

ENERGY
RECOVERY COUNCIL

RENEWABLE ENERGY FROM WASTE

“The Role of Waste-to-Energy in a Renewable and Carbon-Constrained Environment”

Ted Michaels President Energy Recovery Council	Managing Waste: A Workshop on Addressing Perception, Establishing Metrics, and Developing Systems and Partnerships
October 19, 2010	Portland, OR

Outline

- Industry Overview
- WTE Process Overview
- Life Cycle Analysis
- Policy Recognition
- Cap & Trade / Offsets
- How to Craft an Offset in Legislation
- Voluntary Carbon Standard
- Summary



Energy Recovery Council & Industry Overview

- ERC represents companies and local governments engaged in the nation's waste-to-energy sector.
- There are 86 waste-to-energy facilities in the United States which produce clean, renewable energy through the combustion of municipal solid waste in specially designed power plants equipped with the most modern pollution control equipment to clean emissions.
- Trash volume is reduced by 90% and the remaining residue is safely reused or disposed in landfills.
- The 86 waste-to-energy plants in the nation have a baseload electric generation capacity of approximately 2,700 megawatts and can process more than 28 million tons of trash per year.



What is Waste-to-Energy?

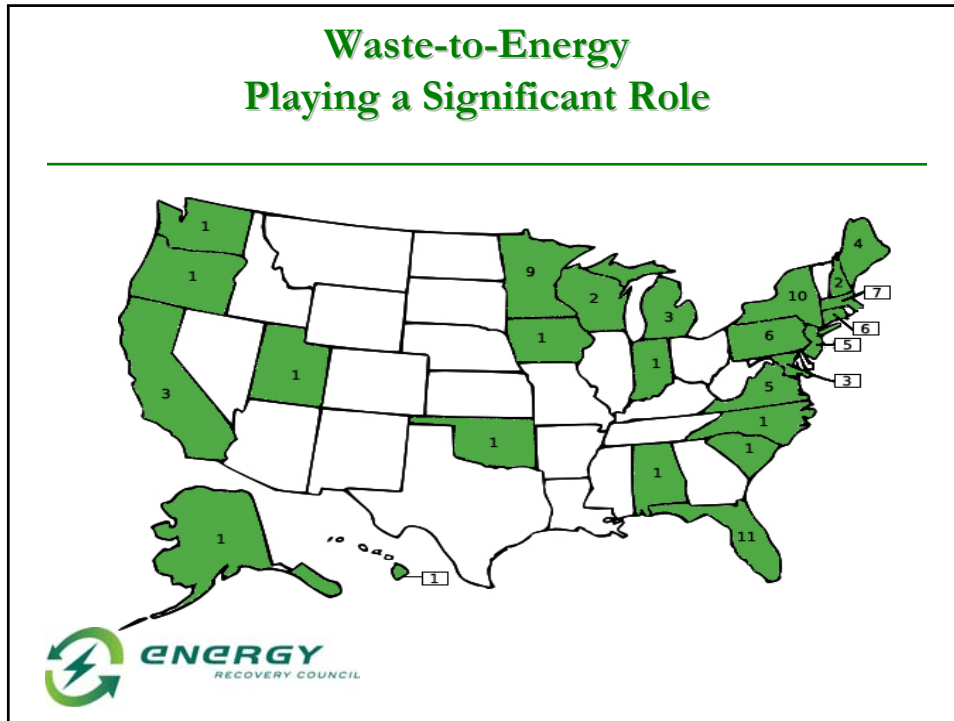
Waste-to-Energy is a specially designed energy generation facility that uses household waste as fuel and helps solve some of society's big challenges

Municipal Solid Waste 1 ton



- Power: up to 750 kWh
- Metal: 50 lbs
- Ash: 10% of original volume





Waste-to-Energy Facility

Reducing the Volume of Waste & Saving Space in the Landfill while
Generating Clean, Renewable Energy

13,000 KWh generated

IN	90% volume reduction	OUT
100 cubic yards of waste		10 cubic yards of (inert) ash

Clean, Renewable Energy

- U.S. EPA has stated that Waste-to-Energy “produces electricity with less environmental impact than almost any other source”
- 25 States, the District of Columbia, Puerto Rico, and the federal government define Waste-to-Energy as renewable
- Waste-to-Energy produces up to 750kWh per ton while landfill gas produces 65 kWh per ton
- Waste-to-Energy complements other renewable sources
 - 24 hours per day, 7 days per week
- A new 1,500 ton/day facility = 50 MW electricity



