



THE GOVERNMENT OF THE HONG KONG
SPECIAL ADMINISTRATIVE REGION
ENVIRONMENTAL PROTECTION DEPARTMENT

Tender Ref: 12-03059

**Provision of Services for
Comprehensive Review on Estimation of Waste Recovery Rate**

Executive Summary

February 2014

AECOM

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1 Project Background

- 1.1 “Municipal Solid Waste (MSW) Recovery Rate” is one of the measuring tools to gauge the performance of recycling in Hong Kong. It is calculated in accordance with the following formula:

$$MSW \text{ Recovery Rate} = \frac{\text{Total Quantity of MSW Recovered}}{\text{Total Quantity of MSW Generated}}$$

where the “Total Quantity of MSW Generated” is the sum of the quantity of MSW recovered and the quantity of MSW disposal.

- 1.2 The total quantity of MSW recovered each year is currently derived from the sum of (i) the annual total of recyclable materials exported from Hong Kong to other places for recycling as compiled by the Census and Statistics Department (C&SD) (based on domestic export declarations submitted by exporters to the Customs and Excise Department (C&ED)) and (ii) the annual total of MSW recycled locally (estimated from the statistical surveys on local recyclers conducted by the Environmental Protection Department (EPD)). The total quantity of MSW disposal is the annual total of MSW disposed of at waste disposal sites (primarily landfills).
- 1.3 Starting from 2006, it has been observed that there is a large fluctuation in the quantity of the MSW recovered while the quantity of MSW disposal remains relatively stable. AECOM was hence appointed by the EPD to review the methodology for determining the MSW recovery rate which, as in other countries, is difficult to be developed due to lack of complete information.
- 1.4 In Hong Kong, there are three major recyclable materials of which the combined quantity contributes over 90% of the total quantity of recyclable materials recovered in any one year. They are: (a) plastics, (b) paper, and (c) metals.
- 1.5 Of the three major recyclable materials, it is the quantity of waste plastics recovered from MSW which shows a vigorous fluctuation with a trend correlating with that of the quantity of the MSW recovered and the MSW recovery rate over the period from 2006 to 2011.
- 1.6 It is therefore considered that the quantity of recovered waste plastics is the key driver giving rise to the fluctuation in the quantity of MSW recovered and hence the peculiarities observed in the MSW recovery rate in Hong Kong since 2006.
- 1.7 As such, the focus of AECOM’s review was put on the methodology for collecting information to estimate the quantity of waste plastics recovered from MSW.

2 Scope of Review

- 2.1 The scopes of the Review are:
- (i) To holistically review and investigate the abnormal fluctuation observed in the estimation of waste recovery rates;
 - (ii) To review the appropriateness of the present methodology, approach and database for estimating waste recovery rate; and
 - (iii) To propose improvement measures for the present methodology with a view to estimating a more representative waste recovery rate in future.
- 2.2 This Review comprises three main tasks, they are:

Task I – Review and investigation of the abnormal fluctuation

Task II – Review of appropriateness of present methodology

Task III – Formulation of improved or new methodology

3 Results of Surveys and Interviews

3.1 To investigate and review the methodology of estimating the quantity of recovered waste plastics, 175 key stakeholders to the waste plastics industry including waste generators (i.e. manufacturers), waste collectors, waste recyclers and traders / exporters were invited to participate in the surveys and interviews, of which 41 were successfully surveyed and/or interviewed.

3.2 The major findings from the surveys and interviews are as follows:

- (i) If the plastics are recovered from the local wastes, they must come to the hands of the local collectors / recyclers, no matter whether they are to be recycled locally or to be exported to overseas including Mainland China.
- (ii) Waste generators, collectors and recyclers are usually not clear about the definitions of domestic export, re-export and the HKHS Code 3915 (which is the code used for trade declaration of waste plastics) since they do not normally participate in the export procedure including declaration of waste plastics. Moreover, most traders / exporters also have confusion about the definitions even though exporting waste plastics is one of their main businesses and they are required to fill in the declaration forms which use these terms.
- (iii) Commercial and industrial (C&I) sectors usually dispose/recover their waste plastics arising from C&I activities by themselves without passing through the normal systems (e.g. 3-colour recycling bin systems) set up by property management companies who are responsible for collecting disposed wastes and recovered wastes in C&I buildings.
- (iv) There are local recyclers who apply process of shredding to imported waste plastics (which would change the physical form of imported waste plastics).
- (v) There are collectors and recyclers who do not register in EPD's Collectors / Recyclers Directory on which the annual Waste Recovery Survey (WRS) is based.
- (vi) Collectors and recyclers can differentiate the waste plastics collected by them from the primary sources (e.g. imported from overseas or not).

