



PLASTIC WASTE MANAGEMENT AND BURDEN IN INDONESIA

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IPEN is a network of non-governmental organizations working in more than 100 countries to reduce and eliminate the harm to human health and the environment from toxic chemicals.

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1. POLICY AND REGULATIONS RELATED TO WASTE MANAGEMENT IN INDONESIA

1.1 THE UMBRELLA POLICY

On the 2nd of February 2021, the Indonesian Government enacted 49 implementing regulations to the Omnibus Law. This new law consists of 45 Government Regulations and four Presidential Regulations. The Omnibus Law amends 76 laws across a wide range of sectors and industries, including the laws on energy and mining, plantations, telecommunications, healthcare, tourism, land and buildings and employment.

The Job Creation Act (*Undang-Undang Cipta Kerja*), officially Act Number 11 of 2020 on Job Creation¹ (*Undang-Undang Nomor 11 Tahun 2020 Tentang Cipta Kerja* or UU 11/2020), is a bill that was passed on 5 October 2020 by Indonesia's People's Representative Council (DPR), with the aim of creating jobs and raising foreign and domestic investment by reducing regulatory requirements for business permits and land acquisition processes.

The Omnibus Law was first introduced during President Widodo's speech after being appointed the President of the Republic of Indonesia for a second term in October 2019. It represents the first time in the country's legal history that such extensive amendments are made to various laws through a single legal instrument.

The Omnibus Law has received a positive response from investors. It purports to open more doors to foreign investment and introduce employment provisions regarded as more favourable to business owners. Being almost 1,028 pages long, the Omnibus Law left a range of crucial matters

1 Law Number 11 year 2020 on Job Creation <https://peraturan.bpk.go.id/Home/Details/149750/uu-no-11-tahun-2020>

addressed by implementing regulations and protested by many groups all over Indonesia.^{2,3,4,5}

The Omnibus Law also leaves a gap on the calculation of severance package upon employment termination. As such, the recently issued suite of implementing regulations have been much anticipated by the market.

The Omnibus law⁶ changes Indonesia's environmental legal framework with comprehensive provisions on environmental protection and management. To implement those provisions, the Indonesian government has just issued new Government Regulation No. 22 year 2021.⁷

One significant change brought about by Regulation 22 relates to environmental licensing for businesses. The new law stipulated that businesses must obtain an environmental license or *Izin Lingkungan* instead of acquiring an Environmental Approval (*Persetujuan Lingkungan*).

An Environmental Approval will be valid for the term of the business license. An Environmental Approval can be either:

- a feasibility decree for business activities that significantly impact the environment; or
- a statement of capability in environmental management for businesses whose activities do not significantly impact the environment and who must have an environmental management and monitoring programme, in Indonesian, *Upaya Pengelolaan Lingkungan Hidup dan Upaya Pemantauan Lingkungan Hidup*.

Businesses that do not fall under the above categories do not need to obtain Environmental Approval but must prepare their environmental management statement and monitoring capability. The Business Identification Number (*Nomor Induk Berusaha*) of the business will integrate this statement.

Whether a business must obtain Environmental Approval or prepare its statement of capability will depend on various factors. Regulation 22 sets

2 <https://www.bbc.co.uk/news/world-asia-54460090>

3 <https://www.asia-pacific-solidarity.net/index.php/news/2020-01-20/omnibus-law-clearly-and-explicitly-interests-of-oligarchy-lbh-jakarta.html>

4 <https://en.tempo.co/read/1306889/omnibus-is-throwing-people-and-democracy-under-the-bus>

5 <https://indonesiaatmelbourne.unimelb.edu.au/major-procedural-flaws-mar-the-omnibus-law/>

6 Law Number 11 year 2020 amended the primary environmental regulation, Law Number 32 of 2009 on Environmental Protection and Management. See <https://peraturan.bpk.go.id/Home/Details/149750/uu-no-11-tahun-2020>

7 Government Regulation Number 22 of 2021 on the Implementation of Environmental Protection and Management <https://peraturan.bpk.go.id/Home/Details/161852/pp-no-22-tahun-2021>

out the rules by which companies may judge whether they need approval and which type of approval they should apply for.

The Omnibus Law and Regulation 22 also set out means by which the government will assist micro and small enterprises to make their environmental approval applications. Any environmental licenses and documents issued before Regulation 22 will remain valid.

1.2 WASTE MANAGEMENT POLICY AND REGULATIONS

The Ministry of Environment and Forestry stated that the local government had improved the quality of waste management through the preparation of the Regional Waste Management Strategy Policy (Jakstrada), which is a mandate from Presidential Regulation No. 97 year 2017 on

	<div> <div></div> Ministry of Environment and Forestry <div></div> Ministry of Public Works <div></div> Ministry of Trade <div></div> Ministry of Industry </div>			
National Law	UU No. 18 / 2008 Law on Solid Waste Management	UU No. 11 / 2020 Law on Job Creation		
Government Regulation	PP No. 81/2012 Government Regulation on Management of Household and Household-like Waste	PP No. 22/2021 Implementation of Environmental Protection and Management	DRAFT Government Regulation on Excise on Plastic	PP No. 27/2020 Management of Specific Wastes
Presidential Regulation	Perpres No. 97/2017 Presidential Regulation on National Policy and Management Strategy of Household Waste and Household-like Waste	Perpres No. 83/2018 Presidential Regulation on Marine Debris Management	Perpres No. 18/2015 Presidential Regulation on Income Tax Facilities for Investment in Certain Business Fields and/or in Certain Regions	Perpres No. 15/2018 Presidential Regulation on Acceleration of Damage and Pollution Control on Citarum River Basin
	Perpres No. 35/2018 Presidential Regulation on Acceleration of Development of Waste-to-Energy Installation Using Environmentally-sound Technology			
Presidential Decree	Keppres No. 61/1993 and No. 47/2005 Presidential Decree on Ratification of the Basel Convention on the Control of the Transboundary Movement of Hazardous Waste and Their Disposal			
Ministerial Regulation	Ministry of Trade Regulation No. 83/2020 Third Amendment to the Min. of Trade No. 84/2019 concerning Provisions for Importation of Non-hazardous Waste as Industrial Raw Material	Ministry of Public Works Regulation No. 3/2013 on Implementation of Solid Waste Infrastructure and Facilities	Ministry of Environment and Forestry Regulation No. P.75/2019 on Roadmap to Waste Reduction by Producers	Ministry of Environment and Forestry Regulation No. 13/2012 concerning Bank Sampah
	Ministry of Trade Regulation No. 48/2015 on General Provisions in the Import Sector	Ministry of Trade Regulation No. 70/2015 on Importer Identification Number	Ministry of Industry Regulation No. 48/2015 on Requirements for Income Tax Facilities Implementation	
Regional/Local Regulation	Regional/Local Regulations on SUPs - PerGub Bali No. 97/2018 - PerGub DKI Jakarta No. 142/2019	- Perwali Denpasar 36/2018 - Perwali Bogor 61/2018 - Perwali Banjarmasin 18/2016		- Perwali Balikpapan 8/2018 - Perwali Padang 36/2018 - Perda Purwokarta 37/2016

Figure 1. Summary of Indonesia's national waste management regulations (as of July 2021). Source: KLHK-SWI (2019), Nexus3-ICEL-AZWI (2021)

National Policy and Management Strategy on Household Waste and Household-like Waste.⁸

This policy provides a direction towards balanced waste management based on the amount of waste generated in 2025, phase-out and prohibition of several types of single-use plastics such as plastic shopping bags, plastic straws, and styrofoam containers.

By the end of June 2021, two provinces and 58 regencies/cities have issued regional policies related to waste reduction through the prohibition and restriction of single-use plastics. Figure 1 provide summary of Indonesia's national waste management regulations (as of July 2021). Due to the pandemic, several draft regulations are still in the pipeline and might be released in 2022.

1.3 SINGLE-USE PLASTIC BANS

Since 2016 until now, several provinces and cities/regencies across Indonesia have enacted single-used plastic bans regulation:

- At regency and city levels: 54 regencies^{9,10,11,12}
- At provincial level: two provinces, Bali and DKI Jakarta^{13,14}

Although, there was an increase in single-use plastic usage during the COVID-19 pandemic, in general, the regulations are still enforced by the government and retailers.

In 2019, when Bali Governor issued the new regulation to prohibit SUPs, several plastic producers and retailers sued the Governor. After several months of hearings, the Supreme Court verdict ruled out the judicial review request submitted by the Association of Plastic Recyclers (ADUPI).

8 Perpres No. 97/2017 tentang Kebijakan dan Strategi Nasional Pengelolaan Sampah Rumah Tangga dan Sampah Sejenis Sampah Rumah Tangga <https://peraturan.bpk.go.id/Home/Details/73225/perpres-no-97-tahun-2017>

9 <https://dietkantongplastik.info/download/>

10 <https://www.liputan6.com/bisnis/read/4454331/41-daerah-sudah-terapkan-larangan-penggunaan-kantong-plastik>

11 ibid

12 <http://lh.surabaya.go.id/fileupload/SURAT%20EDARAN%20WALIKOTA%20PELARANGAN%20KANTONG%20PLASTIK.pdf>

13 Peraturan Gubernur DKI Jakarta No. 142 tahun 2019 tentang Kewajiban Penggunaan Kantong Belanja Ramah Lingkungan Pada Pusat Perbelanjaan, Toko Swalayan Dan Pasar Rakyat https://jdih.jakarta.go.id/uploads/default/produk hukum/ PERGUB_NO_142_TAHUN_2019.pdf

14 Peraturan Gubernur Bali Nomor 97 Tahun 2018 tentang Pembatasan Timbulan Sampah Plastik Sekali Pakai <https://dklh.baliprov.go.id/wp-content/uploads/2020/07/20.-PERGUB-97-TH-2018-compressed.pdf>

Furthermore, 94% of respondents stated that they use reusable shopping bags, and 86% said that they have no difficulties finding alternatives to plastic bags.

Meanwhile, the evaluation in Jakarta concerning the effectiveness of Jakarta Governor Decree Number 142/2019 also shows significant reduction of single-use plastics as follow:

- 82% reduction of single-use plastic bags;
- 42% reduction of single-use plastic bags at household level;
- 95% reduction of single-use plastic bags at shopping centers;
- 100% reduction of single-use plastic bags at supermarkets; and
- 50% reduction of single-use plastic bags at traditional markets.

However, in general, the regulations are still enforced by the government and retailers. Although, there was an increase in single-use plastic usage during the Covid-19 pandemic.

2. PETROCHEMICALS INDUSTRY IN INDONESIA

Law No. 3 year 2014. Article 8 paragraph 1 mandated the government of Indonesia to develop a National Industrial Development Master Plan or *Rencana Induk Pembangunan Industri Nasional* (RIPIN). RIPIN serves as a guideline for the government and industry players in planning and developing the industry so that the government and industry's stakeholders can achieve the strategy's objectives.

The upstream industries that are listed under the top ten priority sectors are the upstream Agro industry, base metals and non-metallic minerals industry, as well as petroleum and gas-based basic chemical industry and coal.

Three sectors in Indonesia's real sector, namely agriculture, trade, and industry, have been hardest hit by the corona pandemic. Data from the Central Statistics Agency (BPS) shows that these three contribute the most to Gross Domestic Product (GDP).

The agriculture sector's contribution to GDP reached 12.84 per cent, trade by 13.20 per cent, and industry 19.98 per cent. In total, the three sectors have contributed 46.02 per cent to Indonesia's GDP (Perindustrian, 2015).

Further, in terms of employment, these three sectors are also the highest job providers, therefore the impact on the unemployment rate is also huge. During the pandemic, the national unemployment rate increased from 6.88 million people (February 2020) to 10.58 million (July 2020).

The petrochemical industry is an industry that relies on oil and gas products as the primary raw material source, which includes olefin, aromatic, normal paraffin, synthesis gas (H₂ & CO gas), and organic compounds derived from the primary raw materials (Matar & Hatch, 2001). Traditional plastics production involves the transformation of petroleum or natural gas into their constituent monomers. This process is highly energy-intensive and accounted for 400 million tonnes of greenhouse gas emissions (around 1% of the global total) in 2012 (OECD, 2018).

The fossil fuel feedstock used in plastics production accounts for 4% to 8% of global oil and gas production. This share could increase further in the future if we don't stop the production and consumption of Single-Used Plastics and other unnecessary packaging (W. E. F. WEF, EMaF, & McKinsey, 2016). The hydrocarbon molecules that are bound into the structure of plastics are initially inert but release carbon dioxide and other greenhouse gases when burned and or incinerated.

The availability of raw materials derived from oil and gas products is increasingly limited and expensive, prompting the search for alternative raw materials, namely ethane (ethane cracker), coal, methane-coal (coal bed methane), waste refinery (green coke), and agricultural products (biomass, starchy materials, vegetable oils, etc.).

Thus, the definition of the petrochemical industry becomes broader, not only covering the chemical industry group that processes oil and gas raw materials, but also those that process non-oil and gas raw materials and produce products that are traditionally produced from processing oil and gas products (Pales & Levi, 2018).

The Ministry of Industry recorded that the plastic recycling rate in 2019 was around 14%, while the Ministry of Environment and Forestry stated that the overall plastic recycling rate was only 7%. Meanwhile, a representative of the Indonesia Olefin, Aromatic, and Plastic Industry Association said that the low percentage of plastic recycling in the country is reflected in the low utility of plastic recycling manufacturers capacity, which is around 70%.

Indonesia's petrochemical industry is categorized into three groups (Perindustrian, 2014), namely:

1. Upstream (basic) petrochemical industry

The primary petrochemical industry is the most upstream group in the petrochemical industry, processing raw materials in the form of naphtha and condensate into olefins, aromatics, and paraffin.

Examples of products are:

- The olefin industry (ethylene, propylene, butadiene, etc.).
- Aromatic industry (benzene, toluene, xylene, etc.).
- C-1-based industry (ammonia, methanol).

2. Intermediate or middle-stream petrochemical industry

The intermediate or middle-stream petrochemical industry is an industry that processes olefins, aromatics (products of the upstream petrochemical industry) into derivative products.

Examples of products are vinyl chloride, styrene, ethylene, glycol, etc.

3. Downstream petrochemical industry

The downstream petrochemical industry is an industry that processes materials produced by the intermediate petrochemical industry into various final products that are used by other sectors or end consumers/users (industrial and consumer goods).

