

Waste to Energy in the United States: Where is it Going?

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G.A.A. Background

- Governmental Advisory Associates, Inc. is a research and consulting firm focusing on solid waste management issues.
- Firm serves as consultant to federal, state and local governments as well as to the private sector.

G.A.A. Background-WTE

- Since 1982, firm has been periodically surveying waste to energy facilities in the United States.
- Results published as *Municipal Waste Combustion Industry in the United States: Yearbook and Directory*. The 8th edition was just published.

Paper Theme

- For the first time in more than a decade the waste-to energy industry (WTE) is mounting a modest comeback.
- Current developments in waste management and high energy prices have again created a favorable environment for WTE, in some ways mirroring the 1980s.
- The future looks bright for WTE

Organization of Paper

- Factors leading to stagnation of WTE through early 2000s
- Response of facilities to a problematic operating environment
- How the confluence of plant response and new challenges of the future have put WTE in a favorable position to grow.

Growth of WTE in the United States: 1970-1990

- Energy crises of the 1970s
- Impending waste disposal crisis due to the closure of thousands of municipal “dumps.”
- Favorable government policies in the form of grants, technical assistance and tax incentives.

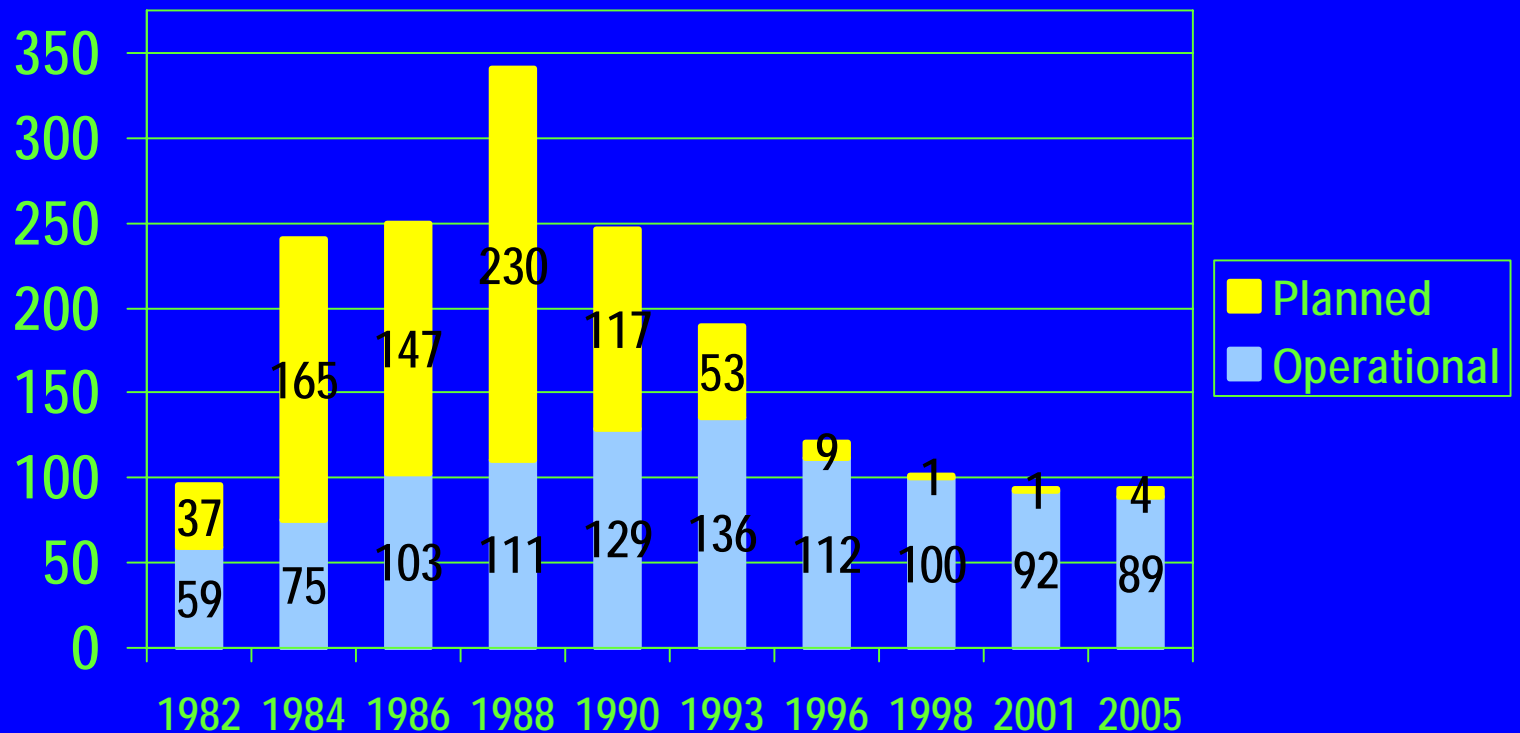
What Stopped the Growth

- The *Carbone* decision in 1994, striking down flow control coupled with the creation of the sanitary landfill and the growth of inexpensive disposal capacity.
- The promulgation of the federal Clean Air Act Amendments in 1995.
- Expiration of favorable tax policies in 1986.
- The relative stability of low energy prices and the beginning of deregulation of public utilities.

Specific Impacts on WTE

- Loss of waste stream through competition with lower cost landfills. Forced to reduce tip fees and thus revenues
- Increase in additional capital costs to bring plants into U.S. E.P.A. air emissions compliance.
- Loss of access to low cost capital.
- Downward pressure on energy revenues due to falling prices and de-regulation