4 Review of Overseas Experience

4.1 While the formula for estimating the waste recovery rate stated in **Paragraph 1.1** can be considered appropriate worldwide, different countries / regions adopt information of different datasets for the estimation in accordance with the actual circumstances such as data availability and reliability. In general, the quantity of waste disposal can be easily assessed from the records of waste management facilities while the estimation of the quantity of waste recovered is comparatively difficult. Most overseas countries / regions adopt a combination of data sources for the purpose. According to the review of the overseas experience, there are generally three different data collection methods for the quantity of waste recovered including: (1) data collected from centralised waste management systems; (2) use of export data; and (3) surveying.

- (i) Data Collected from Centralised System or Mandatory Reporting Mechanism

Countries / Regions Adopted: Taiwan, South Korea, Singapore, US and UK

- a. Taiwan and South Korea implement volume-based waste charging schemes in which wastes and recyclable materials are collected by centralised systems for

sorting before sending to different treatment facilities (i.e. recycling facilities, thermal treatment facilities and landfills). Through this centralised sorting, accurate quantities of waste generated, recycled / recovered and disposed of can be obtained.

- b. Centralised system is also implemented in some cities and states of the UK and US, all wastes and recyclable materials are collected and processed by the system. Under this centralised system, the quantities of waste disposal and waste recovered are believed to be reliable and accurate.
- c. In some countries like the UK, Singapore, Taiwan and South Korea, waste collectors or recycling facilities are required to obtain operation permits or licenses. For instance, in Oregon of the US, recovery and recycling companies must complete surveys conducted by the authority by law.

(ii) Use of Export Data

Countries / Regions Adopted: Singapore and Hong Kong

- a. Similar to Hong Kong, trade data of domestic export and data from surveys to recyclers are used in Singapore to estimate the amount of waste recovered.

(iii) Surveying

Countries / Regions Adopted: UK, US, Singapore and Hong Kong

- a. In some cities of the UK, surveys to C&I sectors are conducted every few years to obtain the quantity of waste recovered.
- b. US EPA published a booklet of guidelines about the yearly survey on the collectors, processors and end-users to obtain the disposal and recycled amount.

5 Review of Available Data and Information

- 5.1 For those countries / regions without centralised collection or recycling systems for recyclable materials or licensing systems for recyclers, most of them including Hong Kong are facing difficulties of data scarcity. Relevant data are available at different levels of the collection and recycling system as shown in **Figure 1**.

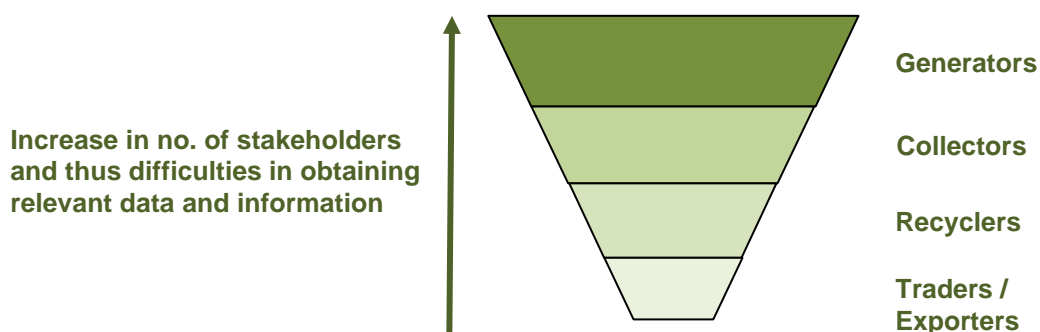


Figure 1: Graphical Presentation of Different Levels of Stakeholders in Collection and Recycling System

- 5.2 In addition to the surveys and interviews, a desktop study was also conducted on the five readily-available datasets for estimating the quantity of waste plastics recovered from MSW in Hong Kong.

