PWMI Newsletter

NO 51 2022.2

Plastic Waste Management Institute
JAPAN

Plastic Products, Plastic Waste and Resource Recovery [2020]

Background information and notes on the publication of the Flowchart of Plastic Products, Plastic Waste and Resource Recovery (2020)

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

(1) Revision to amount of mechanical recycling

We had not updated the calculation scheme for the amount of mechanical recycling originating in post-use products for some time. We therefore summed up the amount of mechanical recycling by identifying as much as possible post-use products subjected to mechanical recycling and closely checked those amounts based on a variety of statistics.

(2) Revision to amount of mechanical recycling products

Up to now, Japan has been exporting mechanical recycling products (mainly intermediately processed scrap plastic) in large volumes to overseas locations (mainly China), but due to enhanced plastic-waste import restrictions imposed by China in 2018, the amount of exported mechanical recycling products (the amount of exported "scrap plastic" according to Japan trade statistics) decreased significantly. On the other hand, it was surmised, for example, that cases in which mechanical recycling products were exported in the form of recycled material such as pellets, which is not grasped by those trade statistics, had actually increased. To therefore grasp the export state of mechanical recycling products (= scrap plastic + recycled material), we determined, for main resins (polyethylene, polypropylene, and polystyrene), the amount of exported recycled material by subtracting the "amount of exported resin material not including recycled material" as grasped and announced by the Japan Petrochemical Industry Association from the "amount of exported resin material including recycled material" as obtained from trade statistics. Then, on conducting interviews with exporters and industry associations, we added the amount of exported recycled material for collected resins other than the above main resins to calculate the amount of recycled material exported overseas in a form other than scrap plastic. In 2020, this amount reached 620 kt, and it became clear that the trend in producing recycled material within Japan and exporting it overseas had been strengthening amid the gradual weakening of the trend in exporting scrap plastic to countries other than China (mostly Southeast Asian countries), which had strengthened immediately after China imposed enhanced plastic-waste import restrictions. The amount of mechanical recycling products calculated by adding the amount of exported "scrap plastic" from trade statistics to this amount of exported recycled material came to 1,360 kt, so it appears that nearly 80% of mechanical recycling products were exported overseas.

From the perspective of material balance in plastic waste, a portion of plastic waste used in mechanical recycling is exported overseas as scrap plastic and recycled material, while recycled products using plastic waste other than the above are produced and used domestically (recycled) (appearing in the following year's flowchart). A rough value for the amount of recycled products circulating domestically can therefore be estimated by subtracting the amount of exported mechanical-recycling products from the amount of mechanical recycling. To verify this calculation, we estimated the amount of recycled products based on the obtained amount of exported mechanical recycling products and found that it generally agreed with the amount of "Plastic Waste Products" from the Ministry of Economy, Trade and Industry, Industrial Statistics, in relation to the domestic shipping of recycled resin.

2020 Highlights

(1)For 2020, resin production and domestic plastics products consumption decreased significantly to 9,630 kt and 8,410 kt, respectively, due to the effects of the COVID-19 pandemic.

(2)Total plastic waste discharge decreased to 8,220 kt.

(3)Effectively used plastic waste was 7,100 kt making for an effective plastic utilization rate of 86%, one point higher than that of the previous year.

In 2020, the demand for plastic products decreased due to restrictions in production activities and a drop in consumption brought on by the effects of COVID-19. As a result, resin production, resin import, and domestic plastics products consumption all decreased significantly to 9,630 kt (-870 kt relative to 2019; -8.3%), 2190 kt (-300 kt; -12.2%), and 8,410 kt (-980 kt; -10.4%), respectively. On the other hand, the number of exported automobiles decreased and exported plastic parts from assembled products decreased to 480 kt (-170 kt; -25.9%) so that domestic plastic input came to 8,370 kt (-810 kt; -8.8%) thereby reducing somewhat the extent of its decrease. In addition, total plastic waste discharge decreased to 8,220 kt (-280 kt; -3.3%). On breaking down total plastic waste discharge, domestic (general) waste was mostly unchanged at 4,100 kt (-20 kt; -0.6%) since consumption did not relatively decrease due an increase in demand for products related to staying at home and hygiene. However, production and processing waste discharged from factories and elsewhere decreased due to restrictions in production activities, so industrial waste decreased significantly to 4,130 kt (-260 kt; -5.8%).