Planned and Operational WTE Plants Over Time



Plant Start Ups and Shutdowns by Technology and Time Period⁽¹⁾

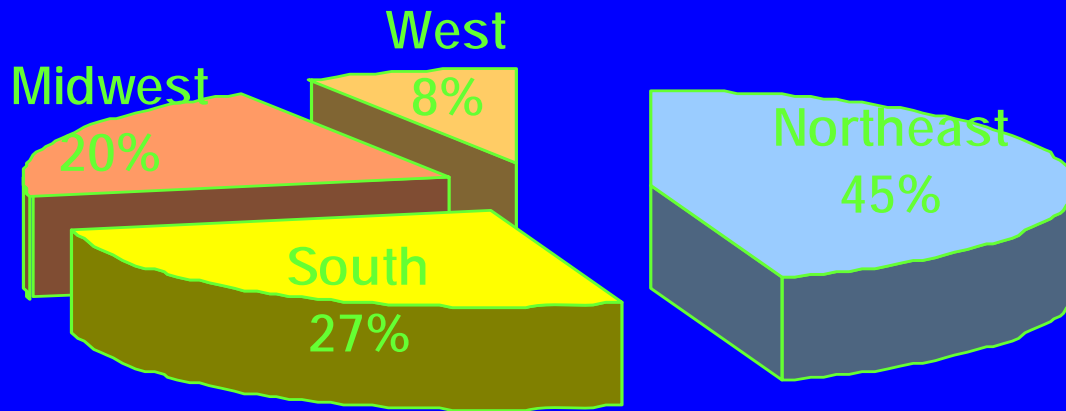
Type	Up to 1990		1991-1999		2000-2005 ⁽²⁾		Total		
	Open	Close	Open	Close	Open	Close	Open	Close	2005
MB	55	6	24	9	4 ⁽³⁾	4	83	19	64
RDF	39	7	2	16	0	2	41	25	16
Mod.	56	19	1	22	0	7	57	48	9
Total	150	32	27	47	4	13	181	92	89

(1) Data through 1998 from U.S. Department of Energy, Energy Information Administration. *The Impact of Environmental Regulation on Capital Costs of Municipal Waste Combustion Facilities: 1960-1998. Renewable Energy 2000: Issues and Trends*, February 2001.

(2) Total includes new Harrisburg, PA facility, completing construction

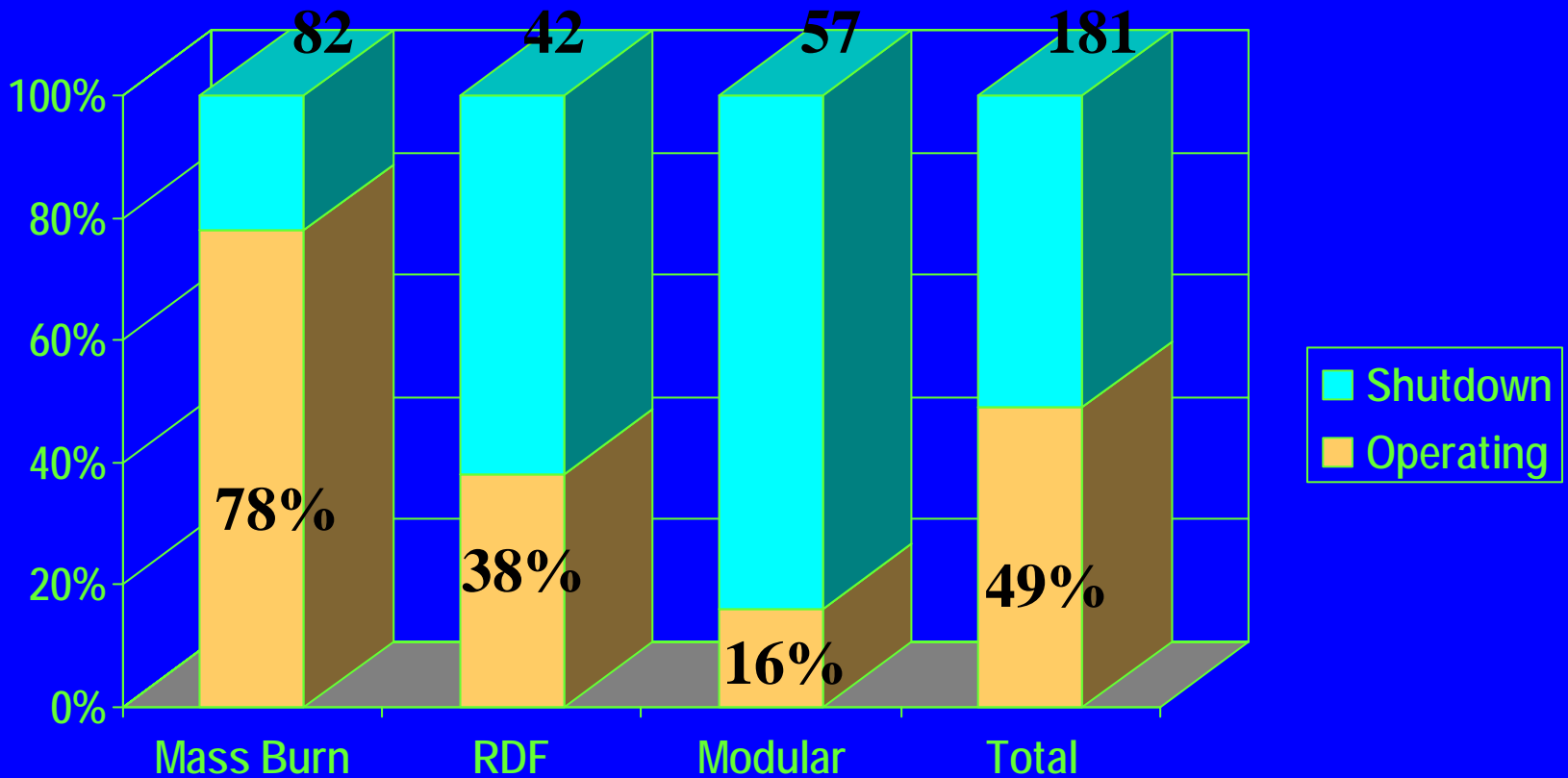
(3) Facilities include Wayne County, MI which subsequently closed, and 3 rebuilt projects, Harrisburg, PA, Harrisonburg, VA and Perham, MN