Environmental Performance Waste-to-Energy

U.S. EPA: “The performance of the MACT retrofit has been outstanding.”
8/10/2007



Pollutant	1990-2005% reduction
Dioxin	99
Mercury	96
Cadmium	96
Lead	97
Particulate Matter	96
HCl	94
SO2	88
NOx	24



WTE & Greenhouse Gas Avoidance

Waste-to-energy plants are tremendously valuable contributors in the fight against global warming. According to the U.S. EPA MSW Decision Support Tool nearly one ton of CO2 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 CO2 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 CO2 emissions from metal recycling.** Waste-to-energy plants recover more than 700,000 tons of ferrous metal for recycling annually. Recycling metals saves energy and avoids CO2 emissions that would have been emitted if virgin materials were mine and new metals were manufactured, such as steel.



EPA's MSW Decision Support Tool

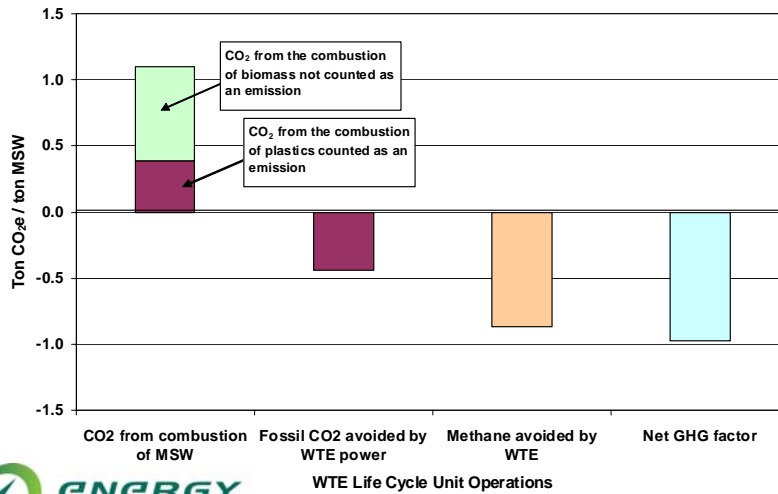
- The Decision Support Tool is a peer-reviewed tool^[1] that enables the user to directly compare the energy and environmental consequences of various management options for a specific or general situation. Technical papers authored by EPA^[2] report on the use of the Decision Support Tool to study municipal solid waste management options.

^[1] Available through US EPA and its contractor RTI International.

^[2] "Moving From Solid Waste Disposal to Management in the United States," Thorneloe (EPA) and Weitz (RTI) October, 2005, and "Application of the U.S. Decision Support Tool for Materials and Waste Management," Thorneloe (EPA), Weitz (RTI), Jambeck (UNH), 2006



Environmental Performance of Waste-to-Energy Climate Change



Biogenic vs. Anthropogenic CO₂ emissions

- There are two types of carbon dioxide emissions: biogenic and anthropogenic.
- The combustion of biomass generates biogenic carbon dioxide. Although waste-to-energy facilities do emit carbon dioxide from their stacks, the biomass-derived portion is considered to be part of the Earth's natural carbon cycle.
- Anthropogenic carbon dioxide is emitted when man-made substances in the trash are burned, such as plastic and synthetic rubber.
- Testing of stack gas from waste-to-energy plants using ASTM Standards D-6866 can determine precisely the percentage of carbon dioxide emissions attributable to anthropogenic and biomass sources. Long-term measurements of biogenic CO₂ from waste-to-energy plants measure consistently at approximately sixty-seven percent.

Fuel Type	Direct CO ₂ ¹	Life Cycle CO ₂ E ²
Coal	2,138	2,196
Residual Fuel Oil	1,496	1,501
Natural Gas	1,176	1,276
Waste-to-Energy ³	1,294	-3,636

¹Based on 2007 EPA eGRID data except WTE which is a nationwide average using 34% anthropogenic CO₂.
²Life 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 CO₂ was included.
³Life Cycle CO₂E for WTE based on nominal nationwide avoidance ratio of 1 ton CO₂E per ton of MSW using the Municipal Solid Waste Decision Support Tool, which includes avoided methane and avoided CO₂.



