PWMI Newsletter

NO 50 2021.3

Plastic Waste Management Institute
JAPAN

Plastic Products, Plastic Waste and Resource Recovery [2019]

Background information and notes on the publication of the Flowchart of Plastic Products, Plastic Waste and Resource Recovery (2019)

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 of the amount of domestic plastics products consumption

The amount of domestic plastics products consumption has been calculated using a material-balance approach from the upstream side of the flowchart based on various statistical quantities. This time, we put this amount to a test by adding up the amount of plastics for every individual product domestically consumed (in other words, from the downstream side of the flowchart). We confirmed that both sets of data for products in each demand-generating field generally agreed. On the other hand, in past flowcharts, the amount of imported PET resin for non-targeted "fiber" applications (making up about one half of PET resin imports) had not been subtracted, so it became clear that the amount of domestic plastics products consumption had been overestimated. We therefore made a revision for this in the 2019 PWMI flowchart. Additionally, in the calculation of domestic plastic input in past flowcharts, we had been correcting for the inflow of resin included in imported products for only four types of home appliances, but this time, we corrected for this inflow for other home appliances as well based on recent test results (resulting in an additional 150 kt).

(2) Updating of coefficient related to processing waste

The amount of processing waste at the time of resin product processing discharged directly from factories had been calculated by the following formula: (amount of resin material used by processors and manufacturers) × (processing waste ratio). However, continuing on from the update to the processing waste ratio made last fiscal year, we updated this ratio again based on the results of a questionnaire-based survey. The new processing waste ratio is 7.3%, somewhat higher than the past figure of 6.1%. The reasons given for having to make this update are that the volume of defective articles at the time of processing is increasing as products become increasingly complex and that some products can no longer be reused as resin material in processing due to the trend toward highly composite products. In addition, while most processing-waste products are used in mechanical recycling, that ratio has also been updated to 58% from the past figure of 100%.

As described above, we continued our studies from last fiscal year on improving accuracy in the flowchart. As a result, we consider that this 2019 PWMI flowchart has been prepared using the latest and most accurate data (coefficients, etc.) to date. However, the values of the 2019 flowchart prepared using up-to-date data do not maintain continuity with the values of the 2018 and prior flowcharts. To therefore clarify the transitions in plastic disposal and recovery conditions, we recalculated the values in the flowcharts of the past four years as far back as 2015, a period to which we consider the latest data to be applicable, and then compared those values over those years.

Moreover, in past flowcharts, despite the fact that gasification products were used for either chemical materials or fuel, all were included in feedstock recycling. However, from April 2019 on, given that gasification (fuel use) lost its approval as a product recycling method in the Containers and Packaging Recycling Law, it was decided to divide the amount of use according to gasification application from the 2019 flowchart on, and for the case of fuel as gasification application, to include that amount in energy recovery.

2019 Highlights

(1) For 2019, resin production and domestic plastics products consumption were 10,504 kt and 9,393 kt, respectively.

(2) Total plastic waste discharge was 8,501 kt.

(3) Effectively used plastic waste was 7,255 kt making for an effective plastic utilization rate of 85%.

Resin production for 2019 decreased from the previous year to 10, 504 kt (-169 kt relative to 2018; -1.6%). In addition, resin export increased to 4,261 kt (+172 kt; +4.2%) while resin import decreased to 2,492 kt (-167 kt; -6.3%). At the same time, the amount of mechanical recycling products (reclaimed products) produced in the previous year that are thought to have been domestically distributed this year increased significantly to 911 kt (+492 kt; +117.4%) due to a decrease in exports. These figures essentially canceled each other out so that domestic plastics products consumption was nearly the same as the previous year at 9,393 kt (+75 kt; +0.8%). In addition, total plastic waste discharge hardly changed from the previous year at 8,501 kt (-113 kt; -1.3%). On breaking down total plastic waste discharge, domestic (general) plastic waste continued its year-on-year increase to 4,119 kt (+70 kt, +1.7%) due, in part, to a gradual increase in recent years in the consumption of containers and packaging (having a short product lifetime). Industrial waste, on the other hand, decreased to 4,382 kt (-183 kt, -4.0%).

