PWMI Newsletter

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Plastic Waste Management Institute
JAPAN

Start of a New Stage in Plastic Waste Recycling

In the plastics industry, the recycling of PET bottles has started in compliance with the provisions of the Containers and Packaging Recycling Law that went into effect in April of this year. Moreover, within three years in accordance with the targets for the new law, local governments throughout Japan will have the additional task of collecting the huge amount of "other plastics" for recycling from the year 2000.

The two types of recycling methods that are presently in use are materials recycling and liquefaction, but whether or not these two methods alone will be able to accommodate all of the "other plastics" has now become a serious problem.

For this reason, JPIF has started seven research projects which have, as their common objectives, the conversion of plastic waste into recycled products for practical use. These projects include among them the conversion of plastic waste into oil (liquefaction) and gas (gasification), into a raw material for use in blast furnace blow-in operations and in cement kiln firing operations, and into products such as "ecocement" and RDF (refuse derived fuel.)

The results of these projects will not set immediate final goals but will instead establish starting lines from which a variety of new systems will emerge in the future.

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Facilities for Recycling PET Bottles Now Operating in East and West Japan

WITH PET Bottle Recycling Co., Ltd. | Yono PET Bottle Recycling Co., Ltd.

WITH PET Bottle Recycling Plant Now in 5th Year of Operation

Until the start of operations at the new plant established by Yono PET Bottle Recycling, the plant that was launched in July of 1993 by WITH PET Bottle Recycling was the only facility in Japan for the recycling of PET bottles. Since the opening of the WITH plant, steady progress has been made there in improving recycling technologies, upgrading the quality of reclaimed products and reducing costs.

A total of approximately 9,500 metric tons of PET bottles has been delivered to the plant to date and it has assumed increasing importance in the field of PET bottle recycling as the quantity of bottles accepted has risen year after year.

The role of the plant is to wash and remove the foreign matter from baled PET bottles delivered by local governments and process the bottles into flakes of PET resin for recycling in clothing and other products.

Now in its fifth year of operation, the plant has adapted technologies that manufacture products of extremely high quality. Present plans are to maintain this level of quality while simultaneously achieving further reductions in costs.

At the same time, however, in addition to the efforts of the managers of the plant, a decisive factor in achieving cost cuts and other favorable progress in the recycling of PET bottles is whether or not a sufficient quantity of collected bottles can be secured.

Year	Quantity (metric tons)
1993	518
1994	1,365
1995	2,511
1996	3,738
1997	1,341 (through April)

WITH PET Bottle Recycling plant

Two separators employ X-ray technology to segregate PVC bottles during the sorting process (right and left)

The PET flakes are cleaned by an alkali-based detergent during the washing process

According to Yasuo Tomizawa, president of WITH PET Bottle Recycling Company, smooth operations in the recycling of PET bottles in the future are entirely dependent upon constant increases in the recovery rate.

A new state of affairs now exists in activities related to the recycling of PET bottles since the bidding system introduced under the provisions of the Containers and Packaging Recycling Law in April of this year have encouraged new businesses to participate in the industry. Nevertheless, in view of the processing capacity of the WITH plant, it cannot be said that the recovery rate has yet reached a satisfactory level.

The keys to the plant's future activities and to PET bottle recycling in Japan are a still higher level of social awareness of the importance of recycling on the part of the public as well as a higher recovery rate for PET bottles through the cooperation of local governments and private citizens.

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In January of 1993, WITH Waste Japan Co., Ltd., a general waste processor, and a business partnership made up of 19 members from the PET Bottle Council established a joint venture for the recycling of PET bottles. The recycling plant was completed and started operations in July of the same year.

The Containers and Packaging Recycling Law that became effective in April of 1997 prompted the starting of still more intensive efforts to recycle PET bottles and convert them into reclaimed products. In the same month, a new plant was completed and placed into operation by Yono PET Bottle Recycling Co., Ltd. to become the base for the recycling of PET bottles in the Kinki, Tokai and Hokuriku regions. This facility marks the creation of a two-site system for recycling operations that now covers both East and West Japan. The following article describes the present situation at these two recycling strongholds.