Examples of downstream petrochemical products are:

- Polyethylene (HDPE, LDPE, LLDPE);
- Polypropylene (PP); Polystyrene (PS);
- Polyvinylchloride (PVC);
- Polyethylene terephthalate (PET),
- synthetic rubber (ABS),
- synthetic fibre (polyester, nylon), etc.

The petrochemical industry also grouped based on the type of building block raw materials that are processed namely:

- a) Methane-based (C-1) petrochemical industry and its derivatives: ammonia, methanol, urea, formaldehyde, acetic acid, etc.
- b) Olefin petrochemical industry and its derivatives: ethylene, propylene, butene, butylene, ethylene glycol, polyethylene, etc.
- c) Aromatic petrochemical industry and its derivatives: para-xylene, ortho-xylene, toluene, benzene, ethyl benzene, purified terephthalic acid (PTA), etc.

2.1 UPSTREAM PETROCHEMICALS INDUSTRY

The upstream petrochemical industry's raw materials or feedstock comes from petroleum sources (naphtha, condensate), natural gas, coal, and biomass. These sources can produce olefin compounds, aromatics, synthesis gas, and other organic compounds derived from these materials, which have a higher value than the raw materials.

TABLE 1. CAPACITY OF PETROCHEMICAL UPSTREAM PRODUCERS, OLEFINS AND AROMATICS IN INDONESIA 2020 (IN TON PER YEAR)

Type of products	Chandra Asri (CAP)	Pertamina [Refinery Unit (RU) III Plaju]	Pertamina [Refinery Unit (RU) IV Cilacap]	TPPI (Trans-Pacific Petrochemical Indotama)	Sub-Total	End products
UPSTREAM						
Olefin						
Ethylene	900,000	0	0	0	900,000	PE
Propylene	490,000	45,000	0	0	535,000	PP, automotive spareparts, toys, films
Butadiene	137,000	0	0	0	137,000	Synthetic rubber, gloves (PPE)
Aromatic						
Benzene	0	0	100,000	207,000	307,000	Material for PS
Pygas (Pyrolysis gasoline)	418,000	0	0	0	418,000	Gas, olefins
Para-xylene (p-Xylene)	0	0	270,000	500,000	770,000	Raw material for polymers
Crude C4/ Mixed C4	330,000	0	0	0	330,000	Solvent
Sub-Total Upstream	2,275,000	45,000	370,000	707,000	3,397,000	

Source: CAP, 2021; Kemenperin, 2020; Pertamina, 2020

There are only a few companies produced the upstream petrochemical products, such as olefins (ethylene, propylene, butadiene) and aromatic products (benzena, pygas, para-xylene, mixed C4). The companies that produce olefins and aromatics products are PT Chandra Asri Petrochemicals Tbk, Pertamina Refinery Unit III (RU III Plaju) and Unit IV (RU IV Cilacap) and PT Trans Pacific Petrochemical Indotama. Table 1 shows the capacity of petrochemicals upstream producers, including olefins and aromatics.

FRACTIONAL DISTILLATION CRUDE OIL

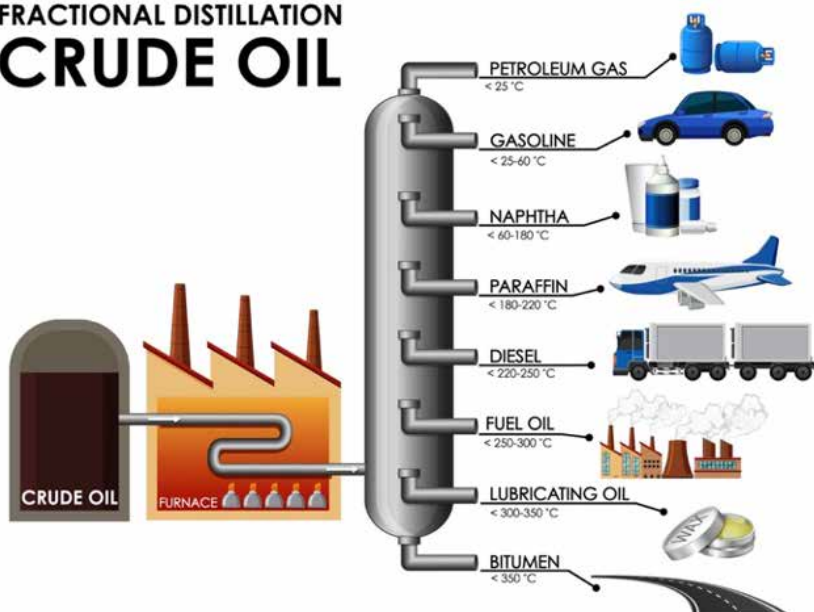


Figure 3. Illustration of fractional distillation of crude oil. Source: British Plastic Federation

Petrochemical Manufacturing Basics

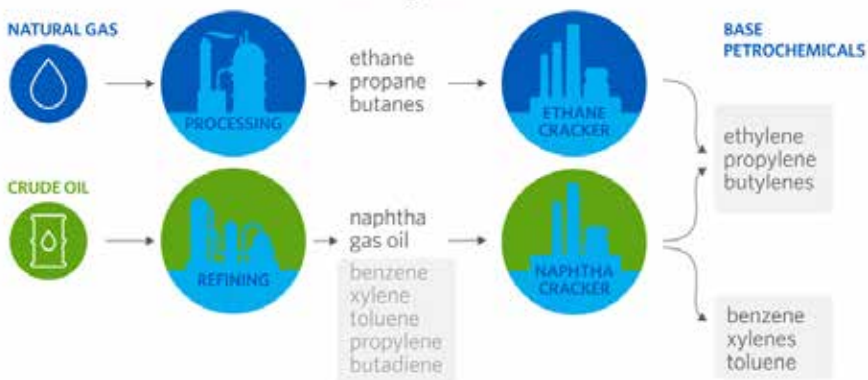


Figure 4. Illustration of various chemicals obtained from fossil fuel after oil refining. Source: American Fuel and Petrochemical Manufacturers

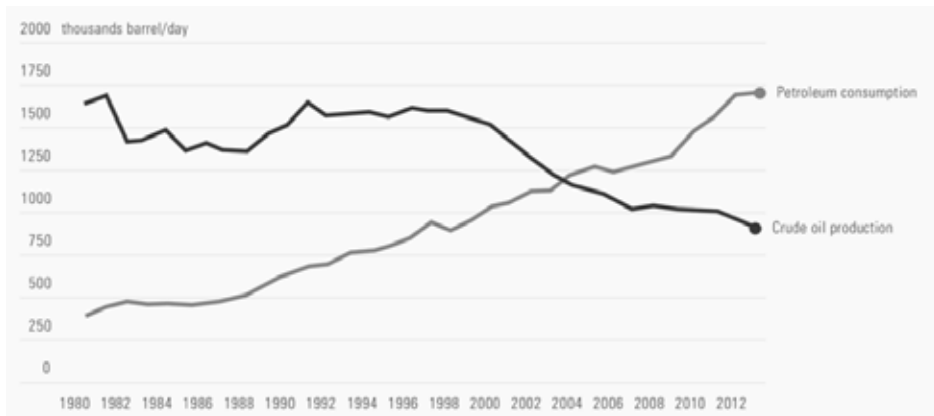


Figure 5. Crude oil production in Indonesia has already declining since 2004 and struggling to fulfill the domestic petroleum consumption.

Source: Siagian, Ucock et al. (2015)

2.2 MIDDLESTREAM PETROCHEMICALS INDUSTRY

The next industry are the middle-stream manufacturers of virgin plastics sheets or pellets to be use further by the downstream industry. The middlestream industries produced butanol, butene-1, Methyl Tert-Butyl Ether (MTBE), ethylene dichloride and vinyl chloride monomer for PVC, raffinate-1, and styrene monomer. The producers at the middlestream level are Chandra Asri Petrochemical, Asahimas Chemicals, Sulfindo Adiusaha, Indorama Petrochemicals Indonesia and others.

In the middle stream petrochemical industry, PT Asahimas Chemical (ASC) is the major producer of PVC and its precursor chemicals. ASC has integrated Chlor Alkali-Vinyl Chloride plants in Cilegon, Banten, Indonesia, to produce basic chemicals for many downstream industries. In 1989, it started operation as a state-of-the-art production complex in Banten Province. Over the years, the complex has expanded several times, substantially increasing production capacity. The total investment of ASC now stands at USD 1,015 million.

[[table 2]]

TABLE 2. CAPACITY OF PETROCHEMICAL MIDDLESTREAM PRODUCERS IN INDONESIA 2020 (IN TON PER YEAR)

Type of products	Chandra Asri Petrochemical (CAP)	ASC (AGC Group - PT Asahimas Chemical)	PT Sulfindo Adiusaha	PT. Indorama Petrochemicals (PTIP) Indonesia Cilegon	Other	Sub-Total	End products
MIDDLESTREAM							
Butanol	0	0	0	0	20,000	20,000	Phthalates basic ingredient
Butene-1	43,000	0	0	0	0	43,000	Material for PP
Ethylene Dichloride	0	760,000	380,000	0	0	1,140,000	PVC
Methyl Tert-Butyl Ether (MTBE)	128,000	0	0	0	0	128,000	Anti-knocking agent
Purified terephthalic acid (PTA)	0	0	0	500,000	0	500,000	PTA for polyester coatings resin
Raffinate-1	170,000	0	0	0	0	170,000	Precursor MTBE & DIB
Styrene monomer	340,000	0	0	0	0	340,000	PS, cups, helmet pad
Vinyl Chloride Monomer	0	875,000	130,000	0	0	1,005,000	PVC
Sub-Total Mid-dlestream	681,000	1,635,000	510,000	500,000	20,000	3,346,000	

Source: CAP, 2021; Kemenperin, 2020; PTIP, 2020

ASC operates the largest chlor alkali-vinyl chloride plant in Southeast Asia. By focusing on chemical and industrial markets, ASC has the capacity to produce Caustic Soda (NaOH), Ethylene Dichloride (EDC), Vinyl Chloride Monomer (VCM), Polyvinyl Chloride (PVC), Hydrochloric Acid (HCl) and Sodium Hypochlorite (NaClO).

ASC has three plants in Banten, operated by a distributed control system, highly efficient and set high-quality standards. In the first process, which consists of three trains, Caustic Soda is produced. The derivative products include Chlorine Gas, Hydrogen, Hydrochloric Acid solution and Sodium Hypochlorite solution. The second process produces Vinyl Chloride Monomer as a raw material for the production of PVC.

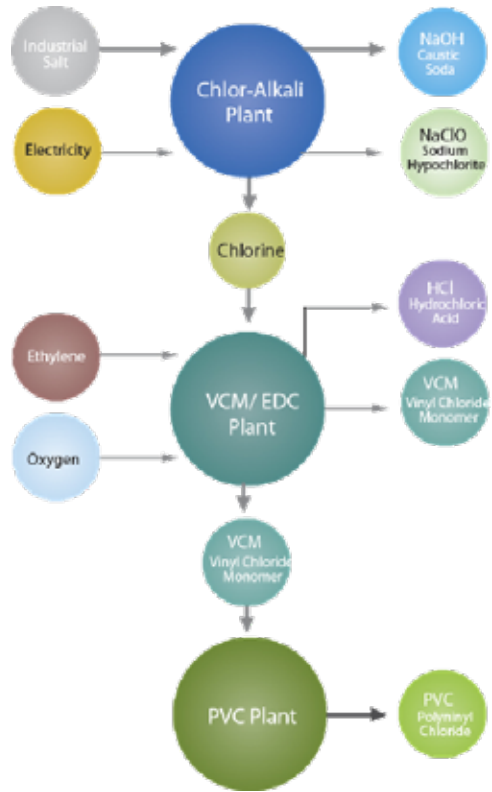
This plant consists of two trains. Chlorine Gas, generated in the Chlor Alkali plant, reacts with Ethylene to produce Ethylene Dichloride; this is then cracked into VCM.

The third process, made up of three trains, produces Polyvinyl Chloride, and it is at this stage, VCM is polymerized into PVC.



Figure 6. Chimneys stand tall at the newly constructed gas processing plants operated by Chandra Asri in the industrial city of Cilegon in Banten, West Java.
Source: Jakarta Post

Figure 7. ASC's state-of-the-art integrated Chlor-Alkali to Polyvinyl Chloride production complex.
Source: ASC



2.3 DOWNSTREAM PETROCHEMICALS INDUSTRY

The downstream industries produced polyethylene, HDPE, LLDPE, PP, PVC, PET, rPET, ABS, polyester, acrylic acid, and 2-ethylhexanol. The producers at the downstream level are Chandra Asti, Asahimas Chemicals, Sulfindo Adiusaha, Indorama Petrochemicals Indonesia and others.

For production volumes of types of plastic polymers in Indonesia, PE, PP and PET account for 34%, 31% and 12% (totaling 77%) respectively. The production of PVC is 11%, PS is accounted for 7% while ABS and PC are 3% and 2% respectively.¹⁷

CAP is the largest integrated petrochemical producer in Indonesia and operates the country's only Naphtha Cracker, Styrene Monomer, Buta-

¹⁷ Dimas Andi and Anna Suci Perwitasari, Kontan.co.id, 04 April 2021. Pemerintah dorong industri manufaktur berbasis ekonomi sirkular. Accessed by 7 June 2021 <https://industri.kontan.co.id/news/pemerintah-dorong-industri-manufaktur-berbasis-ekonomi-sirkular>

diene, MTBE (Methyl Tert-Butyl Ether/Butene-1) and Butene-1 plants. CAP's naphtha annual consumption is 2,500 tons at total capacity, and currently, on average, the cracker utilization rate is >90%.

The market share of CAP is approximately 50%, 30%, and 32% of the domestic market (including imports) in Olefin, Polyethylene, and Polypropylene, respectively. Polyolefin producer manufactured plastic raw materials and primary petrochemical products used for packaging products, pipes, automotive, electronics to support Indonesia's growth and industrialization. PT Chandra Asri Petrochemical Tbk (CAP) is a subsidiary of PT Barito Pacific Tbk. Their plants are located in Cilegon and Serang, Banten Province, Java.

In 2020, PT Trans-Pacific Petrochemical Indotama (TPPI) produced 1.2 million tons of benzene, toluene, and xylene (BTX) per year. BTX is an important chemical raw material that can boost non-food industries such as textiles and tires.

In addition to producing BTX, TPPI will also produce olefins from light naphtha, processing around 500,000 tons-1 million tons per year. However, TPPI is still waiting for the government to determine whether the light naphtha will be mixed with fuel or become industrial raw materials.

