PWMI Newsletter

NO 47 2018.3

Plastic Waste Management Institute
JAPAN

Plastic Products, Plastic Waste and Resource Recovery [2016]

Background information and notes on the publication of the Flowchart of Plastic Products, Plastic Waste and Resource Recovery (2016)

The following improvements and assessments were performed to improve the accuracy of the Flowchart of Plastic Products, Plastic Waste and Resource Recovery.

(1) Revision of the model for product discharge by demand areas

"Post-use products discharge" has been computed using "domestic plastic input" by demand area (annual usage quantities from 1976 on) and a model created by PWMI for product discharge by demand area.

The discharge model used up to last year was created 20 years ago, and given the possibility that it was not reflecting actual conditions in recent years, we made some revisions and began to apply them as a new discharge model this fiscal year.

In parallel with this study, we used new data to revise the domestic/industrial ratio obtained by dividing "post-use products discharge" into domestic waste and industrial waste by demand area and began to apply this new domestic/industrial ratio this fiscal year.

(2) Assessment of incineration with power generation of industrial waste

Incineration with power generation of industrial waste has been estimated using a coefficient based on the results of questionnaires given once every five years to dischargers of waste. This time, we conducted separate interviews with resources-saving business operators and confirmed the suitability of this estimation method.

2016 Highlights

(1) Resin production decreased somewhat by 100 kt (-1.0%) relative to 2015. On the other hand, domestic plastic products consumption increased by 160 kt (+1.7%).

(2) Total plastic waste discharge decreased somewhat by 150 kt (-1.7%) relative to the previous year to 8,990 kt. Of this amount, effectively used plastic waste came to 7,590 kt resulting in an effective plastic utilization rate of 84%, a one-point increase relative to the previous year.

(3) The percentage contributions to the effective plastic utilization rate by mechanical recycling, feedstock recycling, and energy recovery were 23%, 4%, and 58%, respectively. This increase in the effective plastic utilization rate is attributed to a large increase in energy recovery as in the use of industrial plastic waste for densified-refuse derived fuel and cement material/fuel.

(4) Exports of plastic waste for mechanical recycling continued to decrease falling to 1,380 kt (-70 kt; -4.9%).

Resin production for 2016 decreased somewhat from the previous year to 10,750 kt (-100 kt relative to 2015; -1.0%). In addition, resin export, resin import, and product import increased to 3,960 kt (+110 kt; +2.9%), 2660 kt (+190 kt; +7.5%), and 1,960 kt (+60 kt; +2.9%), respectively, while product export decreased somewhat to 780 kt (-20 kt; -1.8%).

Domestic plastic products consumption increased to 9,800 kt (+160 kt; +1.7%). Total plastic waste discharge, however, decreased slightly relative to the previous year to 8,990 kt (-150 kt; -1.7%). This decrease can be attributed to revision of the discharge model as described above.

This figure for total plastic waste discharge can be broken down into domestic (general) plastic waste and industrial plastic waste, with the former decreasing to 4,070 kt (-270 kt; -6.2%) and the latter increasing to 4,920 kt (+120 kt; +2.4%). This decrease and increase can be attributed to revision of the domestic/industrial ratio as described above.

As for disposal and recovery methods, mechanical recycling increased to 2,060 kt (+10 kt; +0.4%), feedstock recycling was essentially unchanged at 360 kt (-0 kt; -0.7%), and energy recovery in total decreased to 5,170 kt (-40 kt; -0.8%). The effective plastic utilization rate showed little change at 7,590 kt (-40 kt; -0.5%). On the other hand, non-utilized plastic waste by incineration without power generation or heat utilization facility or by landfilling showed a large decrease to 1,400 kt (-120 kt; -7.6%).

*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 prepared by the Ministry of Economy, Trade and Industry (METI) on the basis of chemical-industry statistics.

1-2 Reclaimed products

- For convenience sake, the figure used here is that of mechanical recycling at 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 METI.
- Figures for plastic product export and import are based on trade statistics from the Ministry of Finance.
- Figure for resin processing waste is 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 METI.

(2) Discharge

2-1 Post-use products discharge

- This figure is calculated by an estimation system developed by PWMI based on input 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 2017 PWMI 100-year discharge model).
- 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.
- Discharge ratios for domestic waste and industrial waste have been estimated using a 2017 PWMI discharge model by demand-generating fields.

