

Burning trash

Most garbage-to-energy plants in the United States use direct burning of garbage to reduce the volume, meanwhile attempting to intercept valuable resources before or after burning. This method has been adopted in many communities in the United States and Europe because of the shortage of landfill space (and the opposition of practically everybody to new landfills). The cost of disposal in landfills rose by a factor of 6 between 1980 and 1985 to \$15 per ton in California and \$30 per ton in Minnesota.⁽¹⁰⁹⁾ Philadelphia has had to truck some of its refuse 350 miles to western Ohio ⁽¹¹⁰⁾ and must pay an average of \$90 per ton to dispose of garbage. Disposal cost for garbage in northern New Jersey has risen to over \$100 per ton.⁽¹¹¹⁾ It should also be noted that incineration merely reduces the volume of waste; landfills are still needed. About a 60% reduction in volume is a normal experience with an incinerator facility.⁽¹¹¹⁾

Trash-burning in America has gone through several stages, from basic ignorance, to great interest,⁽¹⁰²⁻¹⁰⁶⁾ to focusing on problems. This is similar to, but much later in time than, the cycle followed by Germany starting in about 1920.⁽¹¹²⁾ In the U.S. economy today it is clearly advantageous to burn trash (a total of 140 Mt/yr of MSW) rather than send it to landfills. About one-sixth of all MSW is burned. American trash even has more heating value than European trash (an average of 10.3 MJ/kg versus 8.3 MJ/kg),⁽¹⁰²⁾ as well as being generated at greater per capita rates. The amounts of trash involved are stupendous. New York City alone sends 20,000 tonnes of garbage into landfills every day and must somehow dispose of another 8 million tonnes a year.⁽¹¹³⁾

Costs of disposal using energy generation generally prove higher than originally estimated, both here and abroad.^(114,115) Many large cities have trash-burning power plants, among them Hempstead, Long Island; Albany, New York; Baltimore, Maryland; St. Petersburg,

Florida; Saugus, Massachusetts; North Andover, Massachusetts; and Minneapolis-St. Paul, Minnesota. Forty-five trash-burning plants were operational as of mid-1985, with about as many more were under construction.⁽¹¹⁶⁾ The number of trash-burning plants is now around 200.⁽¹¹⁷⁾ Current U.S. capacity is about 33 kt/d.⁽¹¹⁸⁾

Because there are so few trash-burning facilities in the United States, there are no really typical examples. However, there has been consistent opposition to siting of the plants. Columbus, Ohio, was home to an abortive attempt to run a publicly owned trash-burning facility. The plant was permanently closed after a long and loud debate over dioxin emissions. In its operation, it was not atypical of other trash-burning plants, and I visited the plant while it was operating so I can report on how it worked.

Three shredders were scattered about the city, with an additional shredder of 50 t/h capacity in the plant itself. City trash was shredded at the satellite facilities; trash brought by private haulers and other municipalities was shredded at the plant. All shredding facilities have had problems with bedspring coils and with long lengths of nylon-reinforced hose. For this reason, several employees were assigned to fish out such objects in addition to separating out large items, such as washing machines, and hazardous items, such as compressed gas cylinders and gasoline. Other ferrous metals were separated electromagnetically. Glass was held to a small proportion of trash to prevent formation of clinkers (solid hot masses of material) and hot spots in the combustors.

The Columbus trash-burning plant was designed to operate on a 10% mixture of coal. At the time I visited the plant, coal was used only for startup and for maintaining one boiler on standby, in case of pressure loss in one of the trash-fired boilers. The boiler temperature was low, only 265 °C. At the present time, the plant used about 120 tonnes of coal and around 1800 tonnes of refuse per day. The energy content of the trash burned

in Columbus averaged 10.5 MJ/kg (about one-third that of the coal). An abandoned water-filled quarry next to the site was used for cooling water.

The Clean Air Act Amendments set standards for waste incineration.⁽¹¹⁹⁾ The Columbus facility met all the requirements of the EPA, but citizens became concerned about dioxin emissions and succeeded finally in closing the plant. Dioxins occur when the combustion of hydrocarbons is incomplete, and are emitted when plastics are burned at low temperatures, such as existed in the Columbus plant (and other plants; see below). The plant had severe financial troubles for many years before the city of Columbus sold it to the Franklin County Solid Waste Authority, which finally closed it down.

