The Big Picture: The State of Recycling and Opportunities for Innovation

Presented to:

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GBB SOLID WASTE MANAGEMENT CONSULTANTS

Agenda

1. Before Earth Day 1970
2. Earth Day 1970
3. Solid Waste Management in the Recent Past
4. Advice GBB Gives
5. Where does Waste-to Energy or Alternative Technologies Fit in
6. Closing

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1. BEFORE EARTH DAY 1970

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Looking Back Personally….

- The backyard burn barrel
- The in-ground garbage can
- Deposits on soda bottles
- Polluted Blackstone River
- Grandpa's ball of string
- Grandpa's oak leaves brushes
- Annual trips to the scrap yard with Dad
- Fly ash from the City incinerator

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2. EARTH DAY 1970

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Earth Day Origin – April 22, 1970

So, why is Earth Day different from any other day?

- Federal legislation in 1970s led to changing the U.S. environment
  - Clean Air Act
  - Clean Water Act
  - Resource Conservation and Recovery Act

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Earth Day Origin – April 22, 1970

- Solid waste hierarchy
  - Reduce
  - Reuse
  - Recycle
  - Recover
- *How did this affect me?*
  - *In 1970, a Senior Mechanical Engineering student*
  - *"Reclamation for a Town of 20,000" design team project*

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3. SOLID WASTE MANAGEMENT IN THE RECENT PAST

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Some Events That Helped Recycling Along

- 1987 - the Mobro 4000 barge with barge with 3,168 tons of trash and no where to unload
- 1990s - Environmental concern over dioxin emissic from waste-to-energy faciliti
- Remotely located disposal facilities owned by others
- Late 1990s into the 2000s Domestic and international markets for recyclables expand

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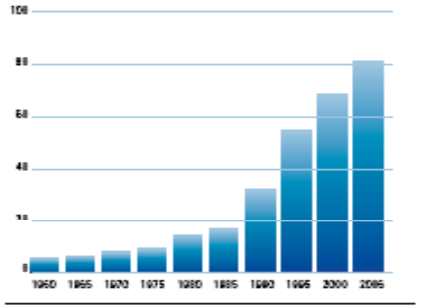
MSW Recycling Rates, 1960-2006 In Millions of Tons

Source: U.S. EPA



Source: 'Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2006', U.S. EPA, www.epa.gov/epaoswer/non-hw/muncpl/pubs/mswf06.pdf

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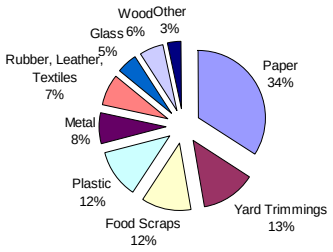
Waste Facts

- Each person in U.S. today generates 1,606 lbs. per year
  - In 2010 to grow to 1,752 lbs. per year
- What is in our waste?
  - Recyclables
    - Feasible now to recycle up to 50-70%
  - Energy content of remainder: 5,500 BTUs per pound
    - Coal at 9,000 BTUs per pound



Total: 245 Million Tons (Before Recycling)
Source: US EPA, 2005 data

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Residential Collection

Ontario, CA

Carts for Recyclables, Waste, Yard Waste

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Recyclables Processing/MRF

MRF = Materials Recovery Facility

Recyclables sorted by machine, air, magnet, and hand into each marketable material category

Single-stream processing trend now

Waste Management Recycle America, Elkridge, MD

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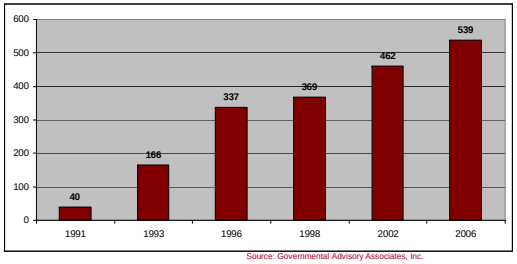
MRFs Operating in the U.S.



Source: Governmental Advisory Associates, Inc.

