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# PWMI Newsletter

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NO 43 2014.4



Plastic Waste Management Institute  
JAPAN

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## Plastic Products, Plastic Waste and Resource Recovery [2012]

### Background information and notes on the publication of the Flowchart of Plastic Products, Plastic Waste and Resource Recovery (2012)

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Resin production in 2012 dropped sharply compared to 2011 as resin exports decreased in the face of an appreciating yen and a world economic slowdown caused mostly by the European sovereign debt crisis, and as resin imports increased and production-plant problems occurred.

Plastic waste used as raw material or fuel in cement factories has been reported as “densified-refuse derived fuel” in all flowcharts up to 2011 based on the results of annual questionnaires. However, it has been found that about 400 kt of plastic waste other than densified-refuse derived fuel had also been used as cement material and fuel, so we added the item “amount of plastic

waste used as cement material and fuel” to the questionnaire in preparing the flowchart for 2012 (the recipients of the questionnaire were the same as those of the 2011 flowchart). The results of that question were tabulated and reported as “densified-refuse derived fuel and cement material/fuel” in this flowchart.

Plastic Waste Management Institute would like to extend its deep appreciation to the Ministry of the Environment (MOE), Ministry of Economy, Trade and Industry (METI), various local governments, and related organizations for the valuable data and useful advice that they graciously provided during the course of this survey.

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# 2012 Highlights

**(1) Resin production dropped by 1050 kt (-9.1%) relative to 2011 and fell below 11,000 kt for the first time in 25 years. Domestic plastic products consumption as well dropped by 260 kt (-2.7%).**

**(2) Total plastic waste discharge decreased by 230 kt (-2.4%) relative to 2011 to 9,290 kt.**

**(3) For the reasons described above, densified-refuse derived fuel and cement material/fuel increased by 420 kt (+65.5%). As a result, the energy recovery rate increased by two points while the effective plastic utilization rate also increased by two points over the previous year to 80%.**

In 2012, resin production decreased sharply to 10,540 kt (-1,050 kt relative to 2011; -9.1%), while resin export and product export also decreased to 3,420 kt (-480 kt; -12.4%) and 800 kt (-70 kt; -7.8%), respectively. On the other hand, resin import and product import increased to 2,470 kt (+200 kt; +8.9%) and 1,880 kt (+30 kt; +1.5%), respectively. As a result of the above, domestic plastic products consumption decreased to 9,600 kt (-260 kt; -2.7%).

Total plastic waste discharge decreased to 9,290 kt (-230 kt; -2.4%). Plastic waste discharge can be broken down into domestic (general) plastic waste at 4,460 kt (-190 kt; -4.0%) and industrial plastic waste at 4,820 kt (-40 kt; -0.8%).

In terms of disposal and recovery methods, the portion of total plastic waste discharge (which decreased by 230 kt from 9,520 kt to 9,290 kt) applied to mechanical recycling and feedstock

recycling\*1 decreased to 2,040 kt (-90 kt; -4.2%) and increased to 380 kt (+20 kt; +4.4%), respectively. The portion applied to energy recovery\*2 increased overall to 5,020 kt (+60 kt; +1.3%).

The percentage contributions to the effective plastic utilization rate by mechanical recycling, feedstock recycling, and energy recovery were 22%, 4%, and 54%, respectively, showing that energy recovery increased by two points and that the plastic utilization rate increased by two points overall to 80% relative to 2011.

Exports of plastic waste for mechanical recycling increased to 1,670 kt (+40 kt; +2.6%).

\*1: feedstock recycling = blast/coke furnaces + gasification + liquefaction

\*2: energy recovery = densified-refuse derived fuel and cement material/fuel + incineration with power generation + incineration with heat utilization facility

## 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 mechanical 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.

#### 1-4 Domestic plastic input

- (domestic plastic input) = (domestic plastic products consumption) – {(exported plastic parts from assembled products) – (imported plastic parts from assembled products)}
- Assembled products: automobiles, home appliances (televisions, refrigerators, freezers, air conditioners, washing machines and dryers)
- Number of exported/imported assembled products: Automobile figures are based on Monthly Motor Vehicle Statistics of Japan from Japan Automobile Manufacturers Association (JAMA); home appliance figures are based on “Current Production Statistics” from Ministry of Economy, Trade and Industry (METI).

## (2) Discharge

#### 2-1 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 from 1976) and on product lifetimes by demand-generating fields (using a PWMI discharge model for the last 60 years)
- Since the export of used automobiles affects the amount of plastic waste in Japan, corrections are made to plastic waste discharge in the transport industry. Here, the number of used automobiles is based on “number of post-use automobiles” issued by JAMA and the number of exported used automobiles is based on data released by Japan Automobile Dealers Association (JADA).
- Discharge ratios for domestic waste and industrial waste have been estimated using a PWMI discharge model for demand-generating fields.