Baltimore, Maryland, has a privately constructed trash-to-energy plant. The owner, Signal Environmental Systems, runs several other facilities in Florida, Massachusetts, and New York. It sells the electricity from its 60 MW_e turbine generators to Baltimore Gas and Electric Company and distributes hot water to the downtown heating loop run by Thermal Resources of Baltimore, Inc. Despite its for-profit nature, the plant was partly financed through the sale of tax-exempt government bonds. In this plant, the trash is not presorted. The raw refuse is simply dumped onto the furnace feed hopper. The trash is burned at high temperature (almost 1400 °C) to break down and burn most noxious chemical compounds. The facility can process as much as 2 kilotonnes of refuse per day, but it is currently processing at about 80% of its capacity. The clinkers are sorted to recover ferrous metals, which are sold; the remaining aggregate is dumped.

Not all trash-burning facilities have met with EPA approval. The Hempstead, New York, facility was opened with great hopes in 1979,⁽¹²⁰⁾ but had to be closed in 1980 because of problems with dioxin emissions.^(113,113) The Hempstead plant was relatively small, processing 4000 tons of garbage a day into 2 GWh of electricity. It was built by a private

company, Parsons and Whittemore, which had agreed to take trash for payment of \$16 per ton and give back 25% of its recycling earnings and 40% of its electricity sales to the town.⁽¹¹⁹⁾ Environmentalists across the country have since argued against such plants because of the possibility of dioxin emission.^(117,121)

There are also concerns about other toxic products emitted by incinerators, including heavy metals.^(108,117,122) For example, the Detroit incinerator (the world's largest) had to be shut down temporarily in 1990 because of mercury escape, a common problem because mercury's condensation temperature is so low.^(117,123) Batteries are the cause of the mercury, lead, and cadmium problems in incinerators.^(117,124)

Other plants have had problems as well. There have been several explosions in the facilities in Akron, Ohio, and in the satellite shredders in Columbus, Ohio, while they were operating, as well as unanticipated problems in operating and feeding materials through. Incineration clearly has great virtue in reducing the volume of waste if the plastics causing the chlorine and dioxin problems can be kept out of the garbage stream.⁽¹²⁵⁾ Another way to prevent problems is to burn the trash at temperatures above 1000 °C, because this causes complete combustion of all components of the plastic; however, this does have the effect of increasing emissions of nitrogen oxides (see Chapter 13). This high-temperature combustion method has also been used by Signal in its plants; its Peekskill, New York, plant registered the lowest dioxin emissions on record according to the New York State Department of Environmental Conservation.⁽¹¹¹⁾

Americans throw away almost 300 million tires per year, adding to the 2.5 to 3 billion already there. Reclaiming of tires used to be routine, and there were some 30 plants in the 1960s, but the tires have become more difficult to reclaim and only two firms are left. Tire burning for energy is occurring, but it has attendant problems, too, including being

uneconomic. The presence of steel belts and the difficulties of reusing the rubber make the economics very tenuous.

Oxford Energy Corporation, located in Modesto, California, operated at a loss in 1989 despite being paid 8.5 cents/kWh.⁽¹²⁶⁾ Modesto was the site of the world's largest tire fire. It is difficult to start tires burning, but once the burning begins, it is devilishly hard to put out the fire. The Modesto fire burned for weeks, as did a smaller, but still huge tire fire in central Ohio.

Creative ways of using the tires need to be explored. One certain way to use the tires is to mix them with the materials being cooked to make Portland cement. The tires are ultimately consumed and produce a better cement with fewer emissions. Unfortunately, there are too many tires around to be disposed of this way. Ohio, like many other states, has a tire disposal fee assessed on each tire sold. Many tire stores make this a profit center, charging a fee substantially greater than mandated by the state. The state fee money in Ohio goes into actual disposal of the tires and into maintenance of the former tire fire site, which still has millions of tires buried.

Used tires can be used to make asphalt, but this is more expensive than usual asphalt although it lasts longer.^(119,126) American Tire Reclamation shreds tires, then purifies them by pyrolysis (in which organic material at elevated temperatures decomposes in the absence of air) to get oil products and carbon black (but not carbon black of original quality). The oil is separated and refined.⁽¹²⁷⁾