Loose Newsprint

Mixed Paper and baled Aluminum Cans

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WTE is Accepted Worldwide

Location	Number of Facilities	Amount of MSW Managed by WTE as % of Total MSW Generated
USA	89	8-15% based on MSW reported by EPA and Biocycle data
Europe	400	varies from country to country
Japan	100	70 to 80%
Other nations (Taiwan, Singapore, China, etc.)	70	varies from country to country

Source: IWSA website; (statistics as of 2004)

Brescia, Italy

Vienna, Austria

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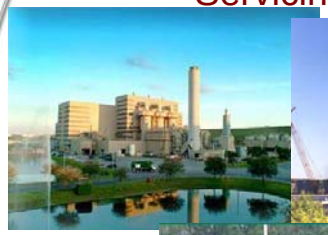
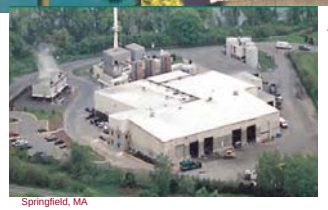
Waste-to-Energy: $14 Billion of Productive Assets Servicing the U.S.



North Broward County, FL

Alexandria/Arlington, VA



Springfield, MA

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Zero Waste Movement

How much waste are we for?
...as little as possible!

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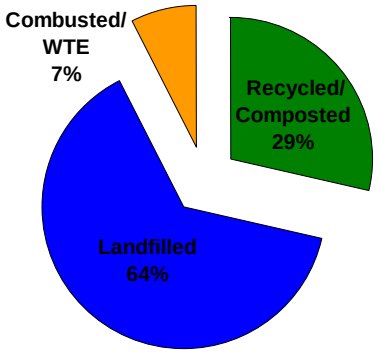
MSW Disposal in America



Source: Biocycle, April 2006

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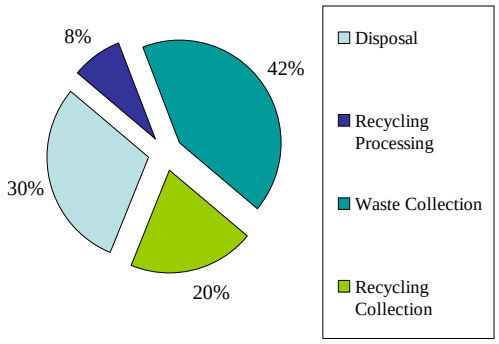
MSW Management System Costs
$100-$360 per ton



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4. GENERAL GUIDANCE GBB GIVES

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Getting Closer To Zero Waste

- Carts
- Variable rate structures
- Weekly collection of recyclables, yard and food waste
- C&D processing and recycling
- Education: people and politicians
- Collection control
- Collection efficiency, including use of co-collection vehicles
- Diversion incentives for Service Providers
- Making Buy Recycled a Priority
- Changing local ordinances and regulations
- Reuse centers
- Mandatory separation requirements
- Landfill bans

Service Changes Save Money

- **Once per week once per 2 weeks (Olympia, WA) waste service**
- Dual stream Vs. single stream recyclables
  - Answer: Single-Stream
- Alternate week or monthly recyclables
- Yard Waste/organics; seasonally
- Back yard composting and "leave the grass"
- Alternative: no source separation and mixed waste processing
  - Cost concern here
- Bulk call In
- Commercial and new construction recyclables

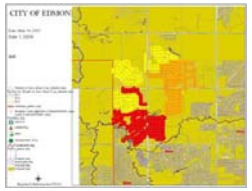
EPA

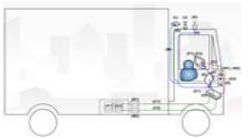
Reducing Collection Costs

- There is better technology today - hardware and software
- The public *can* compete with the private sector
- ***Controlling who collects should lower costs; set up franchises and/or contract areas***
- Charge the customer for service

Collection Technology Improvements

- ✓ Hardware
  - ✓ Semi-automation
  - ✓ Automation
  - ✓ Split packers
  - ✓ Split toters
  - ✓ Cell phones
- ✓ Software and services
  - ✓ Computerized Routing
  - ✓ GPS
  - ✓ Asset management
  - ✓ Customer service
  - ✓ Web site and email reminders for customers
  - ✓ Cell phones, especially Nextels
- ✓ Maintenance contracts
- ✓ Closed market contracting





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PLANNING AND PROCUREMENT ISSUES

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What are your goals?