In terms of disposal and recovery methods, mechanical recycling decreased to 1,857 kt (-19 kt; -1.0%), feedstock recycling[*1] increased to 267 kt (+12 kt; +4.7%), and energy recovery[*2] increased in total to 5,131 kt (+59 kt; +1.2%). As a result, effective plastic utilization increased slightly from the previous year to 7,255 kt (+52 kt; +0.7%). Here, one reason that can be given for the decrease in mechanical recycling is that resource recovery from PET bottle waste decreased. At the same time, the non-utilized plastic waste by simple incineration or by landfilling decreased to 1,246 kt (-165 kt, -11.7%). The percentage contributions to the effective plastic utilization rate by mechanical recycling, feedstock recycling, and energy recovery were consequently 22%, 3%, and 60%, respectively, resulting in an overall two-point jump from the previous year to 85%. We consider that this increase in effective plastic utilization rate is largely due to in increase in incineration of domestic waste and especially incineration with power generation (= decrease in landfilling) and an increase in the use of industrial waste as cement material and fuel.

The export of recycled materials and products that constitute a large percentage of mechanical recycling decreased again from the previous year to 794 kt (-111 kt; -12.3%) due to stricter import regulations imposed on plastic waste by China from 2018.

*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 previous year's recycled products (domestically used portion) are used in the current year while taking figures for export and import of plastic waste 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.

・Figures for the mechanical recycling of industrial plastic waste were determined by deducting the amount of mechanical recycling of domestic plastic waste from the total amount of mechanical recycling using statistics from industry associations and the results of questionnaires sent to recycling companies. 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 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 for recycled material and recycled products (export figure for plastic waste) was calculated after correcting for the “scrap plastic” export figure based on trade statistics from the Ministry of Finance. Moreover, while the import figure for recycled material and recycled products was small enough to be ignored, it was subtracted from the export figure.

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.

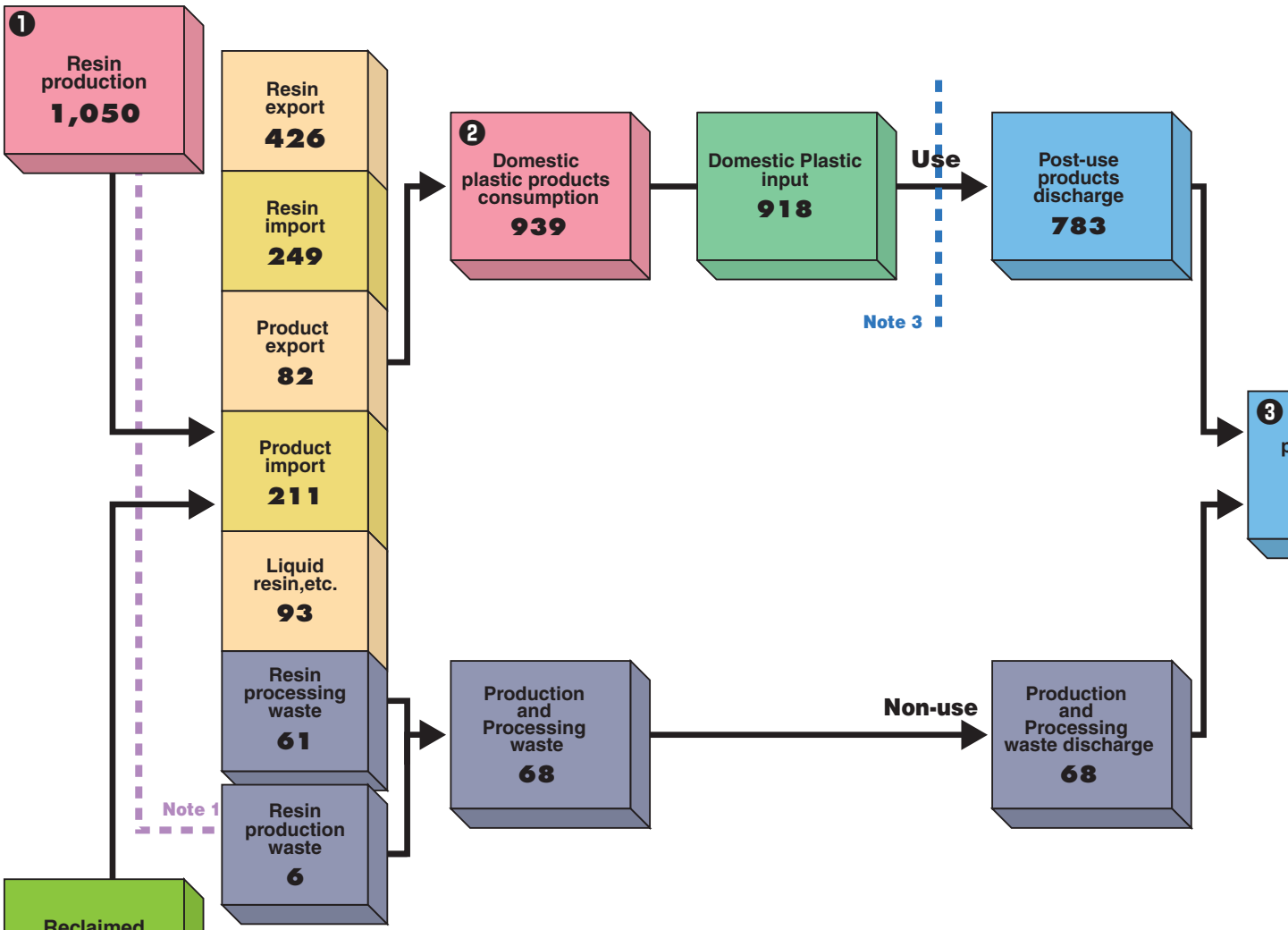
・For business operators, the incineration/landfilling ratio and the percentage breakdown of incineration processing into incineration with power generation, incineration with heat utilization facility, and simple incineration were new values calculated from the results of the survey conducted in fiscal year 2018.