#### 2-2 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.

#### 2-3 Total plastic waste discharge

- (total plastic waste discharge) = (post-use products discharge) + (resin production waste) + (resin processing waste)

#### 2-4 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 Mechanical recycling

- Figures for the mechanical recycling of domestic plastic waste are based on the volume of collected PET bottles (The Council for PET Bottle Recycling) and volume of collected white trays (Japan Plastic Food Container Industry Association), and figures for the mechanical

recycling of other plastic containers and packaging are based on data released by The Japan Containers And Packaging Recycling Association. From this year on, residual amounts after the mechanical recycling of other plastic containers and packaging will be allocated to densified-refuse derived fuel and other items using figures released by The Japan Containers and Packaging Recycling Association as coefficients. (In previous years, residual amounts were all allocated to landfilling.)

- Total figures and breakdowns for the mechanical recycling of industrial waste are extrapolated from the results of questionnaires sent to recycling companies.

#### 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 and power-generation.

#### 3-3 Disposal and recovery of domestic waste

- Incineration/landfilling ratio

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

- Incineration with power generation / incineration with heat utilization

“Incineration with power generation” means incineration processing by an incinerator equipped with power-generation facilities and “incineration with heat utilization” means incineration processing by an incinerator that, while not equipped with power-generation facilities, has facilities for utilizing heat externally. The ratios shown are determined by PWMI surveys based on values published by the Ministry of the Environment. The announcement of these values, by the way, is now made at an earlier date by the ministry, and this report therefore uses actual values from the previous fiscal year.

#### 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 domestic waste processing.

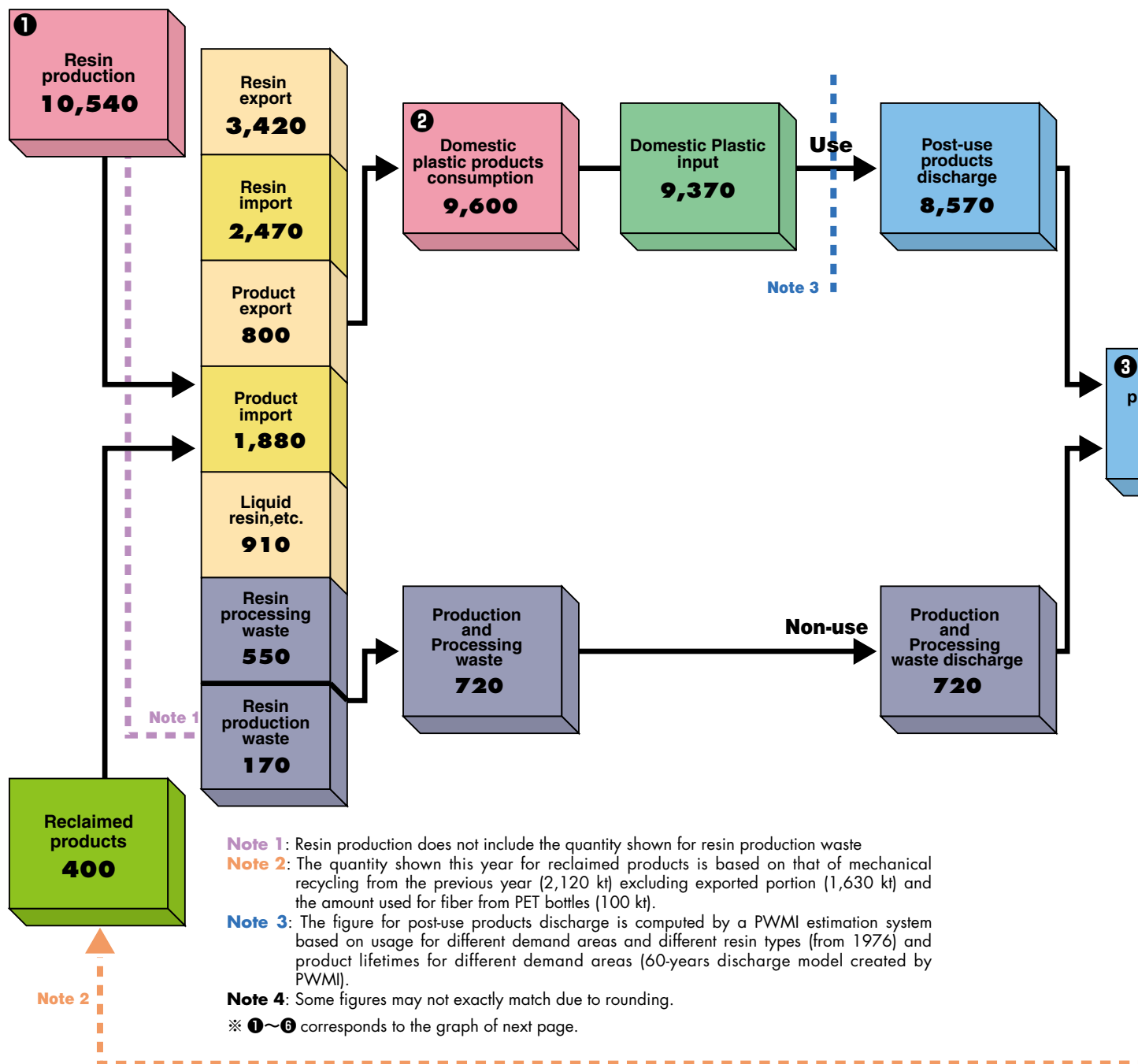
The incineration/landfilling ratio in the processing of industrial waste and the energy recovery rate in incineration with power generation are based on the latest surveys conducted by PWMI in fiscal years 2006/2008.

