HCR 10

<TARGET><BILL>HCR 10</BILL><SUBJECT>HCR 10</SUBJECT><COMM>HENE27</COMM></TARGET>

Alaska State Legislature

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Representative Pete Petersen
Serving Northeast Anchorage and Muldoon

Table of Contents: Background Information for HCR 10 Encouraging Waste-to-Energy Technology

HOUSE CONCURRENT RESOLUTION NO. 10

IN THE LEGISLATURE OF THE STATE OF ALASKA

TWENTY-SEVENTH LEGISLATURE - FIRST SESSION

BY REPRESENTATIVE PETERSEN

Introduced: 3/18/11
Referred: House Special Committee on Energy, Community and Regional Affairs

A RESOLUTION

Encouraging the state, municipalities of the state, and private organizations in the state to weigh the benefits and costs of waste-to-energy technology and to consider waste-to-energy technology to help meet the energy and waste management needs of the state, municipalities of the state, and private organizations in the state.

BE IT RESOLVED BY THE LEGISLATURE OF THE STATE OF ALASKA:

WHEREAS communities, families, and businesses across the state are struggling to meet high energy costs; and

WHEREAS, in 2010, the Twenty-Sixth Alaska State Legislature unanimously passed, and the Governor signed into law, House Bill No. 306, which set a goal for the state to produce 50 percent of its electricity from renewable sources by 2025; and

WHEREAS municipal waste management represents a continuing challenge and expense for communities in the state; and

WHEREAS waste-to-energy technologies using municipal solid waste have been successfully used around the world and in at least 24 states in the United States to produce energy and reduce landfills; and

WHEREAS waste-to-energy technology is currently used at Fort Wainwright, and the Municipality of Anchorage is in the process of constructing facilities to use natural gas created by the Anchorage regional landfill; and

WHEREAS several different means of creating energy from solid waste materials are currently available, including direct combustion of solid waste or using solid waste to produce a combustible fuel; and

WHEREAS modern solid waste combustion technology can produce energy while reducing landfills and emissions created by waste stored in landfills; and

WHEREAS waste-to-energy technology is generally considered to be a renewable energy source since it is produced from biomass and material that was already produced for reasons not related to energy;

BE IT RESOLVED that the Alaska State Legislature encourages the state, municipalities of the state, and private organizations in the state to weigh the benefits and costs of waste-to-energy technology and to consider waste-to-energy technology to help meet the energy and solid waste management needs of the state, municipalities of the state, and private organizations in the state.

COPIES of this resolution shall be sent to the Alaska Municipal League, the Denali Commission, the Alaska Energy Authority, and the University of Alaska.

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Sponsor Statement

HCR 10
Encouraging Waste-to-Energy Technology

This resolution encourages the state, municipalities, and private organizations to consider the benefits of costs of waste-to-energy technology and evaluate whether this technology is appropriate for their energy and waste management needs.

Across the state, residents, communities, and businesses have been struggling to pay high energy costs, and waste management is a continuing challenge and expense for communities. Waste-to-energy technology produces renewable energy from garbage while reducing the amount of landfill space needed. Modern waste-to-energy actually produces fewer emissions than if the garbage were simply dumped in a landfill.

Waste-to-energy technology has been utilized across the world and in 24 states, including Alaska. For example, at Eielson Air Force Base garbage is burned along with coal to generate electricity, and the Municipality of Anchorage is in the process of developing the ability to use natural gas produced by the Anchorage Regional Landfill.

Last year the Legislature adopted a statewide energy policy that established a goal of creating 50% of our electricity from renewable energy sources. Waste-to-energy technology has the potential to help Alaska meet this goal while also reducing the need for additional landfill space.

FISCAL NOTE

STATE OF ALASKA
2011 LEGISLATIVE SESSION

Fiscal Note Number	
Bill Version	HCR 10
() Publish Date	

Identifier (file name)	HCR10-LEG-COU-04-04-2011	Dept. Affected	Legislature
Title	"Encouraging Waste-to-Energy Technology"	Appropriation	Legislative Council
		Allocation	Session Expenses
Sponsor	Representative Petersen		
Requester	House Spec Comm on Energy, Comm & Reg Affairs	OMB Component Number	782

Expenditures/Revenues (Thousands of Dollars)

Note: Amounts do not include inflation unless otherwise noted below.

	Appropriation Required	Information					
OPERATING EXPENDITURES	**FY 2012**	**FY 2012**	**FY 2013**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**
Personal Services							
Travel							
Contractual							
Supplies							
Equipment							
Grants & Claims							
Miscellaneous							
TOTAL OPERATING	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAPITAL EXPENDITURES							
CHANGE IN REVENUES							

FUND SOURCE (Thousands of Dollars)

1002 Federal Receipts							
1003 GF Match							
1004 GF							
1005 GF/Program Receipts							
1037 GF/Mental Health							
Other Interagency Receipts							
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Estimate of any current year (FY2011) cost ______

POSITIONS

Full-time							
Part-time							
Temporary							

Why this fiscal note differs from previous version

Initial Version

Prepared by	Shane Miller, Finance Manager	Phone	465-6626
Division	Administrative Services Division	Date/Time	4/4/11 7:16 AM
Approved by	Pamela Varni, Executive Director	Date	4/4/2011
	Legislative Affairs Agency		

(Revised 12/29/2010 OMB)

STATE OF ALASKA
2011 LEGISLATIVE SESSION

BILL NO. HCR 10

Analysis

This fiscal note has zero impact on the Legislative Affairs Agency.

27-LS0685\B
Bullock/Kane
3/21/11

CS FOR HOUSE CONCURRENT RESOLUTION NO. 10( )

IN THE LEGISLATURE OF THE STATE OF ALASKA

TWENTY-SEVENTH LEGISLATURE - FIRST SESSION

BY

Offered:
Referred:

Sponsor(s): REPRESENTATIVE PETERSEN

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Summary of Changes from the Original to Draft CS Version B

HCR 10
Encouraging Waste-to-Energy Technology

The only change in this version is correcting and error on page 2 line 1. This version correctly notes that waste-to-energy technology is being utilized at Eielson Air Force Base, not Fort Wainwright.

The 2010 ERC Directory of Waste-to-Energy Plants

ENERGY RECOVERY COUNCIL

By Ted Michaels

The 2010 ERC Directory of Waste-to-Energy Plants provides current information about the waste-to-energy sector in the United States. Since this Directory was last published in 2007, waste-to-energy capacity has increased for the first time in many years and additional capacity is under development. In the past three years, three facilities have completed construction on expansion units, and more expansions are both planned and under construction. Several communities are also in the process of developing greenfield waste-to-energy facilities. The development of new capacity reflects the desire of local governments to exercise control of solid waste decisions, rather than be at the mercy of economic fluctuations of distant landfills. In addition, energy generation in densely populated areas could greatly benefit communities that struggle with transmission congestion.

In 2010, 86 plants operate in 24 states and have capacity to process more than 97,000 tons of municipal solid waste per day. According to the latest BioCycle estimates, 26 million tons of trash were processed by waste-to-energy facilities in 2008. While this amount is less than the 28 million tons processed in 2006, it reflects reduced waste generation during difficult economic times rather than decreased waste-to-energy capacity. In fact, policymakers are looking at the development of waste-to-energy and other renewable resources as a source of green jobs during these difficult economic times. Policies have been put in place that are intended to spur this technology that will create a significant number of construction jobs for two to three years and an average of 58 full-time jobs per facility for the next forty to fifty years. ERC is working to ensure that additional policies are implemented that will provide waste-to-energy with opportunities to grow.

The nation's waste-to-energy facilities have the capacity to generate the energy equivalent of 2,790 megawatt hours of electricity. This figure includes an electric generating capacity of 2,572 megawatts and an equivalent of 218 megawatts based on steam exports estimated at approximately 2.8 million pounds per hour. The fact that waste-to-energy provides baseload power and that most plants operate in excess of 90 percent of the time translates to a significant number of renewable kilowatt-hours produced by waste-to-energy.

The Energy Recovery Council (ERC) was formed in 1991 and encourages the use of waste-to-energy as an integral component of a comprehensive, integrated solid waste management program. In addition to providing essential trash disposal services cities and towns across the country, today's waste-to-energy plants generate clean, renewable energy. Through the combustion of everyday household trash in facilities with state-of-the-art environmental controls, ERC's members provide viable alternatives to communities that would otherwise have no alternative but to buy power from conventional power plants and dispose of their trash in landfills.

Waste-to-Energy Reduces Greenhouse Gas Emissions

Waste-to-energy plants are tremendously valuable contributors in the fight against global warming. According to the U.S. EPA, nearly one ton of CO_2 equivalent emissions are avoided for every ton of municipal solid waste handled by a waste-to-energy plant due to the following:

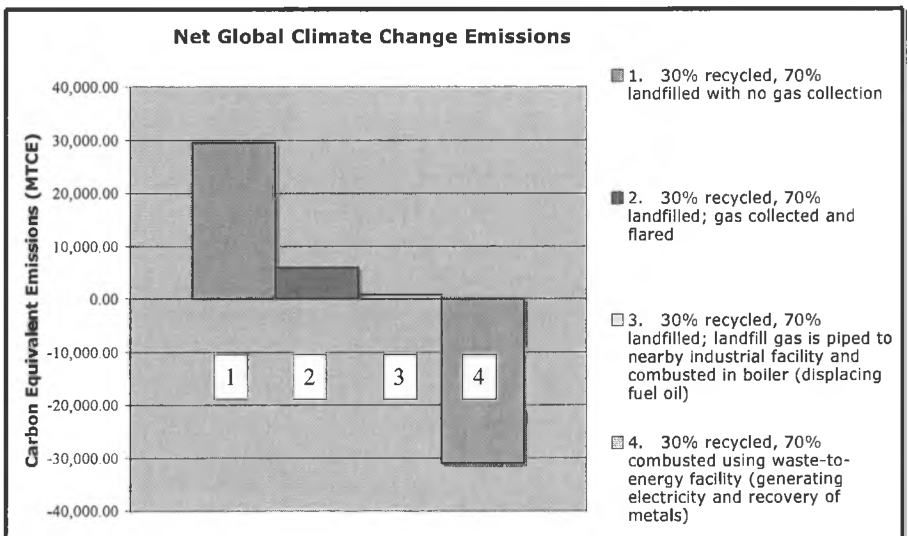
- **Avoided methane emissions from landfills.** When a ton of solid waste is delivered to a waste-to-energy facility, the methane that would have been generated if it were sent to a landfill is avoided. While some of this methane could be collected and used to generate electricity, some would not be captured and would be emitted to the atmosphere.

- **Avoided CO_2 emissions from fossil fuel combustion.** When a megawatt of electricity is generated by a waste-to-energy facility, an increase in carbon dioxide emissions that would have been generated by a fossil-fuel fired power plant is avoided.

- **Avoided CO_2 emissions from metals production.** Waste-to-energy plants recover more than 700,000 tons of ferrous metals for recycling annually. Recycling metals saves energy and avoids CO_2 emissions that would have been emitted if virgin materials were mined and new metals were manufactured, such as steel.

The United States Conference of Mayors adopted a resolution in 2005 endorsing the U.S. Mayors Climate Protection Agreement, which identifies waste-to-energy as a clean, alternative energy source which can help reduce greenhouse gas emissions. As of September 30, 2010, over 1,040 mayors have signed the agreement.

In the European Union, waste-to-energy facilities are not required to have a permit or credits for emissions of CO_2, because of their greenhouse gas mitigation potential. In a 2008 briefing, the European Environment Agency attributes reductions in waste management greenhouse gas emissions to waste-to-energy.

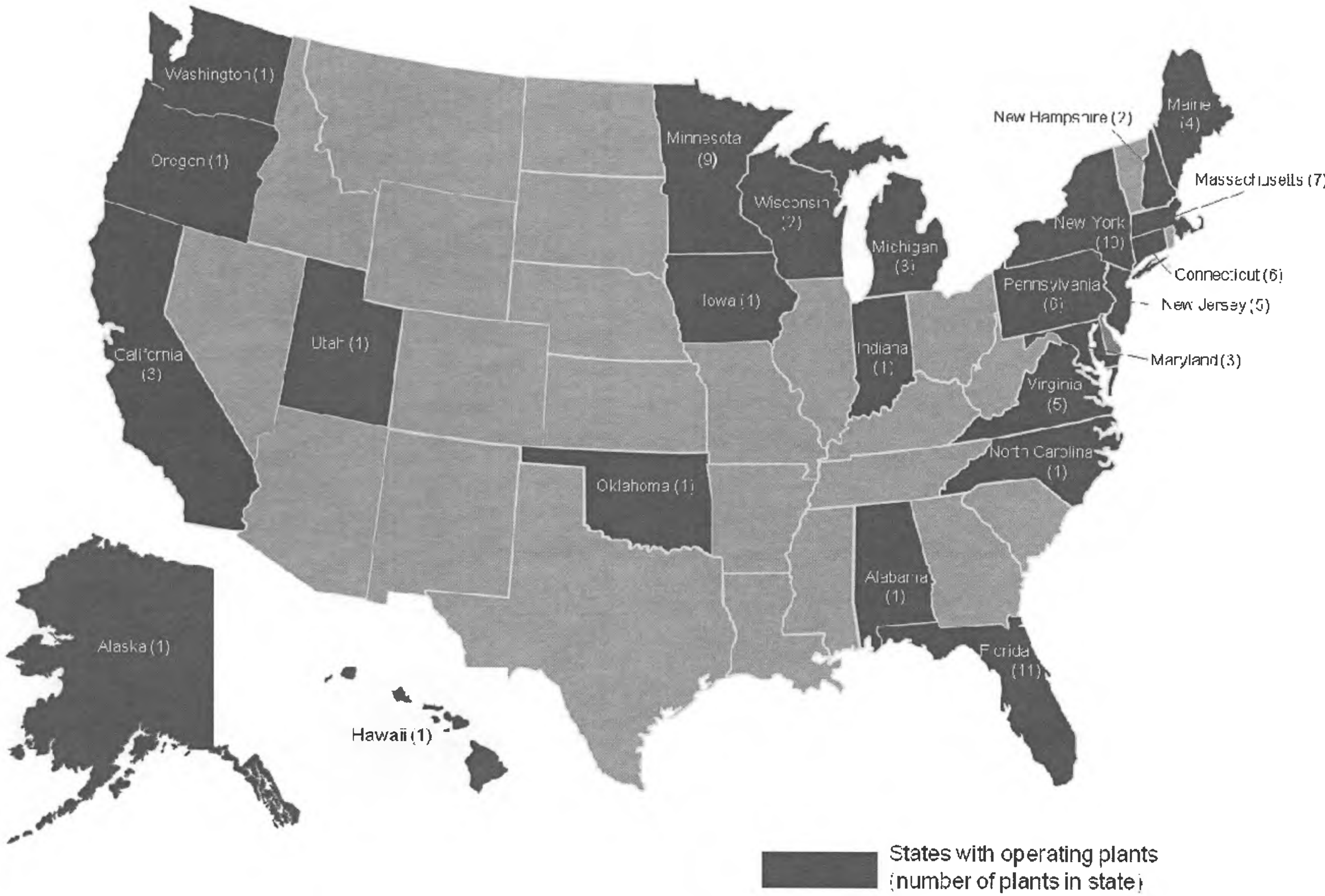


Data Source: Thorneloe SA, Weitz K, Jambeck J. Application of the U.S. Decision Support Tool for Materials and Waste Management. WM Journal 2006 August.

