
PWMI Newsletter

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Plastic Waste Management Institute
JAPAN

Plastic Products, Plastic Waste and Resource Recovery [2000]

Background information and notes on the publication of the Flowchart of Plastic Products, Plastic Waste and Resource Recovery (2000)

The Plastic Waste Management Institute conducts annual surveys on matters related to plastic waste. These include a questionnaire-based survey on amount of recycling, a survey on the amount of plastic waste discharge, a survey directed toward local governments on general waste management, and a survey on industrial waste management. The results of these surveys are combined and published as the Flowchart of Plastic Products, Plastic Waste and Resource Recovery. This flowchart is published annually and provides quantitative information on the macro flow of plastic production in Japan, its manufacture into products, and its use and disposal, as well as resource recovery and disposal processing of plastic waste.

Please note that the quantities shown in the flowchart are the result of statistical processing performed by the Plastic Waste Management Institute based on statistical

data and replies to questionnaires.

The year 2000 saw the enactment of important laws toward the formation of a recycling-oriented society. This year, in fact, can be viewed as the first year of Japan in the new century as a recycling-oriented society. To make the most effective use of resources, these laws aims to “reduce” the generation of waste, “reuse” products, and “recycle” materials, reflecting a move from “1R to 3R’s.”

An active “reduce” and “reuse” movement can also be found in the plastics industry. For example, resin manufacturers and processors are working together to develop lighter PET bottles and thinner plastic shopping bags and, in the automotive industry, to integrate the various grades of car-bumper materials.

The outstanding features of this year in recycling and disposal processing are as follows.

- (1) A utilization rate of 50% was achieved.
 - (2) Energy recovery in the form of incineration with power generation, cement kiln fuel, etc. is on the increase.
 - (3) Material recycling, liquefaction, and gasification and the application of blast furnace raw materials (including coke-oven chemical materials) have either begun or expanded in conjunction with the enactment of the Containers and Packaging Recycling Law.
- The 4,940 thousand tons of utilized plastic waste represents an increase of 420 thousand tons over the previous year. This increase features 50 thousand tons for material recycling and 60 thousand tons for liquefaction, gasification, and blast furnace materials (chemical recycling), or 110 thousand tons combined (due, for the most part, to the Containers and Packaging Recycling Law). It also includes 100 thousand tons for

densified-refuse derived fuel including energy recovery as cement kiln fuel and 220 thousand tons for incineration with power. Each of the above therefore contributes about 1/4, 1/4, and 1/2, respectively, toward this increase.

Among the 1,390 thousand tons of source materials for material recycling, post-use products came to 510 thousand tons (compared to 470 thousand tons the previous year), with PET bottles contributing the most at 125 thousand tons, an increase of about 40 thousand tons from last year.

In order of descending tonnage, PET bottles are followed by agricultural plastics, wrapping film, expanded polystyrene packing material, etc., containers and the like, electric-wire covering material, automobile parts, pipes, etc., expanded polystyrene trays, home electric-appliance housings, etc., and non-PET bottles.

Explanation of flowchart items

(1) Resin production, resin processing, and marketing of products

1-1 Resin production

This figure was determined on the basis of chemical-industry statistics from the Ministry of Economy, Trade and Industry (METI).

1-2 Reclaimed products

For convenience sake, the figure used here as input is that of material recycling from the previous year taking figures for export and import of plastic waste into account (Ministry of Finance, trade statistics).

1-3 Domestic plastic products consumption

· *(Domestic plastic products consumption) = (Resin production) - (Resin export) + (Resin import) - (Liquid resin, etc.) - (Resin processing waste) + (Reclaimed products) - (Product export) + (Product import)*

- Resin export and import figures are based on trade statistics from the Ministry of Finance.
- Figures for liquid resin, synthetic fiber, etc. that fall outside plastic waste discharge are based on

chemical-industry statistics from the Ministry of Economy, Trade and Industry.

- Figures for plastic product export and import are based on trade statistics from the Ministry of Finance.
- Figure for processing waste considers discharged waste from the processing step that is not turned into products.

(2) Discharge

2-1 Industrial waste and general waste

- Industrial waste is waste generated by business activities as defined by the Waste Disposal and Public Cleansing Law, and includes ashes, sludge, waste oil, waste acid, waste alkali, and waste plastic. Its disposal is generally the responsibility of the party that generates the waste. General waste is waste other than industrial waste and its disposal is mainly handled by local governments.

2-2 Post-use products discharge

- This figure is determined by an estimation system developed by PWMI based on usage quantities by demand-generating fields and by

resin type (usage quantities have been calculated annually for the last 15 years) and on product lifetimes by demand-generating fields (using a PWMI discharge model for the last 15 years).

