WASTE-TO-ENERGY IN THE U. S. - 1999 IWSA UPDATE

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ABSTRACT

This paper explores the status of waste-to-energy in the United States, providing a complete breakdown of plants now operating and under construction. Issues including technology type, processing capacity, recycling efforts, and energy generation are covered. The type of air pollution control devices on waste-to-energy plants is also discussed, along with what contribution members of the Integrated Waste Services Association (IWSA) make in terms of managing municipal waste in the U. S.

INTRODUCTION

During the period of December 1998 through mid-February 1999, telephone and written surveys were completed with all waste-to-energy plants in the United States. The U. S. Environmental Protection Agency (U. S. EPA) municipal waste combustion inventory, as well as the 1997 - 98 Resource Recovery Yearbook And Directory (Governmental Advisory Associates, Inc.) were also consulted. The objective was to update the 1997 - 1998 IWSA Directory Of U. S. Plants.

Waste-to-energy facilities include the following technologies: 1) Mass burn plants generate electricity and/or steam from trash by feeding mixed municipal waste into large furnaces dedicated solely to burning trash and producing power; 2) Refuse-derived fuel plants remove recyclables or unburnable materials and shred or process the remaining trash into a uniform fuel. A dedicated combustor, or furnace, may be located on-site to burn the fuel and generate power; or the RDF may be transported off-site for use as a fuel in boilers that also burn fossil fuels. Incinerators, which combust trash but do not recover energy from waste, were not included as a part of this effort.

IWSA was formed in 1991 to promote integrated solutions to municipal solid waste management problems. Within this capacity, the association strives to encourage the use of waste-to-energy technology as a key component of community programs. IWSA's members include: American Ref-Fuel Company, Constellation Power, Inc., Energy Answers Corporation, Foster Wheeler Power Systems, Inc., Katy-Seghers, Inc., Montenay Power Corporation, Ogden Energy Group, Inc., Westinghouse Electric Corporation, and Wheelabrator Technologies Inc.

PRIMARY FINDINGS

Waste-to-energy remains a steady, viable, and environmentally sound method to dispose of trash. There are 103 waste-to-energy plants now operating in the U. S., see Table 1. Of this total, 69 employ mass burn technology, 13 utilize the RDF process including on-site processing and combustion, and 13 are modular systems. In addition, eight facilities were identified that generate RDF for combustion off-site, and another eight plants exist that burn RDF at off-site locations. Plants that only generate RDF for off-site combustion are not included in the waste-to-energy facility total of 103 operations. Further, there is one mass burn facility under construction in Central Wayne County, Michigan. This 800 ton per day (tpd) facility is scheduled for commercial start-up by January 2000.

Nearly 31 million tons of trash, or about 15% of America's solid waste, is being used as fuel at waste-to-energy facilities. These plants generate an equivalent amount of power to meet the electricity needs of 2.4 million homes, see Table 2. This statistic was determined applying an average electrical consumption of 1.138 KWH/household/hour, which was supplied by the U. S. Department of Energy's Energy Information Administration. This corresponds to an 80 megawatt (MW) facility serving about 70,000 households.

More than 39 million people in 31 states safely dispose their trash at waste-to-energy facilities. Communities with waste-to-energy plants recycle an average of 32% of their

trash, compared with the national average of 27% as reported by the U. S. EPA (1996). Nearly 462,000 tons of waste is recovered on-site for recycling at waste-to-energy plants, including glass, metals, paper, plastics, batteries, yard waste, white goods, and combustion ash. Waste-to-energy facilities nationwide recycle more than 773,000 tons of ferrous metals annually, before and after the combustion process.

TRENDS

Since the release of IWSA's 1997 - 1998 waste-to-energy directory, the number of facilities operating in the U. S. has decreased from 112 to 103. There has also been a corresponding drop of 1.1 million tons of annual disposal capacity, which is the equivalent of about 3,000 tpd. Accounting for this drop was the closure of a 950 tpd RDF facility in Massachusetts, and a number of smaller, older plants.

In spite of this decline, the latest U. S. EPA (1996) data show that waste-to-energy operations continue to manage 15% of the nation's municipal solid waste. Also, more than 39 million people have their waste disposal needs met by waste-to-energy. This represents a 22% increase since the last IWSA Directory and is explained by the fact that U. S. EPA's (1996) most current per capita waste generation rate is lower than the year before. More specifically, during 1996, U. S. EPA estimated that each person living in the U. S. generated 4.3 pounds of waste per day. This compared to 4.4 pounds per person per day in 1995. For a given ton of garbage, as the per capita generation rate decreases, the number of people contributing to the generation of that ton increases.