Under the Kyoto Protocol, by displacing fossil fuel-fired electricity generation and eliminating methane production from landfills, waste-to-energy plants can generate tradable credits (Certified Emission Reductions [CERs]) through approved Clean Development Mechanism protocols. These CERs are accepted as a compliance tool in the European Union Emissions Trading Scheme.

In the United States, Lee County (FL) has been certified by the Voluntary Carbon Standard to generate carbon offsets which can be sold to those entities wishing to acquire carbon credits. The 636 ton-per-day expansion of Lee County's waste-to-energy plant is the first waste-to-energy capacity in the nation to sell its own carbon credits on the voluntary market.

Operating WTE Plants in the U.S. – By State



Source: Ted Michaels, Energy Recovery Council, October 2010.

Waste-to-Energy is a Renewable Resource

Waste-to-energy meets the two basic criteria for establishing what a renewable energy resource is—its fuel source (trash) is *sustainable* and *indigenous*. Waste-to-energy facilities recover valuable energy from trash after efforts to "reduce, reuse, and recycle" have been implemented by households and local governments.

Waste-to-energy facilities generate clean renewable energy and deserve the same treatment as any other renewable energy resource.

Federal Statutes and Policies Defining Waste-to-Energy as Renewable (as of 10/1/10)
American Recovery and Reinvestment Act of 2009
Energy Policy Act of 2005
Federal Power Act
Public Utility Regulatory Policy Act (PURPA) of 1978
Biomass Research and Development Act of 2000
Pacific Northwest Power Planning and Conservation Act
Internal Revenue Code (Section 45)
Executive Orders 13123 and 13423
Federal Energy Regulatory Commissions Regulations (18 CFR.Ch. I, 4/96 Edition, Sec. 292.204)

- **Trash Would Otherwise go to a Landfill.** Waste-to-energy facilities use no fuel sources other than the waste that would otherwise be sent to landfills.
- **State Renewable Statutes Already Include Waste-to-Energy.** 25 states, the District of Columbia, and Puerto Rico have defined waste-to-energy as renewable energy in various state statutes and regulations, including renewable portfolio standards.
- **Communities with Waste-to-Energy Have Higher Recycling Rates.** Several studies have demonstrated that communities served by waste-to-energy have recycling rates that are nearly twenty percent higher than the national average.
- **Waste-to-Energy Emissions Comply with EPA's Most Stringent Standards**. All waste-to-energy facilities comply with EPA's Maximum Achievable Control Technology (MACT) standards. After analyzing the inventory of waste-to-energy emissions, EPA concluded that waste-to-energy facilities produce electricity "with less environmental impact than almost any other source of electricity."
- **Waste-to-Energy Has a Long History as Renewable**. Waste-to-energy has been recognized as renewable by the federal government for nearly thirty years under a variety of statutes, regulations, and policies. Many state have recognized as renewable under state statutes as well. The renewable status has enabled waste-to-energy plants to sell credits in renewable energy trading markets, as well as to the federal government through competitive bidding processes.
- **Renewable Designations Benefit Many Local Governments and Residents.** The sale of renewable energy credits creates revenue for local governments that own waste-to-energy facilities, helping to reduce a community's cost of processing waste. The U.S. Conference of Mayors has adopted several resolutions supporting the inclusion of waste-to-energy as a renewable resource.

States Defining Waste-to-Energy as Renewable in State Law (as of 10/1/10)		
Alaska	Maine	Oklahoma
Arkansas	Maryland	Oregon
California	Massachusetts	Pennsylvania
Connecticut	Michigan	Puerto Rico
District of Columbia	Minnesota	South Carolina
Florida	Nevada	South Dakota
Hawaii	New Hampshire	Virginia
Iowa	New Jersey	Washington
Indiana	New York	Wisconsin

EPA's Solid Waste Hierarchy

Waste-to-Energy is Preferable to Landfilling

Waste-to-energy has earned distinction through the U.S. Environmental Protection Agency's solid waste management hierarchy, which recognizes combustion with energy recovery (as they refer to waste-to-energy) as preferable to landfilling. EPA's hierarchy reflects what EPA has stated previously—that the nation's waste-to-energy plants produce electricity with "less environmental impact than almost any other source of electricity." EPA's hierarchy is also consistent with actions taken by the European Union, which established a legally binding requirement to reduce landfilling of biodegradable waste.

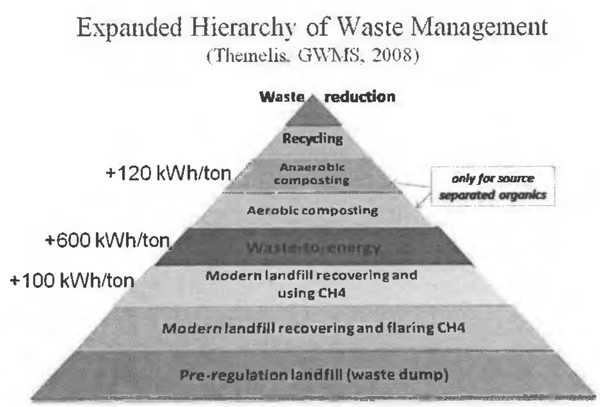
Source: U.S. Environmental Protection Agency

The Waste-to-Energy Research and Technology Council (www.wtert.org)

By Prof. Nickolas J. Themelis, Director of Earth Engineering Center of Columbia University

Sustainable waste management

The mission of the Earth Engineering Center (EEC) is to analyze existing and novel technologies for the recovery of materials and energy from "waste" materials, carry out additional research as required, and disseminate this information by means of the EEC publications, web pages, and meetings. The guiding principle is that "wastes" are resources and must be managed on the basis of science and best available technology and not on ideology or economics that exclude environmental costs. One of the EEC activities is a survey of waste generation and disposition in the U.S., carried out in collaboration with BioCycle journal. The *State of Garbage in America* (SOG) is based on data provided by the waste management departments of the fifty states. By now, the results of the SOG Survey are used by U.S.EPA for estimating the Greenhouse gas (GHG) effects of MSW management.



In recognition of the fact that there was not enough academic research on the subject of sustainable waste management, especially energy recovery from wastes, in 2003 EEC co-founded, with Energy Recovery Council (than called IWSA), the Waste-to-Energy Research and Technology Council. WTERT brings together scientists, engineers, and managers concerned with advancing sustainable waste management in the U.S. and worldwide. During the first decade of this century, WTERT has sponsored nearly thirty academic research theses and published about one hundred papers on all means of waste management, including waste reduction, recycling, aerobic and anaerobic composting, waste-to-energy by combustion and by gasification, and landfill gas recovery from modern sanitary landfills (see www.wtert.org, Publications). By now WTERT has sister organizations in Brazil, Canada, China, France, Germany, Greece, Japan, and the U.K.

COLUMBIA UNIVERSITY
EARTH ENGINEERING CENTER
Advancing the Goals of Sustainable Waste Management

Public Information on Sustainable Waste Management

During each year, WTERT and its sister organizations (e.g., look up www.wtert.eu and www.wtert.gr) receive many requests for information on WTE and on waste management practice, in general. The principal means of communication between WTERT and the general public is its web page (www.wtert.org). It continues to be the premier source of up-to-date technical information on domestic and international waste-to-energy and sustainable waste management.

Workplace Health & Safety — A Waste-to-Energy Priority

The Occupational Safety & Health Administration (OSHA) sets standards for America's workers to ensure employees are safe and their health is protected. Waste-to-energy facilities, like all other workplaces, must meet these tough standards. The waste-to-energy industry takes tremendous pride in its health and safety programs and often goes beyond what is required by law. Great importance is placed on developing and implementing successful programs that protect the people working in our plants.

OSHA has recognized the stellar accomplishments of 51waste-to-energy facilities with the designation of STAR status under the Voluntary Protection Program (VPP). VPP STAR status is the highest honor given to worksites with comprehensive, successful safety and health management systems. STAR sites are committed to effective employee protection beyond the requirements of federal standards and participants develop and implement systems to effectively identify, evaluate, prevent, and control occupational hazards to prevent injuries and illnesses. The keys to health and safety success under VPP are the employee engagement and ongoing involvement in on-site health and safety program development combined with long-term commitment and support from management. VPP-level recipients routinely incur injury and illness rates that are at or below the state average for their specific industry.

Impressively, 51 of the 86 waste-to-energy facilities have earned VPP STAR status. Less than 0.02 percent of all worksites in the United States are enrolled in VPP, yet more than 59 percent of U.S. waste-to-energy facilities are have achieved STAR status. This illustrates the commitment of this sector is superior attention to health and safety.

SAFETY: DO IT FOR LIFE

Created under an ERC-OSHA Alliance Agreement, ERC and its members have designated the month of June as "Hauler Safety Month". Throughout the month of June each year, ERC members host a "Hauler Safety Day" at their facilities to educate public and private waste haulers, municipal and private owners and operators, and facility employees about best health & safety practices to ensure a safe and healthy workplace. ERC member companies have coordinated the event by developing and utilizing a unified campaign with posters, stickers and "12 Rule" cards to get the message out regarding health and safety on waste-to-energy tipping floors. Our goal is to ensure that everyone who conducts business at or visits a waste-to-energy facility will return home safe and sound at the end of each and every day.

A Compatibility Study: Recycling and Waste-to-Energy Work in Concert

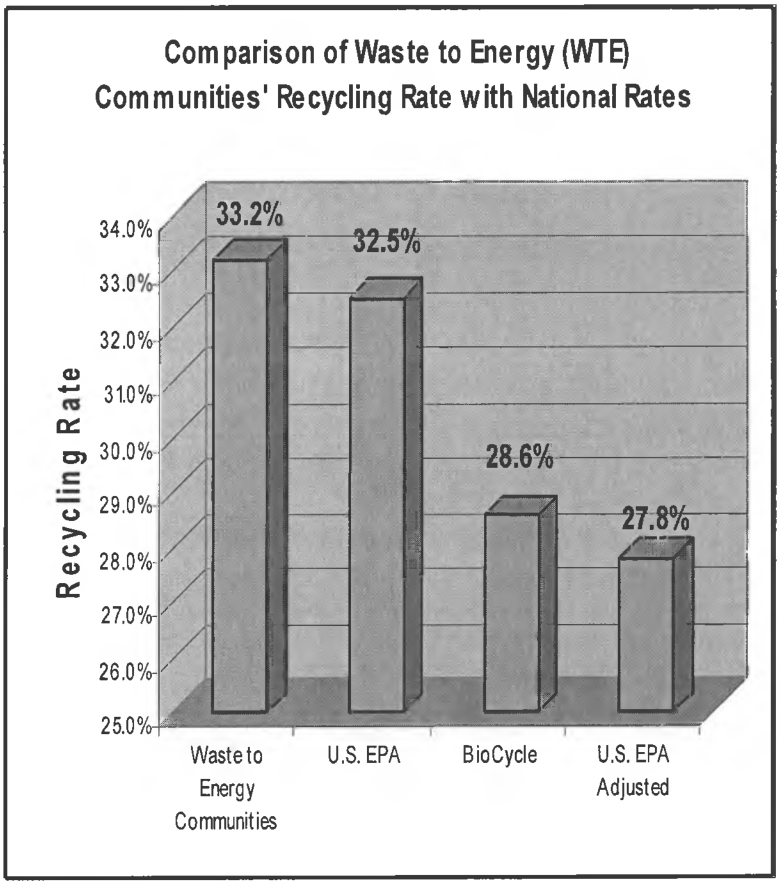
By Eileen Brettler Berenyi, Ph.D.

Government Advisory Associates, Inc.

Executive Summary (for the full report, please visit www.energyrecoverycouncil.org):

Critics of waste-to-energy have argued the presence of a waste combustion facility in an area inhibits recycling and is an obstacle to communities' efforts to implement active recycling programs. As this study will show, this contention has no basis in fact. In an examination of recycling rates of more than 500 communities in twenty-two states, which rely on waste-to-energy for their waste disposal, it is demonstrated that these communities recycle at a rate higher than the national average. Many of these areas have recycling rates at least three to five percentage points above the national average and in some cases are leading the country in recycling. The study concludes that recycling and waste-to-energy are compatible waste management strategies, which are part of an integrated waste management approach in many communities across the United States.

Key Findings:



- The study covers 82 waste-to-energy facilities in 22 states. Recycling data was obtained from 567 local governments, including 495 cities, towns and villages and 72 counties, authorities or districts. In addition, statewide data was obtained for each of the 22 states.

- Communities nationwide using waste-to-energy have an aggregate recycling rate **at least 5 percentage points** above the national average.

- Communities using waste-to-energy for disposal are recycling at about 33.3%, which is higher than the national rate, no matter how the national rate is calculated as shown to the right.

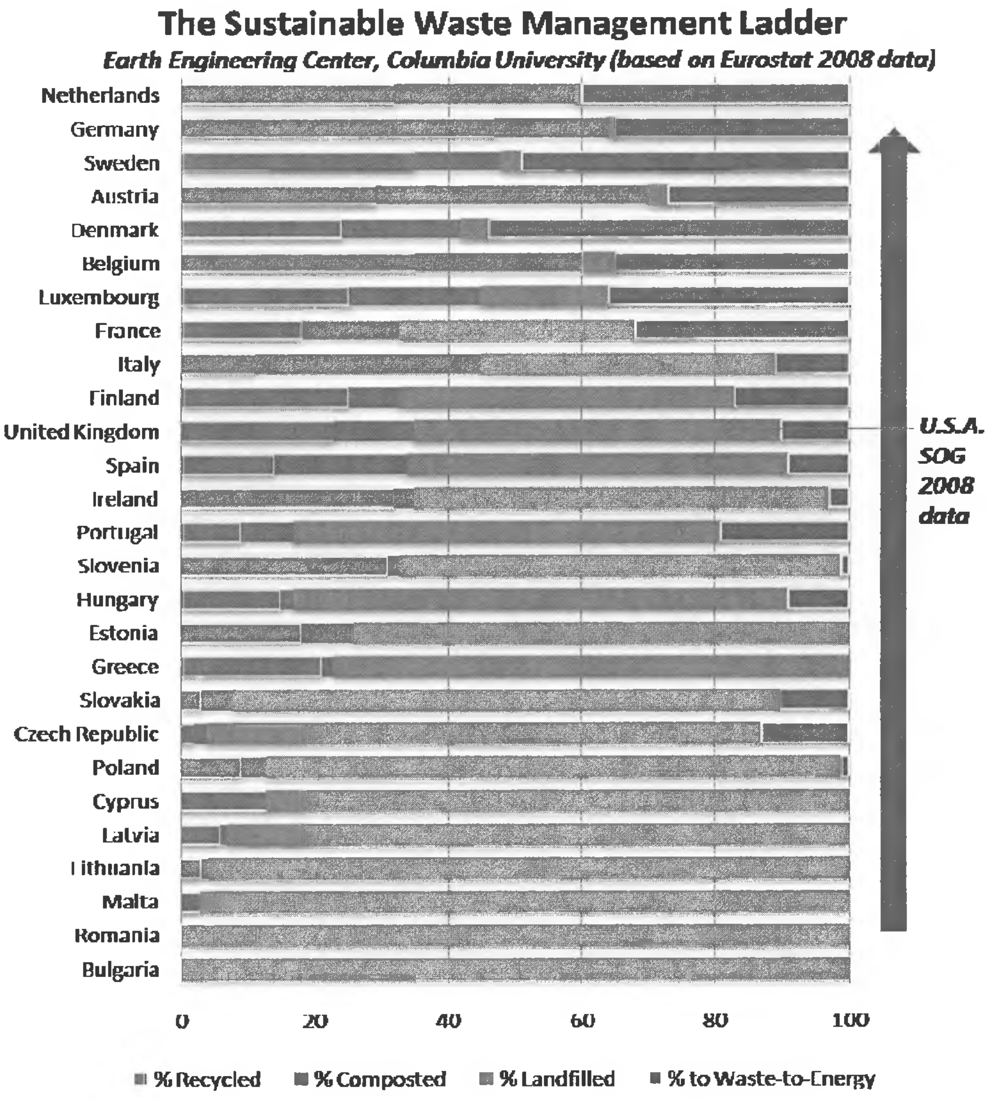
- The unadjusted U.S. EPA computed national recycling rate is computed using a waste stream model and includes certain commercial/industrial components and yard waste. These materials are often excluded in individual state and local recycling tonnages. Therefore the figure to the right also includes an adjusted EPA rate, which excludes these tonnages, adjusting the rate downwards.