# Flowchart of plastic products, plastic waste and resource recovery 2012

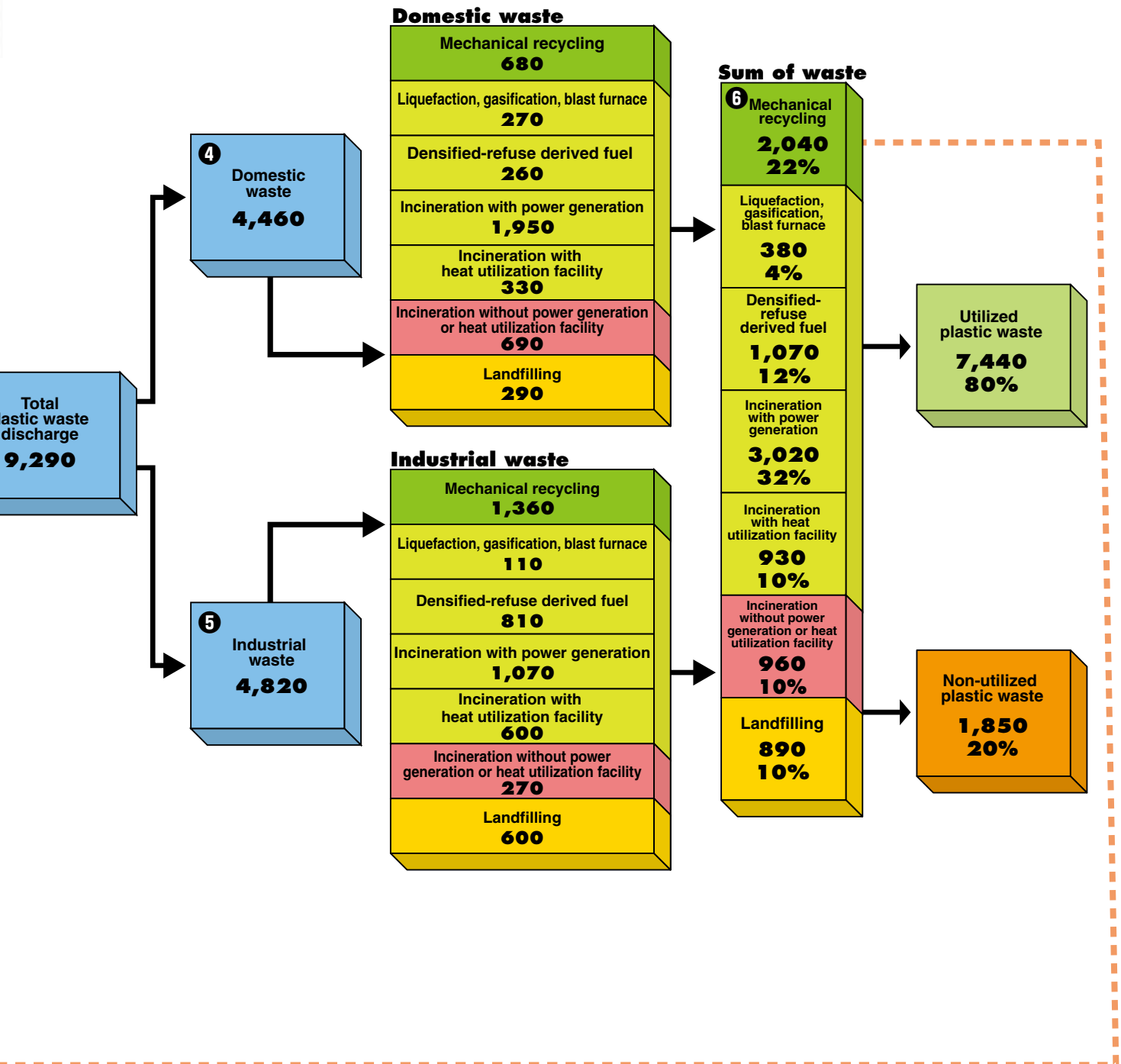
[ Unit; kt (thousand tons) ]

