



Research Office
Legislative Council Secretariat

Fact Sheet

Management of plastic waste in selected places

FS01/18-19

1. Introduction

1.1 In spite of efforts to set up collection and recycling systems, the global recycling rate of plastic waste stayed rather low at only 18% in 2015.¹ This was partly attributable to greater technical difficulties encountered in the recycling of poorly sorted plastic waste on the one hand, and lower market demand and commercial viability of recycled plastic products on the other.² As such, many advanced places used to export such waste to other places for processing, mostly to the Mainland which took up as much as two-thirds of the global trade in plastic waste in 2015.³ Most recently, such trade was severely dampened by a tightening in imports of solid waste (including plastic waste) in the Mainland to resolve its own pollution problems since January 2018.⁴ This resulted in piling up of plastic waste in some places, as local recycling systems are not well-equipped to handle this trade fluctuation. In response, some advanced places (e.g. the United Kingdom, France, Germany and South Korea) announced during March-August 2018 to step up their efforts to reduce plastic waste, such as banning single-use plastic items and setting more ambitious targets on waste reduction and recycling rates.⁵

1.2 In Hong Kong, while 14% of the plastic waste was recovered in 2016, most (99%) of such recovered plastic waste was exported to the Mainland for

¹ In 2015, the world generated about 300 million tonnes of plastic waste. Within this total, up to 18% was collected for recycling, 24% for thermal treatment, while the rest was disposed of at landfills. See Organisation for Economic Co-operation and Development (2018).

² There is a rich variety of plastic materials requiring different recycling processes. For instance, polyethylene terephthalate (PET) used in beverage bottle can be repeatedly melted and reformed, but this is difficult for other plastics (e.g. silicone kitchen utensils). How to decompose various plastic materials from a single plastic product poses a big challenge to plastic recycling.

³ Organisation for Economic Co-operation and Development (2018).

⁴ In December 2017, the Central Government announced that imports of plastic waste could contain at most 0.5% of non-target materials, with effect from 1 March 2018. This has eliminated a large bulk of existing trade on plastic waste.

⁵ For instance, France announced an action plan on plastic waste in August 2018, banning single use plastic products and making non-recyclable plastic packaging more expensive to consumers.

recycling.⁶ Local plastic recycling is almost non-existent notwithstanding some recycling measures introduced by the Government over the years, partly because of ineffective waste separation and high recycling costs.⁷

1.3 At the request of the Panel on Environmental Affairs and based on limited information in the public domain, the Research Office has broadly reviewed the policy measures taken in overseas places to reduce plastic waste and to promote plastic recycling. Three places namely South Korea, Taiwan and Germany are selected for further study, as they are widely considered to have good practices in waste management, although they cannot be immune from the adverse effects arising from the tightening of waste imports in the Mainland recently. This note is also a follow-up study focusing on the stream of plastic waste, after the two earlier information notes on "Separation and collection of household waste in selected places" and "Waste recycling system in selected places" completed in 2017.⁸

2. Management of plastic waste in South Korea

2.1 Over the past two decades, plastic waste generated in South Korea has grown by a cumulative 87% to 1.99 million tonnes in 2016, partly due to increased usage of disposable plastic items and delivery packaging for online shopping.⁹ Boosted by a number of policy measures, the amount of recycled plastic waste has increased by 50% in two decades to 413 000 tonnes in 2016. The recycling rate of plastic waste in South Korea has therefore surged from 26% in 1996 to 38% in 2016 (**Appendix**).

⁶ In 2016, a total of 904 080 tonnes of plastic waste was generated in Hong Kong, but only 125 900 tonnes or 14% were recovered for local recycling or exports after preliminary sorting and baling.

⁷ Measures introduced to promote plastic recycling include (a) providing three-coloured recycling bins for voluntary waste separation; (b) implementing plastic bag levy since 2009; (c) allocating a cheaper land slot (5 000 square metres) at Eco Park for plastic recycling since 2007; and (d) providing subsidies to recyclers under the Recycling Fund with funding support of HK\$1 billion from the Government. However, plastic waste dumped in the landfills has still grown by 25% between 2005 and 2015. The Government now plans to launch a pilot free collection scheme of plastic waste for residential buildings, schools and public bodies in 2019. It is also studying the feasibility of introducing a producer responsibility scheme for plastic containers.