· Considering that the export/import of new and used automobiles affects the amount of domestic plastic waste, corrections have been made to amounts of reclaimed products and discharge in the transportation field.

· Discharge ratios for general waste and industrial waste have been estimated using a PWMI discharge model for demand-generating fields.

2-3 **Production and processing waste discharge**

· Amount of production waste is not included in amount of resin production, and amount of processing waste is extrapolated from the results of questionnaires.

2-4 **Total plastic waste discharge**

· This figure is the sum total of post-use products discharge and production and processing waste discharge.

2-5 **Breakdown of total plastic waste discharge by resin type**

· These breakdown figures were estimated from amounts for post-use products discharge, production and processing waste discharge, breakdown of resin production, etc.

(3) Disposal and recovery

3-1 **Material recycling**

· All material recycling figures and breakdowns are extrapolated from the results of questionnaires sent to recycling companies.

· “Recycled material” indicates pellets, flakes, fluff, blocks, and ingots, while “recycled products” refer to film sheets, stakes, pipes, etc.

3-2 **Densified-refuse derived fuel, liquefaction, gasification, blast furnace raw material**

· Figures for liquefaction, gasification, blast furnace raw materials, and coke-oven chemical materials approved as product recycling procedures by the Containers and Packaging Recycling Law have been determined on the basis of bids announced by the Japan Containers and Packaging Recycling Association and results of

questionnaires.

· The figure for densified-refuse derived fuel includes energy recovery as cement kiln fuel.

3-3 **Disposal and recovery of general waste**

· Incineration/landfilling ratio

This ratio is determined on the basis of past surveys conducted by PWMI.

· Incineration with power generation

This figure refers to incineration processing by an incinerator equipped with power-generation facilities in waste processing conducted by local governments. The ratio shown is determined on the basis of PWMI surveys.

· Incineration with heat utilization facility

This figure refers to incineration processing by an incinerator that, while not equipped with power-generation facilities, has external facilities for utilizing heat. The ratio shown is determined on the basis of PWMI surveys.

3-4 **Disposal and recovery of industrial waste**

· Disposal and recovery of industrial waste is partially commissioned to local governments as business-related waste. The ratio of such processing by business to that commissioned to local governments is determined on the basis of PWMI surveys. The percentage breakdown of commissioned processing into incineration with power generation, incineration with heat utilization facility, incineration without power generation or heat utilization facility, and landfilling is based on figures for general waste processing.

· The incineration/landfilling ratio in the processing of industrial waste is based on the results of PWMI surveys.

· The ratios for energy recovery such as power generation in incineration handled by industrial waste management contractors are based on the results of PWMI surveys.