2-2 Production and processing waste discharge

- Amount of resin production waste is not included in amount of resin production, and amount of resin production waste and amount of resin processing waste are estimated using each predefined waste ratio.

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 of post-use products discharge, production and processing waste discharge, resin production, etc.

(3) Disposal and recovery

3-1 Mechanical recycling

- Figures for the mechanical recycling of domestic plastic waste are based on the weight of collected PET bottles (The Council for PET Bottle Recycling) and weight 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. Residual amounts after the mechanical recycling of other plastic containers and packaging will be allocated to densified-refuse derived fuel and other items using as coefficients figures released by The Japan Containers and Packaging Recycling Association.
- Total figures and breakdowns for the mechanical recycling of industrial waste are extrapolated from the results of questionnaires sent to recycling companies. Production waste and processing waste are taken to be the total of mechanical recycling.
- "Recycled material" indicates pellets, flakes, fluff, blocks, and ingots, while "recycled products" refer to film sheets, stakes, pipes, etc. other than the above.
  The export figure under "destination of recycling use" for mechanical recycling is based on "scrap plastic" statistics from Ministry of Finance trade figures.

3-2 Densified-refuse derived fuel, blast-furnace/coke-oven raw materials, gasification, liquefaction

- Figures for densified-refuse derived fuel includes plastic waste for power generation; figures for densified-refuse derived fuel and cement kiln fuel are based on the results of surveys targeting industry associations.
- With respect to domestic waste, figures for blast furnace raw materials, coke-oven chemical materials, gasification, and liquefaction approved as product recycling methods by the Containers and Packaging Recycling Law are based on data released by The Japan Containers And Packaging Recycling Association.
- With respect to industrial waste, these figures are based on the results of questionnaires.

3-3 Disposal and recovery of domestic waste

- Incineration/landfilling ratio
  This ratio is determined from the results of past PWMI surveys based on the "FY2015 Nation Survey on the State of Discharge and Treatment of Municipal Solid Waste" of the Ministry of the Environment.
- 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 released by the Ministry of the Environment.

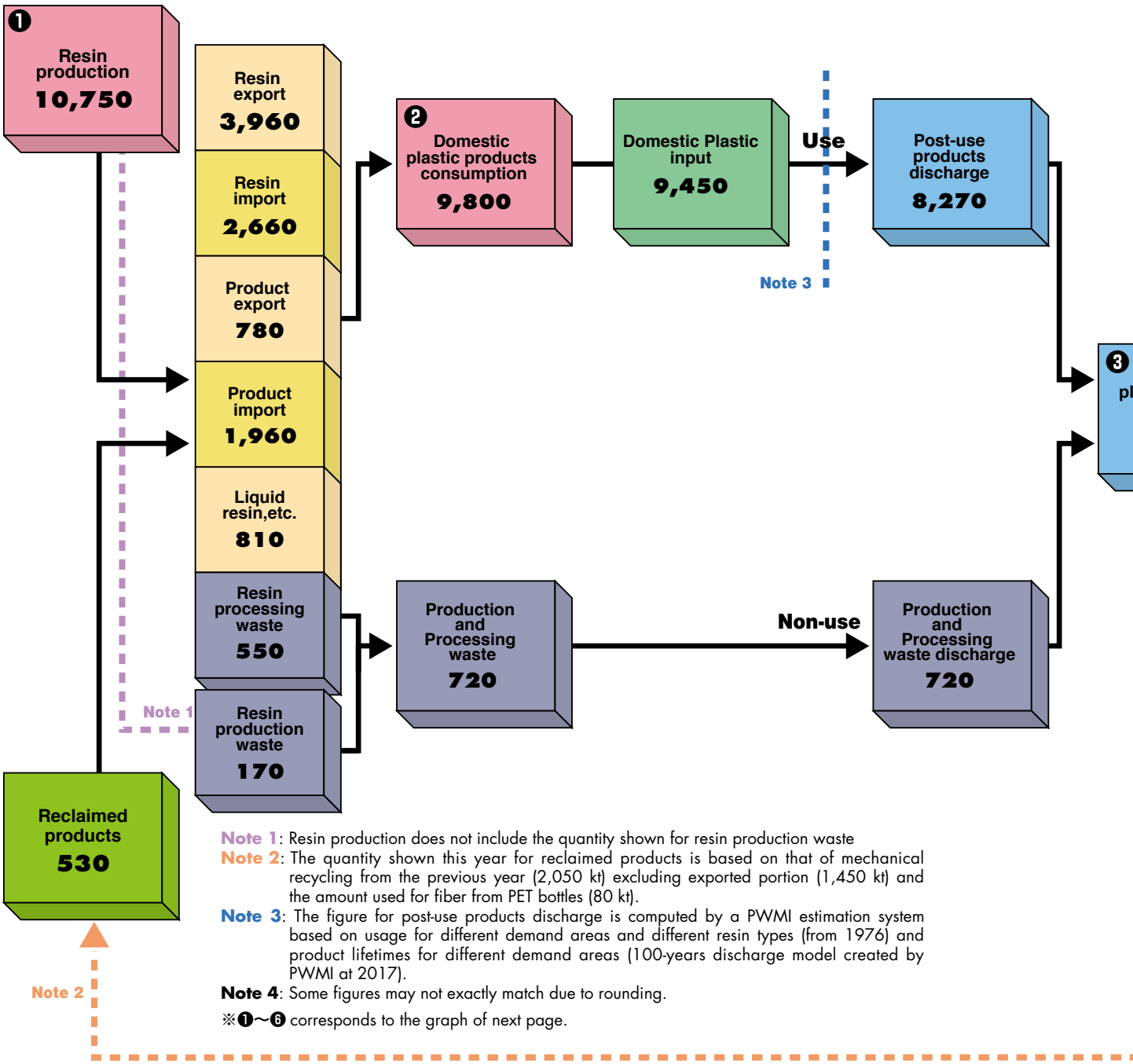
3-4 Disposal and recovery of industrial waste

