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Status of E-waste and Plastic Waste Recycling and Pollution in Asia

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Plastic Waste

This photo was taken at the beach in Tokyo Bay, Japan.

How may plastics you can find? You can easily find colored plastics, such as yellow one and red one.



Red circle indicate plastic resin pellet.



Resin pellet could beleaked from manufacturer making plastic products, and during transportation.



Plastic Recycling Factory near landfill site for Vientiane, Laos, 2013,



Plastic waste are stocked on the soil and no. Plastic waste are not well managed. Heavy rain or strong wind may cause leakage from the stockyard.



A Junk Shop in Cambodia

The condition of storage is not good enough. Plastic are scattered around in a junk shop in Cambodia (2013).



A Plastic Recycling Village near Hanoi in 2008



Plastic wastes were also leaked to the environment from the storage(?) of plastic wastes.

Guideline for Preventing Leakage of Resin Pellet.

- Operation Clean Sweep
 - Various industrial associations in the world issued the manual to prevent leakage of resin pellet. The manual cover following process: pellet transport/packaging, unloading hopper cars and trucks, bagging, boxing and palletizing, other transport vehicle concerns, marine transport, waste recycling and disposal. https://p2infohouse.org/ref/05/ 04001.pdf
- Japan
 - Japanese industrial associations on plastics made the manual jointly in 1993, which cover pelletizing equipment, pellet transport and storage, molding equipment, research and testing, machine manufacturing and molding, recycling, transport and storage of plastic waste and recycled pellet, disposal of plastics.
 - http://www.jpif.gr.jp/9kankyo/cont s/gl_roboshi2_c.htmaste. (Only Japanese)

Leakage of Plastics from Factories including Recyclers

- Probably leakage of plastics from plastic industries including recycler may be smaller than littering and mismanaged waste.
- But it is important to prevent leakage of plastics from industries.
- Possible measures
 - It is better to require Environmental Impact Assessment on factories using plastics, regarding the prevention of leakage of plastics. The preventive measures should be required.
- ERIA asked AIT to make report on the study on the leakage from recycling and preventive measures. It will be published soon.

Export and Import of Plastic Wastes by ASEAN Countries. (Red Number: Import>Export)

	2017		2018		2019		2020		2021		2022	
	Import	Export										
Brunei	0.1	0.4	0.1	0.4	0.4	0.4	0.3	0.0	0.1	0.1	0.0	0.1
Cambodia	0.6	11.6	0.6	4.4	0.1	8.1	0.0	6.95	0.2	5.2	0.0	2.0
Indonesia	129.0	193.5	320.5	98.5	249.6	73.3	181.8	43.7	104.5	44.1	194.1	34.1
Lao	3.9	1.4	7.9	0.8	99.4	2.2	63.7	3.1	22.2	2.6		
Malaysia	549.8	165.8	872.5	46.1	333.5	39.4	478.0	19.0	405.0	21.3	351.2	16.0
Myanmar	1.9	39.6	3.3	11.4	2.7	6.1	10.2	7.2	12.0	2.7	11.9	4.8
Philippines	3.8	79.1	11.8	65.1	16.3	133.4	9.9	75.1	13.3	106.1	8.3	91.7
Singapore	6.4	60.7	9.0	44.1	4.2	33.6	5.6	34.7		32.4	1.4	34.7
Thailand	152.7	296.8	552.7	190.6	138.4	228.2	150.8	85.3	158.6	70.3	179.2	0.0
Vietnam	149.9	302.1	191.0	196.7	279.7	55.0	328.8	37.1	378.9	26.1		

E-waste

Copy Machine collected by Fuji Xerox in Asia and Pacific

(Australia,) Indonesia, Malaysia, Philippines, (New Zealand,) Singapore, (South Korea,) Hong Kong and Thailand

Fuji Xerox collected discarded copy machine and toner cartridge from their customer

Countries in () established recycling system separately in 2012.

Japan

Material recycling and proper disposal. Fluorescent Lamp, LCD back light, Ni-Cd battery, Selenium Drum

Thailand

Fuji Xerox established factory dismantling copy machine for recycling and toner cartridge for reuse of parts and recycling. They also conducted remanufacturing of some parts.

