

Use of Technology to Reduce Waste Disposal Volume and Generate Renewable Energy

- Incineration Plant -

Kanazawa Incineration Plant

Development of Incineration Plants using Japan's Highly Advanced Technology



Project Summary

Source: Resources and Waste Recycling Bureau, City of Yokohama

From the sixties up to the eighties, Yokohama City experienced rapid population growth due to urbanization. To cope with the resulting increase in municipal waste generated every day, the city government established a solid waste management program that focused on reducing the amount of wastes for final disposal.

Because waste incineration is the most effective method to reduce waste disposal volume, Yokohama City built incineration plants and required sorting of combustible waste and other materials at source.

By the seventies, the city's incineration plants could burn almost all waste collected from the city. By 2001, the city's seven incineration plants, with a total capacity of 7,740 tons per day, were fully operational.

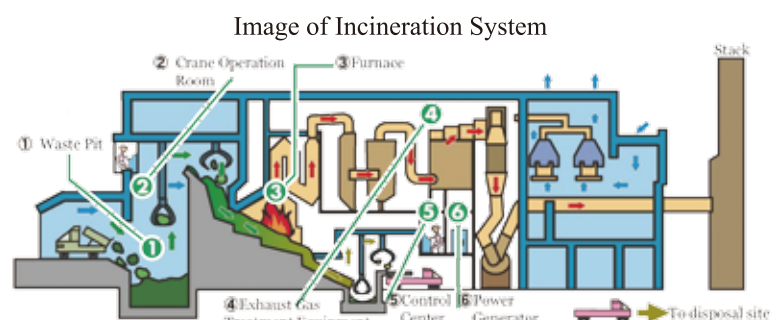
Currently, the city operates only four incineration plants handling

about 4,140 tons of waste a day due to reduced waste, a result of the widespread practice of the 3 Rs (reduce, reuse, recycle) by the public, business establishments, and the city government.

These incineration plants were designed as waste-to-energy plants and have been operated and maintained using an appropriate treatment system not only to meet international emission standards but also to recover renewable energy, thereby establishing it as environment-friendly plants. Consequently, these plants have dramatically reduced final disposal

volumes and have helped prolonging the life of landfills, in addition to reducing greenhouse gases and detoxifying or stabilizing residual ashes for final disposal.

Nowadays, the waste-to-energy scheme is widely practiced in waste disposal in Yokohama City through the development and application of modern incineration systems. This has minimized the costs of construction, operation, and maintenance and has mitigated negative environmental impact, while generating electricity from municipal waste.



Source: Resources and Waste Recycling Bureau, City of Yokohama

From Waste to Energy

Development of Waste to Energy Plants

In the early seventies, Yokohama City built seven incineration plants with capacity for power generation. As of 2013, only four waste-to-energy plants are in operation, with a total rated capacity of 4,140 tons/day for the incinerators and 78 MW for the power generators.

Waste to Energy Plant	Operation Start (year)	Plant Capacity (t/d)	Generator Capacity
Konan (demolished)	1974	900	2,800
Sakae (demolished)	1976	1,500	5,100
Hodogaya (suspended)	1980	1,200	4,200
Tsuzuki (in operation)	1984	1,200	12,000
Tsurumi (in operation)	1995	1,200	22,000
Asahi (in operation)	1999	540	9,000
Kanazawa (in operation)	2001	1,200	35,000

Source: Resources and Waste Recycling Bureau, City of Yokohama

Financial Sources for the Plants

The total cost of constructing these four plants, which have been in operation since 1984, reached JPY170.3 billion. More than 50% of this cost was covered by city bonds, followed by central government subsidy in the range of 20 to 30% and by the city's annual budget, which varied by year.

