

PWMI Newsletter

SPECIAL ISSUE

NO 9 1995.4



Plastic Waste Management Institute

Means to Promote Advances in the Recycling of Plastic Waste

Past PWMI Efforts and Future Plastic Recycling Projects

A Proposition for Recycling and Volume Reduction of Municipal Solid Waste

The year of 1994 will probably be recorded as the one in which the first giant step forward was taken in regard to the construction of practical plastic recycling systems in Japan as well as the establishment of several basic principles for use in determining recycling methods.

In May of 1994, a Proposition for Recycling and Volume Reduction of Municipal Solid Waste was adopted at the Committee for Study on Plastic Waste Recycling, which was chaired by Keiichi Higuchi, a Managing Director of Mitsubishi Chemicals Corporation. At the Committee, which was participated in by plastics manufacturers and processors, representatives from the Ministry of International Trade and Industry, and other concerned parties, various problems pertaining to plastic waste were placed under scrutiny and it was decided that it would be necessary in the future to form a social consensus on such matters as (1) the establishment and support of markets for reclaimed products, (2) the economies of recycling, and (3) the sectors which should bear the responsibility for the recycling operations and/or shoulder the burdens of the costs incurred.

Material Recycling and Thermal Recycling

At the Committee, the fundamental concepts expressed in respect to plastic recycling had to do with (1) material recycling, in which plastic waste is converted into a resource in the form of reclaimed plastics and (2) thermal recycling, in which plastic waste is incinerated and converted into a resource in the form of energy. Flexibility was recommended so that a choice of either of the two methods might be selected in accordance with the conditions of a specific situation.

In the future, in order to promote the construction of practical recycling systems, it is anticipated that major problems will be encountered, e.g., the matters of deciding which sectors should be responsible for the recycling operations and/or which parties should cover the costs incurred by such operations.

At the Committee, in regard to the sectors which should perform recycling, it was decided that the consideration of minimizing social costs was a prerequisite and that this matter should be considered to be separate from the expenses involved in the operations.

In addition, in regard to the burden of expenses, it was deemed appropriate that the basic principle should be that refuse collections should be made by local governments as well as distributors and that the expenses for recycling treatments should be borne by those who discharge the waste. (Please see the related article on page 3.)

PWMI REPORT

PWMI Operational Plan for FY 1995

Budget : ¥693 million (\$7.7 million) (FY 1994 budget: ¥600 million /\$6.7 million ; at 1\$=¥90)

Operational Policy

PWMI plans to promote material recycling and thermal recycling primarily by launching operations that will bring to fruition the Proposition for Recycling and Volume Reduction of MSW that was adopted at the Committee for Study on Plastic Waste Recycling that was held in May of 1994.

Promotion of Thermal Recycling

To promote thermal recycling (pyrolytical production of oil from waste plastics), PWMI is managing the Thermal Recycle Project (Oil-from-Plastics Project). This project consists of the following activities:

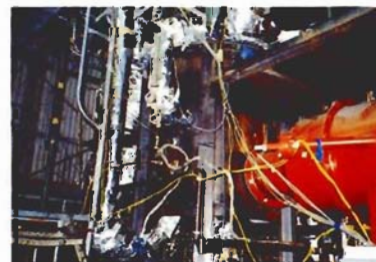
- Developing state-of-the-art technology for the pyrolytical production of oil
- Constructing and operating model plants

- Establishing an appropriate social system for speeding up the use of reclaimed (recovered) oil, etc.

Development of Next-Generation Technology

Development of next-generation technology subsidized by MITI for the pyrolytical production of oil from municipal waste plastics is planned to begin in 1995. The main object of this development work is to establish a refined process to handle a variety of plastics as feedstock to the plant.

In FY 1995, for example, this financial aid will make up ¥160 million (\$1.78 million) of the total budget of ¥240 million (\$2.67 million).



Organizations Cooperating with PWMI in Matters Relating to the Recycling of Plastic Waste

Japan PET Bottle Association

Fukide Bldg., 4-1-13 Toranomon, Minato-ku, Tokyo 105, Japan
Tel: 81-3-3437-2257 Fax: 81-3-3437-1313

Japan Expanded Polystyrene Recycling Association

Fax Bldg., 6th Floor, 2-20 Sakuma-cho, Kanda, Chiyoda-ku, Tokyo 101, Japan
Tel: 81-3-3861-9046 Fax: 81-3-3861-0096

Japan Polystyrene Foamed Sheet Industry Association

Tokon Bldg., 26 Higashi Konya-cho, Kanda, Chiyoda-ku, Tokyo 101, Japan
Tel: 81-3-3257-3334 Fax: 81-3-3257-3339

Japan PVC Recycle Promoting Council

Iino Bldg., 2-1-1 Uchisaiwai-cho, Chiyoda-ku, Tokyo 100, Japan
Tel: 81-3-3601-2010 Fax: 81-3-3506-6487

Activities of PWMI's Recycling Research Society

Aiming at the Creation of Optimal Recycling Systems

Toward the Realization of the Recycling of Plastic Waste

The establishment of methods and distribution channels for both thermal and material recycling represents a most effective way to access the recycling society of the 21st century.

PWMI's Research Society has been inaugurated with the goal of studying concrete concepts to realize the Proposition for Recycling and Volume Reduction of MSW. Two task forces have been set up within the Society to accomplish this objective.

One conducts research on thermal recycling, which recovers energy from plastic waste; the second performs studies on material recycling, which recovers and reclaims resins for recycling as raw materials.

These two teams constantly engage in energetic research activities aimed at the perfection of new methods by which to develop optimal systems for their respective recycling operations. (Please see the related article on page 1.)