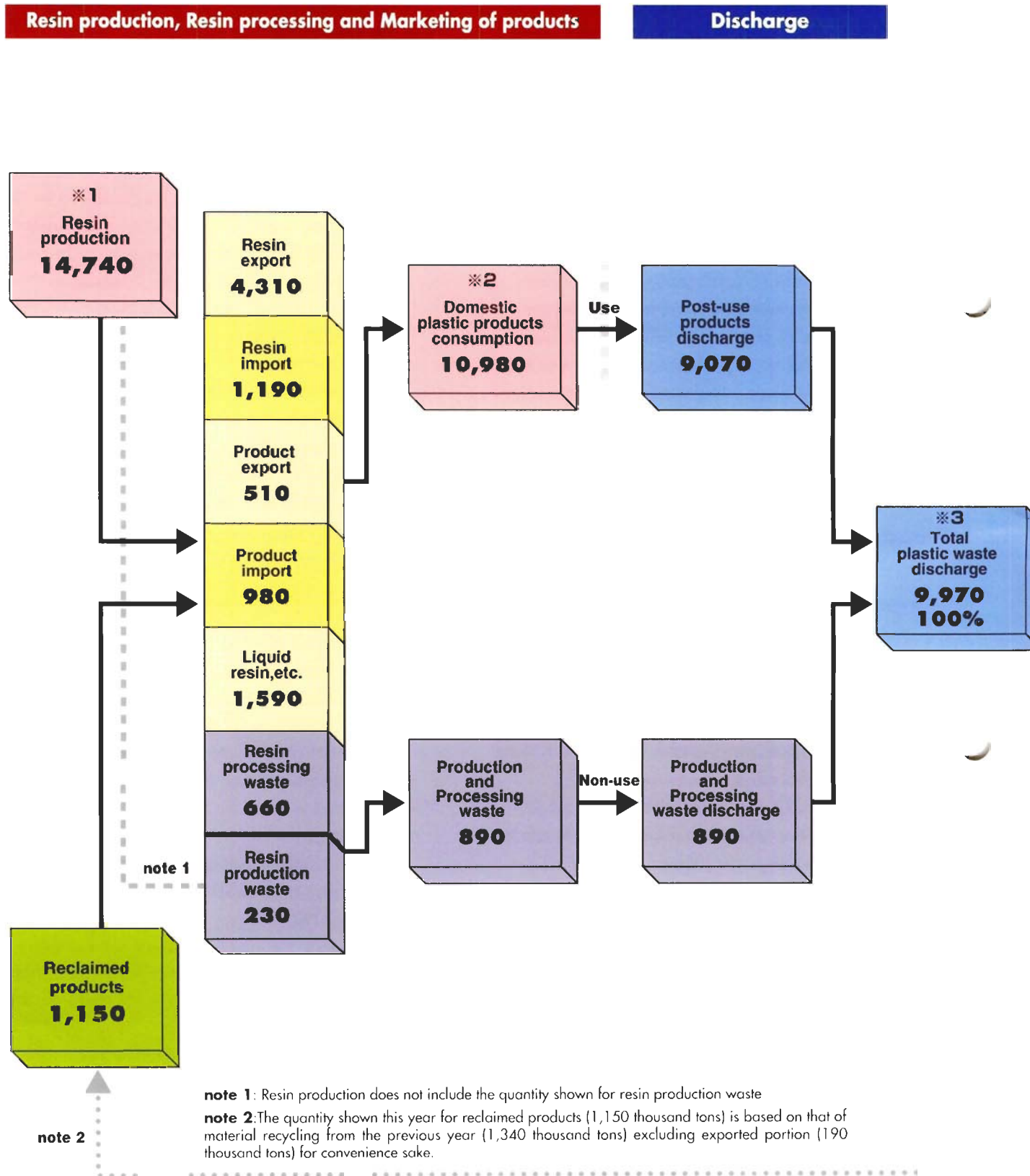
· Incineration with heat utilization facility

Ratios for heat utilization in industrial-waste incineration processing by local governments and industrial waste management contractors are based on the results of PWMI surveys.

Flowchart of plastic products, plastic waste and resource recovery

2000

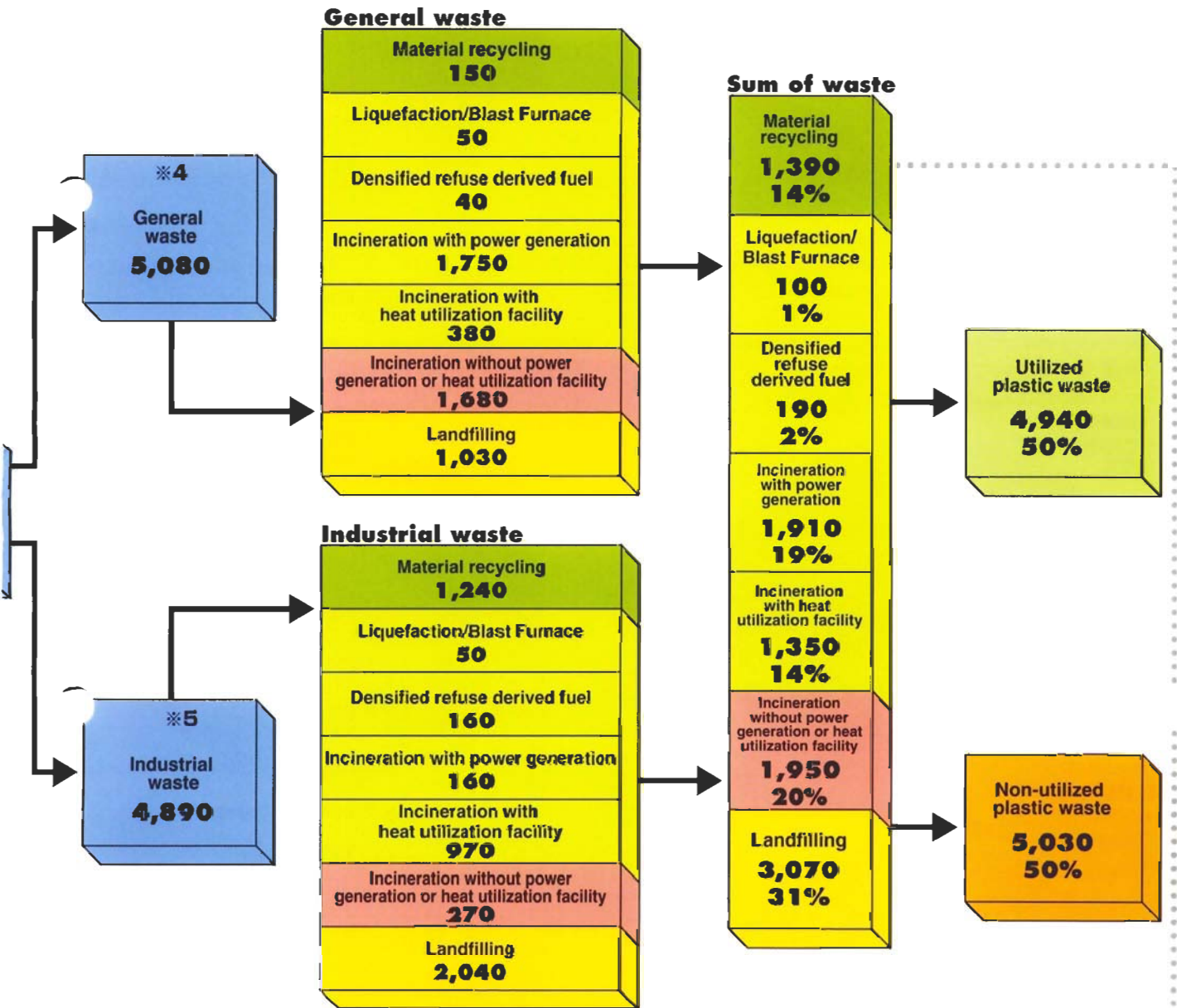
[Unit: thousand tons]