- Almost all communities using waste-to-energy provide their residents an opportunity to recycle and most have curbside collection of recyclables. In fact, some of these communities are leaders in the adoption of innovative recycling programs, such as single stream collection and food waste collection and composting. The coincident nature of recycling programs and waste-to-energy in each community is evidence that these two waste management strategies are compatible.

Waste-to-Energy is an Important Factor in Sustainability

This publication provides information on waste-to-energy plants in the United States, but it is important to acknowledge the role of waste-to-energy in the waste management practices of countries around the world. Waste-to-energy has proven itself successful in nations that have high population densities, limited available landfill space, and intense energy demands.

For instance, nations in Western Europe and Asia have utilized waste-to-energy as an environmentally friendly method of waste disposal and energy production that will assist in the reduction of greenhouse gas emissions. The European Union (EU) requires all members to reduce landfilling of biodegradable municipal solid waste by 65 percent by 2020, which has placed higher emphasis on waste-to-energy and recycling. Countries within the EU, such as Germany, have an outright ban on landfilling of biodegradable waste. As such, nation's that rely on waste-to-energy also tend to have exceptional recycling rates, while minimizing landfilling. The figure below highlights the waste management practices of European countries. Not surprisingly, the countries that landfill the most also recycle the least and do not utilize waste-to-energy. This is another illustration (as described in more detail on page 9) of how waste-to-energy and recycling are compatible.



ERC Membership

Waste-to-Energy Providers

Covanta Energy Company
445 South Street
Morristown, NJ 07960
(862) 345-5000
www.covantaenergy.com

Babcock & Wilcox
20 South Van Buren Avenue
Barberton, OH 44203-0351
(330) 753-4511
www.babcock.com

Wheelabrator Technologies Inc.
4 Liberty Lane West
Hampton, NH 03842
(800) 682-0026
www.wheelabratortechnologies.com

ERC Municipal Members

City of Alexandria/Arlington County (VA)
Bristol (CT) Resource Recovery Facility Operating Committee
Broward County, FL
Camden County (NJ) Pollution Control Financing Authority
City of Long Beach, CA
City of Red Wing, MN
City of Tampa, FL
Connecticut Resource Recovery Authority
Dade-Miami County, FL
Delaware Solid Waste Authority
ecomaine
Fairfax County, VA
Islip (NY) Resource Recovery Agency
Lancaster County (PA) Solid Waste Management Authority
Montgomery County (PA) Waste Systems Authority
Northeast Maryland Waste Disposal Authority
Onondaga County (NY) Resource Recovery Agency
Olmsted, MN
Pinellas County (FL)
Polk County (MN) Solid Waste Resource Recovery Plant
Pope-Douglas (MN) Solid Waste Management
Solid Waste Authority of Palm Beach County (FL)
Spokane (WA) Regional Solid Waste System
Union County (NJ) Utilities Authority
Wasatch (UT) Integrated Waste Management District
York County (PA) Solid Waste Authority

ERC Associate Members

Babcock Power, Inc.
Dvirka & Bartilucci Consulting Engineers
Energy Answers International
Gershman, Brickman, and Bratton, Inc.
Green Conversion Systems, LLC
Jansen Combustion & Boiler Technologies, Inc.
Martin GmbH
Minnesota Resource Recovery Association
Resource Recovery Technologies, Inc.
Resource Recycling, LLC
Rich and Henderson, P.C.
Zar-Tech

ENERGY RECOVERY COUNCIL

Waste-to-Energy Directory: Key Terms

Trash Capacity: The trash capacity is the rated capacity for each unit housed at a facility. The number of units at a facility is provided, followed by the capacity for each unit (i.e. 2x250 represents a facility with two units, each designed to process 250 tons per day, reflective of a 500 ton-per-day facility). The total daily design capacity is also provided.

Energy Capacity: Expressed in gross megawatts (MW) capacity for electric generating facilities (ELE) or pounds of steam per hour for steam generating facilities (STM). Some facilities produce both steam for export and electricity for either internal use or for sale on the electric grid.

Continuous Emissions Monitors (CEMS): All facilities employ continuous emissions monitors (CEMS) and the directory identifies emissions at each plant which are monitored continuously. References to *Link* in the CEMS column means that the facility is connected to the state regulatory agency by way of computer for emissions-monitoring purposes.

Technology: An abbreviated summary of the furnace technology employed at a facility is provided. The following technologies are listed in their abbreviated form:

- *MBWW:* Mass Burn, Water Wall furnace
- *MBRW:* Mass Burn, Refractory Wall furnace
- *MCU:* Modular Combustion Unit
- *RWW:* Rotary Water Wall combustor
- *RRW:* Rotary bed combustion chamber, Refractory Wall
- *RDF:* Refuse-Derived Fuel facility that burns the RDF previously processed from trash
- *SSWW:* Spreader Stoker, Water Wall furnace

Project Startup: Actual year of commercial startup is listed.

APC System: This entry reflects the Air Pollution Control System in use at the facility:

- *CI:* Activated Carbon Injection
- *CYC:* Cyclone Separator
- *DSI:* Duct Sorbent (dry) Injection (downstream of furnace)
- *ESP:* Electrostatic Precipitator
- *FF:* Fabric Filter
- *FGR:* Flue Gas Recirculation
- *FSI:* Furnace Sorbent (dry) Injection
- *GSA:* Gas Suspension Absorber
- *SDA:* Spray Dryer Absorber, or Scrubber
- *SNCR:* Select Non-Catalytic Reduction for NOx Control (e.g. aqueous ammonia)

Owner: The current owner of the facility is listed in this column.

Operator: The current operator of the facility is listed in this column.

The North American Waste-to-Energy Conference (NAWTEC)

Co-sponsored by the Energy Recovery Council (ERC), the American Society of Mechanical Engineers (ASME), the Solid Waste Association of North America (SWANA), and in partnership with the Waste-to-Energy Research and Technology Council (WTERT) at Columbia University, the North American Waste-to-Energy Conference (NAWTEC) is widely recognized as the leading industry technical conference and trade show focusing on municipal waste-to-energy.

NAWTEC has taken place annually for the past 18 years and has showcased the latest research, technology, innovations, and policies affecting the municipalities and companies involved in the waste-to-energy industry. The 19th NAWTEC will take place May 16-18, 2011 in Lancaster, PA.

For more information, please visit http://www.nawtec.org.

ALABAMA

Huntsville Solid Waste-to-Energy Facility
Huntsville, AL

Trash Capacity: 2 units @ 345 tpd = 690 tpd
Energy Capacity: 178,620 Lbs/Hr steam export
Project Startup: 1990
Technology: MBWW
CEMS: CO; NOx; Temp; Opacity, SO_2
APC System: SDA; FF; SNCR; CI
Owner: City of Huntsville Solid Waste Disposal Authority
Operator: Covanta Huntsville, Inc.

ALASKA

Eielson Air Force Base
North Pole, AK

Trash Capacity: 5 units @ 2 tpd = 10 tpd
Energy Capacity: STM: 2,775 Lbs/Hr
ELE: 0.2 MW
(RDF Attributed-Peak)
Project Startup: 1995
Technology: RDF (co-fired in Coal Boiler)
CEMS: Opacity
APC System: FF
Owner: Eileson Airforce Base
Operator: Eileson Airforce Base

CALIFORNIA (3 facilities; combined capacity of 2,540 TPD and 69.5 MW)

Commerce Refuse-to-Energy Facility
Commerce, CA

Trash Capacity: 1 units @ 360 tpd = 360 tpd
Energy Capacity: ELE: 10 MW
Project Startup: 1987
Technology: MBWW
CEMS: CO; NOx; O_2; Temp; Opacity; SO_2
APC System: SDA; FF; SNCR, CYC; FSI
Owner: Commerce Refuse-to-Energy Authority
Operator: Sanitation Districts of Los Angeles County

Southeast Resource Recovery Facility (SERRF)
Long Beach, CA

Trash Capacity: 3 units @ 460 tpd = 1,380 tpd
Energy Capacity: ELE: 37.5 MW
Project Startup: 1988
Technology: MBWW
CEMS: CO; CO_2; NOx; O_2; Opacity; Temp; Moisture; SO_2
APC System: SDA; FF; SNCR
Owner: City of Long Beach
Operator: Covanta Energy Renewable Energy Corp.

Stanislaus County Resource Recovery Facility
Crow's Landing, CA

Trash Capacity: 2 units @ 400 tpd = 800 tpd
Energy Capacity: 22 MW
Project Startup: 1989
Technology: MBWW
CEMS: CO; O_2; NOx; Temp; Opacity; SO_2
APC System: SDA; FF; SNCR; CI
Owner: Covanta Stanislaus, Inc.
Operator: Covanta Stanislaus, Inc.

"Discarded MSW is a viable energy source for electricity generation in a carbon-constrained world. [...] Waste-to-energy appears to be a better option than landfill gas-to-energy. If the goal is greenhouse gas reduction, then WTE should be considered as an option under U.S. renewable energy policies."

—"Is It Better to Burn or Bury Waste for Clean Electricity Generation?, *(Environ. Sci. Technol.* 2009, 43, 1711–1717), Kaplan (EPA), DeCarolis (NC State Univ), Thorneloe (EPA)

CONNECTICUT (6 facilities; combined capacity of 6,537 TPD and 194 MW)

Bristol Resource Recovery Facility
Bristol, CT

Trash Capacity: 2 units @ 325 tpd = 650 tpd
Energy Capacity: 16 MW
Project Startup: 1988
Technology: MBWW
CEMS: CO; O_2; Link; NOx; Opacity; SO_2; Temp
APC System: SDA; FF; SNCR; CI
Owner: Covanta Bristol, Inc.
Operator: Covanta Bristol, Inc.

Mid-Connecticut Resource Recovery Facility
Hartford, CT

Trash Capacity: 3 units @ 676 tpd = 2,028 tpd
Energy Capacity: 68 MW
Project Startup: 1987
Technology: RDF—SSWW
CEMS: CO; CO_2; NOx; O_2; Opacity; SO_2
APC System: SDA; FF; SNCR
Owner: Connecticut Resource Recovery Authority
Operator: Covanta Mid-Conn, Inc.

Riley Energy Systems of Lisbon Connecticut Corp.
Lisbon, CT

Trash Capacity: 2 units @ 250 tpd = 500 tpd
Energy Capacity: 15 MW
Project Startup: 1995
Technology: MBWW
CEMS: CO; NOx; O_2; Opacity; Temp; Moisture; CO_2; SO_2
APC System: SDA; FF; SNCR; CI
Owner: Eastern Connecticut Resource Recovery Authority
Operator: Riley Energy Systems of Lisbon Corp

Southeastern Connecticut Resource Recovery Facility
Preston, CT

Trash Capacity: 2 units @ 344.5 tpd = 689 tpd
Energy Capacity: 17 MW
Project Startup: 1991
Technology: MBWW
CEMS: CO; NOx; O_2; Opacity; Temp; CO_2; SO_2
APC System: SDA; FF; CI; SNCR
Owner: Covanta Company of Southeastern Connecticut
Operator: Covanta Company of Southeastern CT

Wallingford Resource Recovery Facility
Wallingford, CT

Trash Capacity: 3 units @ 140 tpd = 420 tpd
Energy Capacity: 11 MW
Project Startup: 1989
Technology: MBRW
CEMS: CO; O_2; NOx; Opacity; Temp; SO_2
APC System: SDA; FF; CI; CYC; FGR
Owner: Covanta Energy Corporation
Operator: Covanta Projects of Wallingford, L.P.

Wheelabrator Bridgeport Company, L.P.
Bridgeport, CT

Trash Capacity: 3 units @ 750 tpd = 2,250 tpd
Energy Capacity: 67 MW
Project Startup: 1988
Technology: MBWW
CEMS: CO; O_2; NOx; Temp; Opacity; SO_2
APC System: SDA; FF; SNCR; CI
Owner: Wheelabrator Technologies Inc.
Operator: Wheelabrator Technologies Inc.

FLORIDA (11 facilities; combined capacity of 18,756 TPD and 530.4.4 MW)

Bay County Resource Recovery Center
Panama City, FL

Trash Capacity: 2 units @ 250 tpd = 500 tpd
Energy Capacity: ELE: 10 MW
Project Startup: 1987
Technology: RWW
CEMS: O_2; CO; NOx; SO_2; Opacity; Temp
APC System: SDA; FF; CI
Owner: Bay County
Operator: EnGen, LLC

Miami-Dade County Resource Recovery Facility
Miami, FL

Trash Capacity: 4 units @ 648 tpd = 2,592 tpd
Energy Capacity: ELE: 77 MW
Project Startup: 1979
Technology: RDF—SSWW
CEMS: CO; NOx; O_2; Temp; Opacity; SO_2
APC System: SDA; FF; SNCR; CI
Owner: Miami-Dade County
Operator: Covanta Southeastern Florida Renewable Energy

Hillsborough County Resource Recovery Facility
Tampa, FL

Trash Capacity: 3 units @ 600 tpd = 1,800 tpd
Energy Capacity: ELE: 46.5 MW
Project Startup: 1987 (units 1&2); 2009 (unit 3)
Technology: MBWW
CEMS: CO; NOx; Temp; SO_2; O_2; Opacity
APC System: SDA; FF; SNCR; CI
Owner: Hillsborough County
Operator: Covanta Hillsborough, Inc.

Lake County Resource Recovery Facility
Okahumpka, FL

Trash Capacity: 2 units @ 264 tpd = 528 tpd
Energy Capacity: ELE: 14.5 MW
Project Startup: 1991
Technology: MBWW
CEMS: CO; CO_2; NOx; Opacity; SO_2; O_2
APC System: SDA; FF; SNCR; CI
Owner: Covanta Lake, Inc.
Operator: Covanta Lake, Inc.

Lee County Resource Recovery Facility
Fort Myers, FL

Trash Capacity: 2 units @ 600 tpd
1 unit @ 636 tpd
1,836 tpd total
Energy Capacity: ELE: 59 MW
Project Startup: 1994 (units 1&2); 2007 (unit 3)
Technology: MBWW
CEMS: CO; CO_2; NOx; O_2; Opacity; Temp; Moisture; SO_2
APC System: SDA; FF; SNCR; CI; FGR
Owner: Lee County
Operator: Covanta Lee, Inc.