As for disposal and recovery methods, mechanical recycling decreased to 1,730 kt (-120 kt; -6.7%), feedstock recycling[*1] increased to 270 kt (+10 kt; +2.5%), and energy recovery[*2] decreased in total to 5,090 kt (-40 kt; -0.8%), and effectively used plastic waste decreased to 7,100 kt (-160 kt; -2.2%) partly due to decrease in total plastic waste discharge. This decrease in mechanical recycling can be attributed to the apparent decrease (-40 kt) associated with the "Revision to amount of mechanical recycling" in our study performed this year on improving the accuracy of the flowchart, as well as to the decrease in mechanical recycling originating in production and processing waste (-50 kt relative to 2019) and the decrease in mechanical recycling of PET bottle waste (-20 kt). At the same time, simple incineration and unused plastic waste by landfilling together decreased to 1,120 kt (-120 kt; -9.8%). The percentage contributions to the effective plastic utilization rate by mechanical recycling, feedstock recycling, and energy recovery were 21% (-0.8 points to 2019), 3% (+0.2 points), and 62% (+1.6 points), respectively, resulting in an overall one-point jump from the previous year to 86%. The main reason for this increase is given to be the increase in the use of densified-refuse derived fuel (+120 kt; +13.5%).

*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: automobiles, home appliances (televisions, refrigerators, freezers, air conditioners, washing machines and dryers)

・Number of exported/imported assembled products: Automobile figures were determined from an automobile database (Japan Automobile Manufacturers Association (JAMA)); home appliance figures were based on "Current Production Statistics" from METI.

(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).

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

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 export, but the amounts of imported recycled material and exported recycled products were ignored.

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 "FY2016 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

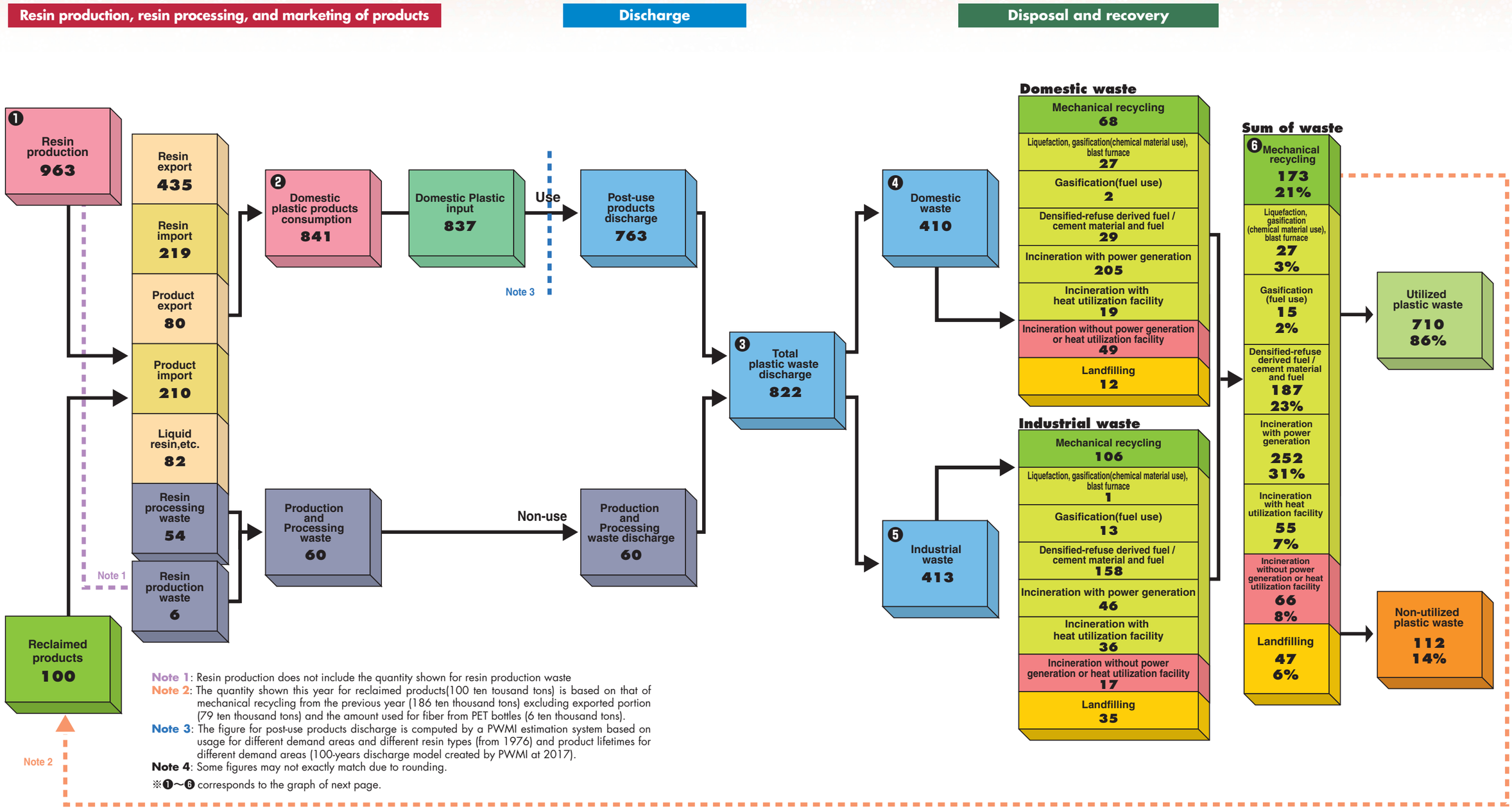
・The disposal and recovery of industrial waste is partially commissioned to local governments as business-related waste. Here, for the ratio of such processing by business operators to that commissioned to local governments, we used a new value calculated from the results of the survey conducted in fiscal 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 2020

