PWMI Newsletter

NO 53 2024.1

Plastic Waste Management Institute
JAPAN

Plastic Products, Plastic Waste and Resource Recovery [2022]

Background information and notes on the publication of the Flowchart of Plastic Products, Plastic Waste and Resource Recovery (2022)

To improve the accuracy of the Flowchart of Plastic Products, Plastic Waste and Resource Recovery, we (1) surveyed the amount of plastic waste generated from disasters and (2) surveyed the amount of scattered plastic waste (marine litter).

(1) "Post-use products discharge" appearing in the discharge stage of the flowchart has been calculated from past domestic plastic input and average product lifetime by type of use, so large amounts of plastic waste generated in the short term by unpredictable disasters have not been taken into account. We therefore assessed the need for reflecting those amounts in the flowchart by calculating the amount of plastic waste generated at the time of a disaster. In the absence of a large-scale disaster (such as the 2011 Great East Japan Earthquake), the amount of plastic discharged in relation to disasters was calculated to be about 10–20 kt based on statistical data. However, it has been established that several years are needed to determine the amount of plastic discharged at the time of a large-scale disaster, so reflecting it in the flowchart in a timely manner has been found to be difficult. With this in mind, we decided to set disaster-related plastic waste for a year in which no large-scale disaster occurs (such as 2022) at 15 kt/year and to calculate plastic waste at the time of a large-scale disaster by a separate, special calculation taking into account disaster conditions. Disaster-related plastic waste is handled as domestic (general) waste, and with regard to the disposal-and-recovery classification, we converted the recycled classification and final-recovery classification in the "Report on the Study and Survey of Wide-Area Movement of Waste and Related Measures and Survey on the Actual Amounts of Recycled Waste " of the Ministry of the Environment to the disposal-and-recovery classification of PWMI for reflection in the flowchart from this year on.

(2) Plastic waste resulting from littering such as PET bottles (as well as illegally dumped plastic waste) is included in domestic waste, but since the amount of such plastic waste is unclear, it has not been possible to enter it as a constituent element on the flowchart. We therefore assessed the need for reflecting it in the flowchart by calculating that amount. The amount of plastic spilling into the ocean is presently estimated to be several 10 kt/year, so its effect on the flowchart is considered to be limited. The accuracy of that figure, however, is still being tested, and to investigate means of improving the accuracy of the flowchart, the amount of spillage not only into the ocean but also onto land, in the air, etc. must be understood. For this reason, we decided not to reflect that figure in this year's flowchart and to continue our survey of spillage as scattered plastic waste.

2022 Highlights

(1)At 9,510 kt, resin production decreased to 2020 levels at the time of the COVID-19 pandemic, but resin export decreased while resin import increased, so domestic plastics products consumption increased slightly from the previous year to 9,100 kt.

(2)Total plastic waste discharge was about the same at 8,230 kt.

(3)Effectively used plastic waste was the same as the previous year at 7,170 kt while the effective plastic utilization rate was also the same at 87%.

In 2022, resin production decreased from the previous year coming to 9,510 kt (-940 kt relative to 2021, -9%). Resin export and product export also decreased coming to 3,460 kt (-450 kt; -12%) and 870 kt (-40 kt; -4%), respectively. On the other hand, resin import and product import increased coming to 2,610 kt (+240 kt; +10%) and 2,180 kt (+60 kt; +3%), respectively, and as a result, domestic plastics products consumption increased slightly to 9,100 kt (+110 kt; +1%). The figures for exported and imported plastic parts from assembled products were about the same thereby canceling each other out so that domestic plastic input also increased slightly to 8,950 kt (+80 kt; +1%).

Total plastic waste discharge was about the same at 8,230 kt (-10 kt; ±0%), which can be broken down into an increase in domestic (general) plastic waste to 4,240 kt (+50 kt; +1%) and a decrease in industrial waste to 3,990 kt (-60 kt; -2%). It can be seen from these figures that the ratio of industrial waste continued to drop from the previous year.

In terms of disposal and recovery methods, mechanical recycling increased to 1,800 kt (+30 kt; +1%), feedstock recycling*1 decreased to 280 kt (-20 kt; -7%), and energy recovery*2 decreased in total to 5,100 kt (-10 kt; ±0%). As a result, effective plastic utilization at 7,170 kt (±0 kt; ±0%) was about the same as was the case with total plastic waste discharge. Unused plastic waste by simple incineration and landfilling was also about the same as the previous year at 1,070 kt (-10 kt; -1%).

On breaking down mechanical recycling, the export of scrap plastic came to 510 kt (-50 kt; -10%) while the export of recycled material came to 710 kt (-40 kt; -5%). The amount of scrap plastic processed and exported as recycled material decreased for the first time due to the ongoing effects of amendments to the Basel Convention and other regulations. At the same time, the domestic use of recycled products in mechanical recycling continued its upward trend at 530 kt (+140 kt; +35%). The percentage contributions to the effective plastic utilization rate by mechanical recycling, feedstock recycling, and energy recovery were 22% (+0.3 points), 3% (-0.2 points), and 62% (±0 points), respectively, resulting in the same value as the previous year at 87%.