- Disposal and recovery of industrial waste is partially commissioned to local governments as business-related waste. The ratio of such processing by business operators 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 is based on the latest survey conducted by PWMI in fiscal year 2013. The energy recovery rate in incineration by power generation, etc. is taken to be the same as the results of previous surveys conducted by PWMI in fiscal years 2006/2008.
- Figures for incineration with power generation includes plastic waste traded for a price.

Flowchart of plastic products, plastic waste and resource recovery 2016

[Unit; kt（thousand tons）]

Resin production, resin processing, and marketing of products | **Discharge**



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

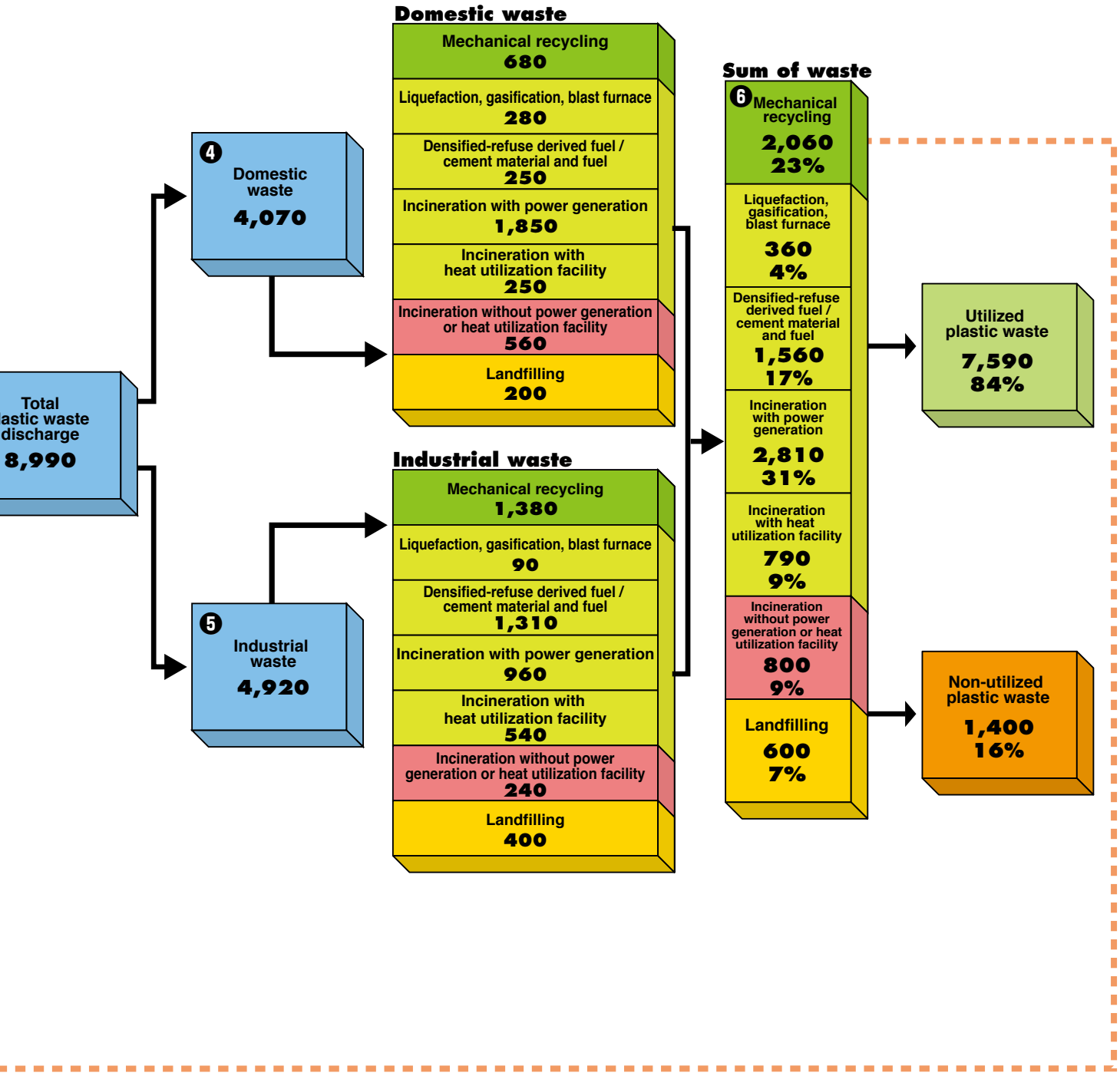
Note 2: The quantity shown this year for reclaimed products is based on that of mechanical recycling from the previous year (2,050 kt) excluding exported portion (1,450 kt) and the amount used for fiber from PET bottles (80 kt).