Biogenic vs. Anthropogenic CO₂ emissions

There is significant international and domestic precedent for the exclusion of biogenic CO₂ emissions:

- CO₂ emissions from the combustion of biomass are not included in national and international inventories, including the EPA GHG inventory, in accordance with the IPCC Guidelines for National Greenhouse Gas Inventories.
- Biomass emissions from combustion or non-combustion sources have not been capped under the current draft of the California cap and trade system, the Kyoto Protocol, the European Union Emission Trading Scheme (EU-ETS), or the Regional Greenhouse Gas Initiative.
- The Clean Development Mechanism of the Kyoto Protocol does not include CO₂ from biogenic sources as an emission. Biogenic emissions are not counted in the applicability determination for the EPA's Greenhouse Gas Reporting Program.



Life Cycle Analysis of WTE & GHG

“Discarded MSW is a viable energy source for electricity generation in a carbon constrained world. One notable difference between LFGTE and WTE is that the latter is capable of producing an order of magnitude more electricity from the same mass of waste. In addition, as demonstrated in this paper, there are significant differences in emissions on a mass per unit energy basis from LFGTE and WTE. On the basis of the assumptions in this paper, WTE appears to be a better option than LFGTE. 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?

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Domestic Recognition of WTE as a Greenhouse Gas Reducer



- The ability of waste-to-energy to reduce greenhouse gas emissions has been embraced by the U.S. Conference of Mayors.
- The USCM adopted a resolution in 2004 recognizing the greenhouse gas reduction benefits of waste-to-energy, while supporting a 7 percent reduction in greenhouse gases from 1990 levels by 2012.
- The Agreement recognizes waste-to-energy technology as a means to achieve that goal. As of today, 1,044 mayors have signed the agreement.



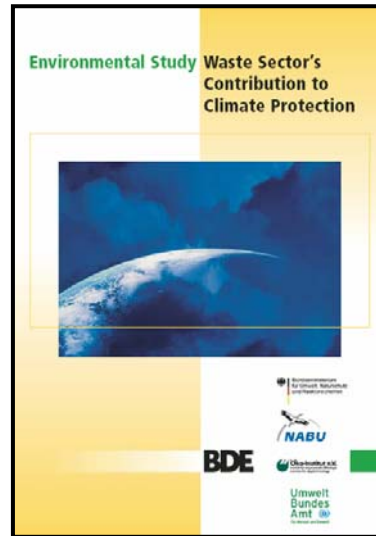
Domestic Recognition of WTE as a Greenhouse Gas Reducer

- The Global Roundtable on Climate Change (GROCC) was convened by Columbia University's Earth Institute and issued a statement on February 20, 2007 identifying waste-to-energy as a means to reduce CO2 emissions from the electric generating sector and methane emissions from landfills.
- The GROCC joint statement said that "Efforts to reduce global emissions of methane from landfills should be expanded, including increased use of waste-to-energy facilities where appropriate and cost-effective."
- The GROCC position had broad support as evidenced by those that have signed the joint statement, including Dr. James Hansen of the NASA Goddard Institute for Space Studies, as well as entities as diverse as American Electric Power and Environmental Defense.



International Recognition of Waste-to-Energy as a Greenhouse Gas Reducer

- In the 2005 report, “Waste Sector’s Contribution to Climate Protection”, the German Ministry of the Environment stated that “...waste incineration plants and co-incineration display the greatest potential for reducing emissions of greenhouse gases.” The report concluded that the use of waste combustion with energy recovery coupled with the reduction in landfilling of biodegradable waste will assist the European Union-15 in meeting its obligations under the Kyoto Protocol.
- In a 2008 briefing, the European Environment Agency attributes reductions in waste management greenhouse gas emissions to waste-to-energy.



International Recognition of Waste-to-Energy as a Greenhouse Gas Reducer

The World Economic Forum in its 2009 report, “Green Investing: Towards a Clean Energy Infrastructure,” identifies waste-to-energy as one of eight technologies likely to make a meaningful contribution to a future low-carbon energy system.