note 1: Resin production does not include the quantity shown for resin production waste

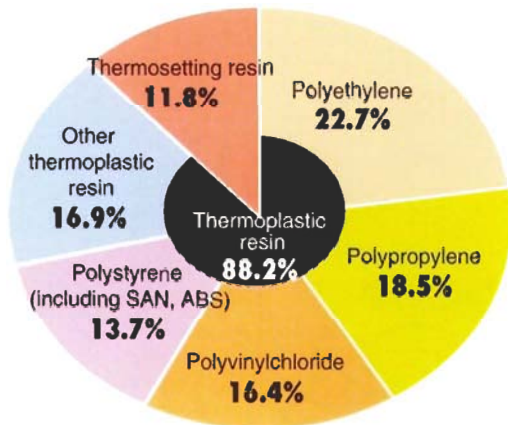
note 2: The quantity shown this year for reclaimed products (1,150 thousand tons) is based on that of material recycling from the previous year (1,340 thousand tons) excluding exported portion (190 thousand tons) for convenience sake.

Disposal and recovery



Details of flowchart elements

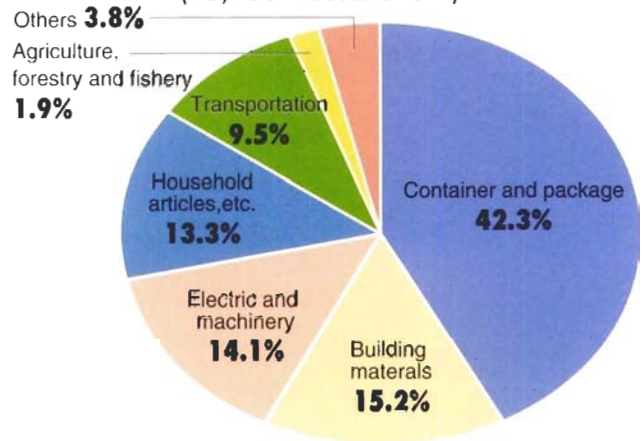
※1 Breakdown of resin production (14,740 thousand tons) by resin type



(Source: METI chemical-industry statistics)