When specified by the customer,extruders convert flakes into easy-to-process pellets for use as raw materials in reclaimed products

After the PET bottles have been washed, sensors automatically detect and sort the colored bottles

Yono PET Bottle Recycling Provides Base of Operations in West Japan

Yono PET Bottle Recycling Co., Ltd. started operations at its new plant in Iga-cho, Mie Prefecture in April of this year.

The installation is on a site that has an area of 12,770 m² and its buildings occupy an area of 6,214 m². Facilities are provided for the storage of raw materials, pre- and post-treatment processes, extrusion processes, the storage of products and the treatment of wastewater. The plant has an annual processing capacity of 8,000 metric tons.

While reference was made to the Kanto Plant that had been previously built by WITH PET Bottle Recycling as an example in the design stage, the major feature of the Yono Plant is the improved accuracy in the removal of foreign matter that has been achieved through the incorporation of many new types of leading edge equipment. Other features include:

- Savings in manpower: Many sensors have been introduced to permit a single operator to sort all of the colored bottles.
- Two-stage crushing process: Initial rough crushing is followed by final crushing that reduces the size of the product to 8 mm.
- Superior flake sorting: Gravity separation is employed to assure greater accuracy.
- Improved operational efficiency: Recovered bottles are transported from the pit and deposited into the direct process by a conveyor system.
- Effective washing procedures: Emphasis has been placed on the importance of thoroughly washing the bottles and the flakes.
- Improved purity: The use of extruders to produce pellets enhances the purity of the product.
- Wastewater treatment: The circulating water that is used for washing is treated in the final stage prior to disposal.

Yono PET Bottle Recycling plant

Yono PET Bottle Recycling Company, which was formed by a group of six organizations involved in the PET bottle industry, plans the gradual building of new recycling plants so that recycling capacities will neither exceed nor fall short of the quantity of sorted collections of bottles received from local governments and other sources in the years to come. The company's fundamental policy is to be prepared to recycle the 30% of the total quantity of disposed bottles that is expected to be recovered ten years from now.

In accordance with this policy, operations at Yonos' first plant for the recycling of PET bottles have started in a manner that is concomitant with the enforcement of the Containers and Packaging Recycling Law. The establishment of this plant means that a two-site system with strongholds in both East and West Japan has now been prepared to accept recovered PET bottles for recycling from all over the country.

It is hoped that the recycling of PET bottles will proceed smoothly in the future through the higher recovery rates that can result from promotional efforts by local governments and private citizens to bring about a better public understanding of the common recycling problems that face society.

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Yono PET Bottle Recycling Co., Ltd. was established in March of 1996 by six organizations in the PET bottle industry with the objective of becoming a for-profit business in keeping with the spirit of the Containers and Packaging Recycling Law. The founding members are led by R & D Engineering Co., Ltd. and the other participants are the National Soft Drink Industry Association, the PET Bottle Council, the Federation of Fruit Juice Agricultural Cooperatives of Japan, the Japan Soy Sauce Association and the Liaison Council for PET Bottles for Alcoholic Beverages. Construction of the company's first plant started in August of 1996.

Development of Ecocement Enters Stage of Practical Use

Hiroshi Obana
Deputy General Manager, Ecocement Program
Chichibu Onoda Cement Corporation

A Construction Material Produced from the Incinerated Ash of Municipal Solid Waste

In the world's first development of its kind, "Ecocement" which is a construction material for civil engineering applications that has been produced from incinerated ash from municipal solid waste, treated sewage sludge, plastic waste, etc., has been placed into practical use.

The disposal of the growing amount of incinerated ash from burned refuse has become an increasingly serious problem in Japan in recent years. Changes in the surrounding environment and other factors have made it difficult to secure final disposal sites. In addition, legislative amendments have now made it impossible to bury fly ash that has been collected in dust collectors until it has been treated to detoxify it.

Under these circumstances, a means of treating fly ash, other than by burying it in landfill was urgently required, and a plan for an Ecocement experimental plant emerged from the concept of recycling refuse into a useful resource.

Summary of Planning for Experimental Plant

Planning for the Ecocement experimental plant started at the beginning of fiscal 1993. Chichibu Onoda Cement Corporation served as the organization that initiated research themes relating to

Ecocement experimental plant.


