PWMI Newsletter

NO 54 2025.2

Plastic Waste Management Institute
JAPAN

Plastic Products, Plastic Waste and Resource Recovery [2023]

Background information and notes on the publication of the Flowchart of Plastic Products, Plastic Waste and Resource Recovery (2023)

In FY2023, we conducted a questionnaire-based survey for the first time in five years on the discharge and disposal/recovery of industrial plastic waste targeting plastic waste dischargers (plastic manufacturers, processors, and users).

(1) Production waste ratio: Ratio of the amount of plastic discarded as unused product without becoming raw material like pellets at the time of resin production (production waste product) to the amount of input resin

(2) Processing waste ratio: Ratio of the amount of plastic discarded as unused product without becoming a manufactured product at the time of resin processing (processing waste product) to the amount of input resin

(3) Ratio of mechanical recycling originating in production waste: Ratio of production waste product used as recycled products (mechanical recycling)

(4) Ratio of mechanical recycling originating in processing waste: Ratio of processing waste product used as recycled products

(5) Local-government/business-operator consignment ratio: Ratio of industrial plastic waste consigned to local governments and business operators for incineration or landfilling

(6) Local-government incineration/landfilling ratio: Ratio of industrial plastic waste consigned to local governments for incineration or landfilling

(7) Business-operator incineration/landfilling ratio: Ratio of industrial plastic waste consigned to business operators for incineration or landfilling

(8) Breakdown of business-operator incineration processing by incineration method: Breakdown by incineration method of incinerated plastic waste among industrial plastic waste consigned to business operators for processing (incineration with power generation, incineration with heat utilization facility, and simple incineration)

The types of industries targeted by our previous (FY2018) questionnaire-based survey were only seven manufacturing industries, but in the survey we conducted last fiscal year, we added another manufacturing industry plus a construction industry and non-manufacturing industry thereby targeting a wide range of industries. We therefore consider that the results of this questionnaire are more accurate than those of the previous questionnaire, so we applied the coefficients that we revised this time retroactively up to 2018. Additionally, while we have been releasing a flowchart pertaining to plastics on the whole up to now, we here include a “Material Flowchart of Expanded Containers and Packaging” with respect to domestic (general) waste broken down into different fields.

2023 Highlights

(1) At 8,870 kt, resin production decreased from the previous year by 7%, and since both imports and exports decreased from the previous year by about the same rate, domestic plastics products consumption also decreased from the previous year by 7% to 8,430 kt.

(2) At 7,690 kt, total plastic waste discharge decreased from the previous year by 6% due to the effects of a decrease in domestic plastics products consumption in container and packaging fields with a short product lifetime.

(3) Effectively used plastic waste decreased from the previous year by 5% to 6,880 kt, but the effective plastic utilization rate, being heavily affected by the decrease in total plastic waste discharge, came to 89% reflecting an increase of one point.

In 2023, resin production decreased from the previous year coming to 8,870 kt (-640 kt relative to 2022; -7%). Both resin export and product export also decreased coming to 3,260 kt (-200 kt; -6%) and 810 kt (-70 kt; -8%), respectively, and similarly, both resin import, and product import decreased coming to 2,470 kt (-140 kt; -5%) and 1,990 kt (-190 kt; -9%), respectively. As a result, domestic plastics products consumption also decreased to 8,430 kt (-620 kt; -7%) by an amount equivalent to the decrease in resin production. Exported plastic parts from assembled products were slightly higher than imported ones, so domestic plastic input also decreased to 8,320 kt (-580 kt; -7%).

Total plastic waste discharge also decreased to 7,690 kt (-520 kt; -6%) due to the effects of a decrease in domestic plastics products consumption in container and packaging fields with a short product lifetime. Discharge destination can be broken down into domestic (general) waste at 3,870 kt (-360 kt; -9%) and industrial waste at 3,820 kt (-160 kt; -4%) indicating a decrease in the amount of waste in both cases. Since there was a large decrease in the amount of domestic (general) waste where consumption in container and packaging fields is high, it can be seen that the percentage of domestic (general) waste dropped from the previous year.