Waste to Energy Plant	Construction Cost	Central Government	Prefectural Government	City Bond	Annual City Budget
	Mil. Yen (%)	Mil. Yen (%)	Mil. Yen (%)	Mil. Yen (%)	Mil. Yen (%)
Tsuzuki	28,683 (100.0)	8,044 (28.0)	0	16,428 (57.3)	4,211 (14.7)
Tsurumi	51,778 (100.0)	12,450 (24.0)	0	27,532 (53.2)	11,797 (22.8)
Asahi	27,289 (100.0)	4,633 (17.0)	96 (0.4)	13,911 (51.0)	8,649 (31.6)
Kanazawa	62,594 (100.0)	11,030 (17.6)	47 (0.1)	43,344 (69.2)	8,173 (13.1)

Source: Resources and Waste Recycling Bureau, City of Yokohama

Amount of Incinerated Waste

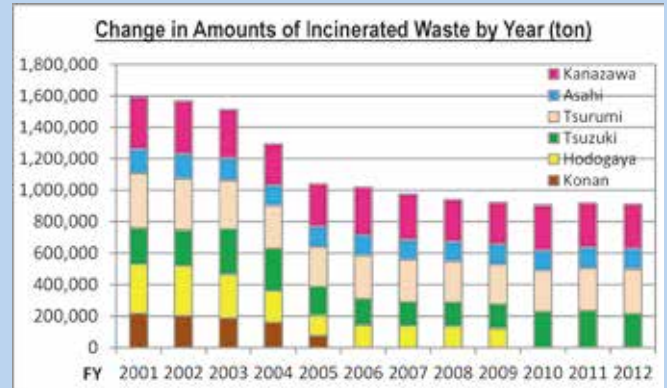
In FY2012, the amount of incinerated waste was 912 thousand tons or 2,499 tons/day, representing a 43%

Use of Technology to Build a "Future City" for Environment

Initially, the residents were concerned that the waste-to-energy plants would become sources of pollutants, especially dioxins. To assure them of the plants' safety, the city government held dialogues with residents, explaining the project in detail from the planning stage to the implementation of environmental impact assessment.

Using highly advanced technology developed in the country, the plants to this day are able to properly treat exhaust gas, fly ash, and wastewater, among others. To keep the generation and emission of potential pollutants, especially dioxins, at minimum levels, Yokohama City adopted combustion control technologies to maintain fur-

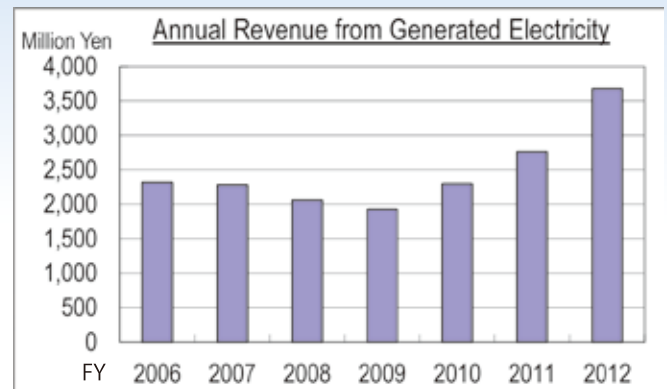
reduction from the incinerated amount of 1.59 million tons in 2001. The smaller amount of waste for final disposal has extended the life span of offshore waste disposal facilities, which started operation in 1993. From a planned life span of only 10 years, the landfill is still in service today because of the implementation of a comprehensive approach to reduce waste, which includes incineration and the adoption of the 3Rs.



Source: Resources and Waste Recycling Bureau, City of Yokohama

Revenue from Electricity

In FY2012, the total power generated by the plants reached 344 million kWh. About 115 million kWh was used in plant operation, and the balance of 229 million kWh was sold to an electric company, which generated an income of JPY3.7 billion. This amount covered a significant portion of the operation and maintenance cost of the plants.



Source: Resources and Waste Recycling Bureau, City of Yokohama

nance temperatures between 800 and 950 degree. In addition, plant operation is monitored and controlled from a central control room to maintain stability. Results of plant operation are disclosed to the public through a website.

Waste to Energy Plant	No.1 Furnace	No.2 Furnace	No.3 Furnace	Emission Standard
Tsuzuki	0.051	0.085	0.022	1 ¹
Tsurumi	0.0065	0.0011	0.004	1 ¹
Asahi	0.000035	0.00015	0.00064	1 ¹
Kanazawa	0.0000063	0.000008	0.00013	0.1 ²

Note: 1¹ for existing plant, 0.1² for new plant

Source: Resources and Waste Recycling Bureau, City of Yokohama