*1:feedstock recycling = blast/coke furnaces + gasification(chemical material use) + liquefaction

*2:energy recovery = gasfication(fuel use)+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 estimated on the basis of chemical-industry statistics from the Ministry of Economy, Trade and Industry (METI). Note that (synthetic) resin does not include synthetic rubber or synthetic fiber.

1-2 Reclaimed products

・For convenience sake, this figure was estimated assuming that the domestically used portion of the previous year's produced mechanical recycling products (recycled resin) is used in the current year while taking figures such as the amount of exported recycled resin into account.

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/import figures are based on trade statistics from the Ministry of Finance.

・Figures for liquid resin, etc. such as additives and paints that fall outside the scope of plastic waste at the time of 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.

・Resin processing waste refers to 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: transportation related products (mainly automobile), Electrical and electronic equipment (mainly home appliances)

・Number of exported/imported assembled products:Automobile figures were determined from an automobile database(Japan Automobiles Dealers Association (JADA), etc);home appliance figures were based on the statics of "Association for Electric Home Appliances (AEHA)","Japan Electrical Manufacturers' Association (JEMA)","Japan Electronics and Information Technology Industries Association (JEITA)" , etc.

(2) Discharge

2-1 Post-use products discharge

・This figure is calculated by a PWMI estimation system based on domestic plastic input by demand-generating fields and by resin type (usage quantities have been calculated annually from 1976) and on a new product discharge model by demand-generating fields ("100-year discharge model" formulated by PWMI in 2017).

・Since the export of used automobiles or used home appliances affects post-use products discharge in Japan, corrections were made to plastic waste discharge in the transport industry or the electronics/electronic-equipment industry. Here, the number of exported used automobiles was based on data released by the Japan Automobile Dealers Association while the number of exported used home appliances was based on "2017 Flow Estimation Results" in the "Current State of the Implementation of Recycling Based on the Home Appliances Recycling Act"

prepared by the Ministry of Economy, Trade and Industry (METI) and Ministry of the Environment (MOE).
- Discharge ratios for domestic waste and industrial waste were estimated using a new product discharge model by demand-generating fields (formulated by PWMI in 2017).
- Disaster-related plastic waste is handled as domestic (general) waste, and for a year in which no large-scale disaster occurs, the amount of disaster-related plastic waste is set to 15 kt/year, while in the event of a large-scale disaster, it is set by a separate, special calculation taking into account disaster conditions.

2-2 Production and processing waste discharge
- Amount of resin production waste (resin discharged as waste in the resin-production stage) is not included in the amount of resin production. The amount of resin production waste and amount of resin processing waste were each estimated using a prescribed waste ratio.In addition, we used a new value for the production waste ratio calculated from the results of the survey conducted by PWMI in fiscal year 2018.

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

- With regard to the disposal-and-recovery classification of disaster-related plastic waste, the recycled classification and final-recovery classification in the "Report on the Study and Survey of Wide-Area Movement of Waste and Related Measures and Survey on the Actual Amounts of Recycled Waste " of the Ministry of the Environment was converted to the disposal-and-recovery classification of PWMI and calculated accordingly.

3-1 Mechanical recycling
- Figures for the mechanical recycling of domestic plastic waste were 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 as specified by the Containers and Packaging Recycling Law were based on data released by The Japan Containers And Packaging Recycling Association. Residual amounts after the mechanical recycling of other plastic containers and packaging were allocated to densified-refuse derived fuel using figures released by The Japan Containers And Packaging Recycling Association as coefficients.
- The amount of mechanically recycled industrial waste was determined by subtracting the amount of mechanically recycled domestic waste from the total of mechanical recycling originating in post-use products (revised in fiscal year 2021) and mechanical recycling originating in production and processing waste estimated from statistical figures of industry associations. Furthermore, based on the results of the survey conducted in 2018, the amount of mechanically recycled production waste was set to approximately 70% from the 2018 flowchart on while the amount of mechanically recycled processing waste was set to approximately 60% from the 2019 flowchart on.
- Recycled resin = scrap plastic + recycled material + recycled products. Scrap plastic refers to plastic waste subjected to intermediate processing (crushing, washing, etc.) as an objective of mechanical recycling. Recycled material, meanwhile, refers to pellets, ingots, flakes, fluff, etc., while recycled products refer to shipping pallets, building materials, miscellaneous daily goods, etc.
- The export figure for recycled resin was taken to be the total export figure for scrap plastic and recycled material. The amount of exported scrap plastic was calculated after correcting the amount of exported "scrap plastic" based on trade statistics from the Ministry of Finance. In addition, the amount of exported recycled material was calculated using trade statistics from the Ministry of Finance in relation to resin material and statistics from the Japan Petrochemical Industry Association. Moreover, the amount of imported scrap plastic, though being small enough to be ignored, was still a statistical figure and therefore subtracted from the amount of import, but the amount of imported recycled products was ignored. Furthermore, since the amount of imported recycled material and the amount of exported recycled products were already recorded in the amount of imported/exported resin and products, they were not included in this calculation.

3-2 Densified-refuse derived fuel and cement material/fuel, blast/coke furnaces, gasification, and liquefaction
- Figures for densified-refuse derived fuel includes plastic waste for power generation; figures for densified-refuse derived fuel and cement material/fuel are based on the results of surveys covering respective industry associations.
- 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. Associated figures for industrial waste were based mainly on the results of questionnaires.

