Waste to Energy Technologies

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Outline

- Introduction
- MSW Management Overview
- Waste Conversion Technologies
- Representative Projects
INTRODUCTION

Steve Simmons

- Senior Vice President and owner in GBB
- Over 35 years of experience in MSW and biomass conversion technologies
- Has developed, designed, built, and operated multiple waste conversion systems
Waste to Energy Facility Experience

- 15 years with the American Ref-Fuel Company (now a part of Covanta)
- Had a variety of engineering, project development and business management roles
  - Project Engineer for the American Ref-Fuel team that built the 2,750 tpd Essex County Facility
  - Business / P&L Manager of the 3,300 tpd Delaware Valley Facility

GBB Quality – Value – Ethics – Results

- Established in 1980
- Solid Waste Management and Technology Consultants
- Helping Clients Turn Problems into Opportunities
GBB’s Waste Consulting Services

- Economic, technical and environmental reviews
- Procurements
- Due diligence third-party reviews
- Waste characterization and sourcing
- Process planning and conceptual designs
- Independent feasibility consultant

US MSW MANAGEMENT OVERVIEW
MSW Composition

Composition of the MSW as generated, before recycling

- Paper & Paperboard: 26.6%
- Food Scraps: 14.9%
- Yard Trimmings: 13.5%
- Plastics: 12.9%
- Metals: 9.0%
- Rubber, Leather, & Textiles: 8.4%
- Wood: 6.2%
- Glass: 4.6%
- Other: 3.2%

Composition of the MSW as disposed, after recycling and composting

- Paper & Paperboard: 14.3%
- Food Scraps: 21.6%
- Yard Trimmings: 7.9%
- Plastics: 18.5%
- Metals: 9.4%
- Rubber, Leather, & Textiles: 10.8%
- Wood: 8.1%
- Glass: 5.2%
- Other: 4.2%

Source: US EPA, 2016 (2014 data)

MSW Disposal: Over 50% is Still Landfilled

- Landfill: 52.8%
- Recycling: 34.3%
- Waste to Energy: 12.9%
History of US MSW Composition

Source: USEPA, 2013

MUNICIPAL SOLID WASTE CONVERSION TECHNOLOGIES
MIXED WASTE PROCESSING (MWP) TECHNOLOGIES

- Mixed Material Recovery Facilities
- Refuse Derived Fuel Facilities
- Mechanical Biological Treatment Approach
Advanced Systems Start with Waste Processing

- Mixed Waste Processing
- Recyclables
- Organics
- Source Separated Organics
- MSW
- WWTP
- Composting
- Anaerobic Digestion
- Soil Amendment
- Biogas
- Residue
- Landfill

Thermal Processing
- MSW
- Derived Fuel
- Residue
- Landfill

• Cement Kilns
• Dedicated Boilers
• Paper Mills

Mixed Waste Processing Facility

- Recovers additional recyclables from mixed waste
- Focus on additional containers and removal of organics
- Best viewed as a complement to single stream recycling, not a replacement
- Mechanical Biological Treatment (MBT) Concept in Europe
Mechanical Biological Treatment (MBT)

Source Separated Recyclables

Mixed MSW

Source Separated Organics

MSW source

Mechanical (grinding, screening, recyclables separation, palletizing)

Biological (bio-drying, aerobic composting, anaerobic digestion)

Recyclables

Compost

Biogas/Electricity

RDF/EF

Products:

RDF key to MBT diversion results: 54% to dedicated boilers, 16% to coal plants, 11% to cement kilns and 19% to others

330 plants in EU most in: Germany, Austria, Italy, Switzerland and the Netherlands; UK catching up

Landfill

Recycling

Organics

Mixed Waste Processing

Refuse Derived Fuel

MSW

Thermal Processing

MSW

Steam

Power

Biofuel

Residue

Landfill

Cement Kilns

Dedicated Boilers

Paper Mills

Waste-to-Energy Technologies

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Managing Organic Waste

Source Separated Organics  →  Aerobic Composting  →  Anaerobic Digestion

Anaerobic Digestion (AD)