## Resin production, resin processing, and marketing of products

## Discharge

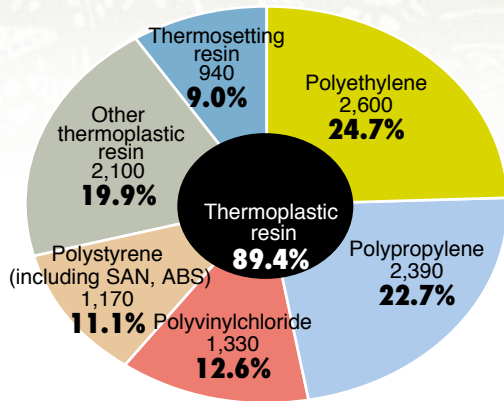


## Disposal and recovery



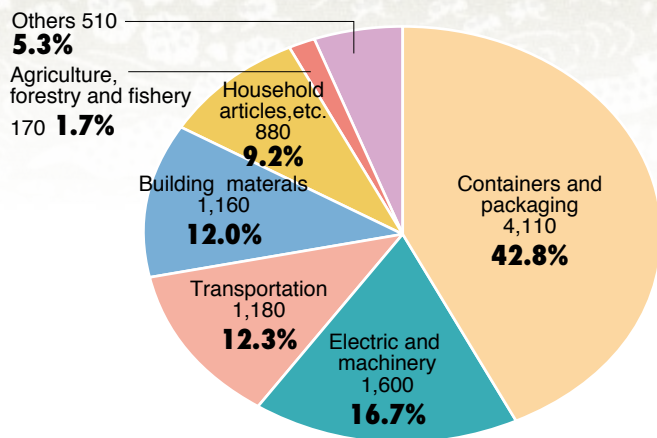
# Details of flowchart elements

① Breakdown of resin production (10,540kt) by resin type



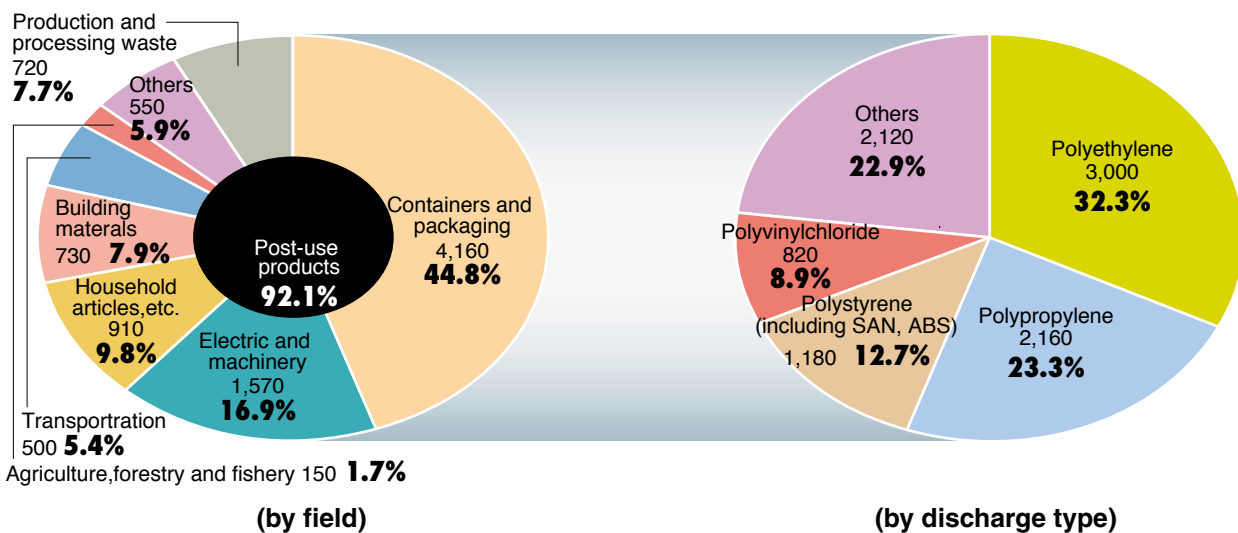
(Source: METI chemical-industry statistics)

② Breakdown of resin products by field (9,600kt)