Concrete product made of Ecocement. As Ecocement contains chlorine, it is used for nonferro-concrete products, soil stabilizers, etc.

Ecocement and an affiliate, Mikawa Onoda Cement Corporation, constructed the experimental plant (with a production capacity of 50 MT/day) at its site in Aichi Prefecture. Verification tests were carried out with the target of having Ecocement in practical use within a five-year period ending with the close of fiscal 1997.

Research was performed on (1) establishing technologies for producing cement on a long-term basis, (2) obtaining an understanding of the composition, compression strength and other physical properties of the cement produced and then improving these characteristics, and (3)developing methods to treat waste gases and other measures to protect the environment.

The raw materials required to produce 1.0 tonne of Ecocement are approximately 500 kg of incinerated ash (generated from 5.5 tonnes of municipal solid waste), 300 kg of treated sewage sludge, and 300 kg of filler materials. Clinker is produced when these raw materials are subjected to crushing and firing processes; Ecocement is produced when gypsum is added to the clinker.

Trouble-free Processing of Chlorine-based Plastic Waste

The most troublesome problem in the verification experiments was the presence of chlorine in the incinerated ash from municipal solid waste, since it was anticipated that the use of chlorine as a raw material in cement would pose difficulties with regard to the strength of the cement. It was also thought that the chlorine would cause rust in ferrous metals used to reinforce structures built with such concrete and that shutdowns would be caused in the machinery used in the cement production process, since the raw material would clog the equipment during the high temperature firing stage.

For these very reasons, the presence of chlorine is one of the most severe problems that is also faced in the recycling of industrial waste. Pre-treatment is necessary at present to remove the chlorine from materials that contain it before the materials can be processed in many other types of recycling systems.

In the Ecocement experimental plant, however, all of these problems have now been fundamentally solved by using a system that has been created to accept all of the incinerated ash from municipal solid waste

as it is without the need for complicated pre-treatment operations. It can be said that this represents a system which can accept and is resistant to materials containing chlorine, and that Ecocement is thus a development that will bring good news to the entire plastics recycling industry in the future.

The Use of Chlorine with Extracted Heavy Metals

Small amount of heavy metals are also contained in the incinerated ash from municipal solid waste and it is necessary to remove these components during the production process for cement. Here, it is necessary to add chlorine to the heavy metals when removal of them is required, and plastic waste that contains it can thus serve as a secondary source of this element.

While most types of plastic waste can be recycled and used as fuel in cement plants, it can be said that the positive utilization as a supplementary source of chlorine, as mentioned above, is a unique feature of the Ecocement production process.

Local Governments Show Great Interest

The success of the Ecocement experimental plant has attracted intense interest from local governments throughout the country since all of them are concerned about the problem of handling increasing amounts of incinerated ash. Approximately 75% of the municipal solid waste in Japan is presently treated by incineration, but governmental studies are now under way at both the national and local levels on the construction of Ecocement plants to serve as a new auxiliary measure to dispose of waste. It is anticipated that the building of such plants will begin in the near future, starting with facilities in the large metropolitan areas.

Since Ecocement contains chlorine, it is thought that its immediate applications will be in nonferro-concrete products, soil stabilizers, etc. Since the present annual demand for nonferrous concrete is of the order of 6,300,000 metric tons, it is clear that the amount of incinerated ash generated from municipal solid waste is more than adequate for the size of the market. In addition, it is possible to use large amounts of Ecocement in tetrapods, artificial reefs that serve a gathering places for fish, and in other concrete products for marine applications.

What is Ecocement?

Ecocement is a cement that is produced from the composition of raw materials resulting from the addition of limestone to ash generated by the incineration of municipal solid waste and sewage sludge that has been treated and dried. One of the features of Ecocement is that its hardening time is shorter than that of ordinary cement. Since chlorine is one of the components in Ecocement, it is expected to find use in fields such as nonferro-concrete products, etc.

Cutting fuel costs has also become an important issue, since the production of cement requires the consumption of large amount of energy. The utilization of industrial waste as a fuel is among the technologies that have been developed for the purpose of achieving such reductions. The development of Ecocement adds to this economic objective by combining it with the disposal of incinerated ash from minicipal solid waste in a way that contributes to the benefit of society.