⁸ These two information notes were prepared for the Subcommittee on Refuse Collection and Resource Recovery and were completed in March 2017 and May 2017 respectively.

⁹ The figures only covered plastics in mixed waste and separately discharged plastic recyclables from households and businesses. See Ministry of Environment (2018).

2.2 By and large, the national government of South Korea has introduced the following policies to reduce and recycle plastic waste over the years:

(a) **Mandatory separation of recyclable waste by households:**

Since 1995, all households in South Korea have been subject to volume-based waste charging, discouraging waste generation. More importantly, they are mandatorily required to sort the recyclable waste (including plastic waste) for separate collection since 1992, providing a more reliable supply of input for recycling in the downstream;

(b) **Extended producer responsibility system ("EPRS"):**

In short, EPRS means that producers (both manufacturers and importers) are required to be responsible for the environmental impacts of their products from the design to end-of-life phases.¹⁰ In South Korea, producers of ten different types of plastic packaging need to pay the Korean Packaging Recycling Cooperatives ("KPRC") for the collection and recycling of used packaging at prescribed rates, ranging from 65 won (HK\$0.4) to 883 won (HK\$6.1) per kg.¹¹

KPRC will then use such proceeds to hire recyclers in the downstream to meet the targeted recycling rate for plastic packaging imposed by the government, ranging from 44.2% to 80.8%.¹² In 2016, a total of 813 489 tonnes or 93.5% of the ten items of plastic packaging were recycled under EPRS;

(c) **Advance disposal fee:**

For those plastic products outside the scope of EPRS which are deemed to be more difficult to recycle (e.g. PVC pipes, plastic toys, kitchenware or plastic containers used for holding toxic materials), an advance disposal fee

¹⁰ EPRS has been implemented on a rather limited scale in Hong Kong. While the Product Eco-responsibility Ordinance setting out the legal framework for producer responsibility system was enacted in 2008, only two legislations covering waste electronic and electrical equipment and glass bottles have been passed.

¹¹ EPRS in South Korea covers four packaging materials (i.e. glass, paper, metal and plastic), but is applicable only to those producers with a minimum annual revenue of 1 billion won (HK\$6.9 million) or minimum annual imports worth 300 million won (HK\$2.07 million). More specifically on plastic packaging, the ten items cover PET bottles, polyvinyl chloride ("PVC"), expanded polystyrene ("EPS") and polystyrene paper ("PSP").

¹² KPRC estimates that it will receive about 149 billion won (HK\$1 billion) of fee and pay about 128 billion won (HK\$883 million) subsidy to recyclers of plastic packaging in 2018.

reflecting the product's estimated disposal cost is imposed on the producers.¹³ Yet, producers can be exempted from such fees if they enter into a voluntary recycling agreement with the Ministry of Environment and meet the required targets;

- (d) **Restricting the use of disposable items and plastic bags:** Since 1994, prescribed businesses (e.g. restaurants) in South Korea are legally required to restrict the use of disposable items. While large retail stores are prohibited from giving out free plastic bags, the Ministry of Environment has also entered into voluntary agreements with the retail and catering sectors to reduce the use of disposable items and plastic bags;
- (e) **Regulations on over-packaging:** Based on the Act on the Promotion of Saving and Recycling of Resources effective since 2003, the government regulates packaging method to minimize waste generation and to prohibit the use of packaging materials that are difficult to recycle (e.g. PVC);¹⁴ and
- (f) **Financing support to overall recycling industry:** The Korean government has been offering low-interest loan to the recycling industry since 1994, with a total of 103.6 billion won (HK\$714 million) granted to 230 recyclers as at 2015. It also mandates public agencies to establish procurement plans for green products including recycled products since 2004.¹⁵

2.3 Against the backdrop of the above measures, plastic recycling in South Korea has registered strong growth over the past two decades. There were over 2 600 businesses engaging in recycling of plastics of various kinds in 2015, representing a 116% increase over that in 2003.¹⁶ Reportedly, the PET bottle recycling industry is dominated by a few large businesses in South Korea, with the top four recyclers taking up 85% of the overall market of PET bottle in 2016. The largest PET recycler had an annual capacity of

¹³ The fees reflect the disposal cost of the products. For example, the fee for a plastic container of toxic material with a volume less than 500 ml is 24.9 won (HK\$0.17) and 30.7 won (HK\$0.21) for those above 500 ml.