This 1999 investigation generated more complete energy output and recycling data that the IWSA's 1997 - 1998 effort. The results reveal that 2,769 MW are generated by waste-to-energy, compared to 2,775 MW in 1998. The 1999 number includes 2,573 MW of electricity generation and the equivalent of 196 MW generated as steam at cogeneration waste-to-energy plants. In addition, recycling in waste-to-energy communities increased from 26% in 1998 to 32% in 1999. Ferrous metals recovery at waste-to-energy plants dropped slightly, from more than 774,000 tons in 1998 to more than 773,000 tons in 1999. Other on-site recycling jumped from nearly 135,000 tons in 1998 to nearly 462,000 tons. Included in this category for the first time are waste-to-energy ash reuse initiatives, totaling more than 330,400 tons. Finally, total on-site recycling increased from more than 909,000 tons in 1998 to more than 1.2 million tons in 1999.

AIR POLLUTION CONTROL

U. S. EPA's maximum achievable control technology (MACT) requirements dictate that waste-to-energy facilities with large units (i.e., > 250 tpd) comply with the new Clean Air Act standards on or before December 2000. In response to this mandate, there has been a movement to retrofit operating plants with acid gas control equipment, e.g., Spray Dryer Absorbers (SDA), Duct Sorbent Injection (DSI), Furnace Sorbent Injection (FSI), Cyclone Separators (CYC); NOx control, e.g., Selective Non-Catalytic Reduction (SNCR); and control for mercury, dioxin, and other emissions, e.g., Activated Carbon Injection (CI). In plants with SDA, DSI, or FSI, calcium-based lime is typically injected. Some plants have also replaced their Electrostatic Precipitators (ESPs) with Fabric Filters (FFs). Table 3 reflects this trend, particularly among the mass burn and RDF operations. Not all facilities reported pending retrofit activity.

Table 4 provides a closer look at waste-to-energy air pollution control devices by dividing plants into large and small unit categories. Plants with large units represent 90% of the total U. S. waste-to-energy capacity. Since the compliance clock for large units is ticking, it is not surprising that far more of these plants are equipped with SDA, FF, SNCR, and CI than their small unit counterparts. These large unit facilities typically use a combination of air pollution control devices to control acid gases and particulates. By comparison, plants with small units (e.g., 250 tpd or less) are subject to a separate EPA rulemaking expected to be promulgated around the turn of the century.

IWSA MEMBER CONTRIBUTION

IWSA members currently operate 64 waste-to-energy facilities, with a combined daily plant design capacity of nearly 85,000 tons, see Table 5. This translates into about 26 million tons of net processing capacity on an annual basis, which includes a 15% allowance for scheduled maintenance down-time. And while IWSA member plants account for 62% of the total number, they have 86% of the total throughput capacity. Further, some 33 million people in 23 states safely dispose of their trash at IWSA member waste-to-energy facilities. These plants generate the equivalent of 2,243 MW of electricity, enough to meet the power needs of 2 million homes.

REFERENCE

U. S. Environmental Protection Agency, 1996 Data, "Characterization Of Municipal Solid Waste In The U. S.: 1997 Update; Executive Summary," May 1, 1998, p. 2.

TABLE 1
OPERATING U. S. WASTE-TO-ENERGY PLANTS
BY TECHNOLOGY

Technology	No. of Operating Plants	Daily Design Capacity (TPD)	Annual Capacity[1] (Million Tons)
Mass Burn	69	73,920	22.9
Modular	13	1,116	0.3
RDF-Processing & Combustion	13	19,307	6.0
RDF-Combustion	8	4,745	1.5
RDF-Processing	8	6,370	2.0
Total U.S. Plants[2]	111	105,458	32.7
Waste-to-Energy Facilities	103	99,088	30.7

[1] Annual Capacity equals daily design capacity multiplied by 365 (days/year) multiplied by 85%. Eighty-five percent of design capacity is a typical system guarantee of annual facility throughput.

[2] Total U.S. Plants include RDF Processing Facilities that do not generate power on-site.

Source: J.V. L. Kiser and M. Zannes, Integrated Waste Services Association, 2/99.

TABLE 2
KEY FACTS PERTAINING TO
OPERATING WASTE-TO-ENERGY PLANTS

Percent of U.S. Waste Managed by Waste-to-Energy	15%
Annual Disposal Capacity of Waste-to-Energy Facilities	31 million tons
Number of Facilities	103
Waste Disposal Needs Met by Waste-to-Energy	39 million people
States with Waste-to-Energy Plants	31
Ferrous Metals Recovered at Waste-to-Energy Facilities	773,302 TPY
On-Site Recycling at Waste-to-Energy Facilities	461,852 TPY
Homes Served by Power from Waste-to-Energy Facilities	2.4 Million
Total Megawatts generated[1]	2,769 MW

[1] Includes 2,573 MW of electricity generation and the equivalent of 196 MW generated as steam at cogeneration waste-to-energy facilities.

Source: J.V. L. Kiser and M. Zannes, Integrated Waste Services Association, 2/99.