Task Force for Thermal Recycling

The task force for thermal recycling has as its target the development of methods for incinerating plastic waste and reclaiming resources in the form of energy. This team is presently engaged in studies on the following subjects:

1) The receiving of reclaimed products by business operators

These studies focus on problems encountered when business operators are asked to receive oil produced through pyrolysis, solid fuels, and other reclaimed products generated by thermal recycling.

2) Encouragement and support for business operators who handle reclaimed fuel

These studies aim at ways to encourage business operators to

handle reclaimed fuel and assist those who do. To perform these activities, the "Organization for the Development and Promotion of Recovered Fuel Business" (tentatively titled) is planned.

3) The implementation of a model business for oil produced by pyrolysis

These studies are directed at achieving a business that can serve as a model case of a system which has thermal recycling as its core and produces oil from pyrolysis.

4) Additional

Studies are also being carried out on the effective use of equipment for industrial waste treatment. And developmental work is also progressing on related technological systems, such as those for powdered fuels and slurried fuels.

Task Force for Material Recycling

The task force for material recycling has as its target the establishment of methods of reclaiming resources of plastics from plastic waste. This group is presently performing studies on the following subjects:

1) Understanding the loop of social costs

An attempt is being made to understand the loop of social costs, which can be thought to be the greatest problem involved when converting plastic waste into reclaimed resources.

2) Diversified recycling selectability

Investigations are being conducted on the position that each type of plastic occupies when its effect on the environment is evaluated. These studies are designed to provide a diversified range of recycling selectability.

3) Assistance to industrial circles

Studies are being made on ways that PWMI can support related industrial circles.

4) New projects

Studies are underway in respect to new projects that might be launched in the future.

Inauguration of PET Bottle Recycling

Japan PET Bottle Association

WITH Waste Japan Co., Ltd.

Recycling Operations Started at Plant with an Annual Capacity of 8,000 Metric Tons

Recycling operations were launched for the first time in Japan in the summer of 1993 for the PET bottles that are popularly used by consumers throughout the world.

WITH PET Bottle Recycling Plant

The recycling plant, which was jointly funded by the Japan PET Bottle Association and WITH Waste Japan Co., Ltd, was constructed in Tochigi Prefecture by WITH PET Bottle Recycling Co., Ltd. and is presently performing recycling operations on bottles that have been collected by local governments from throughout the entire Kanto District.

The recycling plant was built in the Nishi Tsuboyama Industrial Park in Minami Kawachi-cho, Tochigi Prefecture on a land area of approximately 19,000 square meters and at a total construction cost of some ¥3 billion. The facility can carry out recycling operations on some 8,000 metric tons of PET bottles per year.

The PET bottles that have been collected in the Kanto

District are sorted, washed, pulverized, dried, and then shipped in the form of flakes in 500-kg-capacity flexible containers.

The flakes can then be used as a raw material for textile products, molded products, industrial parts, etc.

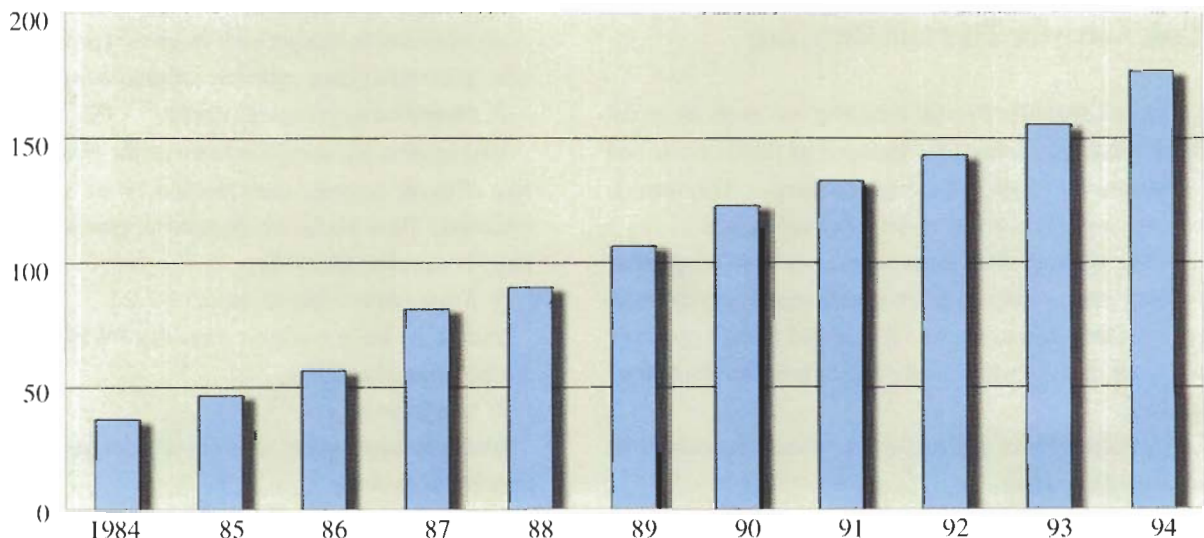
The Japan PET Bottle Association and the Japan Recycling Business Partnership for PET Bottles plan to take full advantage of the success of this recycling operation for the Kanto District and will cooperate in the future with local governments and consumers in all relevant fields in a vigorous effort to perfect new recycling technologies, provide pertinent information, and perform developmental work.

WITH PET Bottle Recycling Plant



DEMAND FOR RESIN FOR PET BOTTLES IN JAPAN

Unit: 103 Metric tons



EPSY PLAZA 200 Plan

Recycling Operations Advanced by the Japan Expanded Polystyrene Recycling Association [JEPSRA]

Network Completion and Recycling Plan

The Japan Expanded Polystyrene Recycling Association is promoting operations for reclaiming resources from expanded polystyrene (EPS), which was used as a packaging buffer and containers for transporting fish, etc., and is making progress with the JEPSRA EPSY PLAZA 200 Plan, which envisions the installation of recycling "operational strongholds" at strategic locations throughout Japan.

