East Asia and Pacific Region: **MARINE PLASTICS SERIES**

Appendices

MARKET STUDY FOR VIETNAM: PLASTICS CIRCULARITY OPPORTUNITIES AND BARRIERS

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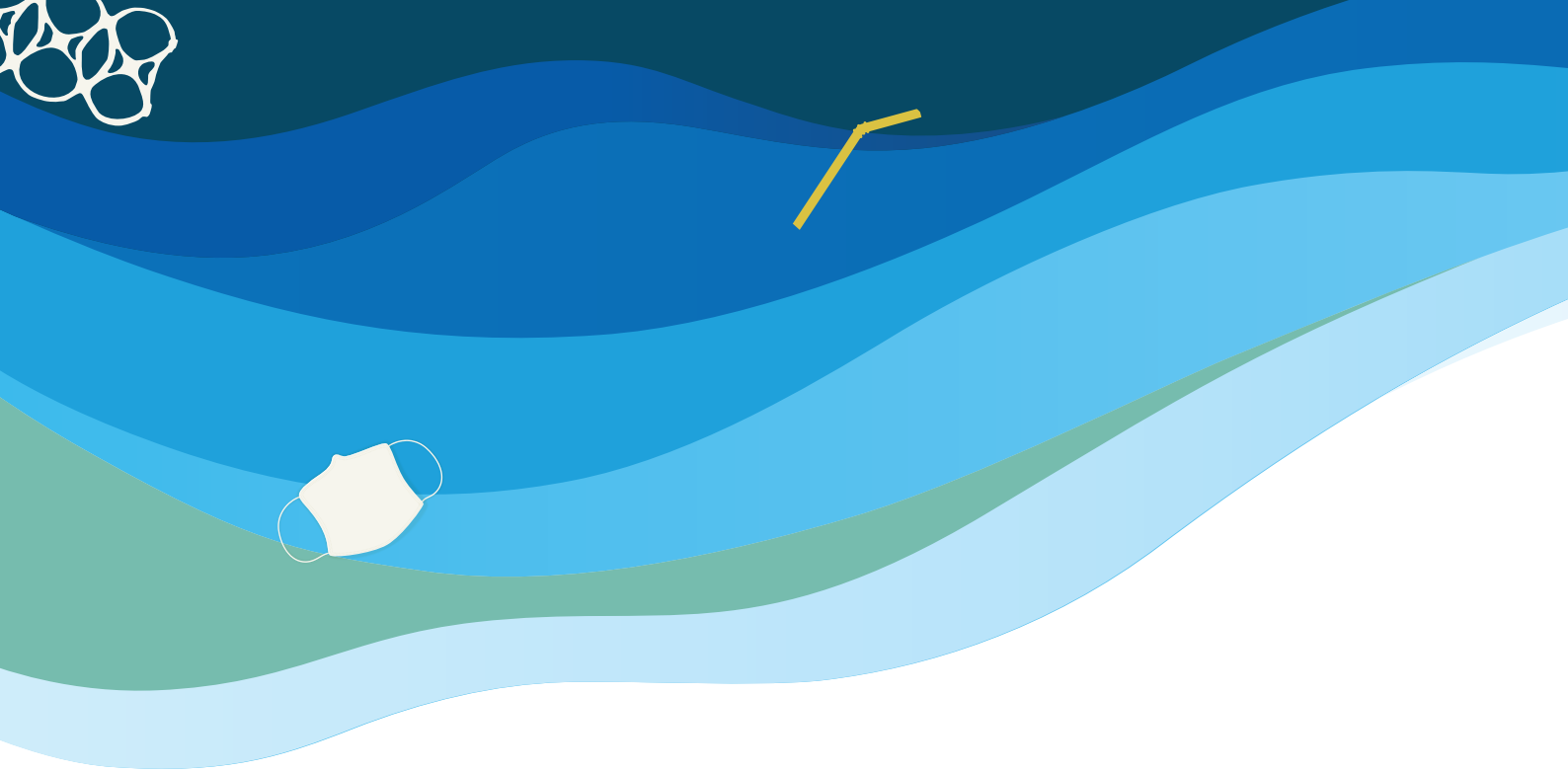

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APPENDICES

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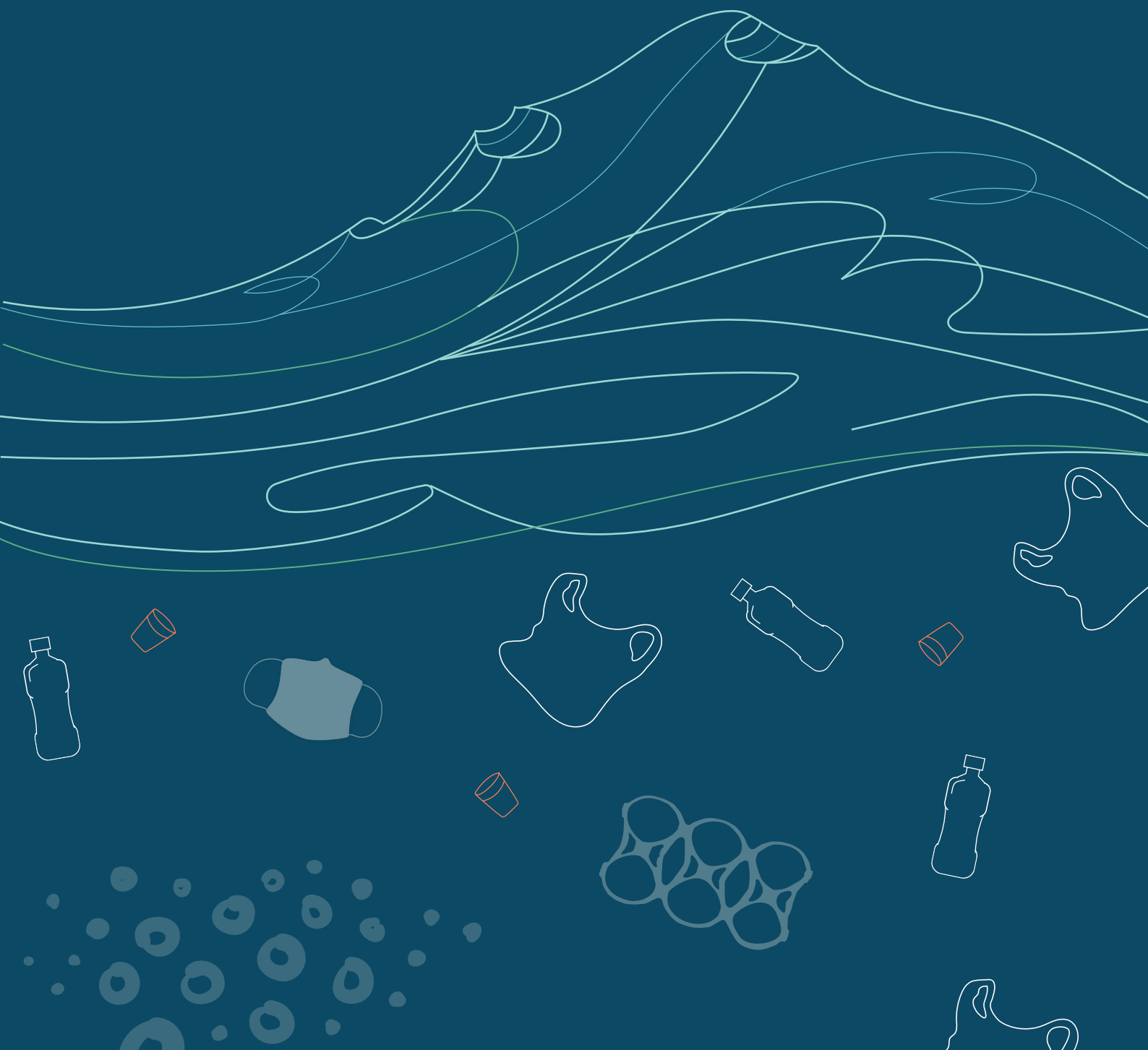

APPENDIX 1:

VIRGIN RESIN PRODUCERS ACTUAL/ PLANNED CAPACITIES

Summary of Existing Virgin Resin Production and Planned Capacity for Vietnam

Resin Producer	Resin	Virgin Resin Production Capacity in 2019 (TPY)	Actual Virgin Resin Production in 2019 (TPY)	Planned Additional Capacity 2020 Onwards (TPY)
No Planned Additional Capacity				
Hung Nghiep Formosa	PET	145,000	100,000	-
Polytex Far Eastern (Vietnam) Co Ltd	PET	400,000	400,000	-
Haosheng Vina	PET	50,000	50,000	-
Binh Son Refining & Petrochemical JSC	PP	150,000	165,000	-
Nghi Son Refinery and Petrochemical	PP	400,000	400,000	-
LG Vina Chemicals	DOP	40,000	40,000	-
TPC Vina Plastic & Chemical Corporation Limited	PVC	190,000	190,000	-
AGC Chemicals Vietnam Co Ltd	PVC	150,000	150,000	-
Polystyrene Vietnam Co Ltd	PS	54,000	54,000	-
Planned Additional Capacity				
Long Son	PE	-	-	800,000
	PP	-	-	450,000
	Others (PVC, softeners, etc)	-	-	350,000
Hyosung	PP	-	-	600,000
Billion Tay Ninh	PET	-	-	400,000

Notes:

- *The resin producer capacity figures are based on survey responses or interviews with private sector stakeholders and where not possible by survey/interview, through publicly available information.*
- *Data points for PET, PP and PE that have been validated through the Vietnam Plastics Association (VPA) include Hung Nghiep Formosa, Polytex Far Eastern (Vietnam) Co Ltd, Binh Son Refining and Petrochemical JSC and Nghi Son Refinery and Petrochemical. The key data point that has not been obtained directly through stakeholder interviews or validated by VPA is the PET production for Hoasheng Vina. The data is through publicly available information and it has been assumed as 50%-50% split between PET Packaging and PET Polyester production.*
- *Polytex Far Eastern (Vietnam) and Hung Nghiep Formosa can produce PET polyester resin, but as of 2019, their production was focused only on PET packaging resin.*
- *For Binh Son Refining & Petrochemical JSC, the actual virgin resin production rate of 165,000 TPY is higher than the virgin resin production capacity in the above table. This is because the virgin production capacity was obtained from the 2019-2020 Vietnam Plastics Directory overview while the actual virgin resin production rate is based on company's responses to questionnaires for this study. This increase in actual production rates was due to increased demand in 2019.*
- *There are no PE resin producers in Vietnam as of 2019.*

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APPENDIX 2:

DEFINITIONS OF CIRCULARITY AND OTHER RELATED CONCEPTS

2.1 DEFINITION OF CIRCULARITY

To better understand and utilize this definition for this study on plastics circularity, it is important to further understand the definition. This can be done via three approaches:

1. Plastics circularity for a strong, innovative, and resilient plastics recycling industry

This approach to plastics circularity is the focus of this study and it builds on the foundation of Vietnam's existing plastics manufacturing and recycling industries. This approach to plastics circularity includes the following activities:

- Reduction of plastics usage / single-use plastics usage
- Increasing local plastics recycling capacity
- Increasing production and use of recycled plastics content
- Moving towards 100% reusable, recyclable, biodegradable or compostable plastics materials

2. Plastics circularity to address climate change

The world is increasingly becoming aware of the climate crisis. However, the efforts to tackle this crisis have mainly focused on energy efficiency and a transition to renewable energy which only addresses 55% of global greenhouse gas emissions. The remaining 45% comes from making the products we use every day, according to a 2019 report by The Ellen MacArthur Foundation.[1] If countries are serious about achieving the climate goals, they need to tackle this remaining 45%.

3. Plastics circularity to address resource inefficiency

According to a United Nation (UN) Environment report in 2019, each year, 90 billion tonnes of primary materials are extracted and used globally, with only 9% recycled.[2] This is commercially and environmentally unsustainable. In the last two decades, not only have resource inefficiencies and pollution challenges become more severe, countries around the world are seeing the limits of a linear economy which is built in the model of 'take-make-dispose'. The current linear economy system is no longer working for businesses, people, or the environment. Addressing the question of resource efficiency through plastics circularity however is out of scope and this approach will not be covered in this study.

1 Ellen MacArthur Foundation, "Completing the Picture"
2 United Nations Environment Programme, "Global Resources Outlook"

2.2 OTHER DEFINITIONS USED IN THE STUDY

The following definitions and terms in the context of a circular economy are also used in this report:

Waste: Waste is defined as "substances or objects which are disposed of or intend to be disposed of by provisions of National Law" under the Basel Convention.

Municipal Waste / Post-Consumer Waste: Municipal waste is waste that has been disposed of by households or commercial entities after consumption. It is collected through the public waste collection infrastructure of the city. Therefore, post-consumer waste is typically dirty as organic waste that is also produced by residential and commercial sources is mixed into the municipal waste collection system.

Industrial Waste / Post-Industrial Waste: Industrial waste is waste that is generated from industrial activities. These include materials such as chemical containers, pallet film wraps and factory offcuts. These wastes are typically disposed of through privately contracted waste collection services. Hence, they are usually less contaminated than post-consumer waste as it is not typically mixed with other types of waste unless it has already been contaminated due to the industrial activity it is produced from. In fact, in some cases, factories might engage recyclable collectors to collect their recyclables as it is usually cheaper than simply disposing of the materials.

Recycling: Recycling processes may be categorized as two types; Mechanical Recycling and Chemical Recycling.

- **Mechanical Recycling** is defined as "the processing of plastic waste into secondary raw material or products without significantly changing the chemical structure of the material" by the Basel Convention. For example, the flaking and conversion of post-consumer PET bottles into recycled PET (rPET) pellets are an example of mechanical recycling.
- **Chemical Recycling:** the Basel Convention defines Chemical Recycling as "the depolymerization of long polymer chains into monomers through a chemical reaction by means of heat and/or chemical agents to produce monomers, chemical raw materials and/or fuels". Technologies that convert plastics back into secondary raw materials or fuels can be considered to fall under 2 broad categories: (a) plastic-to-plastic (via naphtha or monomer recycling); (b) plastic-to-fuel (PTF).[3] Pyrolysis of multilayer flexibles into refuse derived fuel is an example of PTF recycling. While harmonized definitions for chemical recycling are still to be developed, in the European Union (EU), which leads in the development of these technologies, plastic-to-fuel technologies are considered by the chemical recycling industry to be energy recovery, not recycling (as they are linear); only plastic-to-plastic technologies (such as those that produce naphtha or monomers directly) are considered to fall under existing EU definition of recycling in the EU Waste Framework Directive.

Mechanical recycling is preferred to chemical recycling as it requires less energy and has a lower technological requirement. Meanwhile, chemical recycling is advantageous for types of material that are not yet recyclable through mechanical recycling methods (e.g. multi-layer flexibles).

Mechanical recycling where the product of the recycling process is like input materials (e.g., bottle-to-bottle recycling), is preferred to downcycling, where the products are different from the original input (e.g., PET to rPET fiber). This is because downcycling degrades the integrity and quality of the material and hence, reduces the value and results in products that eventually must be disposed of by landfilling or other means.

Note: The report mentions the term smaller recyclers and larger recyclers. In the context of this report, larger recyclers are defined as recyclers with a capacity of more than 3,000 tonnes per year.

3 A Circular Solution to Plastic Waste by BCG

APPENDIX 3:

STAKEHOLDER ENGAGEMENT LIST

APPENDIX 3A:
LIST OF PRIVATE SECTOR STAKEHOLDERS ENGAGED FOR IN-DEPTH INTERVIEWS

For references, the key private sector stakeholder categories are:

- **Resin Producers** - Resin producers produce virgin resin (e.g., PET, PP, PE) from fossil-fuel based feedstocks
- **Converters** - Converters use virgin resin, and in some cases recycled resins from recyclers, to manufacture a variety of plastic products.
- **Collectors** - Collectors are informal workers who collect post-consumer plastic products to re-sell for recycling.
- **Aggregators** - Aggregators collect large quantities of post-consumer or post-industrial plastics from their supply chain (consisting of collectors and junk shops) to re-sell to recyclers.
- **Processors & Recyclers** - Processors and Recyclers convert the waste plastics collected by the collectors and aggregators and convert them into the recycled raw materials

Photo: S.SUPHON - shutterstock

List of Private Sector Stakeholders Contacted for this Study

Name of Stakeholder	Stakeholder category	Name of contact person	Position
Binh Son Refining	Resin Producer	Phan Quoc Toan	Sales Director
Nghi Son	Resin Producer	Interviewed by Ms. Hong My (Secretary General, VPA)	
Hung Nghiep Formosa	Resin Producer	Interviewed by Ms. Hong My (Secretary General, VPA)	
Polytex Far Eastern	Resin Producer	Interviewed by Ms. Hong My (Secretary General, VPA)	
SCG Vietnam (Long Son)	Resin Producer	Phuong Trinh	Marketing Director
BASF	Resin Producers / Plastic Convertors	Tanachart Ralsiripong	Country Director
An Phat	Resin Producer / Plastic Convertors	Long Nguyen	Head of R&D
DynaPlast	Plastic Convertor	Bennett Jap	Director
Duy Tan	Plastic Convertor	Le Anh Duong Tu Uyen Thao	Vice President Sale Manager
Euro Film JSC	Plastic Convertor	Tran Van Thach	General Director
OPEC	Plastic Trader	Nguyen Minh Tu	General Director
FrieslandCampina	FMCG Company	Berend van Wel	Managing Director
Nestle Vietnam & La Vie Vietnam	FMCG Company	Fausto Tazzi	CEO of La Vie & Board member of PRO Vietnam
Suntory PepsiCo Beverages Vietnam	FMCG Company	Jahanzeb Khan	CEO
Coca-Cola Vietnam	FMCG Company	Casper Durandt	Sustainability Director Coca-Cola (ASPOU) Asia and South Pacific Operating Unit
URC Corporation	FMCG Company	Laurent Levan	Senior Vice President, Regional Director Indochina Cluster
PRO Vietnam	Industry Association	Fausto Tazzi	CEO of La Vie & Board member of PRO Vietnam

Name of Stakeholder	Stakeholder category	Name of contact person	Position
Vietnam Plastic Association	Industry Association	Huynh Thi My	Secretary General
Vietnam Plastic Recyclers Association	Industry Association	Hoang Duc Vuong	Chairman
Vietnam Chamber of Commerce & Industry	Industry Association	Pham Hoang Hai	Chief of Secretariat, Vietnam Business Council for Sustainable Development.
INSEE Ecocycle Vietnam	Waste Co-processor	Bruno Fux	Ecocycle & Sustainable Development Director
Duy Tan	Recycler	Le Anh Duong Tu Uyen Thao	Vice President Sales Manager
HL Plastics	Recycler	Andy Nguyen	Director
Vinatic Hai Phong	Recycler	Nguyen Phu Binh	Sale Associate
Hoang Anh	Recycler	Nguyen Thi Hoang Anh	Owner
Cong Ty Co Phan A Dong Adg	Recycler	Mr. Binh	Vice president
Vinh Thanh Corporation	Recycler	Hoang Duc Vuong	Director
Q.M.T - JP Plastic	Recycler	Ms. Lan	Sale Director
Lam Tran	Recycler	Mr. Thang	Owner
Phu Hung	Recycler	Lan Anh	Director
Trinh Nghien	Recycler	Trinh Nghien	Director
Vikohasan	Recycler	Ngo Anh Tuyet	Director
Hat Nhua H.A	Recycler	Quang Tuan	Director
Khanh Quynh Long An	Recycler	Ms. Lan	Sale Director
Mai Tan Dat	Recycler	Mr. Dat	Director
Mai Hieu Sai Gon	Recycler	Ms. Hong	Director

Name of Stakeholder	Stakeholder category	Name of contact person	Position
Nhat Nam Tra Vinh	Recycler	Phan Huong	Director
Dai Duong L.A	Recycler	Mrs. Loan	Director
TontoTon	Recycler/Processor	Barak Ekshtein	CEO
Viet Trung	Recycler	Mr. Tung	Director
Viet Tin	Recycler	Lam Tan Nha	Director
Shun An	Recycler	Lui Hong Jeng	Director
Viet Nhat	Recycler	Mr. Huy	Director
Son Trang	Recycler	Mr. Son	Director
Thanh Cong	Recycler	Tran Ngoc Tong	Director
HM Plastic	Recycler	Andy Nguyen	Director
Tan Phu	Recycler	Nguyen Dang Tan	Director
Dai Tin Phat	Recycler	Mr. Khanh	Director
AustDoor Ninh Binh	Recycler	Pham Thi Huyen	Director
Hiep Phat	Recycler	Tran Thanh Quy	Director
Nam Thien Sang	Recycler	Phan Thanh Trung	Director
Ngu Long	Recycler	Luong Ngoc Dam	Director
Lavergne	Recycler	Chu Ba Trung	Director
Khanh Toan	Recycler	Phan Thi Thanh Tuyen	Director
Sheido	Recycler	Ms. An	Director
VP Bank	Financial Institution	Tran Minh Hoang	E&S Specialist – FI Department
Circulate Capital	Impact Investor	Karina Cady Eric See	Operations & Investment Director, Investment Manager