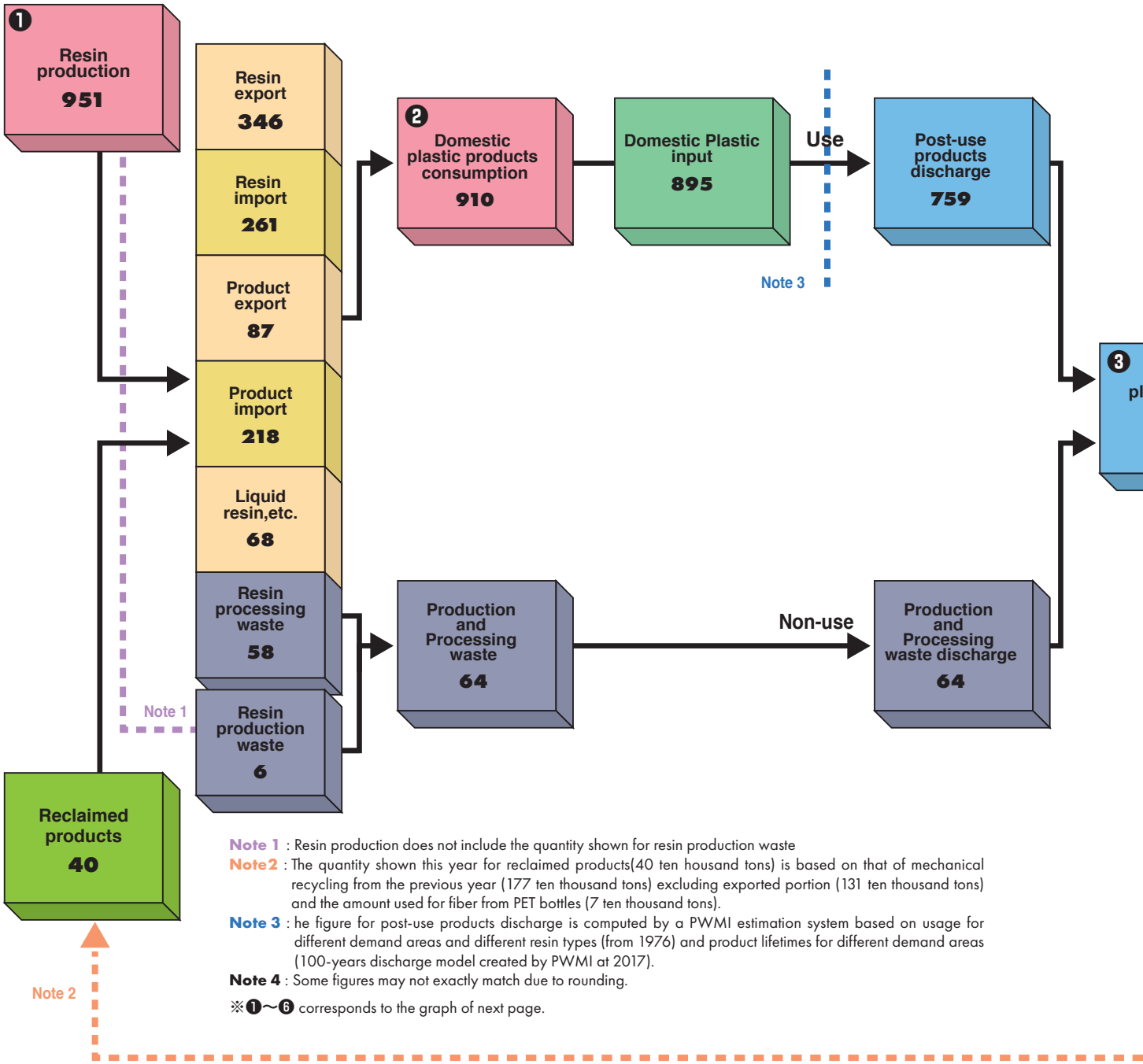
3-3 Incineration/landfilling of domestic waste
- Incineration/landfilling ratio
  This figure was estimated using the results of PWMI surveys based on figures in the "FY2020 Nation Survey on the State of Discharge and Treatment of Municipal Solid Waste" released by the Ministry of the Environment.
- Incineration with power generation, incineration with heat utilization, and simple incineration of domestic waste
  "Incineration with power generation" means incineration processing by an incinerator equipped with power-generation facilities, "incineration with heat utilization" means incineration processing by an incinerator that, while not equipped with power-generation facilities, has facilities for utilizing heat externally, and simple incineration means incineration processing by an incinerator other than that above. The ratios shown were estimated using the results of PWMI surveys based on values released by the Ministry of the Environment.

3-4 Incineration/landfilling of industrial waste
- The disposal and recovery of industrial waste is partially commissioned to local governments as business-related waste. Here, for the ratio of such processing by business operators to that commissioned to local governments, we used a new value calculated from the results of the survey conducted in fiscal year 2018. The percentage breakdown of commissioned processing into incineration with power generation, incineration with heat utilization facility, simple incineration, and landfilling was based on figures for domestic waste processing.
- For business operators, the incineration/landfilling ratio and the percentage breakdown of incineration processing into incineration with power generation, incineration with heat utilization facility, and simple incineration were new values calculated from the results of the survey conducted in fiscal year 2018.
- Figures for incineration with power generation includes plastic waste traded for a price.