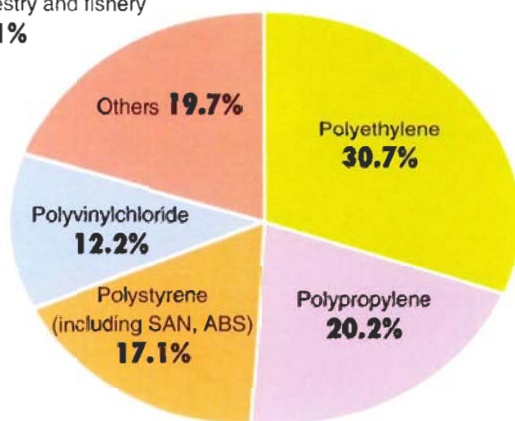
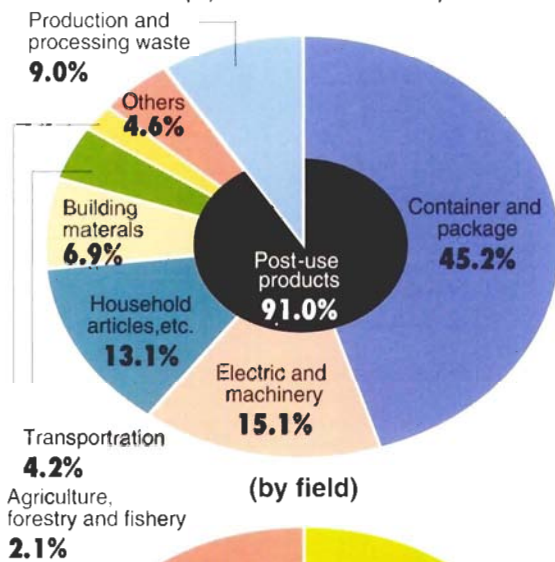
For convenience sake, the other 1.3% of resins not categorized as thermosetting resin or thermoplastic resin are included in "other thermoplastic resin."

※2 Breakdown of resin products by field (10,980 thousand tons)



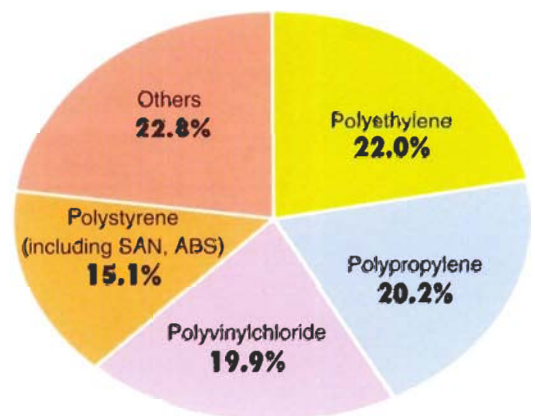
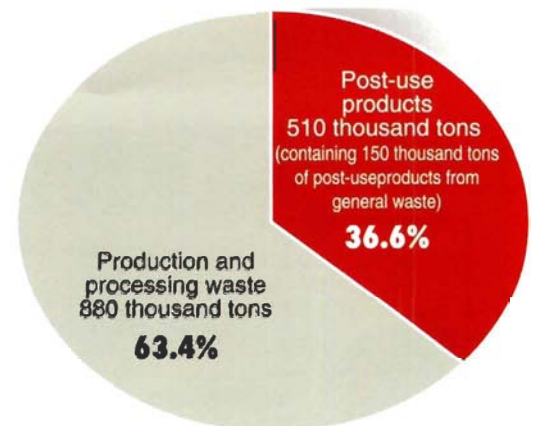
(Source: Estimations by groups concerned, etc.)

※3 Breakdown of total plastic waste (9,970 thousand tons)

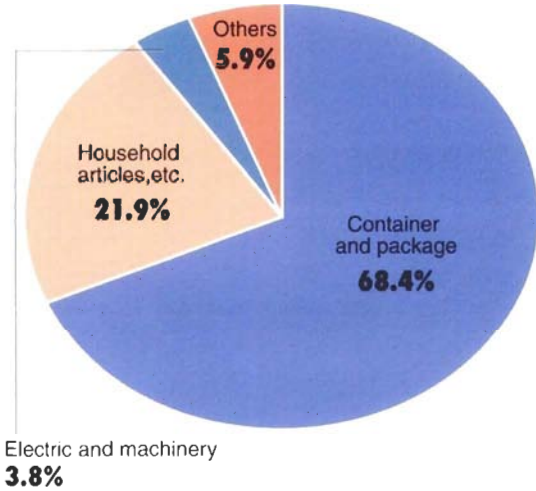


※6 Breakdown of material recycling (1,390 thousand tons)

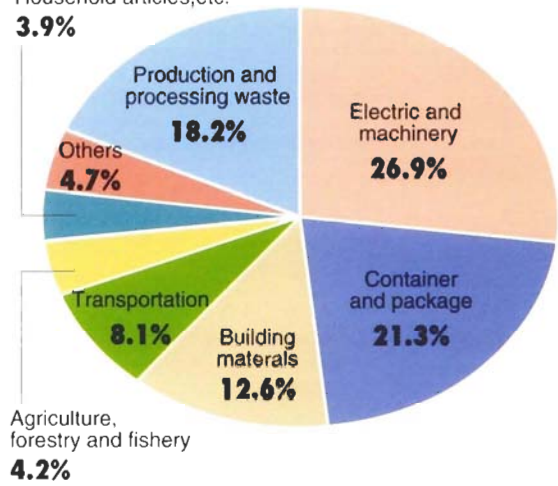
● Breakdown of material recycling resources