Decomposition of biodegradable waste in oxygen depleted conditions to biogas and solid residue (digestate)

Organic Waste → Preprocessing → Digester

- Residue for landfilling
- Digestate
- Biogas
  - Compost
  - Electricity/ CNG
Classification of AD Technologies

Feedstock Introduction
- Continuous flow
- Plug flow
- Batch

Solids Content
- Low Solids
- Pumpable material ("wet")
- <15% Solids content
- High Solids
- 25-30% pumpable ("wet")
- >50% stackable ("dry")

AD Feedstock
- Grocers
- Restaurants and Cafeterias
- Urban Farms
- Food Processing Industries
- Curbside Collections

Source: Getty Images
Source: Seattle Public Utilities
BioMethane Application

IC Engine/Electricity and Heat

Renewable Natural Gas (RNG)

Source: GBB Visit to Zero Waste – Monterey, CA

Source: CleanEnergy

Compost

Source Separated Organics

Maturing Windrows

Screened Final Compost

Source: GBB Visit to Zero Waste – Monterey, CA
THERMAL PROCESSING TECHNOLOGIES

- Mass-Burn Combustion
- RDF Combustion
- Gasification
- Pyrolysis

Thermal Processing

- MSW
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What is gasification?

Thermal conversion of organic or fossil fuel based carbonaceous materials into carbon monoxide, hydrogen and carbon dioxide in partial combustion with controlled amount of oxygen and/or steam.

Gasification Output Pathways
Edmonton
Waste-to-Biofuels Facility, Alberta, Canada

- 330 TPD refuse derived fuel
- 10 million gallons/year of ethanol
- Edmonton Waste Management Centre:
  - Refuse Derived Fuel Facility
  - Enerkem Waste-to-Biofuels Facility
  - Advanced Energy Research Facility

Source: SWANA Northern Lights 2013, Bud Latta, Processing and Disposal Waste Management Services, City of Edmonton

Pyrolysis Process

Thermal processing of non-recyclable plastics in oxygen-free high temperature chamber to be made into a crude oil like fuel and synthetic gas.
Newest Traditional WTE: Solid Waste Authority of Palm Beach County, FL

- 3,000 TPD Mass Burn facility (1,040,000 TPY)
- Babcock & Wilcox
- 130 MW renewable power; enough for over 86,000 houses
- $668 million construction price
- $20.5 million first year O&M cost
- Advanced emissions controls, ferrous and non-ferrous metals recovery

Source: SWA of Palm Beach County

Copenhagen, Denmark – Ski Slope Plant

- 400,000 TPY
- Electricity and steam for district heating
Representative Projects

Metlakatla Indian Community
Small Scale Waste to Energy Facility

Phase 1: Evaluated three technical solutions
- Waste-to-Electricity
- Waste-to-Heat
- Off-Island Disposal

Phase 2: WTE development
- Project Renderings
- Project Economics
- Architectural Rendering
- Detailed site plan
- Environmental Critical Issues and Permits

Phase 3: Beneficial use of heat options: greenhouse & biomass drying
Mesa Grande Band of Mission Indians
Conceptual Study for a Biomass Facility

Ongoing/by the end of 2017

- Conceptual Study
- Feedstock Procurement Plan
- Compost market study

2018

- RFIQ
- Identify the best applicable AD & Composting technologies
- Business Plan
- Preliminary design and renderings of the facility
- Project Implementation Strategy

2019

- Final “go”- “no go” decision

Us District Court - Guam Consent Decree

- Appointed Receiver of Solid Waste Program on Guam
- Managed Entire Solid Waste System and Engineered 180° Turnaround for island – population 165,000
- Created a self-sustaining system based on Revenue
- Opened first Landfill on island –Subtitle D
- Closed violating 70 year old open dump
- Renovated Residential/Convenience Centers
- Provided all coordination management with Region 9 EPA
Guam - Closed Ordot Dump

Guam – New Subtitle D Landfill
Guam – New Citizen Convivence Centers

Thank You

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