APPENDIX 3B:
LIST OF POLICY EXPERTS/PUBLIC SECTOR STAKEHOLDERS ENGAGED FOR IN-DEPTH INTERVIEWS

List of Policy Experts and Public Sector Stakeholders Contacted as Part of the Analysis for This Study

Name of stakeholder	Stakeholder category	Name of contact person	Position
Sustainable Consumption and Production Office/ Ministry of Industry and Trade (SCPO/MOIT)	Government	Tran Thu Hang	Secretary Sustainable Consumption and Production Office
	Government	Dang Hai Dung	Sustainable Consumption and Production Office
Vietnam Association for Supporting Industries (VASI)	Government	Luu Anh Duc	Deputy Director, Department of Science, Technology, and International Cooperation (DSTIC), VASI
Expertise France	NGO	Fanny Quertamp	Senior Advisor Vietnam
GreenHub	NGO	Nguyen Thi Thu Trang	Manager
World Wildlife Fund (WWF)	NGO	Nguyen Thi Dieu Thu	Plastic Smart Cities and MPA Lead
		Huy Ho	Project Officer, Plastic Policy & EPR
		Son Hoai Nguyen	Project Manager
Circular Economy Advisory (CL2B)	NGO	Kim Le	Manager
Global Green Growth Initiative (GGGI)	Development Partner	Thinh Ngoc Tran	Investment Officer
		Hien Minh Tran	Investment Officer

APPENDIX 3C:
ATTENDEE LIST FOR STAKEHOLDER CONSULTATION WORKSHOPS

Attendee List of Stakeholder Consultation Workshops

Name of stakeholder	Stakeholder category	Name of contact person	Position
BASF	Resin Producer	Erick Contreras	Managing Director
Dow Vietnam	Resin Producer	Son Hoai Nguyen	Corporate Affairs Director
Dow Vietnam	Resin Producer	Viera Feckova	Senior Operation Officer
Far Eastern Polytex (VN)	Resin Producer	Huyen Trinh	Chemical Engineer
Sabic	Resin Producer	Ngoc Vu	General Director
An Phat Holdings	Plastic Manufacturer	Thanh Hoa Ha	Market Research Manager – R&D Dept
An Phat Holdings	Plastic Manufacturer	Bich Ngoc Pham	R&D specialist – R&D Dept
RKW Group	Plastic Manufacturer	Antony Taing	Managing Director

Name of stakeholder	Stakeholder category	Name of contact person	Position
RKW Group	Plastic Manufacturer	To Anh Le	Assistant to Managing Director
RKW Group	Plastic Manufacturer	Ngohung	No position provided
Huhtamaki	Plastic Manufacturer	Sawitree Buranapaiboon	Director of Innovation
Tashing	Plastic Manufacturer	Uyen Vu	Director
Tashing	Plastic Manufacturer	Vinh Khuu	Director
Andat Plastic	Plastic Manufacturer	Truong Dang	Director
Alta	Plastic Manufacturer	Tran Hue	No position provided
Alta	Plastic Manufacturer	Pham Minh	No position provided
Omya	Plastic Manufacturer	Khoa Huynh	No position provided
Omya	Plastic Manufacturer	Tran Khoa	Technical Sales Engineer
Thanh Binh	Plastic Manufacturer	Nguyen Minh	No position provided
Song Song Co., Ltd.	Plastic Manufacturer (Machinery Distributor)	Tu Nguyen	No position provided
Coca-Cola Vietnam	FMCG Company	Tran Pham	Public Affairs, Communication & Sustainability Manager
Coca-Cola Vietnam	FMCG Company	Casper Durandt	Director Sustainable Packaging and Climate Protection South East Asia
Unilever Vietnam	FMCG Company	Truc Le	Sustainable Business Manager
Unilever Vietnam	FMCG Company	Van Anh Nguyen	Senior SCF Manager
URC Corporation	FMCG Company	Laurent Levan	Senior Vice President, Regional Director Indochina Cluster
Nestlé Vietnam	FMCG Company	Hoai Thuong Le	Senior Corporate Affairs Manager
Nestlé Vietnam	FMCG Company	Hung Khuat	Communications Manager
Nestlé Vietnam	FMCG Company	Thuy Tran	No position provided
FrieslandCampina Vietnam	FMCG Company	Ho My (Linh)	No position provided
FrieslandCampina Vietnam	FMCG Company	Hoai Tran	No position provided
PRO Vietnam	Industry Association	Tuong Nguyen	Technical Operation Manager
PRO Vietnam	Industry Association	Lien Hoang	No position provided
PRO Vietnam	Industry Association	Trung Hà Phan	No position provided
Vietnam Plastic Recyclers Association	Industry Association	Duc Vuong Hoang	Chairman of Recycling Branch
Duy Tan	Recycler / Plastic Manufacturer	Tracy Duong	Business Director
TonToTon	Recycler	Roxane Lauzet	Sustainability Compliance & Marketing

Name of stakeholder	Stakeholder category	Name of contact person	Position
TonToTon	Recycler	Le Le	Project Executive
Vikohasan Fiber	Recycler	Tuan Pham Minh	Director
Trung Dong	Recycler	Trang Nguyen	Director
Vinatic	Recycler	Quang Minh Nguyen	CEO
Vinatic	Recycler	Ha Doan Nguyen	Business Development Director
Vinatic	Recycler	Phu Binh Nguyen	Business Development Executive
INSEE Ecocycle Vietnam	Cement Plant / Waste Co-processor	Bruno Fux	Director Ecocycle and Sustainable Development
INSEE Ecocycle Vietnam	Cement Plant / Waste Co-processor	Nguyen Vi	No position provided
Global Green Growth Initiative	Development Partner	Hien Tran	Policy officer
Global Green Growth Initiative	Development Partner	Ngoc Thinh Tran	Investment Officer
World Wildlife Fund Vietnam (WWF Vietnam)	NGO	Huy Ho	Project Officer
WWF Vietnam	NGO	Hoai Pham Manh	Plastic Policy and EPR Coordinator
WWF Vietnam	NGO	Thuy Nguyen	No position provided
Expertise France	NGO	Fanny Quertamp	National Senior Advisor
GreenHub	NGO	Ha Ngan Ha	Program Officer
Circular Design Vietnam	NGO	Mai Nguyen	No position provided
Circular Economy Advisory (CL2B)	NGO	Kim Le	Director
CL2B	NGO	Nguyen Hoang Cam Ha	Project Manager
CL2B	NGO	Radio Duong	No position provided
Keep Vietnam Clean and Green	NGO	Tue Phan	Advisor
Nkc Vietnam	Engineering Consultant	Hong Nguyen Thi	Team Leader
Ministry of Industry and Trade (MOIT)	Government	Tran Thu Hang	Secretary, Sustainable Consumption and Production Office
Bank of Tokyo-Mitsubishi, MUFG	Bank	Tracy Duong	Analyst

Name of stakeholder	Stakeholder category	Name of contact person	Position
VP Bank	Bank	Huyen Thanh	FI Relationship Manager
VP Bank	Bank	Tran Minh Hoang	Green Specialist for VP Bank's green Projects
International Finance Corporation (IFC)	Host	Kieu Anh Nguyen	Administrative Assistant
International Finance Corporation (IFC)	Host	Navneet Chadha	Regional Circular Economy Lead
International Finance Corporation (IFC)	Host	Mira Nahouli	Upstream Officer
International Finance Corporation (IFC)	Host	Jihu Park	Upstream Analyst
International Finance Corporation (IFC)	Host	Tuong Anh Vu	Energy Specialist
International Finance Corporation (IFC)	Host	Tuyen Nguyen	Asia Regional Lead, Manufacturing Advisory
International Finance Corporation (IFC)	Host	Nhung Cao	Programme Assistance
International Finance Corporation (IFC)	Host	Minh Nguyet Pham	Upstream Analyst
International Finance Corporation (IFC)	Host	Viera Feckova	Senior Operation Officer
International Finance Corporation (IFC)	Host	Dirk Sommer	Senior Officer
World Bank	Host	Ashraf El-Arini	Environmental Specialist
World Bank	Host	Hoa Trinh	WRG 30 Vietnam Program Coordinator
World Bank	Host	Thuy Duong	Senior Environmental Specialist
GA Circular	Host	Ashwin Subramaniam	Founder & CEO
GA Circular	Host	Laura Allen	Co-founder & COO
GA Circular	Host	Tam Nguyen	Project Director
GA Circular	Host	Thao Pham	Project Executive
GA Circular	Host	Samantha Phillips	Project Executive
GA Circular	Host	Joshua Tan	Project Executive
GA Circular	Host	Juline Lew	Project Executive

APPENDIX 4:

METHODOLOGY DIFFERENCES BETWEEN MATERIAL FLOW ANALYSIS CONDUCTED UNDER THIS WBG STUDY AND IUCN/ UNEP STUDY

Comparison Between Material Flow Analysis of This Study and the International Union for Conservation of Nature (IUCN) and United Nations Environment Programme (UNEP) Study for National Guidance for Plastic Pollution Hot spotting and Shaping Action

No.	Methodology Areas	MFA under Market Study by WBG	IUCN and UNEP MFA for National Guidance for Plastic Pollution Hot spotting and Shaping Action[4]
1	Key Objective	To define the addressable market size in terms of tonnes and market value in plastics circularity, from production to disposal, in Vietnam. To identify the barriers and opportunities for plastics recycling and other areas of plastics circularity (i.e., reuse).	To provide Vietnam with a common methodological framework to prioritize interventions to tackle plastic pollution through identification of hotspots on plastic leakage and impacts along the value chain. Hotspots covered include polymer, application, sector, region, and waste management.
2	Materials Studied	MFA covers plastics from production until post-consumption for all products under the 4 key resins (PET Packaging, PET Polyester, PP, HDPE, LDPE/LLDPE). Thus, total plastic tons covered in MFA is 4.0 million tonnes (2019).	MFA covers the input (import of primary form, products and waste and local production) and output (i.e. the flow/final destination of plastic) for all plastic types with the major resins in focus being PP, LDPE, HDPE, PVC, Polyester, PET Polyester, PET and PS. Remaining plastic types have been grouped under others. Thus, the total plastic covered in MFA is approximately 7 million tonnes (2018).

4 IUCN and UNEP, Preliminary result of "National Guidance for Plastic Pollution Hotspotting and Shaping Action: Hotspot Results For Vietnam" (2019)

No.	Methodology Areas	MFA under Market Study by WBG	IUCN and UNEP MFA for National Guidance for Plastic Pollution Hot spotting and Shaping Action[5]
3	Data Collection	The methodology uses in-depth stakeholder interviews with 57 public and private sector stakeholders from resin producers, convertors, recyclers and associations and additional consultation with more stakeholders. Data from these interviews is coupled with other data sources (e.g., VPA, Customs Department, UN Comtrade).	The methodology used employs data from available sources such as Comtrade, GreenHub Vietnam and Vietnam Material Marketplace report.
4	Type of Plastic Products	The objective of these MFAs is to provide a directional estimate of recycling rates for the resins of focus and they are not intended to account for every ton of plastic produced, consumed, or recycled in Vietnam.	MFA hotspot analysis covers 10 product applications that are short lived and are said to be 80% of total plastic (2017). The applications are food packaging, straws, polystyrene foam, disposable items, flakes, package belt, single use plastic foam, bottles, bottle cap and nylon bag.

5 IUCN and UNEP, Preliminary result of "National Guidance for Plastic Pollution Hotspotting and Shaping Action: Hotspot Results For Vietnam" (2019)

Separately, WWF Vietnam will be working on a material flow analysis (MFA) to assess the status quo of the waste management system and plastic packaging material flows and recommend a relevant Extended Producer Responsibility (EPR) scheme for Vietnam. This will be done as part of WWF's study titled "Assessing the implementation of an EPR system for packaging waste in Vietnam". However, the MFA work as part of the WWF study has not yet begun and thus a detailed comparison between the methodologies of the WWF Vietnam study and this study is not yet possible.

Photo: Susie Hedberg - shutterstock

APPENDIX 5:

RESIN USAGE BREAKDOWN BY INDUSTRY SECTOR

Breakdown of Resin Usage Per Industry Sector and the Corresponding Mean Plastic Product Lifespan Per Industry Sector[6]

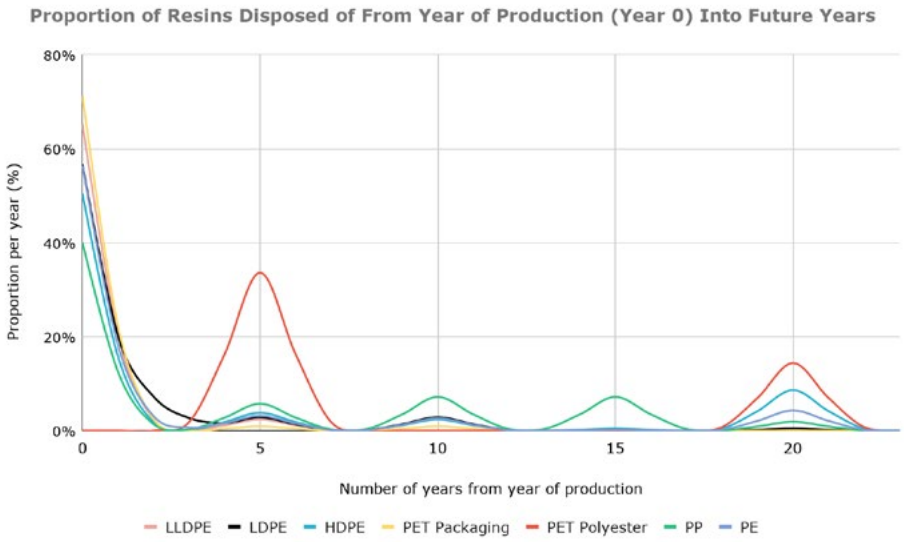
Industry Sector	Mean of Plastic Product Lifespan (Years)	Standard Deviation	Material Breakdown									
			LLDPE/LDPE		HDPE		PP		PET Bottle + Film		PET Polyester	
			Tonnes (2019)	Proportion (2019)	Tonnes (2019)	Proportion (2019)	Tonnes (2019)	Proportion (2019)	Tonnes (2019)	Proportion (2019)	Tonnes (2019)	Proportion (2019)
Packaging	0	0.83	768,813	83%	447,227	60%	713,891	50%	369,994	95%	0	0%
Construction	20	0.83	9,263	1%	134,168	18%	57,111	4%	0	0%	123,173	30%
E&E	10	0.83	55,577	6%	29,815	4%	142,778	10%	7,789	2%	0	0%
Automotive	15	0.83	0	0%	7,454	1%	214,167	15%	0	0%	0	0%
Textile	5	0.83	0	0%	0	0%	0	0%	0	0%	287,404	70%
Recreation	10	0.83	0	0%	7,454	1%	71,389	5%	0	0%	0	0%
Footwear	2	0.83	37,051	4%	0	0%	0	0%	0	0%	0	0%
Filament non-textile	0	0.83	0	0%	59,630	8%	42,833	3%	0	0%	0	0%
Medical	0	0.83	0	0%	0	0%	14,278	1%	3,895	1%	0	0%
Lens	0	0.83	0	0%	0	0%	0	0%	0	0%	0	0%
Agriculture	5	0.83	37,051	4%	37,269	5%	14,278	1%	0	0%	0	0%
Houseware	5	0.83	9,263	1%	14,908	2%	142,778	10%	3,895	1%	0	0%
Safety	5	0.83	0	0%	0	0%	14,278	1%	3,895	1%	0	0%
Security	5	0.83	9,263	1%	7,454	1%	0	0%	0	0%	0	0%
Total			926,280	100%	745,378	100%	1,427,782	100%	389,467	100%	410,577	100%

6 Plastics Institute of Thailand (for percentage breakdown for end-use industry)

Notes:

- The breakdown above is used to determine 2019 disposal amounts, by determining the amounts consumed in 2019 and kept in use beyond 2019, and the amounts from past years that are being disposed of in 2019
- Data from the Plastics Institute of Thailand (PIT) has been used to calculate the material breakdown as Vietnam does not have such data available, and PIT data has been deemed the most representative

Normal Distribution Curves Used Showing Average Lifespan of Plastic Products from Different Resins[7]



7 Plastics Institute of Thailand (as Vietnam specific data was not available), GA Circular modelling


Photo: Olga Miltsova - shutterstock

APPENDIX 6:

NET RESIN IMPORT/EXPORT AND NET SEMI-FINISHED PRODUCT IMPORT/EXPORT

APPENDIX 6A:
HS CODES USED FOR NET RESIN IMPORT/EXPORT AND NET SEMI-FINISHED PRODUCT IMPORT/EXPORT CALCULATIONS

The following table provides the descriptions of the HS codes used to determine the net import/export of resin and semi-finished product for each of the resin types studied.

HS Codes Used and Respective Descriptions

HS Code	HS Description	Type of Resin	Primary form/ Semi-finished Product/ Waste
390110	Polyethylene having a specific gravity of less than 0.94 (TNE)	PE	Primary
39011012	Linear low-density polyethylene in liquid or paste form (TNE)	LLDPE	Primary
39011019	Other polyethylene of specific gravity below 0.94 in liquid or paste form (TNE)	LDPE	Primary
39011092	Linear low-density polyethylene in other primary forms (TNE): in powder form	LLDPE	Primary
	Pharmaceutical grade, granules		
	Cable grade, granules		
	Used in manufacture of telephonic or electric wires		
	Other		
39011099	Other polyethylene of specific gravity below 0.94 in other primary forms (TNE): in powder form	LDPE	Primary
	Pharmaceutical grade, granules		
	Cable grade, granules		
	Used in manufacture of telephonic or electric wires		
	Other		

HS Code	HS Description	Type of Resin	Primary form/ Semi-finished Product/ Waste
390120	Polyethylene of specific gravity 0.94 or more (TNE)	PE	Primary
	In powder form		
	Pharmaceutical grade, granules		
	Cable grade, granules		
	Used in manufacture of telephonic or electric wires		
	Other		
390130	Ethylene polymers; in primary forms, ethylene-vinyl acetate copolymers	PE	Primary
	In powder form		
	In liquids or pastes		
	In granules		
	Other		
390140	Polymers of ethylene, in primary forms. ethylene-alpha-olefin copolymers, having a specific gravity of less than 0.94	PE	Primary
	In dispersion		
	Other than in dispersion		
390190	Ethylene polymers; in primary forms, n.e.c. in heading no. 3901	PE	Primary
39019040	In dispersion		
39019090	In powder form		
	In liquids or pastes		
	In granules		
	Other		
390210	Propylene, other olefin polymers; polypropylene in primary forms	PP	Primary
390210	In dispersion		
	In powder form		
	Used in manufacture of telephonic or electric wires		
	Liquids or paste		
	Other		

HS Code	HS Description	Type of Resin	Primary form/ Semi-finished Product/ Waste
390230	**Propylene copolymers: in the form of liquids or pastes**	**PP**	**Primary**
39023030	In the form of liquids or pastes		
39023090	In powder form		
	Used in manufacture of telephonic or electric wires		
	Other		
390290	**Propylene, other olefin polymers; n.e.s. in heading no. 3902, in primary forms.**	**PP**	**Primary**
	Chlorinated polypropylene used for printing ink formulation (TNE)		
39029090	In powder form		
	In liquids or pastes		
	In granules		
	Other		
390760	**Polyethylene terephthalate; in primary forms**	**PET**	**Primary**
390761	**Polyethylene terephthalate; in primary forms, having a viscosity of 78 ml/g or higher (TNE)**	**PET**	**Primary**
390769	**Polyethylene terephthalate; in primary forms, having a viscosity of less than 78ml/g**	**PET**	**Primary**
39076910	Other polyethylene terephthalate in the form of granules (TNE)		
39076990	Other polyethylene terephthalate excluding those in the form of granules (TNE)		
391610	**Polymers of ethylene**	**PE**	**Semi-finished Product**
39161010	Monofilament of ethylene polymers of which cross-sectional dimension exceeds 1mm (TNE)		
3916102000	Rods sticks & profile shapes of ethylene polymers (TNE)		
391721	**Plastics; tubes, pipes, and hoses thereof, rigid, of polymers of ethylene**	**PE**	**Semi-finished Product**