・Figures for incineration with power generation includes plastic waste traded for a price.

Flowchart of plastic products, plastic waste and resource recovery 2019

[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

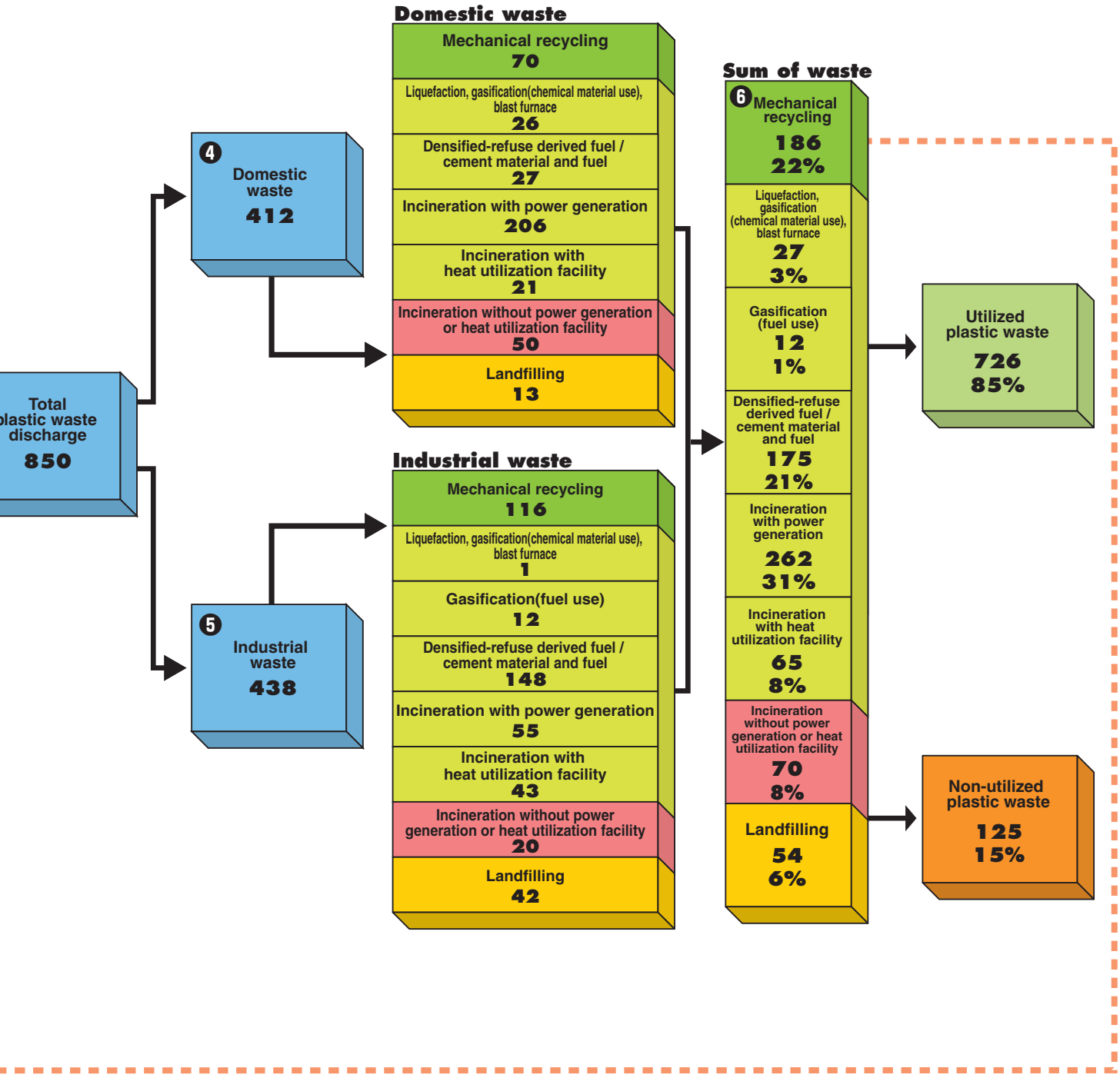
Note 2: The quantity shown this year for reclaimed products(91 ten tousand tons) is based on that of mechanical recycling from the previous year (188 