Flowchart of plastic products, plastic waste and resource recovery 2022

[Unit：10kt （ten 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

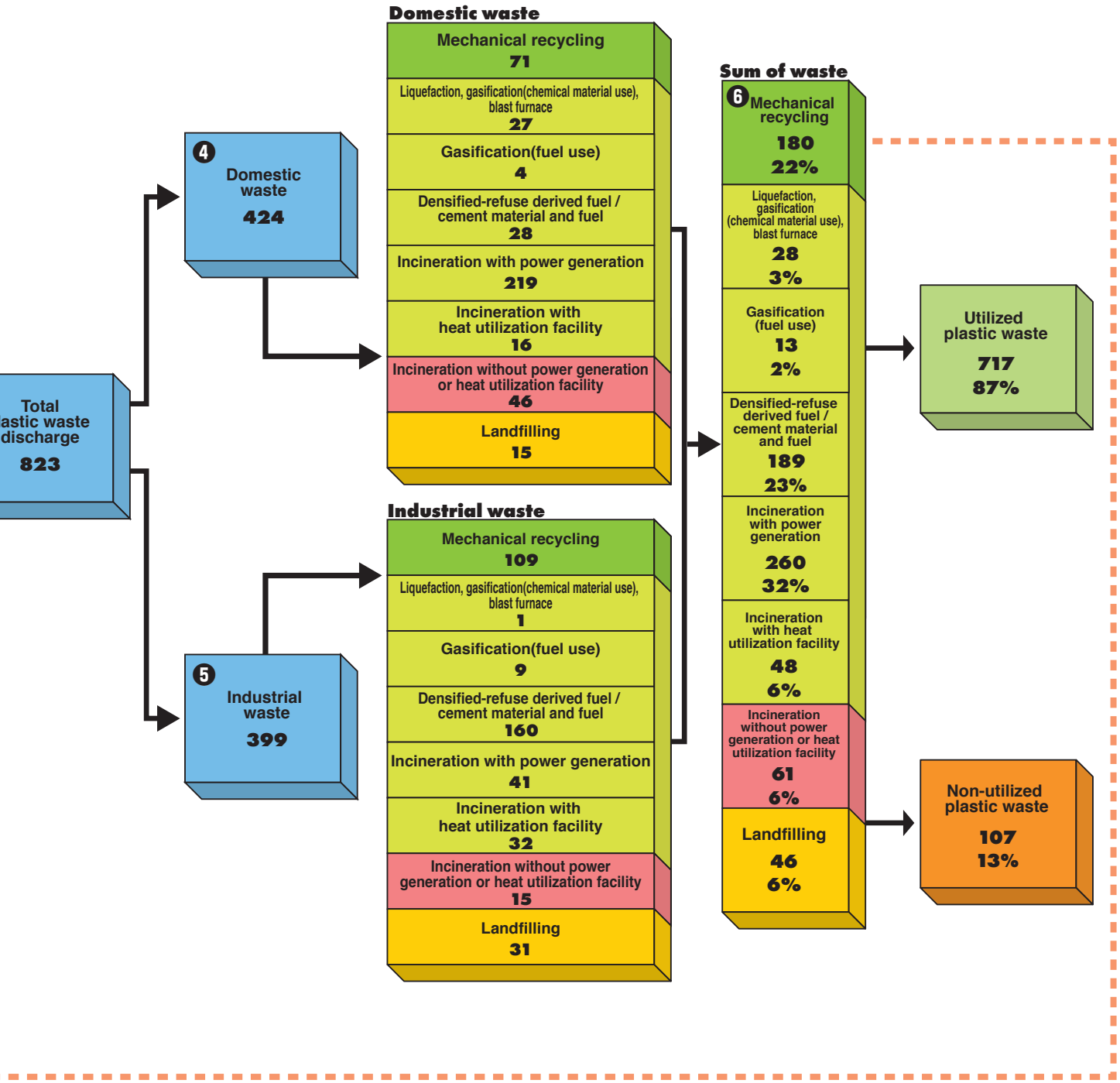
Note 2 : The quantity shown this year for reclaimed products(40 ten housand tons) is based on that of mechanical recycling from the previous year (177 ten thousand tons) excluding exported portion (131 ten thousand tons) and the amount used for fiber from PET bottles (7 ten thousand tons).

Note 3 : he 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.

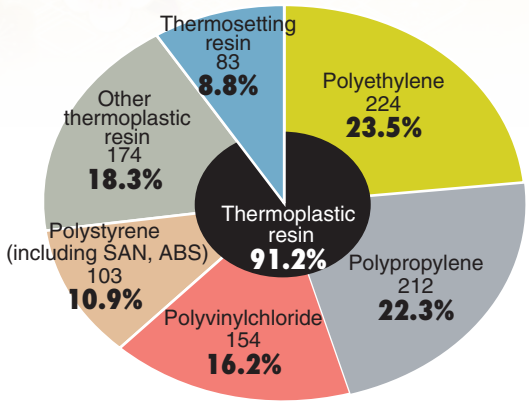
※❶～❻ corresponds to the graph of next page.