Note 3: The figure for post-use products discharge is computed by a PWMI estimation system based on usage for different demand areas and different resin types (from 1976) and product lifetimes for different demand areas (100-years discharge model created by PWMI at 2017).

Note 4: Some figures may not exactly match due to rounding.

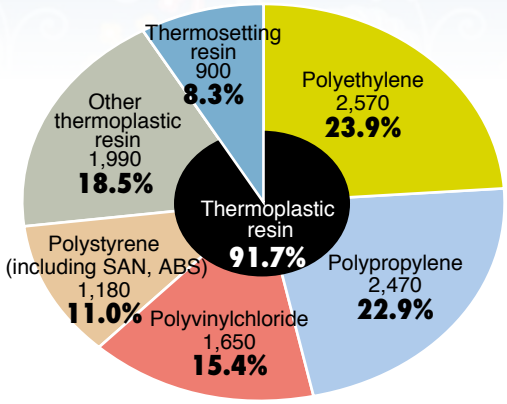
※❶～❻ corresponds to the graph of next page.

Disposal and recovery

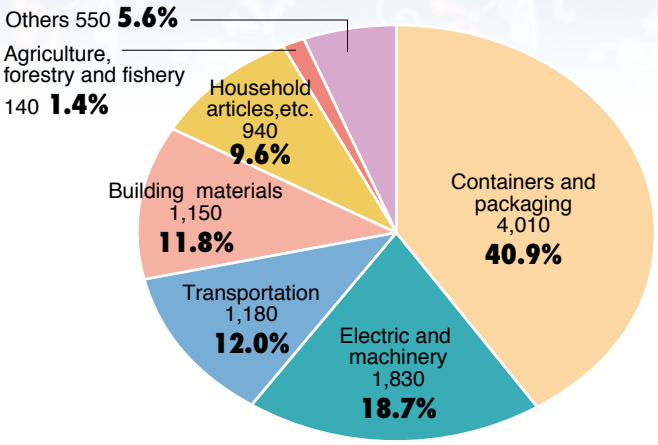


Details of flowchart elements (unit : kt (thousand tons))

