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WASTE MANAGEMENT PROGRAMS IN JAPAN

BY

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Presented at the
WASTE-TO-ENERGY '88: THE INTEGRATED MARKET

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John T. Foti, is the President of Riley Energy Systems, a full-service supplier to the Waste-to-Energy and Recycling Industry and a wholly owned subsidiary of Ashland Oil, Inc. Riley Energy Systems, within their scope of full-service, provides Takuma Grate Technology and Recycling Systems under license to Takuma for the United States market.

Mr. Foti has a BSME from Polytechnic Institute of New York. His professional career includes a 25-year association with the Japanese power, process, and waste management industries. He has recently made several visits to Japan, to confer with Takuma Company Ltd., government officials in solid waste management, and Municipalities.

Japan is a country that is approximately the size of California, with one-half of the population of the entire United States. Only 21 percent of its land area is habitable resulting in a population density thirty times greater than that of the United States. The people enjoy a high standard of living, with a society that is rapidly becoming almost totally urban. Land for waste disposal is, therefore, more critical and obviously less available than anywhere else in the highly developed world and this has essentially been the case for at least the last 25 years.

The inherent waste disposal problems described above have resulted in the erection of approximately 2000 waste incinerators which burn approximately two-thirds of Japan's unrecycled municipal waste. There are extremely high levels of material recycling purported to be almost 50% of the total waste stream. Statistically, of the remaining 50 percent, and as aforementioned, approximately 70 percent is burned in incinerators with the rest primarily landfilled (Figure 1 and Table 1). The landfill amount includes all ash, noncombustibles and non-recyclables. Very little bypass waste finds its way to a landfill because of the high levels of redundancy in the incinerator applications. Because of the high volume of ash and its compactability, the total volume of landfill space consumed is very small.

Although the Japanese society is rapidly catching up to the United States in relation to an ever in-

creasing packaging content, a highly effective integrated system of solid waste management is practiced. Virtually all newspapers, magazines, cans, and bottles are sorted and recycled. Additionally, residents remove most incombustible materials and hazardous wastes, with the remaining items sent to a resource recycling center. At these centers, bulky waste is screened and reusable items are sent to a workshop where they are refurbished and sold to the public. Remaining bulky waste is shredded and metals are recovered. A very small amount, not exceeding one and one-half percent is left for various other methods of volume reduction, such as composting. The centers are often combined with a waste-to-energy facility, that in many cases provides high temperature hot water or steam for heating of recreational facilities, greenhouse applications, and municipal buildings and classrooms.

As previously mentioned, 50 percent of the total waste stream is in some manner recycled. In order to draw a distinction between what we understand in this country as recycling and that which is practiced in Japan, attention should be brought to the fact that of the total of 50 percent, a majority is separated at the source. Japan is a country with very few natural resources and consequently manufactured goods are usually considered recyclable in order to preserve their precious natural resources.

Even their definitions display their philosophy, recyclable wastes are called "resources," the remainder is still defined as waste. The Japanese society is extremely disciplined in the generation and segregation of waste products. Special collections, by municipalities and in some cases private haulers, of separated recyclables are made on a weekly basis.

Industry is conditioned to incorporate recyclables in their manufacturing processes and consequently, a very high percentage of the waste stream is, in fact, recyclable. It should be noted however, that Japan has been in this recycling mode in excess of 25 years, and still has only achieved levels of 50 per cent (Figure 2).