Disposal and recovery

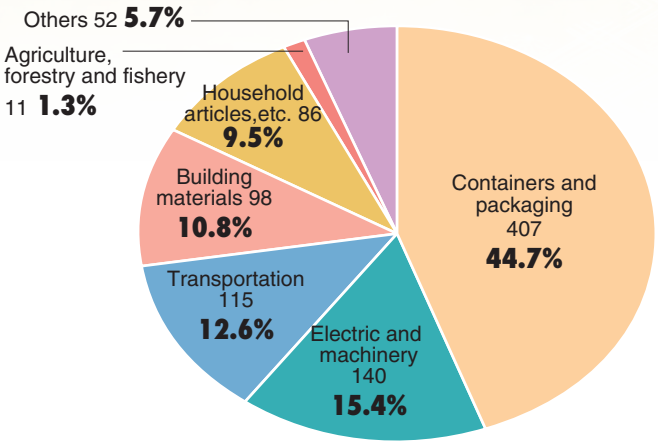


Details of flowchart elements (unit : 10kt (ten thousand tons))

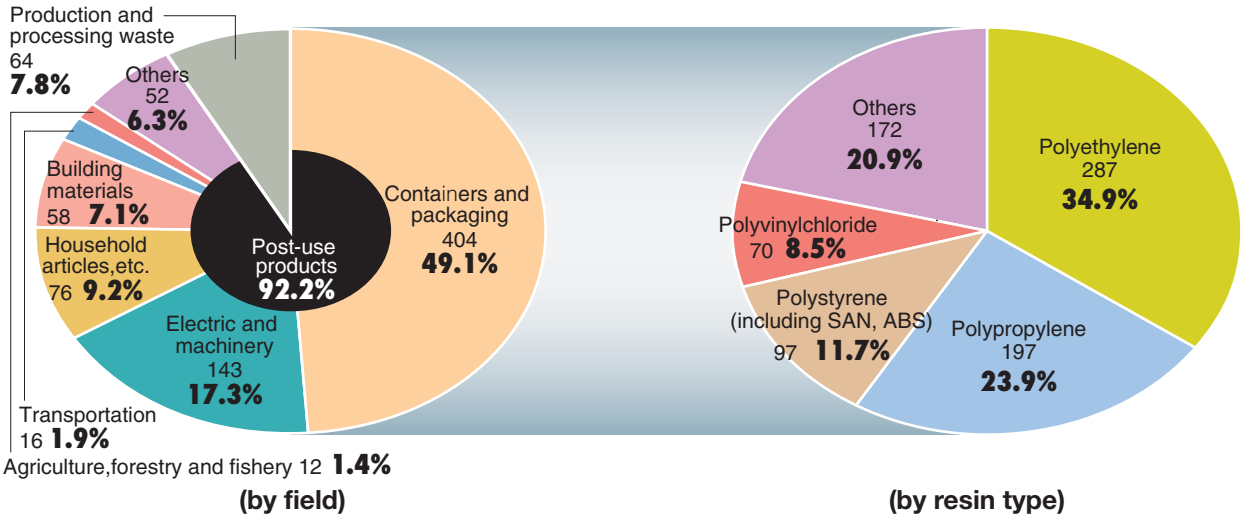
❶ Breakdown of resin production by resin type (951 ten thousand tons)



❷ Breakdown of domestic (general) plastic products consumption by field (910 ten thousand tons)

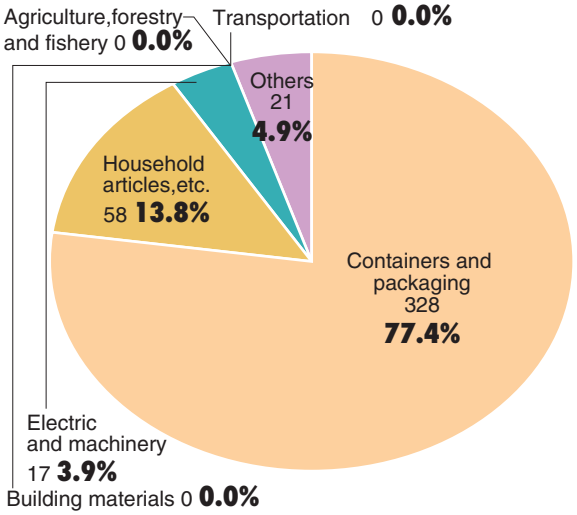


❸ Breakdown of total plastic waste by field and resin type (823 ten thousand tons)

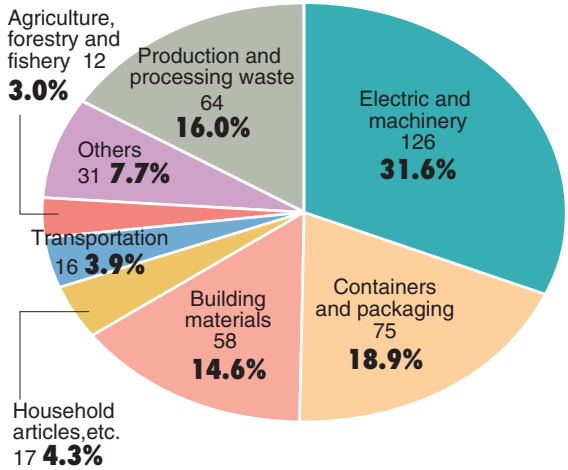


(by field) (by resin type)