Regional Distribution of Facilities



N=89

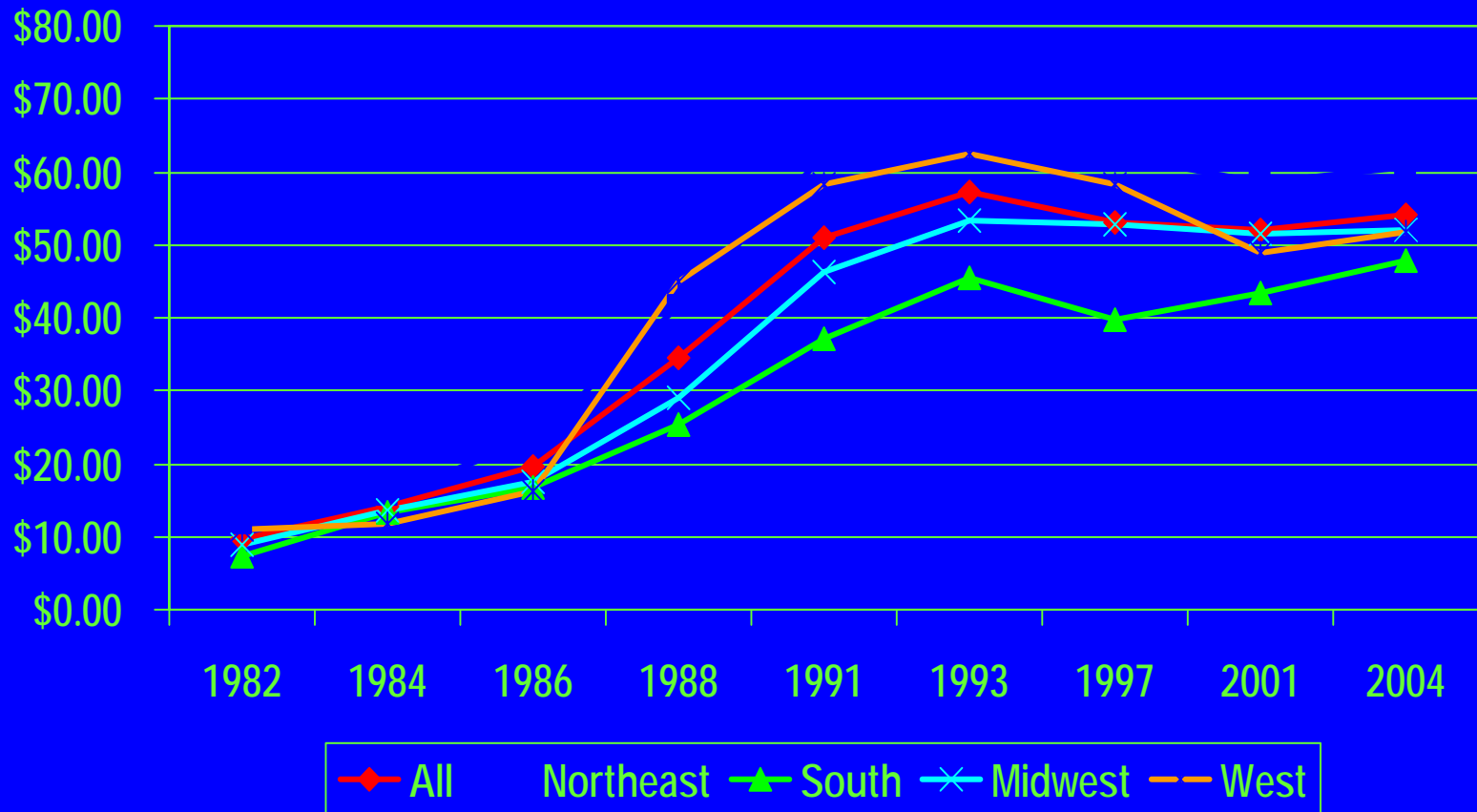
Percent Total Operating and Shut Plants by Technology



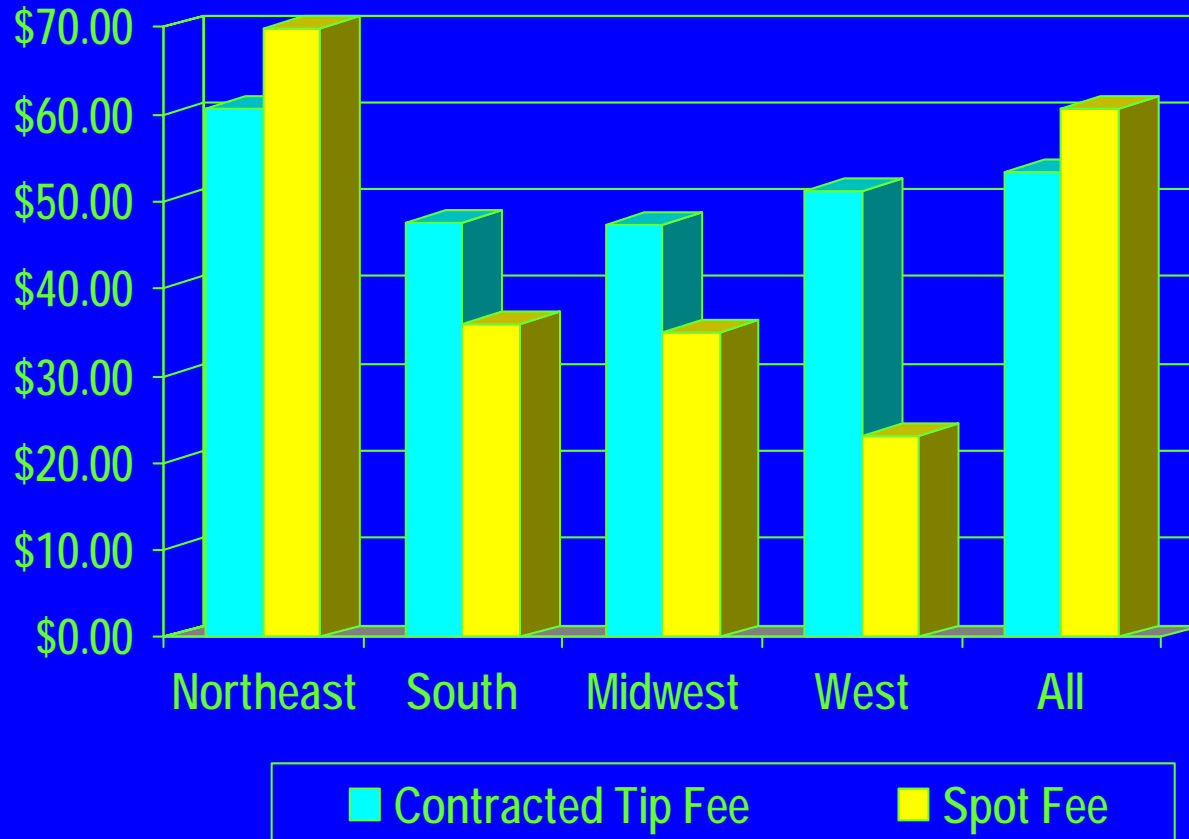
Response to *Carbone*: Development of Alternative Revenue Streams

- Restructure Tip Fees
 - ◆ Renegotiate long term contracts
 - ◆ Attract new customers
 - ◆ Subsidize tip fees by special tax assessments, generation fees, or tax surcharges.
- Seek Out Additional Revenue Streams
 - ◆ Special Wastes
 - ◆ Materials Recycling