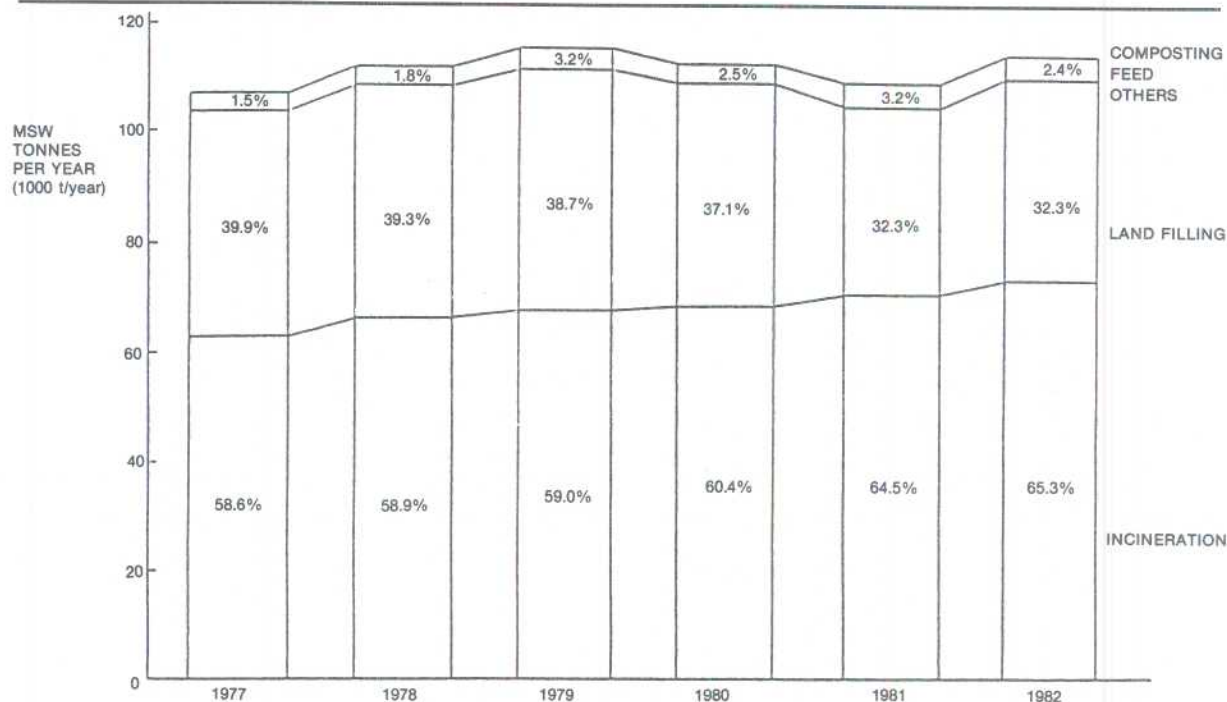


Figure 1. Disposition of Waste In Japan, 1977 - 1982

Source: "Introduction of Takuma Incineration Plant."

Table 1
Solid Waste Disposal in Japan
1979 - 1983

	1979	1980	1981	1982	1983
Total waste disposed (t/d)	115,158	113,728	110,209	115,256	110,976
Incineration					
(t/d)	67,887	68,739	71,102	75,264	75,022
(%)	59.0	60.4	64.5	65.3	67.6
Landfill					
(t/d)	44,509	42,139	35,651	37,261	32,842
(%)	38.7	37.1	32.3	32.3	29.6
Compost					
(t/d)	279	291	140	165	211
(%)	0.2	0.2	0.1	0.1	0.2
Other					
(t/d)	2,483	2,559	3,316	2,566	2,901
(%)	2.1	2.3	3.0	2.2	2.6

Note: Does not include self disposed waste or all recycled waste.

Source: Quality of the Environment in Japan 1985, Solid Waste Management and Night Soil Treatment (I).

Some of the targeted goals in the United States should be seriously looked at in this light. To further this point, the United States dependence on imported natural resources, doesn't nearly approach the needs of Japan. In Japan 40 percent of the aluminum is reused for new aluminum products, 42 percent of the glass cullet is reused to make new glass products. Glass bottles are reused an average of three times, with some unique bottles in the larger sizes reused as much as twenty times.

PLANT RECYCLING

Resource Recycling Centers, which are usually adjacent to waste-to-energy facilities, are primarily dedicated to the separation of combustibles and non combustibles. I recently visited three Takuma Installed Recycling Centers, of which there are eleven in operation, processing between 100 to 250 tons per 5-hour shift, with the remaining 3 hours being utilized for maintenance. A twelfth plant will come on-line in February of 1989 (Table 2). The Plants operate for one shift per day, and each of the Plants vary as to what is separated and the type of separating system. The Plants visited separated the non-combustible fraction of the waste stream to

aluminum, ferrous materials, glass and cullett, brass, inorganics, organics, and plastics. Some plants used hand picking while others used automatic systems. Several of the facilities had been built in conjunction with waste-to-energy facilities, while others are at separate locations.