[Unit：10kt（ten thousand tons）]



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

Note 2: The quantity shown this year for reclaimed products(100 ten tousand tons) is based on that of mechanical recycling from the previous year (186 ten thousand tons) excluding exported portion (79 ten thousand tons) and the amount used for fiber from PET bottles (6 ten thousand tons).

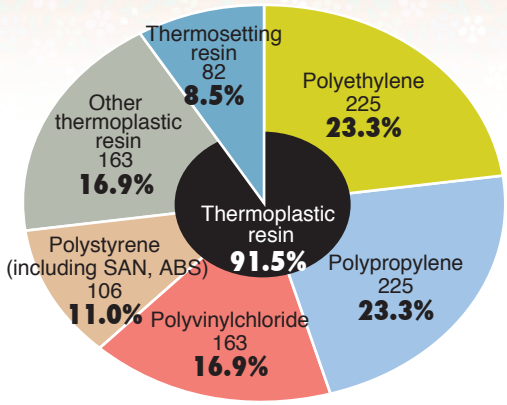
Note 3: The figure for post-use products discharge is computed by a PWMI estimation system based on usage for different demand areas and different resin types (from 1976) and product lifetimes for different demand areas (100-years discharge model created by PWMI at 2017).

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

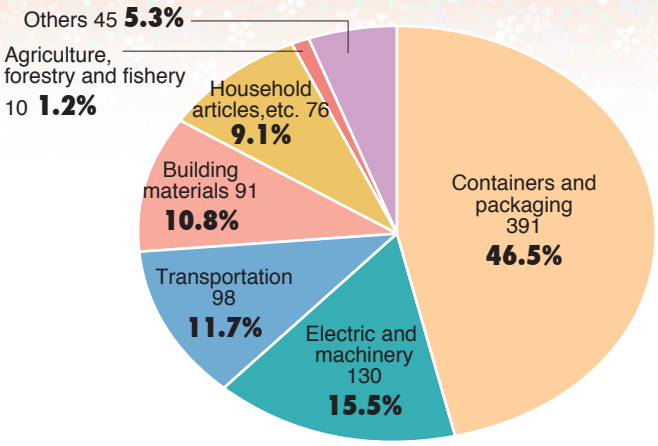
※❶～❻ corresponds to the graph of next page.