Average Tip Fees Over Time



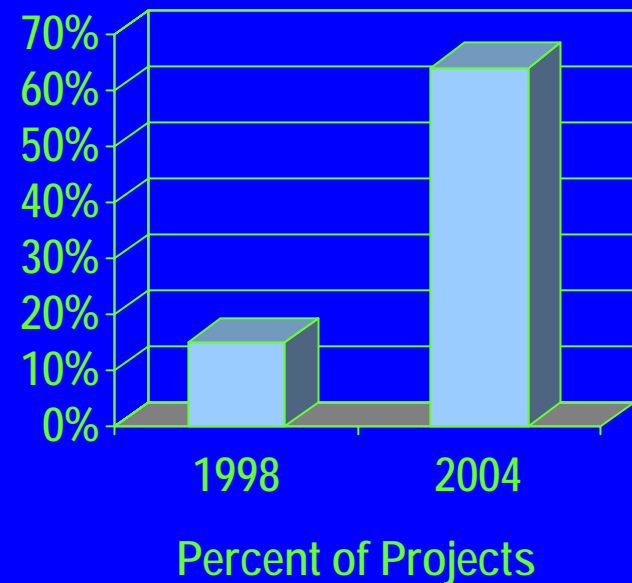
Weighted Average Tip Fees by Region by Type of Fee



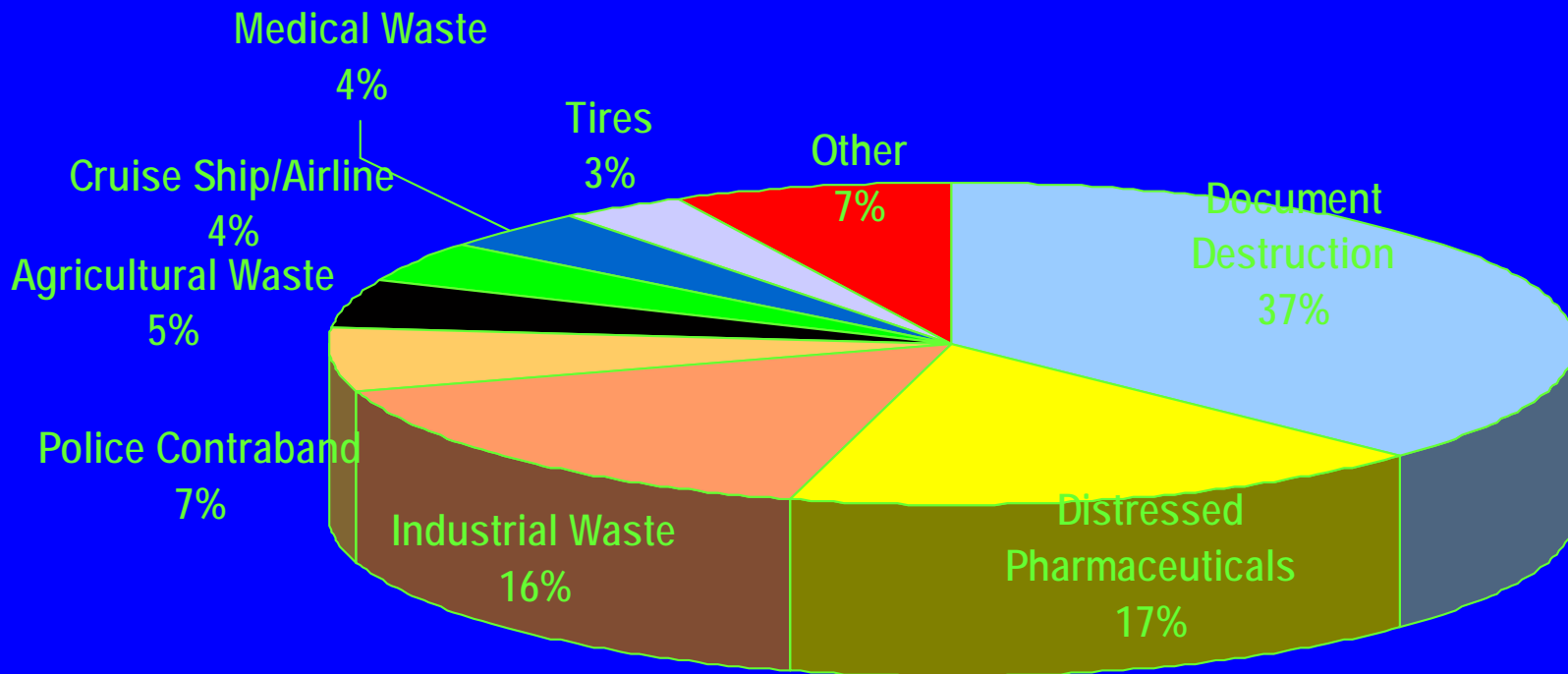
Additional Revenue Streams: Special Wastes

- Facilities have solicited non-hazardous special wastes
- Special wastes include:
 - ◆ Distressed Pharmaceuticals
 - ◆ Industrial residues
 - ◆ Police contraband
 - ◆ Secured document destruction
 - ◆ Cruise ship waste

Percent of WTE Facilities Accepting Special Wastes



Types of Special Wastes Taken by WTE Plants

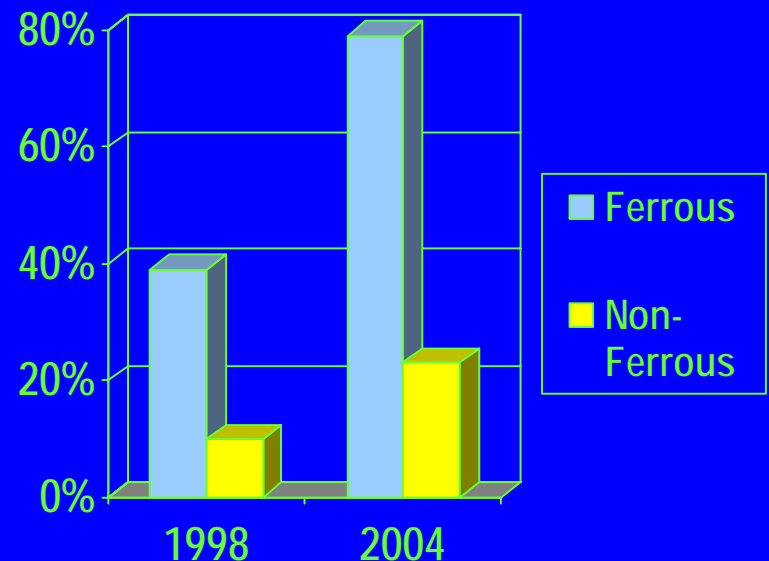


Average \$/ton = \$213.00

Additional Revenue Streams: Materials Recycling

- Facilities in 2005 are active metal recyclers
- Always recovered ferrous metals, but are now going after non-ferrous metals, mainly on the back end.
- On average about 10,000 tons per year of ferrous and 1200 tons of non-ferrous were recovered per facility in 2004.