In terms of disposal and recovery methods, mechanical recycling decreased to 1,710 kt (-40 kt; -2%), feedstock recycling*1 decreased to 260 kt (-10 kt; -5%), and energy recovery*2 decreased overall to 4,910 kt (-330 kt; -6%). In short, all methods showed a decrease due to the effects of a decrease in total plastic waste discharge. As a result, effectively used plastic waste likewise decreased to 6,880 kt (-370 kt; -5%). Unused plastic waste by simple incineration and landfilling also showed a large decrease to 810 kt (-140 kt; -15%).

On breaking down mechanical recycling, the export of scrap plastic came to 540 kt (+40 kt; +7%) while the export of recycled material came to 710 kt (±0 kt; ±0%). These results indicate an easing in the trend toward a decrease in the amount of scrap plastic processed and exported as recycled material 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 at 430 kt (-60 kt; -12%) appears to be hitting a plateau. The percentage contributions of mechanical recycling, feedstock recycling, and energy recovery were 22% (+1.0 point), 3% (+0.1 point), and 64% (+0.1 point), respectively. Although effectively used plastic waste decreased, effective plastic utilization rate increased by one point to 89% from the previous year being heavily affected by the decrease in total plastic waste discharge.

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

*2: energy recovery = gasification (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 Manufactures Association (JAMA), 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. Additionally, starting with the 2023 Flowchart of Plastic Products, Plastic Waste and Resource Recovery, we applied the latest calculated values based on the results of the survey conducted in FY2023 retroactively to the production waste ratio up to 2018 and to the processing waste ratio up to 2015.

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.

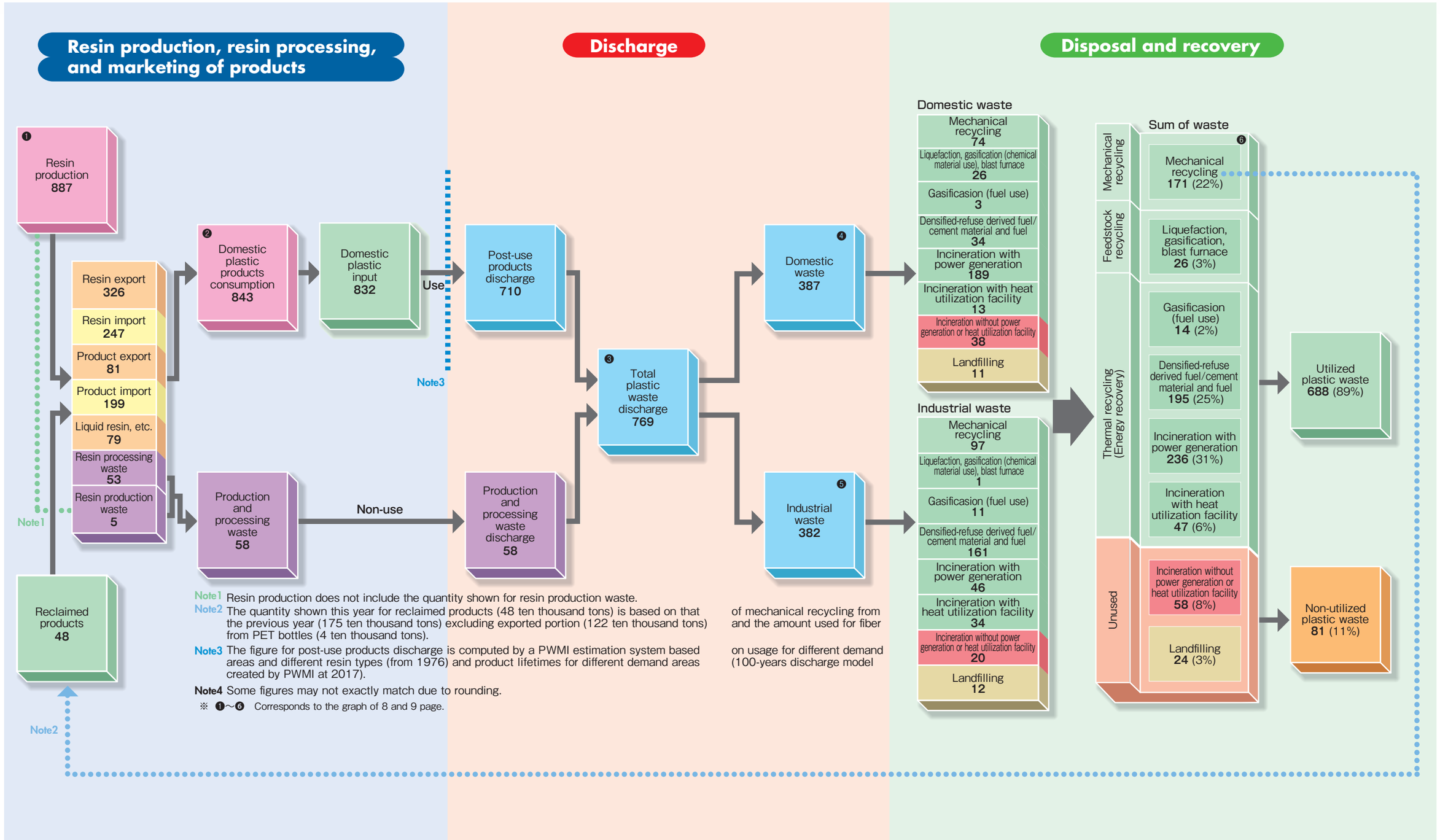
3-4 Incineration/landfilling of industrial waste