HS Code	HS Description	Type of Resin	Primary form/ Semi-finished Product/ Waste
39172100	Porous tubes suitable for agricultural watering		
	Other		
391722	**Plastics; tubes, pipes, and hoses thereof, rigid, of polymers of propylene**	**PP**	**Semi-finished Product**
39172200	Porous tubes suitable for agricultural watering		
	Other		
391890	**Floor, wall, or ceiling coverings; of plastics (excluding polymers of vinyl chloride), whether self-adhesive, in rolls or in the form of tiles**	**PE**	**Semi-finished Product**
39189011	Floor tiles of polyethylene (TNE)		
39189013	Other floor coverings of polyethylene (TNE)		
39189091	Wall or ceiling coverings of polyethylene (TNE)		
391910	**Self-adhesive plates sheets film foil tape strip & other flat shapes of polyethylene in rolls of width not over 200mm (TNE)**	**PE**	**Semi-finished Product**
39191020	Tapes used in the manufacture of telephonic or electric wires		
	Other		
392010	**Plastics: plates, sheets, film, foil, and strip of polymers of ethylene, non-cellular and not reinforced, supported, or similarly combined with other materials**	**PE**	**Semi-finished Product**
39201011	Rigid plates & sheets of polymers of ethylene non-cellular & not reinforced laminated supported or combined with other materials (TNE)		
39201019	Non rigid plates & sheets of polymers of ethylene non-cellular & not reinforced laminated supported or combined with other materials (TNE)		
39201090	Film foil & strip of polymers of ethylene non-cellular & not reinforced laminated supported or combined with other materials (TNE)		

HS Code	HS Description	Type of Resin	Primary form/ Semi-finished Product/ Waste
392020	Plastics: of polymers of propylene, plates, sheets, film, foil, and strip, non-cellular and not reinforced, laminated, supported, or similarly combined with other materials	PP	Semi-finished Product
39202010	Biaxially oriented polypropylene film non-cellular & not reinforced laminated supported or combined with other materials (TNE)		
39202091	Other plates & sheets of polymers of propylene non-cellular & not reinforced laminated supported or combined with other materials (TNE)		
39202099	Other film foil & strip of polymers of propylene non-cellular & not reinforced laminated supported or combined with other materials (TNE)		
392062	plastics: plates, sheets, fil, foil, and strip, of PET, non-cellular and not reinforced, laminated, supported, or similarly combined with other materials	PET	Semi-finished Product
39206210	Plates & sheets of polyethylene terephthalate non-cellular & reinforced laminated supported or combined with other materials (TNE)		
39206290	Film foil & strips of polyethylene terephthalate non-cellular & reinforced laminated supported or combined with other materials (TNE)		
392063	Plastics: plates, sheets, film, foil, and strip, of unsaturated polyesters, non-cellular and not reinforced, laminated, supported, or similarly combined with other materials	Polyester	Semi-finished Product
	Used as an adhesive by melting		
	Other		
392069	Plastics: plates, sheets, film, foil, and strip (not self-adhesive), of polyesters n.e.c. in heading no. 3920, non-cellular and not reinforced, laminated, supported, or similarly combined with other materials	Polyester	Semi-finished Product
	Used as an adhesive by melting		
	Other		

HS Code	HS Description	Type of Resin	Primary form/ Semi-finished Product/ Waste
392119	Plastics; plates, sheets, film, foil, and strip, of plastics n.e.s. in heading no. 3921, cellular	PP	Semi-finished Product
3921192015	Other plates, sheets, film, foil, and strip, of plastics, cellular: of other plastics other than of polymers of styrene, of polymers of vinyl chloride, of polyurethanes and of regenerated cellulose: rigid: of other addition polymerisation products: plates and sheets, of polypropylene		
3921192019	Other plates, sheets, film, foil, and strip, of plastics, cellular: of other plastics: rigid: of other addition polymerisation products: other than plates and sheets, of polypropylene		
392321	Ethylene polymers; sacks and bags (including cones), for the conveyance or packing of goods	PE	Semi-finished Product
39232111	Aseptic bags of ethylene polymers reinforced with aluminium foil of width 315mm or more & length 410mm or more incorporating a sealed gland		
39232119	Other aseptic bags of ethylene polymers reinforced with aluminium foil		
39232191	Aseptic bags of ethylene polymers not reinforced with aluminium foil of width 315mm or more & length 410mm or more incorporating a sealed gland		
39232199	Sacks & other aseptic bags of ethylene polymers not reinforced with aluminium foil		
48239030	Die cut polyethylene coated paperboard used for making paper cups	PE	Semi-finished Product
540234	Textured polypropylene yarn not for retail (kgm)	PP	Semi-finished Product
540244	Yarn, synthetic; filament, monofilament (less than 67 decitex), other than high tenacity or textured yarn, elastomeric, single, untwisted or twisted 50 turns or less per metre, not for retail sale, not sewing thread	Polyester	Semi-finished Product

HS Code	HS Description	Type of Resin	Primary form/ Semi-finished Product/ Waste
540244100	Synthetic filament yarn (other than sewing thread), not put up for retail sale, including synthetic monofilament of less than 67 decitex. other yarn, single, untwisted or with a twist not exceeding 50 turns per metre: elastomeric: of polyesters		
540248	Other polypropylene yarn single untwisted or a twist not over 50 turns per metre not for retail (kgm)	PP	Semi-finished Product
540253	Other polypropylene yarn single with a twist over 50 turns per metre not for retail (kgm)	PP	Semi-finished Product
540263	Other polypropylene yarn multiple or cabled not for retail (kgm)	PP	Semi-finished Product
540412	Polypropylene monofilament of 67 decitex or more & no cross-sectional dimension exceeds 1mm (kgm)	PP	Semi-finished Product
540710	Fabrics, woven; from high tenacity yarn, of nylon, other polyamides or of polyesters	Polyesters	Semi-finished Product
54071021	Woven tyre fabrics & conveyor duck of high tenacity yarn of nylon or other polyamides or polyesters unbleached (MTK)		
54071029	Woven tyre fabrics & conveyor duck of high tenacity yarn of nylon or other polyamides or polyesters not unbleached (MTK)		
54071091	Other woven fabrics of high tenacity yarn of nylon or other polyamides or polyesters unbleached (mtk)		
54071099	Other woven fabrics of high tenacity yarn of nylon or other polyamides or polyesters not unbleached (mtk)		
540751	Fabrics, woven; containing 85% or more by weight of textured polyester filaments, unbleached/ bleached	Polyester	Semi-finished Product
	Fabrics, woven; containing 85% or more by weight of textured polyester filaments, unbleached/ bleached		
	Other		
540752	Fabrics, woven; containing 85% or more by weight of textured polyester filaments, dyed	Polyester	Semi-finished Product

HS Code	HS Description	Type of Resin	Primary form/ Semi-finished Product/ Waste
540753	Fabrics, woven; containing 85% or more by weight of textured polyester filaments, of yarns of different colours	Polyester	Semi-finished Product
540754	Fabrics, woven; containing 85% or more by weight of textured polyester filaments, printed	Polyester	Semi-finished Product
540761	Fabrics, woven; containing 85% or more by weight of non-textured polyester filaments	Polyester	Semi-finished Product
54076110	Taffeta (including umbrella cloth)		
	Other		
540769	Fabrics, woven; containing less than 85% by weight of non-textured polyester filaments	Polyester	Semi-finished Product
54076910	Unbleached/ Bleached		
540220	Yarn: (not sewing thread), high tenacity yarn of polyesters (including synthetic monofilament of less than 67 decitex), not put up for retail sale	Polyester	Semi-finished Product
540233	Yarn: textured, (not sewing thread), of polyesters (including synthetic monofilament of less than 67 decitex), not put up for retail sale	Polyester	Semi-finished Product
540246	Yarn: synthetic; filament, monofilament (less than 67 decitex), of polyesters (not high tenacity or textured), partially oriented, single, untwisted or twisted 50 turns or less per metre, not for retail sale, not sewing thread	Polyester	Semi-finished Product
540247	Yarn: synthetic; filament, monofilament (less than 67 decitex), polyesters (not high tenacity or textured), not partially oriented, single, untwisted or twisted 50 turns or less per metre, not for retail sale, not sewing thread	Polyester	Semi-finished Product
540252	Yarn: (not sewing thread), single, of polyesters (including synthetic monofilament of less than 67 decitex), with a twist exceeding 50 turns per metre, not put up for retail sale, not textured, not high tenacity	Polyester	Semi-finished Product
540262	Yarn: (not sewing thread), multiple (folded) or cabled, of polyesters (including synthetic monofilament of less than 67 decitex), not put up for retail sale, not textured, not high tenacity	Polyester	Semi-finished Product

HS Code	HS Description	Type of Resin	Primary form/ Semi-finished Product/ Waste
550120	Fibers: synthetic filament tow, of polyesters	Polyester	Semi-finished Product
550140	Synthetic filament tow of polypropylene (kgm)	PP	Semi-finished Product
550320	Fibers: synthetic staple fibres, of polyesters, not carded, combed, or otherwise processed for spinning	Polyester	Semi-finished Product
550340	Synthetic staple fibers not carded combed or otherwise processed for spinning of polypropylene (kgm)	PP	Semi-finished Product
550620	Fibers: synthetic staple fibres, of polyesters, carded, combed, or otherwise processed for spinning	Polyester	Semi-finished Product
550640	Synthetic staple fibers carded combed or otherwise processed for spinning of polypropylene (kgm)	PP	Semi-finished Product
56013020	Polypropylene fiber flock	PP	Semi-finished Product

APPENDIX 6B: COMPARISON OF IMPORT/ EXPORT DATA FROM VARIOUS SOURCES

The import and export data used for the MFA in this report is sourced from VPA, Vietnam Customs Data and UN Comtrade. The differences of resin and product import-export amounts between VPA data, Vietnam Customs Data and UN Comtrade data are summarized in the table below. As per the legend below, data points highlighted in green are the values used to determine the net import and export of resins and semi-finished products in Vietnam. The cells highlighted in dark grey are data points of Vietnam Customs Data for semi-finished products, which were determined by converting 70% of the USD value of the semi-finished products imported/exported into tonnage (as recommended by VPA).

As the table below shows, the tonnages differed between VPA data, Vietnam Customs Data and UN Comtrade. Some of the Vietnam Customs Data points were deemed incorrect, as they are not possible (e.g., Vietnam could not have had 647 million tonnes of PE semi-finished product imports, as it is more than the global consumption of PE), hence were not used when determining the net import/export into Vietnam. The values deemed incorrect are denoted with *^"). Finally, VPA provided estimates of semi-finished and finished product exports (in the column denoted with "*") but was unable to provide estimates of semi-finished and finished product imports, thus finished product imports and exports could not be considered (as accounting for finished product exports without accounting for finished product imports would incorrectly reduce local consumption and post-use disposal). Thus, semi-finished products figures were used for both imports and exports.

Legend	
	Value Used in determining Net Import/ Export
	Vietnam Customs data points for semi-finished products, determined by converting 70% of the USD value (as recommended by VPA)
^	Incorrect data points
*	VPA estimates of semi-finished and finished product exports

Resin and Product Import (TPY)

Import of Resins and Semi-finished Products as According to VPA Data, UN Comtrade Data and Vietnam Customs Data (TPY)

Resin	Resin Imports			Semi-Product Imports		
	VPA	Vietnam Customs Data (Based on 100% of USD Value)	UN Comtrade (VN as reporting for imports)	VPA	Vietnam Customs Data (Based on 70% of USD Value)	UN Comtrade (VN as reporting for imports)
PET Packaging	190,400	31,800	30,900	-	37,700	108,500
PET Polyester	321,300	528,000	442,600	-	116,700	817,800
PP	1,400,400	1,475,000	1,158,300	-	95,500	108,500
PE	2,305,300	3,119,900	1,944,500	-	647,332,900 ^	149,400

Resin and Product Export (TPY)

Export of Resins and Semi-finished Products as According to VPA Data, UN Comtrade Data and Vietnam Customs Data (TPY)

Resin	Resin Exports			Semi-Product Exports		
	VPA	Vietnam Customs Data (Based on 100% of USD Value)	UN Comtrade (VN as reporting for imports)	VPA*	Vietnam Customs Data (Based on 70% of USD Value)	UN Comtrade (VN as reporting for imports)
PET Packaging	373,300	368,800	321,100	146,300	453,132,400 ^	10,100
PET Polyester	36,600	27,400	22,400	321,300	1,085,611,800 ^	318,500
PP	371,300	330,100	212,800	571,800	447,097,500 ^	1,700
PE	261,600	278,200	90,200	959,900	1,025,507,800 ^	249,900

Net Resin and Product Import - Export (TPY)

Net Import/Export of Resins and Semi-Finished Products into Vietnam

Resin	Net Resin Import-Export	Net Semi-Product Import-Export
PET Packaging	-182,900	98,400
PET Polyester	284,700	499,300
PP	1,144,900	106,800
PE	2,027,100	-100,500

Notes:

- A negative value indicates a net export of material. This is the case for PET Packaging resins and PE semi-finished products where 182,900 tonnes and 100,500 tonnes respectively, was exported out of Vietnam in 2019.
- A positive value indicates a net import of material.

APPENDIX 7:

DATA SOURCES AND KEY ASSUMPTIONS FOR MATERIAL VALUE LOSS CALCULATIONS

The material value loss calculations are based on low and high range estimations of the CFR rate. These ranges are used to account for 2 factors:

1. The fluctuation in CFR throughout the year based on seasonality and other variations - e.g., due to fluctuations in virgin price which affects recycled plastic demand and thus CFR rates. CFR rates also shift against each other - for example, when recycled PP (rPP) is more attractive recyclers will process more PP, which given that recycling capacity is essentially the same, results in lower recycling for HDPE and/or LDPE (as polyolefin recyclers can generally recycle any 3 of these resins, and the proportion between the 3 will change depending on market conditions); and
2. The variance of CFR estimates provided by different stakeholders.

CFR rates are informed by past studies by GA Circular focused on volumes of different plastics collected by the informal sector and what recyclers recycle. All CFR rate ranges have been triangulated against estimated recycling capacity (factoring in utilization and scrap plastic imports).

The term Most Valuable Recycled Product (MVRP) for each resin refers to the best circular scenario based on an assumed optimal proportion of various recycled products. The calculation of the price of MVRP uses an average of the prices of various possible recycled products weighted according to the proportions of each type of recycled product under a best-case scenario of maximum value unlocked for the resin. This method takes into consideration that it is not realistic to expect 100% of resins to be recycled into the recycled product which has the most value.

PET PACKAGING

Price (USD/ton)	
Food grade rPET	$1,051
rPSF/rPOY	$960
Non-food grade rPET	$860
Flakes	$714
MVRP Allocation %	
Food grade rPET	50%
rPSF	15%
Non-food grade rPET	15%
Flakes (Clear)	15%
MVRP Weighted Average	$953.2
Current RP breakdown (%)	
Food grade rPET	0%
rPSF/rPOY	0%
Non-food grade rPET	57%
Flakes	43%
Total	100%

PET Packaging starting data points		
Data Points	Value	Units
PET Packaging Consumption	389,467	TPY
CFR rate (PET Packaging) (Low Range)	35%	%
CFR rate (PET Packaging) (High Range)	65%	%
CFR Tonnes (PET Packaging) (Low Range)	136,313	TPY
CFR Tonnes (PET Packaging) (High Range)	253,154	TPY
Price of MVRP under weighted average	$953.23	USD/Tonne

PET Packaging						
Post-Consumer Destination		Tonnage	Price (USD/ Tonne)	Price difference from MVRP	Total Value Lost (Millions USD)	Total Lost (Millions USD)
Low Range Estimate of Recycling Rate	Food Grade	0	$1,051	-$98	$0	$263
	PSF/POY	0	$960	-$7	$0	
	Non-food grade	77,893	$860	$93	$7	
	Flakes	58,420	$714	$239	$14	
	Not recycled	253,154	$0	$953	$241	
High Range Estimate of Recycling Rate	Food Grade	0	$1,051	-$98	$0	$169
	PSF/POY	0	$960	-$7	$0	
	Non-food grade	144,659	$860	$93	$13	
	Flakes	108,494	$714	$239	$26	
	Not recycled	136,313	$0	$953	$130	

PET Packaging								
Post-Consumer Destination		Post-Consumer Destination (as a % of market inputs)	Weighted average price difference from MVRP	Price yield (a)	Volume yield (b)	Value yield (a x b) [Y-AXIS]	Collected for recycling rate [X-AXIS]	Economic value unlocked [X-AXIS x Y-AXIS]
Low Range Estimate of Recycling Rate	Food Grade	0.00%	$156	83.65%	93.33%	78.07%	35.00%	27.32%
	PSF/POY	0.00%						
	Non-food grade	57.14%						
	Flakes	42.86%						
	Not recycled							
High Range Estimate of Recycling Rate	Food Grade	0.00%	$156	83.65%	93.33%	78.07%	65.00%	50.75%
	PSF/POY	0.00%						
	Non-food grade	57.14%						
	Flakes	42.86%						
	Not recycled							

PET Packaging				
Post-Consumer Destination		Theoretical max of economic value unlocked Total Lost (Millions USD)	Value unlocked (after factoring in process loss) Total Lost (Millions USD)	Value lost Total Lost (Millions USD)
Low Range Estimate of Recycling Rate	Food Grade	$371	$101	$270
	PSF/POY			
	Non-food grade			
	Flakes			
	Not recycled			
High Range Estimate of Recycling Rate	Food Grade		$188	$183
	PSF/POY			
	Non-food grade			
	Flakes			
	Not recycled			

PET POLYESTER

MVRP Allocation %	
rPSF/rPOY	43%
Flakes	57%
MVRP Weighted Average	$819.3
Current RP breakdown (%)	
rPSF/rPOY	0%
Flakes	100%

PET Polyester starting data points		
Data Points	Value	Units
PET Polyester Consumption	410,577	TPY
CFR rate (PET Polyester) (Low Range)	0%	%
CFR rate (PET Polyester) (High Range)	2%	%
CFR Tonnes (PET Polyester) (Low Range)	0	TPY
CFR Tonnes (PET Polyester) (High Range)	8,212	TPY
Price of MVRP under weighted average	$819.31	USD/Tonne

PET Polyester						
Post-Consumer Destination		Tonnage	Price (USD/ Tonne)	Price difference from MVRP	Total Value Lost (Millions USD)	Total Lost (Millions USD)
Low Range Estimate of Recycling Rate	Recycled	0	$714	$106	$0	$336
	Not recycled	410,577	$0	$819	$336	
High Range Estimate of Recycling Rate	Recycled	8,212	$714	$106	$1	$331
	Not recycled	402,366	$0	$819	$330	

PET Polyester						
Post-Consumer Destination (as a % of market inputs)	Weighted average price difference from MVRP	Price yield (a)	Volume yield (b)	Value yield (a x b) [Y-AXIS]	Collected for recycling rate [X-AXIS]	Economic value unlocked [X-AXIS x Y-AXIS]
100.00%	$106	87.12%	90.00%	78.41%	0.00%	0.00%
100.00%	$106	87.12%	90.00%	78.41%	2.00%	1.57%

PET Polyester				
Post-Consumer Destination		Theoretical max of economic value unlocked (Millions USD)	Value unlocked after factoring in process loss (Millions USD)	Total value lost (Millions USD)
Low Range Estimate of Recycling Rate	Recycled	$336	$0	$336
	Not recycled			
High Range Estimate of Recycling Rate	Recycled		$5	$331
	Not recycled			

PP

Price (USD/ton)	
Food grade rPP	$1,041
Natural rPP	$876
White rPP	$756
Colored rPP	$756
Black rPP	$529
MVRP Allocation %	
Food grade rPP	20%
Natural rPP	40%
White rPP	20%
Colored rPP	10%
Black rPP	10%
MVRP Weighted Average	**$838.3**

PP starting data points		
Data Points	Value	Units
PP Consumption	1,427,782	TPY
CFR rate (PP) (Low Range)	20%	%
CFR rate (PP) (High Range)	50%	%
CFR Tonnes (PP) (Low Range)	285,556	TPY
CFR Tonnes (PP) (High Range)	713,891	TPY
Price of MVRP under weighted average	$838.32	USD/Tonne

PP		
Post-Consumer Destination	Tonnages	Prices (USD)
Natural rPP	57,111	$876
White rPP	57,111	$756
Colored rPP	71,389	$756
Black rPP	99,945	$529
Not recycled	1,142,225	0
Natural rPP	142,778	$876
White rPP	142,778	$756
Colored rPP	178,473	$756
Black rPP	249,862	$529
Not recycled	713,891	0

PP						
Post-Consumer Destination		Tonnage	Price (USD/ Tonne)	Price difference from MVRP	Total Value Lost (Millions USD)	Total Lost (Millions USD)
Low Range Estimate of Recycling Rate	Natural rPP	57,111	$876	-$38	-$2	$997
	White rPP	57,111	$756	$82	$5	
	Colored rPP	71,389	$756	$82	$6	
	Black rPP	99,945	$529	$309	$31	
	Not recycled	1,142,225	$0	$838	$958	
High Range Estimate of Recycling Rate	Natural rPP	142,778	$876	-$38	-$7	$671
	White rPP	142,778	$756	$82	$21	
	Colored rPP	178,473	$756	$82	$59	
	Black rPP	249,862	$529	$309	$0	
	Not recycled	713,891	$0	$838	$598	