Percent of Facilities Recovery Metals



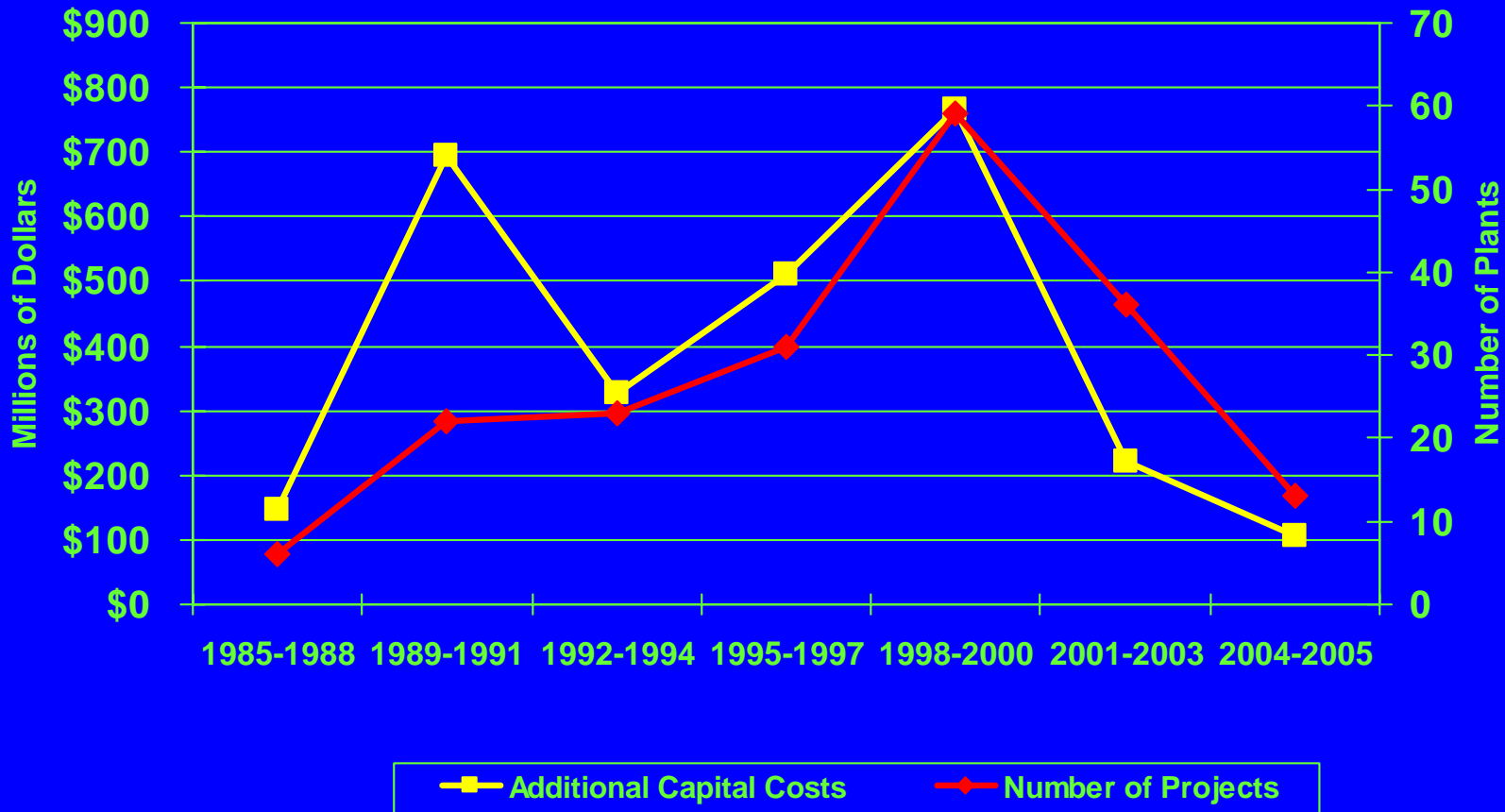
1990 Clean Air Act Amendments For MWCs

- New standards based on MACT (Maximum Achievable Control Technology) finalized in 1995.
- More stringent standards than previously for: Organics-dioxins/furans; Metals-cadmium, lead, mercury; Opacity and particulate matter; Acid Gases-hydrogen chloride, nitrogen oxides, sulfur dioxide; Carbon Monoxide and fugitive ash emissions
- Continuous Emissions Monitoring (CEM)
- Good Combustion Practices
- Deadlines: December 2000 for large (250 tpd and above) and 2005 for small units.