- The disposal and recovery of industrial waste is partially commissioned to local governments as business-related waste. We applied the latest calculated values based on the results of the survey conducted in FY2023 to the local-government and business-operator consignment ratios retroactively to 2018. In addition, the ratios of incineration with power generation, incineration with heat utilization facility, simple incineration, and landfilling for local-government consigned processing were based on the processing of domestic (general) waste.
- We also applied the latest calculated values based on the results of the survey conducted in FY2023 to the incineration/landfilling ratios and the ratios of incineration with power generation, incineration with heat utilization facility, and simple incineration in incineration processing by business operators retroactively up to 2015.
- Figures for incineration with power generation includes plastic waste traded for a price.

Flowchart of plastic products, plastic waste and resource recovery 2023

The "plastics" handled by our association do not include synthetic rubber, synthetic fibers, or liquid resins such as paints and adhesives.

(unit: 10kt (ten thousand tons))



Note1 Resin production does not include the quantity shown for resin production waste.

Note2 The quantity shown this year for reclaimed products (48 ten thousand tons) is based on that the previous year (175 ten thousand tons) excluding exported portion (122 ten thousand tons) from PET bottles (4 ten thousand tons).

Note3 The figure for post-use products discharge is computed by a PWMI estimation system based areas and different resin types (from 1976) and product lifetimes for different demand areas created by PWMI at 2017).

Note4 Some figures may not exactly match due to rounding.

※ ❶~❻ Corresponds to the graph of 8 and 9 page.

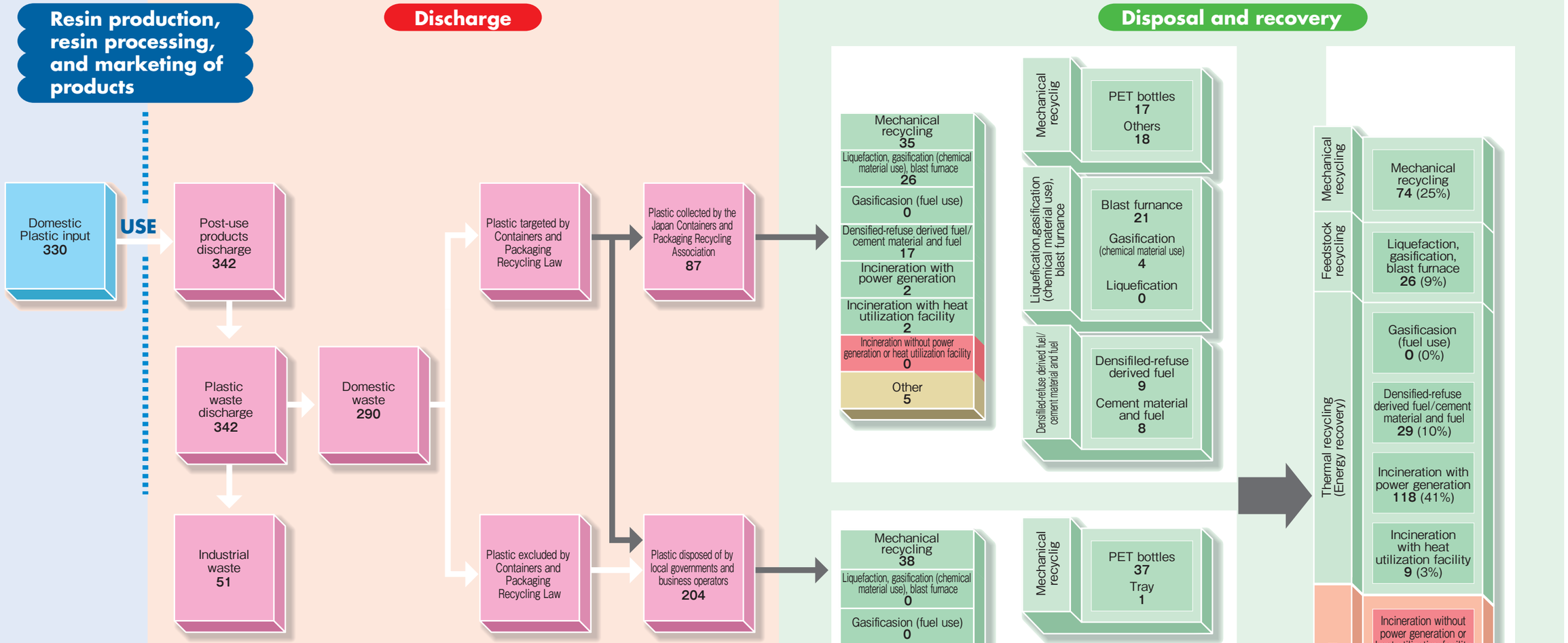
of mechanical recycling from and the amount used for fiber

