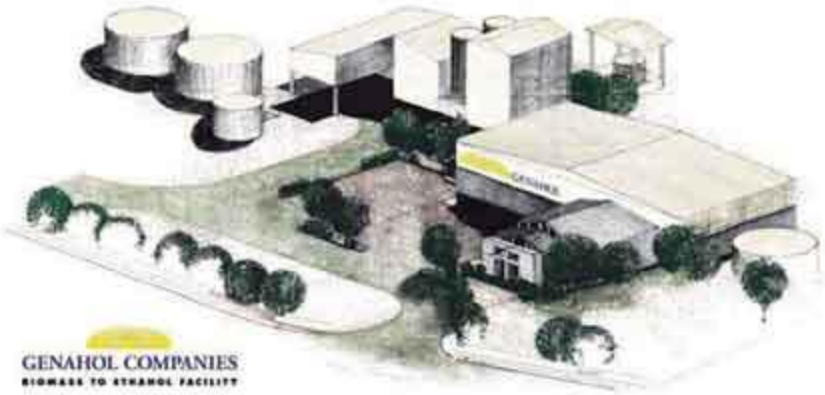
In Dec. 2009, awarded DOE bio-refinery grant of $50 million for project in Mississippi (Company putting up $90 million)

INEOS Bio Waste into Ethanol



In Dec. 2009, received $50 million DOE grant for project in Vero Beach (Indian River County) – biomass gasification

Lake County, IN
Waste-to-Ethanol Project



Genahol Powers 1 LLC

Initially…now

Powers Energy One of Indiana LLC

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

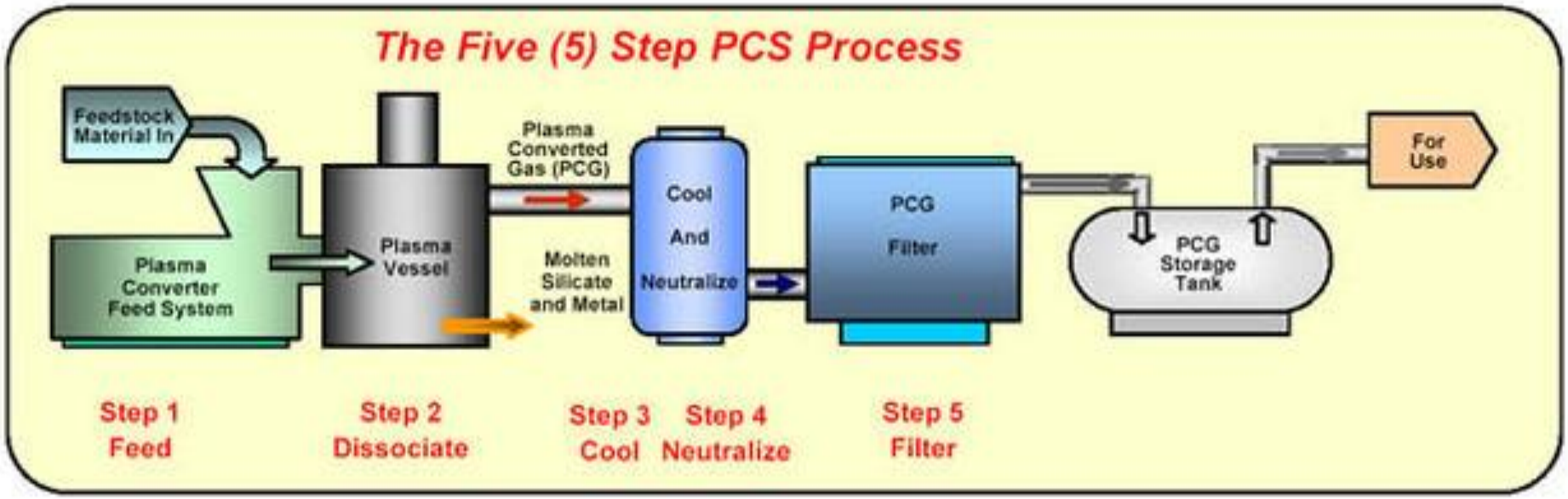
- Powers (developer) to use INEOS technology
- 2,000 tons per day facility with multiple lines sized for 125 tons per day each (16 lines)
- Capital cost: $256 million
- Plans include expanding up to10,000 tons per day
- INEOS guaranteeing 90 gallons ethanol per ton MSW input
- Tipping Fee projected to 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