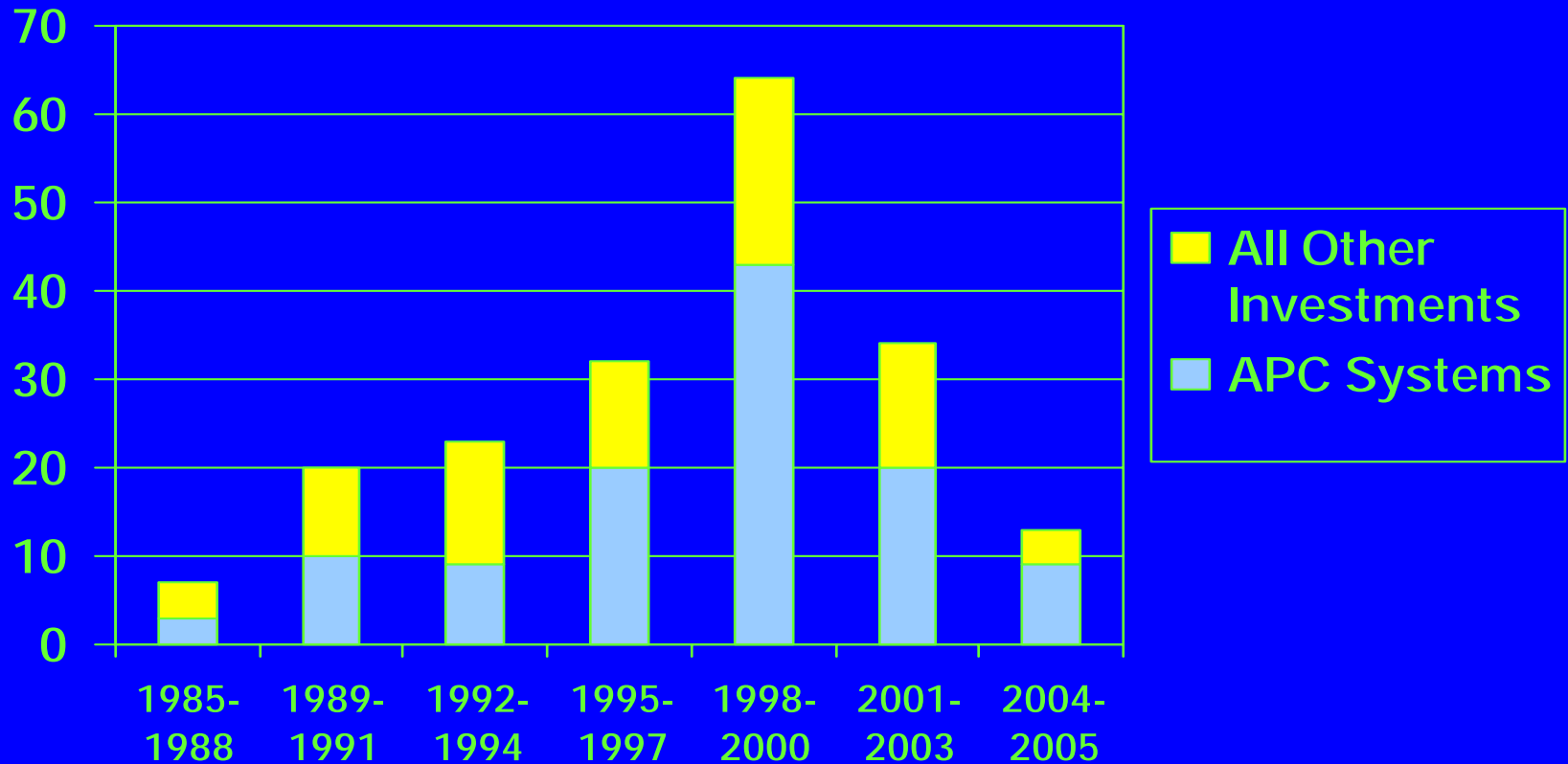
Impact of 1995 EPA Regulations

- EPA set guidelines based on specific set of technology: scrubber/baghouse, selective non-catalytic reduction for nitrogen oxides control, carbon injection for mercury control.
- On average facilities built before the 1990s had to spend \$50,000,000 to meet the new emission guidelines and many had much larger capital expenditures.

Total Additional Capital Costs (2004) and Number of Projects



Number of Capital Upgrades by Period



Average Initial and Additional Capital Costs Per Facility Per Design Ton in 2004 Dollars

COST	Mass Burn	Modular	RDF	ALL
Initial Cap. Cost	\$151,272	\$98,023	\$106,315	\$137,205
Add'l Cap. Cost	\$30,857	\$41,207	\$37,361	\$33,205
Total	\$182,129	\$139,230	\$143,676	\$170,410
PERCENT				
Initial Cap. Cost	83.1%	70.4%	74.0%	80.5%
Add'l Cap Cost	16.9%	29.6%	26.0%	19.5%
Total	100.0%	100.0%	100.0%	100.0%

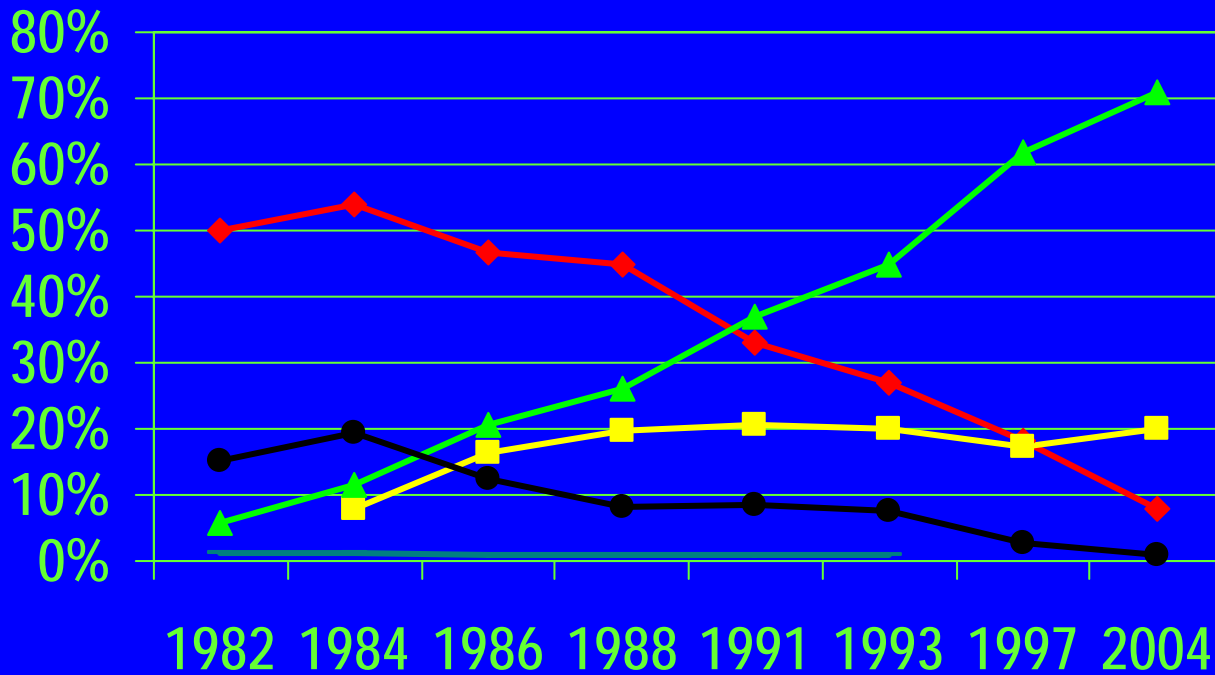
Results of the 1990 Clean Air Regulations

- By 2005 most facilities had modernized and incorporated state-of-the-art air pollution control equipment.
- These facilities serve as a model for coal-fired utilities, which are facing the necessity of upgrades for mercury and other emission controls.
- While the federal regulations imposed a large financial burden, at a time when facilities could ill afford it, they also stimulated improved APC systems and operating procedures.