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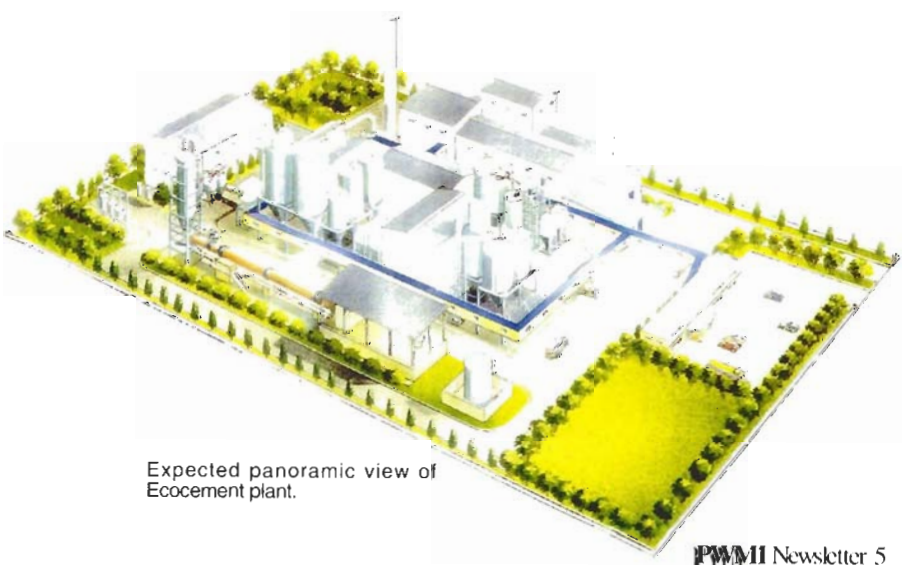
The construction of an Ecocement production plant