on usage for different demand (100-years discharge model

Material Flowchart of Expanded Containers and Packaging 2023

The "plastics" handled by our association do not include synthetic rubber, synthetic fibers, or liquid resins such as paints and adhesives.

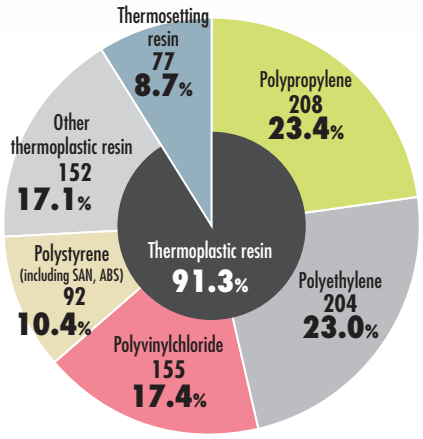
(unit: 10kt (ten thousand tons))



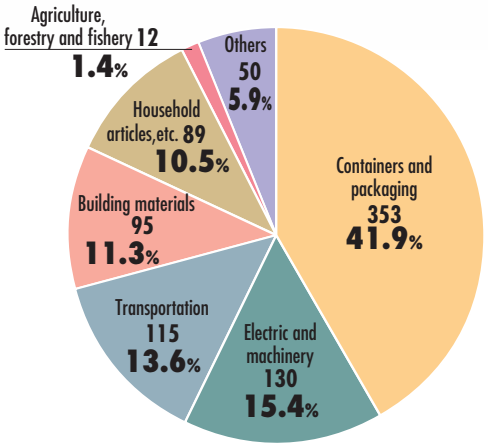
- The flowchart on this page is serving as a test—its configuration, numerals, etc. may change from next year on.
- "Expanded containers and packaging" means a range broader than containers and packaging targeted by the Containers and Packaging Recycling Law.
- "Expanded containers and packaging" may include various types of containers.
- Since used packaging is the assumed target here, processing waste discharged from container manufacturing and processing operators is excluded.
- The amount of plastic collected by the Japan Containers and Packaging Recycling Association includes PET bottles and plastics. This includes an amount of product plastics based on Article 32 of the Act on Promotion of Resource Circulation for Plastics but does not consider that based on Article 33.
- "Other" in the processing/disposal of plastics collected by the Japan Containers and Packaging Recycling Association includes PET bottle recycling residue, etc.
- Incineration with power generation is mainly performed by local governments.
- Material flow of industrial plastic waste is to be studied from next year on.
- This flowchart is specific to certain fields within the "Plastic Material Flowchart" on the preceding page, so the footnotes on that page still apply.