¹⁴ Ministry of Strategy and Finance (2016).

¹⁵ Under the Act on the Encouragement of Purchase of Environment-friendly Products since 2005, government agencies shall procure products awarded with the "Good Recycled Mark".

¹⁶ Korean Statistical Information Service (2018).

70 000 tonnes, representing about one-third of the PET bottles recycled under EPRS. This plant was also reported to have employed advanced sorting technologies like near-infrared sensors in the recycling process.

2.4 That said, the local market for recycled plastics in South Korea was still small relative to the plastic waste generated. According to the Ministry of Environment, as much as 75% of the PET flakes produced there were subsequently exported to Mainland for further processing, with just 25% for domestic consumption.¹⁷ After the aforementioned waste import restriction in the Mainland, there were reports that plastic recyclables were not collected in some places of South Korea in the early months of 2018, as some recyclers of plastic waste were unable to cope with the trade fluctuations.

2.5 In response, the Korean government announced an ambitious plan in May 2018, targeting to reduce plastic waste generation by 50% and to increase the recycling rate of plastic waste to 70% by 2030. Key measures proposed include (a) phasing out from 2020 the production of coloured PET bottles which are more difficult to be recycled;¹⁸ (b) expanding the coverage of plastic products under EPRS by 20 more items by 2022; (c) reducing plastic bag distribution by large retailers by 50%; (d) enhancing public education to improve the quality of source separation of recyclable waste; and (e) establishing a fund to stabilize market price of plastic waste.

3. Management of plastic waste in Taiwan

3.1 In Taiwan, the amount of collected plastic recyclables has surged by nearly six-folds in 16 years to a record high of 358 792 tonnes in 2016.¹⁹ Within this total, most (73%) were plastic containers, followed by other plastic products (16%), while the rest was rubber products.²⁰ While there is no

¹⁷ PET flakes are recycled PET materials (through the process of sorting, cleaning and shredding) which can be reused to manufacture other plastic products.

¹⁸ The current share of coloured PET bottle was 36%, and the Korean government aims to lower the share to 15.5% by 2019 and 0% by 2020.

¹⁹ The figure covers not just plastic but also rubber waste collected by government agencies.

²⁰ According to the Customs of Taiwan, Taiwan imported 201 400 tonnes of plastic waste in 2017. It exported 132 000 tonnes of such waste in the same year, of which 52% were exported to the Mainland.

statistics on the overall recycling rate of plastics, the recycling rate for plastic containers alone was 84% in 2016, up from 74% in 2010.²¹

3.2 The following measures are taken in Taiwan to reduce plastic waste and to promote its recycling:

- (a) **Mandatory separation of recyclable waste by households:** Similar to South Korea, the volume-based waste charging scheme was implemented first in Taipei since 2000, while the mandatory requirement to separate recyclable waste at source was introduced across Taiwan since 2005. These provide a solid basis for the development of local recycling industry;²²
- (b) **Recycling Fund under EPRS:** After the amendment of the Waste Disposal Act in 1997, producers in Taiwan are obliged to recycle 33 items of recyclable waste, including eight items of plastic containers. Producers need to pay levies based on the treatment cost of individual items to a centralized Recycling Management Fund ("RMF") managed by the government. RMF will issue recycling subsidies based on published rates for different regulated items to eligible waste recyclers. The subsidy rates for recycling of different types of plastic containers now ranges from NT\$4.5 (HK\$1.1) per kg for PET container to NT\$31.6 (HK\$7.9) per kg for polystyrene foam;
- (c) **Restricting the use of plastic bags and disposable tableware:** To reduce plastic waste at source, seven trades are prohibited by law from distributing plastic shopping bags for free since 2002. The coverage has been expanded to 14 trades since 2018, which is expected to reduce consumption of 1.5 billion plastic shopping bags. Public bodies (e.g. schools, hospitals and government institutions) are not allowed to provide disposable plastic tableware since 2002, while supermarkets and food retailers are encouraged to reduce the use of plastic packaging;²³

²¹ In Taiwan, a total of 185 882 tonnes of plastic containers were recycled under EPRS in 2016, with a recycling rate of 84% for all plastic containers regulated there.