In 1994, the amount of EPS that was reclaimed in the form of resources was approximately 39,000 metric tons and this is thought to represent about 24% of the total amount of EPS that was distributed throughout Japan during the year. JEPSRA has targeted a raise in the resource-recovery rate to 25% by the end of 1995, and an increase in the number of recycling locations (EPSY PLAZAs) is indispensable to the achievement of this goal.

At present, there are 70 "operational strongholds" in Japan, but this number must be increased to 113 in order to attain the 25% target. Moreover, a total of 257 EPSY PLAZAs will be required when intermediate locations, at which the EPS is

temporarily stored, and information service centers, at which information on the treatment of EPS is provided, are included.

Since EPS can yield heat in amounts that are on the order of those contained in heavy oil, the outlook for heat-recovery operations from recycling treatments appears to be full of promise.

The Association has also launched a "Thermal Project" in order to promote the realization of the EPSY PLAZA 200 Plan in a concrete form. The first heat-recovery EPSY PLAZA is already on-stream in Maebashi City, Gunma Prefecture, and facilities are also in operation in Chitose City, Hokkaido and in Kawakita-cho, Yamagata Prefecture.

Financial Assistance to Promote Recycling

Another activity being carried out by the Japan Expanded Polystyrene Recycling Association is providing funds for the installation of compacting machines at wholesale market places. The objective of this funding is to promote the recycling of containers used for fish, fruit, etc., and has been given at 47 locations to date.

The EPSY PLAZA



Promoting the Development of Technology for Producing Oil from Plastic Waste

Japan Small Business Corporation
(Okegawa City)

Recovery of Petroleum from Municipal Solid Waste

We are now entering the practical stage in the development of recycling technologies (techniques for liquefaction by pyrolysis) by which waste plastic can be returned to its primary petroleum origins and used as a form of energy.

In Okegawa City, Saitama Prefecture, the Japan Small Business Corporation in cooperation with private enterprises (Nippon Steel Corporation, Fuji Recycle Industry K. K., and Shinagawa Fuel Co., Ltd.), has completed the experimental stage of a project to produce oil from the waste plastic contained in municipal solid waste that was carried out over a three-year period beginning in 1990.

At present, the experimental facilities are on loan from the Japan Small Business Corporation and ongoing research and development activities are in progress with the objective of improving the performance and quality of the recovered oil.

The experimental equipment in use first performs a pre-treatment process, in which the plastic refuse is compacted, washed, and dried after all of the metals, glass bottles, wood, and other foreign matter has been removed from it. Following this, a second process is performed in which the oil is produced by pyrolysis after the hydrogen chloride that is generated from the PVC in the plastics has been removed.

Enthusiasm of Local Governments

The major features of the oil-producing technology developed by the Japan Small Business Corporation include:

1) High-quality oil composed of fractions of gasoline, kerosene, light oil, etc. can be obtained since decomposition is performed in two stages, i.e., by pyrolysis and by catalytic cracking that employs a catalyzer.

2) The hydrogen chloride that is generated from the PVC in the plastics is washed, neutralized, and made harmless. In addition, a dechlorinating tank is provided to prevent the impregnation of chlorine compounds into the oil that is produced.

This new oil-producing technology is attracting great interest from local governments and circles concerned with industrial wastes since it makes possible the recycling of plastics containing PVC and can also be employed for the types of plastics found in municipal solid waste, as it provides the solution to the problem of removing foreign matter that had been difficult to achieve by earlier methods of treatment.

Any type of plastic contained in municipal solid waste can be treated by the plastic waste liquefaction experimental equipment developed by the Japan Small Business Corporation in Okegawa City, Saitama Prefecture.



Densified Refuse Derived Fuel (d-RDF) from Plastic Waste to Contribute to the Welfare of the Elderly

Matsudo City, Chiba Prefecture (Public Cleansing Department)
Sakata Construction Co., Ltd. / Dynamic Ocean Co., Ltd.

Leading the Way in Separated Waste Collection

A system developed jointly by the Public Cleansing Department of the Matsudo City government, Chiba Prefecture, and two private companies will use plastic waste to assist welfare activities for the elderly. The system will recycle plastic waste into d-RDF for boiler operations. The high-temperature steam generated by the boiler will then be used to wash and dry linen items used by elderly citizens.

Matsudo City, a city which has long implemented a separate collection for plastic waste, presently requests its citizens to separate waste under five different categories for collection: recyclable, combustibles, non-combustibles, bulky, and noxious waste. The new system will separate non-combustible waste into further categories, with macromolecular waste to be recycled as fuel at the Higurashi Clean Center, a facility reconstructed especially for this purpose.

The Higurashi Clean Center was completed in 1988 at a cost of ¥1.5 billion. It was not until 1992, however, that fuel generation operations were commenced, when a system that crushes and sorts waste plastics, compresses the plastics using a compacting machine, and makes the raw material for d-RDF (fluff) was introduced.

This system was jointly developed by the Public Cleansing Department of the Matsudo City government and two private companies, Sakata Construction and Dynamic Ocean, and will process 6,000 tons, or approximately 1/3 of the macromolecular waste generated by Matsudo City every year.

D-RDF to be Used as Boiler Fuel

The fluff generated by the above process will be sold to Sakata Construction to be transformed into d-RDF at their fuel plant. This d-RDF will be used as an energy source to run boilers and generate steam. The generated steam will then be sent to an adjoining cleaning plant, and will be used to wash diapers and other items used by the elderly. The hot air produced will also be used to dry the washed linen.

Dynamic Ocean is overseeing the overall design of this

system, and will take charge of management when the system is introduced.

This system is attracting much attention as a revolutionary experiment by a local government, with the cooperation of private companies, to use plastic waste as a source of thermal energy to contribute to the welfare of elderly citizens.