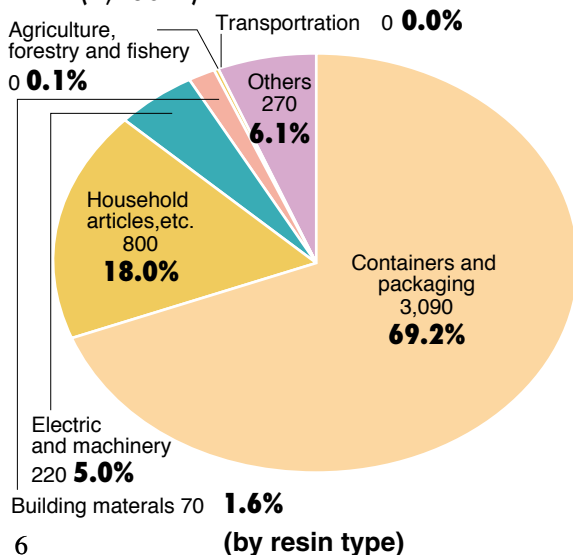


(Source: estimates from related organizations)

③ Breakdown of total plastic waste by field (9,290 kt)

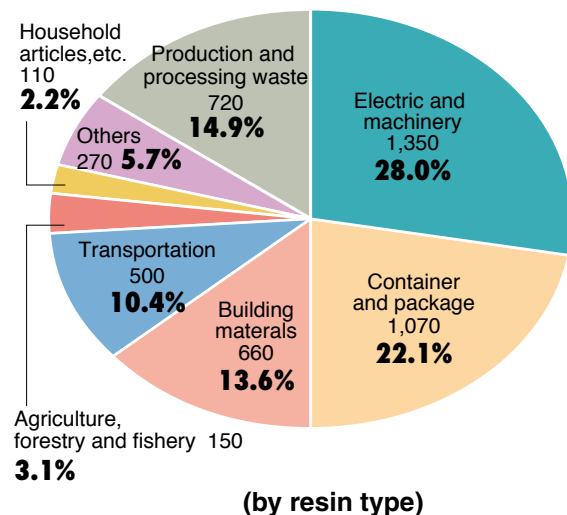


④ Breakdown of domestic waste by field (4,460 kt)



(by resin type)

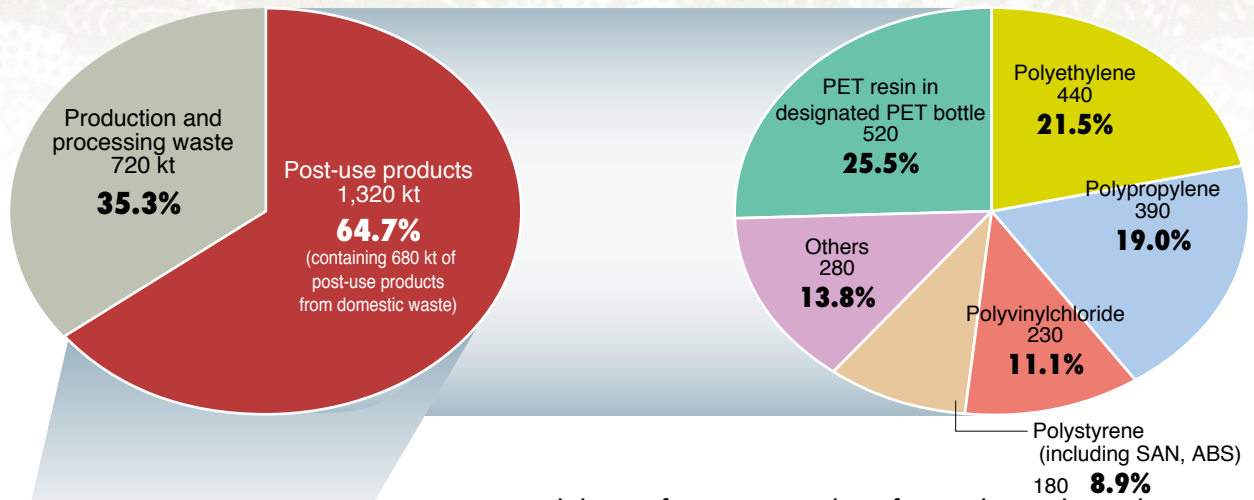
⑤ Breakdown of industrial waste by field (4,820 kt)