The Lotte factory in Cilegon, Banten, targets a total naphtha cracker production capacity of 2 million tons per year. If the Lotte and Chandra Asri factories operate in 2023, Indonesia can reduce imports of petrochemical products by more than 60 per cent.¹⁸

PT Chandra Asri Petrochemical Tbk is also building a second naphtha cracker processing plant (CAP2) which requires an investment of USD 4-5 billion. With the additional investment from Lotte Chemical and Chandra Asri, Indonesia will produce 3 million tons of naphtha cracker-based chemical raw materials per year. Thus, Indonesia can position itself as the 4th largest producer of naphtha crackers in ASEAN after Thailand, Singapore and Malaysia.¹⁹

Siam Cement Group plans to build a naphtha cracker production facility worth USD5.5 billion in Cilegon, Banten. This petrochemical plant will have a production capacity of 1.2 million tons per year. This investment creates jobs and increases added value, and the output is also to meet the needs of the domestic and export markets.

18 Ministry of Industry, 19 May 2018. Accessed by 10 January 2021. <https://kemenperin.go.id/artikel/19269/Bangun-Pabrik-Akhir-2018,-Industri-Petrokimia-Korea-Bisa-Substitusi-Impor>

19 <https://www.chandra-asri.com/files/attachments/downloads/Presentasi/2021/Chandra%20Asri%20Earnings%20Update%20Q1%202021.pdf>

TABLE 3. CAPACITY OF PETROCHEMICAL DOWNSTREAM PRODUCERS IN INDONESIA 2020 (TON PER YEAR)

Type of products	PT Veolia Services										Sub-Total	Other	Remarks	
	Chandra Asri Petrochemicals (CAP)	Lotte Chemical Titan	Pertamina Refinery Unit III Plaju	Masplene/PT Polytama Propindo	ASC (AGC) Group - PT Asahimas Chemical	PT Sulfindo Adihsaha	Investama (Danone Aqua)	PT. Indorama						PT Indorama Polyester Industries Indonesia Karawang
								PT. Indorama Ventures Indonesia (PTIVI) Tang.	Polypet Indonesia (PTIPPI) Cilegon	Polypet Indonesia (PTIPPI) Karawang				
DOWNSTREAM														
Polyethylene	736,000	0	0	0	0	0	0	0	0	0	736,000	0	PE, PET, containers	
HDPE	336,000	250,000	0	0	0	0	0	0	0	0	586,000	0	HDPE	
LLDPE	400,000	200,000	0	0	0	0	0	0	0	0	600,000	0	LLDPE	
Polypropylene (PP)	590,000	0	45,000	300,000	0	0	0	0	0	0	935,000	0	PP	
Polyvinyl Chloride	0	0	0	0	550,000	110,000	0	0	0	0	862,000	202,000	PVC	
Polyethylene Terephthalate (PET)	0	0	0	0	0	0	0	95,000	102,000	0	197,000	0	PET	
recycled Polyethylene Terephthalate (rPET)	0	0	0	0	0	0	25,000	0	0	0	25,000	0	rPET	
Synthetic Rubber (ABS)	120,000	0	0	0	0	0	0	0	0	0	195,000	75,000	Tires, O-ring, etc.	
Polyester	0	0	0	0	0	0	0	0	0	38,000	38,000	0	Polyester	
Acrylic Acid	0	0	0	0	0	0	0	0	0	0	140,000	140,000	Plastic diapers, textile, etc	
2-ethylhexanol	0	0	0	0	0	0	0	0	0	0	140,000	140,000	Plasticizers	
SUB-TOTAL DOWNSTREAM	2,182,000	450,000	45,000	300,000	550,000	110,000	25,000	95,000	102,000	38,000	557,000	557,000	4,454,000	

Source: CAP, 2021; Kemenperin, 2020; PTIP, 2020



Figure 8. PVC application in products. Photo: ASC



Figure 9. Various products of synthetic rubber. Photo: Prasad International

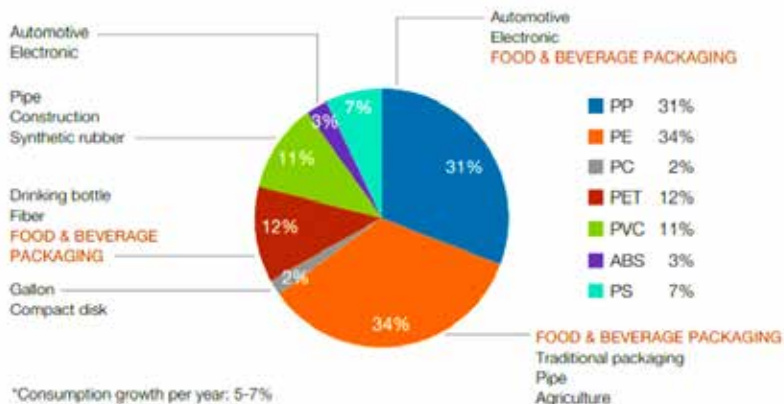


Figure 10. Type of plastic produce and utilization in various sectors.
Source: KLHK, 2020



Figure 11. PT TPPI's light naphtha storage tank capacity of 11,400 m³.
Photo: PT TPPI



Figure 12. Pertamina and CPC Taiwan have signed an agreement to build a naphtha cracker plant, to produce 1 million tons/year of ethylene. Photo: Pertamina

The Ministry of Industry noted that naphtha crackers from national industrial production reach only 900 thousand tons per year, while domestic demand is 1.6 million tons. The petrochemical industry is designated as one of the strategic upstream sectors because it provides raw materials for almost all downstream sectors, such as the plastics, textile, paint, cosmetics and pharmaceutical industries.

From the petrochemical industry's perspective, sustainability in the development of the petrochemical industry is considered crucial for Indonesia's economic activity. With its capital-intensive, technology-intensive, and massive energy-consuming nature, it is not surprising that the development of the petrochemical industry has received special attention from the government.²⁰

20 Andi Arif. 2019. Evaluation of the Plastic Industry in 2019. Bisnis.com. Accessed by 5 December 2020. <https://ekonomi.bisnis.com/read/20191230/12/1185390/evaluation-industri-plastik-tahun-2019>.

TABLE 4. SUMMARY OF THE CAPACITY OF UPSTREAM, MIDDLESTREAM AND DOWNSTREAM PETROCHEMICAL, OLEFIN AND AROMATIC PRODUCERS IN INDONESIA 2020 (IN TON PER YEAR)

Type Of Products	Sub-Total	End Products
UPSTREAM		
Olefin		
Ethylene	900,000	PE
Propylene	535,000	PP, automotive sparepart, toys, films
Butadiene	137,000	Synthetic rubber, gloves
Aromatic		
Benzene	307,000	Material for PS
Pygas (Pyrolysis gasoline)	418,000	Gas, olefins
Para-xylene (p-Xylene)	770,000	Raw material for polymers
Crude C4/Mixed C4	330,000	Solvent
Sub-Total Upstream	3,397,000	
MIDDLESTREAM		
Styrene Monomer	340,000	Material For PS, Cups, Helmet Pad
Vinyl Chloride Monomer	1,005,000	PVC
Methyl Tert-Butyl Ether (Mtbe)	128,000	Anti-Knocking Agent
Purified Terephthalic Acid (Pta)	500,000	PTA For Polyester Coatings Resin
Raffinate-1	170,000	MTBE & DIB
Butene-1	43,000	Material For PP
Ethylene Dichloride	1,140,000	PVC
Butanol	20,000	Phthalates Basic Ingredient
Sub-Total Middlestream	3,346,000	

Type Of Products	Sub-Total	End Products
DOWNSTREAM		
Polyethylene	736,000	PE, PET, containers
HDPE	586,000	HDPE
LLDPE	600,000	LLDPE
Polypropylene (PP)	935,000	PP
Polyvinyl Chloride	862,000	PVC
Polyethylene Terephthalate (PET)	197,000	PET
recycled PET (RPET)	25,000	rPET
Synthetic Rubber (ABS)	195,000	Tires, O-ring, etc.
Polyester	38,000	Polyester
Acrylic Acid	140,000	Plastic diapers, textile, etc
2-ethylhexanol	140,000	Plasticizers
Sub-Total Downstream	4,454,000	
TOTAL	11,197,000	

3. PLASTICS INDUSTRY IN INDONESIA

3.1 DISTRIBUTION AND SCALE OF THE PLASTIC MANUFACTURERS

Indonesia's domestic demand for plastics has increased by five per cent to 4.6 million tons in the last five years. Currently, the national demand for plastic raw materials reaches 7.2 million tons per year. Of that amount, there are as many as 2.3 million tons of raw materials in the form of local virgin plastic supplied by the domestic petrochemical industry. The plastics industry faces various challenges as it develops, including supply and demand for raw materials such as polyethylene and polypropylene (Pardosi & Mulyana, 2019).

Meanwhile, the need for raw materials for the national plastic recycling industry is around 2 million tons with a domestic supply of approximately 913,000 tons, and the rest is imported. The Minister of Industry stated that the plastic recycling industry could produce various value-added products with economic potential reaching more than Rp 10 trillion per year or US\$ 690 million per year. Meanwhile, the export potential of recycled plastic derivative products can reach US\$141.9 million per year.²¹

According to the Ministry of Industry's records, the value of petrochemical imports reached USD20 billion or Rp.284 trillion in 2019. Throughout 2019, the trade balance for all chemicals was still a deficit of Rp.193 trillion, with an export value of Rp.124 trillion.

Ministry of Industry data show that in 2019 there were 1,581 companies - around 380 large industries and 1,200 small-medium industries - with an investment value of IDR 7.15 trillion engaged in the plastics industry, with a total of 177,300 workers employed.^{22,23}

21 Elsa Catriona, Bambang P. Jatmiko. Kompas.com, April 05, 2021. Minister of Industry: The Use of Plastics in Indonesia is at the Bottom of the World. Accessed 7 June 2021 from <https://money.kompas.com/read/2021/04/05/172547126/menperin-use-plastik-di-indonesia-berada-di-peringkat-ter-Bawah-dunia>

22 Dimas Andi and Anna Suci Perwitasari, Kontan.co.id, 04 April 2021. Pemerintah dorong industri manufaktur berbasis ekonomi sirkular. Accessed by 7 June 2021 <https://industri.kontan.co.id/news/pemerintah-dorong-industri-manufaktur-berbasis-ekonomi-sirkular>

23 ADUPL, Focus Group Discussion Nexus3 with plastic and paper recycling industries, 29 July 2021.

Approximately 892 companies are manufacturing plastic packaging.²⁴ Most plastic manufacturers and recycling industries are concentrated in Java and Sumatra as shown in Figure 11.

The total production capacity of these producers is about 5 million tons per year, and most of these companies produce conventional petroleum-based downstream plastics products. The domestic petrochemical industry supplied 50% of the raw materials of the downstream plastic industry to make a limited type of product.

On the other hand, the demand for domestic petrochemical products is still huge. The volume of polyethylene demand, for example, reaches 2.3 million tons per year. Domestic production can only meet 280,000 tons per year, and the rest has to import 1.52 million tons from other countries.

3.2 TAX HOLIDAYS, TAX ALLOWANCE, AND PLASTIC TAX

3.2.1 *Tax holidays*

Indonesia's petrochemical industry is currently referred to as one of the sectors that imports raw materials. The Indonesian government hopes to stop importing petrochemicals within the next 4–5 years. To that end, several policies have been developed, including tax incentives, such as tax allowances and tax holidays.²⁵

Tax Holiday is a tax facility or tax incentive that applies and can be used by newly established companies. Tax Holiday is also given in the form of exemption from payment of corporate income tax or it can also be in the form of reduction of the Corporate Income Tax rate from companies that invest new capital in the country within a certain period.

The birth of this tax holiday is based on the statement contained in Law no. 25 of 2007, Article 18 concerning Investment. Tax holidays are developed and enforced in the industry to promote growth. However, not all industries can easily enjoy this tax holiday facility. Investors who wish to enjoy this facility must meet all the requirements requested, such as creating a lot of jobs, bringing in new technology, entering small and underdeveloped areas, and providing added value to the industry.

Chandra Asri, a major petrochemical industry in Indonesia, received 100% tax holiday for their corporate income tax for the first 20 years on its commercial production, followed by 50% tax reduction for 2 years.

²⁴ Ibid

²⁵ Petrokimia Jadi Tumpuan Masa Depan. Monday, 31 August 2020. Accessed by 7 June 2021 <https://indonesia.go.id/kategori/indonesia-dalam-angka/2025/petrokimia-jadi-tumpuan-masa-depan>

Chandra Asri contributed to more than 50% of its petrochemical Olefins and Polyolefins importations. In addition, they planned to double their production to 8 million tonnes a year with products including: PE, PP, and aromatics.²⁶

Tax holidays is part of the Indonesian government regulations, Minister of Finance Regulation No.159 of 2015 concerning Corporate Income Tax Reduction Facility (PMK No. 159/2015). This fiscal incentive facility is given to any industry that invested The Indonesian government has set a 100 per cent reduction in income tax without exception and can be given for investments worth IDR 500 billion (approx. USD35 million) in 17 pioneer sectors.

This regulation is looser than before, where income tax reductions range from 10 per cent to 100 per cent and would be granted for investment value is more significant than IDR 1 trillion (approx. USD70 million) in eight sectors.²⁷

The tax holiday rules are rooted in Law (UU) Number 25 of 2007 concerning Investment. Article 18, paragraph 5 of the regulation states that the government can provide an exemption or reduction of income tax in a certain amount and time and can only be given for new investments in the pioneer industry.

3.2.2 Tax allowance

Just like a tax holiday, a tax allowance is also included in one of the tax facilities provided to investors to reduce their income tax which is calculated based on the amount of investment invested in business fields in the region. David Holland and Richard J. Vann defined a tax allowance as a form of tax relief based on the value of expenditure on qualified investments (Holland & Vann, 1996).