D-RDF becomes boiler fuel at the cleaning plant (top). The steam generated by the boiler is then used as a heat source for such operations as washing.

Using Refuse as Fuel for Thermal Power Plants

East Cleaning Cooperative of Saitama Prefecture



24,000-kW Plant to be Japan's Largest

The East Cleaning Cooperative of Saitama Prefecture is proceeding with the introduction of a system that will generate electricity and provide heat to surrounding areas by taking advantage of the opportunity presented by the necessary reconstruction of a superannuated refuse incineration plant. A total of approximately ¥40 billion has been invested in the project. As of this writing, trial operations of the system are set to begin in April of 1995.

In 1965, a project was started by the Cooperative with the goal of preserving the living environment and improving public sanitation in Koshigaya City, Soka City, two other cities, and two towns that lie within 25 kilometers of the heart of Tokyo.

Since all six of these cities and towns serve as "bed towns" for Tokyo, the population of this area is continuing to increase even today, and recent changes in life styles have led to corresponding changes in both the volume and composition of municipal solid waste.

The refurbished plant will have the capacity to treat 800 metric tons of refuse per day (200 metric tons in each of its four sections). The river water that will be used to cool the plant, dilute night soil, etc., will be purified in equipment that has a capacity of 8,400 m³ per day. The drying facilities for night soil sludge can handle 30 metric tons per day and the system for caking ash will be able to treat 50 metric tons per day.

In addition, the plan calls for the provision of two 12,000-kW-capacity steam-driven, power-generating turbines that will generate electricity by using all of the steam that can be produced by the incineration of refuse.

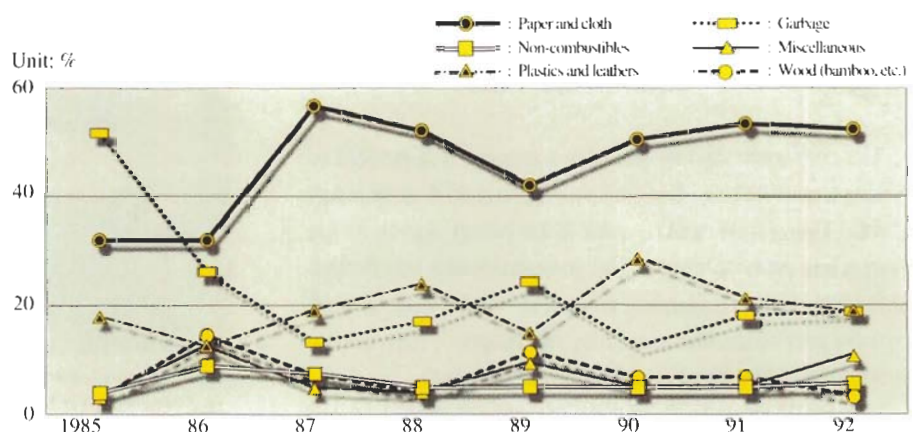
Along with its work in improving the refuse treatment facilities, the Cooperative has taken into account the latest advances in new materials technologies to employ for the first time previously non-existent super-heater materials that make possible the utilization of high-temperature, high-pressure steam for the generation of electric power from municipal solid waste.

Furthermore, after the electricity has been generated, the temperature of the steam from the turbines (saturation temperature: 60°C) will be raised by heat pumps to 80°C and the heat will be supplied to a nearby municipal hospital, a public gymnasium, a soon-to-be-built heated swimming pool, a tropical botanical garden, and other facilities.

A Heat Supply for Nearby Facilities

Since the new facility is situated in a metropolitan area that serves as a "bed town" for Tokyo, there are no plants in the vicinity from which the demand for large amounts of heat can be anticipated. For this reason, the Cooperative concluded that its best choice would be to convert heat into easy-to-handle electricity, the demand for which is expected to expand on a long-term basis.

YEAR-BY-YEAR CHANGES IN THE COMPOSITION OF MUNICIPAL SOLID WASTE (East Cleaning Cooperative of Saitama Prefecture)



High-Tech Stakes from Waste Plastic

RIPRO Co., Ltd.

"Information stake systems" that employ the high technology imbedded in plastic waste are attracting a great deal of attention.

As a leading enterprise engaged in the production of stakes made of waste plastic that serve to mark surveyed boundaries and the positions of buried objects, RIPRO Co., Ltd. develops systems that act like entries in the memory by recording various kinds of vital information. RIPRO is a pioneer in markets which cover a wide range of applications that includes everything from facilitating accurate surveys of land area to marking the positions of underground lifelines such as gas pipes, water mains, cables, etc.

Since the stakes were developed and placed on sale in June of 1994, numerous inquiries have been received from the national and local governments, electric power companies, gas companies, and other interested parties. Personnel in charge of

development and sales have been busy carrying demonstration machines throughout Japan.

These stakes provide permanent "underground information" accurately, efficiently, and economically. And they can also play an important role in the quick repair and return-to-service of underground lifelines in the event of earthquakes or other disasters.



Transforming Waste Magnetic Tape into Adiabatic Panels

Fuji Kasei Kogyo Co., Ltd.

Fuji Kasei Kogyo Co., Ltd. has developed adiabatic panels for architectural use by utilizing as raw material the end scraps and other segments of waste magnetic tape that are produced during the tape manufacturing process. The panels are said to possess good sound-absorbing and electromagnetic wave characteristics.

Fuji Kasei Kogyo conducted trial operations by employing equipment built in FY 1993 at a cost of approximately ¥130,000,000 (\$1,400,000) by the Clean Japan Center, a foundation that received assistance from the Japanese National Treasury. Full-fledged production started in October of 1994

and the facility now has a processing capacity of 1.68 metric tons per day. The panels for use in construction applications are manufactured in a process that involves the pulverization of the tape, heat treatment, mixing, forming, molding, cooling, and cutting.