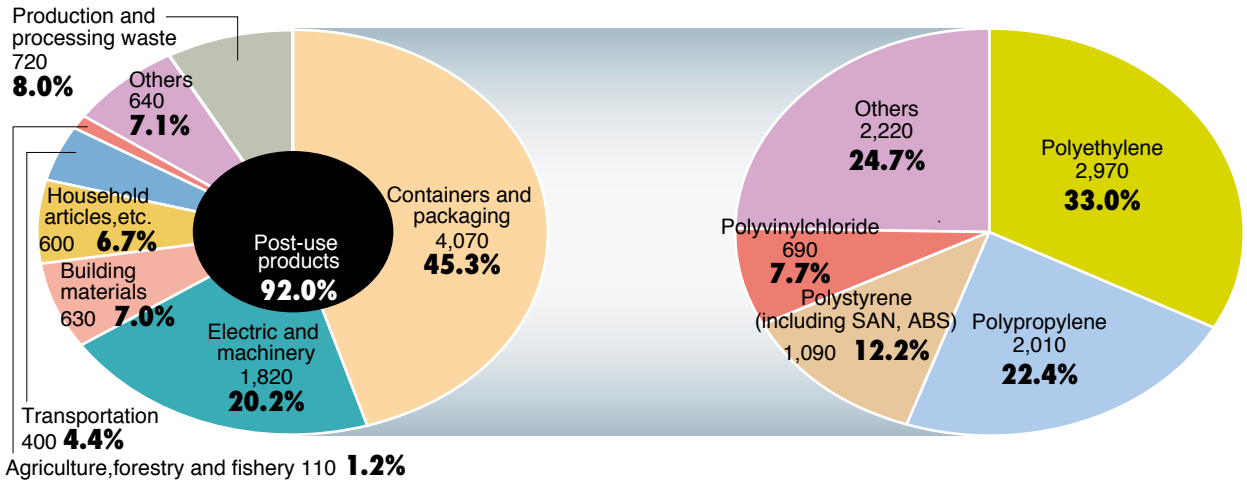
❶ Breakdown of resin production (10,750kt) by resin type



❷ Breakdown of resin products by field (9,800kt)

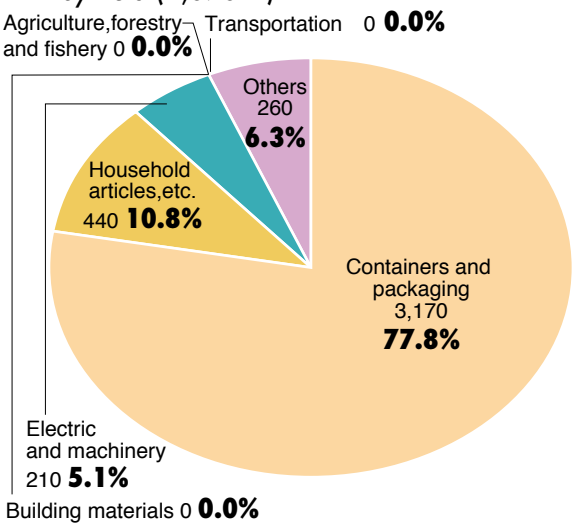


❸ Breakdown of total plastic waste by field and resin type (8,990 kt)

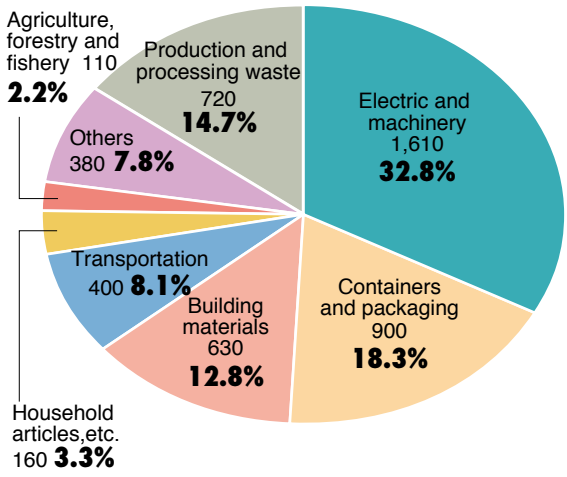


(by field) (by resin type)

❹ Breakdown of domestic(general) waste by field (4,070 kt)