ten thousand tons) excluding exported portion (91 ten thousand tons) and the amount used for fiber from PET bottles (6 ten thousand tons).

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.

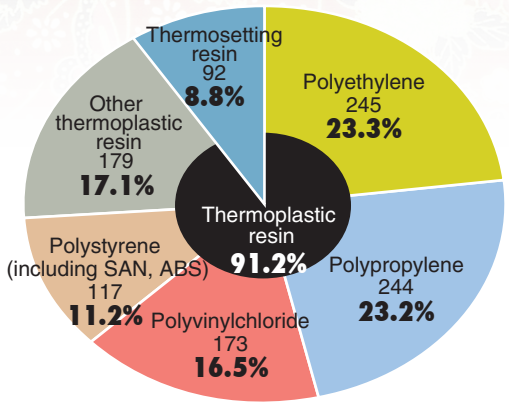
※❶～❻ corresponds to the graph of next page.

Disposal and recovery

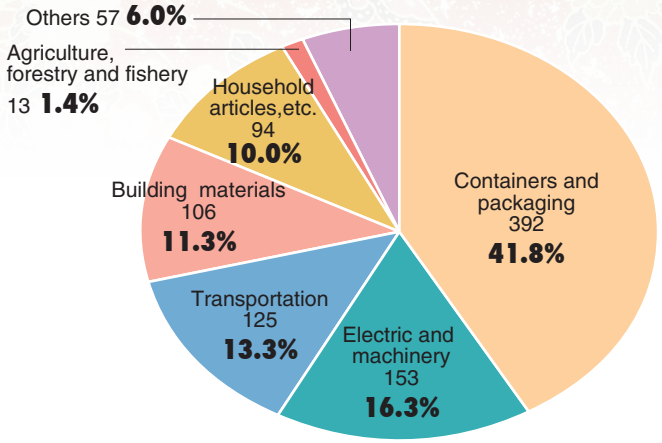


Details of flowchart elements (unit : 10kt (ten thousand tons))