McKay Bay Refuse-to-Energy Facility
Tampa, FL

Trash Capacity: 4 units @ 250 tpd = 1,000 tpd
Energy Capacity: ELE: 22.2 MW
Project Startup: 1985
Technology: MBWW
CEMS: CO; Opacity; SO_2; NOx; Temp; Moisture; O_2
APC System: SDA; FF; SNCR; CI
Owner: City of Tampa
Operator: Wheelabrator McKay Bay Inc.

FLORIDA (continued)

North County Resource Recovery Facility
West Palm Beach, FL

Trash Capacity:	2 units @ 900 tpd = 1,800 tpd
Energy Capacity:	ELE: 62 MW
Project Startup:	1989
Technology:	RDF-SSWW
CEMS:	NOx; CO; SO_2; Opacity; CO_2
APC System:	SDA; ESP
Owner:	Solid Waste Authority of Palm Beach County
Operator:	Palm Beach Resource Recovery Corporation (Bacock & Wilcox)

Pasco County Resource Recovery Facility
Spring Hill, FL

Trash Capacity:	3 units @ 350 tpd = 1,050 tpd
Energy Capacity:	ELE: 31.2 MW
Project Startup:	1991
Technology:	MBWW
CEMS:	CO; NOx; O_2; Opacity; Temp; SO_2; CO_2
APC System:	SDA; FF; SNCR; CI
Owner:	Pasco County
Operator:	Covanta Pasco, Inc.

Pinellas County Resource Recovery Facility
St. Petersburg, FL

Trash Capacity:	3 units @ 1,050 tpd = 3,150 tpd
Energy Capacity:	ELE: 75 MW
Project Startup:	1983 (units 1&2); 1986 (unit 3)
Technology:	MBWW
CEMS:	CO; NOx; O_2; Opacity; SO_2
APC System:	SDA; FF; SNCR; CI
Owner:	Pinellas County
Operator:	Veolia ES Waste-to-Energy, Inc.

Wheelabrator North Broward, Inc.
Pompano Beach, FL

Trash Capacity:	3 units @ 750 tpd = 2,250 tpd
Energy Capacity:	ELE: 67 MW
Project Startup:	1991
Technology:	MBWW
CEMS:	CO; NOx; O_2; Opacity; Temp; SO_2; CO_2
APC System:	SDA; FF; SNCR
Owner:	Wheelabrator Technologies Inc.
Operator:	Wheelabrator Technologies Inc.

Wheelabrator South Broward, Inc.
Ft. Lauderdale, FL

Trash Capacity:	3 units @ 750 tpd = 2,250 tpd
Energy Capacity:	ELE: 66 MW
Project Startup:	1991
Technology:	MBWW
CEMS:	CO; NOx; O_2; Opacity; Temp; SO_2; CO_2
APC System:	SDA; FF; SNCR
Owner:	Wheelabrator Technologies Inc.
Operator:	Wheelabrator Technologies Inc.

"Squeezing energy out of garbage puts trash to good use. That's not just green. It's smart. And it's the best plan the county has in the works for dealing with its growing trash pile."

—Editorial from the South Florida Sun-Sentinel on Palm Beach County's proposed new waste-to-energy facility. (2/27/10)

HAWAII

Honolulu Resource Recovery Venture (HPOWER)

Honolulu, HI

Trash Capacity: 2 units @ 925.5 tpd = 1,851 tpd
Energy Capacity: ELE: 58.6 MW
Project Startup: 1990
Technology: RDF-SSWW
CEMS: CO; NOx; Opacity; Temp; SO_2; O_2
APC System: SDA; ESP
Owner: City & County of Honolulu
Operator: Covanta Honolulu Resource Recovery Venture (HPOWER)

The City of Honolulu broke ground in December, 2009 on an expansion of Honolulu's H-Power plant. The $302 million project will expand the waste-to-energy plant's capacity by 50 percent to handle an added 300,000 tons of garbage per year.

When it is complete, the 900,000 tons processed by the facility each year will be able to generate 84 megawatts of power, which represents about 6 percent of Oahu's electricity needs.

INDIANA

Indianapolis Resource Recovery Facility

Indianapolis, IN

Trash Capacity: 3 units @ 725 tpd = 2,175 tpd
Energy Capacity: STM: 587,400 Lbs/Hr
Project Startup: 1988
Technology: MBWW
CEMS: CO; NOx; Opacity; SO_2; Temp; O_2
APC System: SDA; FF; SNCR; CI
Owner: Marion County
Operator: Covanta Indianapolis, Inc.

IOWA

Ames Municipal Electric Utility

Ames, IA

Trash Capacity: 1 units @ 175 tpd = 175 tpd
Energy Capacity: ELE: 10 MW (RDF Attributed)
Project Startup: 1975
Technology: RDF-Pulverized Coal WW
CEMS: CO_2; NOx; O_2; Opacity; SO_2
APC System: ESP
Owner: City of Ames
Operator: Ames Municipal Electric System

Air Emissions of Waste-To-Energy and Fossil Fuel Power Plants

(Pounds per Megawatt Hour)

Facility Type	Direct CO_2[1]	Life Cycle CO_2E[2]
Coal	2,138	2,196
Oil	1,496	1,501
Natural Gas	1,176	1,276
Waste-To-Energy[3]	1,294	**-3,636**

[1]Based on 2007 EPA eGRID data except WTE which is a nationwide average using 34% anthropogenic CO_2.
[2]Life Cycle CO2E for fossil fuels limited to indirect methane emissions using EPA GHG inventory and EIA power generation data. Life Cycle value would be larger if indirect CO_2 was included.
[3]Life Cycle CO_2E for WTE based on nominal nationwide avoidance ratio of 1 ton CO_2E per ton of MSW using the Municipal Solid Waste Decision Support Tool, which includes avoided methane and avoided CO_2.

MAINE (4 facilities; combined capacity of 2,800 TPD and 65.3 MW)

Maine Energy Recovery Company
Biddeford, ME

Trash Capacity: 2 units @ 300 tpd = 600 tpd
Energy Capacity: ELE: 22 MW
Project Startup: 1987
Technology: RDF-SSWW
CEMS: CO; Link; NOx; O_2; Opacity; SO_2; Temperature
APC System: SDA; FF
Owner: Casella Waste Systems
Operator: KTI Operations

Mid-Maine Waste Action Corporation
Auburn, ME

Trash Capacity: 2 units @ 100 tpd = 200 tpd
Energy Capacity: ELE: 3.6 MW
Project Startup: 1992
Technology: RWW
CEMS: CO; CO_2; NOx; Opacity; SO_2; Temperature
APC System: SDA; FF; CI
Owner: Mid-Maine Waste Action Corp.
Operator: Mid-Maine Waste Action Corp.

Penobscot Energy Recovery Corp.
Orrington, ME

Trash Capacity: 2 units @ 750 tpd = 1,500 tpd
Energy Capacity: ELE: 25 MW
Project Startup: 1988
Technology: RDF
CEMS: CO; CO_2; O_2; NOx; Opacity; SO_2
APC System: SDA; FF
Owner: USA Energy Group LLC; PERC Holdings LLC; Communities
Operator: ESOCO Orrington LLC

Greater Portland Resource Recovery Facility
Portland, ME

Trash Capacity: 2 units @ 250 tpd = 500 tpd
Energy Capacity: ELE: 14.7 MW
Project Startup: 1988
Technology: MBWW
CEMS: NOx; SO_2; CO; Opacity; Link; Temp; O_2
APC System: SDA; SNCR; CI; CYC; ESP
Owner: ecomaine
Operator: ecomaine

Waste-to-Energy & Steam Exports

Waste-to-energy produces more than just electricity. Many facilities also generate steam that is exported directly to customers located in close proximity to the plant, eliminating the need for those customers to burn fossil fuels to meet their demand for steam.

Many businesses are served by downtown steam loops to which waste-to-energy facilities in Baltimore, Indianapolis, Detroit, and Grand Rapids provide steam. Waste-to-energy facilities in Minnesota serve a local industries, including those as diverse as 3M, Tuffy's Dogfood, Bongard's Cheese, and the S.B. Foot Tannery. The Pittsfield Resource Recovery Facility in Massachusetts exports its steam to a Crane & Company paper mill where currency paper stock for the U.S. Treasury and several other nations is manufactured.

Several waste-to-energy facilities have partnered with the federal government to provide steam. The Huntsville (AL) facility serves the Army's Redstone Arsenal; the Harford (MD) facility serves the Aberdeen Proving Grounds; the Davis (UT) facility serves Hill Air Force Base; the Hampton (VA) facility serves NASA.

MARYLAND (3 facilities; combined capacity of 4,410 TPD, 123 MW, 100,000 lbs/hr)

Harford Waste-to-Energy Facility
Joppa, MD

Trash Capacity: 4 units @ 90 tpd = 360 tpd
Energy Capacity: STM: 100,000 Lbs/Hr
Project Startup: 1988
Technology: MCU
CEMS: SO_2; CO; CO_2; Temp; Opacity; NOx; O_2
APC System: SDA; FF; CI; DSI
Owner: Northeast Maryland Waste Disposal Authority
Operator: Energy Recovery Operations, Inc.

Baltimore Refuse Energy Systems Company (BRESCO)
Baltimore, MD

Trash Capacity: 3 units @ 750 tpd = 2,250 tpd
Energy Capacity: ELE: 60 MW
Project Startup: 1985
Technology: MBWW
CEMS: CO; NOx; O_2; Opacity; Temp; Moisture; CO_2; SO_2
APC System: SDA; ESP; SNCR; CI
Owner: John Hancock Life Insurance Company
Operator: Wheelabrator Baltimore, L.P.

Montgomery County Resource Recovery Facility
Dickerson, MD

Trash Capacity: 3 units @ 600 tpd = 1,800 tpd
Energy Capacity: ELE: 63 MW
Project Startup: 1995
Technology: MBWW
CEMS: CO; CO_2; HCl; Link, NOx; O_2; Opacity; Temp; Moisture; SO_2
APC System: FSI; SDA; FF; SNCR; CI
Owner: Northeast Maryland Waste Disposal Authority
Operator: Covanta Montgomery, Inc.

"EPA strongly supports the use of waste-to-energy facilities. With fewer and fewer new landfills being opened and capacity controls being imposed on many existing landfills, our communities greatly benefit from the dependable, sustainable capacity of municipal waste-to-energy plants."

—USEPA letter from Acting Assistant Administrator William Wehrum, Office of Air and Radiation to Rep. Joe Barton, 9/29/06

MASSACHUSETTS (7 facilities; combined capacity of 9,450 TPD, 265.9 MW, 164,000 lbs/hr)

Haverhill Resource Recovery Facility
Haverhill, MA

Trash Capacity: 2 units @ 825 tpd = 1,650 tpd
Energy Capacity: ELE: 46.9 MW
Project Startup: 1989
Technology: MBWW
CEMS: CO; NOx; Opacity; Temp; SO_2; O_2
APC System: SDA; FF; SNCR; CI
Owner: City of Haverhill
Operator: Covanta Haverhill, Inc.

Pioneer Valley Resource Recovery Facility
Agawam, MA

Trash Capacity: 3x136=408 (design); 3x120=360 (permit)
Energy Capacity: STM: 96,000 Lbs/Hr; ELE: 9.4 MW
Project Startup: 1988
Technology: MBRW
CEMS: CO; NOx; Opacity; SO_2
APC System: FGR; DSI; FF; CI, CYC
Owner: Covanta Springfield, LLC
Operator: Covanta Springfield, LLC

Pittsfield Resource Recovery Facility
Pittsfield, MA

Trash Capacity: 3x120=360 (design); 3x80=240 (actual practice)
Energy Capacity: STM: 68,000 Lbs/Hr; ELE: 0.8 MW
Project Startup: 1981
Technology: MBRW
CEMS: CO; NOx; O_2; Opacity; SO_2
APC System: FGR; ESP; CI; Packed Tower Scrubber
Owner: Covanta Pittsfield, LLC
Operator: Covanta Pittsfield, LLC

SEMASS Resource Recovery Facility
West Wareham, MA

Trash Capacity: 3 units @ 900 tpd = 2,700 tpd
Energy Capacity: ELE: 84.8 MW
Project Startup: 1989
Technology: RDF-SSWW
CEMS: CO; NOx; Temp; Opacity; SO_2; O_2; CO_2
APC System: SDA; ESP; COHPAC (Units 1&2); SDA; FF; SNCR (Unit 3)
Owner: Covanta SEMASS, L.P.
Operator: Covanta SEMASS, L.P.

Wheelabrator Millbury Inc.
Millbury, MA

Trash Capacity: 2 units @ 750 tpd = 1,500 tpd
Energy Capacity: ELE: 46 MW
Project Startup: 1987
Technology: MBWW
CEMS: CO; NOx; O_2; Opacity; SO_2
APC System: SDA; FF; SNCR; CI
Owner: CIT
Operator: Wheelabrator Millbury Inc.

Wheelabrator North Andover Inc.
North Andover, MA

Trash Capacity: 2 units @ 750 tpd = 1,500 tpd
Energy Capacity: ELE: 40 MW
Project Startup: 1985
Technology: MBWW
CEMS: CO; NOx; O_2; $C0_2$; Temp; Opacity; SO_2
APC System: SDA; FF; SNCR; CI
Owner: Wheelabrator North Andover Inc.
Operator: Wheelabrator North Andover Inc.

Wheelabrator Saugus, J.V.
Saugus, MA

Trash Capacity: 2 units @ 750 tpd = 1,500 tpd
Energy Capacity: ELE: 38 MW
Project Startup: 1975
Technology: MBWW
CEMS: CO; NOx; O_2; Temp; Opacity; SO_2
APC System: SDA; FF; SNCR; CI
Owner: Wheelabrator Saugus, J.V.
Operator: Wheelabrator Saugus, J.V.

"[Waste-to-energy] can add in-state capacity so that we can end the practice of burying our waste in someone else's backyard. They can help advance recycling by diverting recyclable wastes from their facilities to recycling centers. And because every ton of trash that we turn into energy is the equivalent of using one less barrel of oil or one-quarter ton less coal, generating energy from waste can contribute to addressing the global challenge of climate change."

—John DeVillars, former environmental secretary of Massachusetts from 1988 to 1991 and New England administrator of the US Environmental Protection Agency from 1994 to 2000, in an op-ed in the *Boston Globe* on 12/2/09.

MICHIGAN (3 facilities; combined capacity of 4,125 TPD, 89.7 MW, 774,800 lbs/hr)

Greater Detroit Resource Recovery Facility
Detroit, MI

Trash Capacity: 3 units @ 1,100 tpd = 3,300 tpd
Energy Capacity: STM: 725,600 Lbs/Hr; ELE: 68 MW
Project Startup: 1991
Technology: RDF-SSWW
CEMS: CO; NOx; Temp; Opacity; SO_2; Link; O_2
APC System: SDA; FF
Owner: City of Detroit, MI (GDRRA)
Operator: Covanta Energy Corporation

Jackson County Resource Recovery Facility
Jackson, MI

Trash Capacity: 2 units @ 100 tpd = 200 tpd
Energy Capacity: STM: 49,200 Lbs/Hr ELE: 3.7 MW
Project Startup: 1987
Technology: MBWW
CEMS: CO; CO_2; NOx; O_2; Opacity; SO_2; Temperature
APC System: SDA; FF; CI
Owner: Jackson County
Operator: U.S. Filter, Inc.

