CLEAN, RENEWABLE,
SAFE, AND ECONOMICAL

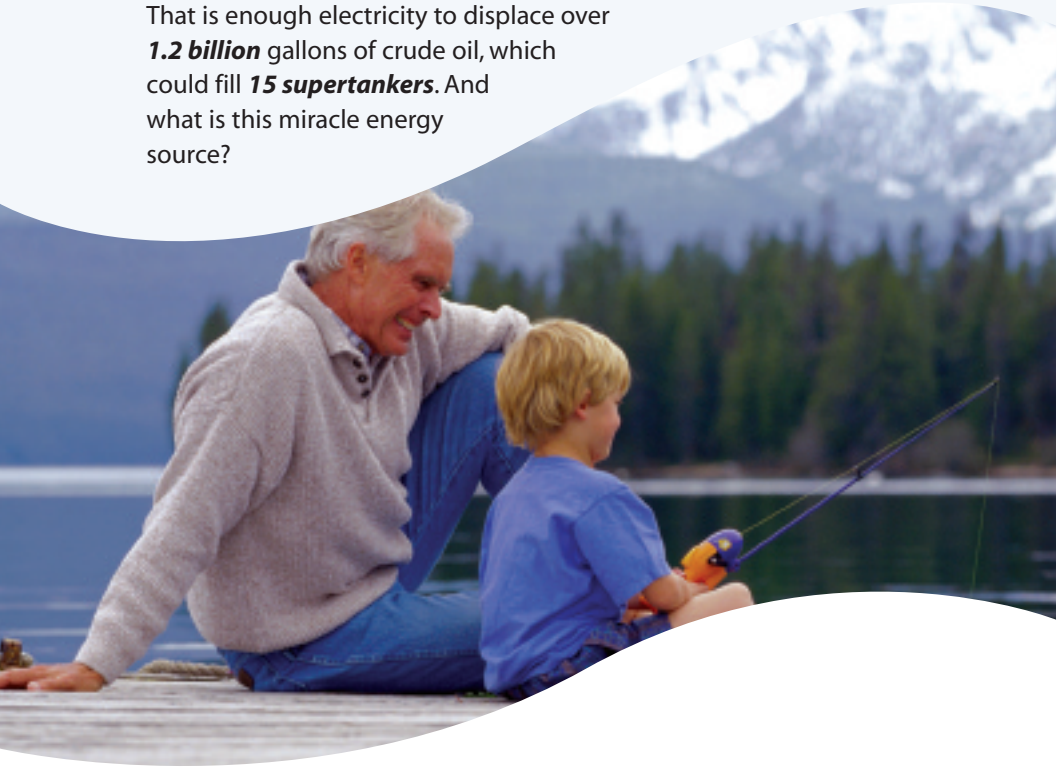
America's Own

Energy Source

CLEAN, RENEWABLE,
SAFE, AND ECONOMICAL

Clean, Renewable Energy

Imagine a fuel that's ***renewable,*** a source of energy that ***reduces the buildup of greenhouse gases***…and that is endorsed by leading environmental scientists. This fuel is being used ***right now***, at 89 plants in the United States, about 400 in Europe and others around the world. Last year, this source of energy generated enough electricity to light all of the homes in Maine, New Hampshire, Vermont, Rhode Island, and most of Massachusetts. That is enough electricity to displace over ***1.2 billion*** gallons of crude oil, which could fill ***15 supertankers***. And what is this miracle energy source?



Garbage!

That's right. Today we have the technology to burn garbage and trash with fewer emissions than conventional fuels burned in most American power plants. These "waste-to-energy" plants are more environmentally-friendly than most power plants and reduce emissions of greenhouse gases by (1) producing electricity that would have been generated by a conventional power plant, (2) disposing of solid waste that would have gone to a landfill, decomposed, and generated methane, a powerful greenhouse gas, and (3) recovering metals for recycling.