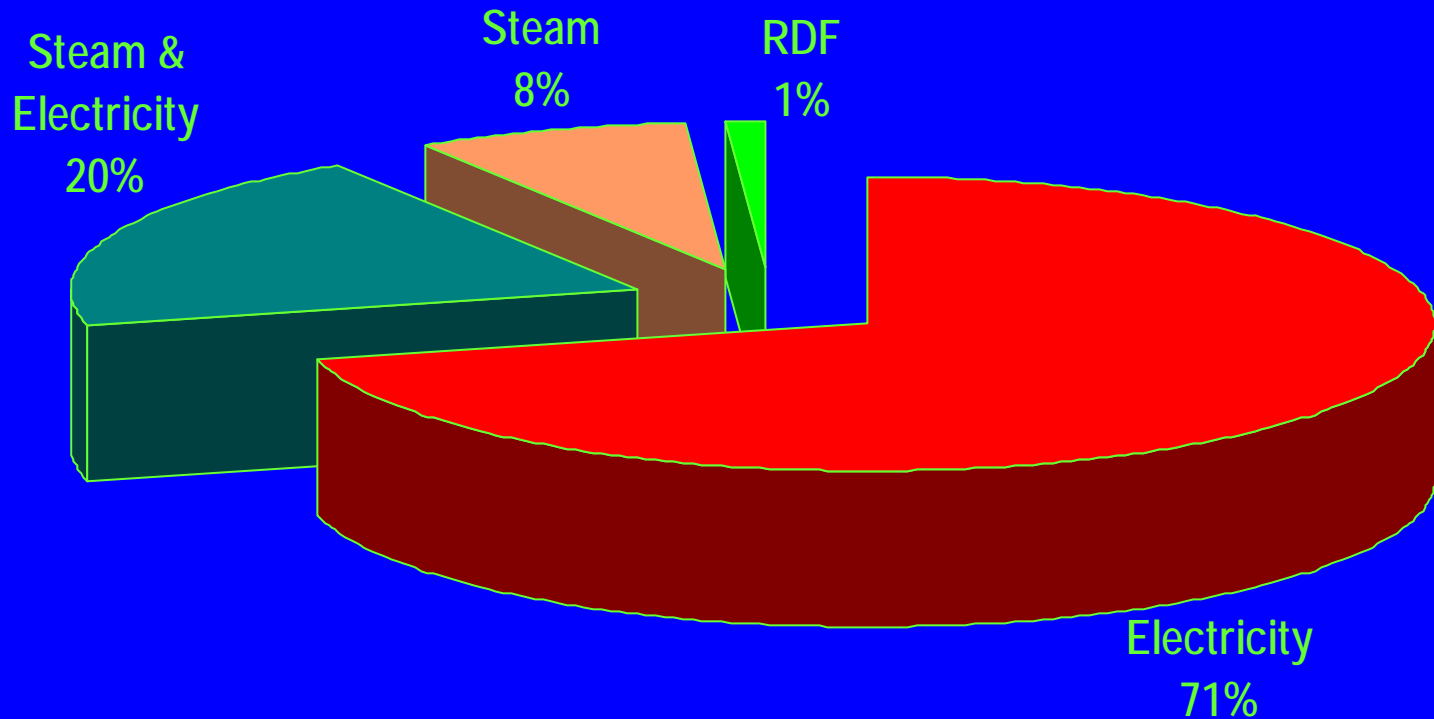
Response to Energy Price Declines through 2004

- Most of the original long term power sales contracts between the WTE facility and purchasing utility permitted the facility to sell its power at a favorable “avoided cost” rate, reflecting anticipated cost of energy over the life of the contract (PURPA).
- Low energy prices in the 1990s and utility deregulation put these rates under pressure. Repeal of PURPA
- Power sales contracts were bought out or renegotiated, forcing more projects to accept market rates for their electricity.
- The result was declining revenues until the last few years when energy prices have begun to rise precipitously.

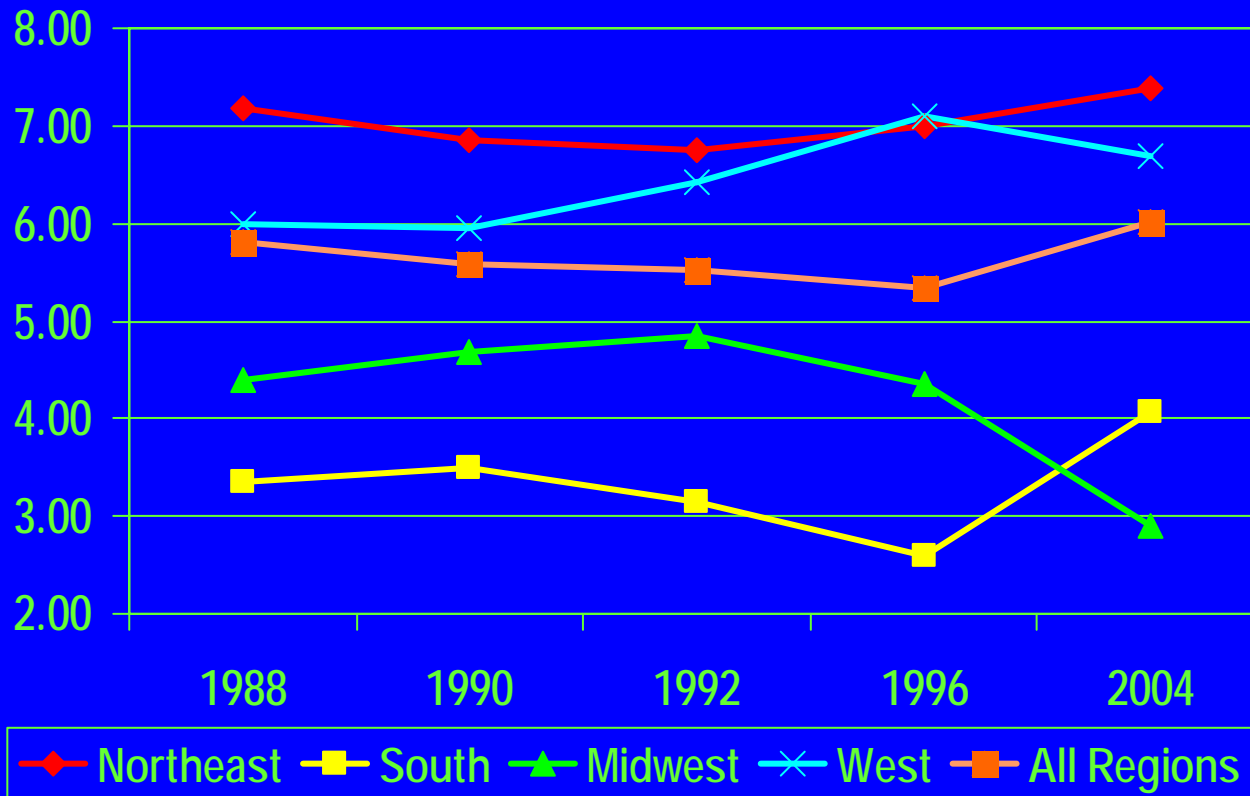
Energy Products at WTE Facilities: 1982-2004