Japan Plastics Effective Utilization Union

Members of this nationwide union are from the plastic recycling industry and the organization's activities include research and development on processing technologies, the joint development of new products, shows and exhibitions, the promotion of study and training programs, and the publication of literature to disseminate information on the union's activities. The organization was founded in June of 1976.

Fukide Bldg., 4-1-13 Toranomon, Minato-ku, Tokyo 105, Japan
Tel: 81-3-3437-2258 Fax: 81-3-3437-5270

INTERNATIONAL COOPERATION

The problem of plastic waste presents the challenge of transmitting to the future the protection of public health, the effective use of limited resources, and plans to preserve nature's riches as well as the global environment. For these reasons, industries and organizations in Japan are participating in international forums in fields related to the environment and are cooperating and conducting interchanges with various international organizations.

Far East Plastics Industry Conference Japan, South Korea & Taiwan

The 20th Far East Plastics Industry Conference held in November of 1994 was the site of information exchanges and cooperative interchanges among groups of people associated with the plastics industries in Japan, South Korea, and Taiwan.

As is the case at each Conference, reports were presented concerning the general conditions in all sectors of the industry in the three countries. At this meeting, however, problems pertaining to plastic waste also received a great deal of attention.

The 20th Conference was divided into sessions on three major themes and the "A" meetings dealt with the topic of "Trends Relating to Plastic Waste."

During discussions on the current situation in regard to the problem of plastic waste and the outlook for the future, a VTR was used to project a video on the subject of the recovery and reuse of plastic trays.

Occasions of this kind which allow the exchange of information produce useful results since concerns about the problem of plastic waste are rising at a swift rate even in the Asian Far Eastern region. In February of 1995, for example, a new plastic recycling association was formed in South Korea.

DAVOS RECYCLE FORUM "JAPAN DAY" SUPER SESSION

Maaek Business Services of Zurich, Switzerland has acted as the main sponsor of global recycling forums and expositions that have been held each spring since 1988 in Davos and have as their primary theme the recycling of resources.

The wide variety of visitors to these forums includes officials from national and local governments, persons belonging to recycling organizations, and managers and specialists of enterprises in various fields and industries. The participants

come from many other countries throughout the world in addition to the European nations. The meetings provide a venue for a unique interchange of international information since reports are presented on a broad spectrum of subjects and lively opinions are exchanged.

Participants from Japan have attended each of the forums, and at the last three meetings, PWMI has provided reports on the present state of the processing and recycling of plastic waste in this country.

The 8th Forum will be held in May of 1995 and presenters of reports from Japan are being organized by PWMI. The reports are intended to introduce overseas in an organized manner the current state of policies in Japan for the recycling of plastic waste; methods of thermal recycling, chemical recycling, and material recycling; related technologies, etc.

Furthermore, this year's Forum will include a special "Japan Day," during which only participants from Japan or from Japanese enterprises incorporated in Europe will assemble and offer their reports. As of this writing, the list of presenters from Japan is as follows:

Mr. T. Kasutani (Ministry of International Trade and Industry)

Dr. M. Takeshita (New Energy and Industrial Technology Development Organization)

Dr. M. Tomikawa (PWMI Japan/Idemitsu Petrochemical Company, Ltd.)

Mr. K. Tsukamoto (Ebara Corporation)

Mr. E. Funahashi (Nippon Steel Corporation)

Mr. S. Seya (Japan Expanded Polystyrene Recycling Association)

Mr. H. Yamamoto (Fuji Heavy Industries, Ltd.)

Mr. T. Amano (Toa Electronics Ltd.)

The following persons from Japanese companies operating in Europe will also deliver reports:

Mr. K. Toh (Mazda Motor Corporation)

Mr. T. Watanabe (Kuraray Europe GmbH)

Dr. L. G. Scheidt (Sony Europa GmbH)

Mr. T. G. Kelly (Mita Europe B. V.)

Asia's First EPS Recycling Organization

Asian Manufacturers of Expanded Polystyrene

In April of 1995, the first international organization to promote recycling in Asia was established in this area of the world, a region which is enjoying remarkable economic growth. The organization, which was given the name "Asian Manufacturers of Expanded Polystyrene (AMEPS)," was founded by Asian companies in the EPS industry for the purpose of cooperating in the recycling of used EPS throughout the region.

At the 2nd Asian Recycling Conference that was held in Manila from November 30 to December 3 of 1994, a proposal to set up AMEPS was made by the members of the Japan Expanded Polystyrene Recycling Association (JEPSRA) and a basic agreement to do so was reached with the other participants.

Upon receipt of this fundamental agreement, representatives from the EPS industry in eight countries signed a memorandum promising participation in AMEPS. The nations are Hong Kong, Indonesia, Japan, South Korea, Malaysia, the Philippines, Singapore, and Taiwan. Furthermore, the countries that do not yet have specialized organizations for EPS recycling agreed to attempt to establish them in the future.

An Outline of AMEPS Activities

The major activities of AMEPS can be summarized as follows:

- 1) The collection and organization of information concerning EPS recycling activities in member nations and the reporting of such information to each member;
- 2) Assistance in the establishment of specialized EPS recycling organizations in each member country and support for recycling activities;
- 3) Assistance to each country affiliated with AMEPS to

facilitate the participation of such specialized organizations in the International Recycling Agreement;

- 4) The collection and organization of information on a global scale, including data provided by the European Manufacturers of Expanded Polystyrene (EUPERS) and the Association of Foam Packaging Recyclers (AFPR) of the U. S. A.

JEPSRA Leadership in EPS Recycling and Networking

JEPSRA has constructed EPSY PLAZA recycling facilities in Japan (please see the article on page 5), participated in projects involving international recycling facilities, and is also taking part in the planning for the promotion of EPS recycling on a worldwide basis.