In addition, the mechanism and technicalities for the provision of this tax allowance have been regulated in Government Regulation No. 9 of 2016 which was updated with PP No. 18 of 2015 concerning Income Tax Facilities for Investment Activities in Certain Business Sectors and in Certain Regions.²⁸

26 Press release by Chandra Asri, 2020, accessed by 7 May 2021. [http://www.chandra-asri.com/files/attachments/press_releases/2020/CAP%20-%20Siaran%20Pers%20-%20Tax%20Holiday%20Chandra%20Asri%20Perkasa%20\(ENG\).pdf](http://www.chandra-asri.com/files/attachments/press_releases/2020/CAP%20-%20Siaran%20Pers%20-%20Tax%20Holiday%20Chandra%20Asri%20Perkasa%20(ENG).pdf)

27 <https://www3.bkpm.go.id/id/publikasi/detail/berita/delapan-perusahaan-berinvestasi-rp-1613-t-dapat-tax-holiday>

28 Peraturan Pemerintah No. 18/2015 tentang Fasilitas Pajak Penghasilan Untuk Penanaman Modal di Bidang-bidang Usaha Tertentu dan atau di Daerah-daerah Tertentu <https://peraturan.bpk.go.id/Home/Details/5582>

3.2.3 Value Added Tax for plastic products

Plastic tax, especially in food and beverage sector, has been discussed in various forum in the last five years. Value Added Tax (VAT) has been discussed among the Indonesian recycling sector as a rule that will hinder the effort in promoting recycling business.

Many players in the downstream recycling chain are not tax registered, which means that the buyers higher in the chain cannot deduct any tax from the tax paid over their sales. In fact, according to the Plastic Recycling Association (ADUPI) and the Indonesian Packaging Federation (IPF), VAT — and/or its percentage — needs to be reviewed in the case of recyclables since the value actually decreases (Halim et al., 2018).

VAT on recyclables affects the price being paid for recyclable materials throughout the supply chain. The tax registered buyers who are high in the chain need to compensate this loss by decreasing the price they pay to the middlemen and the scavengers. When the sales of distributors decreased the price by 10%, the impact on scavengers will also decreased by 30 to 50% of the price paid for their product.

This decrease in prices is due to the removal of contaminants such as the non-recyclable components — i.e. food residues, mud and non-recycled components, such as aluminum lids and labels — causes the volume of material to shrink at every step of the process, and therefore multiply the value loss.

Regarding the VAT, ADUPI and IPF proposed two solutions:

1. VAT payment could be enforced throughout the whole sector, from scavengers to high-tech recycling facilities.
2. To exempt the recycled plastic from VAT. The recycling sector recommends exempting the recycling chain from VAT since registering the complete scavenger network and its supply chain does not seem practically feasible.

Meanwhile, for plastic products, early 2020, the Minister of Finance (Menkeu) Sri Mulyani Indrawati said the application of excise on plastics would take place next year. This is the government's strategy to pursue tax revenues in 2022.²⁹

Minister of Finance Sri Mulyani Indrawati said the application of excise on plastics would take place next year. This is the government's strategy to

²⁹ <https://newssetup.kontan.co.id/news/pemerintah-berencana-terapkan-cukai-plastik-tahun-depan?page=all>

pursue tax revenues in 2022. In the 2022 State Revenue and Expenditure Budget (APBN), the tax revenue target is within the range of Rp. 1,499.3 trillion to Rp. 1,528.7 trillion. This figure rose 8.37% to 8.42% from the projected 2021 tax revenue.

The discourse on plastic excise has been around for a long time. At least last year, the government wanted to implement it, but due to considering the impact of the coronavirus pandemic, it was finally postponed. However, at the end of last year, the Ministry of Finance reported that excise would be imposed on all plastic products. The proposal grew because, previously, it only imposed excise duty on plastic bags with an excise rate of Rp 200 per sheet. This plan is also claimed by the Ministry of Finance that has been approved by Commission XI of the Indonesian House of Representatives.

A researcher from the Institute for Economic and Community Research University of Indonesia (LPEM-UI) assessed the imposition of excise on all plastic products. They considered the plan as appropriate because it will be applied to all plastic products.³⁰

The researcher argued that if excise duty was imposed on plastic products, public consumption would likely not be greatly affected. As a non-elastic product, the price of plastic will be higher, but people will still buy it because it is a supporting component for most food and beverages packaging.

In terms of plastic excise tariffs, the tax should be applied differently depending on the type of plastic and its impact on the environment. This method is also useful so that the government can assess the effectiveness of excise on public consumption of various plastic products.

However, the Secretary-General of the Indonesian Plastic Industry Association (Inaplas) said that the imposition of a plastic excise tax would reduce the industry's profitability. INAPLAS refused the idea to impose a plastic tax as it would decrease the income tax (PPh) and value-added tax (PPN) revenues from plastic bag companies.³¹

The impact of imposing a tax on plastic varied, one of them could include the termination of employment. INAPLAS reminded that next year the Indonesian economy will still be in the recovery stage. Further, INAPLAS representative said that the excise policy is better imposed on imported plastic raw materials or plastic products. They believed that imposing the

³⁰ Ibid

³¹ Ibid

Note: red dot is a special economic zone of with trade facilities. Companies in this special economic zone allowed to import their raw materials but have to export the products and not allowed to sell it to the local or domestic market.



Figure 13. Distribution of plastic industry in Indonesia. Source: KLHK, 2020

tax on imported plastic will quickly boost excise revenues without disrupting the economy of the plastic bag industry. Virgin plastic imports are relatively high reached around 2 million tons per year, while the finished goods get 1 million tons per year.

Through the Directorate General of Customs and Excise, the Indonesian government proposes a plastic excise duty for plastic bags of Rp. 30,000 (approx. USD2.1) per kilogram. The DG Custom & Excise set this amount after comparing the value applied in other Asian countries such as Malaysia, at around Rp. 63,000 (approx. USD4.41), the Philippines at Rp. 200,000 (approx. USD14.00), and Vietnam who charges Rp. 24,900 (approx. USD1.74).

A spokesman for the Indonesia Packaging Federation (IPF) said that plastic excise taxes had been around for a long time since 2019. According to IPF, if the government's reason is related to environmental pollution, then it's better not only plastics that are subject to excise. If the plastic excise tax still wants to be applied, then the excise should be reused for plastic waste management itself, like in Europe.

In Europe, these funds are used as environmental fiscal incentives or incentives for the recycling industry to manage the waste collection, sorting and other incentive mechanisms. There should be a tariff policy for imports of paper scrap from abroad but mixed with plastic, then an EPR (extended producer responsibility), standardization and roadmap policy of a circular economy system according to the mandate of the Waste Law no. 18 of 2008.³²

³² <https://ekonomi.bisnis.com/read/20210506/257/1391496/rencana-cukai-plastik-kembali-muncul-begini-kata-industri>

3.3 PLASTIC CONSUMPTION, RECYCLABILITY, AND CIRCULARITY

3.3.1 Plastic consumption

According to the Indonesian Aromatic and Plastic Olefin Association (INAPLAS), Indonesia's plastic consumption per capita in 2019 was 23 kg per person per year.³³ If Indonesia's population in 2019 was 270 million people, it is estimated that Indonesia's annual plastic consumption was more than 6.2 million tons. The biggest plastic user in Indonesia is the food and beverage packaging sector, which reaches up to 65% of the total national plastic consumption. The nature of food and beverage packaging products are generally disposable (KLHK, 2020).

By the second quarter of 2021, the Indonesia Statistics Bureau announced that there are five sectors with high growth rate: transportations (45.70%), base metals (18.03%), machineries and auxiliaries (16.35%), rubber and plastics (11.72%), chemicals, pharmaceutical, and traditional medicines (9.5%).

With the growing middle-class to 90 million by 2030, there will be an increased demand for products utilizing plastic packaging (WEF, 2020). Several factors that contributed to the increased demand and consumption of packaging by 2030 are:

- Over 35 million people are expected to move to big cities by 2030.
- The urban population could account for 71% of the total population by 2030.
- Increased urbanization contributes to total overall trade and wastes generation.

3.3.2 Plastic waste recycling and for fuel substitutions

There are four tiers of the concept of plastic recycling (Goodship, 2007), namely:

- Level 1: mechanical reprocessing of plastic chips/crushed produced from industrial production processes. This level is called primary recycling or mechanical recycling.
- Level 2: mechanical reprocessing of materials collected from post-consumer plastic goods. This level is called secondary recycling or mechanical recycling.

33 Andi M. Arif. *Bisnis.com*, 30 December 2019. *Evaluasi Industri Plastik 2019*. Accessed by 7 June 2021 <https://ekonomi.bisnis.com/read/20191230/12/1185390/evaluasi-industri-plastik-tahun-2019>

- Level 3: chemical reprocessing of materials collected from post-consumer plastic goods. This level is called tertiary recycling or chemical recycling.
- Level 4: the incineration of materials collected from post-consumer and post-industrial plastic goods. This level is called quaternary recycling or energy recycling.

Many SMEs of plastic recycling in Indonesia are working at Level 2 using mechanical processing with materials collected from post-consumers. At the moment, only one FMCG company, Unilever, piloted a technology Level 3 (chemical recycling) to recycle sachet/multi-layers plastic post-consumer packaging.

Most of the raw materials for plastic bags are recycled plastic. The plastic bag industry absorbs 6.5% of the total national plastic ore/pellets consumption reaches 366,000 tons and employed about 30,000 workers.³⁴

With technological advancement, there are new machines that can recycle all types of plastic at the same time. It is well known among the plastic industry that recycling mixed plastics with different kinds of additives could damage the engine.

Currently, PET and HDPE are the most common plastic that can be recycled. Large plastic producers may be able to recycle LDPE and PP. Most PVC, Poly-Styrene, and other types of plastic cannot be recycled. In many places, scavengers do not collect styrofoam because it is of no value and cannot be recycled.

Several scavenger groups who sort the waste also stated that ABS (acrylonitrile-butadiene-styrene) and polycarbonate (PC) plastics were of no value and could not be recycled.

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Thermoplastics are defined as polymers that can be melted and recast almost indefinitely. They are molten when heated and harden upon cooling. When frozen, however, a thermoplastic becomes glass-like and subject to

³⁴ <https://ekonomi.bisnis.com/read/20191230/12/1185390/evaluasi-industri-plastik-tahun-2019>

fracture. These characteristics, which lend the material its name, are reversible, so the material can be repeatedly reheated, reshaped, and frozen.

As a result, thermoplastics are mechanically recyclable. Some of the most common types of thermoplastic are polypropylene, polyethylene, polyvinyl chloride, polystyrene, polyethylene ether phthalate and polycarbonate.

Thermoplastics have a simple molecular structure comprising chemically independent macromolecules. They are softened or melted upon heating, then shaped, formed, welded, and solidified when cooled. Multiple cycles of heating and cooling can be repeated, allowing reprocessing and recycling.

Thermoplastics have been around for a long time and are an essential component of everyday life today. For example:

- Various automobile parts;
- Eyeglass lenses;
- Acrylonitrile butadiene styrene (ABS) is a thermoplastic used to manufacture:
 - Sports equipment.
 - Toys - for instance, LEGO® blocks.
- Polycarbonate is used to make:
 - CDs and DVDs.
 - Drinking bottles
 - Food storage containers
- Polyethylene is probably the most common thermoplastic and is used to make:
 - Shampoo bottles.
 - Plastic grocery bags.
 - Bullet-proof vests.

Thermosets, alternately known as thermosetting plastics or thermosetting polymers, are materials that remain in a permanent solid state after being cured one time. Polymers within the material cross-link during the curing process to perform an unbreakable, irreversible bond. This means that thermosets will not melt even when exposed to extremely high temperatures.

Common examples of thermoset plastics and polymers include epoxy, silicone, polyurethane and phenolic. In addition, some materials such as polyester can occur in both thermoplastic and thermoset versions. Unlike thermoplastic pellets, the components of thermoset polymers are stored in liquid form, usually in large tanks or containers.

Different thermosets provide different advantages when used as a production material. For example, epoxies are highly elastic, tough and resistant to many chemicals, while phenolic is highly flame resistant.

Sachet and pouch are made of multi-layers of plastics and aluminum. Due to their complex structure is not easily recycled and has no value among scavengers and waste collectors, sachet waste is a significant environmental problem in developing countries. Chemical recycling like solvolysis, introduced by the Fraunhofer Institute and Unilever, has been promoted as the solution to tackle sachet pollution.^{35, 36} In addition to Unilever, Danone has invested USD5.25 million for the Close Loop Fund to produce 25,000 tons per year of food-grade recycled PET Plastic (rPET) which has met food safety standards (food grade) and halal certification.³⁷

Recently, multiple layers of plastic packaging have been considered valuable, not recycled in a chemical recycling plant but shredded and compacted in the form of bricket and sold as RDF (Refuse Derived Fuel). Additionally, flexible plastic packaging has also been traded as fluff or Processed Engineered Fuel (PEF) to feed boilers and coal-fired power plants as a substitute for coal. A guidebook regarding standard of RDF pellets for cement kilns is available and issued by the Centre for Clean Industry, an R&D organization under the Ministry of Industry of Indonesia (ASI, Widowati, Indrawan, Trisnawanditya, & Abdulkadir, 2017). A national standard for RDF pellet already issued by the *Badan Standardisasi Nasional* SNI 8951:2020 in 2020.³⁸

3.3.3 PET recycling

By 2025, Indonesia will reduce 70% of its plastic marine debris from the 2017 baseline. PET plastic, commonly used in bottles, is 100% recyclable and the world's most collected and recycled plastic packaging.

35 <https://www.unilever.com/news/press-releases/2017/Unilever-develops-new-technology-to-tackle-the-global-issue-of-plastic-sachet-waste.html>

36 Unilever <https://www.unilever.com/news/news-and-features/Feature-article/2018/our-solution-for-recycling-plastic-sachets-takes-another-step-forward.html>

37 <https://aqua.co.id/corporate/public/en/danone-aqua-and-veolia-indonesia-inaugurate-the-most-modern-and-largest-plastic-recycling-facility-in-indonesia>

38 <http://sispk.bsn.go.id/sni/DetailSNI/13141>

TABLE 5. RAW MATERIALS FOR PLASTIC PRODUCTION IN INDONESIA AND ITS SOURCES (MoT, 2019)

Source	Volume (ton)
Recycle import	320,452
Recycle local	913,629
Virgin import	3,663,577
Virgin local	2,332,769
TOTAL	7,230,427

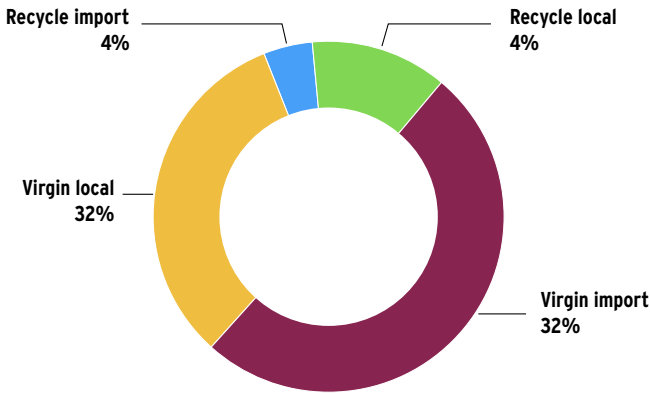


Figure 14. Raw materials for plastic production in Indonesia. Source: Ministry of Industry (2019)

On the 6th of July 2021, Indorama announced the new PET recycling facility in Karawang. The plant aims to recycle 1.92 billion post-consumer PET bottles per year from across Indonesia by the end of 2023. Through this new plant, Indorama claimed will provide 217 ‘green jobs’ and indirect employment to the area.³⁹

Indorama Ventures (IVL) has six Indonesian sites across Purwakarta, Cilegon, Tangerang and Karawang. The new recycling facility, Indorama will bring a circular business model to support its Indonesian operations.