Details of flowchart elements

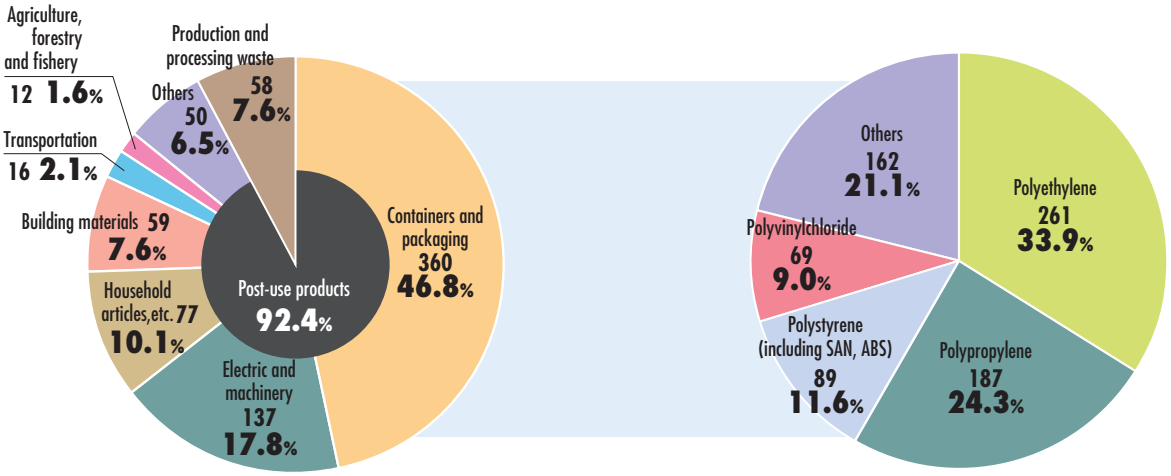
1 Breakdown of resin production by resin type (887 ten thousand tons)



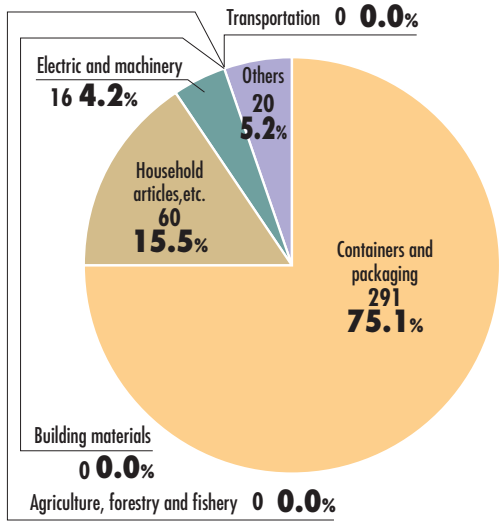
2 Breakdown of domestic (general) plastic products consumption by field (843 ten thousand tons)



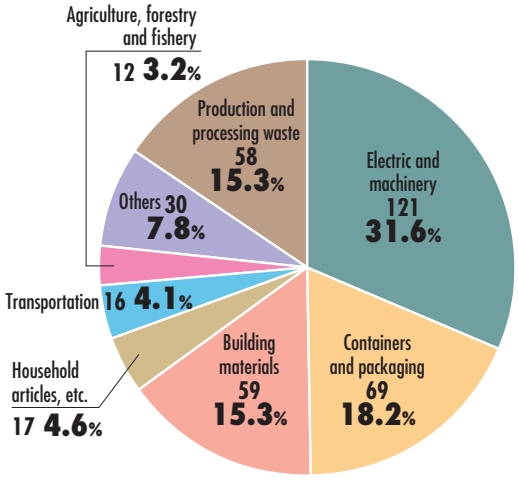
3 Breakdown of total plastic waste by field and resin type (769 ten thousand tons)