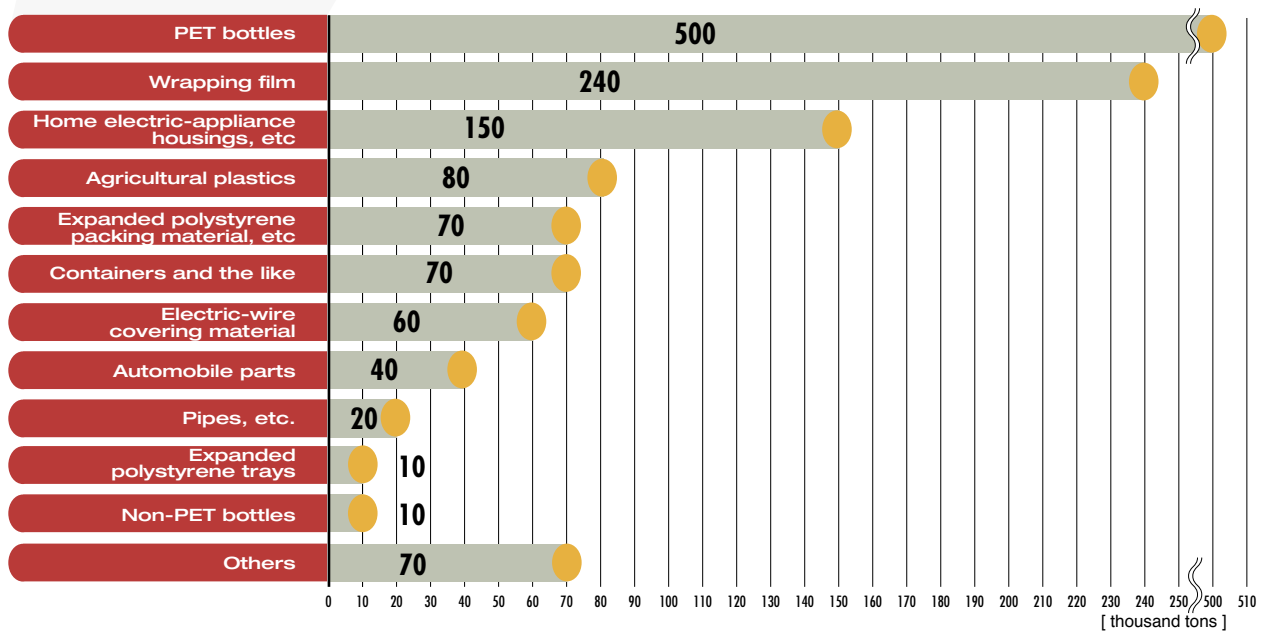
(by resin type)

⑥ Breakdown of mechanical recycling (2,040 kt)

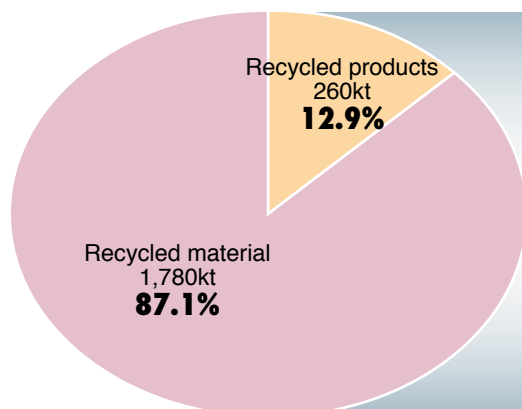
○ Breakdown of mechanical recycling resources



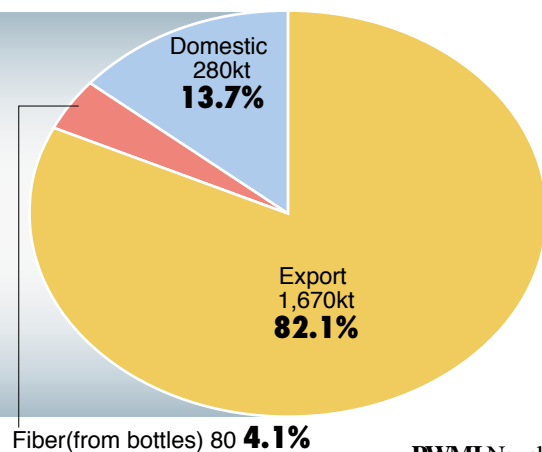
○ Breakdown of post-use products for mechanical recycling (1,320 kt)



(by type of reclaimed products)



(by destination of recycling use)