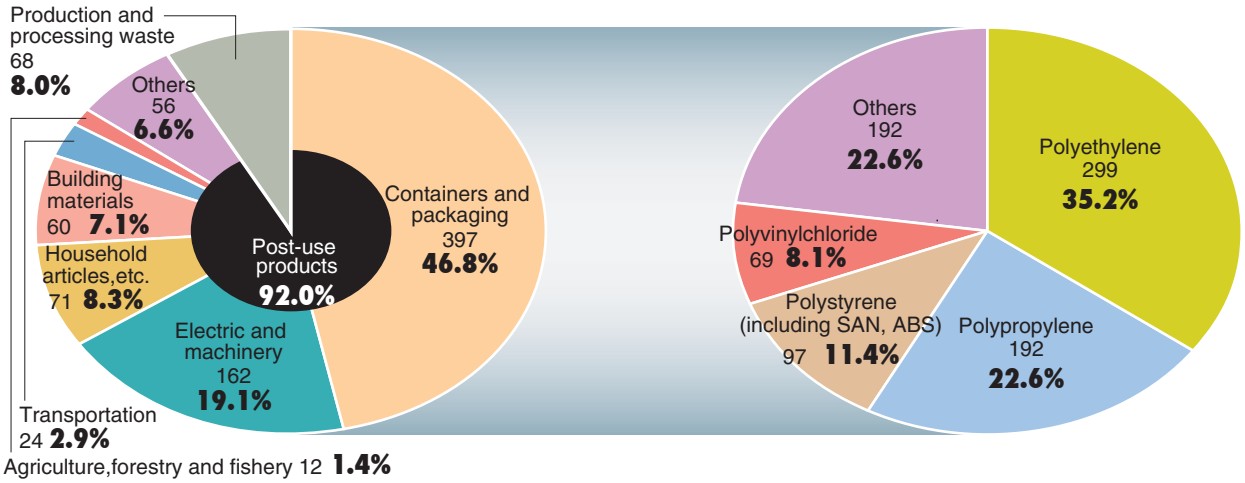
❶ Breakdown of resin production by resin type (1,050 ten thousand tons)



❷ Breakdown of domestic (general) plastic products consumption by field (939 ten thousand tons)

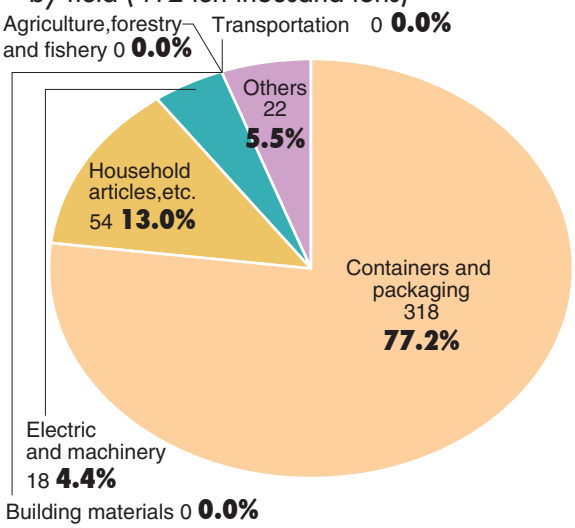


❸ Breakdown of total plastic waste by field and resin type (850 ten thousand tons)

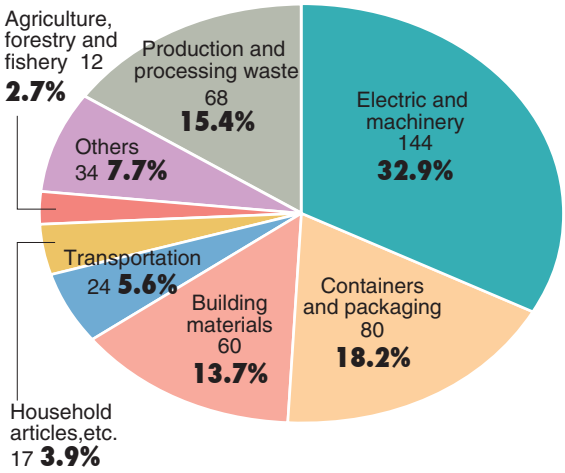


(by field) (by resin type)