America's waste-to-energy facilities meet some of the most stringent environmental standards in the world and employ the most advanced emissions control equipment available. In fact, the US Environmental Protection Agency concluded in 2003 that America's waste-to-energy plants have demonstrated "dramatic decreases" in air emissions, and produce electricity "with less environmental impact than almost any other source of electricity." EPA estimates that waste-to-energy technology annually avoids the release of 33 million metric tons of carbon dioxide, a greenhouse gas.

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 Maria Zannes, IWSA, 2/14/03)

Garbage?!

Today, when we think of garbage and trash we also think of recycling. For many Americans, recycling has become an important part of their routine at home and work. And with good reason: recycling diverts valuable materials that would otherwise be sent for disposal. But the reality is that ***a significant amount of*** the waste material we generate ***is not*** recycled. Some types of waste cannot be re-used or recycled, or are present in such small quantities that recycling is not economical. Alternatively, using these materials as a fuel source to generate electricity is another way of recovering value from them.

Modern waste-to-energy facilities are part of an integrated waste management system of which recycling is an integral part. These systems divert millions of tons of glass, plastic, paper and metal each year for recycling. The remaining trash is converted into energy through the combustion process, reducing the volume by 90 percent. So, for every ten cubic yards of garbage that goes into a waste-to-energy facility, only one cubic yard of ash is landfilled! And the ash can be recycled, too.

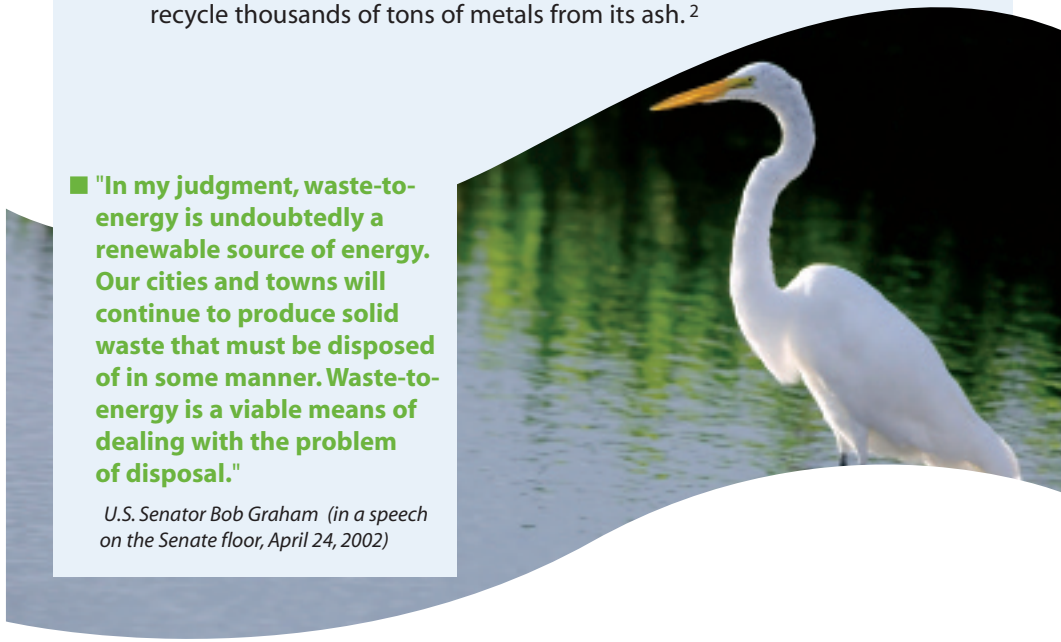
Turning Waste into Energy

The modern waste-to-energy plant is a technical marvel. It must burn a fuel ranging in size from a pea to a mattress. The fuel can be wet or dry, and it varies greatly in energy content.