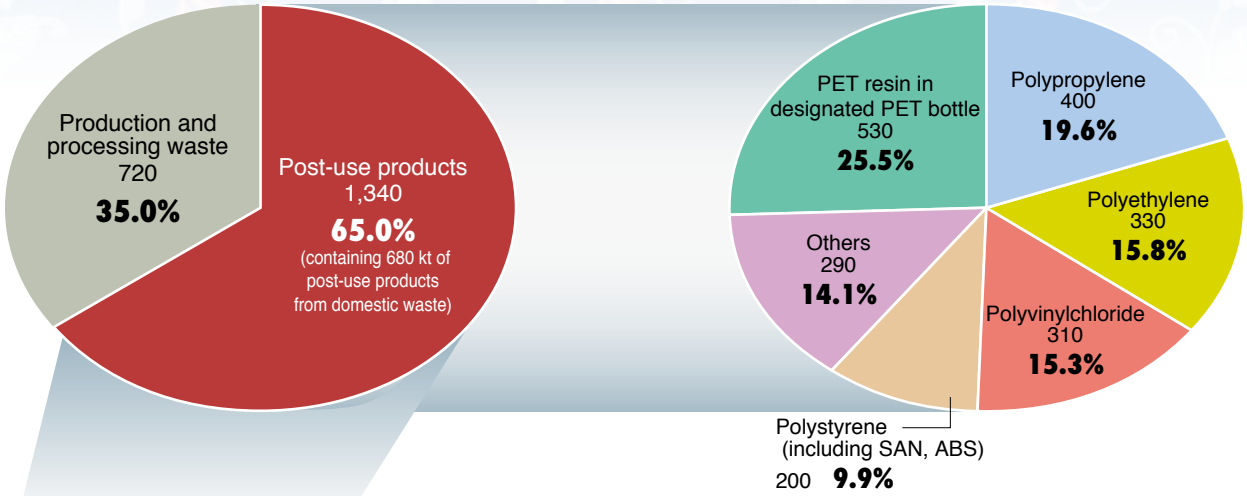


❺ Breakdown of industrial waste by field (4,920 kt)

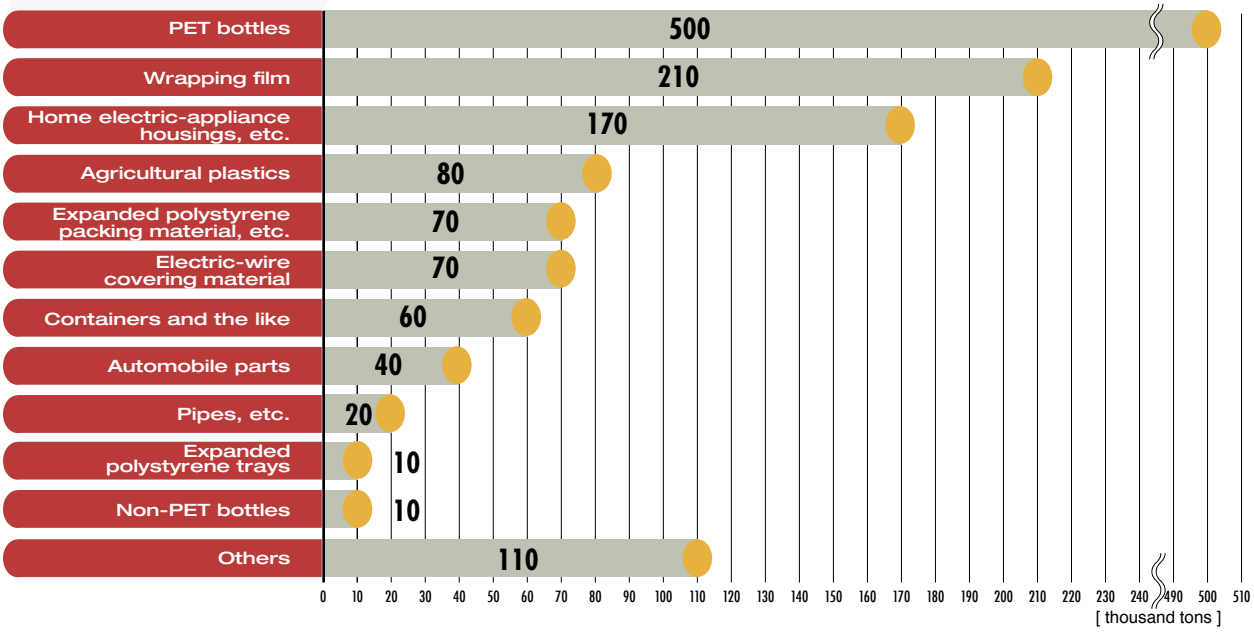


❻ Breakdown of mechanical recycling (2,060 kt)