Kent County Waste-to-Energy Facility
Grand Rapids, MI

Trash Capacity: 2 units @ 312.5 tpd = 625 tpd
Energy Capacity: ELE: 18 MW
Project Startup: 1990
Technology: MBWW
CEMS: CO; O_2; NOx; Temp; Opacity; SO_2; Link
APC System: SDA; FF; SNCR; CI
Owner: Kent County
Operator: Covanta Kent, Inc.

"Waste-to-energy provides double benefits: it diminishes waste reserves and produces clean energy while offsetting greenhouse gas emissions. As our nation's energy needs grown and we continue to discern how best to meet them, we think it is important to take an inclusive view of the ways in which already-existing technologies can be used to reduce our dependence on fossil fuels."

—15 United States Senators (in a letter dated March 4, 2009)

MINNESOTA 9 facilities; combined capacity of 4,418 TPD, 132.4 MW, and 114,000 lbs/hr)

Great River Energy - Elk River Station
Elk River, MN

Trash Capacity: 2 units @ 250 tpd; 1 unit @ 500 tpd =1,000 tpd
Energy Capacity: ELE: 35 MW
Project Startup: 1989
Technology: RDF-SSWW
CEMS: CO; NOx; O_2; SO_2; Opacity
APC System: SDA; FF
Owner: Great River Energy (Rural Electric Gen/Trans Coop)
Operator: Great River Energy

Hennepin Energy Resource Co.
Minneapolis, MN

Trash Capacity: 2 units @ 606 tpd = 1,212 tpd
Energy Capacity: ELE: 39.6 MW
Project Startup: 1989
Technology: MBWW
CEMS: CO; CO_2; NOx; Temp; Opacity; SO_2
APC System: SDA; FF; CI
Owner: Hennepin County
Operator: Covanta Hennepin Energy Resource, Inc.

Olmsted Waste-to-Energy Facility
Rochester, MN

Trash Capacity: 2 units @ 100 tpd
1 unit @ 200 tpd =
400 tpd total
Energy Capacity: ELE: 9.8 MW
Project Startup: 1987 (units 1&2); 2010 (unit 3)
Technology: MBWW
CEMS: CO; CO_2; SO_2; O_2; NOx; Opacity
APC System: SDA; FF; CI
Unit 3 only: FGR; NH_3 Injection
Owner: Olmsted County
Operator: Olmsted County

Perham Resource Recovery Facility
Perham, MN

Trash Capacity: 2 units @ 58 tpd = 116 tpd
Energy Capacity: STM: 37,000 Lbs/Hr
ELE: 4.5 MW
Project Startup: 1986; 2002 (upgrade)
Technology: MCU
CEMS: SO_2; CO; O_2; Opacity; Temp
APC System: SDA; DSI; FF; CI; FGR
Owner: City of Perham
Operator: City of Perham

Polk County Solid Waste Resource Recovery Plant
Fosston, MN

Trash Capacity: 2 units @ 40 tpd = 80 tpd
Energy Capacity: STM: 25,000 Lbs/Hr
Project Startup: 1988
Technology: MCU
CEMS: CO; SO_2; O_2
APC System: CI; DSI; ESP
Owner: Polk County
Operator: Polk County

Pope/Douglas Solid Waste Management
Alexandria, MN

Trash Capacity: 2 units @ 40 tpd = 80 tpd
Energy Capacity: STM: 36,000 Lbs/Hr
ELE: 0.5 MW
Project Startup: 1987
Technology: MCU
CEMS: CO; NOx; SO_2; CO_2; O_2; Opacity
APC System: DSI; FF; CI
Owner: Pope/Douglas Solid Waste Management Board
Operator: Pope/Douglas Solid Waste Management Board

Red Wing Resource Recovery Facility
Red Wing, MN

Trash Capacity: 2 units @ 45 tpd = 90 tpd
Energy Capacity: STM: 16,000 Lbs/Hr
Project Startup: 1983
Technology: MCU
CEMS: CO; SO_2; O_2; Opacity
APC System: GSA; ESP
Owner: City of Red Wing
Operator: City of Red Wing

Xcel Energy - Red Wing Steam Plant
Red Wing, MN

Trash Capacity: 2 units @ 360 tpd = 720 tpd
Energy Capacity: ELE: 21 MW
Project Startup: 1988
Technology: RDF-SSWW
CEMS: SO_2; O_2; NOx; CO
APC System: CI; ESP; GSA
Owner: Xcel Energy
Operator: Xcel Energy

MINNESOTA (continued)

Xcel Energy-Wilmarth Plant
Mankato, MN

Trash Capacity: 2 units @ 360 tpd = 720 tpd
Energy Capacity: ELE: 22 MW
Project Startup: 1987
Technology: RDF-SSWW
CEMS: CO; NOx; O_2; Opacity; SO_2
APC System: SDA; FF
Owner: Xcel Energy
Operator: Xcel Energy

"Waste-to-energy is turning a problem into an energy solution."

—Rick Brandes, Chief, Waste Minimization Branch, Office of Solid Waste and Emergency Response, US Environmental Protection Agency as reported in *The Examiner*, 7/16/07

NEW HAMPSHIRE (2 facilities; combined capacity of 700 TPD and 18.5 MW)

Wheelabrator Claremont Co, L.P.
Claremont, NH

Trash Capacity: 2 units @ 100 tpd = 200 tpd
Energy Capacity: ELE: 4.5 MW
Project Startup: 1987
Technology: MBWW
CEMS: CO; O_2; Opacity; Temp; SO_2
APC System: SDA; FF; CI
Owner: Wheelabrator Claremont Co, L.P.
Operator: Wheelabrator Claremont Co, L.P.

Wheelabrator Concord Company, L.P.
Penacock, NH

Trash Capacity: 2 units @ 250 tpd = 500 tpd
Energy Capacity: ELE: 14 MW
Project Startup: 1989
Technology: MBWW
CEMS: CO; NOx; O_2; Opacity; Temp; SO_2
APC System: SDA; FF; SNCR; CI
Owner: Wheelabrator Concord, L.P.
Operator: Wheelabrator Concord, L.P.

NEW JERSEY (5 facilities; combined capacity of 6,372 TPD and 176.5 MW)

Camden Resource Recovery Facility
Camden, NJ

Trash Capacity: 3 units @ 350 tpd = 1,050 tpd
Energy Capacity: ELE: 34 MW
Project Startup: 1991
Technology: MBWW
CEMS: Opacity; NOx; HCl; SO_2; non-methane hydrocarbons
APC System: SDA; ESP; CI
Owner: Camden County Energy Recovery Associates
Operator: Camden County Energy Recovery Corp

Essex County Resource Recovery Facility
Newark, NJ

Trash Capacity: 3 units @ 933 tpd = 2,800 tpd
Energy Capacity: ELE: 70 MW
Project Startup: 1990
Technology: MBWW
CEMS: CO; NOx, O_2; Opacity, SO_2; Moisture
APC System: SDA; ESP; SNCR; CI; CYC
Owner: Covanta Energy Corporation
Operator: Covanta Energy Corporation

NEW JERSEY (continued)

Union County Resource Recovery Facility
Rahway, NJ

Trash Capacity: 3 units @ 500 tpd = 1,500 tpd
Energy Capacity: ELE: 45 MW
Project Startup: 1994
Technology: MBWW
CEMS: CO; NOx; Opacity; SO_2; Link; O_2; NH_3; HCl; Temp
APC System: SDA; FF; SNCR; CI
Owner: Union County Utility Authority
Operator: Covanta Union, Inc.

Warren Energy Resource Company
Oxford Township, NJ

Trash Capacity: 2 units @ 224 tpd = 448 tpd
Energy Capacity: ELE: 13.5 MW
Project Startup: 1988
Technology: MBWW
CEMS: CO; NOx; Opacity; SO_2; Link; O_2; Temp
APC System: SDA; FF; SNCR; CI
Owner: Covanta Warren Energy Resource Co, L.P.
Operator: Covanta Warren Energy Resource Co, L.P.

Wheelabrator Gloucester Company, L.P.
Westville, NJ

Trash Capacity: 2 units @ 287 tpd = 574 tpd
Energy Capacity: ELE: 14 MW
Project Startup: 1990
Technology: MBWW
CEMS: CO; O_2; SO_2; Opacity; Temp; NOx
APC System: SDA; FF; SNCR; CI
Owner: Wheelabrator Gloucester Inc.
Operator: Wheelabrator Gloucester Inc.

Waste-to-energy is "probably one of the greatest stories never told. We take regular household garbage and use it as a fuel, burning it in a boiler to create electricity."

—Sunil Garg, Executive Director, Union County (NJ) Utilities Authority

NEW YORK (10 facilities; combined capacity of 12,319 TPD, 332.45 MW, and 460,000 lbs/hr)

Babylon Resource Recovery Facility
Babylon, NY

Trash Capacity: 2 units @ 375 tpd = 750 tpd
Energy Capacity: ELE: 17 MW
Project Startup: 1989
Technology: MBWW
CEMS: CO; CO_2; NOx; Opacity; Temp; Moisture; O_2; SO_2
APC System: SDA; FF; CI; CYC
Owner: Covanta Babylon, Inc.
Operator: Covanta Babylon, Inc.

Dutchess County Resource Recovery Facility
Poughkeepsie, NY

Trash Capacity: 2 units @ 225 tpd = 450 tpd
Energy Capacity: STM: 50,000 Lbs/Hr; ELE: 9.25 MW
Project Startup: 1988
Technology: RWW
CEMS: CO; NOx; SO_2; Temperature; Opacity; O_2; CO_2
APC System: SDA; FF; CI
Owner: Dutchess County Resource Recovery Agency
Operator: Covanta Hudson Valley Renewable Energy LLC

NEW YORK (continued)

Hempstead Resource Recovery Facility
Westbury, NY

Trash Capacity: 2 units @ 890.3 tpd = 2,671 tpd
Energy Capacity: ELE: 75 MW
Project Startup: 1989
Technology: MBWW
CEMS: CO; CO_2; NOx; Opacity; Temp; SO_2
APC System: SDA; FF; SNCR; CYC
Owner: Town of Hempstead
Operator: Covanta Hempstead Co.

Huntington Resource Recovery Facility
East Northport, NY

Trash Capacity: 3 units @ 250 tpd = 750 tpd
Energy Capacity: ELE: 25 MW
Project Startup: 1991
Technology: MBWW
CEMS: CO; O_2; NOx; Temp; Opacity; SO_2; NH_3
APC System: SDA; FF; SNCR; CI
Owner: Covanta Huntington, Inc.
Operator: Covanta Huntington, Inc.

MacArthur Waste-to-Energy Facility
Ronkonkoma, NY

Trash Capacity: 2 units @ 243 tpd = 486 tpd
Energy Capacity: ELE: 12 MW
Project Startup: 1989
Technology: RWW
CEMS: CO; NOx; O_2; Opacity; SO_2; Temp; Moisture
APC System: SDA; FF
Owner: Islip Resource Recovery Agency
Operator: Covanta MacArthur Renewable Energy, Inc.

Niagara Falls Resource Recovery Facility
Niagra Falls, NY

Trash Capacity: 2 units @ 1,125 tpd = 2,250 tpd
Energy Capacity: STM: 350,000 Lbs/Hr
ELE: 50MW
Project Startup: 1996
Technology: MBWW
CEMS: CO; NOx; O_2; Opacity; Temp; CO_2; SO_2
APC System: SDA; FF; SNCR; CI; ESP
Owner: Covanta Energy Corporation
Operator: Covanta Energy Corporation

Onondaga County Resource Recovery Facility
Jamesville, NY

Trash Capacity: 3 units @ 330 tpd = 990 tpd
Energy Capacity: ELE: 39.2MW
Project Startup: 1995
Technology: MBWW
CEMS: CO; CO_2; NOx; O_2; Opacity; SO_2; NH_3
APC System: SDA; FF; SNCR; CI
Owner: Onondaga County Resource Recovery Agency
Operator: Covanta Onondaga, L.P.

Oswego County Energy Recovery Facility
Fulton, NY

Trash Capacity: 4 units @ 50 tpd = 200 tpd
Energy Capacity: STM: 60,000 Lbs/Hr
ELE: 4 MW
Project Startup: 1985
Technology: MCU
CEMS: Steam flow; CO; O_2; SO_2; Opacity; Temp; Moisture
APC System: SDA; FF: CI; FGR
Owner: Oswego County
Operator: Oswego County

NEW YORK (continued)

Wheelabrator Hudson Falls Inc.
Hudson Falls, NY

Trash Capacity:	2 units @ 236 tpd = 472 tpd
Energy Capacity:	ELE: 14.4 MW
Project Startup:	1991
Technology:	MBWW
CEMS:	CO; NOx; O_2; Opacity; Temp; SO_2
APC System:	SDA; ESP; CI; CYC
Owner:	Warren & Washington Counties Industrial Development Agency
Operator:	Wheelabrator Hudson Falls Inc.

Wheelabrator Westchester Company, L.P.
Peekskill, NY

Trash Capacity:	3 units @ 750 tpd = 2,250 tpd
Energy Capacity:	ELE: 63 MW
Project Startup:	1984
Technology:	MBWW
CEMS:	Opacity; CO; O_2; SO_2; Temp; NOx
APC System:	SDA; FF; SNCR; CI
Owner:	Wheelabrator Technologies, Inc.
Operator:	Wheelabrator Technologies, Inc.

NORTH CAROLINA

New Hanover County—Wastec
Wilmington, NC

Trash Capacity:	2 units @ 100 tpd 1 unit @ 300 tpd 500 tpd total
Energy Capacity:	ELE: 10.5 MW
Project Startup:	1984 (units 1&2); 1991 (unit 3)
Technology:	MBWW
CEMS:	CO; CO_2; NOx; O_2; Opacity; SO_2
APC System:	SDA; FF; CI
Owner:	New Hanover County
Operator:	New Hanover County

OREGON

Marion County Solid Waste-to-Energy Facility
Brooks, OR

Trash Capacity:	2 units @ 275 tpd = 550 tpd
Energy Capacity:	ELE: 13.1 MW
Project Startup:	1986
Technology:	MBWW
CEMS:	O_2; CO; SO_2; Temp; Opacity; NOx
APC System:	SDA; FF; SNCR; CI; CYC; DSI
Owner:	Covanta Marion, Inc.
Operator:	Covanta Marion, Inc.

As of September 30, 2010, the U.S. waste-to-energy industry has 51 facilities that have earned STAR status under the OSHA Voluntary Protection Program. While less than 0.02% of all worksites are enrolled in VPP, more than 59% of all U.S. waste-to-energy facilities are enrolled in VPP.

MSW Management in the U.S.

Source: BioCycle/Columbia University, 2010 State of the Garbage.
Percentages based on 389 million tons of MSW generated in 2008.

OKLAHOMA

Warren B. Hall Resource Recovery Facility
Tulsa, OK

Trash Capacity:	3 units @ 375 tpd = 1,125 tpd
Energy Capacity:	ELE: 16.8 MW; or STM: 240,000 Lbs/Hr
Project Startup:	1986 (2 units); 1987 (1 unit)
Technology:	MBWW
CEMS:	CO; CO_2; NOx; O_2; Temp; Opacity; SO_2
APC System:	CI; CYC; FF; SNCR; SDA
Owner:	Covanta WBH, LLC
Operator:	Covanta WBH, LLC

The Walter B. Hall Resource Recovery Facility began commercial operation in October 1986 with two units. A third unit was added in October 1987 to meet growing demands of the residents and businesses in the Tulsa area. The facility generates up to 240,000 pounds per hour of steam, which can be used to power a turbine generator to produce 16.8 megawatts of clean, renewable energy that is sold to Public Service Company of Oklahoma. However, on a more regular basis, the steam is sold to the adjacent Sunoco refinery, so it does not have to use fossil fuels to generate their own steam.