Most of parts are recycled in Thailand, but some of them are sent to Japan



Thailand

Most of the materials such as metals, glass and printed circuit board are recycled in Thailand

2004: Fuji Xerox **Eco-Manufacturing**, the regional recycling plant, began operating in Thailand 2005: The plant received an **ISO14001** certification **By 2010:** About 131,000 units have been collected and 21,200 tons have been recycled. The recycling rate reached 99.8%

Achievement of Fuji Xerox Eco-Manufacturing (2)

- Achievement of Fuji Xerox Eco-Manufacturing
 - The achievement of Fuji Xerox is well recognized in Thailand, Japan and other countries.
 - The factory got ISO14001 soon after starting operation.
 - Department of **Industrial Works in Thailand** gave gold Medal of Industrial Waste Management Award, several times.
 - The regional recycling system was awarded with Honda Awards for Resources Recirculation Technologies and Systems **Clean Japan Center** with support of Ministry of Economy, Trade and Industry, in 2007.
 - Hong Kong government also gave an environmental award to activities of Fuji Xerox Hong Kong, including recycling system with Fuji Xerox Eco-Manufacturing.
- But **the facility was closed in June 2019**, because Thailand Government prohibited import of e-waste, after import of e-waste increased due to Chinese ban on importing some recyclable wastes.
 - Chinese recyclers moved to Thailand and other Southeast countries, and imported recyclable wastes. These Chinese companies had processed waste to be flake or pellet of plastics, which is able to be exported to China. The recycling processes generated pollution.

Circular Economy and Supply Chain beyond Border

Non-tariff measures, such as country specific design for recycling, industrial standard for recycled products, and import restriction on recyclable wastes and secondhand goods may become barrier for circular economy beyond borders.



Extended Producer Responsibility and Related Measures

Extended Producer Responsibility: History

- Definition: An environmental policy in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle (OECD 2001)
- First five EPR policies were introduced by four states in the US and a state in Canada in 1970s, in the form of deposit and refund scheme (OECD 2013, and Kaffine and O'Reilly 2015).
- In 1991, German Packaging Ordinance apply EPR, which require producers to establish separate waste management and recycling of all types of packaging outside the public waste disposal system, to satisfy mandatory quotas for recycling.
- Some East Asian countries has applied EPR since 1990s. Recently, several Southeast and South Asian countries apply or are planning to apply EPR.

	Law	Year	Target items and responsibility
Rep ubli c of Kor	Deposit Refund	1992(Aban doned in 2003)	Producer deposit recycling fee to the government, and get reimbursement after recycling. Electronic Appliances (TV, Refrigerator, Washing Machine etc), Tires, Packaging(Carton Pack, Metal Cans, Glass Bottles, PET bottles)
ea	Extender Producer Responsibility System	2003	Government sets mandatory recycling rate, which producer should satisfy. Additional items are Home Appliances (Mobile phones, PCs, Printing Machine, Copy Machines, Fax Machines) Packages(PE, PP, PS/Vinyl), Expanded Polystyrene).
Tai wan	Waste Disposal Act	1988 (revised)	Producer and importer bear the economic responsibility on recycling. (not implemented)
	Resource Recycling Fund Management Committee	1998	The committee collect recycling fee form producers and subsidize the recycler.
Jap an	Containers and Packaging Recycling Law	1995, enforced in 1998	Local government collect target waste. Producer bear cost of recycling. Local government which have better segregation, received financial incentive from producers' financial contribution. Producer is allowed to organize collection program.
	Home Appliance Recycling Law	2001	Bit home appliances: TV, Refrigerator, Washing Machine, Air Conditioner
	End-of-Life Vehicle Recycling Law	2002	Automobile manufacturers and importers (hereinafter referred to as "manufacturers, etc.") are obliged to collect and recycle (destruct in case of CFCs) air bags and shredder residues generated in treatment process of ELVs 17

EPR Policies in Asia (2)