In the Asian region, activities concerning EPS recycling developed at a rapid pace both before and after the 1st Asia EPS Recycling Conference in Tokyo in December of 1993. And efforts have been started to set up specialized organizations in all AMEPS member countries that do not yet have them.

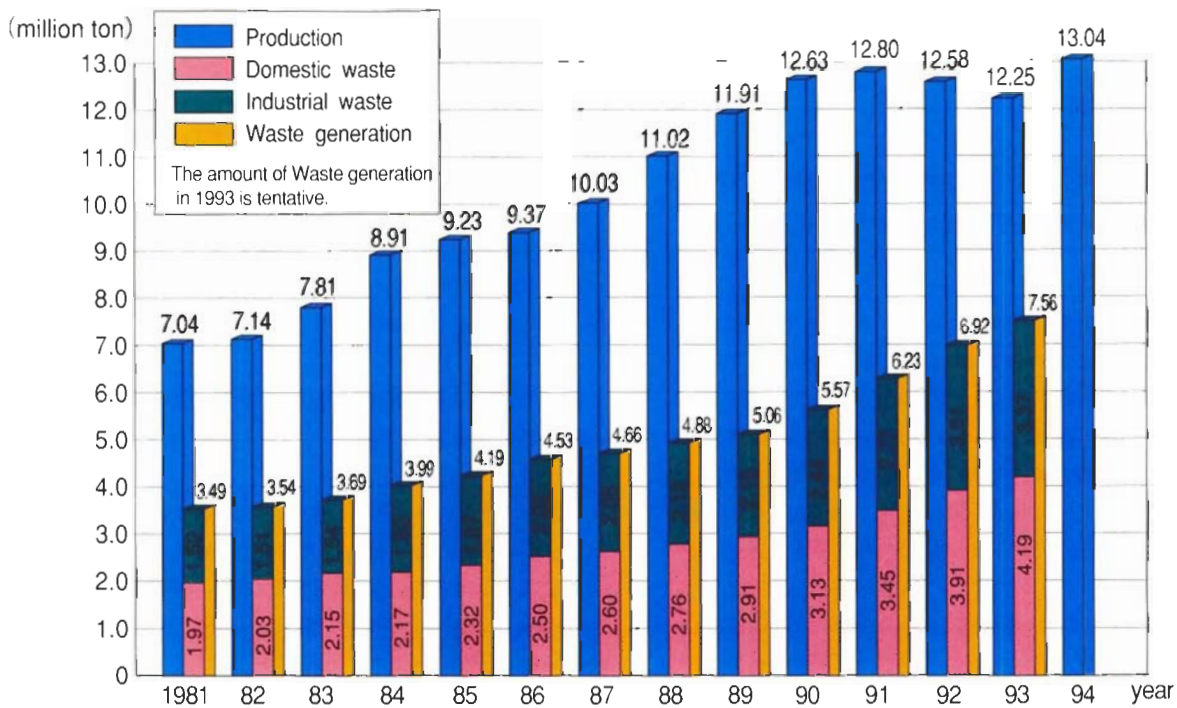
As a result of the founding of AMEPS, activities that have in the past been conducted in a single nation have undergone a transition and are now performed on an organizational level throughout Asia. Finally, AMEPS represents a significant advance toward the creation and perfection of a network for EPS recycling on a truly global scale.

Representatives of various Asian nations signing the agreement to establish AMEPS

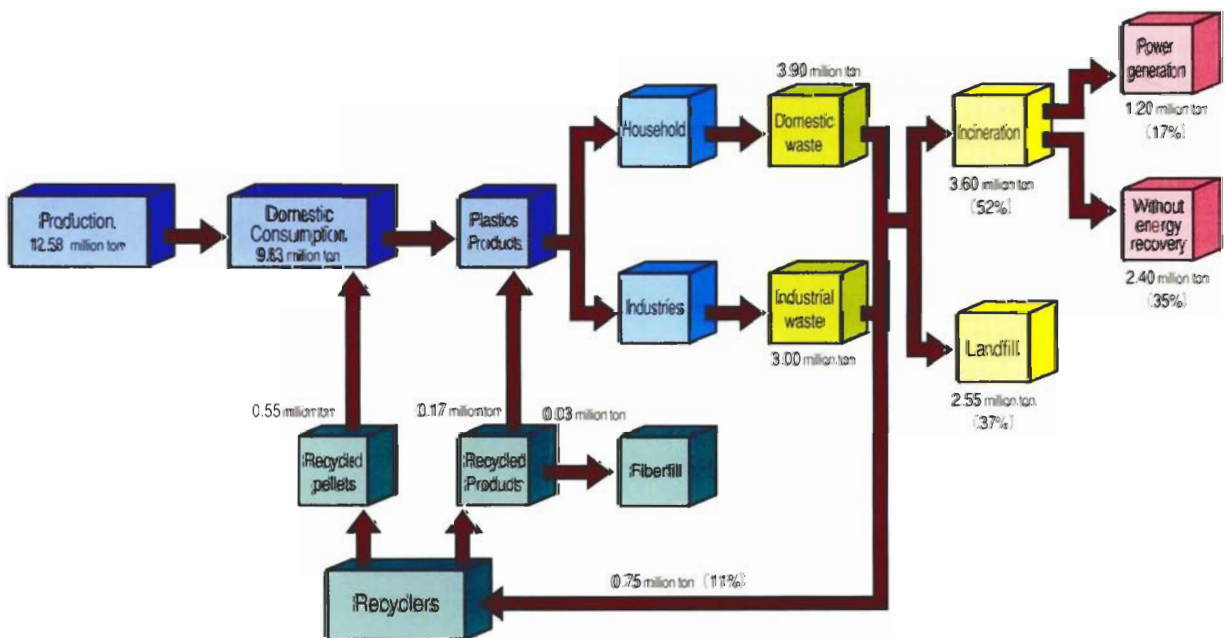




1. Production and Waste generation of Plastics



2. Flowchart showing Plastics Production, Consumption, Disposal, and Recycling in Japan (1992)



Primary Activities of PWMI (FY 1992 to 1994)