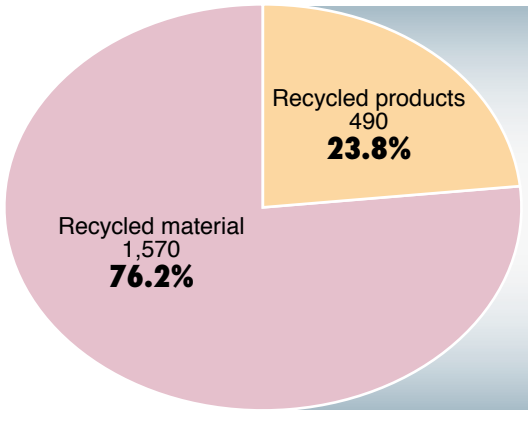
○ Breakdown of mechanical recycling resources and resin type



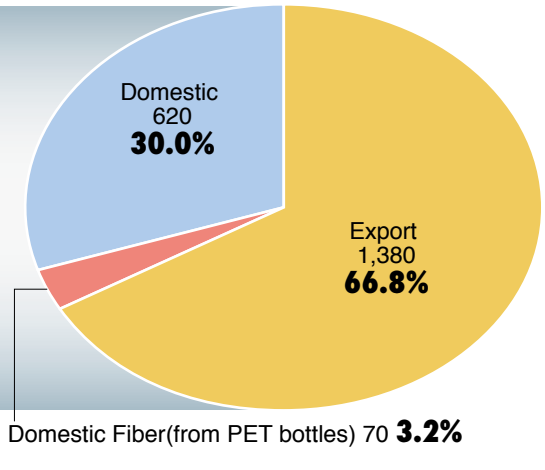
○ Breakdown of post-use products for mechanical recycling (1,340 kt)



(by type of reclaimed products)



(by destination of recycling use)