- ❑ Diversion
- ❑ $$$$
- ❑ Facilities/Services
- ❑ Public-Private Partnerships
- ❑ Union
- ❑ Schedule

How much waste are we for?
...as little as possible!

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What do you have now?

- Collection on a task system
- Union contract constraints
- Asset review
- Contracts review
- Organization review
- Maintenance review
- Input from customers
  - *What do they want?*

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What does it cost?

- Full cost management review
- Functionality benchmarking
- Look for areas to improve
- Revenues review
  - *Are all customers being charged?*
  - *Are customers charged the right amount?*

Functionality	Amount
Waste Collect - Contract	$17.29 million
Litter Bin Collect	$0.064 million
Waste Collect - City	$0.57 million
Disposal (North LF)	$12.34 million
Trash Processing (Wood, WG)	$1.11 million
Recyclables Collection	$3.49 million
Recyclables Processing	$0.47 million
Other Reduce/Recycling	$0.28 million
HHW	$0.045 million
Other	$1.08 million
TOTAL COST	$36.74 million

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What options to consider?

- Changing collection frequency
- Dual vs. single stream for recyclables
- **MRF services or your own MRF**
- Adding food waste to yard waste
- New carts
- **Closing collection market**
- **Mandatory commercial recycling requirements**
- Benchmark comparisons to others

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Factors that Drive Cost Down

- ✓ **Unbundling collection from processing**
- ✓ **Long-term contracts**
- ✓ Automated collection
- ✓ Every other week collection for recyclables and yard waste
  - ✓ Even once per month for recyclables
  - ✓ Seasonal for yard waste
- ✓ Call in bulk service

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Value of Recyclables in One Ton of Waste Sorted and Sold to Markets

Year	$ per Ton Equivalent
1994	$40.00
1995	$104.00
1998	$48.00
2005	$85.00
2008	$150.00

Source: GBB internal data base

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Procurement and Implementation Management

- ✓ Enlightened Elected Officials and Purchasing Agents
- ✓ Staff Resources
- ✓ Game Plan
- ✓ Incremental Decision-Making
- ✓ Management & Operations Capability

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Common Elements for Successful Residential Programs

- ✓ Large carts for residents to place single stream materials
- ✓ Closed market collection services either provided efficiently by municipality or under long-term contract with private service provider
- ✓ Large MRF either publicly owned or under long-term contractor with reasonable revenue sharing back to municipality
- ✓ Pay as you throw charging system or user fees
- ✓ Sustained and excellent public education program
- ✓ Supportive public officials
- ✓ Higher demographics definitely help
- ✓ Urban or suburban environment
- ✓ High avoided disposal costs

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Barriers to Increased Recycling

- ❑ Unorganized, open-market, collection services
- ❑ No state of the art MRF at a reasonable scale
- ❑ Elected officials unwilling, not motivated to take on changes needed
- ❑ Un-sustained public education and outreach at an appropriate funding level
- ❑ Lack of mandatory regulations/ordinances
- ❑ Storage bins for recyclables are too small
- ❑ Expensive/inefficient collection services even in closed markets
- ❑ Value of recyclables not getting back to the residences – wrong business model

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The Road to Discovery

- Proper solid waste management planning, e.g. Hawaii
  - State law with prescriptive process
  - Must involve an advisory committee and public process
  - Plans thus far have put forward 60% diversion target
- CT recent state plan update sets diversion target at 57%

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Examples of Model Programs

- San Francisco
- Seattle
- San Jose
- Montgomery County, MD
- Fort Worth
- Austin
- Portland, OR
- Plano, TX

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What about Deposit Legislation?