Technology Development

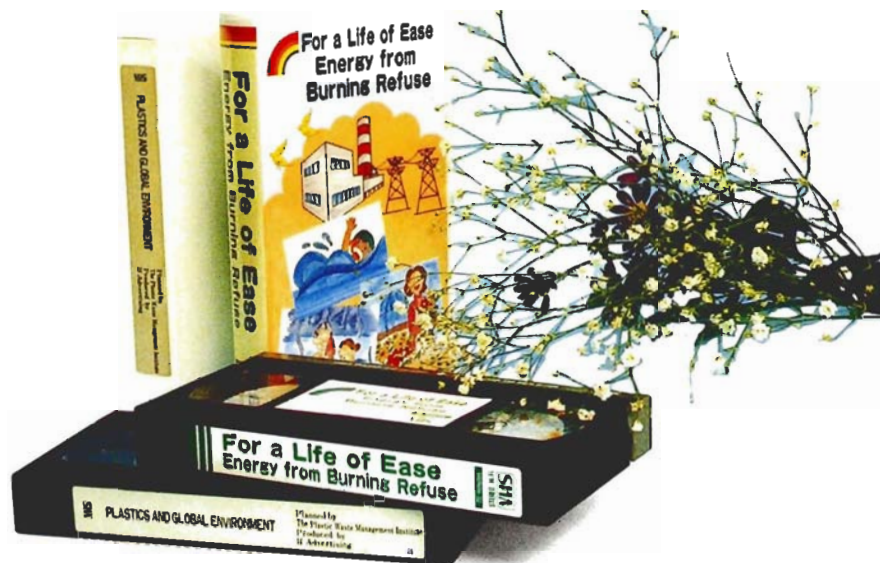
- * Research studies on burning technologies for waste plastic
- * Research studies on basic technologies for recycling plastic waste into fuel for existing electric-power-generating boilers
- * Research and development activities on the separation and sorting of all types of resins contained in plastic waste
- * Experiments to validate the recovery method of monocombustion energy from plastic waste
- * Development of technologies to recycle plastic waste into powdered fuel and experiments to validate the technologies
- * Research and development activities on high-speed sorting and recovery systems for plastic waste
- * Research on means to improve the existing technologies for producing oil through pyrolysis of plastic waste
- * Feasibility studies on the development of upgraded systems for the high-speed sorting and reclamation of plastic waste
- * Basic experiments on energy recovery from the plastic waste incineration in cement kilns
- * Experiments on the incineration and energy recovery of plastics contained in used electrical appliances
- * Development of recycling technologies, development of applications for reclaimed products, and support for the development of incinerating technologies, etc.

Research Studies

- * Studies on the conceptual formation of supply systems for the energy produced from plastic waste
- * Studies and research on the recycling of plastic products
- * Studies on refuse derived fuels (d-RDF)
- * Feasibility studies and support for the commercialization of supply systems for the energy produced from plastic waste
- * Basic research on data relating to the recycling of waste plastic
- * Basic research on plastics that will facilitate the recycling of municipal solid waste
- * Research on the actual conditions and trends relating to the collection and disposal of municipal solid waste
- * Research on refuse derived fuels (oil, etc.)
- * Research studies on methods to evaluate the ecological effect of the recycling of plastic waste
- * Research on problems overseas, such as the regulations in regard to packaging waste in Germany, France, and elsewhere in Europe

Public Relations

Videos: "Plastics and Global Environment" and "For a Life of Ease—Energy from Burning Refuse" (both available in English)



The Plastic Waste Management Institute (PWMI) was founded in November of 1971 originally as the Plastic Waste Management Research Association. The operations of the organization quickly expanded, however, and the name was changed to the present one in July of 1972. At present, PWMI's regular membership is made up of 28 companies and three trade associations and the supporting membership is composed of four associations.

Objectives and Operations

PWMI's objectives are (1) to perform investigations and research and development work on matters relating to the collection, transportation, treatment, and effective utilization of plastic waste, (2) to promote the dissemination of information and the execution of operations in accordance with the results of these investigations and R&D activities and, depending on these promotional activities, (3) to perfect a loop consisting of the manufacture of plastics, distribution, consumption, recycling, and treatment, and (4) to contribute to a healthy way of life for all citizens at minimum cost by improving and rationalizing all of the processes that are involved in the loop.

The following operations are being carried out in order to attain this objective:

1) The implementation of surveys, research and development relating to the collection, transportation, treatment, and effective utilization of plastic waste;

2) Support, including assistance for the necessary hardware and software, for the operations relating to the collection, transportation, treatment, and effective utilization of plastic waste;