Geoplasma

Jacoby Energy

Plasma Converter System Process



Generates a SYNGAS that is available for use in power generation. Plasma vessel based on Westinghouse Plasma furnace. Currently permitting a 600 TPD plant in St. Lucie County, FL to generate 22 MW power

Alternative Conversion Technologies

- Biological
  - Aerobic Composting
  - Anaerobic Digestion/ Codigestion
  - Biodiesel
  - Bioethanol
  - Biological Pretreatment
  - Vermicomposting
- Thermal/Chemical
  - Acid Catalysis & Distillation
  - Direct Combustion
  - Gasification/Pyrolysis
  - Microwave Processes
  - Plasma-Arc
  - Thermal Decomposition
- Processing
  - Fiberboard and Construction Composites
  - Refuse Derived Fuels

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

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/guarantor
- Community acceptance (work with community; don't surprise them!)
- Other risks and unknowns

Recent Planning and Procurement Activities with Waste Processing Technologies in the U.S

- Locations with Planning/Procurements:
  - New York, NY; City of Los Angeles, CA; Los Angeles County, CA; St. Lucie County, FL; Hawaii County, HI; Frederick and Carroll Counties, MD (NMWDA); Harford County, MD (NMWDA); City of Sacramento, CA; Tallahassee, FL; Broward County, FL; Palm Beach County, FL; Taunton, MA; Santa Barbara, CA; San Bernardino County, CA
  - 80 different companies responded

Technologies and Risk

Source: GBB, April 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

Introduction to:

Alexandria/Arlington WTE Facility

City of Alexandria and Arlington County, Virginia

- Original site: 3.3 acres and used to be 300 TPD “incinerator” which closed in 1979 due to inability to meet new stringent APC requirements
- Bond sale: $75 million in 1984 for 975 TPD plant implemented with Ogden (Covanta); in operation since 1988
- Part of contract included building interim transfer station within 180 days of contract (replacing existing City transfer equipment)
- Implemented when:
  - Higher electricity revenues
  - Need for disposal capacity

Original facility (Pre-retrofit)

- Original capital price:

  $55 million in 1984, plus $20 million soft costs (such as Construction Interest and other expenses)

- 20-year facility operating agreement

Waste Supply and Facility Capacity (tons per year)

- Jurisdictions Controlled - 68,000 TPY
- Privately Controlled and Collected in Jurisdictions - 208,000 TPY
- Guaranteed Annual Tonnage (“GAT”) by Jurisdictions - 225,000 TPY
  - Alexandria – 90,000TPY
  - Arlington County – 135,000 TPY
- WTE Guaranteed Processing Capacity - 302,000 TPY
- WTE Nominal Annual Throughput Capacity - 345,000 TPY

Jurisdictions Waste Disposal Trust Fund

- **Typical Income Streams**
  - Property tax payments
  - Misc. payments from Company
  - Interest earnings
- ***Typical Expense Streams***
  - *End of Year Payments*
  - *Differential Tipping Fees for GAT Waste*
  - *Operating Expenses*

In 1998, Trustees Faced with:

- No flow control
- Diminishing waste supply
- Lower electricity revenues
- Need to decide on major retrofit to meet Clean Air Act Amendments

1998 GBB Completed Strategic Analysis

- Closing of the Facility was evaluated and determined to be more costly
- Developed waste supply contracts with major private haulers (at slightly discounted rates with put or pay)
- Facility Agreement ("FA") Amendments negotiated providing for Retrofit/Improvements Project; Operating term extended for 5 years
- Initial Bonds refinanced ($55 million Series 1998A Refunding Revenue Bonds) and $46 million Retrofit Bond financing accomplished in 1998
- Alternative revenue source (e.g. generator fees) deferred until FY 2005- 2007, when Trust Fund diminished

Estimated 1999 Waste Flows, TPY

Jurisdiction controlled collection [1]	68,000
Covanta contracted [1] w/ Municipality OK	159,600
Non-contracted, Spot Waste	81,000
Special waste	4,000
Total	**312,600**