- Good deposit laws
  - Like California and Hawaii
- Bad deposit laws
  - Like Connecticut and New York

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5. WHERE DOES WASTE TO ENERGY OR ALTERNATIVE TECHNOLOGIES FIT IN

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Waste Management Hierarchy

In 2005, EPA designated WTE energy as renewable energy.

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U.S. WTE Plants by Technology

Technology	Operating Plants	Daily Design Capacity (TPD)	Annual Capacity [1] (Million Tons)
Mass Burn	65	71,354	22.1
Modular	9	1,342	0.4
RDF -Processing & Combustion	10	15,428	4.8
RDF -Processing Only	5	6,075	1.9
RDF -Combustion Only	5	4,592	1.4
Total U.S. Plants [2]	94	98,791	30.6
WTE Facilities	89	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: J.V.L. Kiser and M. Zannes, Integrated Waste Management Services Association, April 2004

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Some U.S. WTE Factoids

- Displaces energy from fossil fuels
- In U.S., some 32 million tons of MSW goes to WTE creating over 2,300 MWs of electricity, while some 138 million tons go to landfills annually
- MSW could generate an additional 6,000 MWs of electricity
- Air emissions
  - Controlled under the federal Clean Air Act; more stringent than for utility and industry boilers
  - 89 existing US facilities meet standards
- Ash management issues
  - Bottom and fly ash generally combined for disposal
  - Significant ferrous metals removal at facilities; some non-ferrous; some aggregate and alternative daily cover applications
  - Ash monofills, built to Subtitle D standards, generally used to dispose ash

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Alternative…a.k.a. 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

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

Location	Timeframe - Activity	Number of Respondents
New York, NY	2004 - Study 2007	44 Siting Task Force established and to identify potential sites for pilot facility. RFP to follow
City of Los Angeles, CA	2004 – Study 2005 – RFQ 2007 – RFP	225 screened 26 requested 12 companies submitted proposals; to select for two 200 to 1,000 TPD Facilities
Los Angeles County, CA	2004-05 – Study 2006-07 – Screening 2008 – RFP to be issued	Technologies and sites Companies and sites 4 Selected to go on up to 4 sites
St. Lucie County, FL	2006 – RFQ for Plasma only Geoplasma selected	1 respondent; selected for 3,000 TPD $425 million Facility, product marketing documents being executed. Construction to begin in 6 -8 months permits pending
Hawaii County, HI	2006-07 – RFQ/RFP	3 proposals received; Wheelabrator selected for negotiations. The Hawaii County Council has rejected a $125 million waste-to-energy plant proposed by Wheelabrator, leaving the county with no plan for dealing with Hilo-area trash after 2012

80 Different Companies Responded to the Above Requests!!

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

Location	Timeframe - Activity	Number of Respondents
Frederick and Carroll Counties, MD (NMWDA)	Cooperative agreement signed between counties 2006-07 – RFQ/RFP	8 Pre-Qualified 3 Proposals Received; 2 short-listed
Harford County, MD (NMWDA)	2006-07 – RFQ/RFP	2 Companies Short-listed, best and final offers to be requested, negotiating with Army for sale of steam and electricity
King County, WA	2007 – Study	Under review
City of Sacramento, CA	2007 - RFQ 2008 - RFP	11 Respondents To be released
Broward County, FL	2007 – RFEI 2008	25 Respondents Negotiating w/ Wheelabrator for contract extension
Tallahassee, FL	2006 – Letter of Interest 1/2007 – Negotiation 6/2007 – Vendor selection 6/2007 – Power Purchase Agreement Financing secured	3 Respondents, developer list 2 Respondents added after presentations 1 Respondent negotiating with City