PENNSYLVANIA (6 facilities; combined capacity of 9,408 TPD and 276.5 MW)

Delaware Valley Resource Recovery Facility
Chester, PA

Trash Capacity:	6 units @ 558 tpd = 3,348 tpd
Energy Capacity:	ELE: 90 MW
Project Startup:	1992
Technology:	RWW
CEMS:	CO; HCl; Link; NOx; O_2; CO_2; Opacity; Temp; Moisture; SO_2
APC System:	SDA; FF
Owner:	Covanta Delaware Valley, L.P.
Operator:	Covanta Delaware Valley, L.P.

Harrisburg Resource Recovery Facility
Harrisburg, PA

Trash Capacity:	3 units @ 266 tpd = 800 tpd
Energy Capacity:	ELE: 24.2 MW
Project Startup:	2006 (retrofit completed)
Technology:	MBWW
CEMS:	CO; O_2; SO_2
APC System:	SDA; FF; SNCR; CI
Owner:	City of Harrisburg
Operator:	Covanta Harrisburg, Inc.

"Waste-to-energy plants are a "clean, reliable, renewable source of energy" that 'produce 2,800 megawatts of electricity with less environmental impact than almost any other source of electricity." Communities "greatly benefit from the dependable, sustainable [solid waste disposal] capacity of municipal waste-to-energy plants."

—USEPA letter from Assistant Administrators Marianne Horinko, Office of Solid Waste and Emergency Response, and Jeffery Holmstead, Office of Air and Radiation to IWSA, 2/14/03

Lancaster County Resource Recovery Facility
Bainbridge, PA

Trash Capacity:	3 units @ 400 tpd = 1,200 tpd
Energy Capacity:	ELE: 36 MW
Project Startup:	1991
Technology:	MBWW
CEMS:	CO; CO_2; NOx; Opacity; SO_2; Link; O_2; HCl; Temp; Moisture
APC System:	SDA; FF; SNCR; CI; FSI
Owner:	Lancaster County Solid Waste Management Authority
Operator:	Covanta Lancaster, Inc.

Covanta Plymouth Renewable Energy
Conshohocken, PA

Trash Capacity: 2 units @ 608 tpd = 1,216 tpd
Energy Capacity: ELE: 32 MW
Project Startup: 1992
Technology: MBWW
CEMS: CO; HCl; NOx; O_2; Opacity; Temp; Moisture; SO_2
APC System: SDA; FF; SNCR; CI
Owner: Covanta Plymouth Renewable Energy
Operator: Covanta Plymouth Renewable Energy

Wheelabrator Falls Inc.
Morrisville, PA

Trash Capacity: 2 units @ 750 tpd = 1,500 tpd
Energy Capacity: ELE: 53 MW
Project Startup: 1994
Technology: MBWW
CEMS: CO; HCl; NOx; O_2; Opacity; SO_2
APC System: SDA; FF; SNCR; CI
Owner: Wheelabrator Falls, Inc.
Operator: Wheelabrator Falls, Inc.

The Waste-to-Energy Research and Technology Council (WTERT) started at Columbia University has grown internationally. Universities abroad set up WTERT organizations in their countries as a way to identify and advance the best available waste-to-energy technologies for the recovery of energy or fuels from waste. WTERTs have now been established in: Brazil, Canada, China, Germany, Greece, Japan, and the United Kingdom.

York Resource Recovery Center
York, PA

Trash Capacity: 3 units @ 448 tpd = 1,344 tpd
Energy Capacity: ELE: 41 MW
Project Startup: 1989
Technology: MBWW
CEMS: CO; CO_2; HCl; Link; NOx; O_2; Opacity; SO_2; Temp
APC System: SDA; FF; CI
Owner: York County Solid Waste Authority
Operator: Covanta York Renewable Energy, LLC

UTAH

Wasatch Integrated Waste Management District
Layton, UT

Trash Capacity: 2 units @ 210 tpd = 420 tpd
Energy Capacity: STM: 105,000 Lbs/Hr
ELE: 1.6 MW
Project Startup: 1986
Technology: MBRW
CEMS: CO; NOx; O_2; Temp; CO_2; Opacity; SO_2
APC System: GSA; ESP
Owner: Wasatch Integrated Waste Management District
Operator: Wasatch Integrated Waste Management District

"Generation of energy from municipal solid waste disposed in a waste-to-energy facility not only offers significant environmental and renewable benefits, but also provides greater energy diversity and increased energy security for our nation."

—The United States Conference of Mayors, Adopted Resolution on Comprehensive Solid Waste Disposal Management (2005)

VIRGINIA (5 facilities; combined capacity of 6,415 TPD, 212.5 MW, and 134,000 lbs/hr)

Alexandria/Arlington Resource Recovery Facility
Alexandria, VA

Trash Capacity: 3 units @ 325 tpd = 975 tpd
Energy Capacity: ELE: 24 MW
Project Startup: 1988
Technology: MBWW
CEMS: CO; NOx; O_2; Temp; Opacity; SO_2
APC System: SDA; FF; SNCR; CI
Owner: Covanta Arlington/Alexandria, Inc.
Operator: Covanta Arlington/ Alexandria, Inc.

Hampton-NASA Steam Plant
Hampton, VA

Trash Capacity: 2 units @ 120 tpd = 240 tpd
Energy Capacity: STM: 66,000 Lbs/Hr
Project Startup: 1980
Technology: MBWW
CEMS: CO; O_2; Opacity
APC System: DSI; FF
Owner: NASA and City of Hampton
Operator: City of Hampton

Harrisonburg Resource Recovery Facility
Harrisonburg, VA

Trash Capacity: 2 units @ 100 tpd = 200 tpd
Energy Capacity: STM: 43,000 Lbs/Hr
ELE: 2.5 MW
Project Startup: 1982
Technology: MBRW
CEMS: CO; CO_2; O_2; Opacity; SO_2; Temperature
APC System: DSI; FF; CI
Owner: City of Harrisonburg
Operator: City of Harrisonburg

I-95 Energy-Resource Recovery Facility (Fairfax)
Lorton, VA

Trash Capacity: 4 units @ 750 tpd = 3,000 tpd
Energy Capacity: ELE: 126 MW
Project Startup: 1990
Technology: MBWW
CEMS: CO; O_2; NOx; Temp; Opacity; SO_2; Link
APC System: SDA; FF; SNCR; CI
Owner: Covanta Fairfax, Inc
Operator: Covanta Fairfax,

Wheelabrator Portsmouth, Inc.
Portsmouth, VA

Trash Capacity: 4 units @ 500 tpd = 2,000 tpd
Energy Capacity: STM: 25,000 Lbs/Hr
ELE: 60 MW
Project Startup: 1988
Technology: RDF-SSWW
CEMS: CO; HCl; NOx; O_2; Opacity; Temp; SO_2
APC System: SDA; FF
Owner: Wheelabrator Portsmouth, Inc.
Operator: Wheelabrator Portsmouth, Inc.

Full-time Employees at Waste-to-Energy Facilities
(based on survey of 63 facilities)

Total FTE's	Mean	25th Percentile	Median	75th Percentile
2006	58.4	37.0	46.0	66.0
2007	57.6	37.0	46.0	63.0
2008	57.9	37.5	46.0	65.5

Source: Study conducted by Veris Consulting, 2010.

WASHINGTON

Spokane Regional Solid Waste Disposal Facility
Spokane, WA

Trash Capacity: 2 units @ 400 tpd = 800 tpd
Energy Capacity: ELE: 26 MW
Project Startup: 1991
Technology: MBWW
CEMS: CO_2; NOx; O_2; Opacity; SO_2
APC System: SDA; FF; SNCR; CI
Owner: City of Spokane
Operator: Wheelabrator Spokane, Inc.

"Green energy is a growing field. It is exciting to have a state-of-the-art, renewable power plant created right here in Curtis Bay. It will create 180 'green collar' jobs and is expected to pump millions of dollars into the local economy through salaries and spin-off businesses. This is great news in this struggling economy."

—Congressman C.A. "Dutch" Ruppersberger, Maryland, regarding the development of an Energy Answers International waste-to-energy facility in Baltimore, MD.

WISCONSIN (2 facilities; combined capacity of 500 TPD, 32.3 MW, and 19,000 lbs/hr)

Barron County Waste-to-Energy & Recycling Facility
Almena, WI

Trash Capacity: 2 units @ 50 tpd = 100 tpd
Energy Capacity: STM: 19,000 Lbs/Hr
ELE: 0.265 MW
Project Startup: 1986
Technology: MCU
CEMS: Opacity; Temperature
APC System: SDA; ESP; CI; FF
Owner: Barron County
Operator: ZAC, Inc.

Xcel Energy French Island Generating Plant
LaCrosse, WI

Trash Capacity: 2 units @ 200 tpd = 400 tpd
Energy Capacity: ELE: 32 MW
Project Startup: 1987
Technology: RDF-SSWW
CEMS: SO_2; NOx; Opacity; CO
APC System: DSI; FF; SNCR
Owner: Xcel Energy
Operator: Xcel Energy

Green Investing
Towards a Clean Energy Infrastructure

In this report released in Davos, Switzerland in January 2009, the World Economic Forum highlighted eight renewable energy technologies which look particularly promising.

1. Onshore Wind
2. Offshore Wind
3. Solar Photovoltaic Power
4. Solar Thermal Electricity Generation
5. **Municipal Solid Waste-to-Energy (MSW)**
6. Sugar Based Ethanol
7. Cellulosic and Next Generation Biofuels
8. Geothermal

NOTES

ENERGY
RECOVERY COUNCIL

December, 2010

The Energy Recovery Council is a national trade group located in Washington, D.C. For more information about waste-to-energy and integrated waste management, please visit http://www.eneryrecoverycouncil.org or call ERC at (202) 467-6240.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

AUG 10 2007

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

MEMORANDUM

SUBJECT: Emissions from Large and Small MWC Units at MACT Compliance

FROM: Walt Stevenson
OAQPS/SPPD/ESG (D243-01)

TO: Large MWC Docket (EPA-HQ-OAR-2005-0117)

This memorandum presents information on the overall emissions reductions achieved by large and small municipal waste combustion (MWC) units following retrofit of Maximum Achievable Control Technology (MACT). This memorandum is a companion to the memorandum titled "Emissions from Large MWC Units at MACT Compliance (note a). Consistent with Clean Air Act (CAA) section 129, large and small MWC units completed MACT retrofits by December 2000 and December 2005, respectively. The performance of the MACT retrofits has been outstanding. Emission reductions achieved for all CAA section 129 pollutants are shown below. Of particular interest are dioxin/furan and mercury emissions. Since 1990 (pre-MACT conditions), dioxin/furan emissions from large and small MWCs have been reduced by more than 99 percent, and mercury emissions have been reduced by more than 96 percent. Dioxin/furan emissions have been reduced to 15 grams per year* and mercury emissions reduced to 2.3 tons/year.

Emissions From Large and Small MWC Units

Pollutant	*1990 Emissions (tpy)*	*2005 Emissions (tpy)*	*Percent Reduction*
CDD/CDF, TEQ basis*	4400	15	99+ %
Mercury	57	2.3	96 %
Cadmium	9.6	0.4	96 %
Lead	170	5.5	97 %
Particulate Matter	18,600	780	96 %
HCl	57,400	3,200	94 %
SO_2	38,300	4,600	88 %
NO_x	64,900	49,500	24 %

(*) dioxin/furan emissions are in units of grams per year toxic equivalent quantity (TEQ), using 1989 NATO toxicity factors; all other pollutant emissions are in units of tons per year.

The MACT performance data presented above is from the initial MACT compliance tests from all large and small MWC units. The inventory of large MWC units at MACT compliance identifies 167 large MWC units located at 66 MWC plants (note b). The inventory of small MWC units at MACT compliance identifies 60 small MWC units located at 22 MWC plants (note c). The baseline 1990 emissions data are from the large and small MWC emissions trend memo (note d and e). In combination, the above information defines the 1990 and 2005 emissions for large and small MWC units.

notes

(a) see docket A-90-45, item VIII-B-11.
(b) see docket A-90-45, item VIII-B-6
(c) see docket OAR-2004-0312, "National Inventory of Small Municipal Waste Combustor (MWC) Units at MACT Compliance (Year 2005)", dated November 1, 2006.
(d) see docket A-90-45, item VIII-B-7
(e) see docket OAR-2004-0312, "National Emissions Trends for Small Municipal Waste Combustion Units [year 1990 – 2005]", dated June 12, 2002.

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Waste-to-Energy:
A Renewable Energy Source from Municipal Solid Waste

EXECUTIVE SUMMARY

ASME SWPD Supports WTE - The Solid Waste Processing Division (SWPD) of the American Society of Mechanical Engineers (ASME) supports national policies that encourage the recovery of energy from the controlled combustion of municipal solid waste (MSW), also called Waste to Energy (WTE).

Proven Technology - WTE is a proven, environmentally sound process that provides reliable electricity generation and sustainable disposal of post-recycling MSW. WTE technology is used extensively in Europe and other developed nations in Asia such as Russia, Japan, Singapore, and Taiwan.

WTE Reduces Greenhouse Gases - New policies to encourage WTE can have a sizable effect on reducing the nation's greenhouse gas emissions.(1) In fact, nation-wide use of the WTE technology can become one of the big contributors to America's planned reduction in greenhouse gas emissions.

WTE Reduces Dependence on Fossil Fuel - New policies to encourage WTE can also have a meaningful impact in reducing dependence on fossil fuels and increasing production of renewable energy. MSW is currently comprised of 56% biogenic and 44% non-biogenic materials (2). Combusting the biogenic fraction of WTE is considered renewable by the DOE (1). Currently, there are 86 WTE facilities in the U.S. that process 29 million tons of MSW per year (1). The nation currently landfills about 248 million tons of waste per year so there is significant potential to increase energy production from WTE. Every ton of MSW processed in a WTE facility avoids the mining of one third ton of coal or the importation of one barrel of oil. If all waste were processed in modern WTE facilities it could satisfy 3 to 4 percent of the country's electricity demand.

Additional Environmental Benefits of WTE -

- Complements recycling and reduces landfilling
- Reduces truck traffic and associated emissions
- Recovers and recycles metals thus reducing mining operations

WTE Provides Clean Energy – WTE technology has significantly advanced with the implementation of the Clean Air Act (3), dramatically reducing all emissions. The EPA concluded WTE now produces electricity with less environmental impact than almost any other source (Letter of EPA Administration to Integrated Waste Services Association, Feb. 14. 2003).

Reliable Electricity – WTE operates 24/7 to reduce base load fossil fuel generation and is desirably located in proximity to urban areas where the power is needed the most.

ASME SWPD Recommendations to Congress and the Administration:

- Include WTE in the federal Renewable Portfolio Standard.
- Consider the reduction in greenhouse gases benefits of WTE in climate change policy.
- Direct the EPA to consider "life cycle analysis" of waste disposal options and also to consider Maximum Achievable Control Technology (MACT) type regulations on all emission sources, as have been applied to WTE facilities.

Introduction

ASME represents 127,000 engineers who are engaged in every aspect of energy generation and utilization. The Solid Waste Processing Division (SWPD) of ASME is dedicated to the recovery of energy and materials from the solids discarded by society and the environmental quality of technologies used in all aspects of waste management.