❹ Breakdown of domestic(general) waste by field (424 ten thousand tons)

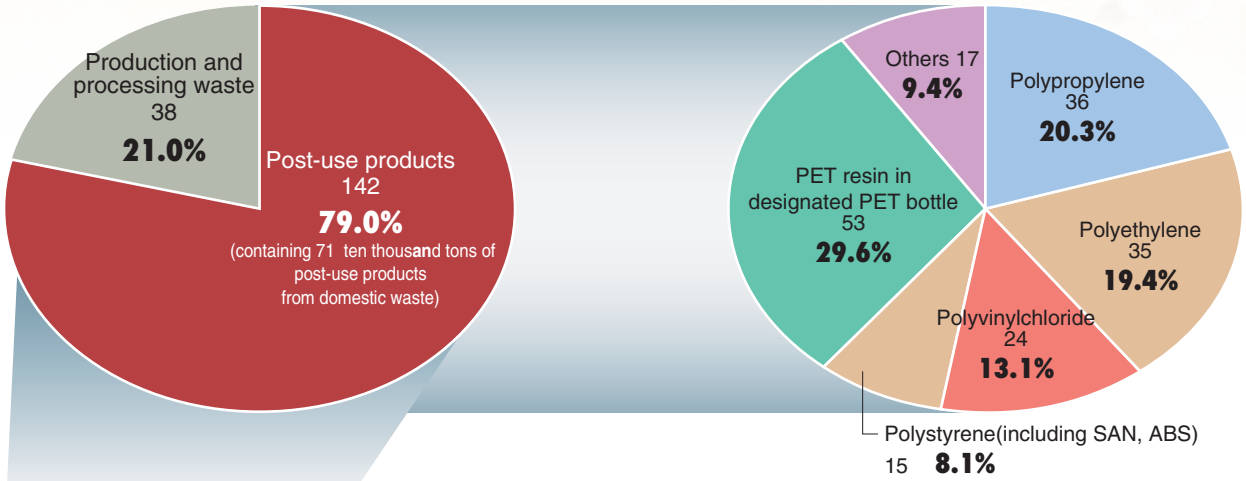


❺ Breakdown of industrial waste by field (399 ten thousand tons)

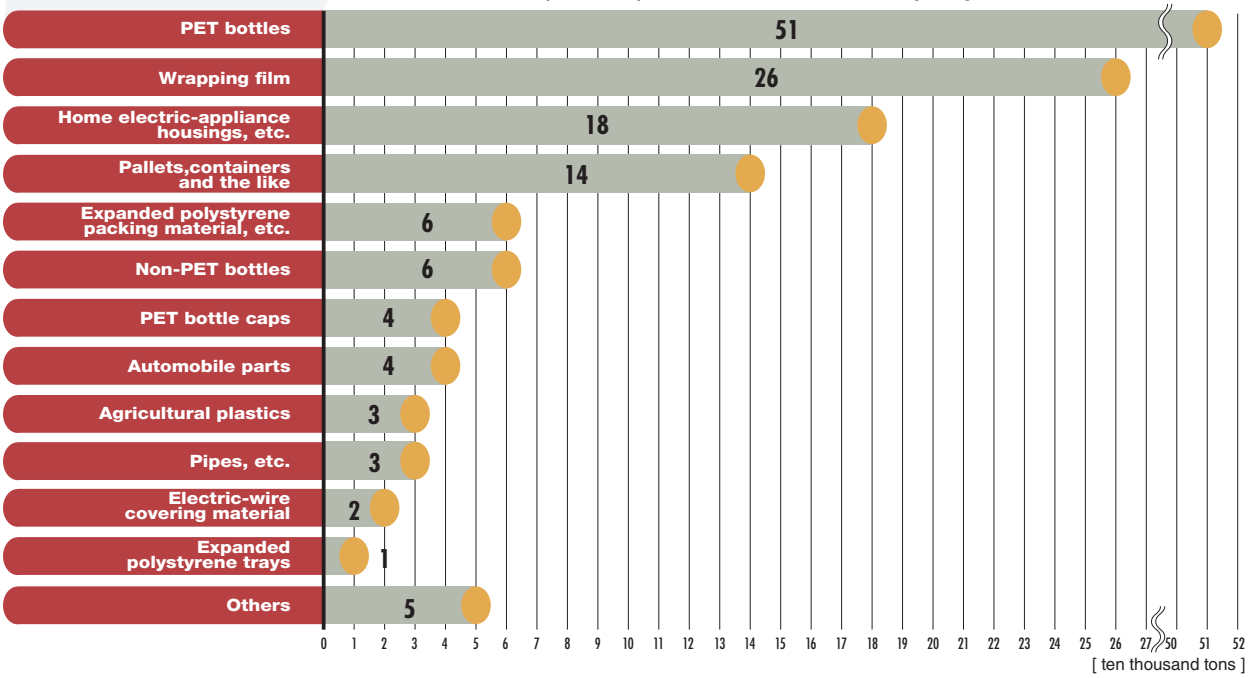


❻ Breakdown of mechanical recycling (180 ten thousand tons)