In 2019 Indorama Ventures announced it aims to recycle a minimum of 750,000 metric tons of PET globally by 2025, investing up to US\$1.5 billion to achieve this goal. IVL’s new plant in Karawang and its other

³⁹ Indorama Venture Press Release, 6 July 2021. <https://www.indoramaventures.com/en/updates/press-releases/1787/new-karawang-facility-to-recycle-2-billion-pet-plastic-bottles-annually>



Figure 15. Plastic bags recycling. An SME outside Jakarta converts 30 tons of used plastic bags into 6 tons of PE pellets per day. Photos: Nexus3

recycling facilities in Southeast Asia will work with existing PET flake production facilities in Indonesia, stated in their press release.

The Thai-listed company has secured a Blue Loan financing package in a total of US\$300 million that would help reduce the environmental impact of plastic and boost the company's recycling plants across the region and in Brazil.

The financing package was announced on the 24th of November 2020, is the first-ever blue loan granted to a global plastic resin manufacturer. It will contribute to the recycling of 50 billion polyethylene terephthalate (PET) bottles globally a year by 2025, diverting plastic waste from landfills and oceans. The package comprises a US\$150 million senior loan

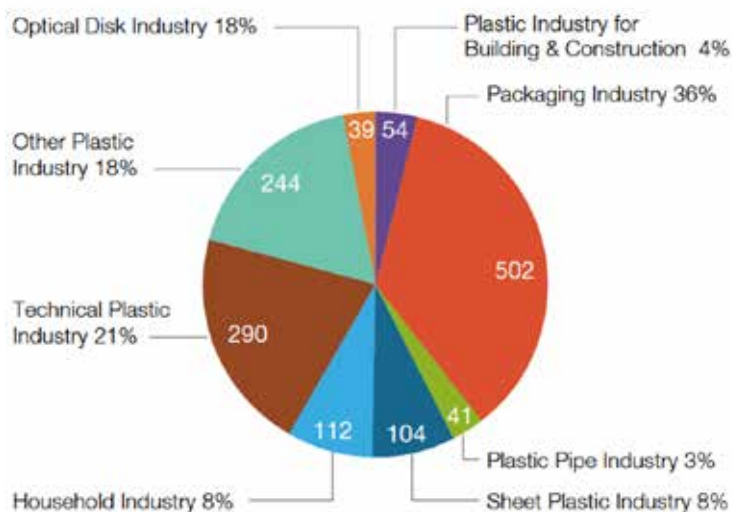


Figure 16. Type of plastic manufacturing industry in Indonesia.

Source: KLHK-SWI, 2019

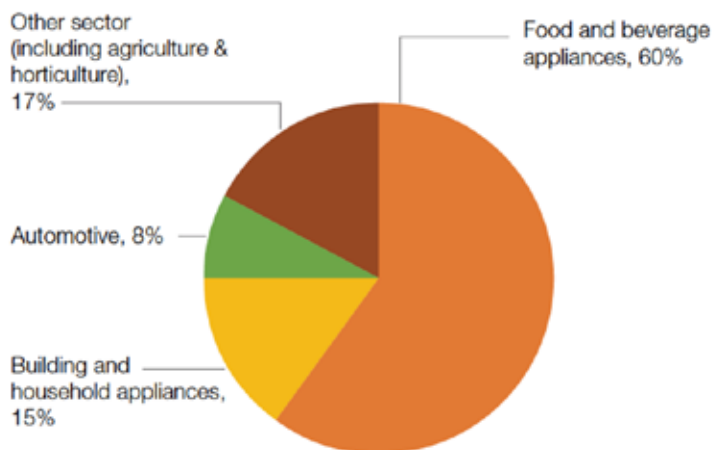


Figure 17. Type of plastic appliance. Source: KLHK-SWI, 2019

from the International Finance Corporation (IFC), US\$50 million from the Asian Development Bank (ADB), US\$50 million from the ADB-administered Leading Asia's Private Infrastructure Fund (LEAP), and US\$50 million from DEG, a German development finance institute.⁴⁰

The funding will help Indorama increase its recycling capacity in Thailand, Indonesia, Philippines, India and Brazil – countries with mismanaged and have severe plastic waste in the environment. This loan marked IFC's first blue loan exclusively focused on addressing marine plastic pollution.

Polyethylene terephthalate is the most widely used packaging material worldwide for bottled water and other non-alcoholic refreshment beverages. However, in recent years, concerns are rising about the safety of polyethylene terephthalate food packaging due to the possible migration of chemical compounds from polyethylene terephthalate bottles into the water contained in it which may pose health risk to consumers (Coniglio, Fioriglio, & Laganà, 2020).

3.3.4 ANTIMONY AND OTHER CHEMICALS MIGRATION IN rPET

Study shows that there is potential migration of several non-intentionally added substances (NIAS) from PET production or recycling process, such as antimony, phthalates, BPA, DEHP, etc. Study shows that there is potential migration of several non-intentionally added substances (NIAS) from PET production, uses under high temperature, or recycling process, such as antimony, phthalates, BPA, DEHP, and so on (Al-Otoum, Al-Ghouti, Costa, & Khraisheh, 2017; Coniglio et al., 2020).

Antimony trioxide is used as a catalyst in polymerising PET. In principle, catalysts remain behind in the PET after polymerisation. That is why PET bottles producers must check the migration of the catalyst residues. Alternative catalysts have also been developed, mainly based on the elements titanium or germanium. However, these alternative catalysts have not yet become established in PET bottles (DLG, 2016).

Antimony migration is higher in PET bottles than in glass bottles, which do not contain antimony. Like all substances used to produce PET, antimony is subject to legal regulations in many countries. A maximum of 0.04 mg antimony may migrate from a PET bottle into one liter of a beverage.

40 ADB, Indorama Ventures Sign \$100 Million Blue Loan to Boost Recycling, Reduce Ocean Plastic Waste, Press Release 24 November 2020, accessed by 6 April 2021. <https://www.adb.org/news/adb-indorama-ventures-sign-100-million-blue-loan-boost-recycling-reduce-ocean-plastic-waste>

TABLE 6. COMMON ADDITIVES FOR PLASTICS

Additives	Purpose
Calcium carbonate	Filler: generally used for cost reduction as much cheaper than polymer
Pigments	Give the colour
Glass fibre	Increase strength and stiffness
Flame retardants	Increase fire resistance
Heat stabilizers	Increase resistance to heat exposure
Light stabilizers	Increase resistance to light exposure
Plasticisers	Process aid which reduces viscosity
Foaming agents	Lightness and stiffness

Source: Vannesa Goodship (2007)

Drinking water limit levels for antimony are much lower than the migration limit level from packagings. In Europe, for example, a maximum of 0.005 mg antimony per liter of drinking water may be detectable. The distinctly lower drinking water limit level by comparison with packaging is because drinking water is additionally used for cooking and washing. The legislature takes this circumstance into account by setting a lower limit level.















Noting that PET is highly recycled and responding to the industry request, the Indonesian Food and Drug Administration (BPOM) already issued the Guideline and Criteria for Safe Recycled Polyethylene Terephthalate (rPET) for Food Packaging to ensure food safety in 2019 (BPOM, 2019). In the guideline, BPOM set the standard for antimony trioxide (as antimony or Sb) maximum of 0.04 ppm, similar to the global standard (BPOM, 2019; Tukur, Sharp, Stern, Tizaoui, & Benkreira, 2012).

The resin used to make recycled PET food packaging quality and safety requirements following SNI 8424:2017 Recycled Polyethylene Terephthalate (PET) Resin.⁴¹ Based on the Ministry of Health Decree No. 907/MENKES/SK/VII/2002 on Drinking Water Standard and Monitoring, antimony concentration in drinking water should be lower than 0.005 ppm.⁴²

Antimony is present in 80 – 85% of all virgin PET. Antimony is a carcinogen and toxic to the heart, lungs, liver and skin. Long term inhalation

⁴¹ <http://sispk.bsn.go.id/SNI/DetailSNI/11534>

⁴² Keputusan Menteri Kesehatan No. 907/MENKES/SK/VII/2002 tentang Syarat-syarat dan Pengawasan Kualitas Air Minum [https:// indok3ll.com/keputusan-menteri-kesehatan-republik-indonesia-nomor-907-menkes-sk-vii-2002/](https://indok3ll.com/keputusan-menteri-kesehatan-republik-indonesia-nomor-907-menkes-sk-vii-2002/)

Symbol	Polymer	Common Uses	Properties	Recyclable?
	Polyethylene terephthalate	 Plastic bottles (water, soft drinks, cooking oil)	Clear, strong and lightweight	Yes; widely recycled
	High-density polyethylene	 Milk containers, cleaning agents, shampoo bottles, bleach bottles	Stiff and handwearing; hard to breakdown in sunlight	Yes; widely recycled
	Polyvinyl chloride	 Plastic piping, vinyl flooring, cabling insulation, roof sheeting	Can be rigid or soft via plasticizers; used in construction, healthcare, electronics	Often not recyclable due to chemical properties; check local recycling
	Low-density polyethylene	 Plastic bags, food wrapping (e.g. bread, fruit, vegetables)	Lightweight, low-cost, versatile; fails under mechanical and thermal stress	No; failure under stress makes it hard to recycle
	Polypropylene	 Bottle lids, food tubs, furniture, houseware, medical, rope, automobile parts	Tough and resistant; effective barrier against water and chemicals	Often not recyclable; available in some locations; check local recycling
	Polystyrene	 Food takeaway containers, plastic cutlery, egg tray	Lightweight; structurally weak; easily dispersed	No; rarely recycled but check local recycling
	Other plastics (e.g. acrylic, polycarbonate, polyacetic fibres)	 Water cooler bottles, baby cups, fiberglass	Diverse in nature with various properties	No; diversity of materials risks contamination of recycling

Source: based on general US & UK guidelines, and chemical polymer properties. Icons graphics from Icon Project. This is a visualization from [OurWorldInData.org](https://ourworldindata.org), where find data and research on how the world is changing.

Licensed under CC-BY-SA by the authors.

Figure 18. Summary of plastics polymer groups, their common uses, properties, and recyclability. Source: OurWorld in Data

causes chronic bronchitis and emphysema (Sundar & Chakravarty, 2010; Winship, 1987). The industry mostly claimed that although antimony is used as a catalyst in the production process, it is ‘locked’ into the finished polymer and not a concern to human health. However, antimony leached from the polymer fibres-making process during the high-temperature dyeing stage.

The antimony that leaches from the fibers is discharged together with the wastewater into our rivers. During the dyeing process, fibers can leach as much as 175ppm of antimony (Stone, Windsor, Munday, & Durance, 2020). This seemingly insignificant amount translates into a burden on water treatment facilities when multiplied by 19 million lbs each year – and it stays as hazardous waste in the sludge (Liu et al., 2019).

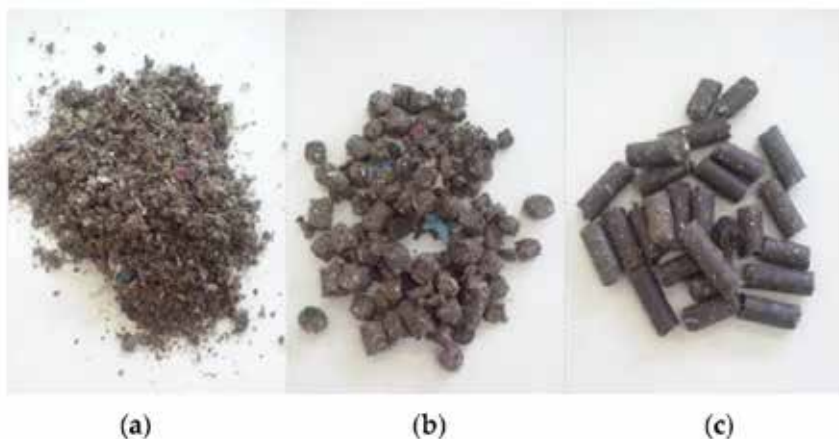


Figure 19. (a) Images of the raw RDF grit, (b) pellets from biomass die, and (c) from modified RDF die. Photo: Jewiarz et al. (2020)



Figure 20. (a) Fine SRF for main burner; (b) Crude SRF for pre-calcination. Photo: Asosiasi Semen Indonesia, et al. (2017)

Countries that can afford technologies that precipitate the metals out of the wastewater solution are left with hazardous sludge that must then be disposed off in a properly managed landfill or incinerator operations. Countries that cannot employ these end-of-pipe treatments release antimony along with a host of other dangerous substances to open waters (McDonough & Braungart, 2002).

Antimony also leaches from PET bottles into the water or soda inside the bottles (Shotyk, Krachler, & Chen, 2006). Antimony is not safe for eating or drinking. Recycling PET is a high-temperature process, which cre-

ates wastewater tainted with antimony trioxide – and the dyeing process for recycled PET is problematic. Another problem occurs when the PET (recycled or virgin) is finally incinerated.

3.3.5 Microplastics in PET water bottles

In the new study, analysis of 259 bottles from 19 locations in nine countries across 11 different brands found an average of 325 plastic particles for every liter of water being sold. In one bottle of Nestlé Pure Life, concentrations were as high as 10,000 plastic pieces per liter of water. Of the 259 bottles tested, only 17 were free of plastics, according to the study (Mason, Welch, & Neratko, 2018).

Polymeric content of micro-plastic particles >100 µm found within bottled water are polypropylene (PP) 54%, nylon 16%, polystyrene (PS) 11%, polyethylene (PE) 10%, polyester + polyethylene terephthalate (PEST) 6%, and others includes Azlon, polyacrylates and copolymers 3%.

Three bottles from Indonesia, Aqua brand, purchased from three different places (Jakarta, Bali, and Medan). The highest maximum microplastic densities was found in the bottle purchased from Bali with concentration of 4,713 MPP/Liter.