Types of Energy Produced at WTE Plants



Average Cents/KWH Net by Region by Year



Average O&M Costs and Revenues Per Region Per Ton

Region	O&M	Debt Service	Energy Revenues	Additional Revenues Needed
Northeast	\$52.21	\$34.99	\$40.00	\$47.20
South	\$39.85	\$32.95	\$20.79	\$52.01
Midwest	\$69.86	\$47.35	\$15.93	\$101.28
West	\$49.82	\$32.84	\$37.40	\$45.26
All	\$50.08	\$34.45	\$35.16	\$49.37

Hints of the Future: Expansions and New Construction 2006 (tpd)

Region	Expansion		New Construction	
	Planned	Permitted	Planned	Permitted
Northeast	1610			
South	1000	1840	4200	
Midwest		200		
West	550	1100	1000	
Total	3160	3140	5200	

The Future: Short and Long Term

- Future – Short Term
 - ◆ *Carbone* and waste competition
 - ◆ Federal Air Emission Regulations
 - ◆ Energy Pricing
- Future – Long Term
 - ◆ Renewable Energy Portfolio Standards
 - ★ State
 - ★ Federal
 - ◆ Greenhouse Gas Reduction Initiatives
 - ◆ New Technology

Short Term: Waste Competition

- Landfill prices are rising, particularly in certain regions such as Northeast and Mid-Atlantic states, West.
 - ◆ Recent agreement between Michigan and Ontario to limit importation of residential refuse to landfills in Michigan
 - ◆ Potential legislation to limit waste imports.
 - ◆ Various state efforts to limit landfills.
- There are capacity issues and landfill siting issues, giving WTE a new life.
- For example disposal prices (inclusive of transportation) are:
 - ◆ \$75.00 to \$100.00/ton in the NY Metro area
 - ◆ \$60.00/ton in Northeast Maryland.

Short Term: Air Emissions Regulations

- Under the law, the U.S. E.P.A. must revisit the regulations for municipal waste combustors every five years. For large combustors, the five year period ended in 2005.
- New regulations issued May 2006.
 - ◆ For existing facilities, by 2009 must achieve lower emissions levels for dioxins, cadmium, lead, mercury, particulate matter.
 - ◆ Particular attention to plants with ESPs
- Increased monitoring by CEMS and extension of CEM to particulates and mercury.

Impact of New Federal Standards

- Impact with respect to capital investment will for most plants not be as significant as the 1995 laws.
- Driven by MACT standards most plants will be able to meet new emissions levels with relatively minor upgrades.
- Thus for the next five years, for municipal waste combustion air emissions the future is clear.

The Short Term: Energy

- Oil and natural gas prices will remain high, due to demand and political environment.
- Renewed attention to domestic alternative energy sources.
- Passage of EPACK 2005
 - ◆ Potential tax credit bonds for renewable energy projects
 - ◆ Requirement that federal government seek to purchase renewable energy to meet 7.5% of its needs by 2013
 - ◆ Loan guarantee programs
 - ◆ Weakening of mandatory energy purchase programs above market rates.

Impact of Energy Prices on WTE

- Higher energy prices tend to make WTE more attractive
 - ◆ Increased energy revenues
 - ◆ Increased transportation costs to landfills
- Changes in the structure of the power industry has positive implications for WTE, especially in high growth areas. Market rates are rising above rates originally negotiated in power sales contracts.

Renewable Energy Portfolio Standards

- Attempts to implement on federal level failed, but some form will probably be coming.
- States have filled the regulatory vacuum.
 - ◆ 21 states have standards with varying degrees of mandatory compliance.
 - ◆ Only 11 include WTE as a renewable, and in many there are qualifications and restrictions,
- In current market, Renewable Credits may not be worth a great deal, which could change.

Greenhouse Gas Reduction Initiatives

- Again, in the future federal action will be forthcoming.
 - ◆ In June 2005, U.S. Senate passed non-binding resolution acknowledging problem of global warming and calling on Congress to pass mandatory greenhouse gas emission limits
 - ◆ Some major corporations are taking the stance that federal inaction is no longer an option.
- States are taking action.
 - ◆ At least 14 states have a plan, or have passed legislation.
 - ◆ Two initiatives are notable: California and the Regional Greenhouse Gas Initiative in the Northeast (CT, DE, ME, NH, NJ, VT)

WTE and Greenhouse Gas Initiatives

- Questions as to whether WTE will be considered as an offset for greenhouse gas emissions. In the Northeast initiative it is not.
- Not clear how cap and trade programs will work. Meeting some resistance in Northeast due to potential of increased costs on electricity bills.

New WTE Technologies

- Increased attention on new technologies to maximize energy production, while minimizing emissions.
- State initiatives may drive search for workable “non-combustion” technologies.
- State and local governments beginning to take an active role in evaluating WTE technologies
 - ◆ New York City– RFI in 2004 for emerging technologies not in widespread commercial use in the U.S. or recently commercialized.
 - ◆ Chicago, IL– RFI in 2006 for WTE Technologies
 - ◆ LA County, CA– 2005– Evaluation of Waste Conversion Technologies (other cities and counties in CA have also conducted studies.
 - ◆ State of California 2005– State of Conversion Technologies

Which Technologies are Being Considered

- Thermal Processing, including pyrolysis, gasification, plasma arcing. This appears to have the most immediate positive responses in evaluations.
- Anaerobic and Aerobic Digestion
- Hydrolysis of waste to produce sugars and then ethanol
- Other types of chemical processing such as depolymerization of the waste.

Conclusions

- Future looks bright for WTE
- More conventional WTE plants must continue to strive to lower emissions
- New types of waste conversion to energy are being considered. The drive to develop new technologies will continue driven by the need for renewable energy and reduction of greenhouse gases.
- Smaller facilities may have attraction as localities seek to lower their fossil fuel dependencies.