PP								
Post-Consumer Destination		Post-Consumer Destination (as a % of market inputs)	Weighted average price difference from MVRP	Price yield (a)	Volume yield (b)	Value yield (a x b) [Y-AXIS]	Collected for recycling rate [X-AXIS]	Economic value unlocked [X-AXIS x Y-AXIS]
Low Range Estimate of Recycling Rate	Natural rPP	20.00%	$138	83.57%	90.00%	75.22%	20.00%	15.04%
	White rPP	20.00%						
	Colored rPP	25.00%						
	Black rPP	35.00%						
	Not recycled							
High Range Estimate of Recycling Rate	Natural rPP	20.00%	$138	83.57%	90.00%	75.22%	50.00%	37.61%
	White rPP	20.00%						
	Colored rPP	25.00%						
	Black rPP	35.00%						
	Not recycled							

PP				
Post-Consumer Destination		Theoretical max of economic value unlocked (Millions USD)	Value unlocked after factoring in process loss (Millions USD)	Total value lost (Millions USD)
Low Range Estimate of Recycling Rate	Natural rPP	$1,197	$180	$1,017
	White rPP			
	Colored rPP			
	Black rPP			
	Not recycled			
High Range Estimate of Recycling Rate	Natural rPP		$450	$747
	White rPP			
	Colored rPP			
	Black rPP			
	Not recycled			

HDPE

Price (USD/ton)	
Food grade rHDPE	$1,441
Natural rHDPE	$996
White rHPDE	$722
Colored rPHDE	$664
Black rHDPE	$645
MVRP Allocation %	
Food grade rHDPE	20%
Natural rHDPE	40%
White rHPDE	15%
Colored rPHDE	15%
Black rHDPE	10%
MVRP Weighted Average	**$959.2**
Current RP breakdown	
Food grade rHDPE	0%
Natural rHDPE	20%
White rHPDE	20%
Colored rPHDE	25%
Black rHDPE	35%

HDPE starting data points		
Data Points	Value	Units
HDPE Consumption	745,378	TPY
CFR rate (HDPE) (Low Range)	20%	%
CFR rate (HDPE) (High Range)	50%	%
CFR Tonnes (HDPE) (Low Range)	149,076	TPY
CFR Tonnes (HDPE) (High Range)	372,689	TPY
Price of MVRP under weighted average	$959.23	USD/Tonne

HDPE						
Post-Consumer Destination		Tonnage	Price (USD/ Tonne)	Price difference from MVRP	Total Value Lost (Millions USD)	Total Lost (Millions USD)
Low Range Estimate of Recycling Rate	Natural rHDPE	29,815	$996	-$37	-$1	$605
	Pipe Grade Black rHDPE	29,815	$722	$237	$7	
	GP Black rHDPE	37,269	$664	$295	$11	
	Mixed Colored Black rHDPE	52,176	$645	$314	$16	
	Not Recycled	596,303	$0	$959	$572	
High Range Estimate of Recycling Rate	Natural rHDPE	74,538	$996	-$37	-$3	$441
	Pipe Grade Black rHDPE	74,538	$722	$237	$18	
	GP Black rHDPE	93,172	$664	$295	$27	
	Mixed Colored Black rHDPE	130,441	$645	$314	$41	
	Not Recycled	372,689	$0	$959	$357	

HDPE								
Post-Consumer Destination		Post-Consumer Destination (as a % of market inputs)	Weighted average price difference from MVRP	Price yield (a)	Volume yield (b)	Value yield (a x b) [Y-AXIS]	Collected for recycling rate [X-AXIS]	Economic value unlocked [X-AXIS x Y-AXIS]
Low Range Estimate of Recycling Rate	Natural rHDPE	20.00%	$224	76.68%	88.75%	68.05%	20.00%	13.61%
	Pipe Grade Black rHDPE	20.00%						
	GP Black rHDPE	25.00%						
	Mixed Colored Black rHDPE	35.00%						
	Not Recycled							
High Range Estimate of Recycling Rate	Natural rHDPE	20.00%	$224	76.68%	88.75%	68.05%	50.00%	34.03%
	Pipe Grade Black rHDPE	20.00%						
	GP Black rHDPE	25.00%						
	Mixed Colored Black rHDPE	35.00%						
	Not Recycled							

HDPE				
Post-Consumer Destination		Theoretical max of economic value unlocked (Millions USD)	Value unlocked after factoring in process loss (Millions USD)	Total value lost (Millions USD)
Low Range Estimate of Recycling Rate	Natural rHDPE	$715	$97	$618
	Pipe Grade Black rHDPE			
	GP Black rHDPE			
	Mixed Colored Black rHDPE			
	Not Recycled			
High Range Estimate of Recycling Rate	Natural rHDPE		$243	$472
	Pipe Grade Black rHDPE			
	GP Black rHDPE			
	Mixed Colored Black rHDPE			
	Not Recycled			

LDPE

Price (USD/ton)	
rLDPE Natural pellets	$1,008
rLDPE black pellets	$945
rLDPE mixed colored pellets	$735
MVRP Allocation %	
rLDPE Natural pellets	30%
rLDPE black pellets	30%
rLDPE mixed colored pellets	40%
MVRP Weighted Average	**$879.90**
Current RP breakdown	
rLDPE Natural pellets	20%
rLDPE White pellets	20%
rLDPE black/colored pellets	60%

LDPE starting data points		
Data Points	Value	Units
LDPE Consumption	1,427,782	TPY
CFR rate (LDPE) (Low Range)	20%	%
CFR rate (LDPE) (High Range)	50%	%
CFR Tonnes (LDPE) (Low Range)	285,556	TPY
CFR Tonnes (LDPE) (High Range)	713,891	TPY
Price of MVRP under weighted average	$879.90	USD/Tonne

LDPE						
Post-Consumer Destination		Tonnage	Price (USD/ Tonne)	Price difference from MVRP	Total Value Lost (Millions USD)	Total Lost (Millions USD)
Low Range Estimate of Recycling Rate	Natural	37,051	$1,008	-$128	-$5	$661
	Black	37,051	$945	-$65	-$2	
	Mixed Colored	111,154	$735	$145	$16	
	Not recycled	741,024	$0	$880	$652	
High Range Estimate of Recycling Rate	Natural	92,628	$1,008	-$128	-$12	$430
	Black	92,628	$945	-$65	-$6	
	Mixed Colored	277,884	$735	$145	$40	
	Not recycled	463,140	$0	$880	$408	

LDPE								
Post-Consumer Destination		Post-Consumer Destination (as a % of market inputs)	Weighted average price difference from MVRP	Price yield (a)	Volume yield (b)	Value yield (a x b) [Y-AXIS]	Collected for recycling rate [X-AXIS]	Economic value unlocked [X-AXIS x Y-AXIS]
Low Range Estimate of Recycling Rate	Natural	20.00%	$48	94.51%	88.75%	83.88%	20.00%	16.78%
	Black	20.00%						
	Mixed Colored	60.00%						
	Not recycled							
High Range Estimate of Recycling Rate	Natural	20.00%	$48	94.51%	88.75%	83.88%	50.00%	41.94%
	Black	20.00%						
	Mixed Colored	60.00%						
	Not recycled							

Photo: Vitawin - shutterstock

LDPE				
Post-Consumer Destination		Theoretical max of economic value unlocked (Millions USD)	Value unlocked after factoring in process loss (Millions USD)	Total value lost (Millions USD)
Low Range Estimate of Recycling Rate	Natural	$815	$137	$678
	Black			
	Mixed Colored			
	Not recycled			
High Range Estimate of Recycling Rate	Natural		$342	$473
	Black			
	Mixed Colored			
	Not recycled			

Summary of Material Value Lost for Each Resin		
Resin	Low Range (USD Millions)	High Range (USD Millions)
PP	$747	$1,017
HDPE	$472	$618
LDPE/LLDPE	$473	$678
PET Polyester	$183	$270
PET Packaging	$747	$1,017
Total	**$2,621**	**$3,600**

APPENDIX 8:

INFORMATION ON PLASTICS RECYCLERS IN VIETNAM

APPENDIX 8A: LIST OF FORMAL MECHANICAL RECYCLERS/PROCESSORS IN VIETNAM

List of All Known PET, PE, and PP Recyclers in Vietnam and the Corresponding Resin Type That They Process

Status	Recycler	Resins		
		PET	PE	PP
Operating & Capacities Known	Hoang Anh recycle company	√	√	√
	A Dong ADG Company		√	√
	Lam Tran Plastic Ltd.		√	√
	JP Plastic - Q.M.T Ltd.	√	√	√
	Phu Hung Plastic Ltd.		√	√
	Trinh Nghien Ltd.		√	√
	Vikohasan Ltd.	√		
	Vinatic Hai Phong Ltd.		√	√
	H.A Plastic Ltd		√	√
	HL plastic	√	√	
	Khanh Quynh Long An Ltd.		√	
	Mai Tan Dat Ltd.	√		
	Minh Hieu Sai Gon	√	√	√
	Nhat Nam Tra Vinh		√	√
	VietTrung Environmental Technology Co. Ltd.		√	√
	Viet Tin Plastic Ltd.	√	√	√
	Shun An Environment Technology	√	√	√
	Viet Nhat Plastic Ltd.		√	√
	Son Trang Plastic Ltd.		√	√
	Tan Phu Plastic Ltd.		√	
	Dai Tin Phat Plastic Ltd.		√	√

Status	Recycler	Resins		
		PET	PE	PP
Operating & Capacities Known	Nhat Nam Packaging Ltd.		√	√
	Hiep Phat Ltd.		√	√
	Nam Thien Sang Ltd.		√	√
	Ngu long Co. Ltd.			√
	Lavergne Ltd.	√		
	Khanh Toan Ltd.		√	
	Seido Ltd.		√	√
	Khai Thanh Trade and Production JSC	√		
Operating, but Capacities Unknown	Sunflower Investment Ltd.			√
	De Nhat Ltd.		√	
	Quang Phat Ltd.		√	√
	Khang An Thinh Ltd.		√	
	Dai A Ltd.			√
	Hung Long Plastic Ltd.		√	√
	API-DK Vietnam Ltd.		√	√
	Hanh Tinh Vang Ltd.			√
	Dong Nai Plastic			√
	Tan Hung Plastic Ltd.		√	√
	Ngu Long Co. Ltd.			√
	Cong Ty Linh Phat			√
	Tin Thanh Plastic Ltd.		√	√
	Hop Thuan Ltd.			√
	Vinh Lac Ltd.	√		√
	Huu Phat Ltd.		√	
	Hung Dong Ltd.	√	√	√
	Mien Bac Plastic Ltd.		√	√
	Trang Yen Ltd.		√	√
	Thuan That Ltd.		√	√
	H.A Plastic Ltd.		√	√
	An Nhu Phuc Ltd.		√	√
	Bao Zheng Ltd.		√	√

Status	Recycler	Resins		
		PET	PE	PP
Operating, but Capacities Unknown	Gia Nguyen Plastic Ltd.		√	√
	Vy Tuyen Ltd.		√	
	PVN Ltd.			√
	Gia Vu recycled Plastic	√	√	√
	Ngoc Anh			√
	Rang Dong Plastic	√		
	Hung Nghiep Formosa	√		

APPENDIX 8B: INFORMAL RECYCLER CAPACITY ESTIMATIONS (INCLUDING CRAFT VILLAGES)

8B.1 DETERMINING TOTAL INFORMAL RECYCLING CAPACITY OF CRAFT VILLAGES AND INFORMAL RECYCLERS

The table below provides the details as to how a lower limit and upper limit were determined for informal recycling capacity. As per the table, the estimates have been provided by the Vietnam Plastic Recyclers Association (VPRA). For reference, the capacity values are retrieved from media articles published between 2014 to 2019 and have been provided below. The VPRA is of the opinion that the figures reported by the media are in most cases significantly underreported.

Lower and Upper Limit Estimations for Craft Village and Informal Recycling Capacity in Vietnam

Estimates of Plastic Recycling Craft Village and Informal Sector Recyclers					
Village	Estimate for 2019 Year by VPRA			Media Reported	
	Min	Max	Basis of VRA Estimate		
	Tons/ Year	Tons/ Year		Tons/ Year	Notes regarding Media Reported volume
Dong Mau (Vinh Phuc)	96,000	144,000	1-2 tonnes/ day/ household multiplied by 320 households.	2,400	The estimated recycling craft village is from 150-200 tons of plastic / month.[8]
Trieu Khuc and Trung Van (Nam Tu Liem district)	63,000	90,000	3-5tons/day/ household multiplied by 70-80 Households.	9,600 (20 factories by 1.5 tons per day)	More than 20 factories in the area are still running machines operating continuously. Thao Vy recycling factory in hamlet is the second largest recycling factory in the village. Every day the factory produces more than 2 tons of finished plastic resins.[9]
Tan Trieu (Thanh Tri district)	19,200	19,200	Per Media reported	19,200	Imports 60 tons of scrap per day.[10]

8 Thoi Bao Kinh Dao, "Dong Mau Village Chipped Plastic': Constantly Polluted!" (2015)

9 Tien Phong, "The break in of a scrap recycling furnace in Hanoi" (2014)

10 Hanoimoi, "The recycling journey of scrap: The advantages and consequences" (2019)

Estimates of Plastic Recycling Craft Village and Informal Sector Recyclers					
Tien Duoc commune (Soc Son district)	28,200	35,250	2-3 tons/day multiplied by 47 Households	18,000	At present, 47 households work in the commune. Each day the village imports about 60 tons of scrap plastic.[11]
Minh Khai craft village (Hung Yen province)	288,000	288,000	2 tons/day/household multiplied by 480 Households.	6,000 (200 tonnes per day)	868 households participated in purchasing, classifying, preliminarily processing and recycling plastic scrap with approximately 480 households directly producing plastic.[12] Each day, the village of Khoai imports about 200 tons of scrap.[13]
Tu Chau village, Lien Chau commune (Thanh Oai district);	28,800	43,200	10-15% of the total capacity of Minh Khai.	18,000	At present, 47 households work in the commune. Each day the village imports about 60 tons of scrap plastic.[14]
Xa Cau village, Quang Phu Cau commune (Ung Hoa district);	28,800	43,200	10-15% of the total capacity of Minh Khai.	18,000	
Tien Duoc and Kim Lu communes (Soc Son district)	28,800	43,200	about 10-15% of the total capacity of Minh Khai.	18,000	
Southern area: Duc Hoa, Long An and Binh Chanh, Ho Chi Minh City.	400,000	900,000	600-1000 informal recyclers. 800-1000 tons/recycler/year.	-	-
Total	**980,800**	**1,606,050**			

Note: For all households, assumption is 320 working days per year to account for 6 days a week of work, less major holiday periods (e.g., Tet holiday).

To not overestimate existing recycling capacity in Vietnam, the lower limit of craft villages and informal recycling capacity (980,800 TPY) has been used to determine the total estimated informal recycling utilization capacity and for each resin type.

11 Ibid.
12 Ibid.
13 Nhan Dan, "Long measure the trade village" (2018)
14 Hanoimoi, "The recycling journey of scrap: The advantages and consequences" (2019)

8B.2 BREAKDOWN OF INFORMAL RECYCLING CAPACITY PER RESIN TYPE (PE, PET AND PP)

Calculations Used to Derive the Estimated Utilization for Craft Villages/Informal Recyclers for Each Resin Type

Craft Villages/Informal Recycler Recycling Capacity Breakdown	
Total Estimated Informal Recyclers Capacity (TPY)	980,800
Total Estimated Informal Recycler Utilization Capacity (TPY)	931,800
Breakdown of informal recycling capacity per resin type	
PE (%)	35%
PP (%)	25%
PET (%)	8%
Estimated utilization for informal recycling capacity per resin type	
PE (TPY)	326,100
PP (TPY)	232,900
PET (TPY)	78,500

Notes:

- The assumed average utilization rate for informal recyclers is 95%. This rate has been applied across all the resin types.
- The breakdown for informal recycling capacity per resin type (i.e., 35% for PE, 25% for PP and 8% for PET) is as per recommended from Mr. Vuong, Chairman of VPRA. GA Circular is of the opinion that the PET percentage would be higher (given the demand for PET), however, VPRA has requested the use of their estimates.

APPENDIX 8C: COMPARISON BETWEEN INSTALLED RECYCLING CAPACITY AND ESTIMATED UTILIZATION FOR THE DIFFERENT RESINS

PET

Estimated Installed Recycling Capacity and Utilization Recycling Capacity for Formal and Informal/Pre-processors of PET Resin in Vietnam in 2019

Recycler Name	Total Installed Capacity	Total Estimated Actual Utilization (73%)
Mai Tan Dat Ltd.	160,000	182,000
Minh Hieu Sai Gon		
Vikohasan JSC		
Khai Thanh Trade and Production JSC		
Lavergne ltd., Co.		
Shun An Environment Technology		
HL plastic		
Q.M.T - JP Plastic JSC		
Hoang Anh recycle company		
Others	88,800	
Total (Rounded)	**248,800**	

Recycler Name	Total Installed Capacity	Total Estimated Actual Utilization (73%)
Estimated informal PET recyclers / pre-processors capacity (2019)	82,600	78,500
Estimated Net PET scrap import (2019)	64,400	64,400
TOTAL	395,800	324,900

Notes:

- Estimated formal recycling capacity is based on known formal recycling capacity of 160,000 TPY (based on interviews with 9 recyclers) which was extrapolated to account for an additional 5 recyclers which are believed to recycle this resin but whose capacity could not be reasonably estimated. The extrapolated value thus results in a total estimated formal PET recycling capacity of 248,800 TPY.
- The informal pre-processor capacity for PET is calculated as 8% of the total assumed utilization informal recycler capacity.
- Based on interviews with the recyclers the average utilization rate is estimated to be 73% for PET recycling in 2019. This figure has been used in the calculation of the total estimated actual utilization for formal recyclers while for informal recyclers/pre-processors the average utilization rate is assumed to be 95% (see Appendix 15 below).
- PET scrap export is an estimate and is based on the net of imports and exports. See Appendix 9 for the assumptions related to scrap plastic imports and exports per resin.

PP

Estimated Installed Recycling Capacity and Utilization Recycling Capacity for Formal and Informal/Pre-processors of PP Resin in Vietnam in 2019

Recycler Name	Total Installed Capacity	Total Estimated Actual Utilization (74%)
A Dong ADG JSC	178,100	304,800
Lam Tran JSC		
Q.M.T - JP Plastic JSC		
Kho Van Phu Hung trade and services JSC		
Trinh Nghien JSC		
H.A resin - H.A Co., Ltd		
Minh Hieu Sai Gon		
Nhat Nam Tra Vinh		
Viet Trung Environmental Technology Co., Ltd		
Viet Tin Counselling Promoting Intertrade Co., Ltd		
Shun An Environment Technology		
Viet Nhat Plastic Export Import Export Service Co., Ltd		
Son Trang Plastic Service and Trading Production Co., Ltd		
Api-Dk Co., Ltd Viet Nam)		

Recycler Name	Total Installed Capacity	Total Estimated Actual Utilization (74%)
Nhat Nam Packaging Production Co., Ltd		
Hiep Phat Plastic Production Co., Ltd		
Nam Thien Sang Export Co., Ltd		
Ngu Long Trading and Manufacturing Co., Ltd		
Seido Import and Export Co., Ltd		
Others	234,300	
Total (Rounded)	412,400	
Estimated informal PP recyclers / pre-processors capacity (2019)	245,200	232,900
Estimated Net PP scrap import (2019)	85,900	85,900
TOTAL	**743,500**	**623,600**

Notes:

- Estimated formal PP recycling capacity is based on known formal recycling capacity of 178,100 TPY (based on interviews, from both present and from past GA Circular studies, with 19 recyclers) which was extrapolated to account for an additional 25 recyclers which are believed to recycle this resin but whose capacity could not be reasonably estimated. The extrapolated value thus results in a total estimated formal PP recycling capacity of 412,400 TPY.
- The informal pre-processor capacity for PP is calculated as 25% of the total assumed utilization informal recycler capacity.
- Based on interviews with the recyclers the average utilization rate is estimated to be 74% for PP recycling in 2019. This figure has been used in the calculation of the total estimated actual utilization for formal recyclers while for informal recyclers/pre-processors the average utilization rate is assumed to be 95% (see Appendix 15 below).
- PP scrap export is an estimate and is based on the net of imports and exports. See Appendix 9 for the assumptions related to scrap plastic imports and exports per resin.