❹ Breakdown of domestic(general) waste by field (412 ten thousand tons)

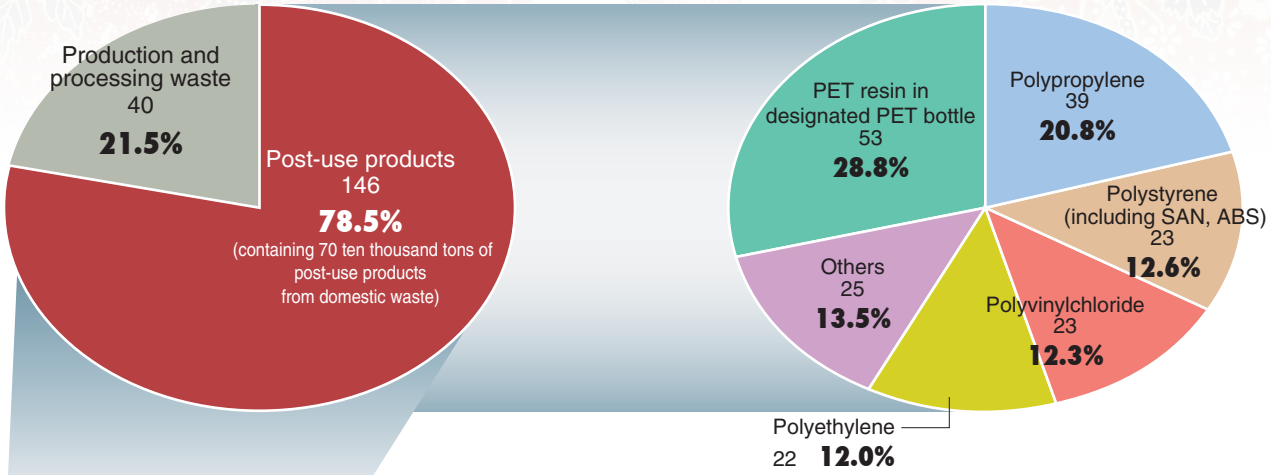


❺ Breakdown of industrial waste by field (438 ten thousand tons)