# Plastics production and waste discharge

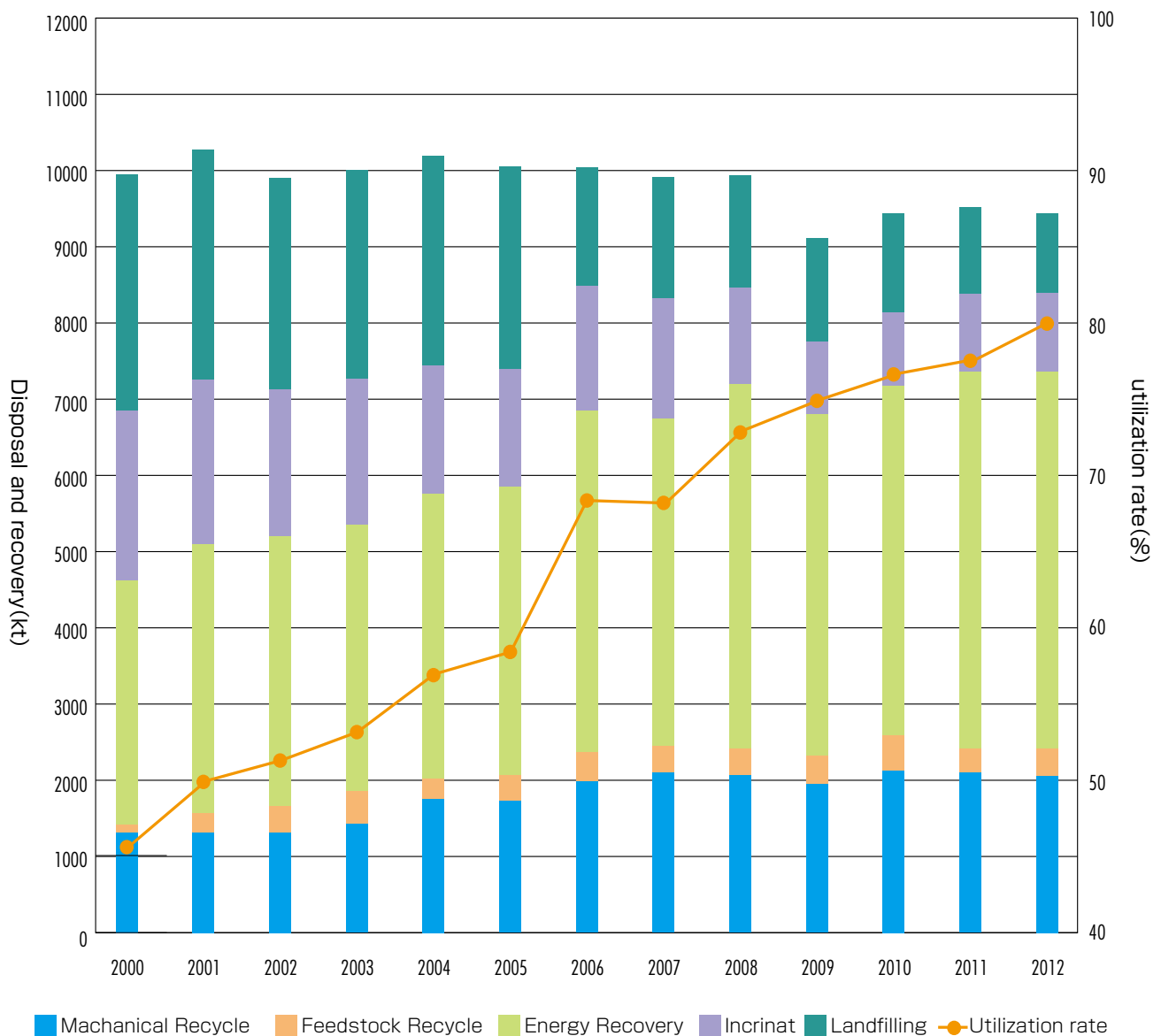
Year	Resin production	Domestic plastic products consumption	Total plastic waste discharge	Domestic waste		Industrial waste	
	kt /year	kt /year	kt /year	kt /year	%	kt /year	%
1980	7,520	5,520	3,260	1,780	55	1,470	45
1985	9,230	6,990	4,190	2,320	55	1,870	45
1990	12,630	9,990	5,570	3,130	56	2,440	44
1995	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	10,980	9,970	5,080	51	4,890	49
2001	13,880	10,960	10,160	5,280	52	4,890	48
2002	13,850	10,570	9,900	5,080	51	4,820	49
2003	13,980	11,010	10,010	5,130	51	4,880	49
2004	14,460	11,360	10,130	5,190	51	4,940	49
2005	14,510	11,590	10,060	5,200	52	4,860	48
2006	14,450	11,200	10,050	5,080	51	4,980	50
2007	14,650	11,030	9,940	5,020	51	4,920	49
2008	13,450	10,890	9,980	5,020	50	4,960	50
2009	11,210	8,430	9,120	4,440	49	4,680	51
2010	12,700	9,700	9,450	4,590	49	4,860	51
2011	11,590	9,870	9,520	4,650	49	4,860	51
2012	10,540	9,600	9,290	4,460	48	4,820	52



# Change in Utilized Plastic Waste by Amount and Rate Over Time

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total Plastic waste discharge (kt)	10,160	9,900	10,010	10,130	10,060	10,050	9,940	9,980	9,120	9,450	9,520	9,290
Utilization amount (kt)	5,130	5,160	5,410	5,750	5,820	6,880	6,920	7,330	6,890	7,230	7,440	7,440
Utilization rate(%)	50	52	54	57	58	69	69	73	75	77	78	80

Please see the PWMI Web site for detailed data on the production, discharge, reuse, and disposal of plastic products.