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

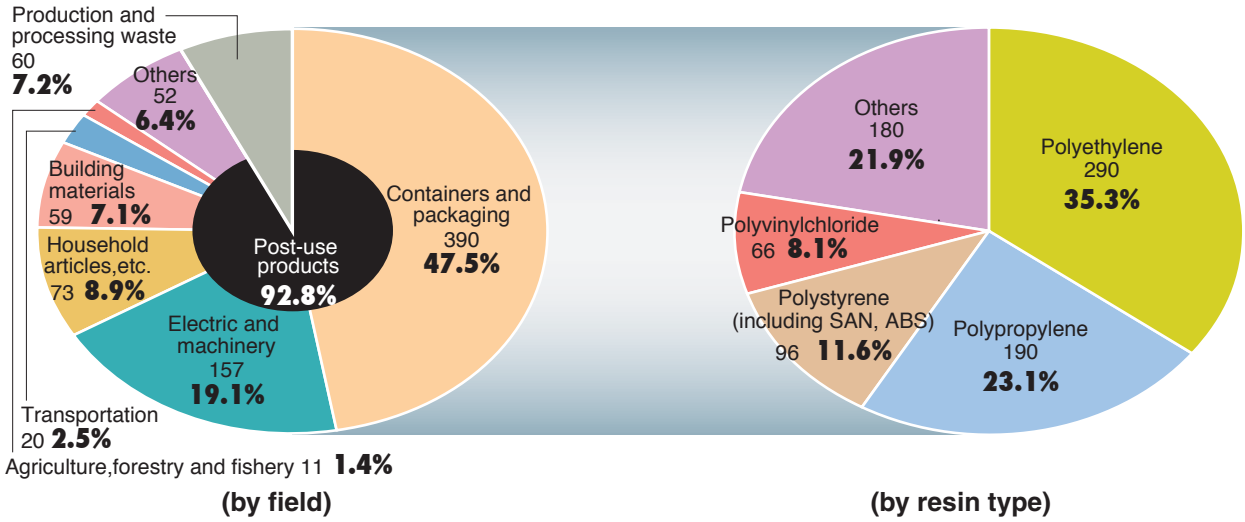
❶ Breakdown of resin production by resin type (963 ten thousand tons)



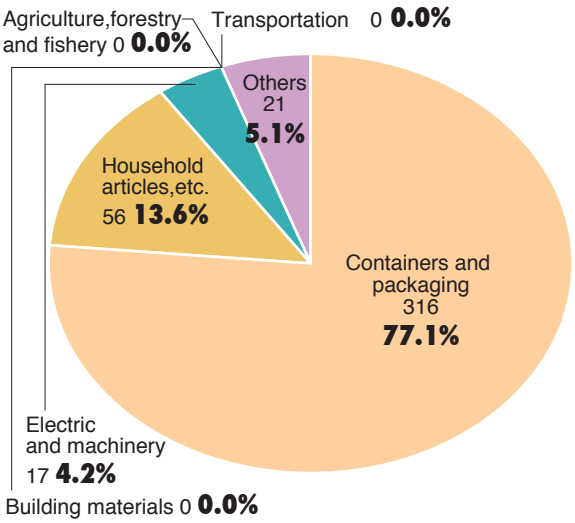
❷ Breakdown of domestic (general) plastic products consumption by field (841 ten thousand tons)



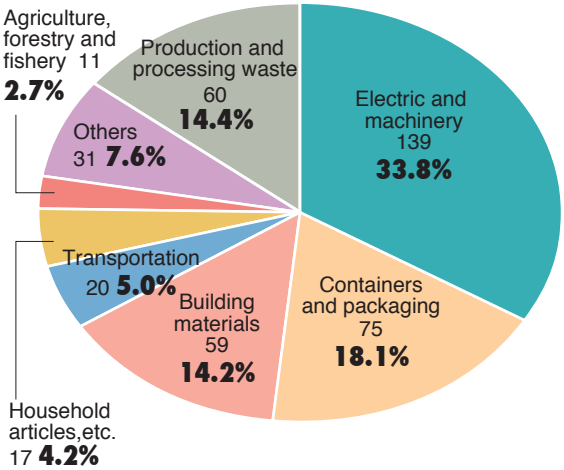
❸ Breakdown of total plastic waste by field and resin type (822 ten thousand tons)