These plants burn the trash completely and scrub their exhaust with a number of sophisticated air pollution control systems to constantly comply with federal, state and local regulations. How clean are these plants? An EPA study demonstrates that waste-to-energy provides the most energy recovery with the least environmental impact of any waste management option.[1]

The first step in processing the trash is the receiving building. Most municipalities served by waste-to-energy plants have some sort of recycling program, so the trash that is recieved at the plant has already had recyclables removed. The trash, which in some cases may be shredded first, is deposited onto the floor or into a large concrete pit in the enclosed receiving building. From this area, the trash is then loaded into the furnaces. Air for the combustion process in the furnaces is drawn from within the receiving building so that air is always flowing into the building from the outside. This creates a "negative pressure" within the building that prevents dust and odors from escaping the building. The next step is the furnace itself, where high temperature combustion completely destroys viruses, bacteria, rotting food and other organic compounds found in household garbage that could potentially impact human health. The heat from the burning garbage boils water flowing inside the boiler tubes and turns the water into steam. The steam can be used directly in a heating system or a factory.

The steam is generally used to turn a turbine-generator to make electricity. After any non-combustible residue (ash) cools, magnets and other mechanical devices pull metals from the ash for recycling. This is an important step, since a waste-to-energy plant can recycle thousands of tons of metals from its ash.[2]



"In my judgment, waste-to-energy is undoubtedly a renewable source of energy. Our cities and towns will continue to produce solid waste that must be disposed of in some manner. Waste-to-energy is a viable means of dealing with the problem of disposal."

U.S. Senator Bob Graham (in a speech on the Senate floor, April 24, 2002)

Advanced Air Quality Control

But the furnace is only half the story. The really advanced technology in trash burning is the air quality (emission) control system.

If you've ever seen leaves burning, or rubber burning, or even just wood burning in an open fire, it may be hard to picture how garbage can be burned cleanly.

But waste-to-energy plants do not use an open fire. The combustion process occurs in a sealed furnace with an automatic combustion control system for maintaining a consistent process that maintains a low level of air emissions. All flue gases from the combustion process are directed to a series of air quality control systems for additional cleaning. As a result, waste-to-energy plant emissions are much cleaner than those from most fossil fuel power plants.

Sophisticated monitoring systems can respond quickly and automatically to changes in the fuel and the furnace. Computer-controlled monitors sample the air continuously in the furnace, the air quality control system, and in the stack. The computers adjust the air feeding the fire. They also adjust the addition of lime and other chemicals used to remove pollutants.

In addition to the computerized controls, skilled operators in the control room constantly monitor the system. Their primary goals are to keep emissions as low as possible to improve the plant's efficiency, reduce operating costs and protect the environment.

In many plants today, the computers also send information directly to the state or local environmental agencies. Every plant must report its air quality data to environmental regulators. Waste-to-energy plants are among the most closely regulated power plants in the country.

Like coal, oil and natural gas, burning trash produces various gases

that must be controlled to protect human health and the environment. These are:

- carbon monoxide
- nitrogen oxides
- the acid gases sulfur dioxide and hydrogen chloride
- solid particulate, which can contain heavy metals
- other trace constituents such as mercury and dioxins

Waste-to-energy plants meet or exceed the strictest federal standards set by federal and state environmental agencies. Waste-to-energy employs a multi-step process to achieve superior environmental performance.

Good air quality control begins in the furnace. Good combustion minimizes the formation of carbon monoxide and products of incomplete combustion. [3]