The second highest was the Aqua bottle purchased from Medan (3,722 MPP/L). Currently, no standard for micro plastics in water bottled produced and sold in Indonesia. The highest microplastics density was found in Nestle Pure Life bottle purchased from amazon.com with maximum concentration of 10,390 MPP/L.

The study revealed that the polymeric content of microplastic particles >100 µm within bottled water are consist of 54%polypropylene (PP), about 11% are polystyrene (PS), 10% polyethylene (PE); 6% polyester+polyethylene terephthalate (PEST); and 3% other polymer includes Azlon, polyacrylates and copolymers.

Meanwhile, various morphologies of microplastics >100 µm were found within the bottled water samples. Microplastics in the form of fragments are the most common (65%), followed by films (14%), fibers (13%), foam (5%), and pellet (3%).

The study found a significant variation even among bottles of the same brand and lot. This variation most likely results from the complexities of microplastics sources, the manufacturing process and particle-fluid dynamics.

TABLE 7. MICROPLASTIC DENSITIES (MPP/L), BY SIZE FRACTIONS AND TOTAL, AVERAGED ACROSS ALL BOTTLES WITHIN THE SAME LOT

Brand	Lot	Purchase location	Microplastic densities (MPP/L)				
			NR + FTIR confirmed particles (>100µm)	NR tagged particles (6.5-100µm)	Total (MPP/L)		
					Average	Minimum	Maximum
Aqua	IB 101119	Jakarta	6.68	30.4	37.1	3	133
Aqua	BB 311019 08:11 PSRL6	Bali	10.5	695	705	1	4,713
Aqua	BB 311019 09: 50 STB1	Medan	6.93	397	404	0	3,722

Source: Mason, S. A., Welch, V. G., & Neratko, J. (2018). Synthetic Polymer Contamination in Bottled Water. *Front Chem*, 6, 407. doi:10.3389/fchem.2018.00407

TABLE 8. TECHNICAL SPECIFICATION AND STANDARD OF PARAMETERS MIGRATION CONCENTRATION LIMIT IN rPET IN INDONESIA

No.	Parameter	Unit	General requirement for Mechanical Recycling with Alkaline	General requirement for Mechanical Recycling with non-Alkaline
A. Technical Specification				
1	Intrinsic Viscosity (IV)	dL/g	0.60 - 0.70	0.71 - 1.00
2	Water content	% mass fraction	Max. 1.0	Max. 1.0
3	Bulk density	kg/m3	Min. 400	Min. 400
B. Migration				
4	Acetaldehyde residue	mg/kg	-	Max. 6
5	Total migration	mg/kg	-	Max. 60
6	Total heavy metals: Pb, Cd, Hg, Cr ⁺⁶	mg/kg	-	Max. 1
7	Antimony trioxide	mg/kg	-	Max. 0.04 (in form of antimony)

Source: BPOM, 2019

TABLE 9. SUBSTANCES IN PET AND THEIR SPECIFIC MIGRATION LIMIT LEVELS IN EUROPE

Substance	Specific migration limit level
Acetaldehyde	6 mg/L
Ethylene glycol and diethylene glycol	30 mg/L
Terephthalic acid	7.5 mg/L
Isophthalic acid	5 mg/L
Antimony trioxide	0.04 mg/L
Anthranilamide	0.05 mg/L

Source: DLG, 2016

3.4 PLASTIC WASTE: LEAKAGES AND RECYCLING

Several reports about plastic wastes generation, leakage and plastic waste management in Indonesia available (Muhammad Reza Cordova et al., 2019; Danone & SWI, 2018; KLHK, 2020; MacQuarie, 2020; Shuker & Cadman, 2018; WEF, 2020).

Waste generation in Indonesia differs between big cities and small cities. However, the World Bank estimates that the waste generation rates are 3.57 liter/capita/day, equivalent to 0.87 kg/capita/day (Shuker & Cadman, 2018). Meanwhile, plastic waste generated per capita is 0.07 kg of plastic waste/capita/day or about 8% of the total waste generation rate (KLHK, 2020).

The National Plastic Action Partnership (NPAP) report revealed that Indonesia's plastic recycling rate in 2020 was approximately 10% of the total plastic waste generation, 6.8 million tonnes (WEF, 2020). The study also identified around 4.2 million tonnes or 61% of post-consumer plastic wastes are not collected by waste collectors or management systems but leaked to the environment. The rest are ended up in the landfills.

The World Bank observed approximately three million people engaged in waste recycling, including informal collection, waste picking, collection, processing, and trade. An informal collection of recyclables in Java is estimated at 10%, less on other islands due to transport costs and lack of local capacity for trade and treatment. Most of the items collected by waste pickers are plastic, metals, and cardboard with varying price per kilogram, depending on the product type, source, and collection level (from the source, from waste pickers, from collector/middleman, etc.), ranging from US\$.04 - US\$1.19 (Shuker & Cadman, 2018).

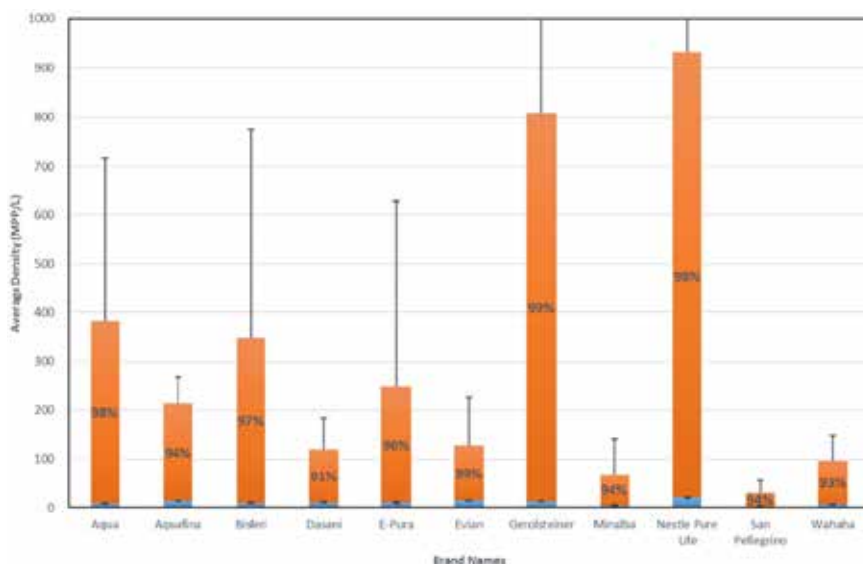


Figure 21. Microplastic density averaged across individual bottles and lots by brand. Blue bars represent “NR + FTIR confirmed particles” (>100 µm); Orange bars show “NR tagged particles” (6.5-100 µm). Error bars are one standard deviation. Percentages are for the contribution to the total for “NR tagged particles” (6.5-100 µm); Contribution of larger particles can be inferred.

Source: Mason, S. et al. (2018)

Proper recycling around 2% is happening through waste banks/Bank Sampah through the voluntary segregated collection at the community level, and around 8% from sorting of mixed waste in the form of self-reported, including household composting.

Data such as up to 4,000,000 tons per year of plastic recycling and low percentages of valuable recyclables in disposed waste suggest overall recycling around 20%, and thus quite effective. Further improvements will need effort and funding from various sources. Public knew that the high-end recycling (business to business) is at IDR 700,000/ton.

The population of the plastic recycling industry in Indonesia is currently around 600 large industries and 700 small industries, with an investment value of IDR 7.15 trillion (approx. USD500 million) and a production capacity of 2.3 million tons per year.⁴³

⁴³ <https://industri.kontan.co.id/news/pemerintah-dorong-industri-manufaktur-berbasis-ekonomi-sirkular>

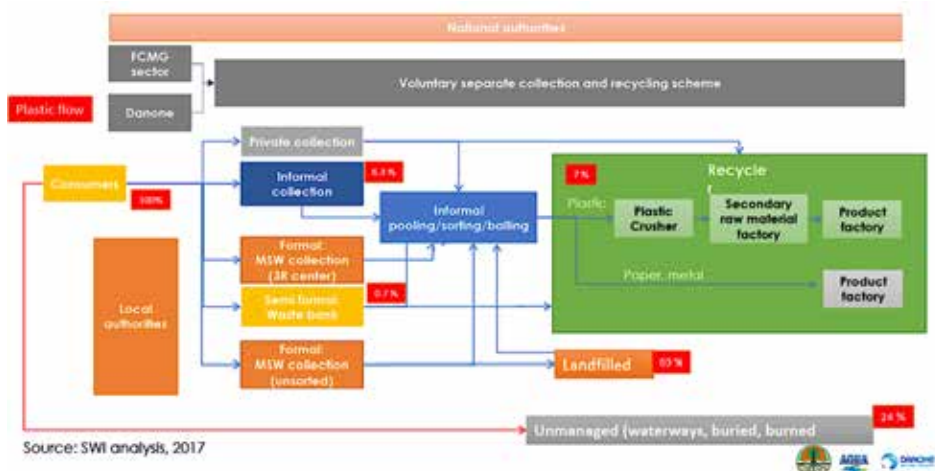


Figure 22. Flow of post-consumers plastic recycling in Indonesia. Source: Danone-Aqua, 2018

The informal sector (including waste pickers, junk shops and aggregators/*bandar lapak*) plays a critical role in collection. Nearly all plastic waste collected by the informal sector ends up at a recycling facility.

Figure 22 was released in 2018 from a study funded by Danone-Aqua, showing the flow of post-consumers plastics recycling chain. The study revealed that only 7% of post-consumers plastics, paper and metals went to the recycling plants, 69% to landfills and 24% unmanaged (leaked to waterways, buried or burned) (Danone & SWI, 2018).

This sector collects around 500,000 tonnes of plastic waste (7% of total plastic waste) directly from residential areas and 560,000 tonnes of plastics (8% of the total) from collected waste that is in transit to landfill and from the actual landfills (WEF, 2020). Nearly all waste collected by the informal sector ends up at a recycling facility (Danone & SWI, 2018).

According to Indonesia Plastics Recycler Association, due to the Covid-19 pandemic, there has been a 70% drop in the market, with 54% less absorbed plastic waste into the recycling industry.⁴⁴

The Indonesian Institute of Science (LIPI) conducted a survey in 2018 and revealed that the most common trash found was styrofoam waste.⁴⁵

44 <https://www.indonesiawaterportal.com/news/can-plastic-and-rubber-industry-recover-from-covid-19.html>

45 <https://www.republika.co.id/berita/q2ect5328/dominasi-sampah-stirofoam-di-laut-indonesia>

Further, LIPI released a baseline number of 0.27-0.59 million tonnes of ocean plastic per year based on the field results in 18 locations collected using stranded beach data collection over a year. This figure was adopted by the National Taskforce on Marine Plastic Debris as a preliminary national baseline in December 2019 (Muhammad Reza Cordova et al., 2019).

Additionally, LIPI study recommended several actions to be adopted and further implemented by the Indonesian government as follow:

- Establish a standard method of monitoring marine debris washed up on the beach as an approach in measuring the distribution of marine debris in Indonesian waters;
- Conduct monitoring studies and modeling the distribution of marine debris on a regular basis so that the latest data is always available based on standardized methods; and
- Carry out further studies related to the impact of plastic waste on marine biota and humans.

Plastic recycling industries are primarily concentrated in Java and Sumatra (see [Fig. 13 in Distribution and scale of plastic recycling](#)). In 2020, the recycling rate in Indonesia is low at only 11% (KLHK, 2020; WEF, 2020).

Interviews with several plastic recyclers revealed some challenges faced by plastic recyclers, among others:

- lack of infrastructures to tap plastic wastes from domestic sources;
- poor quality of plastic waste due to poor waste separation;
- lack of incentives from the government to support the recycling industry.

3.5 BANK SAMPAH/GARBAGE BANKS

Many communities in Indonesia now have TPS 3R (Tempat Penampungan Sampah 3R) similar to Material Recovery Facility or MRF that have their own *Bank Sampah* or Garbage Bank. Every household can bring their recyclables to the nearest *Bank Sampah*.

According to the Ministry of Environment Regulation No. 13 of 2012 concerning the GUIDELINES for IMPLEMENTATION of REDUCE, REUSE, and RECYCLE through *Bank Sampah*, the *Bank Sampah* is a place for sorting and collecting waste that can be recycled and/or reused that has economic value.

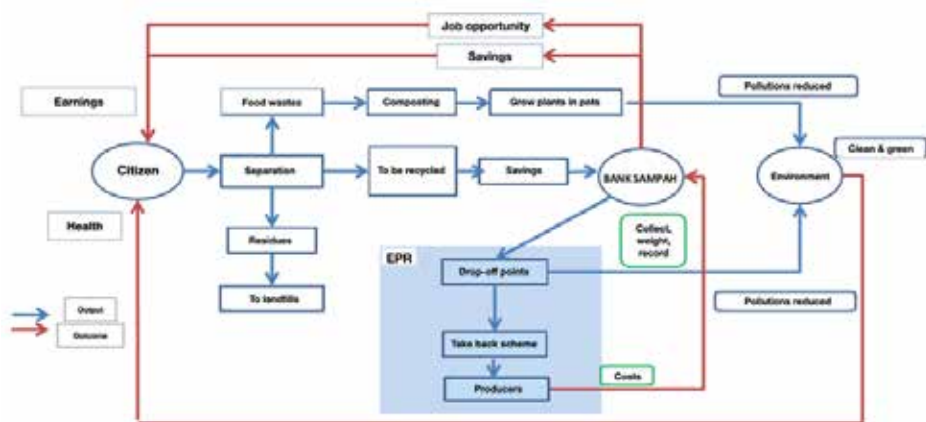


Figure 23. Conceptual diagram of the Bank Sampah integration to EPR. Source: PermenLHK No. 13 tahun 2012

The management system is slightly similar to the banking system, where residents as depositors have savings books. Waste brought to the *Bank Sampah* will be weighed, valued based on the price provided by the brokers or the factories cooperated with the *Bank Sampah*, and then recorded in the book. The price of every commodity fluctuates based on the market price. Customers are allowed to withdraw their funds once a month.

Currently, there are more than 11,500 *Bank Sampah* operates in Indonesia and collected about 13,715 ton per year.⁴⁶ The total annual turnover of *Bank Sampah* in 2020 was approximately US\$1,657,894.

The Central Statistics Agency (BPS) noted that the number of waste banks in Indonesia grows every year. In 2018, the waste bank reached 7,488 units. This figure is up to more than five times from 2014, which amounted to 1,172 units (Safitri, Purba, Pratiwi, & Hidayat, 2019).