# Business Overview

## History

Originally founded in December 1971 as the Plastic Management Research Association, the Plastic Waste Management Institute (PWMI) received its current name in July of the following year as operations expanded. For the last 40 years or so, PWMI has endeavored to research and develop technology for the optimal processing and effective use of plastic waste and to publicize its findings.

In addition, PWMI has changed into a general incorporated association as a result of Laws Related to the Reform of the Public-Interest Corporations System (enacted in December 2008). As a result of this change, PWMI's objectives were newly established in April 2013 as "surveying and researching the recycling of plastic waste and contributing to a reduction in environmental load by the total recycling of plastic, and helping plastic-related industries to expand their business soundly and contributing to the creation of a society capable of sustainable growth."

## Business Content

(1) Survey and research the generation, recycling, and disposal of plastic waste and promote the appropriate use of plastic waste through various means including techniques for evaluating environmental load

(2) Support the education and study of the recycling of plastic and plastic waste and engage in related public relations activities

(3) Interface and collaborate with domestic and foreign institutions in the plastic and plastic-waste industries

## Activities

The three core activities of PWMI are summarized below.

(1) Provision of life cycle assessment (LCA) base data and LCA evaluation of recycling technologies

PWMI provides scientific and high-reliability data for widespread use by related industries and general citizens for

application to carbon footprint systems, etc. It also works to solve technical issues so that the effective use of plastic waste can be evaluated by LCA.

(2) Preparation of the Flowchart of Plastic Products, Plastic Waste and Resource Recovery and ongoing improvements to its accuracy

PWMI strives to obtain a clear understanding of the entire lifecycle of plastic from its production stage to its disposal and recycling and to prepare and provide a highly accurate flowchart of this process.

(3) Support of environmental education  
PWMI continues to hold instructor training courses and on-site classes and works to raise the level of consciousness in society regarding the usefulness of plastic. In addition to holding on-site classes on plastic recycling at primary and middle schools especially in Japan's Kanto region, PWMI will honor as much as possible requests for instructor training courses in line with new teaching guidelines and for lectures at universities specializing in environmental science.

## Members (as of January 2014)

Regular members: 17 corporations and 3 organizations

Supporting members: 3 organizations

### Regular members

Asahikasei Chemicals Corporation

DuPont-Mitsui Polychemicals Co. Ltd.

Japan Polyethylene Corporation

Japan Polypropylene Corporation

JNC Corporation

Kaneka Corporation

Maruzen Petrochemical Co., Ltd.

NUC Corporation

Prime Polymer Co., Ltd.

Shin Dai-Ichi Vinyl Corporation

Shin-Etsu Chemical Co., Ltd.

Sumitomo Chemical Co., Ltd.

SunAllomer Ltd.

Taiyo Vinyl Corporation

Tosoh Corp.

Tokuyama Sekisui Co., Ltd.

Ube-Maruzen Polyethylene Co., Ltd.

## 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

## Directors

Chairman: Hiroaki Ishizuka

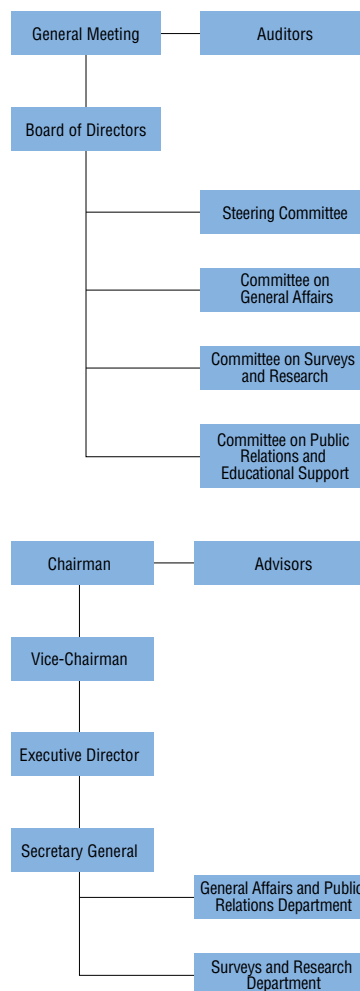
Vice-Chairman: Shunzo Mori

Executive Director: Hisao Ida

Directors: 10

Auditors: 2

## Organization



## Plastic Waste Management Institute

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