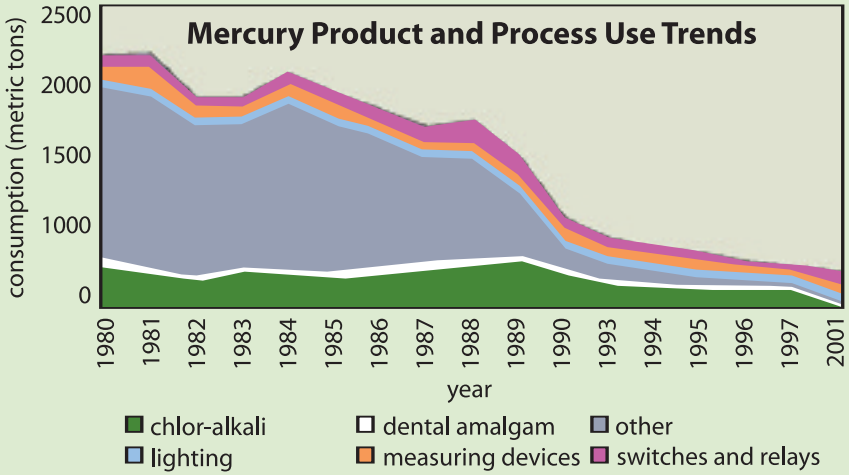
Good combustion control also limits the formation of nitrogen oxides. Nitrogen oxides that do form are reduced by spraying ammonia or urea into the hot flue gas (a technology called Selective Non-Catalytic Reduction), which converts nitrogen oxides to harmless nitrogen and water.

Acid gases are removed by a "dry scrubber," a device that typically sprays a mixture of lime and water into the hot exhaust. The scrubber uses lime to neutralize acid gases, just as a gardener uses lime to neutralize acid soil. The hot gases evaporate the water, leaving a dry particle that is captured before exiting the stack.

The dry scrubber also traps much of the heavy metals and organics. By injecting powdered activated carbon into the hot flue gases, waste-to-energy is the only solid waste management method that permanently removes significant quantities of mercury from the environment. The greatest advances in mercury control, however, have come from the reduction of mercury in batteries, paint, and

other consumer products, an effort manufacturers, states and the U.S. Environmental Protection Agency began several years ago.

In fact, between 1980 and 2000, use of mercury in manufacturing dropped by almost 90 percent.[4]



The final step in pollution control is to remove all these potential contaminants---the lime salts, the activated carbon, and particulates. These particles are called "fly ash" because they are light and tend to be carried along in the hot flue gas. Fly ash is usually removed by a "bag house," which works like a giant vacuum cleaner with hundreds of fabric filter bags. Some plants use a different device, called an electrostatic precipitator, which uses electrically charged plates to capture the small particles of fly ash, much like a television screen attracts house dust.

Flue gas that is discharged from the stack is primarily carbon dioxide, nitrogen, oxygen and water with trace amounts of other constituents.

Cleaner, Healthier Air

Waste-to-energy plants make steam and electricity. Compared to other fuels burned to produce steam and electricity, they are very clean. In many cases, building a waste-to-energy plant improves air quality by replacing other fossil fuel burning power plants.

The following table provides a direct comparison of typical air emissions from power plants using different types of fuel. The emission factor identifies the amount of air pollutants (pounds) for every megawatt hour of electricity produced by that power plant.

While all power plants have air emissions, the use of waste-to-energy plants creates fewer emissions than fossil fuel plants. As an example, the following table shows that the use of trash to generate a megawatt of electrical power instead of coal would avoid approximately 1,412 pounds of carbon dioxide (837-2,249 = -1,412), 12.2 pounds of sulfur dioxide and 0.6 pounds of nitrogen oxide from entering the environment. The amount of avoided emissions is even greater if you consider the benefits of recovering iron and aluminum for recycling and methane emissions avoided from landfill.

Air Emissions of Waste-to-Energy and Fossil Fuel Power Plants (pounds per megawatt hour)[5]

Facility Type	Carbon Dioxide	Sulfur Dioxide	Nitrogen Oxides
Coal	2,249	13	6
Oil	1,672	12	4
Natural Gas	1,135	0.1	1.7
Waste-to-Energy	837	0.8	5.4

Other Environmental Advantages of Waste-to-Energy

By replacing fossil fuels, waste-to-energy reduces the buildup of carbon dioxide in the atmosphere. Trash is mostly biomass[6] (including materials like paper, natural rubber, wood, cloth and food waste), which comes from materials that are made from plants and trees. Biomass is renewable energy, and does not add to the buildup of greenhouse gases like fossil fuels (oil, coal and natural gas), which release carbon that was stored deep underground.