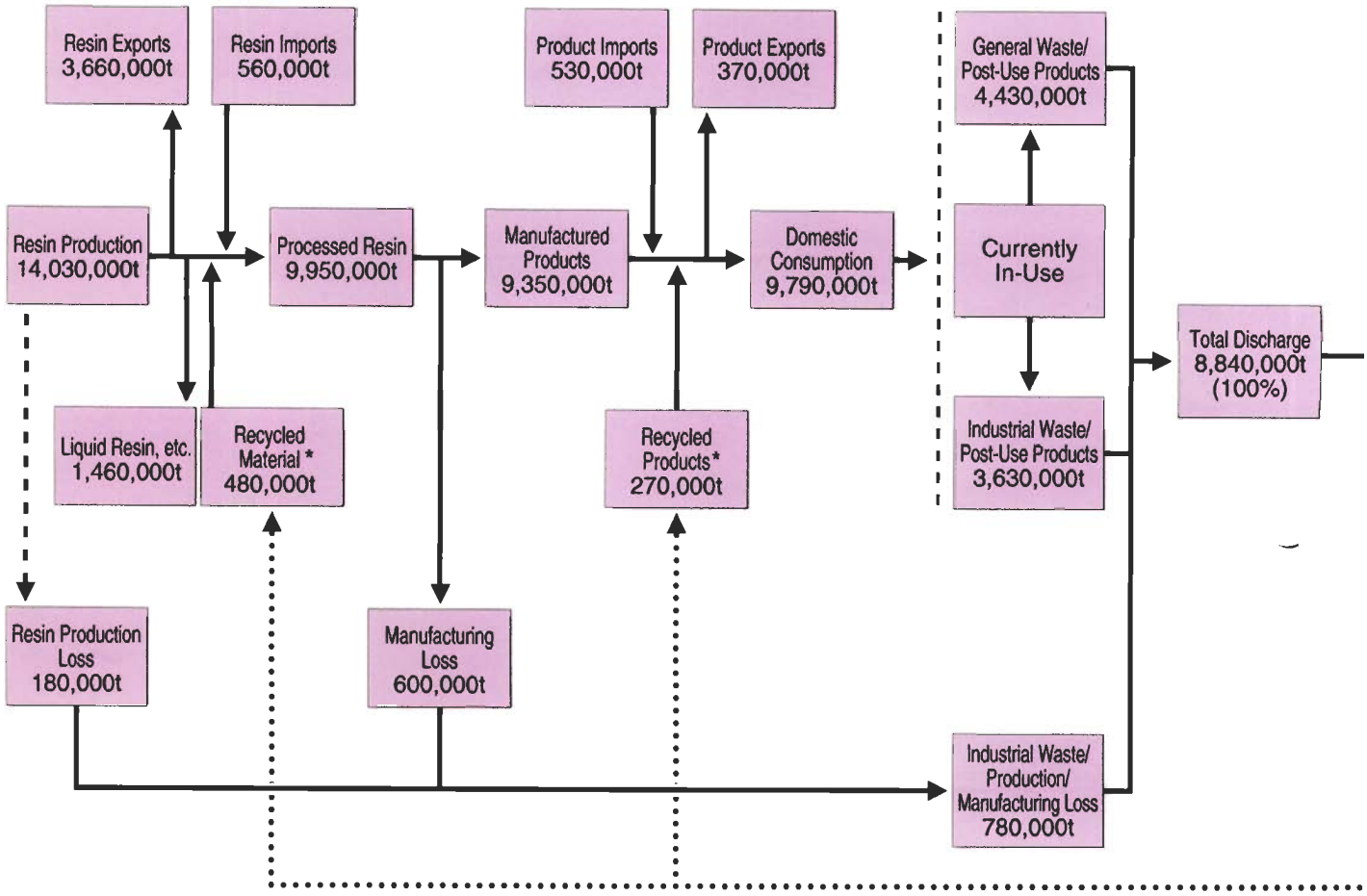
According to a newspaper report on July 8, the 31 cities, towns and villages in Tokyo's Tama district will jointly undertake the construction of an Ecocement production plant. This plant will use the 130,000 tons of incinerated ash generated annually in this area as raw material.
The plant will cost about ¥20 billion (US$175 million) and is expected to begin operation in 2001. Production technology has already been confirmed as effective by a project of the New Energy And Industrial Technology Development Organization (NEDO) participated in by the Chichibu Onoda Cement Corporation and other companies.
Manufactured products will be sold by the cement companies operating the plant.

Ecocement is cement that is produced by the fly ash, sewage sludge, pastic waste, etc.
Chlorine in Ecocement has the effect to shorten hardening time.