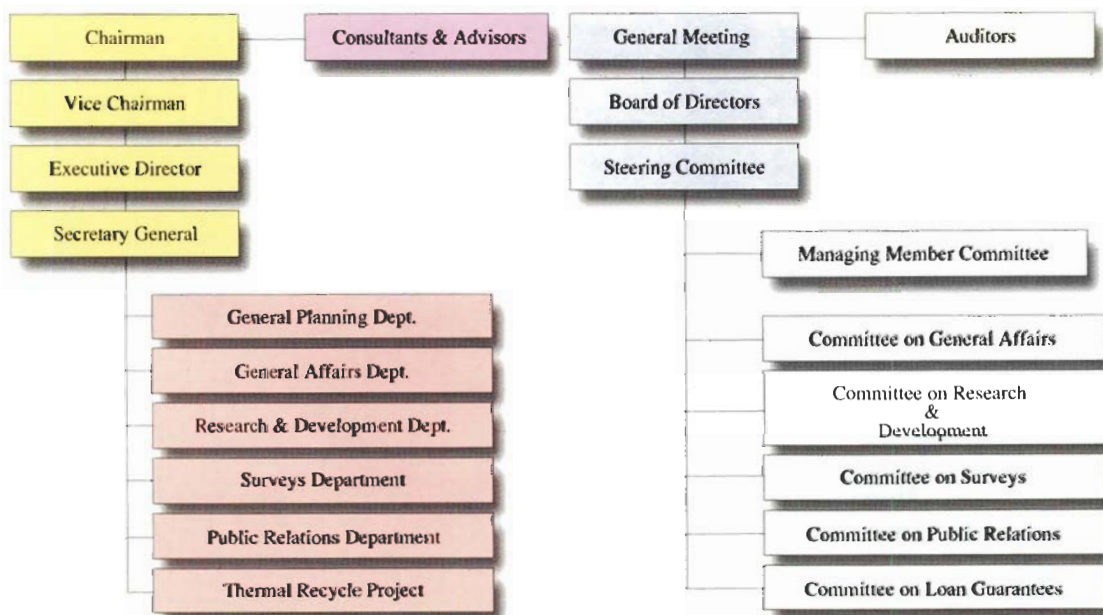
3) Public relations activities aimed at the public, the government, the mass media, etc. that will facilitate the smooth implementation of the operations described above;

4) The practice of overseas surveys and the participation in international conferences, etc. in order to foster cooperation among similar associations throughout the world in an effort to facilitate the implementation of the operations described above on a global scale.

ORGANIZATION

- Chairman: Masahiko Furukawa
- Vice Chairman: Akio Sato
- Vice Chairman: Masatake Hamabe
- Executive Director: Tatsuji Warabioka
- Number of Directors: 26
- Number of Auditors: 2

TABLE OF ORGANIZATION





MEMBERS OF PLASTIC WASTE MANAGEMENT INSTITUTE

Regular Members

Asahi Chemical Industry Co., Ltd.	Nippon Steel Chemical Corporation
Asahi Glass Co., Ltd.	Nippon Unicar Co., Ltd.
Central Chemical Co., Ltd.	Nippon Zeon Co., Ltd.
Chisso Corporation	Maruzen Polymer Co., Ltd.
Dainippon Ink & Chemicals Inc.	Shin-Etsu Chemical Co., Ltd.
Denki Kagaku Kogyo K.K.	Showa Denko K.K.
Du Pont-Mitsui Polychemicals Co., Ltd.	Sumitomo Chemical Co., Ltd.
Idemitsu Petrochemical Co., Ltd.	Sun Arrow Chemical Co., Ltd.
Kaneka Corporation	Toagosei Co., Ltd.
Kureha Chemical Industry Co., Ltd.	Tokuyama Sekisui Co., Ltd.
Mitsubishi Chemical Corporation	Tokuyama Corp.
Mitsui Petrochemical Industries, Ltd.	Tonen Chemical Corporation
Mitsui Toatsu Chemicals, Inc.	Tohso Corp.
Nippon Petrochemicals Co., Ltd.	Ube Industries, Ltd.

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 Recycle Promoting Council



Working Towards a Recycle Society

Masahiko Furukawa
Chairman
Plastic Waste Management Institute (PWMI)

The Plastic Waste Management Institute ("PWMI"), ever since its establishment made by the plastics industry in 1971 with the aim of coping with problems concerning plastic wastes, has been devoted to develop various measures for the quantitative reduction and effective recycling of plastic wastes.

PWMI's basic stance regarding the solution of the plastic waste problem has been to develop and promote "rational" measures so as to make plastics, one of the materials indispensable to today's world, available to the consumers without any uneasiness in using it. "Rational" has been our fundamental, unchanged concept throughout PWMI's activities over the past 25 years, and considering the problems raised by the plastic wastes in recent years, we are even more convinced of the rightfulness of this concept.

Let us elaborate the implications of "rational". Waste plastics are discarded by various industrial activities and consumption behaviors of the general public. Indeed, a large number of manners and factors is involved in dealing with the discarding activities, such as where plastics are discarded, how much and in what form they are discarded, and what type of resins they are composed of. A way of solution to be selected out of some alternatives varies by case; for instance, a different measure would be taken in a case where a landfill space is large enough for the waste disposal from another case where the space is limited, and whether recycling technology for the discarded plastics has been well developed or otherwise. Also included as important factors are the difference of knowledge on environmental pollution and the level of society's acceptance. In short, the plastic waste problem differs greatly depending on the time and place.

It can be said, therefore, that a specific solution needs to be employed as the most appropriate measures in response

to the conditions of a specific situation, which indeed are "rational" measures. In other words, if we look at all facets of society, there could be more than just on single measures to deal with the problems of plastic wastes.

PWMI's activities have been developed with the aforesaid recognition in doing research and studies on a wide range of disposal measures and in offering supports to the implementation of measures. The course of action that seeks for sweeping measures will most likely be maintained from now onward.

In view of the near future, we are at present concentrating our efforts on the following two aspects:

1) With respect to the material recycling (mechanical recycling), PWMI is carrying out (a) technology development to separate/segregate various types of plastics, and (b) educative and supportive activities for companies and industrial organization to engage in recycling, both of which are indispensable to the promotion of the material recycling; and

2) As for the chemical recycling and energy recovery, PWMI's efforts are focused on (a) development of technologies that transform plastic wastes into a source of energy through the development of economical oil-producing technology and other methods, and (b) creation and support of an energy market based on resources such as oil derived from these technologies.

It is the intention of Japan's plastic industry, placing PWMI as its center, to continue to extend utmost efforts to provide a wide range of choices pertaining to measures that address the problem of plastic wastes and, as a result of implementing such measures, achieve wide-spread recycling of waste plastics in order to create a society where people can feel at ease using plastics.



Plastic Waste Management Institute

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