❹ Breakdown of domestic(general) waste by field (410 ten thousand tons)

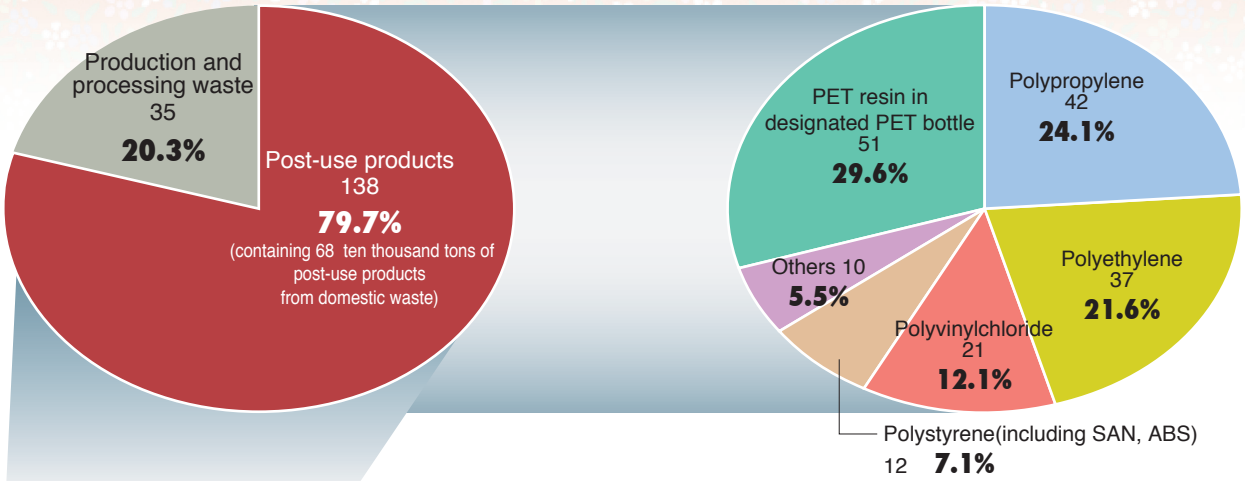


❺ Breakdown of industrial waste by field (413 ten thousand tons)