5.3 As illustrated in **Figure 2** graphically, the five readily-available datasets are as follows:

- (i) Quantity of Waste Plastics Recycled Locally based on annual WRS;
- (ii) Quantity of Waste Plastics Domestic Exported for Recycling compiled by C&SD through trade declaration collected by C&ED;
- (iii) Quantity of Waste Plastics Collected from Institutions and Public Areas compiled by the Food, Environment and Hygiene Department (FEHD);
- (iv) Quantity of Waste Plastics Collected in the Source Separation of Waste (SSW) Programme reported by participated property management companies; and
- (v) Quantity of Local Waste Plastics Collected by Collectors and Recyclers based on annual WRS.

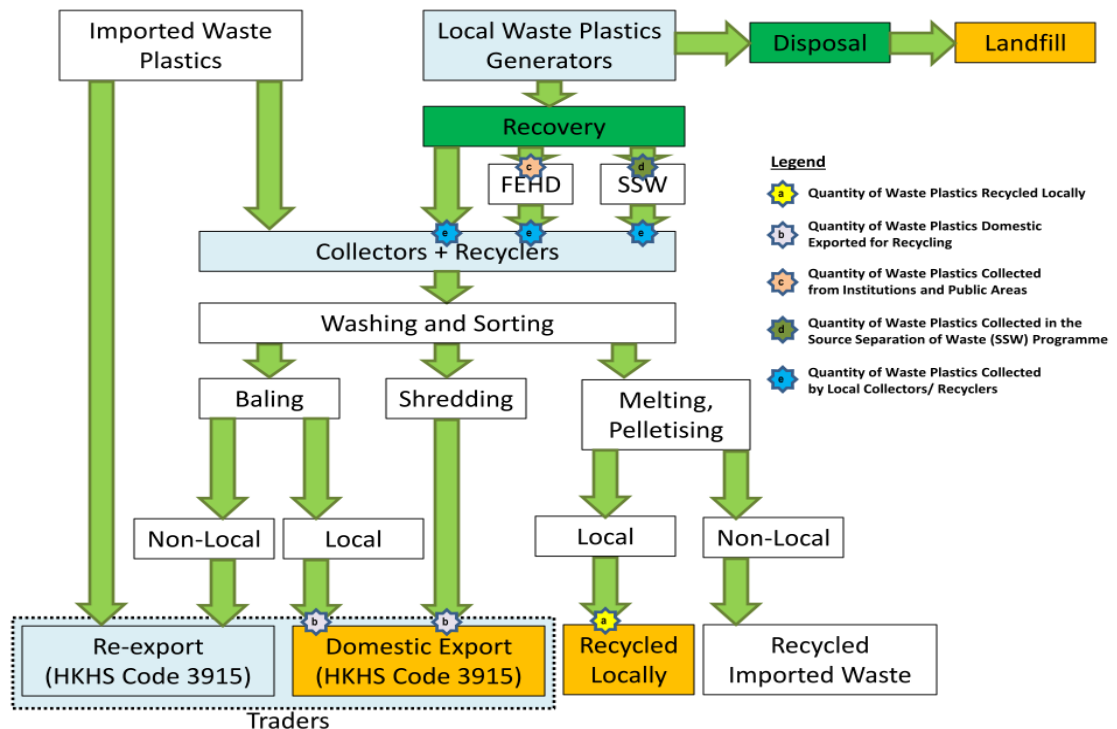


Figure 2: Graphical Illustration of the Five Readily-Available Datasets for Estimating Quantity of Waste Plastics Recovered from MSW in Hong Kong

5.4 Since waste recovery in Hong Kong is dominated by the export market of recyclable materials, the *Quantity of Waste Plastics Recycled Locally* alone cannot provide a fair estimate of the total quantity of waste plastics recovered, a majority of which is exported to overseas without going through any local recycling process (e.g. melting, pelletising etc). Therefore, at present, the first two datasets of the above list (i.e. *Quantity of Waste Plastics Recycled Locally* and *Quantity of Plastics Domestic Exported for Recycling*) are used together for estimating the quantity of waste plastics recovered from MSW in Hong Kong.