Municipal solid waste (MSW) is an unavoidable by product of human activities. Waste management is a particularly serious issue in the US because we consume an estimated 20 to 25 percent of the world's energy and materials and generate twice as much MSW per capita as developed nations in the European Union and Japan. Therefore, there exists a great need for waste reduction and recycling of materials. However, international and US experience has shown that after recycling there remains a large fraction of MSW to be disposed of.

The two proven means for disposal are burying MSW in landfills or combusting it in specially designed chambers at high temperatures, thereby reducing it to one tenth of its original volume. The heat generated by combustion is transferred to steam that can flow through a turbine to generate electricity. This process is called waste-to-energy (WTE). It converts the energy from combustion of MSW to electricity and recovers and recycles the metals contained in the MSW while the remaining ash is either used in landfills for daily cover and landfill roads or cleaned up and used off site for other construction purposes (as is done now in the EU and Japan).

The US WTE industry has existed for over thirty years and its technology has continuously been improved. For example, MSW combustion facilities of all types were once considered a significant source of mercury and dioxin emissions. However, during the 1990's, the WTE industry implemented new EPA regulations on Maximum Achievable Control Technology (MACT) and WTE power plants have become one of the cleanest sources of electricity and heat energy.

Currently there are 86 WTE facilities in the U.S. processing 29 million tons of MSW annually and generating 2.3 GW of electricity. Every ton of MSW processed in a WTE facility avoids the mining of one third ton of coal (9.6 million tons per year) or the importation of one barrel of oil (29 million barrels per year). As our nation begins to focus on conservation and renewables, WTE has already proved to be a reliable technology.

Unfortunately, there have been some setbacks. For instance, the Supreme Court Carbone ruling on "Flow Control" in 1994 (C & A Carbone v. Town of Clarkstown, New York, 511 U.S. 383 (1994)[4] forced many major urban areas in the U.S. to opt for long distance transport of their solid wastes to newly built giant landfills and stopped the growth of this useful energy producing technology in the US. Consequently, from 1995 through 2006, there were no new WTE plants built in the nation. A more recent Supreme Court decision on Flow Control has restored the ability of communities to control the flow of wastes to WTE facilities.

In contrast to what was happening in the U.S., from 1995 through 2006, hundreds of new WTE facilities were built in the European Union, Japan, China, and over thirty other nations where landfilling is regarded as environmentally undesirable and energy- and land-wasteful. In fact, in the years 2000-2007, the global WTE capacity grew at the rate of about four million tons each year. The growth of WTE in the European Union is partly due to a directive of the European Community that mandates that wastes containing over 2 percent combustible material shall not be landfilled in order to reduce landfill emissions of methane, the second most important greenhouse gas, and preserve land for future generations.(5)

In the U.S., as major urban areas have run out of nearby landfill space, post-recycled MSW is increasingly being transported long distances to other states for burial.(6) This has substantially increased the cost to landfill this MSW, and has also increased the associated environmental impacts because of the emissions from transport vehicles to and from the landfills. It has also increased the environmental advantages of WTE versus landfilling. As a result, some WTE facilities have recently begun to expand their capacity by adding new processing lines to their existing operations. These facilities are basing their requests for financing and permitting on their successful records of operation and environmental compliance.

The Conventional WTE Process

The conventional WTE combustion process is similar to the stoker burners in many coal- and wood-fired boilers. Waste is continuously fed onto a moving grate in a furnace where high temperatures are maintained. Air is added to the combustion chamber to ensure turbulence and the complete combustion of the components to their stable and natural molecular forms of carbon dioxide and water vapor.

The hot combustion gases released during the WTE process are directed through boilers to generate superheated steam that can drive turbine generators that produce electricity. Exhausted steam can also be used efficiently for district heating and for industrial processing if those choices are available.

It is interesting to note that, according to the EPA and IPCC protocols, combusting the biogenic fraction of MSW (about 56 percent of the carbon in MSW) results in a GHG reduction because these waste materials decompose into nearly equal portions of carbon dioxide and methane gas if they are landfilled. Methane is 21 times more potent as a GHG than carbon dioxide.

Energy Benefits of WTE

MSW, depending upon the moisture and energy content of the waste materials, is a good fuel source. The thermal treatment of MSW results in the generation of 500-600 kWh of electricity per ton of MSW combusted. European WTE facilities often recover another 600 kWh in the form of steam or hot water that is used for district heating. This additional energy recovery is not generally achieved in the US due to the absence of district heating systems. The corresponding savings in fossil fuel use range from one to two barrels of oil per ton of MSW.

Renewable Energy Source

WTE is designated as renewable by the 2005 Energy Policy Act, by the US Department of Energy (DOE), and by twenty-three state governments. Excluding hydroelectric power, only 2 percent of the US electricity is generated from renewable energy sources. A third of this renewable energy is due to WTE which at this time processes about 8 percent of the US MSW, while nearly 64 percent is landfilled (2004 BioCycle/Columbia national survey; www.wtert.org/sofos/SOG2006.pdf). As of July, 2008, energy recovered from WTE plants in the US is greater than all wind and solar energy combined.

Environmental Benefits

In addition to its energy benefits, WTE avoids the conversion of greenfields to landfills. The 2,500-acre Freshkills landfill of New York City filled up in about 50 years. Under current regulations (daily cover, etc.), it would have filled in 20-25 years. Although the US is blessed with abundant land, the continuous use of land for landfilling is not sustainable, especially in the coastal areas that are experiencing the highest population growth.

Since WTE facilities are a point source of emissions, they have been subjected to very stringent environmental regulations. This is not possible for landfills which are dispersed sources extending over hundreds of acres. For example, EPA assumes that 75 percent of the landfill gas (LFG) is captured in landfills that are equipped for such capture. Other studies estimate the actual LFG capture to be much lower since, under current EPA regulations, landfills are not required to capture LFG during the first five years of operation of a cell.

Landfill gas contains about 50 percent methane which is 21 times more potent as a greenhouse gas than carbon dioxide.(7) Comparative studies of WTE and landfilling have shown that for each ton of MSW combusted, rather than landfilled, the overall carbon dioxide reduction can be as high as 1.3 tons of CO2 per ton of MSW when both the avoided landfill emissions and the avoided use of fossil fuel are taken into account.

WTE processing of MSW has the additional benefit of reducing the transport of MSW to distant landfills and the attendant emissions and fuel consumption. It also reduces interstate truck traffic. According to U.S. Department of Transportation traffic statistics, an average of 7 deaths and over 40 serious injuries occur per year, based on the number of trucks required to transport New Jersey's two million tons per year of excess MSW to landfills in Pennsylvania, Virginia, and Ohio.(6)

Diesel fuel consumption of trucking to and from landfills and by equipment used in the burial of MSW in landfills generates air emissions and has other negative environmental impacts. All this energy consumption and diesel exhaust can be avoided by WTE facilities that use MSW as the fuel for generating electricity and steam energy at plants located near urban centers.

Material Recovery

Another beneficial effect of modern MSW combustion with energy recovery is material recovery. Using magnetic separators, the U.S. WTE industry recovers and recycles over 770,000 tons of ferrous scrap metal annually from the combustion ash residue.(8) At some facilities, non-ferrous metals are also removed through the use of "eddy current separators" that cause these materials to literally jump out of the remaining ash and into a recovery area. Metal processors sort this mixed metal into brass, aluminum, copper and other base metals.(9) The remaining ash can be used in the construction and maintenance of landfills and as an aggregate in construction.(10, 11)

Existing Obstacles for WTE Technology

The progress of WTE in the US has thus far been stifled by three factors that can be addressed through federal legislation and collective local efforts:

- Inconsistent environmental regulations for various energy sources.
- Failure to consider all environmental factors when local community environmental decisions are made.

- Uneven support by local officials and federal agencies.

Flow Control

Flow control is the authority needed by a municipality to direct the “flow” of its generated solid wastes into a disposal process chosen by the community, e.g., the local WTE facility. Normally, a community must issue bonds for construction of a large WTE facility and employ flow control to have firm waste delivery contracts in place during the term of the bond issue.[12]

When the US Supreme Court appeared to rule in the 1994 “Carbone” case that all existing attempts at such control were illegal under the Constitution because they restrained “commerce”, they eliminated the ability of a community to finance WTE facilities. However, in the 2007 "United Haulers" decision, the Supreme Court has clarified the ability of local communities to finance long term revenue bond issues and control the flow of waste to these facilities. Moreover, the court recognized that Congress has, in RCRA, carved out a vital role for local government in the management of the nation's solid waste.

Implementation of Regulations

Environmental impact statements for any waste management facility (recycling, composting, WTE, waste hauling, and landfilling) should include a life-cycle analysis of all associated environmental and energy impacts that will result from each option. Even recycling, though laudatory, has negative, as well as positive, environmental effects. The impacts of the failure to make any community “improvement” should also be weighed in the evaluation of choices.

U.S. WTE facilities have complied with very stringent EPA regulations, known as Maximum Achievable Control Technology (MACT), at an estimated cost of over one billion dollars. By law, the Clean Air Act requires that every five years a review of these stringent emissions limits is conducted in order to determine whether lower limits are achievable.[13] Air quality regulations for all forms of combustion processes should have consistent health-based emissions limits for all facilities. If an emission is dangerous from one type of facility, then it is likely to be equally dangerous from another.

Disposal of solid waste from major urban areas in landfills frequently involves long haul trucking resulting in diesel exhaust pollution and the need for multiple waste transfer stations. Additionally, the landfilling process also results in diesel exhaust emissions and the long term generation of gaseous pollutants from the decomposition of trash in a landfill.

Public decision makers should carefully consider all environmental factors before adopting a solution to an environmental problem such as disposal of MSW. In addition, the public should be educated to know the benefits and burdens associated with each potential solution before making a final decision.

Recommended Actions by US Environmental Protection Agency

The US Environmental Protection Agency needs to fulfill its obligation to the public by advocating for the best solutions to environmental problems, including the disposal of MSW. Sound science should be the basis for decision-making. EPA must lead by educating the public as to the pros and cons that go with any solution and, thus, help overcome misconceptions about proven technological solutions. By means of public education, USEPA must lead in the application of the best environmental solutions.

In recent years, the EPA has taken a more active role in educating the public, by distinguishing in its annual reports between tonnages of MSW going to WTE and to landfilling, instead of lumping them together as “disposal”. Also, some EPA regions have taken a pro-active role in educating the public in the benefits of WTE. For example, EPA Region 2 organized a one-day seminar in Puerto Rico at which they educated the general public on the benefits of WTE vs. landfilling, especially for an island where land is very scarce and precious. EPA has also re-instituted the hierarchy of integrated solid waste management, which places waste-to-energy above landfill disposal. We applaud these efforts undertaken by the EPA and feel that now is the time to build upon them.

It is given that no one wants a new public facility of any sort near their homes, whether it is an airport, highway, water treatment plant or a waste disposal facility. We feel that it is paramount that environmental regulators coordinate with local officials to hold public hearings where new facilities and technologies and the “do-nothing” consequences can be discussed. Additionally, we feel that the EPA should actively promote WTE as a mutually beneficial endeavor for both local communities and the nation.

Recommended Actions by Congress

The following actions are recommended by the ASME Solid Waste Processing Division to advance the use of WTE technology in the US and reap the energy benefits of a homegrown, renewable energy source and of reduced local, regional, and global emissions:

- Congress should re-examine and reconsider the level of regulatory limits required for all new sources of energy. MACT regulations have worked well for waste-to-energy facilities and they are equally able to control emissions from all other sources of combustion based energy production.

- Congress, in an effort to expand WTE, should consider enacting legislation that would make renewable energy credits available for WTE under the definitions of green or renewable energy.

- Congress should direct EPA to study and post notice regarding the effects of the "whole picture" for all available waste management options.

The ASME Solid Waste Processing Division believes that these policy recommendations, if fully adopted, could successfully take advantage of a unique opportunity to develop a renewable, clean energy source at a critical time for our nation. The country will also be well served by recovery of reusable materials, reduced truck traffic and highway congestion, less dependence on landfill for solid waste disposal, and less dependence on foreign sources of energy.

References:

(1) “National Energy Strategy,” USDOE, 1991/1992, pages 181, 182.

(2) LaRiviere, Marie, April 2007, Energy Information Administration (EIA), Trends in Municipal Solid Waste (MSW) Composition, Department of Energy

(3) USEPA, Dec. 1995, Preamble: Proposed Rules and Notice, Federal Register, Pg. 65413.

(4) C & A Carbone, Inc. v. Town of Clarkstown, New York, 511 U.S. 383 (1994).

(5) Directive 99/31/EC, “Landfill of Waste, EEC policy.

(6) J. Norton, Sept 1990, “Don’t Keep on Truckin,” Public Works and New Jersey State Magazine, also presented on behalf of the ASME in Congressional RCRA Subcommittee Testimony, June, 1990.

(7) H. Taylor, Jan. 1990: "Municipal Waste to Energy Facilities Reduce Greenhouse Gas Emissions", Proceeds of the 4th Annual Symposium on Municipal Solid Waste Disposal and Energy Production.

(8) C. Wiles and P. Shephard, April 1999 USDOE, 126 Pg. Booklet #BK-570-25841 "Beneficial Use and Recycling of Municipal Combustion Residues – A Comprehensive Resource Document" by the National Renewable Energy Laboratory.

(9) G. Arcaini, May 2000 NAWTEC[i] "Ash Recycling in Nashville, /TN", Proceedings of the 8th North American Waste to Energy Conference.

(10) S. Lucido, May 2000: "The Use of Municipal Waste Combustor Ash as a Partial Replacement of Aggregate in Bituminous Paving Material", Proceedings of the 8th North American Waste to Energy Conference.

(11) F. Roethel and V. Breslin, 1995: "Municipal Solid Waste Combustion Ash Demonstration Program 'The Boathouse'", USEPA/600/R-95/129, Cincinnati, Ohio.

(12) J. Martin, May 1998: "Demystifying Ratings: How Flow Control Shocks Credit Quality", Proceedings of the 6th North American Waste to Energy Conference, Miami Beach, FL.

(13) USEPA, Dec. 1995, Preamble: Proposed Rules and Notice, Federal Register, Pg. 65409 – 65413.

Other References:

J. Kiser and M Zannes, May 1999 Integrated Solid Waste Management Association: "Waste to Energy in the USA – 1999 Update, Proceedings of the 7th Annual North American Waste to Energy Conference, Tampa, FL.

Floyd Hasselriis, May 1998 ASME, "How Far Have We Come", Proceedings of the 6th Annual North American Waste to Energy Conference, Miami Beach, FL.

A. Licata and D. Minott, April 1996 ASME: "Comparison of Air Emissions from Waste Management Facilities", Proceedings of the 17th Biennial Waste Processing Conference, Atlantic City, NJ.

ASME-SWPD, USEPA Waste Policy Center 1992, and USDOE.

Bruce Ames, Ph.D., Professor of Biochemistry And Molecular Biology and Director of the National Institute of Environmental Health Sciences Center at the University of California, Berkeley, July 1997.

E. Tanenbaum, April 1997: "Planning and Implementing the New York / New Jersey Ash Paving Demonstration", Proceedings of the 5th North American Waste to Energy Conference.