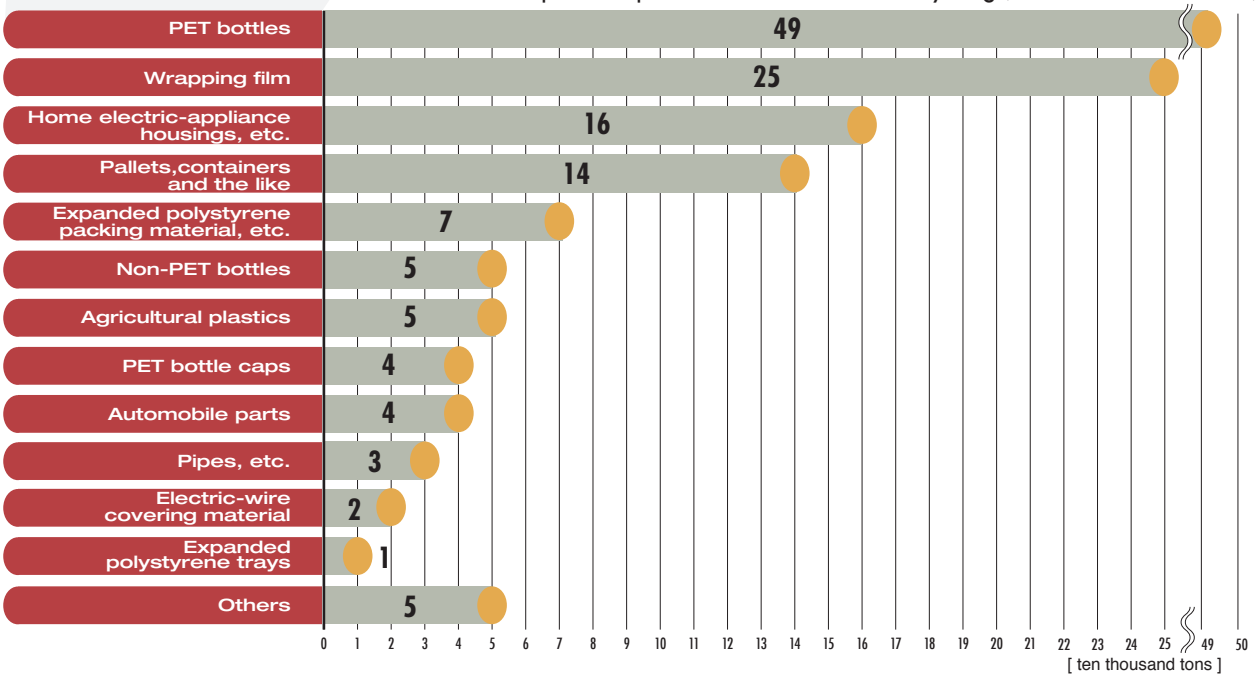


❻ Breakdown of mechanical recycling (173 ten thousand tons)

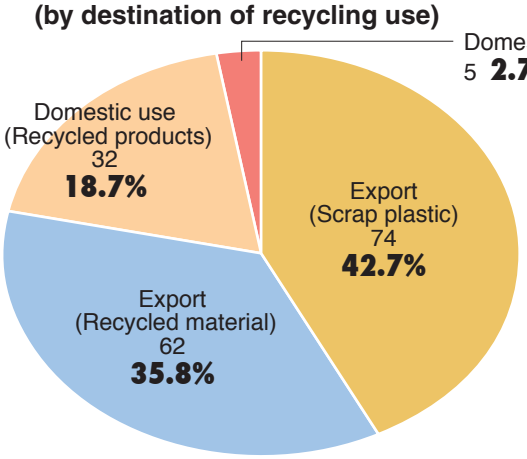
○ Breakdown of mechanical recycling resources and resin type



○ Breakdown of post-use products for mechanical recycling (138 ten thousand tons)



(by destination of recycling use)