²² In 2016, its overall waste recycling rate was 52.5%, up from 12.7% in 2001.

²³ In 2016, over 2 500 supermarkets and food retailers cut the consumption of plastic packaging by 2 600 tonnes, according to the Environmental Protection Administration. Reportedly, more restrictions on plastic bag distribution and use of plastic tableware will be imposed by 2020.

- (d) **Regulations on over-packaging:** Based on the Resource Recycling Act, Taiwan began to regulate excessive packaging of certain products (e.g. bakery, cosmetics and alcohol) in July 2006, with regular product inspection by the Environmental Protection Administration; and
- (e) **Public procurement of recycled products:** To foster the development of the market of recycled products, the Government Procurement Act allows public agencies in Taiwan to offer preferential treatment to products meeting green specifications. For instance, products containing recycled materials are entitled to a price premium up to 10%.²⁴

3.3 Information on the overall situation of plastic recycling facilities in Taiwan is very limited. At present, there are 19 waste container treatment companies eligible for receiving subsidy from the Recycling Fund.²⁵ Reportedly, some recyclers are quite sophisticated, with adoption of advanced optical sensors to sort plastic waste by type for further treatment. Some recyclers also set up their own research division for product development. While some recyclers turn plastic waste into semi-products for processing, others convert them into final products like textiles.²⁶

4. Management of plastic waste in Germany

4.1 As the largest plastic user in Europe, Germany generates as much as 5.9 million tonnes of plastic waste in 2015, 110% more than that in 1994. About half of the plastic waste was plastic packaging which has also grown by 74% in amount during 2006-2016.²⁷ Analysed by treatment types, 46% of the overall plastic waste were recycled, 53% recovered as energy and just 1% sent to landfill for disposal.

²⁴ Article 96 of the Government Procurement Act was promulgated in 1999.

²⁵ According to the Environmental Protection Administration, the value of output (including paper, metal and plastics) generated by waste container recyclers was NT\$3.3 billion (HK\$800 million) in 2017.

²⁶ It is still illegal to use recycled plastic materials for food packaging or container in Taiwan.

²⁷ Despite the growth, Germany still managed to recycle 48.8% of all plastic packaging waste in 2015. See Eurostat (2018).

4.2 Below is a summary of major measures taken by Germany to reduce and recycle plastic waste:

- (a) **Mandatory separation of recyclable waste by households:** While some major states and cities in Germany have established a mandatory system of separating recyclable waste at source as early as in 1999 (e.g. Berlin), the enactment of the Closed-loop Waste Management Act in 2012 as transposed from the relevant law of the European Union has made it a nationwide requirement;
- (b) **Dual System under EPRS:** In Germany, EPRS is also known as "dual system" which was developed upon implementation of the Packaging Ordinance in 1991. In a nutshell, producers or distributors in Germany are required by law to be responsible for the packaging materials (including plastic packaging) they create or bring into the country. Producers need to recycle such materials and fulfil the recycling targets set by law. They need to join the compliance schemes for recycling operated by the private sector on their behalf, and pay for their operation. In 2017, a new Packaging Act was enacted, raising the statutory recycling targets for plastic packaging from existing 36% to 63% by 2022. In 2016, the actual recycling rate was 50%, well above the target rate of 36%;
- (c) **Deposit-refund system:** Outside the scope of EPRS, the Pfand system, which was launched in 2003, now imposes a deposit of €0.25 (HK\$2.2) for each single-use PET bottle for drinks. Consumers can be refunded the deposit upon returning the used bottles to the retailers. The system achieved a high collection rate of 98% for PET bottles in 2015, making subsequent recycling easier;
- (d) **Voluntary agreement to reduce plastic waste:** Although there is no statutory levy on plastic bags in Germany, the Federal government entered into an agreement with the retail trade in 2016 to stop distributing plastic bags for free. Since the measure was introduced, per capita plastic bag consumption has declined noticeably by 34%, from 68 in 2015 to 45 in 2016; and

- (e) **Public procurement of recycled products:** In an attempt to foster development of the market of recycled plastic products in Germany, the national green product label of Blue Angel can be awarded to products containing 80% of recycled plastics, such as office supplies, waste bags and carrier bags.²⁸ Meanwhile, under the Circular Economy Act, federal authorities are obliged to verify the recyclability, waste generation level, and recycled content of such products in procurement.