80 Different Companies Responded to the Above Requests!!

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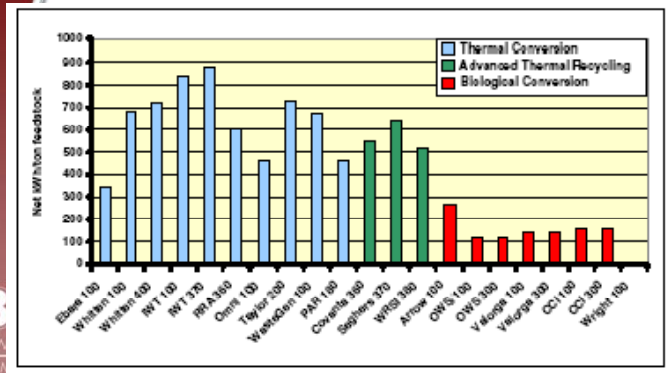
Net Thermal Efficiency KWHr Per Ton of MSW

Evaluation of Alternative Solid Waste Technologies
City of Los Angeles



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Alternative Technologies and Cost – 22 Firms Reviewed

Technologies	Size Range (Tons per Year)	New York City $ Per Ton	City of Los Angeles $ Per Ton
Gasification; Plasma; Anerobic Digestion; Mass Burn; Pyrolysis	180,000-1,000,000	$200-700	$136-900

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Risk Defined

A measure of the probability that:

1. Technology scaled up successfully
2. Cost in expected range: acquisition cost, capital, operating and maintenance costs
3. System performance standards met
4. Contractor (builder/operator) solvent
5. Contractor continuity throughout term of Service Agreement for technology servicing and operating assistance
6. System has reliability at least at 85% + level
7. System complies with regulatory and permitting requirements and is a good neighbor
8. System and contractor stand up to the legitimate concerns of legitimate NGOs (environmental groups, citizens committees, etc.)
9. System addresses concerns of the legislature or other governmental policy groups and their surrogates, etc.

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Technologies and Risk

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

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Energy Savings and CO2 Impacts Recycling and Incineration

Source: National Resources Defense Council

Energy Savings Per Ton Recycled						Energy Generated Per Ton Incinerated	
Materials	Grade	% Reduction of Energy*	Million BTUs	Equivalent in Barrels of Oil	Tons CO2 Reduced	Million BTUs	Equivalent in Barrels of Oil
Aluminum		95	196	37.2	13.8	-1.06	-0.2
Paper**	Newsprint Print/Writing Linerboard Boxboard	45 35 26 26.	20.9 20.8 12.3 12.8	3.97 3.95 2.34 2.43	-0.03 -0.03 0.07 0.04	11.8 11.8 11.8 11.8	2.24 2.24 2.24 2.24
Glass	Recycle Reuse	31 328	4.74 50.18	0.9 9.54	0.39 3.46	-0.34 na	-0.06 na
Steel		61	14.3	2.71	1.52	-0.34	-0.06
Plastic	PET PE PP	57 75 74	57.9 56.7 53.6	11 10.8 10.2	0.985 0.346 1.32	35.9 35.9 38.5	6.8 6.8 7.3
Mixed MSW		na	na	na	na	10	1.9

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EPA Warm Model Comparison Between Recycling Rates with Composting or Waste to Energy

Baseline Description	Alternative	Total GHG Emissions (MTCO2E/day) from:			Barrels of Oil Saved (bbls/day)
		Baseline MSW Generation and Management	Alternative MSW Generation and Management	GHG Emission or Reduction Difference	
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.

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Summary Points

- Set 'real' diversion/recycling goals higher (real 50-60%) with supporting policies, programs, and services
  - Add organics collection
  - Mandate commercial programs
- Make collection efficient to support additional separate collections
- Take market risk for greater share of revenues and lower cost
- Public ownership structure helps assure waste flow control and keep a greater share of revenues
- Current disposal cost environment is low ($50 per ton)

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Summary Points (Cont'd)

- Consider energy and environmental policy implications of mixed waste composting vs. waste-to-energy for the stuff post-recycling
  - Costs for this will be high (upwards of $100 per ton)
  - Require minimum diversion/recycling along if WTE selected, e.g. 50 to 60%
- Do long-term contracts with service providers with track record
- Beware of vendors offering unproven technologies with attractive economics and promises
  - Conversion technologies need to be demonstrated by *'somebody else'*
- Landfill disposal capacity always required – secure under long-term contracts

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Thank you!!
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