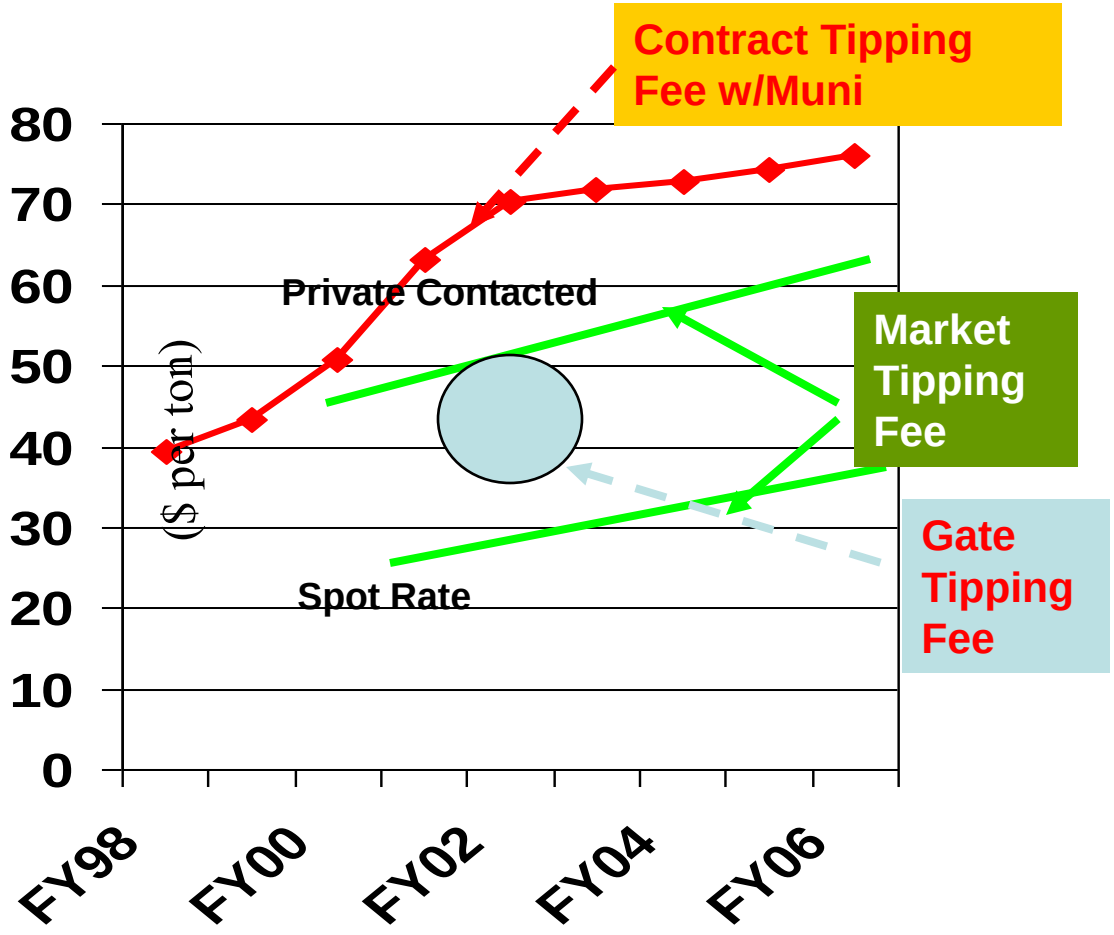
1 – Delivered to jurisdictions credit

Waste Supply Contracts

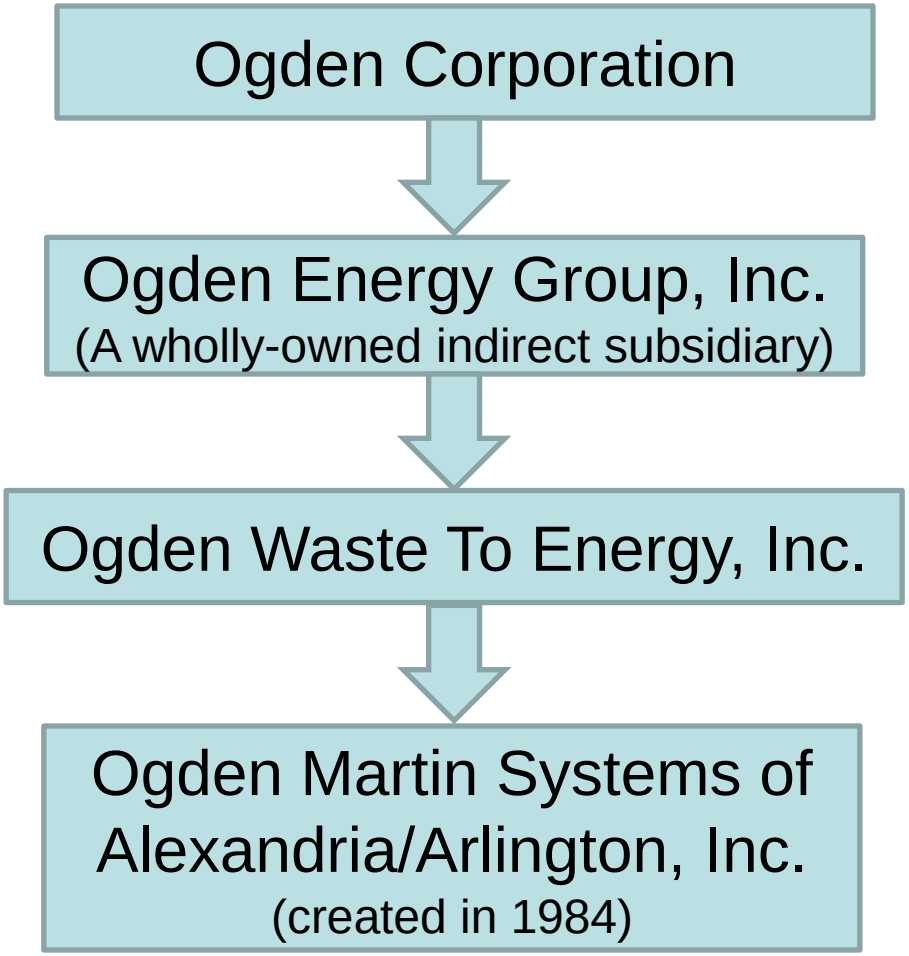
- Contracts executed by Company, with Jurisdictions assistance and consent with 2 private haulers representing 45 % of waste supply for the Facility
- Term: 2-5 years
- Pricing: competitive with marketplace
- Pricing philosophy:
  - *What does it need to be to keep your waste here?*
  - *Where else could they go?*
- Put or Pay provisions for tipping fee revenue included

Alexandria/Arlington Contractual Tipping Fees

Tipping fee differential payments paid from Waste Disposal Trust Fund or user fee through Authorities