PE

Estimated Installed Recycling Capacity and Utilization Recycling Capacity for Formal and Informal/Pre-processors of PE Resin in Vietnam in 2019

Recycler Name	Total Installed Capacity	Total Estimated Actual Utilization (69%)
Lam Tran JSC		
Q.M.T - JP Plastic JSC		
Trinh Nghien JSC		
Vinatic Hai Phong Co., Ltd	320,100	349,300
H.A resin - H.A Co., Ltd		
HL plastic		
Khanh Quynh Long An Ltd.		

Recycler Name	Total Installed Capacity	Total Estimated Actual Utilization (69%)
Minh Hieu Sai Gon		
Nhat Nam Tra Vinh		
VietTrung Environmental Technology Co., Ltd		
Viet Tin Counselling Promoting Intertrade Co., Ltd		
Shun An Environment Technology		
Son Trang Plastic Service and Trading Production Co., Ltd		
HM plastics production, trade and service Co., Ltd		
Tan Phu Production, Trade and Service Co., Ltd		
Dai Tin Phat Co., Ltd. (Api-Dk Co., Ltd Viet Nam)		
Nhat Nam Packaging Production Co., Ltd		
Khanh Toan Co., Ltd		
Seido Import and Export Co., Ltd		
Others	186,100	
Total (Rounded)	**506,200**	
Estimated informal PE recyclers / pre-processors capacity (2019)	**343,300**	**326,100**
Estimated Net PE scrap import (2019)	**150,200**	**150,200**
TOTAL	**999,700**	**825,600**

Notes:

- Estimated formal PE recycling capacity is based on known formal recycling capacity of 320,100 TPY (based on interviews, from both present and from past GA Circular studies, with 19 recyclers) which was extrapolated to account for an additional 13 recyclers which are believed to recycle this resin but whose capacity could not be reasonably estimated. The extrapolated value thus results in a total estimated formal PE recycling capacity of 506,200 TPY.
- The informal pre-processor capacity for PE is calculated as 35% of the total assumed utilization informal recycler capacity.
- Based on interviews with the recyclers the average utilization rate is estimated to be 69% for PE recycling in 2019. This figure has been used in the calculation of the total estimated actual utilization for formal recyclers while for informal recyclers/pre-processors the average utilization rate is assumed to be 95% (see Appendix 15 below).
- PE scrap export is an estimate and is based on the net of imports and exports. See Appendix 9 for the assumptions related to scrap plastic imports and exports per resin.

ALL RESINS

Total Estimated Installed Capacity for Formal Recyclers and Informal Recyclers/Pre-processors Vietnam in 2019

	Total Installed Capacity (million tonnes)
Formal recyclers (verified)	0.66
Formal recyclers (estimated)	0.51
Informal recyclers/ pre-processors	0.67
Total	**1.84**

This table is further elaborated on below:

a. Estimated formal and informal recycling capacity of 1.84 million TPY is comprised of:

- 0.66 million TPY is verified formal recycling capacity (160,000 TPY for PET; 320,100 TPY for HDPE and LDPE and 178,100 TPY for PP across a total of 34 recyclers).
- There is an estimated additional 0.51 million TPY of capacity based on 32 other known formal recyclers. These recyclers could not be contacted for this study and details about them are unknown by the VPRA. The estimated additional capacity of 0.51 million for these 32 recyclers is based on extrapolation from the 34 verified recyclers.
- There is an estimated additional 0.67 million tonnes of informal recyclers (both informal recyclers within craft villages and standalone informal recyclers - i.e., outside of craft villages). This estimate has been developed in collaboration with VPRA.
- Please see Appendix 10B, for further details on the formal and informal recycling capacity estimates.

b. The recycling capacity of 1.84 million tonnes is estimated to have been utilized as follows:

- 1.28 million tonnes of this capacity are utilized for locally sourced post-consumer and post-industrial plastic (i.e., local CFR). This is based on the mid-range estimates for the CFR rates (i.e. 50% for PET packaging, 35% for Polyolefins and 1% for PET polyester).
- 0.30 million tonnes are estimated to have been utilized for imported plastic scrap. Many recyclers reported that imported plastic scrap is cheaper and better quality than locally sourced plastic scrap and thus many recyclers import, or use imported plastic scrap. Please see Appendix 11 for further information regarding plastic scrap imports.
- 0.26 million tonnes of capacity are estimated to have been inefficiently used due to high levels of contaminants and/or been unutilized due to challenging recycling economics. This is based on interviews with formal recyclers where utilization for 2019 was on average 70-80% for the 4 resins, meanwhile it is estimated that informal recyclers operated at 95% utilization. The estimated utilization is higher for informal recyclers as their operating costs are less and thus, they are more able to operate at optimum levels even when the plastic recycling market is challenged.

With this it can be understood that the CFR rates would be lower than the mid-point estimates if: there was less formal and/or informal recycling capacity then estimated; or there were more scrap imports then reported (as many industry stakeholders consider that reported scrap imports are not the complete figure as land and sea borders throughout Southeast Asia are porous). On the other hand, the CFR rates would be higher than the mid-point estimates if there is more formal and/or informal recycling capacity than estimated.

APPENDIX 8D:
CALCULATIONS FOR MISSING CAPACITY VS INSTALLED CAPACITY FOR RECYCLING OF MAJOR RESINS

The following table shows the calculations used to derive the estimated installed capacity and missing capacity for each of the key resins. The recycling capacity figures are based on questionnaire responses/ interviews for this study or other studies by GA Circular, or based on publicly available information or past conversations, which could not be validated as some of these recyclers have not been available for questionnaire responses/ interviews for this study. The missing capacity for each resin is calculated by subtracting the estimated formal recycling installed capacity from the consumption.

Calculations Used to Derive the Estimated Installed Capacity Vs. Missing Capacity for Recycling of Major Resins in Vietnam

Resin	Consumption (TPY)	Estimated Installed Formal Recycling Capacity (TPY)	Current Missing Capacity (TPY)	Current Missing Capacity (TPY)	Verified Planned Additional Formal Recycling Capacity (TPY)	Missing Capacity after factoring planned Additional Capacity	Missing Capacity after factoring planned Additional Capacity	Estimated Informal Recycling Capacity (TPY)	Missing Capacity after also factoring Informal Recyclers	Missing Capacity after factoring Planned Formal Expansions & Current Informal Recyclers
PET Packaging	389,500	248,800	140,700	36%	93,200	47,500	12%	78,500	0	0%
PET Polyester	410,600	0	410,600	100%	0	410,600	100%	0	410,600	100%
PP	1,427,800	412,400	1,015,400	71%	36,200	979,200	69%	232,900	746,300	52%
PE	1,671,700	506,200	1,165,500	70%	87,500	1,078,000	64%	326,100	751,900	45%
Total	3,899,600	1,167,400	2,732,200	70%	216,900	2,515,300	65%	637,500	1,908,800	49%

APPENDIX 8E:
ADDITIONAL PLANNED RECYCLING CAPACITY

Additional planned recycling capacity (from 2020 onwards) includes the following recyclers for each resin:

- PET: Duy Tan Plastic, HL Plastic, Khanh Quynh Long An and Larvegne.
- PP: Larvegne, Dai Tin Phat, Sheido, Nhat Nam Tra Vinh, Viet Nhat and Trinh Nghien.
- PE: Duy Tan Plastic, Vinatic, Trinh Nghien, Dai Tin Phat, Sheido, Nhat Nam Tra Vinh, Khanh Quynh Long An and Viet Nhat.

APPENDIX 9:

ASSUMPTIONS RELATED TO NET SCRAP PLASTIC IMPORTS

The table below shows the breakdown of net plastic scrap imports to Vietnam.

Net Import of Plastic Scrap into Vietnam Per Resin Type

Imports (Tonnes)	484,280
Exports (Tonnes)	55,019
Net Imports (Tonnes)	429,261
Estimated PET, PP, PE composition	70%
PET scrap (%)	15%
PP scrap (%)	20%
PE scrap (%)	35%
PET scrap (Tonnes)	64,389
PP scrap (Tonnes)	85,852
PE scrap (Tonnes)	150,241

Notes:

- Import data is as reported by VPA while export data is as according to UN Comtrade and verified by VPA and VPRA.
- Estimated PET, PP and PE composition is 70% as there are minimal recyclers who recycle other material. Most recyclers in Vietnam recycle PE, PP and PET. For comparison, for virgin imports, these three resins account for about 65%.

Photo: Karol Ciesluk - shutterstock

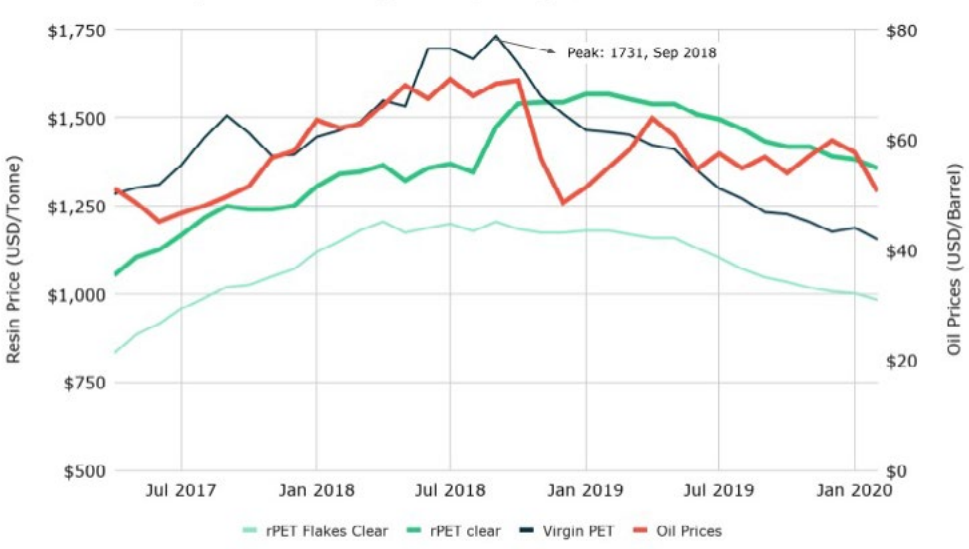
APPENDIX 10:

COMPARISON OF VIRGIN AND RECYCLED RESINS AND OIL PRICES

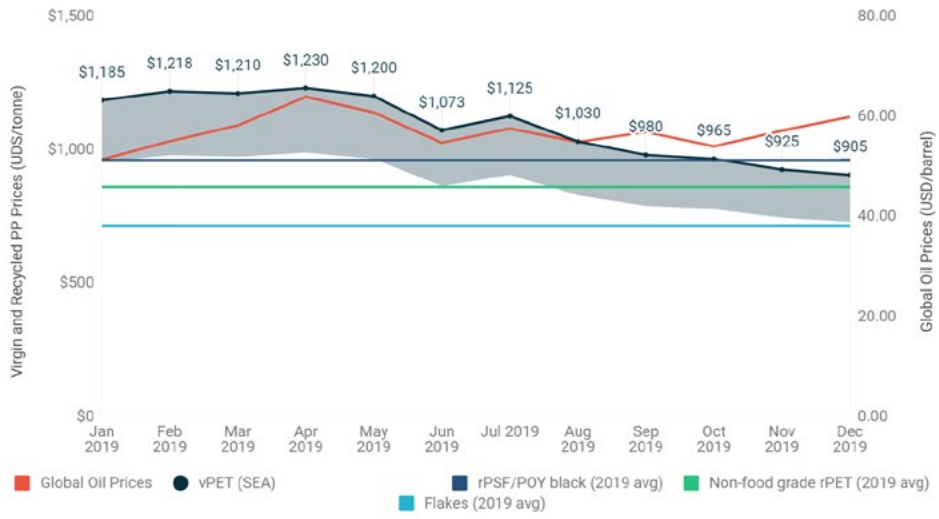
The following charts show the EU price comparison of virgin and recycled resins. Please note that EU prices for virgin plastics and recycled plastics have been used as a proxy for global prices because the EU has the greatest price transparency/ data availability for virgin prices and recycled prices.

PET

EU Price Comparison of Virgin PET and Recycled PET. [15]



Comparison of Virgin PET and Recycled PET Prices in Vietnam and Global Oil Prices.[16]

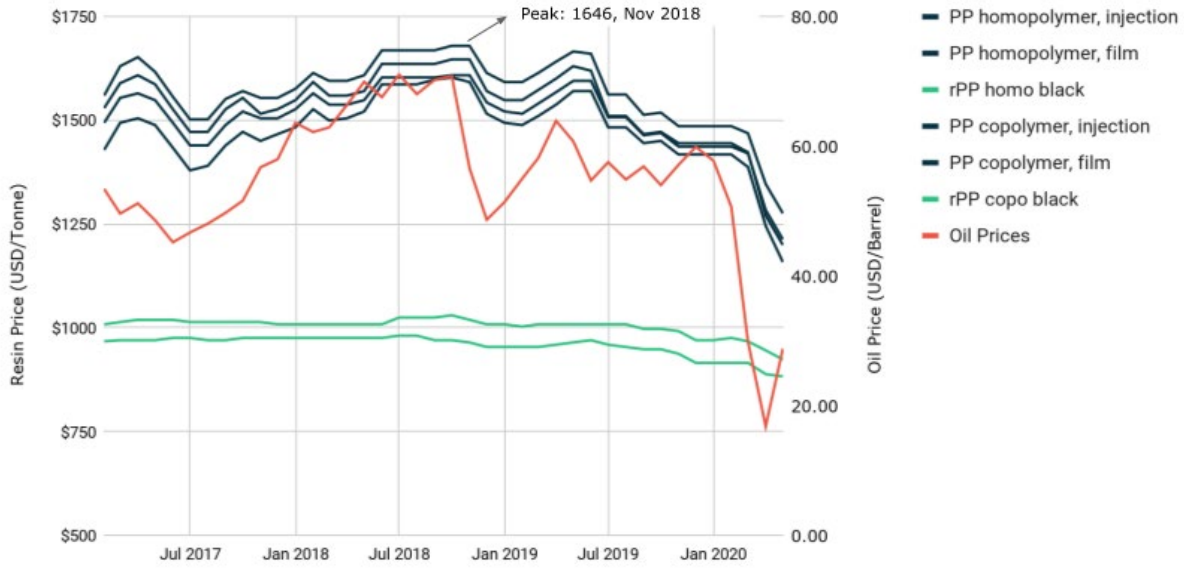


15 Industry data

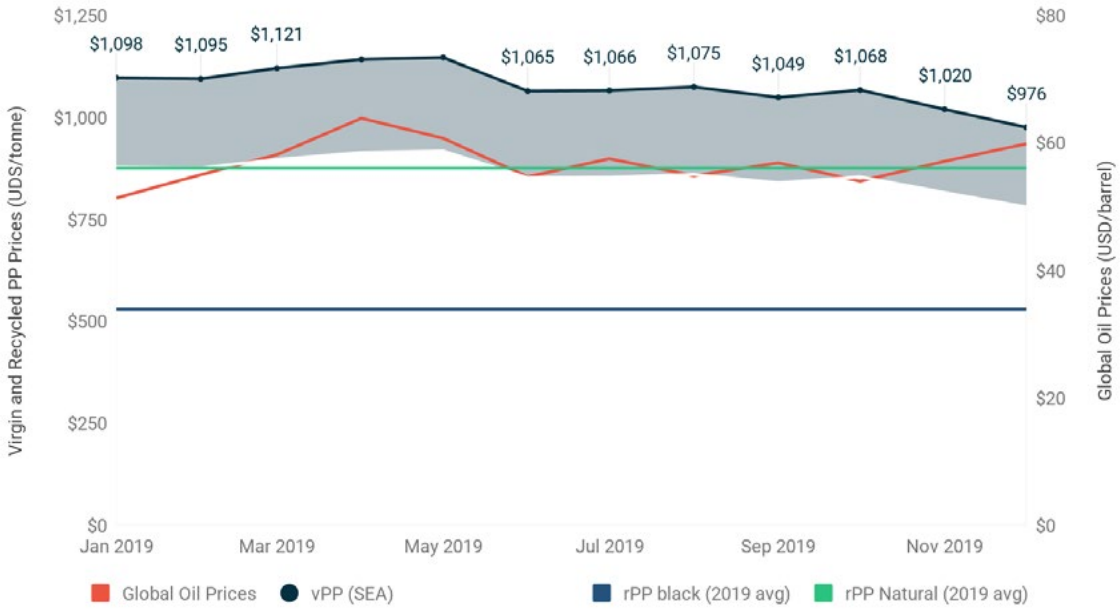
16 Private sector stakeholders for SEA prices of virgin PET resin and Recyclers for Recycled Resin prices

PP

EU Price Comparison of Virgin PP and Recycled PP. [17]



Comparison of Virgin PP and Recycled PP Prices in Vietnam and Global Oil Prices. [18]

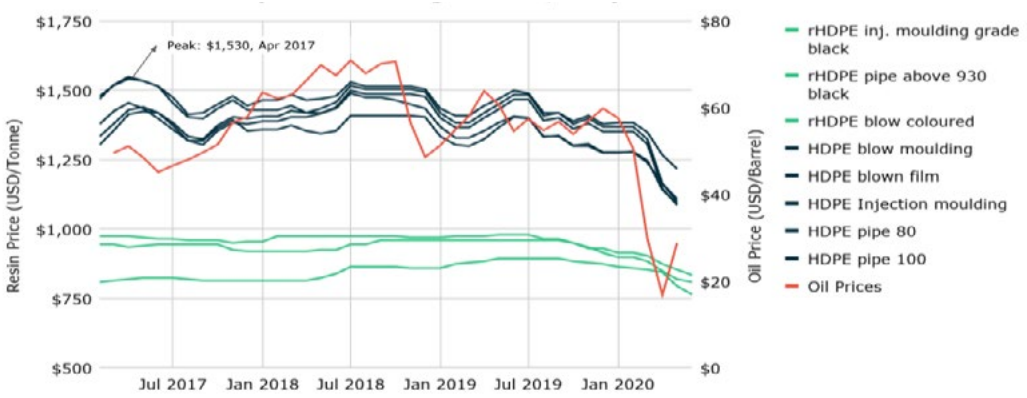


17 Industry data

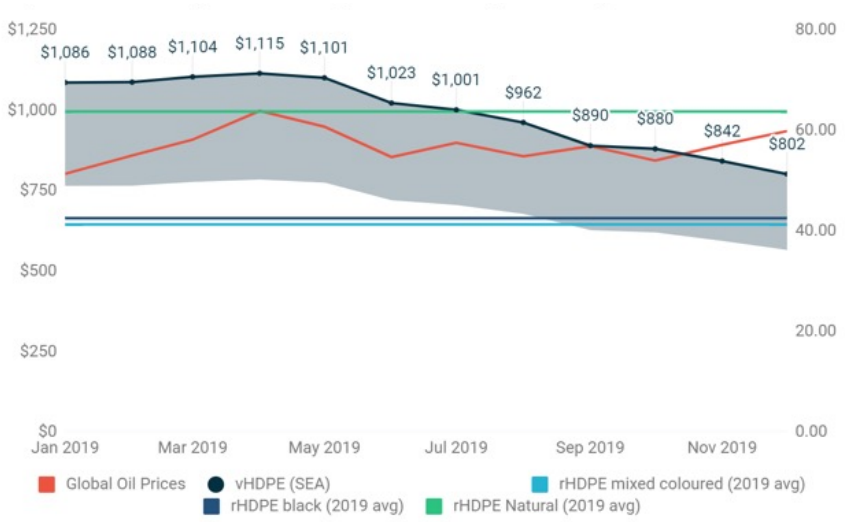
18 Private sector stakeholders for SEA prices of virgin PP resin and Recyclers for Recycled Resin prices

HDPE

EU Price Comparison of Virgin HDPE and Recycled HDPE. [19]

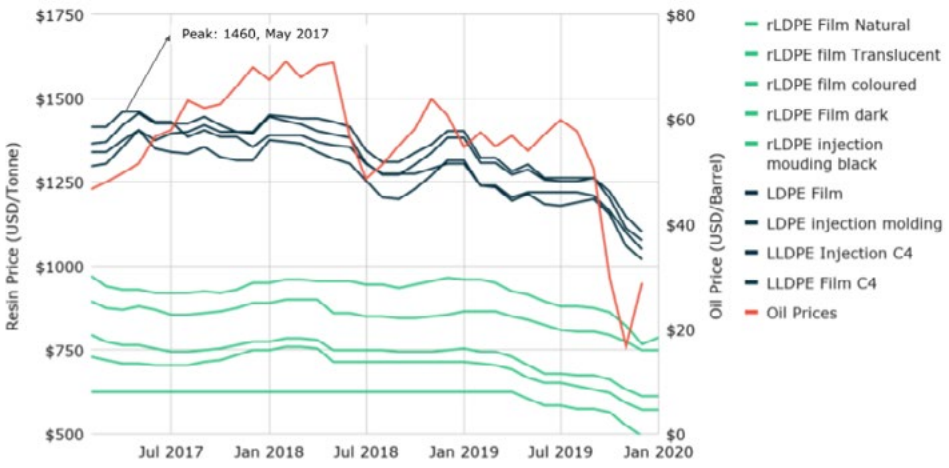


Comparison of Virgin HDPE and Recycled HDPE Prices in Vietnam and global oil prices. [20]



LDPE

EU Price Comparison of Virgin LDPE and Recycled LDPE. [21]

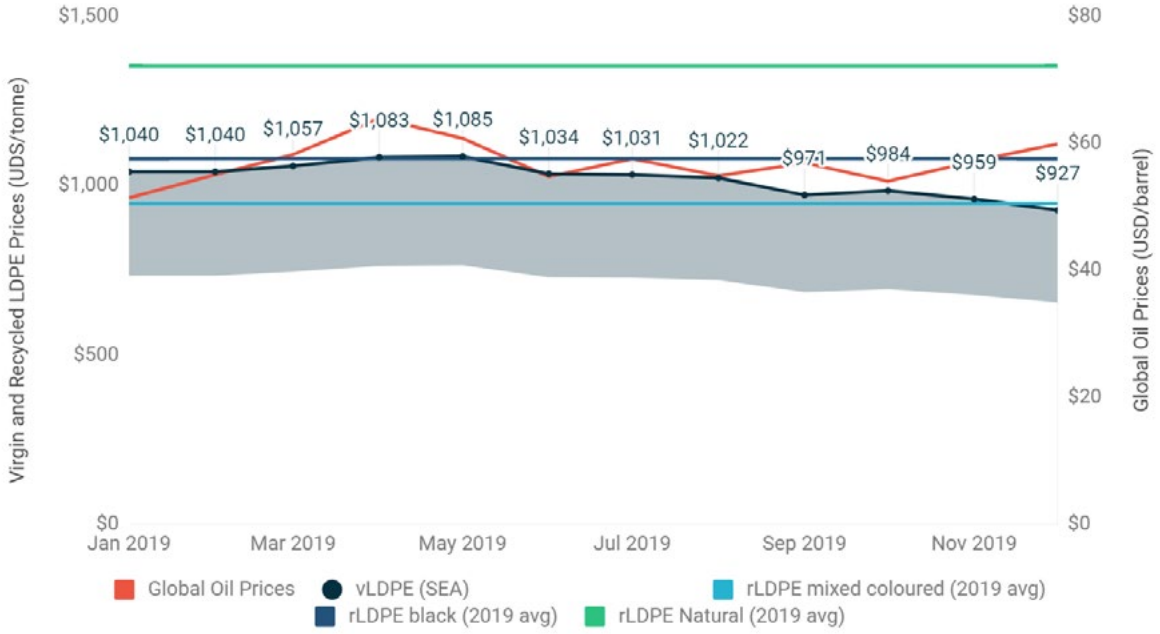


19 Industry data

20 Private sector stakeholders for SEA prices of virgin HDPE resin and Recyclers for Recycled Resin prices

21 Industry data

Comparison of Virgin LDPE and Recycled LDPE Prices in Vietnam and Global Oil Prices. [22]



The following table shows the comparison of virgin prices in Vietnam (please see notes below the table) for both the years 2019 and 2020. The price drops are a direct result of COVID-19 impacts.