Although only contributed to handle 1.2% of the total waste generation nationwide (WorldBank, 2018) *Bank Sampah* contribute to employment in the country. It is recorded that 163,128 people work in the waste bank. Most of them, 49%, are housewives.⁴⁷ In the future, the role of *Bank Sampah* can be increased to support the waste collection rate.

⁴⁶ Sistem Informasi Management Bank Sampah (SIMBA) KLHK, <https://simba.id/>, accessed by 7 June 2021.

⁴⁷ *ibid*

Garbage Banks need to be independently and financially feasible to ensure their sustainability. A study in the urban area revealed that to be economically viable, the minimum amount of inorganic waste that a waste sale of recyclables 38.167,03 kg/year of inorganic waste and minimum number of customers as many as 247 households per month can meet its operational costs if operated independently (Elza, Ekayani, & Ismail, 2020).

Unfortunately, no information available regarding the follow up processing of the recyclables by recyclers or factories. Furthermore, no available explaining the amount of residues from the *Bank Sampah* to the city landfills.



Figure 24. Mechanism of recyclables collection at Bank Sampah. Source: KLHK, 2021, [https:// simba.id/](https://simba.id/)



Figure 25. Bank Sampah in Indonesia in 2020.

Source: KLHK, 2021, <https://simba.id/>



Figure 26. Distribution of Bank Sampah in Indonesia.

Source: KLHK, 2021, <https://simba.id/>

4. PLASTIC WASTE IMPORTS AND EXPORTS

4.1 PLASTIC WASTE IMPORTS

Indonesia imports virgin plastics, plastic scrap, and plastic products, accounted for 6.2% of overall category of non-oil and gas commodity.⁴⁸ Virgin plastics and plastic scraps are imported by plastic manufacturers and recyclers on an annual-rolling contract basis with trade partners in various countries.

For the past five years, Indonesia's import of plastic waste and scrap (HS Code 3915) spiked in 2018 (141% from the previous year) and has declined ever since. As Indonesia reviewed the import policy in 2019, plastic waste import declined 27% in 2020 of the last year.

Based on the collected data from Indonesia Statistics, the most significant five trade partner countries were Netherland, Germany, Slovenia, United States and Singapore. The trade values, however, fluctuate differently from the imported volume. The lowest trade value per ton occurred in 2018, valued at \$321.45 per ton of imported waste on average.

Before 2018, the most imported plastic waste trade falls under HS Code 391590, containing mixed plastic and other types of plastics that are not polyethylene, polystyrene, or polyvinyl chloride. Starting from 2018, coincidentally, after the National Sword took into force, the proportion of 391510 outnumbered 391590 and kept increasing until 2020 (Septiono, Ismawati, & Arisandi, 2021).

Indonesia's import partner of plastic waste dominated North America, mainly from the United States, until 2016. In the same year, emerging shipments came from the Marshall Islands with no export reports from their end (Ismawati, Septiono, Arisandi, & Bell, 2019).

The following year, imports from the United States sharply decreased 70% to 11,000 tons. At the same time, one-sided report shipment from Marshall Island tripled to 68,000 tons, making shipments from Marshall Island the most significant volume of import in 2017.

⁴⁸ KLHK (2020). National Plastic Waste Reduction Strategic Actions for Indonesia.

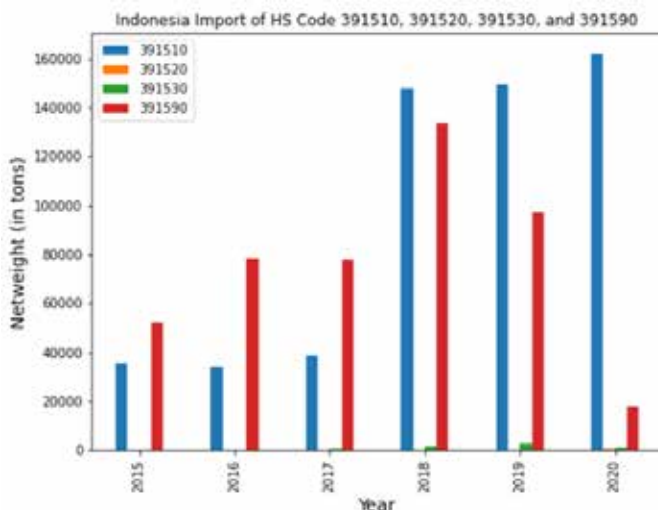


Figure 27. Plastic waste imported by Indonesia 2015-2020. Source: BPS, 2021



Figure 28. Plastic waste imported by Indonesia in 2018 was at its peak due to China's new policy. Source: BPS, 2021

After the restriction and reviewed regulations in Indonesia in 2019, these shipments started to the overall decrease. Shipments from Australia & Oceania dropped by almost half to 43 thousand tons and North America by 30% to 37 thousand tons, dominated by the Marshall Islands and the United States, respectively. However, shipment from the Western European countries rose to 107 thousand tons, making the region the most

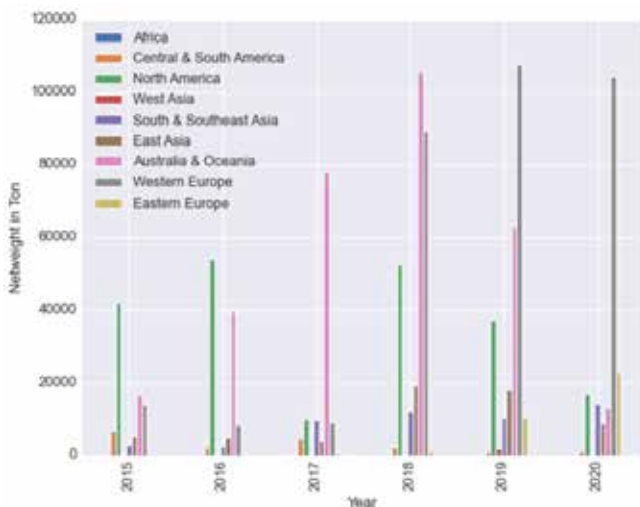


Figure 29. Indonesia's import of plastic waste (HS Code 3915) by region.

Source: Indonesia Bureau of Statistics, 2021

considerable importing plastic waste to Indonesia. The latest data from 2020 showed that shipments from West Europe account for 57% of total imported plastic waste to Indonesia.

In response to China's new policy and the enforcement of the Basel Amendments on plastic waste trade, the Ministry of Trade has issued a new Decree to regulate plastic and paper waste trade through Permendag No. 83/2020. Additionally, joint decrees were signed by three ministers and the Chief of the National Police to set the contaminant standard of 2% in six waste/scraps commodities.

4.2 PLASTIC WASTE EXPORTS

Indonesia is currently one of the countries that have a positive net import of HS 3915. Figure 30 (a) and (b) below show that Indonesia export is declining since 2016, so does the trade value. Indonesia mainly sends out plastic waste under the HS code 391590. Unfortunately, there is no further detail on whether they are mixed plastic waste or cleanly separated plastic waste other than PE, PS, or PVC.

Considering Indonesia and some ASEAN countries play a role in intermediate re-processing countries for plastic waste trade (Barrowclough, Birkbeck, & Christen, 2020), the end product of those processing should either be cleanly separated plastic waste or other products of plastic.

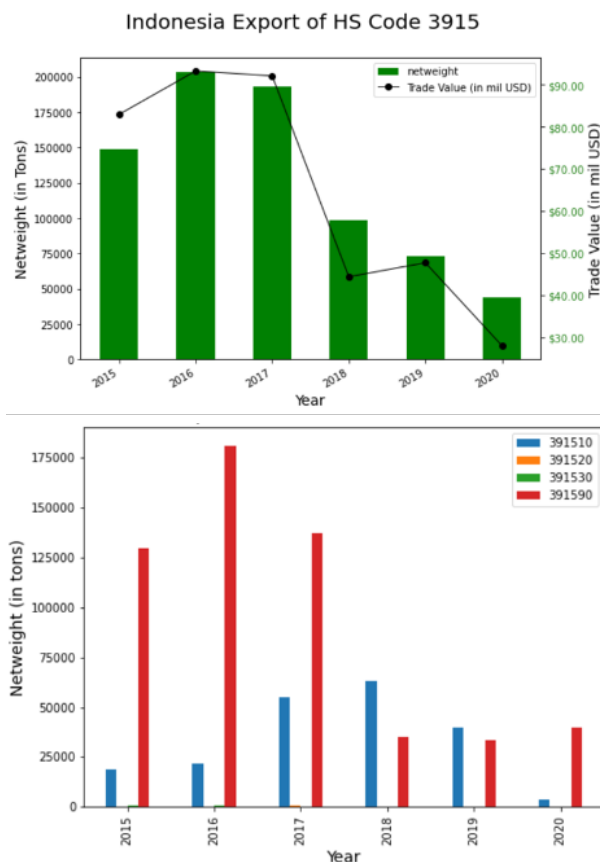


Figure 30. (top) Indonesia's plastic waste export (HS Code 3915); (bottom) breakdown of plastic waste type export. HS 391590 is the commodity code for mixed plastic wastes. Source: Indonesia Statistics Bureau, 2021

Based on the data from Indonesia Statistics, Indonesia used to ship plastic waste mainly to China. In 2020, however, shipment to China dropped 87% to only 4,774 tons. The leading export destination of plastic waste from Indonesia is the United States in 2020, reaching more than 8,000 tons of plastic waste exporter, followed by the United Kingdom (5,721 tons) and China, the third-largest export destination (4,774 tons).

As displayed in Figure 31 below, Indonesia's export market is mainly concentrated in the East Asian Region, either China or Hong Kong. Hong Kong was one of the top transit hubs of plastic waste shipment, usually re-exporting from the US, Japan, Germany, and the UK to mainland China.

After the waste import policy restriction in China, however, the destinations of plastic waste shifted to developing countries like Thailand, Malaysia, and Vietnam (Low, 2019). Indonesia used to export in high volumes to Hong Kong until 2017, which dropped in the following year. Indonesia's shipment to China also dropped after the implementation of the Blue Sky Policy.

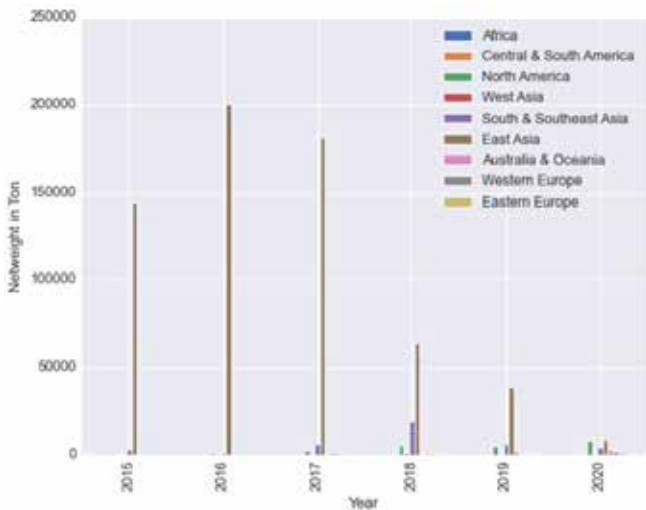


Figure 31. Indonesia's export of plastic waste (HS Code 3915) by region.

Source: Indonesia Bureau of Statistics, 2021



Figure 32. Recycled plastic pellets exported from Indonesia to China and various countries. Photo: PT Mitra Utama Plastindo

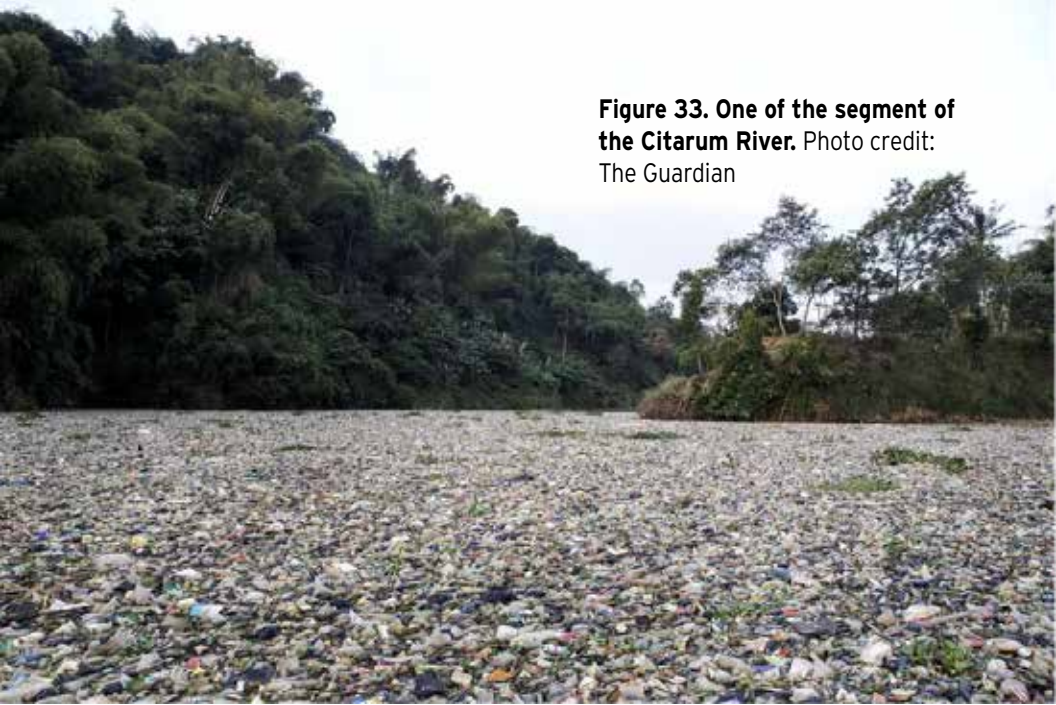


Figure 33. One of the segment of the Citarum River. Photo credit: The Guardian

5. PUBLIC AND ENVIRONMENTAL BURDEN

In the shift to circular economy, it is estimated that \$ 2.3 million of management cost is required to prevent environmental leakage of plastic waste from 2025-2040 (WEF, 2020).

In 2018, almost 54% of the Citarum River segment was heavily polluted, about 23% was moderately polluted, 20% was lightly polluted, and only 3% met the quality standards established by the Ministry of Environment and Forestry.⁴⁹

Some cities allocated the fund from the regional or local fiscal budget to clean up the river. From 2005 to 2009, the Mayor of Surabaya increased funding of 10.2% allocated for cleaning the Surabaya River. A study showed that river recovery costs increase yearly due to heavy pollution discharged into the rivers (Kusumawardani, 2012).