Original Corporate Structure

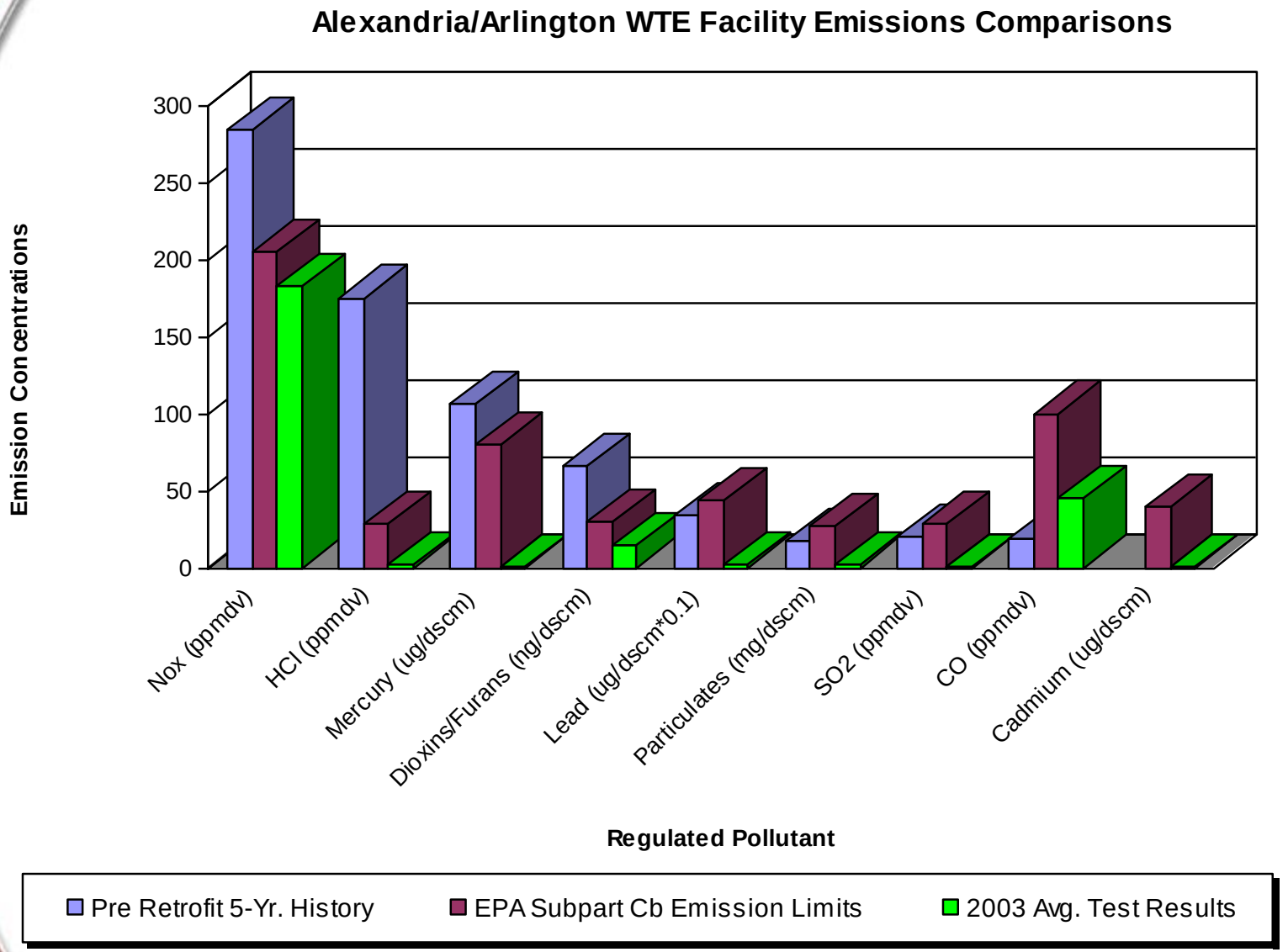


Note: Cooperative agreement to use Martin technology

Retrofit/Improvements Project and 1998 B Bonds

- Public ownership structure to avoid State tax-exempt volume cap; leasing structure
- Site expanded for construction and improved road access (approx. 5 acres total)

- CAA Amendment Retrofit for reduction in the following emissions:
  - *Hydrogen Chloride; Sulfur Dioxide; Nitrous Oxides; Carbon Monoxide; Dioxins; Mercury; Lead and Particulate Matter*
  - *The emissions will be very clean!*
- Stack and windows treatment added for aesthetic improvement


Alexandria/Arlington WTE Facility Emissions Comparisons
Emission Concentrations
300
250
200
150
100
50
0
Nox (ppmdv)
HCl (ppmdv)
Mercury (ug/dscm)
Dioxins/Furans (ng/dscm)
Lead (ug/dscm*0.1)
Particulates (mg/dscm)
SO2 (ppmdv)
CO (ppmdv)
Cadmium (ug/dscm)
Regulated Pollutant
Pre Retrofit 5-Yr. History
EPA Subpart Cb Emission Limits
2003 Avg. Test Results

Retrofit Construction Efforts

- $46 million project for Clean Air Act Amendment requirements and site improvements, $3 million of which were defeased in 2003
- Site improvements are installed and operational, including Stack covering and new windows
- Clean Air improvements completed December 2000 to meet permit regulations
- Landscaping and ferrous removal projects have been added since retrofit completion