4 Breakdown of domestic (general) waste by field (387 ten thousand tons)



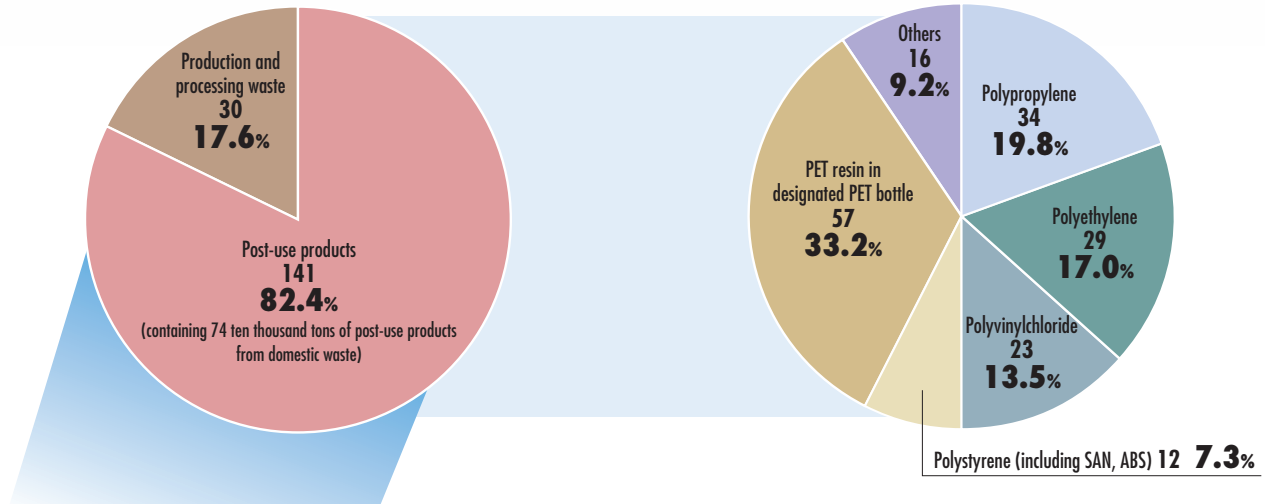
5 Breakdown of industrial waste by field (382 ten thousand tons)



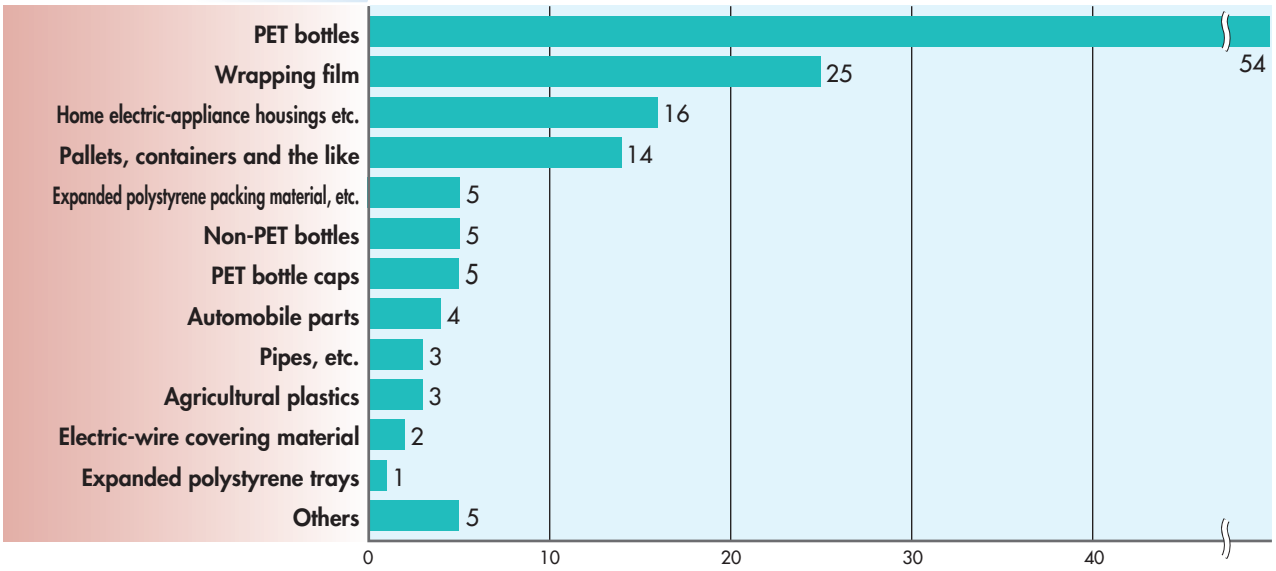
(unit: 10kt (ten thousand tons))