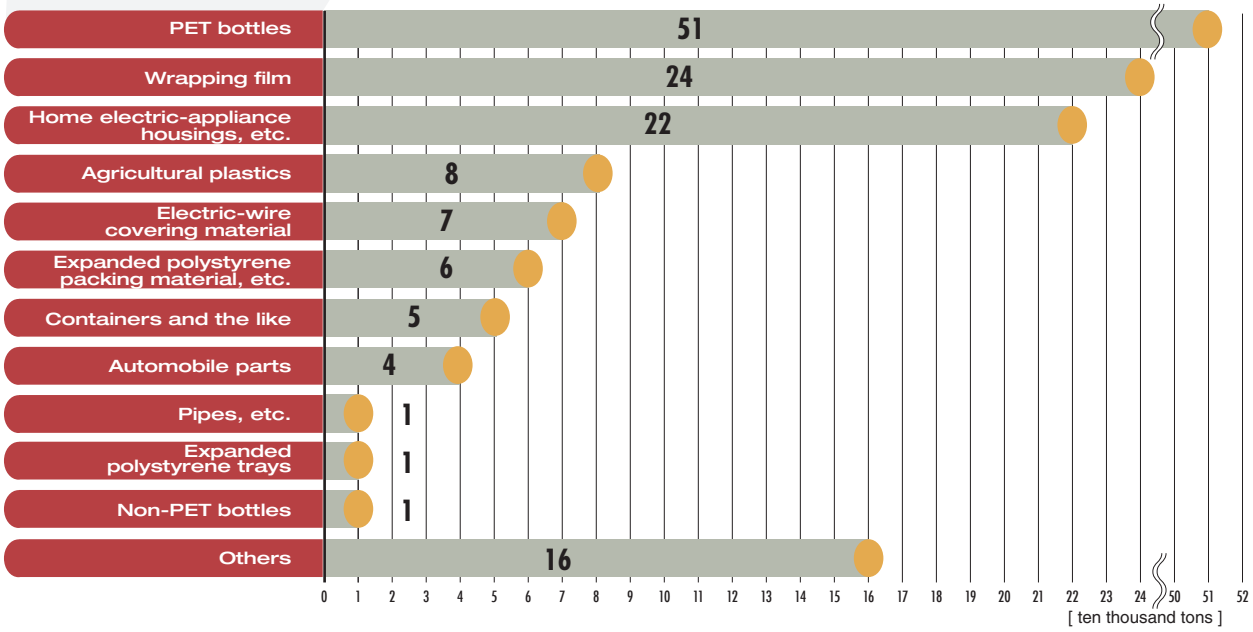


❻ Breakdown of mechanical recycling (186 ten thousand tons)

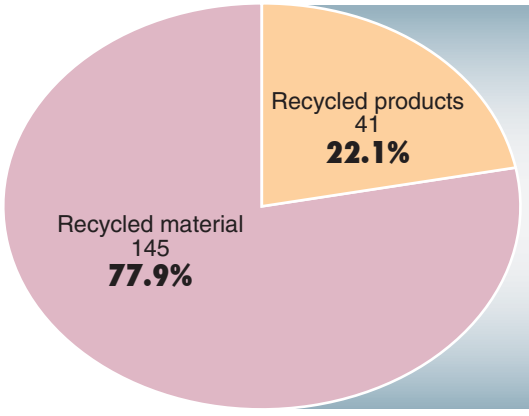
○ Breakdown of mechanical recycling resources and resin type



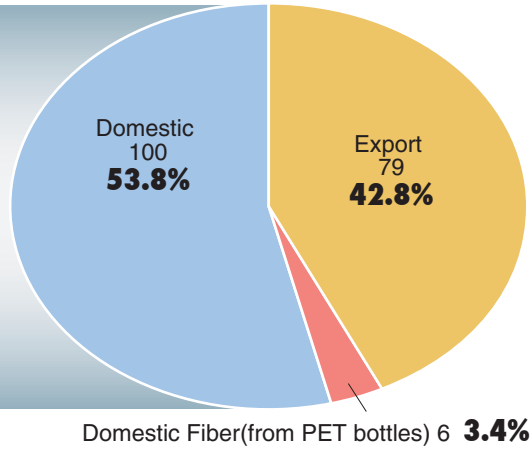
○ Breakdown of post-use products for mechanical recycling (146 ten thousand tons)



(by type of reclaimed products)



(by destination of recycling use)