Price of Virgin Resins in Vietnam in 2019 And 2020 and the Year-on-year Difference

VIETNAM VIRGIN PRICE COMPARISON YoY			
	2019 (USD/Ton)	2020 (USD/ton)	% Price reduction (YoY)
PET	$1,099	$835	24%
HDPE	$1,019	$921	10%
LDPE	$991	$827	17%
PP	$1,077	$921	14%
AVERAGE	$1,047	$876	16%

Notes:

- Virgin resin price data for 2019 is an average of the prices reported for all 12 months of the year. Data sources:
  - PET: Vietnam Plastics Association
  - HDPE, LDPE, and PP: private sector stakeholders
- PET virgin resin price data for 2020 is an average for all 12 months in 2020 as according to VPA. HDPE, LDPE, and PP virgin resin price data for 2020 is an average of the months from January to August as according to private sector stakeholders in Vietnam. The private sector stakeholder data is reported as the price for the Southeast Asia region.

22 Private sector stakeholders for SEA prices of virgin LDPE resin and Recyclers for Recycled Resin prices

APPENDIX 11:

MANDATING RECYCLED CONTENT TARGETS & VIETNAM'S ABILITY TO FULFIL THESE TARGETS

11.1 CHALLENGES THAT NEED TO BE OVERCOME FOR RECYCLED CONTENT TARGETS TO BE EFFECTIVE

It must be noted that while switching to using recycled content that substitutes and hence reduces the need for virgin plastics may be technically feasible for specific applications, specific challenges need to be overcome. These challenges are as outlined below: [23]

- Usage of recycled plastics require sizable investments in upgrading/changing production and packaging lines, expensive re-testing to ensure compliance with safety regulations and quality/durability requirements.
- At least for the initial few years, until demand picks up further, recycled plastics are likely to come from several different suppliers, which are smaller in size than typical suppliers of virgin plastics. Hence, they are less able to meet fluctuations in demand volume as they cannot control the rate of source materials arising without holding expensive feedstock or finished material buffer volumes.
- Consumer acceptance of recycled plastics must be addressed. Cosmetic blemishes from recycled content may not affect technical performance of a product but can still influence aesthetic factors. Thus, it is difficult to expect the wide use of recycled plastics for the products whose design and look can play a critical role in consumer purchase decisions.
- A well-managed formal source segregation and separate collection infrastructure needs to be established to meet increases in demand which will result from the implementation of mandatory recycled content targets. This is required as the current reliance on the supply from the informal sector does not always have the required quality of post-consumer material to address the demand that will result from an industry-wide recycled content target.

11.2 RECYCLED CONTENT VOLUMES TO MEET RECYCLED CONTENT TARGETS

The table below shows the formal recycling capacity needed based on modelling up to 2030 consistent with (i) National Action Plan for Marine Plastic Management by 2030; and (ii) PRO's Vietnam ambition of 100% of packaging sold by member organizations to be collected by 2030[24]. As indicated, there is sufficient overall formal recycling capacity within Vietnam in 2019 to achieve 20% recycled content targets even for the estimated 2030 plastic consumption amount.

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23 Digital Europe: Best Practices in Recycled Plastics (2016)

24 The Coca-Cola Company, "Coca-Cola and PRO Vietnam partner with the Ministry of Natural Resources and Environment "For a Green, Clean and Beautiful Vietnam"" (2019)

Recycled Content Volumes (Tonnes Per Year) Which Would be Required Based on Recycled Content Targets of 20% and 30%

Resin	2030 Estimated Plastic Consumption (TPY)	Recycled Content Volumes (TPY) Based on 2030 Recycled Content Targets		Estimated 2019 Local Formal Recycling Capacity (TPY)
		20%	30%	
PET Packaging	511,015	102,203	153,304	248,800
PET Polyester	538,713	107,743	161,614	NA
PP	1,873,373	374,675	562,012	412,400
HDPE	978,001	195,600	293,400	506,200
LDPE/LLDPE	1,215,360	243,072	364,608	
Total	**5,116,462**	**1,023,292**	**1,534,939**	**1,167,400**

Note: 2030 estimated consumption is based on 2.5% Compound Annual Growth Rate (CAGR).

Photo: Matyas Rehak - shutterstock

APPENDIX 12:

VPBANK GREEN LOAN

12.1 VPBANK GREEN LOAN FRAMEWORK LAUNCHED IN AUGUST 2020

The VP Bank Green Loan Framework launched in August 2020 has a strategic objective of increasing financing for climate-smart initiatives to boost environmentally sustainable development in Vietnam with a high potential of greenhouse gas emissions reduction. It is expected that about one-third of the USD 212.5 million package will be earmarked for climate-friendly projects, creating new options for businesses to obtain green financing.[25]

Under the agreement, VP Bank will also receive technical support from IFC experts in building a green credit policy framework and sustainable financial instruments, as well as monitoring, managing, and reporting on the status of capital used for green projects, which will be certified by a reputable international organization. To meet the stringent requirements of the loan, VP Bank has invested in training a group of green credit experts with international certificates to evaluate the green standards in each project. The eligible Green Asset categories in the VP Bank Green Loan Framework are:

1. Renewable Energy
2. Energy Efficiency
3. Clean Transport
4. Eco-friendly and/ or circular economy adapted products, production, technologies
5. Water Efficiency or wastewater
6. Sustainable construction
7. Agriculture and Forestry
8. Prevention and Pollution Control

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25 Vietnam Investment Review, "VP Bank receives $212.5 million loan from IFC for green projects" (2020)

12.2 DOCUMENTS REQUIRED BY VPBANK FOR FUNDING APPLICATIONS

List of Documents Required by VP Bank for Funding Applications [26]

#	Document criteria	Name of documents
1	Environmental impact assessment	License approval / Certification for 1 of the following types of forms: Environmental impact assessment Detailed proposal of environmental protection Registration form to meet environmental standards Environmental protection commitments Environmental protection plan Simplified proposal of environmental protection
2	Community consultation	Minutes of a consultation meeting with the community directly affected by the project
3	Discharge permits	Permission to discharge wastewater into water sources
4	Environmental protection facilities	Certificate of completion of environmental protection facilities
5	Hazardous substances management	Registration form for source of hazardous waste
6	Import of scrap	Certificate of eligibility for environmental protection for the import of scrap for use as raw production materials Written confirmation of deposit guarantee for imported scrap
7	Chemical safety	License approval / Document certification for 01 of the following report types: Chemical incident prevention and response plan Chemical incident prevention and response measures
8	Radioactive safety	Decision approving the Radiation and Particle Incident Response Plan in the primary level
9	Fire prevention and fighting	Fire protection design approval documents Document for acceptance test of fire protection system A certificate of compulsory fire and explosion insurance
10	Environmental Management System	Confirmation of environmental management system
11	Waste treatment	Common waste collection / transportation / treatment permit Hazardous waste collection / transportation / treatment permit

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#	Document criteria	Name of documents
12	Liability insurance for environmental damages	Written confirmation of purchase of environmental damage liability insurance Documents confirming or setting up environmental risk reserve fund
13	Environmental monitoring	Wastewater discharge report to water sources Periodic monitoring reports on wastewater and / or emissions
14	Occupational safety	Occupational safety and hygiene plan
15	Observe the working environment	Reporting the results of working environment monitoring

12.3 VP BANK GREEN LOAN APPROVED APPLICANTS AND THE RESPECTIVE FUNDING APPLICATION

Approved Applicants and the Respective Funding Allocation Amount [27]

Industry		Approved Applicants	Fund Allocation
Renewable Energy	Solar power	78.4%	46.8%
	Saturated steam from clean fuel	1.5%	1.9%
	Producing wood pellets	10.8%	23.6%
Recycling/ Circular Economy	Steel recycling	1.5%	0.7%
	Processing seafood waste	6.3%	24.7%
Energy efficiency	Electric vehicle production	1.5%	2.3%
Total		**100%**	**100%**

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Photo: Vietnam Stock Images - shutterstock

APPENDIX 13:

THE ENABLING POLICY ENVIRONMENT FOR CIRCULARITY AND INTERVENTIONS

Creating an enabling policy environment for circularity of plastics through a range of policy instruments plays a defining role in the success towards achieving circularity. In this section, the study will analyze the existing national-level regulations, roadmaps and timelines and identify any gaps that are limiting the scale-up of the domestic plastic recycling industry and compare these against a benchmark of best practices from other jurisdictions.

13.1 LIFE CYCLE APPROACH TO PLASTICS CIRCULARITY POLICIES

Assessment of the enabling policy environment for plastics circularity in Vietnam can be approached using a life cycle approach for each of the major end-use industries consuming plastics. Over their lifetime, plastic products can contribute to various environmental impacts. Taking a life cycle approach considers the range of impacts throughout the life of a product and quantifies this by assessing the emissions, resources consumed and pressures on health and the environment that can be attributed to a product. It takes the entire life cycle into account – from the extraction of natural resources through to material processing, manufacturing, distribution and use; and finally, the re-use, recycling, energy recovery and the disposal of remaining waste.[28] Thus a life cycle approach provides a holistic framework for assessment of policies and their impacts.

> For example, taking a life cycle approach can quantitatively address a frequent issue in plastic waste management: whether to recycle or incinerate used plastic products such as plastic bottles. The production of plastic bottles from raw materials requires about 80 MJ/kg (energy per kilogram). Incineration can generate about 3 MJ/kg of electricity and about 10 MJ of process steam from the recovered energy. However, despite this small energy gain, new bottles would have to be produced, requiring high amounts of energy. In contrast, recycling and selective collection consumes 9 MJ/kg while also avoiding the much higher energy consumption used in the production of new plastic from raw materials. Recycling therefore normally results in lower energy consumption than incinerating bottles and producing new ones from raw material.
>
> This example assumes, however, that the plastic is not heavily soiled and is not degraded in the recycling process. If the plastic recycling process produces plastic products of lower value end use applications or under different conditions, then it could result in different conclusions.

For each industry, policies impacting plastics circularity can be divided into the following life cycle stages:

- General Legislative Framework - The overarching legislation which guides policies for the industry.

28 Life Cycle Thinking and Assessment for Waste Management

- Production - Policies which affect the ways and rules under which plastic products are manufactured.
- Consumption - Policies which affect consumption/ consumer behavior.
- Disposal - Policies which relate to what occurs when a product is sent to a landfill, incinerator, or is leaked into the environment.
- Recycling - Policies which affect the recovery of plastics after consumption and the actual recycling process.

The above five life cycle changes have been used to classify and thus analyze different legislations/initiatives pertaining to the different end-use industries.

13.2 PACKAGING: ENABLING POLICY ENVIRONMENT

PACKAGING: POLICY EXAMPLES ACROSS LIFE CYCLE

Examples of Relevant Policies and Interventions for Plastics Circularity with Regards to Packaging

LIFE CYCLE STAGES	General Policy Framework	Production	Consumption	Disposal	Recycling
Policies	MSW Legislation National Targets Export Import Trade Policy	Design Standards Recycled Content Policy Alternative Materials Packaging Taxes	Source Reduction Policies (e.g., plastic bag bans) Green procurement	Landfill bans Diversion from landfill targets Anti-Litter legislation	Source segregation / deposit refund schemes Food-grade standards Extended Producer Responsibility

Across the five industries analyzed in this report, packaging has by far the most developed policies due to its heavy use of plastics and the attention that the leakage of plastics has garnered over the last 5 years. Hence, as described in the table above, the best policies that deal with plastic packaging are those which engage stakeholders across the value chain, plug leakages along the product life cycle and have clear targets which enables each stakeholder to understand what is required of them and hence enables effective implementation.

PACKAGING: CURRENT POLICIES ACROSS LIFE CYCLE

Current Policies Across Packaging Life Cycle

Life Cycle Stages	Vietnam	Benchmarks from other jurisdictions				
		China	Singapore	India	European Union	Japan
General Legislative Framework	No specific plastic packaging legislation however the National Action Plan for Management of Marine Plastic Litter by 2030 (of which majority of plastic litter is single-use packaging items) contributes to the targets of the National Strategy for General Management of Solid Waste by 2025 with vision towards 2050. Ban on the import of scrap plastic waste from 2025.[29]	The 5th Amendment (in 2020) to the Solid Waste Environmental Pollution Prevention and Control Law ("Solid Waste Law") focuses on the solid waste handling principles of reduction, recycling, and harmlessness.[30] Packaging waste is also one of the main fields covered under the pilot list of China's Circular Economy Development Strategies and Action Plan launched in 2013.[31]	The Resource Sustainability Act outlines three focus waste streams (including packaging) and strategies to increase collection for recycling rates for these streams.	Plastic Waste Management (PWM Rules), 2016. Collection targets exist and minimum requirements for EPR schemes do not exist in these rules.	The Packaging and Packaging Waste Directive sets targets for the recovery of packaging waste and covers strategies to be implemented by member states to collect packaging waste.	The Basic Act for Establishing a Sound Material-Cycle Society clarifies the responsibilities of all key stakeholders and articulates fundamental matters for making policies for the formation of a Sound Material-Cycle society.

29 Dat Nguyen, "Vietnam to end plastic scrap imports from 2025" (2019)
30 Beveridge & Diamond, "China promulgates Amendment to its Solid Waste Law" (2020)
31 We Li and Wenting Lin, "Chapter 7 Circular Economy Policies in China" (2016)

Life Cycle Stages	Vietnam	Benchmarks from other jurisdictions				
		China	Singapore	India	European Union	Japan
Production	No specific regulations for manufacturers.	The 5th Amendment requires mandatory reporting of products and packaging listed in a catalog (Article 68) by manufacturers, sellers, and importers. Producers are also required to reduce the packaging volume by limiting excessive packaging.	Requires mandatory reporting of packaging use for producers and retailers from 2022 onwards.	Plastics producers need to work out modalities for waste collection systems for collecting back the plastic waste within a period of six months. No targets set. Maharashtra state requires industrial packaging produced to include at least 20% recycled material.	The "essential requirements of packaging" requires the minimization of packaging volume and weight, design of packaging for reuse or recovery and the encouragement of recycled materials usage in packaging. The EU Commission is also initiating work on new harmonized rules to ensure that by 2030 all plastics packaging placed on the EU market can be reused or recycled in a cost-effective manner.	Requires payment of a recycling fee by manufacturers to the designated organization for recycling.

Life Cycle Stages	Vietnam	Benchmarks from other jurisdictions				
		China	Singapore	India	European Union	Japan
Consumption	Prime minister Nguyen Xuan Phuc launched a campaign that has pledged to ban single-use plastic nationwide by 2025 and remove it from supermarkets and other urban markets by 2021.[32] The National Strategy for Integrated solid waste management to 2025, vision to 2050 has targets of reducing plastic bag usage in supermarkets and trade centers by 85% (from 2010 levels) by 2025.[33]	Under the Amendment, certain single-use plastic products and packaging items such as non-bio-degradable plastic bags are prohibited and restricted from sale and or production (Article 69).	No legislation for consumer behavior yet.	Waste generators including institutional generators, are required to segregate plastic waste.	The Single Use Plastics directive bans selected single-use products made of plastic for which alternatives exist by 2021 and implements EPR systems for others.	The Japanese government has plans to make plastic shopping bag charges mandatory.

32 The ASEAN Post Team, "Will ASEAN ban single-use plastic?" (2019)

33 ASEM Connect, "National strategy for integrated solid waste management to 2025, vision to 2050" (2017)

Life Cycle Stages	Vietnam	Benchmarks from other jurisdictions				
		China	Singapore	India	European Union	Japan
Disposal	The National Strategy for Integrated solid waste management to 2025, vision to 2050 has the viewpoint/objective reducing the volume of solid waste to be buried via increasing reuse and recycling of waste.[34] With objectives such as treating 90% of collected daily life waste (MSW) in urban areas such that it is recycled, reused, energy recovered or used as fertilizer by 2025 hence diverting the amount of waste to be buried.		The Zero Waste Masterplan aims to reduce waste sent to landfill by 30% by 2030.	Local bodies are responsible for segregation, collection, storage, and disposal. No targets set. Local bodies are required to encourage use of plastic waste for road construction or energy recovery or waste to oil or co-processing in cement kilns under Plastic Waste Management Rules 2016.	The EU Landfill Directive aims to phase out landfilling for recyclable material by 2025.	There are no targets for diversion from landfill or landfill bans currently in Japan.