6 Breakdown of mechanical recycling (171 ten thousand tons)

Breakdown of mechanical recycling resources and resin type

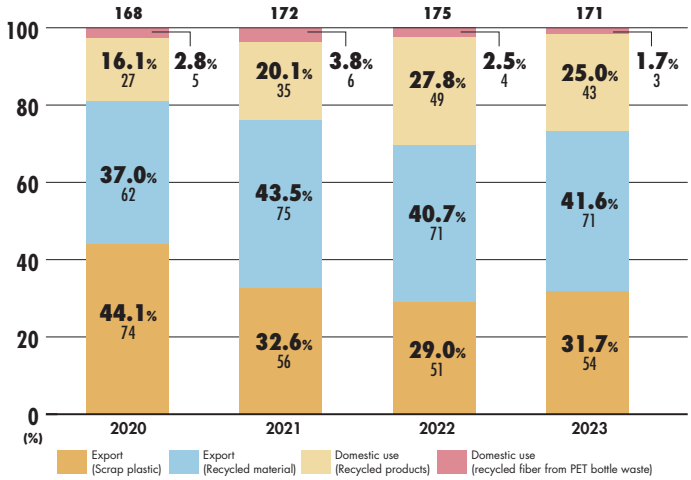


Breakdown of post-use products for mechanical recycling (141 ten thousand tons)



(by destination of recycling use)

Total mechanical recycling (ten thousand)