- The Eight Emerging Large-Scale Clean Energy Sectors include
1. Onshore Wind
 2. Offshore Wind
 3. Solar Photovoltaic (PV)
 4. Solar Thermal Electricity Generation (STEG)
 5. Municipal Solid Waste-to-Energy (MSW)
 6. Sugar-based Ethanol
 7. Cellulosic and Next Generation Biofuels
 8. Geothermal Power



International Recognition of Waste-to-Energy as a Greenhouse Gas Reducer



- The Intergovernmental Panel on Climate Change (IPCC), the Nobel Prize winning independent panel of scientific and technical experts, has recognized waste-to-energy as a key greenhouse gas emission mitigation technology.

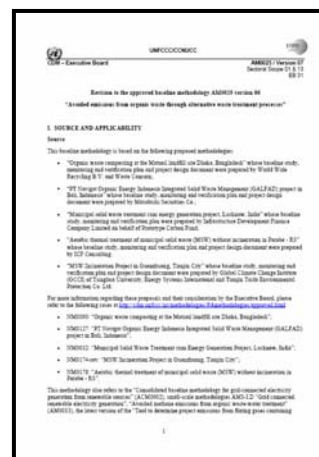
3.7 Waste 3.7.1 Summary of the Second Assessment Report
 “Net GHG emissions from WTE facilities are usually low and comparable to those from biomass energy systems, because electricity and heat are generated largely from photosynthetically produced paper, yard waste, and organic garbage rather than from fossil fuels.”



WTE treatment under the Kyoto Protocol

- 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^[1]]) through approved Clean Development Mechanism protocols. This allows waste-to-energy facilities constructed in developing nations to sell carbon credits.

[1] CDM protocol (AM0025 v7) and associated memorandum, “Avoided emissions from organic waste through alternative waste treatment processes.”



Federal Legislation

Current laws and legislative proposals provide recognize waste-to-energy as renewable and climate-friendly.

TAX CREDITS

- The American Recovery and Reinvestment Act of 2009 signed into law by President Obama extended the Section 45 renewable energy production tax credit (PTC), which includes WTE, until 12/31/2013. (ITC and Sec. 1603 grants also options)

RENEWABLE ENERGY CREDITS

- Bills in both the House and the Senate have proposed establishment of a renewable energy standard (RES or RPS) which define waste-to-energy facilities as generators of renewable energy and make them eligible to generate and sell renewable energy credits. (Waxman-Markey; Bingaman; Bingaman-Brownback; Klobuchar; Lugar)

CAP-AND-TRADE

Would not require WTE facilities to be regulated under a cap-and-trade system if its fuel source was more than 95% MSW on a heat-input basis.



State Legislation

State laws recognize waste-to-energy as renewable:

- | | |
|---|--|
| <ul style="list-style-type: none"> • Alaska • Arkansas • California • Connecticut • District of Columbia • Florida • Hawaii • Iowa • Indiana • Maine • Maryland • Massachusetts • Michigan | <ul style="list-style-type: none"> • Minnesota • Nevada • New Hampshire • New Jersey • New York • Oklahoma • Oregon • Pennsylvania • Puerto Rico • South Carolina • South Dakota • Virginia • Washington • Wisconsin |
|---|--|



Credits on the Voluntary Market

Voluntary Carbon Standard

The VCS Registry System is a custodial system for Voluntary Carbon Units (VCUs), the carbon offsets generated under the VCS Program. The VCS Registry System enables the tracking of all VCUs, from issuance to retirement, and is a key part of the VCS Program which ensures that all VCUs are real, measurable, additional, permanent, independently verified, unique and traceable.

Lee County, Florida

Lee County, Florida's waste-to-energy facility is the first waste-to-energy facility in the United States to be approved under a national voluntary standard to sell offsets.

Renewable Energy Credits


Waste-to-energy facilities have sold renewable energy credits to the Federal Government through solicitation and to private parties who voluntarily acquire renewable energy.



Summary

- Municipal solid waste is a homegrown renewable energy source that can contribute significantly to a renewable and climate-conscious future.
- All levels of government, foreign and domestic, have recognized the benefits waste-to-energy and are shaping policies to promote.
- Increased cost of compliance for fossil fuel electricity sources will make WTE more attractive in the marketplace.
- The political attractiveness of developing GHG-mitigation power sources will make it easier for communities to develop WTE facilities
- The United States has a long way to go to catch up with policies in Europe that promote renewables and WTE, but momentum is building.





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