34 Actual viewpoint "Solid waste management must be performed in an integrated manner to prevent and reduce arising waste at source which is the top priority task and to increasingly reuse and recycle waste to reduce the volume of waste to be buried." (2017)

Life Cycle Stages	Vietnam	Benchmarks from other jurisdictions				
		China	Singapore	India	European Union	Japan
Recycling	Article 82 of the 2014 revision to the Law of Environmental Protection (LEP) requires households in urban and residential areas to classify waste at source.[35] Classification categories specified under the 2005 LEP include for recycling, disposal, incineration, and burial.[36] As part of the 2020 revision of the LEP, the Department of Legal Affairs of MONRE is looking to include the legal framework for EPR in the LEP of which packaging has been identified as 1 of the 5 product groups subject to EPR.[37] *Rates of segregation of waste at source are however inadequate. Additionally, there is insufficient infrastructure required to deal with segregated waste collection and processing.	At the end-of-life, the Amendment to the Solid Waste Law requires manufacturers, sellers and importers of products and packaging present in the mandatory recycling catalog to recycle the products as according to legislative requirements.[38] In 2019, the local government mandated companies and individuals in Shanghai to segregate waste into the following 4 categories: Recyclable goods (e.g. bottles and cans), Harmful waste (e.g. batteries and medicines), Kitchen waste and Other waste (e.g. bathroom products).	A deposit refund system has been announced to be implemented in 2022 and is currently undergoing industry consultations.	The draft 2019 National Resource Efficiency Policy sets targets for packaging recycling including 100% recycling rate for PET by 2025 and 75% recycling and reuse rate for other plastics by 2030.	The Single-Use Plastics Directive establishes EPR systems, by 2025, which covers the costs of collection, transport, treatment, clean-up of litter and awareness-raising measures for all packaging. The directive mandates: (a)new recycling target for plastic packaging, set at 55% in 2030; (b)Specifically for plastic PET bottles a 25% recycled content target by 2025 and 30% recycled content target by 2030; (c) Collection target of 77% of single-use plastic drink bottles by 2025 and 90% by 2029 through EPR or through deposit refund schemes	Act on the Promotion of Effective Utilization of Resources fosters the recycling of reusable resources. Decree 174/2007/ ND-CP on environmental protection fee of solid waste

35 2014 Law of Environmental Protection
36 2005 Law of Environmental Protection
37 IUCN, "Extended Producer Responsibility: an approach to improving solid waste management in Vietnam" (2020)
38 Sphera, "Revision to China's Solid Waste Law" (2020)

Legend	
	Light blue = Best case practices

There are four key lessons to be gained from the above assessment on circularity for the packaging industry:

1. The EU has the best policies for packaging circularity except for the general legislative framework where Japan has the advantage. This reflects the EU's expertise and experience in the Circular Economy. For example, the "essential requirements of packaging" by the EU establishes rules on packaging design to minimize its impact on the environment and to improve recyclability of packaging. By 2025 at least 55% of all plastics packaging in the EU are required to be recycled. As of 2017, this rate is at 42%. The clear requirements and targets mean that there is less confusion and better enforcement. This also reflects the strong governance that the EU and its member states have that enables them to enforce these rules across all the stakeholders in the EU. Therefore, should the Vietnam government want to set its ambitions high, it should look to the targets of the EU as a reference point.
2. Japan has a better general legislative framework than the EU as the Basic Act for Establishing a Sound Material-Cycle Society is an enforceable law with details on how stakeholders should act to increase collection of recyclables. On the other hand, while the Packaging and Packaging Waste Directive of the EU is mandatory (i.e., the targets and actions listed within it must be complied by member states), the directive must be interpreted by member states and then laws in each member state must be enacted to comply with the directive. It is not, by itself, a legislation hence is not applicable to the Vietnamese context. Hence, Japan's Basic Act for Establishing a Sound Material-Cycle Society can be used as a solid reference point to draft an overarching Circular Economy legislation for Vietnam.
3. Vietnam can draw on the example of Singapore's mandatory reporting requirement of packaging use for producers and retailers to incorporate in the legal framework of an EPR system that is currently being drafted by the Department of Legal Affairs of MONRE. This mandatory reporting by Singapore, which will begin from 2022 onwards, is a fact-based mechanism to arrive at relevant Extended Producer Responsibility measures and to track progress on plastics packaging circularity targets.
4. While Vietnam has some policies, which are positive in terms of encouraging circularity (e.g., bans on plastic bags and other single use plastic items as well as on plastic scrap imports), they have yet to be in full effect (e.g., the nationwide single-use plastic elimination target is set for 2025) and hence it is difficult to determine the enforcement and compliance of such plastic bans. To enhance compliance, these bans should be backed up with supporting legislation such that they are enforceable and that offenders would be required to pay a steep fine should they not comply with the ban.

Photo: LELACHANOK - shutterstock

13.3 ELECTRONICS: ENABLING POLICY ENVIRONMENT

ELECTRONICS: POLICY EXAMPLES ACROSS LIFE CYCLE

Examples of Relevant Policies and Interventions for Plastics Circularity with Regards to Plastics in Electronics

LIFE CYCLE STAGES	General Policy Framework	Production	Consumption	Disposal	Recycling
Policies	MSW Legislation National Targets Export Import Trade Policy	Design Standards	Source Reduction Policies Right to Repair Green procurement	Landfill bans Diversion from landfill targets	Source segregation Take-back obligations Extended Producer Responsibility

As plastics are built into electronics, this section will discuss policies related to the recovery of electronic waste and the plastics within it interchangeably. For electronics, a key policy is to ensure that the electronics are easily disassembled so that its component parts can be separated to be fed into their specific recycling processes. While e-waste has a generally high value in the informal recycling market, its high value is derived from its electrical components (e.g., copper wiring, circuit boards). Plastic components of e-waste are not as well recovered as the electrical components as they are either too low value compared to the electronic components or are designed such that it is too difficult to separate from other components to be worth recycling. Hence, formal collection systems with clear recovery targets for all materials need to be implemented to ensure that all parts of an electronic waste are recovered.

ELECTRONICS: CURRENT POLICIES ACROSS LIFE CYCLE

Current Policies Across Electronics Life Cycle

LIFE CYCLE STAGES	Vietnam	Benchmarks from other jurisdictions			
		China	Singapore	European Union	Japan
General Legislative Framework	There is no E-waste specific legislation in Vietnam. E-waste is however one of the products considered under Decision No. 16/2015/QD-TTg for the recall and treatment of products. [39]	E-waste is regulated under the Collection and Treatment Decree of Waste Electric and Electronic Equipment (WEEE) and as part of the 5th Amendment to the Solid Waste Law. Electronic waste is also one of the main fields covered under the pilot list of China's Circular Economy Development Strategies and Action Plan launched in 2013.[40]	The Resource Sustainability Act deals with e-waste as one of its three priority waste streams	A "Circular Electronics Initiative" will be released which will act as the regulatory framework for electronic waste	The Home Appliance Recycling Law divides the responsibilities of stakeholders (e.g., manufacturers, consumers) for the recycling of electronic waste

39 Hong Thi Thu Nguyen et al. "Determinants of Resident's E-Waste Recycling Behaviour Intention: A Case Study from Vietnam" (2018)

40 We Li and Wenting Lin, "Chapter 7 Circular Economy Policies in China" (2016)

LIFE CYCLE STAGES	Vietnam	Benchmarks from other jurisdictions			
		China	Singapore	European Union	Japan
Production	No legislation currently exists which affects production of electronics.	Proclamation on strengthening the environmental management of waste electronics and electrical equipment introduced in 2003 encourages electronic product manufacturers to promote cleaner production and eco-designs.[41]	No legislation currently exists which affects production of electronics.	The Eco-design Directive, as part of the Circular Electronics Initiative, will ensure devices are built for energy efficiency and durability, reparability, upgradability, maintenance, reuse, and recycling	Under the Home Appliance Recycling Law, manufacturers are required to take back home appliances, which they have manufactured or imported from retailers and recycle them.
Consumption	Used electronics is prohibited for importation under Decision No. 69/2018/ND-CP.[42] Decision No. 16/2015/QD-TTg requires end product users including household families and individuals to return e-waste products to the points of recall organized by the retailer or manufacturer.[43]	No legislation currently exists which affects consumption behaviors.	No legislation currently exists which affects consumption behaviors.	The Right to Repair is included as part of the Eco-design initiative.	Consumers are obliged to dispose of electronics appropriately and pay for the costs for collection and recycling.

41 Chenyu Lu et. al. , "An overview of e-waste management in China" (2014)

42 Vietnam Environmental Administration, "E-waste Management in Vietnam" (2020)

43 Le Minh Trung, "Decision No. 16/2015/QD-TTg dated May 25, 2015 of the Prime Minister on regulations on recall and treatment of discarded products" (2015)

LIFE CYCLE STAGES	Vietnam	Benchmarks from other jurisdictions			
		China	Singapore	European Union	Japan
Disposal	Circular No.34/2017/ TT-BTNMT pursuant to the decision mentioned above requires discarded e-waste, after being recalled, to be disposed of pursuant to relevant waste management law/ practices. The decision also requires reporting of discarded products annually to the Vietnam Environment Administration (VEA).	Effective in 2008 the Administrative measures for the prevention and control of environmental pollution by electronic waste. It requires an environmental impact assessment (EIA) to be undertaken for e-waste dismantling, utilization, and disposal projects.[44]	No legislation currently exists which affects disposal of e-waste to the incinerator.	No legislation currently exists which affects disposal of e-waste to the landfill or incinerator.	No legislation currently exists which affects disposal of e-waste to the landfill or incinerator.
Recycling	Under Circular No. 34/2017/ TT-BTNMT, the amount of discarded e-waste that is recovered must be reported to VEA annually. Additionally, as part of the 2020 revision of the LEP, the Department of Legal Affairs of MONRE is looking to include the legal framework for EPR in the LEP of which electric and electronic devices have been identified as 1 of the 5 product groups subject to EPR.	The 5th Amendment requires establishment of an EPR program for electronic and electrical products whereby producers are required to establish and implement a system for recycling.[45]	The Resource Sustainability Act will in the future establish a Producer Responsibility Scheme (PRS) where producers of electronic products must finance the PRS for e-waste collection.	The WEEE Directive 2012/19/ EU Directive provided for the creation of collection schemes where consumers return their WEEE free of charge.	Retailers are to provide take back services for appliances from households and business and deliver them to manufacturers.

44 Lin Wei et. al., "Present Status of e-waste disposal and recycling in China". (2012)

45 Beveridge & Diamond , "China promulgates Amendments to its Solid Waste law" (2020),

Legend	
	Light blue = Best case practices

There are two key lessons to be gained from the above assessment on circularity for the electronics industry:

1. Japan is the clear best-case practice for an enabling policy environment for circularity in electronics across all stages of the life cycle. The Home Appliance Recycling Law is a comprehensive legislation which assigns responsibilities for each stakeholder across the product life cycle. In essence, it compels stakeholders such as retailers and manufacturers to provide for collection infrastructure such as drop-off sites and take-back services. For stakeholders who do not have the ability to provide collection systems, such as households, recycling fees are mandated to be paid to help fund the collection system. Hence, circular electronic policy formulation in Vietnam should draw on this example from Japan.
2. Although Circular No. 34/2017/TT-BTNMT pursuant to Decision No. 16/2015/QD-TTg requires the recall and treatment of discarded electronic devices (e-waste), they are however no targets pertaining to collection hence it is difficult to determine the effectiveness of manufacturers in retrieving the products for recycling and or proper disposal. Vietnam should establish collection and recycling targets in relation to the recall/retrieval of the discarded e-waste products.

13.4 AUTOMOTIVE: ENABLING POLICY ENVIRONMENT

AUTOMOTIVE: POLICY EXAMPLES ACROSS LIFE CYCLE

Examples of Relevant Policies and Interventions for Plastics Circularity with Regards to the Automotive Industry

LIFE CYCLE STAGES	General Policy Framework	Production	Consumption	Disposal	Recycling
Policies	MSW Legislation National Targets Export Import Trade Policy	Design Standards Alternative Materials	Source Reduction Policies	There are no specific policies for the automotive industry	Source segregation Take-back obligations Extended Producer Responsibility

Since automobiles are typically scrapped at the end of their life (i.e., not just disposed of as is to the landfill), disposal policies are not relevant in the discussion of circularity of plastics in automobiles. Like electronics recycling and other plastics in non-packaging applications, the ability to separate the plastic portion from the other materials is key to ensuring that the plastics are recycled in practice.

AUTOMOTIVE: CURRENT POLICIES ACROSS LIFE CYCLE

Current Policies Across Automotive Life Cycle

LIFE CYCLE STAGES	Vietnam	Benchmarks from other jurisdictions			
		China	Singapore	European Union	Japan
General Legislative Framework	The general regulation is Decree No. 116/2017/ND-CP which provides the requirements for manufacturing, assembly and import of automobiles, trade in automobile warranty and maintenance services.[46]	The lifecycle of automobiles in China are governed by The Regulations on Mandatory Standard of Scrapping Vehicles and the Management Measures for Take-back of End-of-Life Vehicles.	The general regulation regarding automobiles in Singapore is the Road Traffic (Motor Vehicles, Quota System) Rules.	The End-of Life Vehicles (ELV) Directive 2000/53/EC provides the regulatory framework where ELVs are governed. It establishes design standards, collection systems and responsibilities and recycling targets.	The Automobile Recycling Law sets out roles and responsibilities for each key stakeholder in the recycling of ELV.
Production	No legislation currently exists which affects circularity at the production stage of automobiles	Article 40 of the Circular Economy Promotion Law entails that the state supports enterprises to reproduce components and parts of motor vehicles, mechanical products and machine tools and renovate tires.[47]	No legislation currently exists which affects circularity at the production stage of automobiles	As part of the End-Of-Life Directive, automobiles should be designed to facilitate proper dismantling and to allow components and materials to be reused, recycled and/or recovered	The 2000 Law for Promoting the Effective Use of Resources encouraged automakers to incorporate more recyclable materials in the production of an automotive.

46 ASEM Connect, "Decree No.116/2017/ND-CP dated October 17, 2017 of the Government on requirements for manufacturing, assembly and import of automobiles and trade in automobile warranty and maintenance services" (2017)

47 Congressional Executive Commission on China, "Circular Economy Promotion Law of the People's Republic of China" (nil)

LIFE CYCLE STAGES	Vietnam	Benchmarks from other jurisdictions			
		China	Singapore	European Union	Japan
Consumption	Decree 116 puts forth stringent requirements for automobile importers. Decision No. 16/2015/QD-TTg requires end product users including household families and individuals to return discarded vehicles to the points of recall organized by the retailer or manufacturer.[48] There are however no collection targets.	The Regulations on Mandatory Standard of Scrapping Vehicles requires consumers to scrap their private cars at the end of their useful life (based on mileage with a limit of 600,000km).[49]	Road Traffic (Motor Vehicles, Quota System) Rules, implements the COE system which limits the number of automobiles purchased in a year.	No legislation currently exists which affects consumption behaviors.	Vehicle owners are required to pay a 'Recycling Fee' annually which helps fund collection and recycling of ELV.
Recycling	Under Circular No. 34/2017/TT-BTNMT, the quantity of discarded vehicles that are recovered must be reported to VEA annually. There are however no targets for material recovered. Batteries, accumulators, and tires (present in vehicles) are part of the 2020 revision of the LEP for the legal framework of products subject to EPR.	The 5th Amendment requires establishment of an Extended Producer Responsibility program not only for E-waste but also for power batteries of vehicles.[50] Producers are required to establish a system for recycling.	After deregistration, automobiles should either be scrapped or exported.	As part of the End-Of-Life Directive, Extended Producer Responsibility is included where producers have a responsibility to take back automobiles.	Manufacturers need to remove Auto-shredding residues, Fluorocarbons, and airbags from ELV before they are sent for recycling

48 Le Minh Trung, "Decision No. 16/2015/QD-TTg dated May 25, 2015 of the Prime Minister on regulations on recall and treatment of discarded products" (2015)

49 Jinhui Li et al. "Recycling and pollution control of the End of Life Vehicles in China" (2014)

50 Beveridge & Diamond. "China promulgates Amendment to its Solid Waste Law" (2020)

Legend	
	Light blue = Best case practices

There are three key lessons to be gained from the above assessment on circularity for the automotive industry:

1. Japan has the strongest enabling environment for automobile recycling. Its "Automobile Recycling Law" tracks the life cycle of an automobile after its end-of-life and delineates the roles and responsibilities for each stakeholder in the chain. For example, consumers are responsible for the payment of a 'Recycling Fee' which funds collection of End-Of-Life Vehicles.
2. The EU's End-of Life Directive has a very good provision which specifies that automobiles should be designed to facilitate proper dismantling. This is important because it then facilitates the separate collection of materials which can then be easily processed according to its specific recycling process.
3. Vietnam does not have any enabling circularity policies addressing all life-cycle stages of an automobile especially the production/ manufacturing stage. Although there are take-back policies (e.g., recall of products), there are no targets for collection of recyclable material from discarded automobiles, hence it is difficult to determine the effectiveness of the policy.

13.5 CONSTRUCTION: ENABLING POLICY ENVIRONMENT

CONSTRUCTION: POLICY EXAMPLES ACROSS LIFE CYCLE

Examples of Relevant Policies and Interventions for Plastics Circularity with Regards to Construction and Demolition Waste

LIFE CYCLE STAGES	General Policy Framework	Production	Consumption	Disposal	Recycling
Policies	MSW Legislation National Targets Export Import Trade Policy	Design Standards Alternative Materials Green Certification	There are no specific policies for construction	Landfill bans Diversion from landfill targets	Source segregation Dismantling procedure

As plastics used in construction are set in place for the lifespan of the building, consumption policies are not relevant to the discussion on circularity of plastics in construction. Like plastics in other industrial uses, policies which encourage the circularity of plastics in construction need to encourage design which allows for easy disassembly of plastic components from buildings. Also, recovery of recyclable materials from demolition waste needs to be encouraged to ensure that plastics are also recovered as it is typically a lower value material than the other materials found in demolition material (e.g., concrete, steel).

CONSTRUCTION: CURRENT POLICIES ACROSS LIFE CYCLE

Current Policies Across Construction Life Cycle

LIFE CYCLE STAGES	Vietnam	Benchmarks from other jurisdictions			
		China	Singapore	European Union	Japan
General Legislative Framework	Construction and Demolition waste (CDW) is classified as non-hazardous solid wastes together with municipal solid waste.[51]	There is no specific law governing construction and demolition (C&D) waste in China, it is instead only covered in subordinated laws including: Environmental Protection Law, Cleaner Production Promotion Law, Solid Waste Pollution Prevention Law, Circular Economy Promotion Law and Building Law.[52]	Construction waste is considered non-incinerable waste under the Environmental Public Health (General Waste Collection) Regulations.	The Waste Framework Directive (2008/98/EC) aims to recycle 70% of Construction & Demolition (C&D) waste by 2030. The EU C&D Waste Management Protocol lays out the procedure for managing C&D waste.	The Construction Material Recycling Law sets a target of 95% recycling rate for construction waste. It stipulates procedures for demolition and key stakeholders involved and their responsibilities.
Production	Circular No. 08/2017/TT-BXD recommends reusing or recycling construction waste on site according to the construction waste management plan.[53] There are however no specific targets.	China's current national standard, the Green Building Evaluation Standard is based on seven indicators, one of which is material saving and material resources utilization.	The BCA Green Mark Scheme encourages the use of sustainable materials in construction and the provision of recyclables collection infrastructure.	Sustainable construction is encouraged through private certification schemes.	There are no specific policies with regards to sustainable production in construction.

51 The World Bank, "Solid and Industrial Hazardous Waste Management: Assessment options and action areas" (2018)

52 AECOM report for Asian Development Bank, "People's Republic of China: Construction and Demolition Waste Management and Recycling" (2018)

53 Vanbanphauat.co ,"Circular 08/2017/TT-BXD construction solid waste management" (2017)

LIFE CYCLE STAGES	Vietnam	Benchmarks from other jurisdictions			
		China	Singapore	European Union	Japan
Disposal	Under Decree No.38/2015/ND-CP[54], construction waste should be classified into the following categories for proper disposal/treatment: › Recyclable solid waste › Solid waste which can be reused on the site or in other construction works › Hazardous waste that must be separately classified and managed as specified in the decree	Existing regulations do not have any quantitative targets on C&D Waste emissions, recycling, or disposal.[55]	Construction waste is considered non-incinerable waste under the Environmental Public Health (General Waste Collection) Regulations and disposed of at the landfill without incineration.	Landfill bans are recommended as part of the EU Construction and Demolition Waste Management Protocol.	There is no specific legislation with regards to disposal of construction waste at landfill.
Recycling	As above, construction waste that is classified as recyclable shall be collected and transported to construction waste treatment facilities for reuse or recycling. There are however no specific targets.		The BCA demolition protocol specifies to carry out sequential demolition where one type of material is carefully dismantled at one time and salvaged for reuse and recycling to maximize the amount of materials recovered.	The EU C&D Waste Management Protocol includes requirements for Waste identification, source separation and collection, Waste logistics, Waste processing, and Quality management.	The Construction Material Recycling Law requires contractors to sort out and recycle wastes generated in demolition work of a building.

54 Vanbanphauat.co, "Circular 08/2017/TT-BXD construction solid waste management" (2017)

55 AECOM report for Asian Development Bank, "People's Republic of China: Construction and Demolition Waste Management and Recycling" (2018)

Legend	
	Light blue = Best case practices

There are three key lessons to be gained from the above assessment on circularity for the construction industry:

1. The best enabling policy environments for circularity in construction can be found in multiple countries. However, Japan's Construction Material Recycling Law is the legislation that offers the most comprehensive coverage of actions to be taken after demolition. In particular, the law "requires contractors to sort out and recycle wastes generated in demolition work of a building" and targets 95% recovery of recyclable materials from demolition waste.
2. Aside from that, Singapore's Green Mark Scheme encourages building owners to include more recycled materials to be included in the design of the building as well as providing for recyclables collection infrastructure. Similar recognition schemes are available in the EU, although they are administered through private programs.
3. Vietnam's existing regulations classify construction and demolition waste together with MSW. Although there are legislations specific to construction waste, there are little to no targets to the rate of recovery of recyclable material or diversion of waste from landfills. Additionally, although CDW is reported as its own stream, in reality there is insufficient focus on separating (at source) and hence separate collection of construction[56] waste hence more focus should be placed on separating the construction waste stream from MSW to further enhance the circularity of material particularly plastics within the CDW.