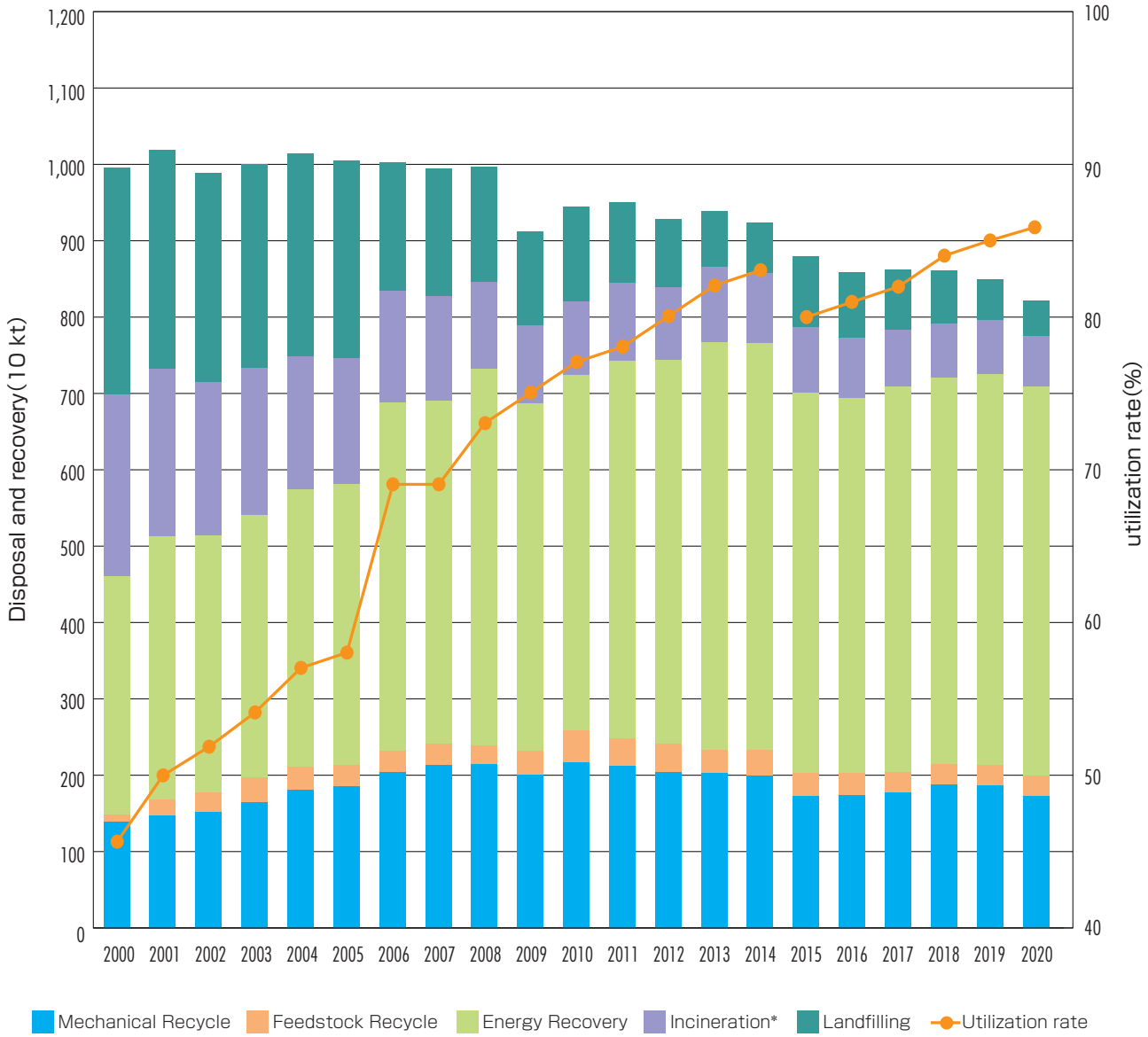


Scrap plastic:plastic waste subjected to intermediate processing (crushing, washing, etc.) as an objective of mechanical recycling
Recycled material:pellets, ingots, flakes, etc.
Recycled products:shipping pallets, building materials, miscellaneous daily goods, etc.

* 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
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
Utilization amount (10kt)	461	513	516	541	575	582	688	692	733	689	723	744	744	767	768	701	695	710	720	726	710
Utilization rate(%)	46	50	52	54	57	58	69	69	73	75	77	78	80	82	83	80	81	82	84	85	86



*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

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 2021)

Regular members: 18 corporations and 3 organizations

Supporting members: 3 organizations

Regular members

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

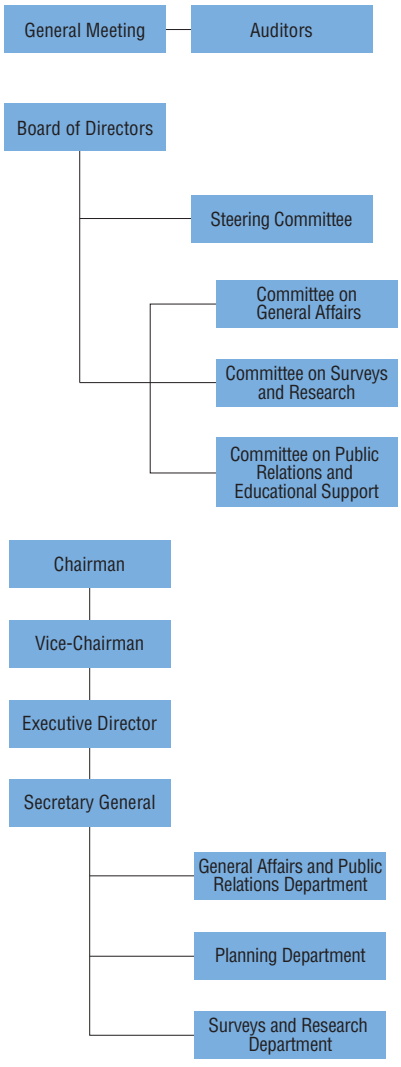
Supporting members

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

Directors

Chairman:Waga Masayuki
Vice-Chairman:Miyajima Masaki
Executive Director:Tsuchimoto Ichiro
Directors: 10
Auditors: 2

Organization



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