Conversion Technologies
Separating the Myths From Reality

Integrated Waste Management

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Why Conversion Technologies?

- Many communities adopting greater diversion goals:
  - State of Florida – Recycling goal of 75% by 2020
  - State of California – Pointing toward 75% diversion

- Landfill capacity concerns and increasing costs

- Move towards Zero Waste: conversion technologies play an important part in a sustainable integrated waste management system

- Favorable economic climate for renewable energy (RPS, tax credits, etc)

- Climate impacts & Environmental impacts

- Some vendors offering “risk free” approaches
City of L.A. – Alternative Technology RFP

- February 2007 RFP Objectives:
  “Identify alternative MSW processing technologies that will increase landfill diversion in an environmentally sound manner, while emphasizing options that are energy efficient, socially acceptable and economical”

- The 3 M’s:
  1. Maximize Siting Feasibility
  2. Maximize Technical Feasibility
  3. Maximize Economic Feasibility

- Commercial and Emerging Technology Components
  - 6 Commercial Proposals
  - 3 Emerging Proposals
Salinas Valley Alternative Technology Evaluation

- SV Solid Waste Authority made up of five California cities & eastern unincorporated Monterey County
- 260,000 ton per year waste stream
- Goal of 75% Diversion by 2015
- Enthusiasm for conversion technologies (CT) grew from opposition to new landfill studies in 2004
- Formed committee in 2006 to study of existing and emerging conversion technologies
- 2-year Testing Program of Steam Classification Technology
- May 2008 RFP to evaluate other CTs
  - 3 technology vendors short-listed
Conversion Technologies Considered

Thermal Treatment

- WTE – Advanced Thermal Recycling
- Gasification
- Plasma Arc Gasification
- Pyrolysis
- Hydrolysis

Biological Treatment

- Anaerobic Digestion

Mechanical Separation

- Aggressive Materials Recovery
- Steam Classification
Technology Providers

- AdaptiveARC
  - Alter NRG/Westinghouse
  - Bioengineering Resources, Inc.
  - Ebara Corporation
  - EntechSolutions
  - EnviroArc Technologies
  - GEM America
  - InEnTec

- EntechSolutions International
  - Environmental Solutions
    - Thermoselect/Interstate Waste Technologies

- Peat International

- PlascoEnergy Group

- PyroGenesis
  - Primenergy, LLC
  - Rigel Resources Recovery and Conversion Co./Westinghouse
  - Solena Group
  - Startech Environmental Corp

- Urbaser
  - Ze-Gen

- Peat International
- PlascoEnergy Group
- PyroGenesis
- Urbaser
- Zegen
Five International Technology Tours in Three Years

- Committed best technical resources to travel with Clients to witness first hand what is state of the art in other countries
- Met with technology developers, facility operators, elected officials and industry trade associations
- Ask the detailed technical and financial questions to come away with the facts

Anaerobic Digestion | Tel Aviv
Gasification | Tokyo
Plasma Arc | Ottawa
Technology Tour | Tokyo
Where We Have Been

- Japan, China, Taiwan
- Israel
- Sweden, Denmark
- Holland, Belgium
- Switzerland, Germany
- France, Spain, Czech Republic
- Italy, Canada
WTE – Advanced Thermal Recycling

WTE Plant – Breisgau, Germany
WTE – Advanced Thermal Recycling

WTE Plant – Antwerp, Belgium
WTE – Advanced Thermal Recycling Schematic Diagram
General Observations on WTE – Advanced Thermal Recycling

- Prevalent throughout Japan and Europe
- Bottom ash processed for construction aggregates & metals recovery
- Fly ash disposed used to fill salt mines (Europe) or melted/vitrified (Japan)
- Some recovery of other byproducts of flue gas treatment process (hydrochloric acid, gypsum, salts)
- All air emissions reported to be well below permit limits at plants visited
- Emphasis on aesthetics with landscape and architectural treatments
- Tipping fees in the $150 - $200 US / Ton range
Gasification Plant Pictures

Gasification Plant – Tokyo, Japan
Gasification Schematic Diagram

Gasification Plant – Tokyo, Japan
Gasification Plant Pictures

Kazua Clean System Co., Ltd. Gasification Plant - Japan
General Observations on Gasification