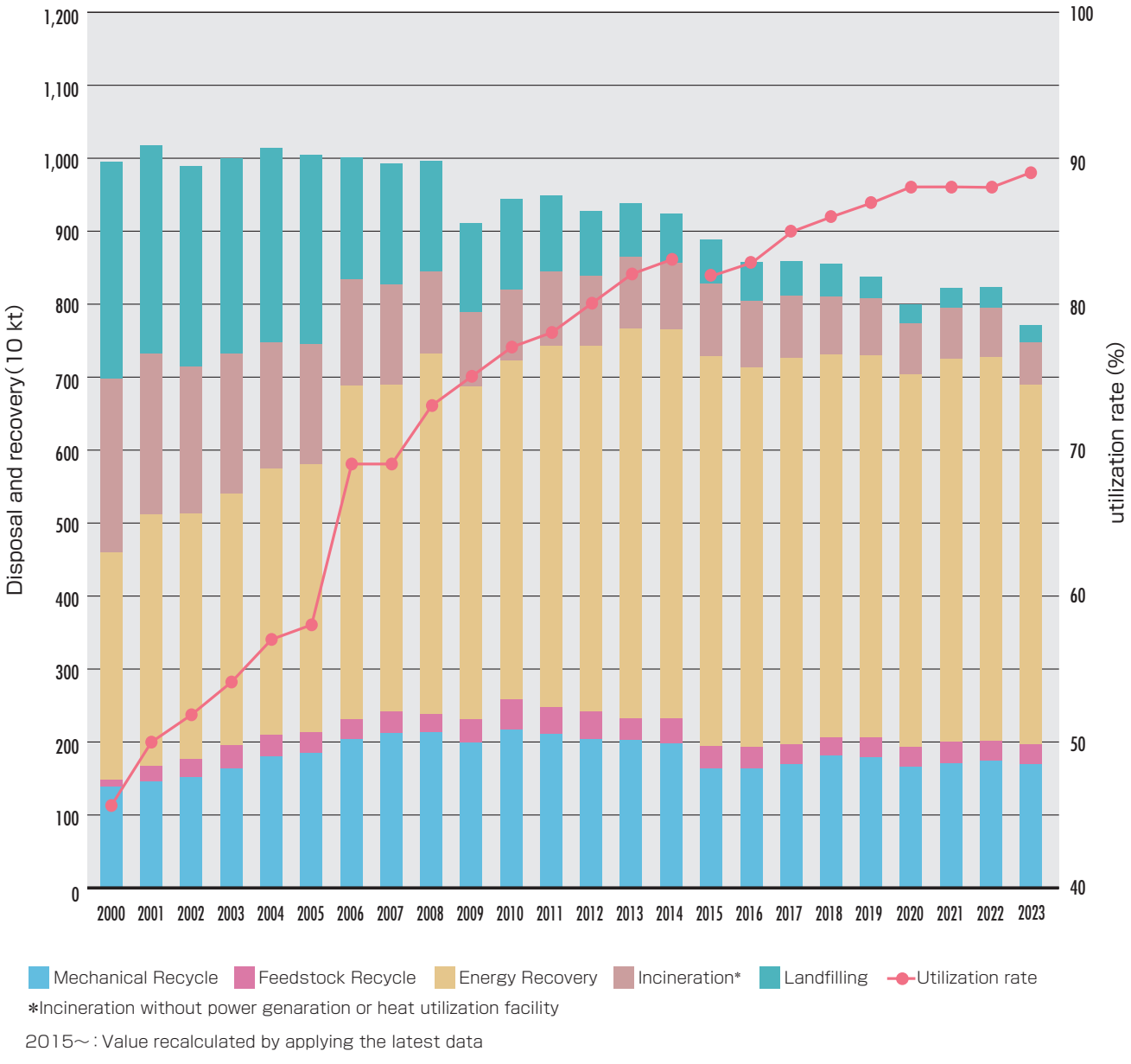


Scrap plastic: plastic waste subjected to intermediate processing (crushing, washing, etc.) as an objective of mechanical recycling
Recycled material: pellets, ingots, flakes, etc.
Recycled products: shipping pallets, building materials, miscellaneous daily goods, etc.

* 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	2023
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	890	858	858	853	835	800	822	821	769
Utilization amount (10kt)	461	513	516	541	575	582	688	692	733	689	723	744	744	767	768	730	715	726	730	728	704	725	725	688
Utilization rate (%)	46	50	52	54	57	58	69	69	73	75	77	78	80	82	83	82	83	85	86	87	88	88	88	89



*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	
	10kt	10kt	10kt	10kt	%	10kt	%
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	907	890	422	47	468	53
2016	1,075	884	858	383	45	475	55
2017	1,102	904	858	391	46	467	54
2018	1,067	911	853	399	47	454	53
2019	1,050	901	835	401	48	434	52
2020	963	791	800	394	49	406	51
2021	1,045	894	822	417	51	404	49
2022	951	906	821	423	51	398	49
2023	887	843	769	387	50	382	50

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 January 2025)

Regular members: 17 corporations and 3 organizations

Supporting members: 3 corporations and 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.
Shin-Etsu Chemical Co., Ltd.
Sumitomo Chemical Co., Ltd.
SunAllomer Ltd.
Taiyo Vinyl Corporation
Tokuyama 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

MITSUI & CO., LTD.
Sekisui Kasei Co., Ltd.
Toyama Kankyo Seibi Co., LTD.

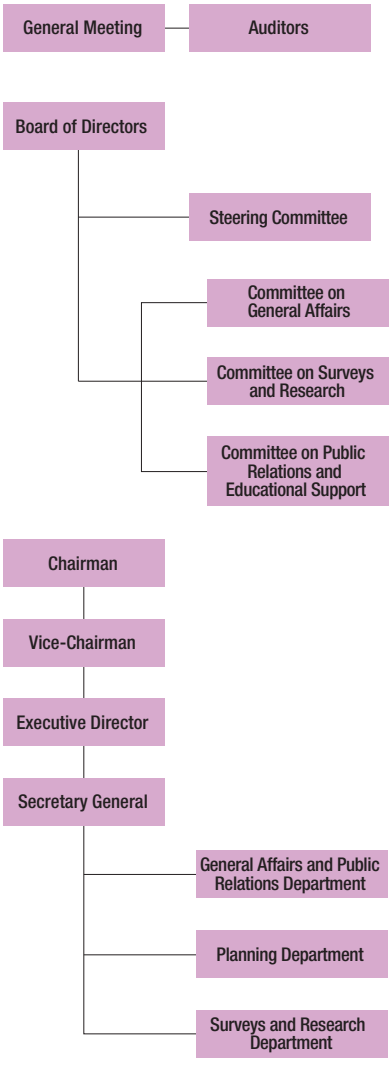
(Trade organizations)

Japan Auto Parts Industries Association
Japan Expanded Polystyrene Association
Japan PET Bottle Association
Japan PVC Environmental Affairs Council

Directors

Chairman: Kudo Koshiro
Vice-Chairman: Fujii Kazuhiko
Executive Director: Tsuchimoto Ichiro
Directors: 11
Auditors: 2

Organization



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