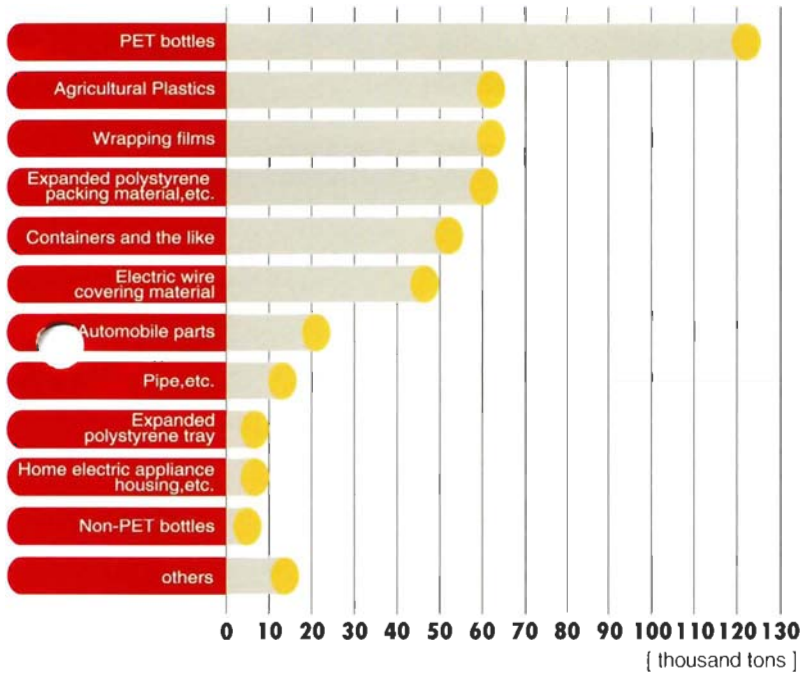
※4 Breakdown of general waste by field (5,080 thousand tons)



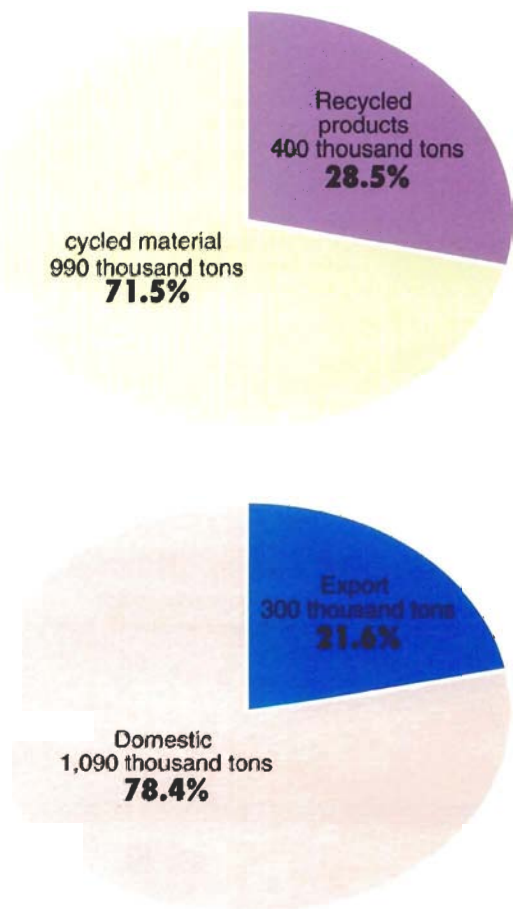
※5 Breakdown of industrial waste by field (4,890 thousand tons)



○ Breakdown of post-use products for material recycling (510 thousand tons)



● Breakdown of reclaimed products



(by destination of recycling use)