WASTE-TO-ENERGY

Of the approximately 2000 incinerators operating in Japan, burning approximately 70 percent of the unrecycled waste stream, only about 361 of them recover energy (Table 3). However, these 361 units represent 105,000 short tons of the total 153,000 tons per day incinerated. Obviously, most of the incinerators are very small batch and intermittent types. Of the 361 plants recovering energy, only 51 generate electricity with the rest using heat for the heating of community projects, swimming pools, heat for sewage treatment plants, and residential heating. Most of the Japanese Plants are "Mass Burn." Many of the energy facilities range from 200-600 tons per day with the largest plant being the Takuma 1800 ton per day Koto Plant in Tokyo. The primary reason for the minimal electricity generation from waste-to-energy plants relative to

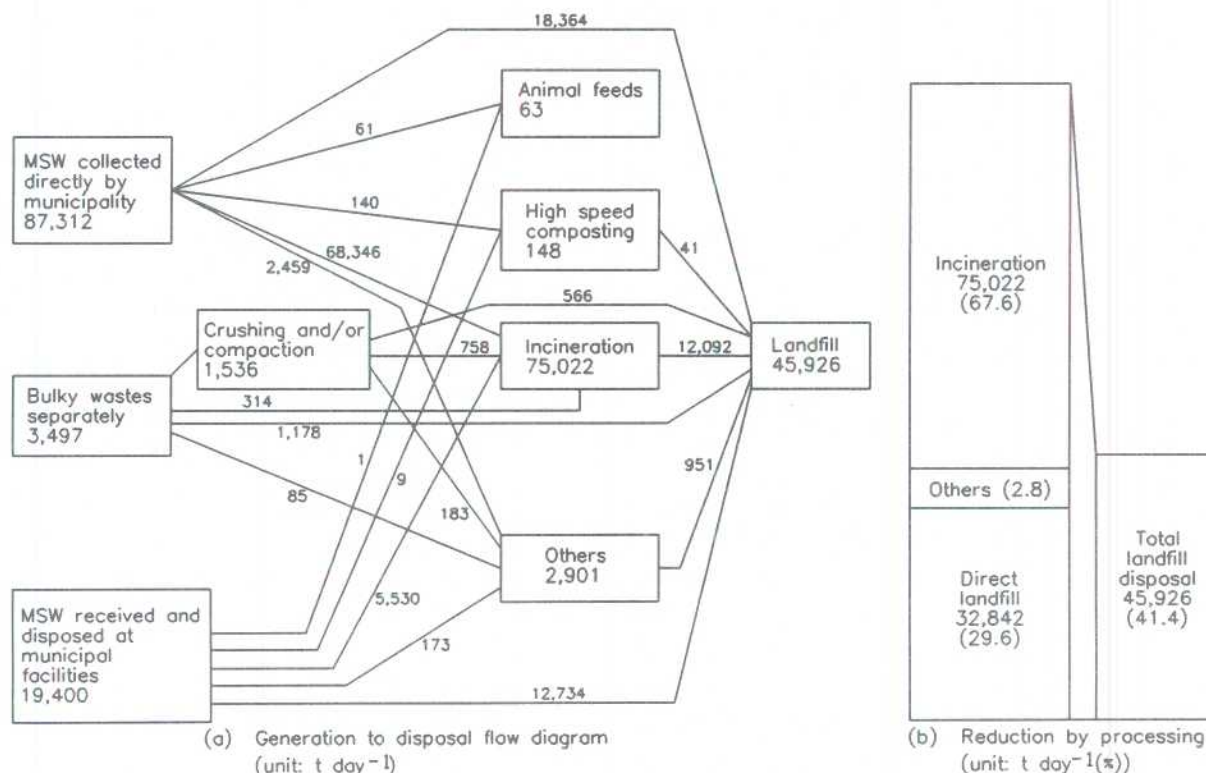


Figure 2. Flow of Municipal Waste in Japan, 1983
Source: Solid Waste Management and Night Soil Treatment (I).

NO	CUSTOMER	CAPACITY	START-UP DATE	SEPARATING ITEMS
1	Kinuura City	40T/5th	Mar., 1978	Fe, Org, Inr
2	Kawagoe City	50 "	Sep., 1978	Al, Fe, Cul, Org, Inr
3	Mitaka City	100 "	Sep., 1980	Al, Brs, Fe, Bot, Cul, Org, Inr
4	Kumagaya City	60 "	Mar., 1983	Al, Fe, Bot, Cul, Pl, Org, Inr
5	Higashine City	30 "	Mar., 1984	Al, Fe, Bot, Cul, Pl, Org, Inr
6	Kadoma City	12 "	Oct., 1985	Al, Fe, Cul, Org, Inr
7	Kashiwara City	20 "	Mar., 1986	Al, Fe, Cul, Org, Inr
8	Fukuoka City (Eastern)	250 "	Sep., 1986	Al, Fe, Org, Inr
9	Inagawa Town	10 "	Mar., 1987	Al, Fe, Org, Inr
10	Biratori Town	30 "	Oct., 1987	Al, Fe, Org, Inr
11	Osaka City (Taisho)	190 "	Mar., 1988	Fe, Org, Inr
12	Ono City	35 "	Feb., 1989	Al, Fe, Org, Inr
Remarks;				
Al: Aluminum		Org:	Organic	(Combustibles)
Brs: Brass		Inr:	Inert	(Non Combustibles)
Fe: Ferrous Metal				
Bot: Glass bottle				
Cul: Cullet				
Pl: Plastic				