⁴⁹ http://ppid.menlhk.go.id/siaran_pers/browse/1643

Study shows that since 2018, about 30% to 50% of plastic and paper waste imported by companies are mismanaged and dumped in the nearby villages. Communities separated the high-value plastics and sold them to



Figure 34. Waste trucks on queue to unload to the landfill. Photo: Richard Gertman



Figure 35. Used PPEs disposed to the environment polluting rivers. Photo: Mohammad Ayudha/Antara



Figure 36. Typical plastic packaging for food delivery. Photo: GoJek



Figure 37. Typical small kiosk in the neighborhood selling daily products in small packaging. Photo: Warkop



Figure 38. For the economic benefits and compensation of the landfills operation, communities who live near the landfills allowed to let their battles roaming around the landfills. This is a common situation in all Indonesia's landfills. Photo: World Bank



Figure 39. Aluminum cans imported as by-products by a plastic recycling company near Jakarta sold to community recycling group. Photo: Nexus3



Figure 40. Plastic debris in mangrove can be found in many coastal areas of Indonesia. Photo: Ecoton



Figure 41. A citizen science research have identified high concentration of microplastics in human feces samples. Photo: Ecoton



Figure 42. Ethylene-Vinyl Acetate (EVA) shoe sole foam residues from shoes company used as fuel to process lime near Karawang. Photo: Nexus3



Figure 43. There are more than 100 unit of lime processing kilns near Karawang released black smoke like this every day. Photo: Nexus3

intermediaries collectors. The remaining scraps are sold to tofu makers, lime kiln plants and or burned periodically.

As a result, high dioxin concentration is found in chicken eggs in villages near plastic and paper companies. The pollution cost has not been determined due to Indonesia's lack of standards and mitigation plans (Petrlik et al., 2020; Petrlik et al., 2019).

In the last 30 years, plastic leakages discharged to the environment from domestic waste generation, industrial activities, institutional settings, and imported wastes have become a public environmental and health burden (Afdal, Werorilangi, Faizal, & Tahir, 2019; Sahwan, Martono, Wahyono, & Wisoyodharmo, 2005; Tahir, Taba, Samawi, & Werorilang, 2019; Uneputy & Evans, 1997; Yudhantari, Hendrawan, & Puspitha, 2019).

During the pandemic, researchers found medical wastes and high amount of PPEs debris in river outlets into Jakarta Bay (M. R. Cordova, Nurhati, Riani, Nurhasanah, & Iswari, 2020). A study found that the mangrove ecosystem in the small island was polluted mainly by plastic film (63%) and fibre (31%). Further, the study identified the source of about 61% of plastic debris in mangrove areas are land-based (Suyadi & Manullang, 2020). This land-based plastic pollution is affecting mangrove health (tree density, survival, and tree size). The effects of plastic pollution reduce the ecological functions and ecosystem services of the mangrove ecosystem.

6. TRANSITIONING TOWARDS THE CIRCULAR ECONOMY

Around 72% of plastic pollution originates in rural regions and small- to medium-sized cities. Currently, only 11% of plastic wastes in Indonesia are being recycled. With a waste collection rate of almost 70%, the mismanagement of plastic waste is a constant domestic challenge. This challenge requires concrete action and policy change from the local level to the national level.

In 2017, Indonesia pledged up to \$1 billion annually to clean its seas from plastic debris and other waste over the next eight years (until 2025).⁵⁰ This pledge was followed by issuing a Presidential Decree Number 83 year 2018⁵¹ and the Minister of Environment and Forestry Decree No. P.75/MenLHK/SetJen/KUM.1/10/2019 concerning the roadmap of waste reduction by producers.⁵²

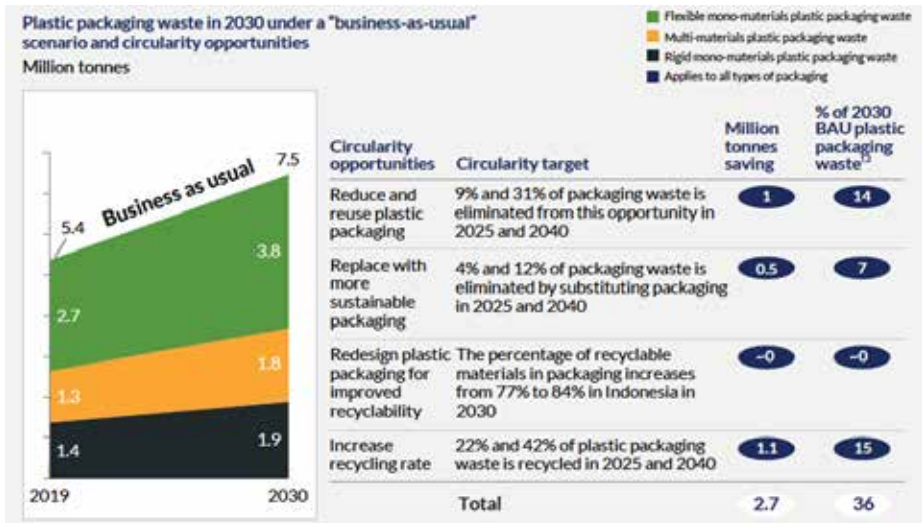
In 2020, a team of researchers and stakeholders of the Indonesian National Plastic Action Partnership formulated the strategy to radically reduced plastic pollution in Indonesia through a system change (WEF, 2020). The NPAP report includes a business-as-usual scenario that estimates plastic pollution will increase by one-third to 6.1 million tonnes in 2025 and will more than double in 2040 – even if plastic waste collection rates keep pace with growing waste generation.

Considering the vast geography of Indonesia, the group proposed solutions must be differentiated by geography and type of plastic. There is a notable difference among different types of plastic. Rigid plastics, such as polyethylene terephthalate (PET) bottles, have a higher value for recyclers and cause less pollution, particularly in urban areas. However, some flexible plastics, particularly those made of multiple layers of different materials, cannot be recycled economically—these multi-layers of plastic packaging form about three-quarters of the plastic waste leaking into the environment.

⁵⁰ <https://jakartaglobe.id/context/indonesia-pledges-1b-annually-to-clean-up-its-seas/>

⁵¹ Peraturan Presiden (PERPRES) Nomor 83 Tahun 2018 <https://peraturan.bpk.go.id/Home/Details/94716/perpres-no-83-tahun-2018>

⁵² Peraturan Menteri Lingkungan Hidup Dan Kehutanan Republik Indonesia Nomor P.75/Menlhk/Setjen/Kum.1/10/2019 Tentang Peta Jalan Pengurangan Sampah Oleh Produsen http://jdih.menlhk.co.id/uploads/files/P_75_2019_PETA_JALAN_SAMPAH_menlhk_12162019142914.pdf



1. Based on National Plastic Action Partnership's solution scenario modelling in 2019 on plastic waste in Indonesia in 2017, 2025, and 2040; 2. Percentages are rounded off
Source: World Economic Forum

Figure 44. Plastic packaging waste in 2030 under a "business-as-usual" scenario and circularity opportunities. Graphic: WEF, 2020

In line with the World Bank's proposal (WorldBank, 2018) to support Indonesia achieve its ambitious target to reduce 70% of plastic pollution by 2025, the System Change Scenario (SCS) proposed by the NPAP combines five system changes to reduce ocean leakage in Indonesia by 70% by 2025.

The SCS combines five system changes to reduce ocean leakage in Indonesia by 70% by 2025. Delivering this 70% ocean leakage reduction scenario from 2017 to 2025 requires a total capital investment of \$5.1 billion and an operational funding budget of \$1.1 billion per year in 2025 to run effective waste management and recycling system. This figure is to address domestic wastes only and does not include plastic waste management.

An action plan of practical recommendations for government, industry and civil society is proposed below:

- **Reduce or substitute plastic usage** to prevent the consumption of more than 1 million tonnes of plastics per year by 2025;
- **Redesign** 500,000 tonnes of plastic products and packaging for reuse or high-value recycling;



1. Non-essential plastics refers to plastics that can be eliminated without compromising the functionality of the original product. For example, plastic micrbeads that are present in many personal cosmetic and personal care products.

Source: Ellen MacArthur Foundation; World Economic Forum; Plastic Oceans; literature review; focus group discussions; expert interviews

Figure 45. Qualitative assessment of potential circularity in plastic packaging in Indonesia. Graphic: Bappenas, 2021

- **Double plastic-waste collection** from 39% to 84% by 2025 by boosting state-funded and informal or private sector collection systems;
- **Double current recycling capacity** to process an additional 975,000 tonnes per year of recycled plastic by 2025; and
- **Build or expand controlled waste-disposal facilities** to manage an additional 3.3 million tonnes of plastic waste per year by 2025.

To support the circular economy of plastic packaging in the wholesale and retail sector, Bappenas identified five interventions in the spectrum of 5R: Reduce, Reuse, Recycle, Refurbish, Renew (see Figure 45).

Eliminating non-essential plastic packaging and increase the plastic recycling rate from its current state is likely to have fewer reuse obstacles where consumer expectations and food and medical packaging standards are potential barriers.

To reduce and recycle 36% of plastic packaging waste in the wholesale and retailer sector of Indonesia, Bappenas recommended these four opportunities:

- **Reduce and reuse plastic packaging.** This term refers to eliminating non-essential plastic packaging since the product design stage, maximizing reuse of plastic packaging, and creating new delivery models that avoid SUPs. Following the NPAP's System Change Scenario, about one million tons of plastic waste packaging (14% of the total plastic wastes) can be reduced by 2030 through the reduction of plastic on the packaging and reusing plastics. This intervention can be done by implementing the Minister of Environment and Forestry Decree No. P.75/MenLHK/SetJen/KUM.1/10/2019 concerning the roadmap of waste reduction by producers. In early 2021, 23 fast-moving consumer group companies already submitted their road map to reduce 30% of their plastic packaging by 2030 to the Ministry of Environment and Forestry.
- **Replace the packaging with more sustainable materials.** Replacing the plastic packaging with more sustainable alternatives means exploring various alternatives, including paper or cardboard or coated paper that meets the criteria for technical recyclability or compostable materials. By replacing plastic with sustainable alternatives, Indonesia could reduce 0.5 million tons of plastic packaging.
- **Redesign plastic packaging for improved recyclability.** This means altering the properties of packaging, which could increase the economic of recycling, such as removing dyes and additives to minimize the loss rate of plastics in mechanical recycling.
- **Increase the recycling rate of recyclable packaging.** It was estimated that Indonesia could improve its recycling rate of post-consumer plastic packaging from 12 percent (2019) to 27 per cent in 2030. Some interventions have been identified includes open-loop, close-loop, and chemical recycling technologies. However, to achieve 27 per cent recycling rate in 2030, Indonesia would have to increase the waste collection rates.

The economic impact from circular economy of plastic packaging could be worth IDR14.4 trillion (approx. USD 1 billion) which is equivalent to 0.5% of the sector's GDP in 2030. The implementation of the four recommendations also could generate 107,000 cumulative jobs between 2021 and 2030 - 85% could be for women. However to unlock the potential for improvement, there are several challenges and barriers such as lack of infrastructures, difficult to change habits of businesses and consumers,

insufficient end market information, lack of capital to increase recycling rate, and imperfect information.

To overcome the barriers and challenges government of Indonesia should enforce EPR and mandatory packaging reporting, provide incentives for sustainable packaging, increase awareness about waste management, upgrade informal waste sector, mobilize investments, and monitor successful local studies to implement solutions.

7. RECOMMENDATIONS

Early 2020 until the first semester of 2021, the government of Indonesia issued several important policies:

- **Declassified the nasty-nine as non-hazardous wastes.** Due to its massive volume of production, nine hazardous wastes have been classified into a new category as “registered non-hazardous waste” to give more opportunities to be recycled and repurposed within the framework of Circular Economy. It is not clear what the implication of this new regulation is for cement kilns, coal-fired power plants and industrial boilers that use RDF containing plastic. The use of RDF pellets and fluffy plastic wastes in coal-fired power plants, cement kilns and industrial boilers potentially will release dioxins through the emission and in the ash. The nine non-hazardous wastes are:
 - Steel slag
 - Nickel slag
 - Mill slag
 - Bottom Ash
 - Fly Ash
 - Foundry sand
 - Electric Arc Furnace (EAF) dust
 - Spent Bleaching Earth (SBE)
 - Precious Slag (PS) Ball
- **Toxic Circular Economy.** Promotion of Circular Economy to utilize plastic wastes using various technology applications, such as chemical recycling, plastic to fuel, plastic to brick, and plastic to new products without precautionary principle will increase risks to the public and environmental health. A clear guidance for plastic recycling should be developed to prevent the accumulation of toxic plastic additives in the new products. Currently, Indonesia is in the process of updating the Stockholm Convention's NIP to include new POPs. Monitoring of new POPs in plastic recycled products should be included in the updated plan and implemented.

Supporting infrastructures, such as POPs laboratories and relevant standards, should be developed. Further, the roadmap for the plastic and paper recycling industry needs to be developed, taking into account other relevant agencies policies and programs, such as Bappenas' Circular Economy Programs, SDG12 Sustainable Consumption and Production's action plan, Low Carbon Development Program, as well as Green Industry Program and Standards.



Figure 46. Recycled plastic into toy, table and paving block without safety guidance and standard is risking consumer and producer's health.

Graphic: Nexus3



Figure 47. Annual emissions released from the life-cycle of plastics is comparable with coal plants.

Graphic: CIEL

- **Net Zero Emission target by 2070.** Indonesia, one of the world's biggest greenhouse gas emitters, has put forward a plan to achieve net-zero emissions by 2070. The government says it's the most ambitious and realistic target for Indonesia, but activists and experts say the government can do much more, much sooner, given that China, the top emitter, has a net-zero deadline of 2060. Activists also criticized the government's plan for its continued reliance on coal as a primary component of the national energy mix over the coming decades, despite universal recognition of coal's role in climate change. In reviewing the net-zero emission target, the Indonesian government should include the CO₂ emissions of the petrochemicals and plastics industry in the whole life-cycle.
- **COVID-19 pandemic wastes.** During the pandemic, many PPEs are used and disposed of by health workers and the public. PPEs are mainly made from plastics. Burning PPEs wastes in the medical waste incinerator should be prohibited. Most PPEs can be disposed of safely through the sterilization process using autoclaves. Recycling of sterilized PPEs should follow proper guidelines provided by the responsible agencies.

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