○ Breakdown of mechanical recycling resources and resin type

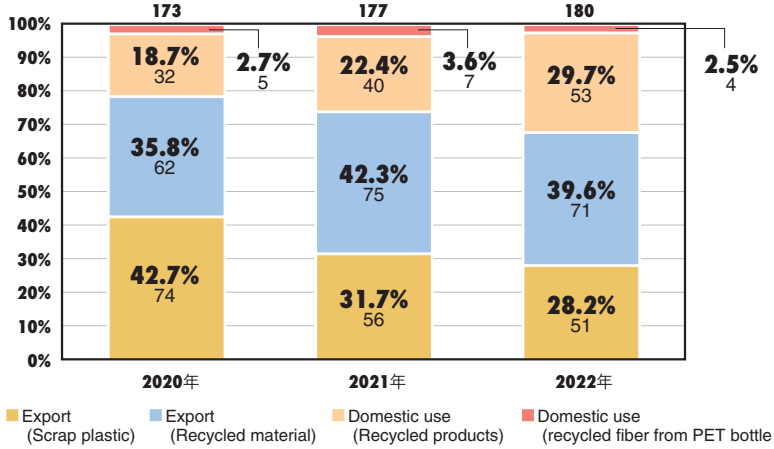


○ Breakdown of post-use products for mechanical recycling (142 ten thousand tons)



(by destination of recycling use)

Total mechanical recycling(ten thousand)

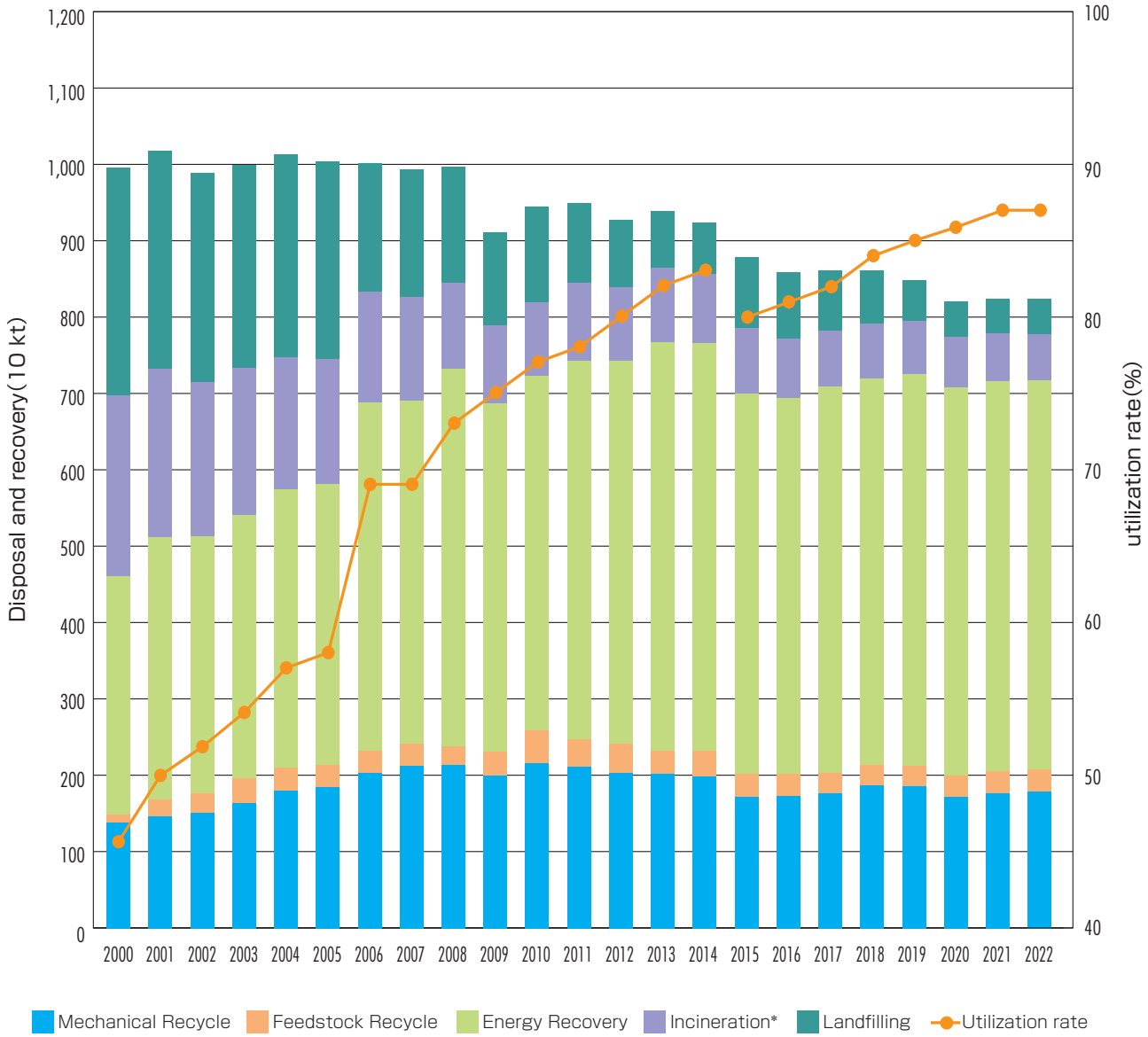


Scrap plastic:plastic waste subjected to intermediate processing (crushing, washing, etc.) as an objective of mechanical recycling
Recycled material:pellets, ingots, flakes, etc.
Recycled products:shipping pallets, building materials, miscellaneous daily goods, etc.