Plastics production and waste discharge

| Year | Resin production | Domestic plastic products consumption | Total plastic waste discharge | General waste | | Industrial waste | |
|------|------------------|---------------------------------------|-------------------------------|---------------|----|------------------|----|
| | 1,000t/year | 1,000t/year | 1,000t/year | 1,000t/year | % | 1,000t/year | % |
| 1975 | 5,170 | 3,150 | 2,610 | 1,470 | 56 | 1,140 | 44 |
| 1980 | 7,520 | 5,520 | 3,250 | 1,780 | 55 | 1,470 | 45 |
| 1985 | 9,230 | 6,990 | 4,190 | 2,320 | 55 | 1,870 | 45 |
| 1986 | 9,370 | 7,300 | 4,530 | 2,500 | 55 | 2,030 | 45 |
| 1987 | 10,030 | 7,920 | 4,650 | 2,600 | 56 | 2,050 | 44 |
| 1988 | 11,020 | 8,610 | 4,880 | 2,760 | 57 | 2,120 | 43 |
| 1989 | 11,910 | 9,570 | 5,060 | 2,910 | 58 | 2,150 | 42 |
| 1990 | 12,630 | 9,990 | 5,570 | 3,130 | 56 | 2,440 | 44 |
| 1991 | 12,800 | 10,070 | 6,220 | 3,450 | 55 | 2,770 | 45 |
| 1992 | 12,580 | 9,280 | 6,920 | 3,910 | 56 | 3,010 | 44 |
| 1993 | 12,250 | 9,020 | 7,560 | 4,190 | 55 | 3,370 | 45 |
| 1994 | 13,040 | 9,660 | 8,460 | 4,230 | 50 | *4,230 | 50 |
| 1995 | 14,030 | 9,790 | 8,840 | 4,430 | 50 | 4,410 | 50 |
| 1996 | 14,660 | 10,810 | 9,090 | 4,550 | 50 | 4,540 | 50 |
| 1997 | 15,210 | 11,360 | 9,490 | 4,780 | 50 | 4,710 | 50 |
| 1998 | 13,910 | 10,200 | 9,840 | 4,990 | 51 | 4,850 | 49 |
| 1999 | 14,570 | 10,810 | 9,760 | 4,860 | 50 | 4,900 | 50 |
| 2000 | 14,740 | 1,0980 | 9,970 | 5,080 | 51 | 4,890 | 49 |

* The method for making estimations was changed in 1994 so that non-use resin production and processing waste would be added to the figure for industrial waste.

Introduction To PWMI

Goals and Tasks

The Plastic Waste Management Institute (PWMI) was originally established as the Plastic Management Research Association in November 1971, and received its current name in July 1972 as a result of expanded operations.

The goals of PWMI are to research and develop systems for optimal processing of plastic waste and effective use of processed waste as a resource, and to promote the use of these systems.

To accomplish these goals, PWMI performs a wide variety of tasks. These include researching and developing technologies for using plastic waste effectively, performing model experiments, disseminating technologies, conducting research surveys, publicizing the work of PWMI, and providing loan guarantees to recycling ventures.

Activities

Ongoing R&D, Surveys, and Public Relations

Since its founding, PWMI has been engaged in various activities related to plastic waste. These range from the development of processing and recycling technologies to the surveying of discharge amounts and waste-processing conditions and publicity work to raise the level of consciousness regarding the processing and recycling of plastic waste. PWMI has also implemented a loan guarantee system to promote the growth of the plastic-waste recycling business. The main activities at PWMI are presented below in the section titled "Operations (1971-2001)." For the future, PWMI plans to continue its work on plastic waste

through activities of this nature.

Responding to New Challenges

In these last few years, waste problems have become increasingly severe and social concern for dealing with these problems through recycling has been growing. Against this background, PWMI has placed much importance on the smooth enactment and implementation of the Containers and Packaging Recycling Law in Japan, and has undertaken the development of recycling technologies indispensable to this end. These include the use of plastic waste as raw material for liquefaction and gasification and as blast furnace fuel. PWMI has also provided information essential to the drafting and enactment of various laws related to plastic waste and recycling. Social conditions with regard to waste handling have, in fact, been changing dramatically in recent years. For

example, the movement toward a recycling-oriented society characterized by the 3R's (reduce, reuse, recycle) is gaining momentum, and laws and regulations related to waste and recycling are being enacted one after another.

To respond to these changing conditions, PWMI will emphasize technical development, surveys, and public relations in relation to the 3R's of plastic. PWMI will also expend efforts on proposing systems that include thermal recycling to promote the smooth reuse of resources and energy.

Finally, in response to rapidly growing concern for people's health and safety, PWMI plans to collect more information on health and safety issues related to plastic, and will continue to inform the general public that plastic is a highly safe material even during waste processing.

Members

The current members consist of the following 22 corporations, 3 organizations and 5 supporting members

Regular members

Asahi Chemical Industry Co., Ltd.
Asahi Glass Co., Ltd.
Central Chemical Co., Ltd.
Chisso Corporation
Du Pont-Mitsui Polychemicals Co., Ltd.
Idemitsu Petrochemical Co., Ltd.
Japan Polyolefines Co., Ltd.
Japan Polychem Corporation
Kaneka Corporation
Kureha Chemical Industry Co., Ltd.
Maruzen Polymer Co., Ltd.
Mitsui Chemicals Inc.
Nippon Unicar Co., Ltd.
Shin Dai-Ichi Vinyl Corporation
Shin-Etsu Chemical Co., Ltd.
Sumitomo Chemical Co., Ltd.
SunAllomer Ltd.
Taiyo Vinyl Corporation
Tohso Corp.
Tokuyama Sekisui Co., Ltd.