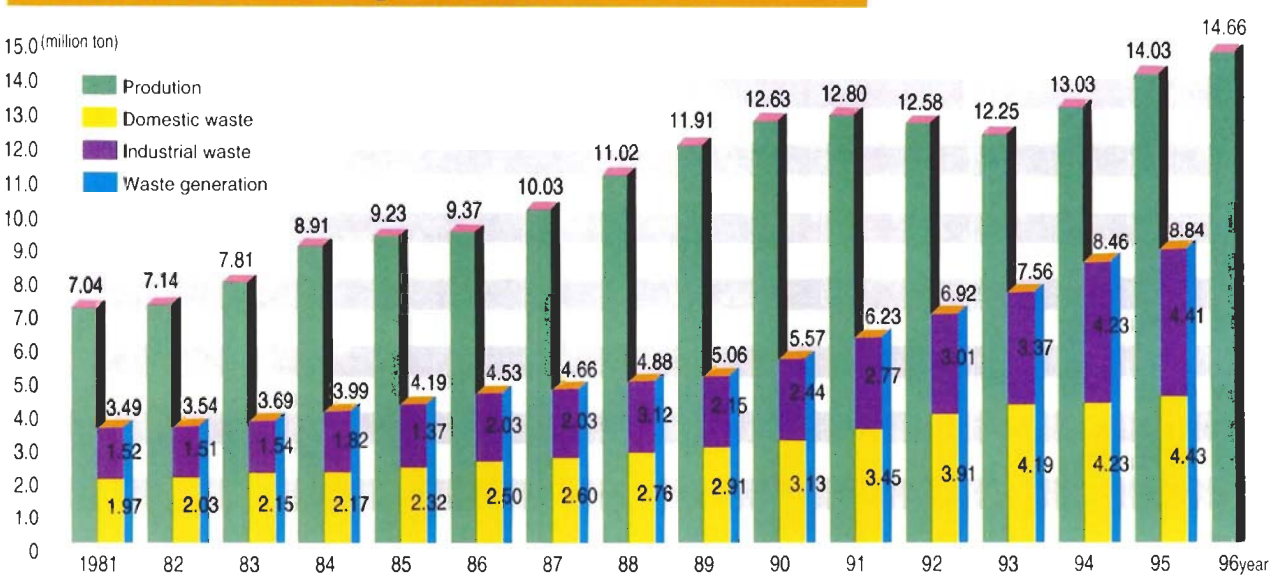


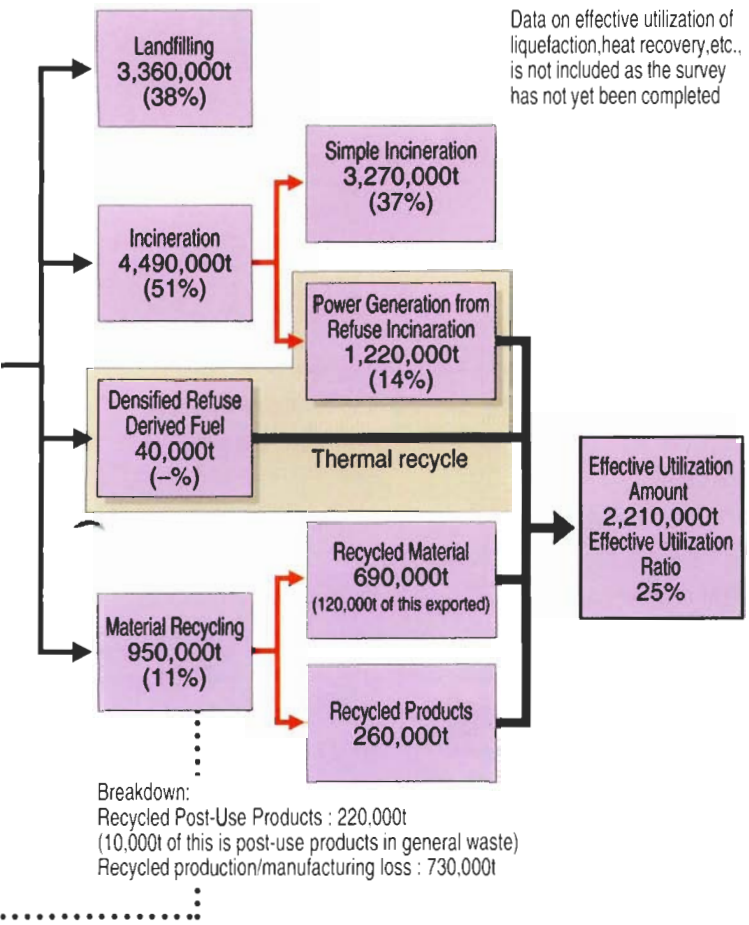
Expected panoramic view of Ecocement plant.

Flow of plastic products, waste materials,and resource recovery (1995)



Production and Waste generation of Plastics





Material Recycling for 11% of Plastic Waste

Plastic waste is made up of articles that become waste as soon as they are used, such as wrapping films for food, and articles that become waste only after they wear out after many years of use, such as durable consumer goods. Because of this, there is a time discrepancy between the production of plastics and the disposal of plastic waste. When looked at in terms of a year of time, in recent years the amount of waste annually has been equal to approximately one half of the amount of the year's production.

In Japan, 51% of the plastic waste is treated by incineration, 38% of it is landfilled, and 11% is processed by material recycling. Material recycling is generally divided into processes that melt the plastic waste and produce products in different forms, and processes that produce the reclaimed raw material from the plastic waste.

Plastic Waste Also Recoverable in the Form of an Energy Resource

Plastic recycling rates are low for mixtures of many types of plastics, since batch recycling processes cannot be performed. The use of recycling therefore tends to be limited to those industrial fields in which easy-to-sort products are manufactured.