Additionally, over long periods of time, trash that goes to a landfill decomposes and forms methane gas, a very potent greenhouse gas. Modern landfills collect a portion of this methane and either vent it, burn it in a flare or use it as fuel in an engine to make electricity. However, some of the methane from the landfill escapes into the atmosphere. Sending trash to a waste-to-energy plant avoids generation of the methane at a landfill and any subsequent release.

Waste-to-energy also preserves valuable space at landfills, minimizing the amount of land that will be taken for the landfill and for the "mining" of soil that must be used as daily landfill cover. Since ash left over after burning is only about 10 percent of the original volume of trash, waste-to-energy helps existing landfills last longer. Ash residue is also being re-used to avoid the consumption of natural minerals in diverse applications such as road-base, landfill cover and other construction applications.

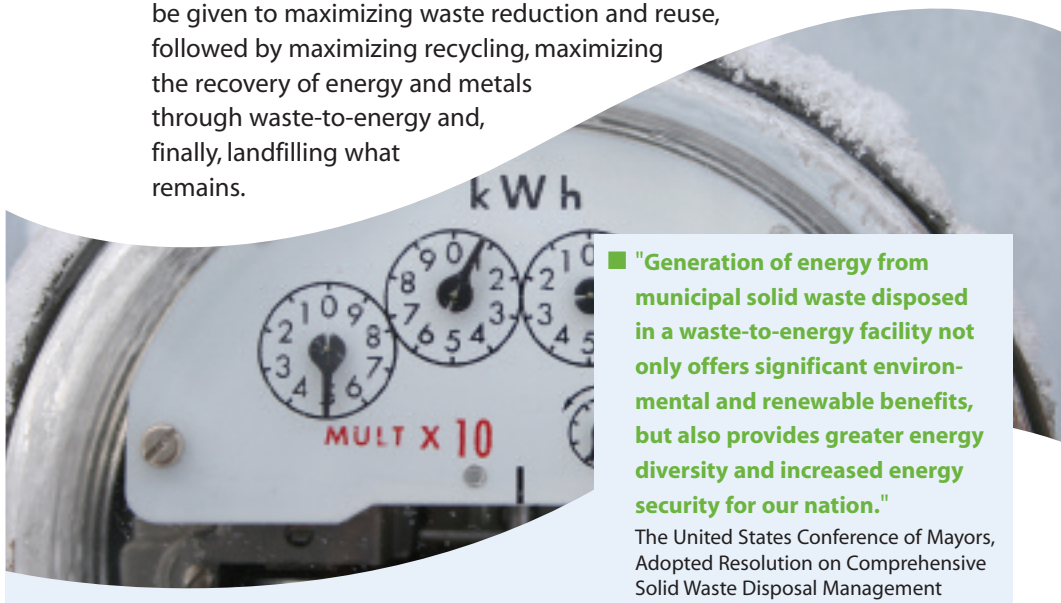
Post-combustion recovery of materials, such as iron and aluminum, also makes it easier to recycle many metals and avoids the emission of greenhouse gases associated with production of metals from virgin materials.

What's the "Best" Way to Take Care of Garbage

Much of our trash now lives a second life. Twenty years ago, America recycled 10 percent of the materials in its trash, and recovered energy from only 2 percent. Today, we recover about 28 percent of our trash for recycling (33 percent in communities that utilize waste-to-energy), and we combust 12 percent for energy.[7] The remainder of our waste is buried in landfills.

Waste-to-energy has been shown to be compatible with recycling programs on a nationwide basis. Some of the leading recycling programs in the country rely on waste-to-energy to take care of the trash left after recycling. In fact, the average recycling rate of communities with waste-to-energy plants is nearly 20 percent above the national average.[8]

Waste disposal options should be managed in a hierarchy that maximizes the lifespan and use of our natural resources. Priority should be given to maximizing waste reduction and reuse, followed by maximizing recycling, maximizing the recovery of energy and metals through waste-to-energy and, finally, landfilling what remains.



"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).

Sources and Notes

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This booklet has been prepared by:

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