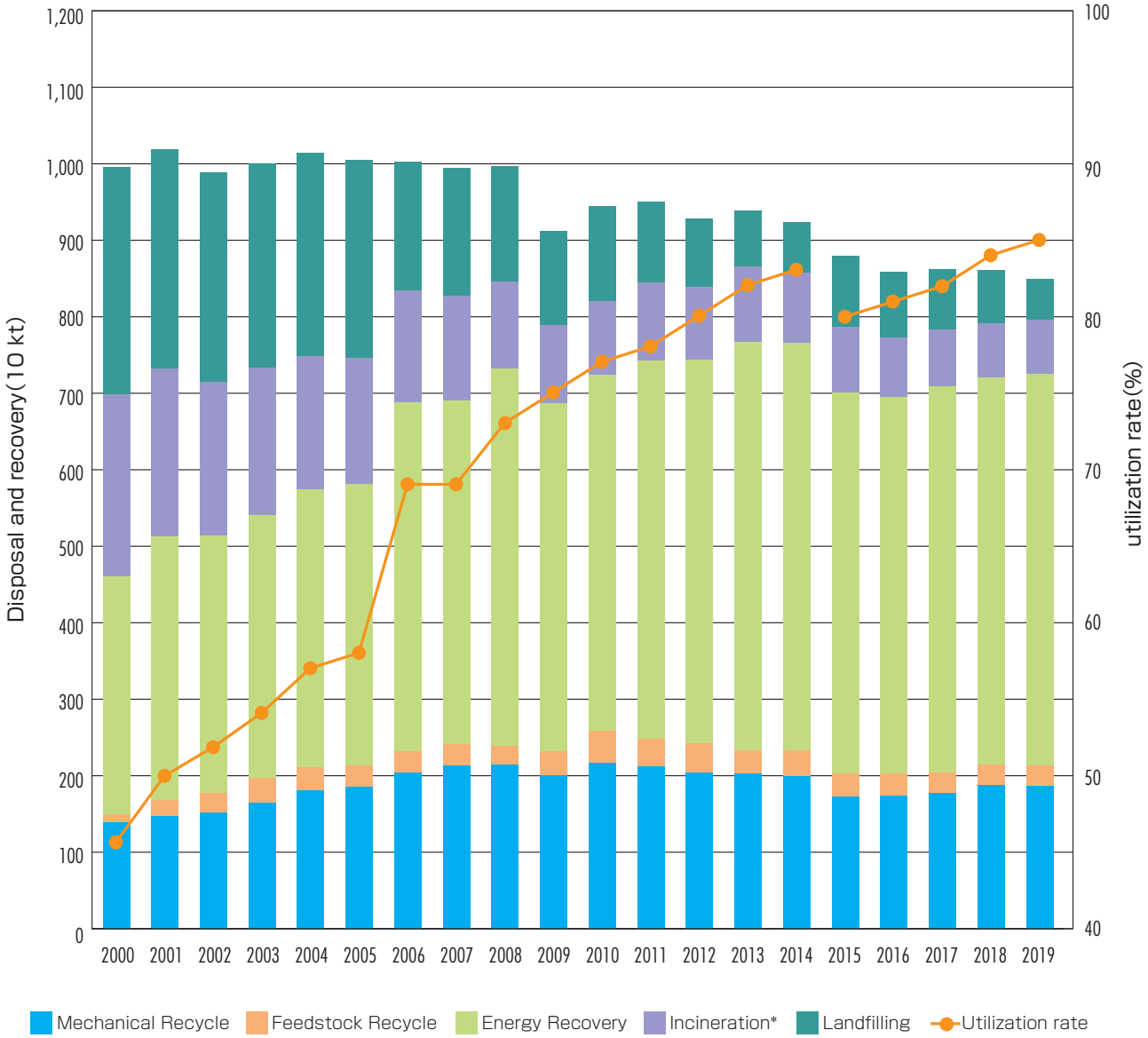
Plastics production and waste discharge

Year	Resin production	Domestic plastic products consumption	Total plastic waste discharge	Domestic waste		Industrial waste	
	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

2015～：Value recalculated by applying the latest data

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



*Incineration without power genaration or heat utilization facility

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 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 2020)

Regular members: 17 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.
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

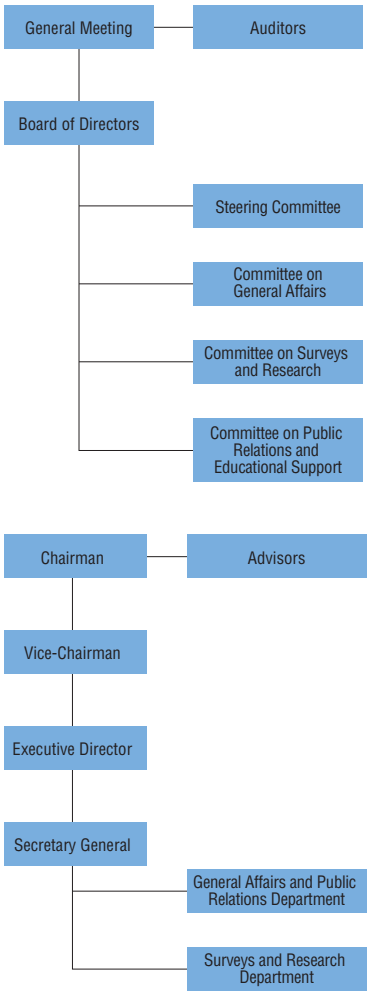
Supporting members

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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