Table 2. Reference List Of Takuma Recycling Facilities

United States applications is essentially the absence of any PURPA type legislation. Electricity sales must be privately negotiated with utilities. The sales price of electricity to utilities averages only 3-5 cents per KW hour. Consequently, energy is more often used for the other purposes mentioned.

Most of the Waste-to-Energy Plants in Japan were built by Takuma Company Ltd; Mitsubishi Industries; Hitachi Ship Building Company; and Nippon Kokan Steel Corporation (See Table 4). Fluidized bed incineration is being developed by some

manufacturers in Japan, with approximately 30 Units in various stages of development. Most of the new Mass Burn Plants in Japan are state-of-the-art, including multistage reciprocating grates, automatic combustion controls, automatic crane operation, computerized weigh-ins, computerized controls, and data processing. The heating value of Japan's refuse is steadily rising as in the United States. Today, the Japanese heating value is averaging 4500 BTU/lb depending on location, compared to United States values approaching 5200 to 5500 BTU/lb.

Year	Fully Continuous		Other Types*		Total Number	Cap. t/d
	Number	Cap. t/d	Number	Cap. t/d		
1978	344	43,803	1,681	94,964	2,025	138,76
1979	341	48,177	1,643	96,396	1,984	144,57
1980	357	47,980	1,642	98,914	1,999	146,89
1981	370	46,981	1,613	101,399	1,983	148,38
1982	360	47,874	1,582	103,479	1,942	151,35
1983	361	48,151	1,554	105,152	1,915	153,30

Table 3. Solid Waste Incineration Facilities in Japan, 1978-1983

Manufacturer	Technology	Number Plants (1982)	Installed Capacity (t/d 1982)
Takuma	Takuma	182	34,345
Mitsubishi	Martin	69	17,884
Hitachi	Von Roll	62	17,406
Nippon	Volund	42	11,461
Total		355	81,096

Table 4. Major Manufacturers of Waste-To-Energy Facilities

Source: "Introduction of Takuma Incineration Plant," Takuma Co., Ltd.

EMISSION CONTROLS

Japan's governing emission standards for incinerators were established in the 1970's. Most of these requirements are not very strict when compared to recent American standards. The Units being built today are more in line with the American standards as each municipality develops its own regulation. Current emission standards for incinerator Plants are coming under the same scrutiny by Municipalities as has occurred in the United States. There are separate standards for large continuous operation incinerators, and in special areas, these standards are more stringent by approximately one-half. The most common method of particulate control has been electrostatic precipitators. However, most modern Plants are requiring acid gas controls and control of NO_x emissions.

Bottom ash from incinerators is mixed with fly ash and disposed of in lined landfill with leachate collection. New methods for the disposal of ash are in various stages of development and practice. Some of the methods employed are the mixing of ash with cement or asphalt for construction uses and/or disposal in landfills; melting the ash into an inert hard state; neutralizing the fly ash by bubbling flue gas CO₂ through a fly ash slurry to form a stable heavy metal carbonate.

SUMMARY

Probably the most startling observation for a foreign visitor at Japanese waste management facilities is the ownership by the population of these facilities. The citizenry are totally integrated into the needs of solid waste management from a very early age. I was shown 4th grade Social Study book that dedicated large sections to the explanation of solid waste management in its various stages from source separation to ultimate landfilling.

Many of the facilities visited were community centers. Tours were continuously in progress for school children, community groups, industry groups, and government employees. Sites for Waste-to-Energy facilities were very often in the midst of the highly populated regions, and for the most part, provided the largest recreational areas in the region. As was previously mentioned, approximately 70% of the waste remaining after recycling is sent to incineration facilities, however, as urbanization increases even further and with incineration the predominately used waste treatment method in the cities, it is anticipated that as much as 88 percent may be incinerated by the year 2000.

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