* The amount of exported recycled products and the amounts of imported scrap plastic and recycled material were small enough to be ignored.

Change in Utilized Plastic Waste by Amount and Rate Over Time

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total Plastic waste discharge (10kt)	997	1,016	990	1,001	1,013	1,006	1,005	994	998	912	945	952	929	940	926	879	860	863	861	850	822	824	823
Utilization amount (10kt)	461	513	516	541	575	582	688	692	733	689	723	744	744	767	768	701	695	710	720	726	710	718	717
Utilization rate(%)	46	50	52	54	57	58	69	69	73	75	77	78	80	82	83	80	81	82	84	85	86	87	87



*Incineration without power genaration or heat utilization facility

2015～: Value recalculated by applying the latest data

Plastics production and waste discharge

Year	Resin production	Domestic plastic products consumption	Total plastic waste discharge	Domestic waste		Industrial waste	
	10 kt	10 kt	10 kt	10 kt	%	10 kt	%
1995	1,403	979	884	443	50	441	50
1996	1,466	1,081	909	455	50	454	50
1997	1,521	1,136	949	478	50	471	50
1998	1,391	1,020	984	499	51	485	49
1999	1,457	1,081	976	486	50	490	50
2000	1,474	1,098	997	508	51	489	49
2001	1,388	1,096	1,016	528	52	489	48
2002	1,385	1,057	990	508	51	482	49
2003	1,398	1,101	1,001	513	51	488	49
2004	1,446	1,136	1,013	519	51	494	49
2005	1,451	1,159	1,006	520	52	486	48
2006	1,445	1,120	1,005	508	51	498	50
2007	1,465	1,103	994	502	51	492	49
2008	1,345	1,089	998	502	50	496	50
2009	1,121	843	912	444	49	468	51
2010	1,270	970	945	459	49	486	51
2011	1,159	987	952	465	49	486	51
2012	1,054	960	929	446	48	482	52
2013	1,060	966	940	454	48	486	52
2014	1,061	977	926	442	48	483	52
2015	1,086	877	879	415	47	464	53
2016	1,075	888	860	385	45	475	55
2017	1,102	917	863	394	46	469	54
2018	1,067	932	861	405	47	456	53
2019	1,050	939	850	412	48	438	52
2020	963	841	822	410	50	413	50
2021	1,045	900	824	419	51	405	49
2022	951	910	823	424	52	399	48

2015～: Value recalculated by applying the latest data

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 LCAevaluation 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 June 2023)

Regular members: 18 corporations and 3 organizations

Supporting members: 3 organizations

Regular members

Asahi Kasei Corp.
Dow-Mitsui Polychemicals Co. Ltd.
ENEOS NUC Corporation
Japan Polyethylene Corporation
Japan Polypropylene Corporation
JNC Corporation
Kaneka Corporation
Maruzen Petrochemical Co., Ltd.
Prime Polymer Co., Ltd.
PS Japan Corporation
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

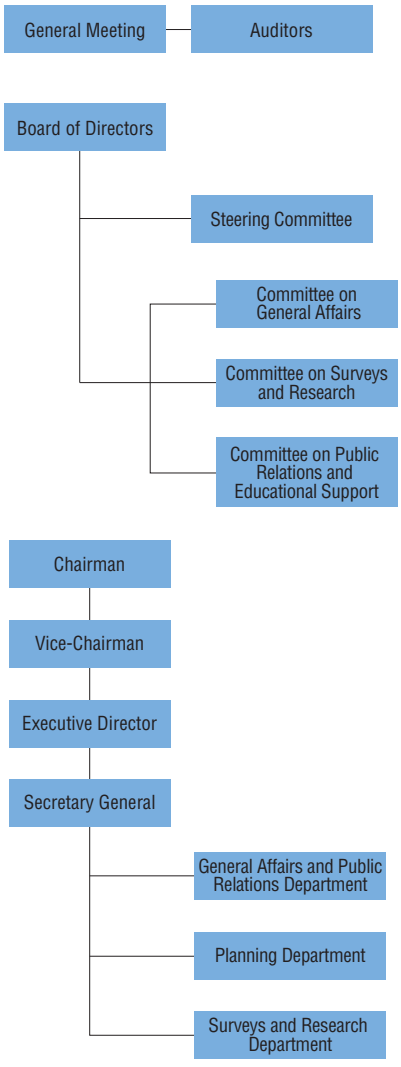
Supporting members

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

Directors

Chairman:Iwata Keiichi
Vice-Chairman:Kuwada Mamoru
Executive Director:Tsuchimoto Ichiro
Directors: 11
Auditors: 2

Organization



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