Waste-to-Energy Research and Technology Council (WTERT); Earth Engineering Center, Columbia University 500 West 120th St., New York, NY, July 2008 http://www.wtert.org

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This position statement represents the views of the Solid Waste Processing Division and Energy Committee of ASME's Technical Communities of Knowledge and Community and is not necessarily a position of ASME as a whole.

Waste-to-energy

From Wikipedia, the free encyclopedia

Waste-to-energy (WtE) or **energy-from-waste** (EfW) is the process of creating energy in the form of electricity or heat from the incineration of waste source. WtE is a form of energy recovery. Most WtE processes produce electricity directly through combustion, or produce a combustible fuel commodity, such as methane, methanol, ethanol or synthetic fuels.[1]

Spittelau incineration plant is one of several plants that provides district heating in Vienna.

Contents

Incineration [edit]

Main article: Incineration

Incineration, the combustion of organic material such as waste with energy recovery is the most common WtE implementation. Incineration may also be implemented without energy and materials recovery; however, this is increasingly being banned in OECD (Organisation for Economic Co-operation and Development) countries.[*citation needed*] Furthermore, all new WtE plants in OECD countries must meet strict emission standards.[*citation needed*] Hence, modern incineration plants are vastly different from the old types, some of which neither recovered energy nor materials. Modern incinerators reduce the volume of the original waste by 95-96 %, depending upon composition and degree of recovery of materials such as metals from the ash for recycling.[2]

Concerns regarding the operation of incinerators include fine particulate, heavy metals, trace dioxin and acid gas emissions, even though these emissions are relatively low[3] from modern incinerators. Other concerns include toxic fly ash and incinerator bottom ash (IBA) management.[*citation needed*] Discussions regarding waste resource ethics include the opinion that incinerators destroy valuable resources and the fear that they may reduce the incentives for recycling and waste minimization activities.[*citation needed*] Incinerators have electric efficiencies on the order of 14-28%.[*citation needed*] The rest of the energy can be utilized for e.g. district heating, but is otherwise lost as waste heat.

The method of using incineration to convert municipal solid waste (MSW) to energy is a relatively old method of waste-to-energy production. Incineration generally entails burning garbage to boil water which powers steam generators that make electric energy to be used in our homes and businesses. One serious problem associated with incinerating MSW to make electrical energy, is the pollutants that are put into the atmosphere when burning the garbage that power the generators. These pollutants are extremely acidic and have been reported to cause serious environmental damage by turning rain into acid rain. One way that this problem has been significantly reduced is through the use of lime scrubbers on smokestacks. The limestone mineral used in these scrubbers has a pH of approximately

8 which means it is a base. By passing the smoke through the lime scrubbers, any acids that may be in the smoke are neutralized which prevents the acid from reaching the atmosphere and hurting our environment. (Field) According to the New York Times, modern incineration plants are so clean that "many times more dioxin is now released from home fireplaces and backyard barbecues than from incineration."[4]

WtE technologies other than incineration [edit]

There are a number of other new and emerging technologies that are able to produce energy from waste and other fuels without direct combustion. Many of these technologies have the potential to produce more electric power from the same amount of fuel than would be possible by direct combustion. This is mainly due to the separation of corrosive components (ash) from the converted fuel, thereby allowing higher combustion temperatures in e.g. boilers, gas turbines, internal combustion engines, fuel cells. Some are able to efficiently convert the energy into liquid or gaseous fuels:

Thermal technologies:

- Gasification (produces combustible gas, hydrogen, synthetic fuels)
- Thermal depolymerization (produces synthetic crude oil, which can be further refined)
- Pyrolysis (produces combustible tar/biooil and chars)
- Plasma arc gasification PGP or plasma gasification process (produces rich syngas including hydrogen and carbon monoxide usable for fuel cells or generating electricity to drive the plasma arch, usable vitrified silicate and metal ingots, salt and sulphur)

Non-thermal technologies:

- Anaerobic digestion (Biogas rich in methane)
- Fermentation production (examples are ethanol, lactic acid, hydrogen)
- Mechanical biological treatment (MBT)
  - MBT + Anaerobic digestion
  - MBT to Refuse derived fuel

Global WTE developments [edit]

During the 2001-2007 period, the WTE capacity increased by about four million metric tons per annum. Japan and China built several plants that were based on direct smelting or on fluid bed combustion of solid waste. In China there are about 50 WTE plants. Japan is the largest user in thermal treatment of MSW in the world with 40 million tons. Some of the newest plants use stoker technology and others use the advanced oxygen enrichment technology. There are also over one hundred thermal treatment plants using relatively novel processes such as direct smelting, the Ebara fluidization process and the Thermo- select -JFE gasification and melting technology process.[5] In Patras, Greece, a Greek company just finished testing a system that shows potential. It generates 25kwatts of electricity and 25kwatts of heat from waste water.[6] In India its first energy bio-science center was developed to reduce the country's green house gases and its dependency on fossil fuel.[7]

Biofuel Energy Corporation of Denver, CO, opened two new biofuel plants in Wood River, NE, and Fairmont, MN, in July 2008. These plants use distillation to make ethanol for use in motor vehicles and other engines. Both plants are currently reported to be working at over 90% capacity. Fulcrum BioEnergy incorporated located in Pleasanton, CA, is currently building a WTE plant near Reno, NV. The plant is scheduled to open in early 2010 under the name of Sierra BioFuels plant. BioEnergy incorporated predicts that the plant will produce approximately 10.5 million gallons per year of ethanol from nearly 90,000 tons per year of MSW.(Biofuels News)

Waste to energy technology includes fermentation, which can take biomass and create ethanol, using waste cellulosic or organic material. In the fermentation process, the sugar in the waste is changed to carbon dioxide and alcohol, in the same general process that is used to make wine. Normally fermentation occurs with no air present. Esterification can also be done using waste to energy technologies, and the result of this process is biodiesel. The cost effectiveness of esterification will depend on the feedstock being used, and all the other relevant factors such as transportation distance, amount of oil present in the feedstock, and others.[8] Gasification and pyrolysis by now can reach thermal conversion efficiencies from of up to 75%, however a complete combustion is superior in terms of fuel conversion efficiency.[9] Some pyrolysis processes need an outside heat source which may be supplied by the gasification process, making the combined process self sustaining.

Carbon dioxide emissions [edit]

In thermal WtE technologies, nearly all of the carbon content in the waste is emitted as carbon dioxide (CO_2) to the atmosphere (when including final combustion of the products from pyrolysis and gasification). Municipal solid waste (MSW) contain approximately the same mass fraction of carbon as CO_2 itself (27%), so treatment of 1 metric ton (1.1 short tons) of MSW produce approximately 1 metric ton (1.1 short tons) of CO_2.

In the event that the waste was landfilled, 1 metric ton (1.1 short tons) of MSW would produce approximately 62 cubic metres (2,200 cu ft) methane via the anaerobic decomposition of the biodegradable part of the waste. This amount of methane has more than twice the global warming potential than the 1 metric ton (1.1 short tons) of CO_2, which would have been produced by combustion. In some countries, large amounts of landfill gas are collected, but still the global warming potential of the landfill gas emitted to atmosphere in e.g. the US in 1999 was approximately 32 % higher than the amount of CO_2 that would have been emitted by combustion.[10]

In addition, nearly all biodegradable waste is biomass. That is, it has biological origin. This material has been formed by plants using atmospheric CO_2 typically within the last growing season. If these plants are regrown the CO_2 emitted from their combustion will be taken out from the atmosphere once more.

Such considerations are the main reason why several countries administrate WtE of the biomass part of waste as renewable energy.[11] The rest - mainly plastics and other oil and gas derived products - is generally treated as non-renewables.

Determination of the biomass fraction [edit]

Several methods have been developed by the European CEN 343 working group to determine the biomass fraction of waste fuels, such as Refuse Derived Fuel/Solid Recovered Fuel. The initial two methods developed (CEN/TS 15440) were the **manual sorting method** and the **selective dissolution method**. A detailed systematic comparison of these two methods has been recently published.[12] Since each method suffered from limitations in properly characterizing the biomass fraction, two alternative methods have been developed.

The first method uses the principles of radiocarbon dating. A technical review (CEN/TR 15591:2007) outlining the carbon 14 method was published in 2007. A technical standard of the carbon dating method (CEN/TS 15747:2008) will be published in 2008. In the United States, there is already an equivalent carbon 14 method under the standard method ASTM D6866.

The second method (so called **balance method**) employs existing data on materials composition and operating conditions of the WtE plant and calculates the most probable result based on a mathematical-statistical model.[13] Currently the balance method is installed at three Austrian incinerators.

A comparison between both methods carried out at three full-scale incinerators in Switzerland showed that both methods came to the same results.[14]

Although carbon 14 dating can determine with some precision the biomass fraction of waste, it cannot determine directly the biomass calorific value. Determining the calorific value is important for green certificate programs such as the Renewable Obligation Certificate program in the United Kingdom. These programs award certificates based on the energy produced from biomass. Several research papers, including the one commissioned by the Renewable Energy Association in the UK, have been published that demonstrate how the carbon 14 result can be used to calculate the biomass calorific value. By contrast the balance method delivers all required information, namely, the ratio between biogenic and fossil energy production, as well as relative and total biogenic and fossil mass and carbon fractions. Moreover it requires no additional measurements and is therefore easy to install at low costs.

Examples of waste-to-energy plants [edit]

According to ISWA there are 431 WtE plants in Europe (2005) and 89 in the United States (2004).[15] Below is a list of a few examples of WtE plants.

- Edmonton Municipal Waste-to-Ethanol gasification Plant fueled by RDF, scheduled to start of construction by the end of 2009[16]

The following are examples of waste incineration WtE plants:

- Montgomery County Resource Recovery Facility in Dickerson, Maryland, USA (1995)
- Spittelau (1971), and Flötzersteig (1963), Vienna, Austria (Wien Energie)
- SYSAV in Malmö (2003 and 2008), Sweden (Flash presentation)
- Algonquin Power, Brampton, Ontario, Canada [17]
- Teesside EfW plant near Middlesbrough, North East England (1998)
- Edmonton Incinerator in Greater London, England (1974)

See also [edit]

- Biohydrogen production
- Biomass
- Cogeneration
- Energy recycling
- List of solid waste treatment technologies
- Manure-derived synthetic crude oil
- Refuse-derived fuel
- Relative cost of electricity generated by different sources
- Waste management

Energy portal

References [edit]

1. ^ NW BIORENEW
2. ^ Waste to Energy in Denmark by Ramboll Consult
3. ^ Emissionsfaktorer og emissionsopgørelse for decentral kraftvarme, Kortlægning af emissioner fra decentrale kraftvarmeværker, Ministry of the Environment of Denmark 2006 (in Danish)
4. ^ http://www.nytimes.com/2010/04/13/science/earth/13trash.html?scp=1&sq=trash&st=cse
5. ^ columbia university
6. ^ clean-tech-Greece
7. ^ clean-tech- India
8. ^ bionomic fuel
9. ^ *The Viability of Advanced Thermal Treatment of MSW in the UK*, 49 by Fichtner Consulting Engineers Ltd
10. ^ Themelis, Nickolas J. An overview of the global waste-to-energy industry, Waste Management World 2003
11. ^ [1], from the homepage of the UK Renewable Energy Association
12. ^ *The biogenic content of process streams from mechanical–biological treatment plants producing solid recovered fuel. Do the manual sorting and selective dissolution determination methods correlate?* by Mélanie Séverin, Costas A. Velis, Phil J. Longhurst and Simon J.T. Pollard., 2010. In: *Waste Management* 30(7): 1171-1182
13. ^ *A New Method to Determine the Ratio of Electricity Production from Fossil and Biogenic Sources in Waste-to-Energy Plants.* by Fellner, J., Cencic, O. and Rechberger, H., 2007. In: *Environmental Science & Technology,* 41(7): 2579-2586.
14. ^ *Determination of biogenic and fossil CO_2 emitted by waste incineration based on $^{14}CO_2$ and mass balances.* by Mohn, J., Szidat, S., Fellner, J., Rechberger, H., Quartier, R., Buchmann, B. and Emmenegger, L., 2008. In: *Bioresource Technology,* 99: 6471-6479.
15. ^ Energy from Waste State-of-the-Art Report, Statistics 5th Edition August 2006. International Solid Waste Association (ISWA)
16. ^ Edmonton Municipal Waste-to-Ethanol plant from the Enerkem web site.
17. ^ Algonquin Power Energy from Waste Facility from the homepage of Algonquin Power

Further reading [edit]

- Field, Christopher B. "Emissions pathways, climate change, and impacts." PNAS 101.34 (2004): 12422–12427.
- Sudarsan, K. G., and Mary P. Anupama. "The Relevance of Biofuels." Current Science 90.6 (2006): 748. 18 Oct. 2009 <http://www.iisc.ernet.in/currsci/mar252006/748a.pdf>.
- Tilman, David. "Environmental, economic, and energetic costs." PNAS 103.30 (2006): 11206–11210.

- "Biofuels News". Chemical Engineering Progress. . FindArticles.com. 18 Oct. 2009. <Http://findarticles.com/p/articles/mi_qa5350/is_200808/ai_n28083407>
- "Waste to Ethanol." Centurymarc. 2007. 10

External links [edit]

- Waste-to-Energy Research and Technology Council
- WtERT Germany
- LowCarbonEconomy.com
- Gasification Technologies Council

v·d·e Topics related to waste management
Anaerobic digestion · Composting · Downcycling · Eco-industrial park · Incineration · Landfill · Materials recovery facility · Mechanical biological treatment · Radioactive waste · High-level radioactive waste management · Recycling · Regift · Reuse · Septic tank · Sewerage · Upcycling · Waste · Waste collection · Waste hierarchy · Waste legislation · Waste management · Waste management concepts · Waste sorting · Waste treatment

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ENERGY RECOVERY COUNCIL

March 22, 2011

Representative Pete Petersen
Alaska House of Representatives
State Capitol, Room 422
Juneau, AK 99801-1182

Dear Representative Petersen:

On behalf of the Energy Recovery Council (ERC), I would like to take this opportunity to commend you for introducing House Concurrent Resolution 10 (HCR 10) and to offer our support for the resolution. The waste-to-energy sector generates clean, renewable energy across the United States while providing communities with and responsible and sustainable waste management alternative.

ERC is a national trade group representing companies and communities engaged in the waste-to-energy sector. Waste-to-energy facilities generate renewable electricity using modern combustion technology equipped with state-of-the-art emissions control systems. ERC members include: Covanta Energy Corporation, Wheelabrator Technologies Inc., Babcock & Wilcox, several dozen businesses and organizations in the municipal solid waste (MSW) management and energy fields, and 28 municipalities that are served by waste-to-energy plants.

ERC supports your resolution which would encourage the State of Alaska, its municipalities, and private organizations to consider waste-to-energy to help meet your energy and waste management needs. Waste-to-energy facilities across the country—and, in fact, the world—have helped communities manage their trash in a sustainable manner that complements recycling and reduces the demand for landfilling. In fact, the U.S. Environmental Protection Agency's solid waste hierarchy stipulates that waste-to-energy is preferable to landfills. In addition, EPA has stated that waste-to-energy facilities produce electricity "with less environmental impact than almost any other source of electricity." Alaska would benefit greatly from generating energy from waste.

In conclusion, ERC supports HCR 10 and urges the Alaska legislature to adopt it quickly. If I can be of any assistance, please do not hesitate to contact me at (202) 467-6240 or tmichaels@energyrecoverycouncil.org.

Sincerely,

Ted Michaels

Ted Michaels
President