Uncertainty in Facility Funding Leads to Flow of Fees Analysis by GBB

- Residences pay in household user fees for collection, recycling, and disposal services
- Commercial waste collection is open market and haulers pay lower “market” tipping fee or contract rate
- Tipping fee differential paid by Trust Fund
- Generator fees and commercial contract areas or franchise fee considered and rejected

Trust Fund Projections

- Post -Financing operating results during Retrofit better than projected
- Waste supply contracting working well
- Updated optimistic and pessimistic forecasts show Trust Fund “crossover” year has moved out

Note: GBB served as Authority’s consultant from 1998 - 2005

Uncertainty about the Future and Issues to Resolve

- Quantity of waste delivered to the Facility
- Competition and regional disposal alternatives
- Revised tipping fee projections
- Negotiating new deal points with private haulers
- Acceptability of alternative revenue sources

Examples of Alternative Funding Approaches

- Environmental Investment Charge across waste generators according to waste generation levels
- Spread burden across all taxpayers through property tax increase or General Fund subsidy
- Establish waste districts
  - Contract collection
  - Franchise commercial haulers

Comparison of Alternative Funding Approaches

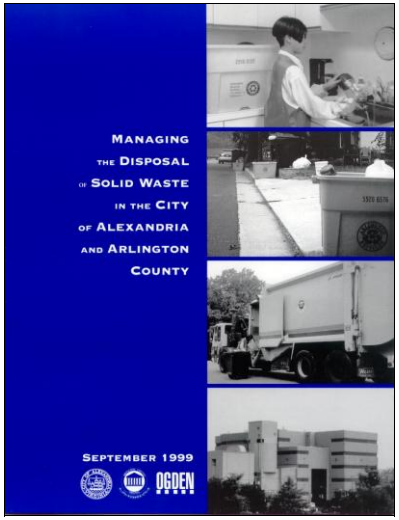
Alternative	Pros	Cons
1. Environmental Investment Charge	• Waste generators share costs equitably • Creates economic flow control to Facility	• Requires additional administrative functions be put in place • Non-residential generators receive new waste charge from County
2. Property Tax Increase or General Fund subsidy	• Easy to administer and implement	• City tax rate increase • Revenue collected based on assessed value and not waste generation
3. Commercial Waste – Contracting – Franchises	• Creates absolute control over waste generated • Contracting offers opportunity for lower collection costs • Franchising keeps existing haulers in place	• 5 year legal notice requirement • 1 year's revenue payment to shorten implementation onerous • Contracting displaces many haulers • Franchising adds costs

Alexandria/Arlington

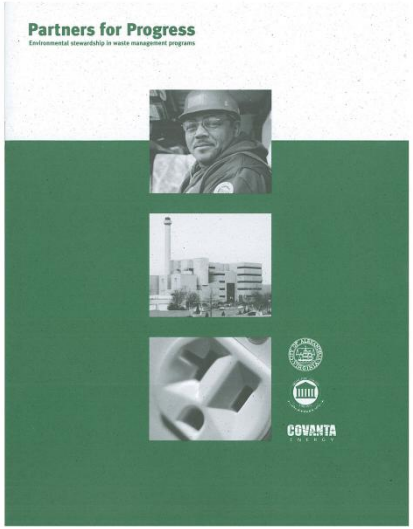
- Keep renegotiating waste supply contracts -- keep your eye on the ‘waste’ ball
  - BFI acquired by Allied, then Republic
  - Large regional presence by Republic initiates consolidation of waste agreements
- Commercial waste control may mean Facility undersized; recycling may need to be stepped up
- Track and participate in renewed interest in Federal legislation in case something passes
- Considered and rejected starting 5-year clock to take over commercial collection services

Public Information

- Blue brochure published in 1999



- Updated “Partners for Progress” in 2003



Summary Points

- Make sure significant recycling is supported; can't assume that project replaces recycling
- A public/private ownership structure will help assure feedstock control and revenue sources
- Know the feedstock preparation requirements and characteristics
- Be aware of competition for the same material
- Know the local disposal market and options for local communities
- Need to prove conversion technologies; some risk must be assumed by someone
- Know the current political climate of the community
- Be aware of the Not In My Backyard (NIMBY) groups

What if a clock was added to the stack?

Would the WTE Facility be called a "Clock Tower"?

Thank you!!

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