In the two types of plastic recycling, the effective utilization rate is 11% for material recycling, in which waste is returned in the form of the reclaimed plastic, and recycling that converts waste into various types of thermal energy, including 14% that is used for electric-power generation. From this, it can be said that the overall effective utilization rate is at least not less than 25%.

And it is expected that the amount of plastic waste recycled for use as an energy resource will further increase in the future.

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Trade Associations

Japan Petrochemical Industry Association
Japan PVC Association
Japan Plastics Industry Federation

Supporting Members

Japan PET Bottle Association
Japan Expanded Polystyrene Recycling Association
Japan Polystyrene Foamed Sheet Industry Association
Japan PVC Environmental Affairs Council
Japan Urethane Industries Institute

VIDEO VIEW

A More Comfortable Lifestyle with Energy from Burning Refuse

25-minute-long videotape now being lent out free of charge

The Plastic Waste Management Institute (PWMI) has prepared a videotape that contains an introduction to the subject of how useful the recycling of waste can be in our daily lives. It is now being lent free of charge to those who wish to view it.

The video, which is entitled "For a Life of Ease—Energy from Burning Refuse," presents numerous examples of facilities that depend on energy from incinerated waste, such as heated swimming pools, regional heating systems, and tropical botanical gardens, in addition to many types of recycled products. The objective is to heighten the interest and concern of viewers in the problems involved in the disposal of waste.

After being used by society and households, plastics which are derived from petroleum are disposed of and then become a form of waste. However, it is possible to utilize this plastic waste as an energy source to substitute for petroleum by converting it into so-called "domestic oil."

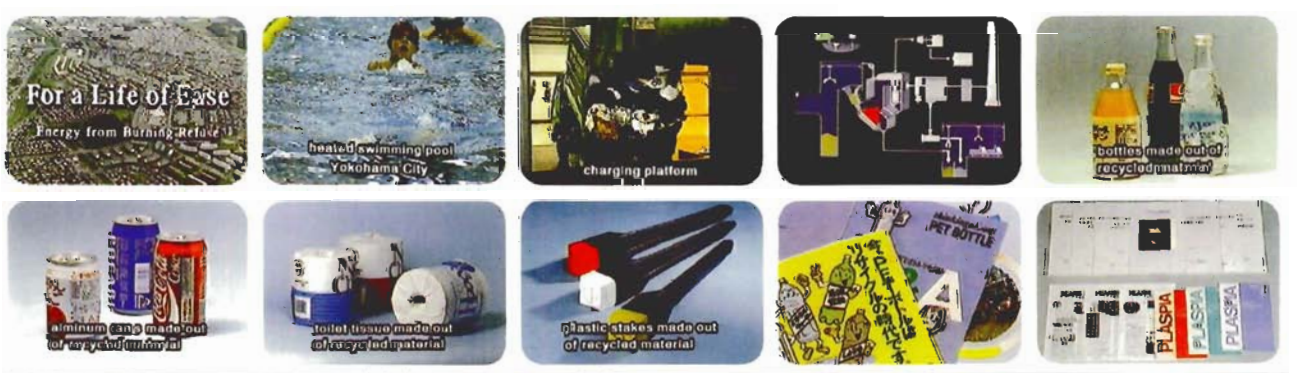
In addition to plastic waste, are there effective ways to use all of the other types of waste? How are wastes being treated today? How can waste incinerators be used to maintain a clean environment? Easy-to-grasp answers and explanations for these questions and problems are given in the video.

PWMI, the producer of the video, has provided the following explanation of its aims.

"There is now a shortage of sites for the final disposal of the increasing amounts of waste that accompany the improvement in our living standards. The goal of this video is to deepen the concern of large numbers of people about the subject of waste management. It is hoped that the video will serve as a guide in accelerating progress toward this end."

"We also hope that 'For a Life of Ease—Energy from Burning Refuse' will be increasingly used as one means of contributing to the solution of the waste problem."

The video won a prize for superiority in the category of science, technology and industry at the 39th festival for movies and videos that are based on subjects that provide an introduction to Japan.



This video is now being lent out at no charge. Those who wish to see it may apply to PWMI by fax:
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