	Law, Plan, Institution	Year	Major Contents		
China	Regulation on the Administration of Recovery and Disposal of Waste and Discarded Electrical and Electronic Products	2009	Collecting recycling fee from producer of electrical and electronic products and distributing the fund to recycling companies to cover the cost of recycling		
Vietnam	Regulation on Recovery and Disposal of Waste Product Removal	2013	Revised in 2015. Applying EPR. (not much effective)		
	Law on Environmental Protection (rev.)	2020	EPR will be applied to packaging and container, e-waste, ELV and others.		
Singapore	Resource Sustainability Act	2019	E-waste		
	Deposit and Refund	2025	Plastic bottle and cans		
Indonesia	RegulationoftheMinisterofEnvironmentandforestryregardingRoadMap to WasteReductionbyProducers	2019	Require producers to make plan and report to reduce packaging and container.		
Philippine s	Extended Producer Responsibility	2022	Plastic waste. Mandatory recycling rate:20% in 2023, 40% in 2024, 50% in 2025, 60% in 2026, 70% in 2027, 80% in 2028		

Various Responsibilities

- Physical Responsibility
 - Mandatory recycling rate
 - Take back if consumer request
 - Setting collection point
- Financial Responsibility
 - Bear the cost of recycling
 - Manage recycling fee from consumer
- Information Responsibility
 - Information for waste generator
 - Information for recycler
 - Information on types of material, such as plastics (PET, PVC, PS and others)
 - information on hazardous material
 - Information on dismantling

- EPR Regulation does not need to mention all of responsibilities.
 - But EPR regulation should clearly define responsibilities.
- Recycling rate
 - There are different types of recycling rate.
 - Collection rate
 - Recycled Contents

Obligation: Target Indicators

- There are several target indicators.
 - (CtoR)/(PtoC) or (CtoR)/(CtoW+CtoR)
 - Collection rate for recycling
 - Lifetime of target items were durable goods, these two indicators are not same.
 - ((CtoE)+(CtoR))/((CtoR)+(CtoW)) : Effective Utilization Rate
 - (RtoP)/(PtoC) : Recycled contents



Design for Recycling: Case of PET Bottle

- A best practice on design for recycling is the voluntary guideline for the design of PET bottles developed by Japan's Council for PET Bottle Recycling. The first version was developed in 1992. The guideline has been revised several times.
 - PE or PP which gravity are less than 1 should be used for caps, in order to sort caps from PET.
 - Prohibit the coloring of PET, because waste PET with color has limited demand of recycling.
 - It is also recommended to have perforation on the labeling.
- You can access English version of voluntary standard here:
 - <u>https://www.petbottle-</u> <u>rec.gr.jp/english/design.html</u>
- In 2020, Japan's collection rate is 96.7%. Bottle to bottle recycling rate is about 32% of total recycling volume.

- PET bottle to bottle chemical recycling was approved by the Food Safety Committee in 2004.
- Bottle to bottle mechanical recycling of PET was also approved in 2012.



No color of PET bottle in Japan.



labeling of PET bottle.

Information: Act on the Promotion of Effective Utilization of Resources

- Act on the Promotion of Recycled Resources (enacted in 1991). The act was revised and renamed in 2001 to Act on the Promotion of Effective Utilization of Resources.
 - Requirement of labeling on material of container and package for source separation.
 - Specifying industries to use recycled material or reused parts: manufacturer of PVC pipe and copying machine.



Cap: Polypropylene Label: Polystyrene

Bottle: PET

Ensuring the demand of recycled products

- It is also important to ensure that demand exist for recycled products. Some recycled products may not satisfy the level of quality desired by customers or defined in conventional industrial standards for products made from virgin plastics.
- To ensure an adequate level of quality for recycled products, and to reduce the transaction cost between the suppliers and buyers, industrial standards for recycled products have been developed in Japan.
- Malaysia also developed standards on recycling products.

JIS Code	Title of Japan Industrial Standard
JIS A5731	Recycled plastics inspection chambers and covers for rainwater
JIS A5741	Products of wood-plastic recycled composite
JIS A5742	Products of wood-plastic recycled composite – assembled decks
JIS K6930	Reclaimed granulate moulding materials of agricultural polyvinyl chloride film
JIS K6931	Reclaimed plastics bars, rods, plates, and piles
JIS K6932	Recycled plastics stakes
JIS A9401	Recycled plastics medial strip block
JIS A9402	Recycled plastics buffer for parking
JIS K9797	Un-plasticised poly(vinyl chloride)(PVC-U) three-layer pipes with recycled solid core
JIS K9798	Un-plasticised poly(vinyl chloride)(PVC-U) three-layer pipes with recycled foamed core

Some Plastic Products Made from Waste Plastic Packaging and Containers.



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