4.3 The recycling capacity for PET bottles in Germany is the largest in Europe, amounting to 560 000 tonnes per annum and accounting for 27% of the total capacity in Europe. Germany can process up to 80% of PET bottles generated by itself.²⁹ Some recycling facilities were reportedly able to handle up to 1 billion PET bottles each year, and could turn them into "food-grade" plastic products. They are also equipped with advanced sorting technologies, like near-infrared sensors, which can sort plastics by type and remove contaminants at the same time, thus enhancing the overall quality of the recycled products. As a whole, Germany is also the largest market for recycled plastic products in Europe, with 38% of its recycled plastics used in construction and 25% in packaging in 2015.

4.4 However, Germany does not recycle all the recovered plastic waste by itself. In 2015, Germany exported 1.34 million tonnes of plastic waste to other countries for processing, of which 42% was sent to the Mainland.³⁰ As Germany is one of the top traders of plastic waste in the world, it is also affected by the recent waste import restriction of the Mainland. In the face of such trade fluctuations, there are calls in Germany to further upgrade both the capacity and technology in local recycling.

5. Concluding remarks

5.1 All of the selected places could recycle part of the plastic waste, with the rest exported to overseas places mainly the Mainland for processing. By

²⁸ The Blue Angel is the eco-label of the federal government of Germany since 1978. It sets standards for environmentally friendly product design.

²⁹ Germany Trade & Invest (2018).

³⁰ It was also reported that about 10.6% of the plastic packaging waste was exported too.

and large, good practices of plastic waste management hinge on several policy ingredients, such as (a) minimizing plastic waste; (b) separation and collection of recyclable waste at source; (c) holding producers responsible for waste generated from their products under EPRS; (d) equipping plastic recycling facilities with sorting technology; and (e) encouraging public procurement of recycled products.

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Plastic waste management in selected places

	Hong Kong	South Korea	Taiwan	Germany
1. Plastic waste recycled (tonnes)	• 125 000 (2016). ³¹	• 413 000 (2016). ³²	• 443 000 (2017). ³³	• 2.72 million (2015).
2. Recycling rate of plastics waste	• 14%.	• 38%.	• Not available.	• 46%.
3. Policy measures on plastic waste				
(a) Volume-based waste charging	• No. ³⁴	• Yes (1995).	• Yes (1998).	• Yes (at local levels).
(b) Mandatory separation of plastic recyclable	• No.	• Yes (1992).	• Yes (Taipei in 2001).	• Yes (Berlin since 1999).
(c) EPRS for plastic products	• No.	• Plastic packaging.	• Plastic containers.	• Plastic sales packaging.
(d) Restrictions on distributing plastic bags	• Charge on plastic bags.	• No free distribution at large retail stores.	• No free distribution in 14 trades.	• Voluntary deal with retailers to stop free distribution.
(e) Deposit-refund system for plastic beverage containers	• No.	• No.	• No. ³⁵	• €0.25 (HK\$2.2) per PET bottle.
(f) Restrictions on distribution and use of disposable plastic item	• No. ³⁶	• Yes (at prescribed venues).	• Yes (at prescribed venues).	• Under study.
(g) Regulations against over-packaging	• No.	• Yes.	• Yes.	• No.
(h) Legislation or guidelines on green public procurement	• Yes.	• Yes.	• Yes.	• Yes.

³¹ The figure includes both local recycling and export for recycling.

³² The figure refers to the collected amount from households and small businesses only.

³³ The figure refers to plastic recyclables including foam for packaging and plastic containers collected by government agencies in 2017.

³⁴ The proposed charging scheme is scheduled for implementation at end-2020.

³⁵ Taiwan once introduced a deposit-refund system for PET bottle between 1992 and 2002.

³⁶ The Environmental Protection Department plans to commence a study on overseas practices of the control of disposable plastic tableware.

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