Ube Industries, Ltd.
V-Tech Corporation

Trade Organizations

Japan Petrochemical
Industry Association
Japan Plastics Industry Federation
Vinyl Environmental Council

Supporting Members

Japan PET Bottle Association
Japan Expanded Polystyrene
Recycling Association
Japan PVC Environmental
Affairs Council
Japan Urethane Industries Institute
Tokuyama Corp.

Operations(1971-2001)

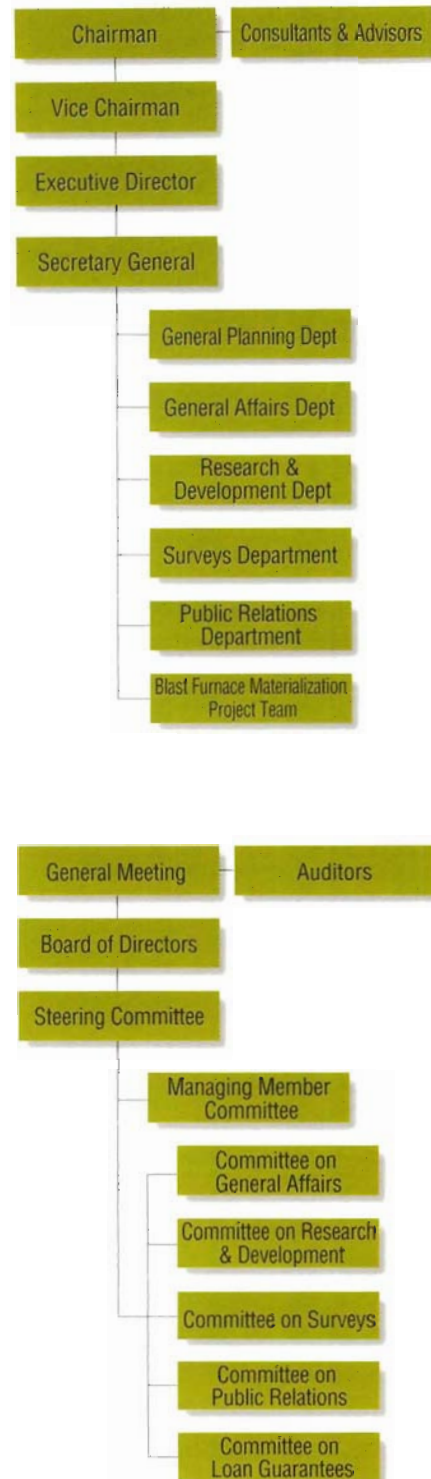
● Technical fields

- Sorting** — One of the difficulties involved in recycling plastic waste is that there are so many types. Solving this problem involves a great deal of technological development; some examples are a plastic bottle collection system and a near infrared ray automatic separation technology.
- Volume reduction** — Plastic waste volume can be significantly reduced for effective transportation or for efficient use as landfill.
- Recycling promotion** — A plastic waste recycling system is being studied. The plastic waste recycling/ reprocessing industry is also being evaluated.
- Technology development support** — The public is being asked for ideas that support technology development (e.g., recycling technology, recycled product usage, and incineration technology). By supporting this technology, plastic waste recycling is further encouraged.
- Clean incineration** — Incinerating plastic waste under proper conditions prevents or reduces generation of toxic gases. Studies are currently trying to determine the proper incineration conditions and methods for removing toxic materials from exhaust gas.
- Oil-from-plastics** — Early oil-from-plastics technology thermally decomposed only certain types of plastic. The goal of this technology is to recycle many types of plastic waste into oil.
- Densified Refuse Derived Fuel** — Plastic waste that contains foreign materials cannot be recycled but can be solidified for energy recovery.
- Gasification** — Plastic waste can be gasified; the gas produced can be a source for city gas and the like.
- Blast furnace reducer** — A technology that recycles plastic waste into iron-manufacturing reducer is being developed.

● Studies and Public Relations

- Study of plastic waste in garbage (domestic)
- Study of plastic waste treatment (overseas)
- Recycled product exhibitions
- Periodical publications
- Videos, CD-ROM, Web Site

Organization



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