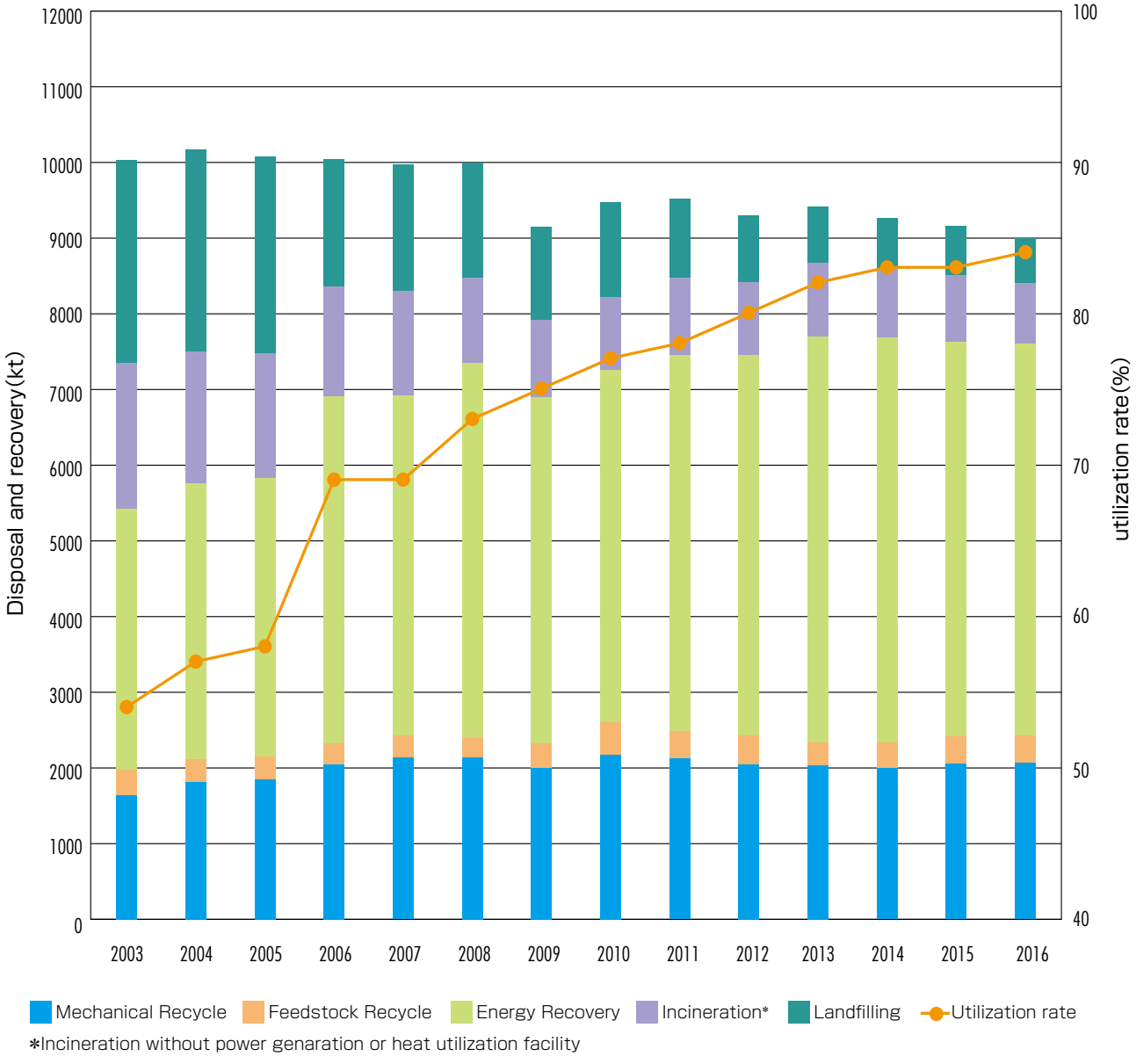


Plastics production and waste discharge

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	%
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
2013	10,600	9,660	9,400	4,540	48	4,860	52
2014	10,610	9,770	9,260	4,420	48	4,830	52
2015	10,860	9,640	9,150	4,350	48	4,800	52
2016	10,750	9,800	8,990	4,070	45	4,920	55

Change in Utilized Plastic Waste by Amount and Rate Over Time

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Total Plastic waste discharge (kt)	10,010	10,130	10,060	10,050	9,940	9,980	9,120	9,450	9,520	9,290	9,400	9,260	9,150	8,990
Utilization amount (kt)	5,410	5,750	5,820	6,880	6,920	7,330	6,890	7,230	7,440	7,440	7,670	7,680	7,630	7,590
Utilization rate(%)	54	57	58	69	69	73	75	77	78	80	82	83	83	84



*Incineration without power genaration or heat utilization facility

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 & recovery (R&R) 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 R&R 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 R&R 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 2018)

Regular members: 17 corporations and 3 organizations
Supporting members: 3 organizations

Regular members

Asahi Kasei Corp.
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
Tokuyama Sekisui Co., Ltd.
Tosoh Corp.
Ube-Maruzen Polyethylene Co., Ltd.

Trade organizations

Japan Petrochemical Industry Association
The Japan Plastics Industry Federation
Vinyl Environmental Council

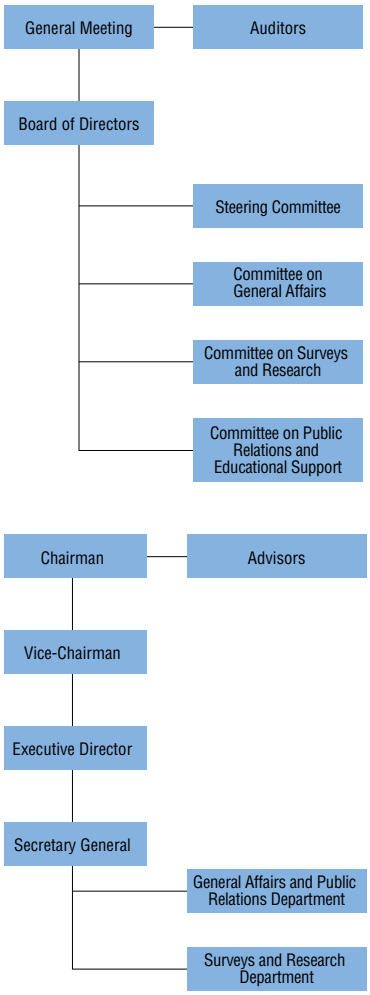
Supporting members

Japan PET Bottle Association
Japan Expanded Polystyrene Association
Japan PVC Environmental Affairs Council

Directors

Chairman: Tsutomu Tannowa
Vice-Chairman: Mamoru Kadokura
Executive Director: Hisao Ida
Directors: 10
Auditors: 2

Organization



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