56 The World Bank, "Solid and Industrial Hazardous Waste Management: Assessment options and action areas" (2018)

13.6 FILAMENT: ENABLING POLICY ENVIRONMENT

FILAMENT: POLICY EXAMPLES ACROSS LIFE CYCLE

Examples of Relevant Policies and Interventions for Plastics Circularity with Regards to Filaments

LIFE CYCLE STAGES	General Policy Framework	Production	Consumption	Disposal	Recycling
Policies	MSW Legislation National Targets Export Import Trade Policy	Design Standards Alternative Materials	Source Reduction Green Procurement	There are no specific policies for textiles	Source segregation Extended Producer Responsibility schemes

Currently, filaments or textiles are not treated as a major waste category. Hence, policies which have a specific focus on textiles are scarce. They are typically treated as part of municipal waste. This study, however, has observed used clothing often has a second life and is being actively traded by the informal sector.

FILAMENT: CURRENT POLICIES ACROSS LIFE CYCLE

Current Policies Across Filament Life Cycle

LIFE CYCLE STAGES	Vietnam	Benchmarks from other jurisdictions			
		China	Singapore	European Union	Japan
General Legislative Framework	There is no specific legislation governing used filaments.	Textile waste is one of the main fields covered under the pilot list of China's Circular Economy Development Strategies and Action Plan launched in 2013.[57]	There is no specific legislation governing used filaments.	Policies for textiles collection and recycling is covered under the Circular Economy package.	There is no specific legislation governing used filaments.
Production	There is no specific legislation governing the use of recyclable materials in filament.	The Development Plan for the Textile Industry focuses on innovation and promoting green manufacturing within the industry. This includes the exploration of alternative materials such as bio-based fibers made from seaweed or crab shells.[58]	There is no specific legislation governing the use of recyclable materials in filament.	The European Clothing Action Plan (ECAP) encourages designers & buyers on more sustainable design practices through the Design for Longevity platform.	There is no specific legislation governing the use of recyclable materials in filament.
Consumption	There is no specific legislation governing the consumption of filaments.	There is no specific legislation governing the consumption of filaments.	There is no specific legislation governing the consumption of filaments.	The EU GPP Criteria for Textile Products and Services are a voluntary instrument for all EU Member States and public authorities, with the goal of facilitating the inclusion of environmental criteria into public tenders.	There is no specific legislation governing the consumption of filaments.

57 We Li and Weiting Lin, " Chapter 7 Circular Economy Policies in China" (2016)

58 Marlous Spuijbroek, "Textile waste in Mainland China" (2019)

LIFE CYCLE STAGES	Vietnam	Benchmarks from other jurisdictions			
		China	Singapore	European Union	Japan
Recycling	There is no specific legislation governing the recycling of filaments.	The 13th five-year plan for Economic and Social Development of the People' Republic of China (2016-2020) includes environmental targets such as the establishment of a recycling system for textiles and implementation of an EPR system.[59] The Domestic Waste Classification System Implementation Plan introduced in 2017 has the goal of achieving the implementation of waste separation legislation by the end of 2020. With the initial waste categories of hazardous waste, kitchen waste and recyclable materials of which textiles is classified under recyclable materials.	There is no specific legislation governing the recycling of filaments.	The 2018 Circular Economy Package requires Member States to ensure that textiles are collected separately by 2025	There is no specific legislation governing the recycling of filaments.

59 Marlous Spuijbroek, "Textile waste in Mainland China" (2019)

Legend	
	Light blue = Best case practices

There are two key lessons to be gained from the above assessment on circularity for the construction industry:

1. Filament / textile waste has traditionally been the least prioritized among the various waste streams across all jurisdictions. It was only in 2018, that the EU took significant steps to address circularity for textile waste. The 2018 Circular Economy Package requires Member States to ensure that textiles are collected separately by 2025.
2. The lack of prioritization for textile waste has resulted in Vietnam having almost no collection or recycling infrastructure for textiles. This has resulted in an average 1% collection for recycling rate for polyester in Vietnam.

13.7 SUMMARY: ENABLING POLICY ENVIRONMENT FOR THE FIVE INDUSTRIES

In summary, to create an enabling environment for plastics circularity, a life-cycle approach needs to be taken to ensure that all parts of the value chain are covered. This is because, in many cases, policies across various life cycle stages rely on each other to work. For example, requirements to recycle a certain percentage or use a certain percentage of recycled materials would be ineffective if the materials are not designed to be recyclable in the first place. Hence, to achieve circularity, policies need to address all parts of the circular economy for it to transition from a linear one.

Photo: MOHAMED ABDULRAHEEM - shutterstock

Summary of Enabling Policy Environment and Best-Case Practice Policy for the 5 Industries

Life Cycle Stage	Packaging						Electronics					Automotive					Construction					Filament				
	VN	CN	SG	IN	EU	JP	VN	CN	SG	EU	JP	VN	CN	SG	EU	JP	VN	CN	SG	EU	JP	VN	CN	SG	EU	JP
General			√	√	√	√			√	√	√	√	√	√	√	√	√	√	√	√	√				√	
Production			√	√	√	√				√	√				√	√	√	√	√	√					√	
Consumption	√	√		√	√	√	√	√		√	√	√	√	√		√									√	
Disposal	√	√	√	√	√		√	√									√	√	√	√						
Recycling	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√				√	

Legend	
	Policy does not exist
√	Policy exists
	Best case practice policy

As shown in the table above, while there are some notable policies in Vietnam with regards to plastics circularity, Vietnam lags behind best-case examples in jurisdictions such as the EU, Japan and other Asian countries such as Singapore who have more comprehensive policies across the plastics life cycle.

APPENDIX 14:

TIGHTENING OF GLOBAL REGULATIONS ON SCRAP PLASTIC & RECYCLED PLASTIC TRADING

14.1 BASEL CONVENTION PLASTIC WASTE AMENDMENTS

Basel convention, a near-universal treaty which regulates the transboundary movements of hazardous wastes and other wastes and of which Vietnam is a signatory, has adopted amendments to Annexes II, VIII and IX to the Convention which deal with the transboundary movement of plastic waste that came into force on the 1st of January 2021.[60]

The following are the amendments made to the Annexes II, VIII and IX:

Annex II

- Insertion of a new entry Y48 (covers non-hazardous plastic waste which is not covered by Basel Listing B3011, including mixtures of such wastes unless they are hazardous.)
- Prior notice and consent are required.

Annex VIII

- New entry A3210 which clarifies the scope of plastic wastes presumed to be hazardous.
- Prior notice and consent are required.

Annex IX

- Entry B3010 is replaced with a new entry B3011 which clarifies the types of plastic wastes that are presumed to not be hazardous.
- Prior notice and consent are not required.

Through three amendments to the annexes to the Convention, this decision specifies the new categories of plastic waste that will be subject to the Convention's:

- Control procedure for transboundary movements, Prior informed Consent (PIC) procedure, and the conditions under which this procedure applies;
- Provisions pertaining to waste minimization; and
- Provisions pertaining to the environmentally sound management of wastes.

60 Secretariat of the Basel Convention, "Basel Convention Plastic Waste Amendments"

Based on these amendments, the types of plastic scrap/ waste that will or will not be controlled are as follows:

- All plastic waste and mixtures of plastic wastes except for waste covered by entry B3011 will require the importing country's prior informed consent before it can be exported. Types of plastic scrap/ waste that will be controlled[61]:
  - Plastic scrap and waste that is contaminated (e.g., with food residue and/or other non-hazardous waste)
  - Plastic scrap and waste mixed with other types of scrap and waste
  - Plastic scrap and waste containing halogenated polymers (e.g., PVC)
  - Mixed plastic scrap and waste, except for shipments consisting of polyethylene (PE), polypropylene (PP), and polyethylene terephthalate (PET) that meet the criteria described in Basel listing B3011
- Only batches of individual non-halogenated polymers (for a very narrow mix of polyethylene, PP and PET), that are sorted, clean, and uncontaminated and effectively destined for recycling can be freely traded globally. Types of plastic scrap/ waste that will not be controlled/ not be subjected to PIC procedure (criteria in Basel Listing B3011)[62]:

Plastic scrap must be pre-sorted, clean, destined for "recycling in an environmentally sound manner" and be classified in one of the following groups:

- Plastic scrap "almost exclusively" consists of one non-halogenated polymer (e.g., PE, PP, PET, PS, ABS).
- Plastic scrap "almost exclusively" consisting of one cured resin or condensation product (e.g., epoxy resins)
- Plastic scrap "almost exclusively" consisting of one of a limited number of fluorinated polymers (e.g., polyvinyl fluoride)
- Mixed plastic scrap consisting of PE, PP, and PET, provided it is destined for "separate recycling" of each material, and in an environmentally sound manner, and almost free from contamination and other types of wastes.

14.2 HONG KONG, CHINA'S UPDATED GUIDELINES IN COMPLIANCE WITH THE AMENDMENTS

Thus far, only Hong Kong, China has updated its guidelines to comply with the Basel Convention Plastic Waste Amendments. The following are the new controls in Hong Kong, China:

- Unrestricted plastic waste: Non-regulated plastic waste items within the Sixth Schedule of WDO (Waste Disposal Ordinance of Hong Kong, China)[63] or entry B3011 of Annex IX of Basel Convention which are almost free from contamination and other types of wastes (with contaminants of not more than 0.5%), can still be imported without the requirement of import permit if it is destined for recycling in an environmentally sound manner.[64]
- Restricted plastic waste: On the other hand, the import of plastic waste items not within the Sixth Schedule of WDO or non B3011 of Annex IX such as Y48 and A3210 will be subject to the control of permit/consent while transhipment will require a notification.
- Export permits or approval issued by the exporting countries must be available in case of import to Hong Kong, China or transhipment via Hong Kong, China.

61 EPA, "New international requirements for the export and import of plastic recyclables and waste"

62 EPA, "New international requirements for the export and import of plastic recyclables and waste"

63 The Waste Disposal Ordinance (WDO), Cap. 354, provides legislative control on pollution caused by all forms of wastes including activities which involve the import or export of waste. It provides the statutory framework for the planning, management, and control of wastes in Hong Kong, China.

64 "Environmentally sound recycling" is defined in the *technical guidelines on the identification and environmentally sound management of plastic wastes and for their disposal.*

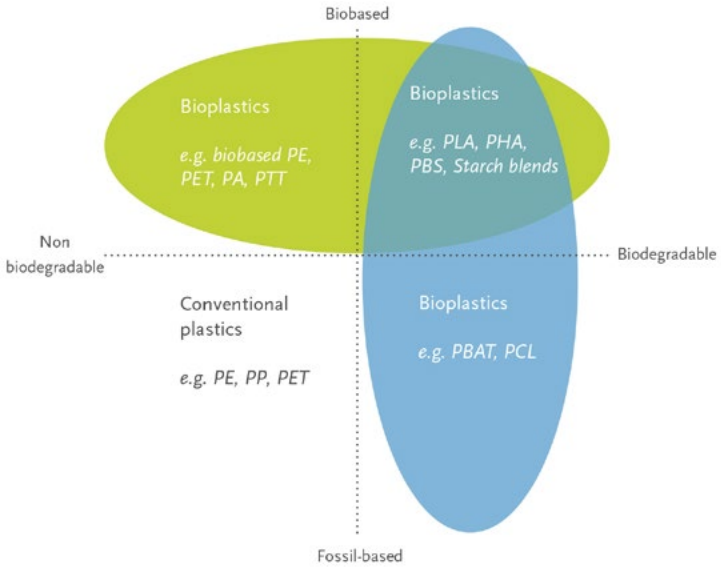
APPENDIX 15:

BIOPLASTIC ALTERNATIVES

Until 2015, bioplastics remained a very niche subcategory of the global plastics industry. However recent attempts by governments around the world to curb the use of single-use plastics and fossil-fuel derived plastics, has given an opportunity for the emergence of bioplastics. Globally, approximately 2 million TPY of different types of bioplastics is produced. In comparison to fossil-fuel derived plastics, this is only 1-2%.

To understand bioplastics in the context of plastics recycling, it is important to understand their sources and biodegradability together with plastics based on conventional, fossil resources.

Overview of Types of Plastic [65]



All plastics can be categorized into four main groups:

- Biobased or partially biobased non-biodegradable plastics such as biobased PE, PP, PET (so-called drop-ins) and biobased technical performance polymers such as PTT, TPC-ET
- Plastics that are both biobased and biodegradable, such as PLA, PHA, PBS
- Plastics that are based on fossil resources and are biodegradable, such as PBAT
- Plastics that are based on fossil resources and are non-biodegradable, such as conventional PET, PP, HDPE, LDPE

Biobased plastics can contribute to lowering greenhouse gas emissions and demand for fossil resources, when substituting the fossil counterparts. Together with a high recycling rate of biobased plastics and the substitution of the fossil fuel inputs by sustainable biobased resources, this would provide an attractive vision for a circular economy.[66]

65 European Bioplastics

66 Biobased plastics in a circular economy, CE Delft (2017)

Photo: Extarz - shutterstock

APPENDIX 16:

ASSUMPTIONS FOR THE IMPACT OF EACH INTERVENTION

Assumptions for the Potential Impact on CFR Rate and Value Yield of Each Intervention

#	Recommendations	Modelling Assumptions	CFR Rate Increase	Value Yield Increase
1	INTERVENTIONS THAT INCREASE VALUE YIELD AND CFR RATE			
A	Build out and enforce plastics circularity in LEP	-	-	-
B	Increase sorting efficiency	**CFR rate:** Implementing this intervention will increase MSW sorting to 40% of all collected MSW, so currently non-recycled plastics reduces by 40%. Assumes there will be a 100% collection of MSW. This leads to an increase in CFR rate of 27%. **Value Yield:** Implementing this intervention will increase demand for all products by approximately 10% of existing value due to better sorting.	27%	8%
C	Improve access to finance and capacity building	-	-	-

#	Recommendations	Modelling Assumptions	CFR Rate Increase	Value Yield Increase
D	Encourage use of recycled content across all major end-use applications	**CFR rate:** Assuming a 30% recycled content target and that all comes from local sources and 10% process losses occur, a minimum CFR rate of 33% is required to achieve a 30% recycled content target. Also, it is assumed that currently 50% of all recycled plastics are exported. When recycled content targets are set, it is assumed the % of plastics that will be exported will reduce to 40% (from 50%) i.e., local demand for recycled plastics will increase to 60% of all recycled plastics. So, 55% CFR rate is needed such that 60% of that becomes 55% CFR rate. Thus, the increase in CFR rate needed is 55%-33%=22% i.e. 22% **Value Yield:** Implementing this intervention will increase demand for all products by approximately 15% of existing value.	22%	11%
E	Mandate "design for recycling" standards for all plastics, especially packaging	**CFR rate:** Based on Ellen MacArthur Foundation's New Plastics Economy Catalysing Action report, without fundamental redesign and innovation about 30% of plastic packaging will never be reused or recycled. Assuming this 30% can be applied across all applications of plastics moves CFR to right by 30%. **Value Yield:** Based on the above-mentioned report, implementing four areas of packaging design changes could have a positive impact on recycling economics amounting to USD 90-140 per tonne collected.	30%	17%
F	Create more data transparency in the plastics market	-	-	-

#	Recommendations	Modelling Assumptions	CFR Rate Increase	Value Yield Increase
2	INTERVENTIONS THAT INCREASE CFR RATE			
G	Increase recycling (mechanical and chemical) capacities & discourage disposal of plastics	**CFR rate:** 100% recycling capacity is needed to achieve very high recycling rates for plastics. Assuming the current value yield stays the same as recycling capacity increases to 100%. Increasing recycling capacity to 100% can enable an additional 67% of plastics to be recycled. It must be noted that this increase in CFR cannot be achieved without the implementation of policies which create a demand pull for recycled plastics (e.g., recycled content targets, virgin plastic taxes) and implementation of actions which enable plastics to be available for recycling (e.g., source segregation, design-for-recycling). **Value Yield:** No change	67%	0%
H	Create industry-specific requirements to collect post-use products	**CFR Rate**: Assuming a 90% CFR rate target for packaging and 50% CFR rate target for all non-packaging applications. 35% of all plastics is consumed by packaging and the rest by non-packaging so this provides a weighted average CFR rate of 64% to be reached. After factoring in the existing CFR rate of 33%, the increase in CFR rate is 31% **Value Yield:** No change	31%	0%

Photo: Romolo Tavani - shutterstock

APPENDIX 17:

SUMMARY OF ALL RECOMMENDED IN-TERVENTIONS AND ACTIONS

Summary of all recommended interventions and actions under this study

Recommended Interventions	#	Actions	Area of Impact	
			Based on CFR / Value Yield	Based on Supply and Demand
A. Enable plastics circularity through sound development of circulars and decrees for the LEP	1	Ensure the responsible agencies have the authority and resources to work with the relevant stakeholders to develop the underlying policy instruments (circulars and decrees) legislation and enforce the LEP.	CFR and Value Yield	Supply and Demand
	2	Incentivize reduction of plastics (e.g. phase-outs of unnecessary plastic items) and reuse systems (e.g. refillable bottles, new delivery, and business models)	CFR and Value Yield	Supply and Demand
B. Increase waste collection & sorting efficiency of plastics	3	Increase waste collection coverage and phase out dumpsites	CFR	Supply
	4	Mandate and harmonize standards and targets for source segregation and separate collection	CFR and Value Yield	Supply
	5	Ensure alignment between public and private sector awareness & behavior change campaigns	CFR and Value Yield	Supply
	6	Provide opportunities for informal sector inclusion and increase transparency of recyclables collection	CFR and Value Yield	Supply
	7	Implement pay-as-you-throw (PAYT) waste collection model to encourage separation at source	CFR and Value Yield	Supply

Recommended Interventions	#	Actions	Area of Impact	
			Based on CFR / Value Yield	Based on Supply and Demand
C. Improve access to finance and capacity building	8	Refine the green finance framework to provide incentives to support the plastics recycling value chain	CFR and Value Yield	N/A
	9	Develop practical processes for financing plastics circularity businesses	CFR and Value Yield	N/A
	10	Build recyclers capacities to meet quality & EHS standards	CFR and Value Yield	Supply and Demand
	11	Assess emissions mitigation potential in plastics circularity to unlock climate finance	CFR and Value Yield	Supply and Demand
D. Encourage use of recycled content across all major end-use applications	12	Develop & launch incentives for using recycled content	CFR and Value Yield	Demand
	13	Set recycled content targets/standards for major plastic use industries	CFR and Value Yield	Demand
	14	Implement Green Public Procurement (GPP) for recycled plastic products	CFR and Value Yield	Demand
	15	Tax plastic applications without minimum recycled content	CFR and Value Yield	Demand
E. Mandate design-for-recycling standards for all plastics, especially packaging	16	MOIT to consult with relevant stakeholders to develop design-for-recycling standards	CFR and Value Yield	Supply and Demand
	17	Align industries on design-for-recycling standards and encourage voluntary adoption of these standards	CFR and Value Yield	Supply and Demand
	18	Mandate national design-for-recycling standards for packaging plastics	CFR and Value Yield	Supply and Demand
F. Create more data transparency in the plastics market	19	MOIT/Customs to formally (i)create publicly accessible database of plastics import/export; (ii)improve accuracy of data entry; and (iii)build a comprehensive list of recyclers	CFR	N/A
	20	VPA to: (i) encourage greater company participation in data sharing; and (ii) create virgin/recycled resin market database	CFR and Value Yield	N/A
	21	Develop VPRA into a separate association; expand membership and representation	CFR	N/A

Recommended Interventions	#	Actions	Area of Impact	
			Based on CFR / Value Yield	Based on Supply and Demand
G. Increase recycling (mechanical and chemical) capacities & discourage disposal of plastics	22	Incentivize increase in recycling capacities for polyolefins (PP, PE) and develop PET Packaging recycling to produce higher-end recycled products	CFR and Value Yield	Supply and Demand
	23	Formalize informal recyclers and reduce unfair competition from illegal recyclers	CFR and Value Yield	N/A
	24	Develop clear standards for the import of quality scrap plastics for production of pellets, semi-finished and/or finished goods; and avoid an outright plastic scrap import ban.	CFR	Supply
	25	Invest in chemical recycling (plastic-to-naphtha / plastic-to-monomer) capacity for low value plastics	CFR	Demand
	26	Increase landfill tipping fees and invest in treatment of organic waste	CFR	Supply
H. Create in-dustry-specific requirements to collect post-use products	27	Mandate collection targets specifically for the packaging industry based on industry consultations	CFR	Supply
	28	Support co-processing of low-value plastics for use in RDF as an interim measure	CFR	Demand
	29	Mandate reporting framework for plastic products	CFR	N/A

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