TABLE 3
TYPE OF AIR POLLUTION CONTROL DEVICES
ON OPERATING WASTE-TO-ENERGY PLANTS

Percentage (Number) of Plants Having APC Device in Each Technology Class[1]

Technology	SDA	WS	Cyclone	DSI/FSI/ Lime Injection	FF	ESP	SNCR	CI
Mass Burn (Total=69)	74% (51)	1% (1)	0% (0)	13% (9)	71% (49)	32% (22)	36% (25)	41% (28)
Modular (Total=13)	15% (2)	23% (3)	8% (1)	15% (2)	23% (3)	54% (7)	0% (0)	15% (2)
RDF (Total=13)	69% (9)	15% (2)	8% (1)	8% (1)	62% (8)	31% (4)	23% (3)	15% (2)
RDF - C (Total=8)	25% (2)	0% (0)	13% (1)	25% (2)	63% (5)	25% (2)	0% (0)	0% (0)
Total WTE (Total=103)	62% (64)	6% (6)	3% (3)	14% (14)	63% (65)	34% (35)	27% (28)	31% (32)

[1]Waste-to-Energy plants typically employ a combination of air pollution control devices to control acid gases (e.g., SDA, WS, CYC, DSI/FSI/Lime Injection), particulates (e.g., FF, ESP), NOx (e.g., SNCR), mercury and dioxin emissions (e.g., CI). For example, the 1,200 tpd mass burn facility in Lee County, Florida has an SDA with FF, plus SNCR and CI.

Source: J. V. L. Kiser and M. Zannes, Integrated Waste Services Association, 2/99.

TABLE 4
TYPE OF AIR POLLUTION CONTROL DEVICES ON OPERATING WTE PLANTS - LARGE VS. SMALL UNITS

Percentage (Number) of Plants Having APC Device in Each Technology Class

Technology	SDA	WS	Cyclone	DSI/FSI/ Lime Injection	FF	ESP	SNCR	CI
Large Unit Mass Burn	89%	0%	0%	4%	77%	28%	45%	53%
(Total=47)	(42)	(0)	(0)	(2)	(36)	(13)	(21)	(25)
Small Unit Mass Burn	41%	5%	0%	32%	59%	41%	18%	14%
(Total=22)	(9)	(1)	(0)	(7)	(13)	(9)	(4)	(3)
Small Unit Modular	15%	23%	8%	15%	23%	54%	0%	15%
(Total=13)	(2)	(3)	(1)	(2)	(3)	(7)	(0)	(2)
Large Unit RDF	90%	10%	10%	0%	70%	40%	30%	20%
(Total=10)	(9)	(1)	(1)	(0)	(7)	(4)	(3)	(2)
Small Unit RDF	0%	33%	0%	33%	33%	0%	0%	0%
(Total=3)	(0)	(1)	(0)	(1)	(1)	(0)	(0)	(0)
Large Unit RDF - C	50%	0%	0%	25%	75%	25%	0%	0%
(Total=4)	(2)	(0)	(0)	(1)	(3)	(1)	(0)	(0)
Small Unit RDF - C	0%	0%	25%	25%	50%	25%	0%	0%
(Total=4)	(0)	(0)	(1)	(1)	(2)	(1)	(0)	(0)
Total Large Unit WTE	85%	2%	2%	5%	74%	29%	39%	44%
(Total=62)	(53)	(1)	(1)	(3)	(46)	(18)	(24)	(27)
Total Small Unit WTE	27%	12%	5%	27%	46%	41%	10%	12%
(Total=41)	(11)	(5)	(2)	(11)	(19)	(17)	(4)	(5)

[1]Large units are defined as greater than 250 tons per day. Waste-to-Energy plants with large units represent 90% of the total U.S. waste-to-energy capacity. Small units are defined as less than or equal to 250 tpd.

[2]Waste-to-Energy plants typically employ a combination of air pollution control devices to control devices to control acid gases (e.g., SDA, WS, CYC, DSI/FSI/Lime Injection), particulates (e.g., FF, ESP), NOx (e.g., SNCR), mercury and dioxin emissions (e.g., CI). For example, the 1,200 tpd mass burn facility in Lee County, Florida has an SDA with FF, plus SNCR and CI.

Source: J.V. L. Kiser and M. Zannes, Integrated Waste Services Association, 2/99.

TABLE 5
IWSA MEMBER CONTRIBUTION IN
MANAGING U. S. MUNICIPAL WASTE DISPOSAL

Operating IWSA Waste-to-Energy Plants	64
Combined Daily Plant Design Capacity	84,892 tons
Annual Net Processing Capacity	26 million tons
IWSA Percent of Waste-to-Energy Plants	62%
IWSA Percent of U.S. Waste-to-Energy Capacity	86%
States with IWSA Plants	23
Waste Disposal Needs Met by IWSA Plants	33 million people
Homes Served with Power from IWSA Plants	2 million homes
Total Megawatts Generated	2,243 MW

Source: J.V. L. Kiser and M. Zannes, Integrated Waste Services Association, 2/99.