- Mostly prevalent on a commercial scale in Japan
- Mostly uniform and select feedstocks used (plastics, biomass, industrial waste)
- Ash is melted and vitrified and rendered non-hazardous – used as aggregate
- Air emissions reported to be well below permit limits at plants visited
- Difficult to get reliable technical and financial information (unit availability, capacity factors, O&M costs) – especially for processing MSW
- Tipping fees in the $300 US / Ton
Plasma Arc Gasification Pictures

Plasma Arc Gasification – Ottawa, Canada

HDR
One Plasma Arc Schematic

Municipal Solid Waste (After Recycling)

1 - Feed Stock Handler
2 - Plasma Torch
3 - Gasification Vessel
4 - Slag Tap
5 - Hot Syn-Gas
6 - Cooled Syn-Gas
7 - Boiler
8 - Filter
9 - High Pressure Steam

“Green” Products

Steam
General Observations on Plasco Energy Plasma Arc Gasification Technology

- Operational issues initially due to fuel feed system design - being worked out
- No extensive operation at full design capacity to date
- No long duration test runs completed to date – 30-day Reliability Test planned for Spring 2009
- No stack testing data released to date
- System looks promising but needs more demonstration at full load for longer operating cycles with engines and all systems operating.
Anaerobic Digestion of MSW – Barcelona, Spain
Anaerobic Digestion of MSW

Anaerobic Digestion of selected MSW – Germany
Anaerobic Digestion of MSW – Tel Aviv, Israel
Anaerobic Digestion of MSW
Anaerobic Digestion of MSW Schematic Diagram
General Observations on Anaerobic Digestion

- Biological decomposition of organic matter in the absence of oxygen
- Bacteria convert organic materials to methane gas
- Produces electricity, steam, hot water and compostable "digestate"
- EU plants utilizing green waste - some taking food waste
- Several EU plants use MSW - many under construction
- Significant pre-processing of mixed MSW at up front MRF
- Potential negative impacts: odor, air emissions
- Compost product quality can be an issue with contaminants
- Biogas and thermal need local market
- Long term operational data difficult to obtain
General Observations on Anaerobic Digestion

- No emissions data provided but expected to be low compared to EPA MACT standards
- The potential for significant production of H2S which needs to be controlled (2,500 ppm)
- Service fee projected in range of $120 – $150/ton (includes other technologies in integrated system)
- Biological treatment of organic waste materials resulting in a source of energy and soils amendment can potentially be an effective component of a multi-faceted integrated waste management program
General Observations on Steam Classification

- Steam-pressure process using an autoclave
- Three demo projects in U.S.
  - Salinas Valley, Ca.
  - St. Paul, MN
  - Anaheim, CA (closed)
- Converts MSW to sterilized organics and in-organics
- Recyclables sent to local and national markets
- Organics used in pulp production, composting or refuse derived fuel
- Environmental concerns: air emissions (VOCs), water pollution
SVSWA Autoclave Testing Program

- 2-year Steam Classification Testing
- Technological
  - O&M requirements
  - Downtime
  - Energy usage
  - Costs
- Marketability of products
  - Ethanol Production (w/USDA)
  - Composting
  - Digestion
- Implementation Decision at the End of the Testing program
Autoclave Conclusions

- Over 60% reduction in waste volume
- Cellulose recovery
  - Ethanol production feedstock
  - Compost feedstock
  - Digester feedstock for methane production
- Factual performance, emissions and cost information
- When proven feasible, conversion technologies will be an important part of sustainable waste management
Conclusions

- As communities move towards trying to achieve greater Diversion goals CTs may become a more desirable option to LF

- Lots of vendors and technologies, but factual performance, technical, environmental and cost information still difficult to obtain

- Some commercial scale facilities abroad, and some pilot and demonstration project development in U.S. (Military Interest)

- As more CTs are proven feasible they will become an important part of the solution for more sustainable waste management
L.A. and Salinas Valley: Next Step

- **L.A. Alternate Technology RFP:**
  - Technical Evaluation Completed
  - Scoring and Preferred Vendor Selections in late Spring/Early Summer 2009

- **Salinas Valley**
  - Complete Technical and Financial Analysis (affect of RPS)
  - Selection of Preferred vendor during Summer 2009
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