5.5 EPD estimates the quantity of local recyclable materials recovered for export based on *Quantity of Waste Plastics Domestic Exported for Recycling*. The domestic exports refer to (i) goods manufactured in Hong Kong; or (ii) products of a manufacturing process in Hong Kong which has changed permanently the shape, nature, form or use of their basic materials.

- 5.6 However, as revealed in the surveys and interviews, it is very likely the current methodology of using *Quantity of Plastics Domestic Exported for Recycling* may not accurately estimate the quantity of waste plastics recovered because:
- (i) most traders / exporters have no clear understanding of the terms used in declaration of “*Domestic Export*” and “*Re-export*”, and
 - (ii) “*Domestic Export*” figures comprise a portion of shredded imported waste plastics, which is eligible for declaration as “*Domestic Export*” (the current methodology assumes that the quantity of imported waste plastics which will be shredded and exported should be negligible and can be ignored in the estimation of waste recovery rate).
- 5.7 Besides, as confirmed in the surveys and interviews, since the waste plastics recovered from C&I activities would normally be directed to collectors and recyclers from waste generators without passing through the 3-colour bin system or the collection systems of property management companies, both *Quantity of Waste Plastics Collected from Institutions and Public Areas* and *Quantity of Waste Plastics Collected in the SSW Programme* (i.e. dataset (iii) and (iv) in **Paragraph 5.3**) do not take most of the waste plastics recovered from C&I activities into account and are therefore considered insufficient for the purpose of estimation of MSW recovery rate.
- 5.8 *Quantity of Local Waste Plastics Collected by Collectors and Recyclers*, which is compiled in the annual WRS, is the quantity of local waste plastics recovered from MSW and should not include any imported waste plastics, as these collectors and recyclers should be able to differentiate the waste plastics collected by them from primary sources. However, similar to the *Quantity of Waste Plastics Recycled Locally*, the limited coverage of EPD’s Collectors / Recyclers Directory and the non-100% response rate in the annual WRS may affect its ability to reflect the actual situation of local recycling of waste plastics.

6 Review of Current Methodology

- 6.1 The current methodology of using the *Quantity of Plastics Domestic Exported for Recycling* to estimate the quantity of local waste plastics for export is considered reasonable and appropriate considering the availability of relevant datasets. However, it may not be able to estimate the quantity of waste plastics recovered in Hong Kong accurately, especially during the period when the import / export activities of waste plastics are frequent, because most traders / exporters are not clear with the definitions of “*Domestic Export*” and “*Re-export*” in trade declaration, and some “imported waste plastics” without being processed by shredding might be declared as “*Domestic Export*”. Moreover, there are certain quantities of imported waste plastics which are shredded in Hong Kong and exported with correct declaration under “*Domestic Export*”.

7 Possible Development of New Dataset

- 7.1 Since each of the five readily-available datasets mentioned in **Section 5** has its own limitations, the feasibility to create a new dataset by conducting waste generation surveys for different types of wastes (i.e. domestic and C&I wastes) was also investigated.
- 7.2 For domestic waste plastics, a full scale territory-wide waste sorting exercise could be carried out to determine both the disposal quantity and recovery quantity of waste plastics sourced from (1) residential buildings, (2) institutional premises, and (3) public cleansing services.

- 7.3 For C&I waste plastics, a full scale territory-wide face-to-face interview of all businesses of different business sectors in Hong Kong could be conducted to determine the quantities.
- 7.4 The sum of the domestic waste plastics quantities (disposal and recovery) and the C&I waste plastics quantities (disposal and recovery) are the total quantity of waste plastics generated in Hong Kong.
- 7.5 By subtracting the total quantity of waste plastics disposal at landfills from the quantity of waste plastics generated in Hong Kong, an 'actual' quantity of waste plastics recovered in Hong Kong will be given. This introduces a new dataset for estimating the quantity of waste plastics recovered.
- 7.6 However, it should be noted that the tremendous scale of these surveys and the huge number of stakeholders to be coordinated make the direct waste survey at the sources of generation a very expensive and time-consuming exercise.
- 7.7 In fact, the study of the overseas practices of estimating the quantity of MSW recovered in this review shows that there is no country or local government, which would conduct full scale territory-wide waste sorting regularly to determine the quantity of waste disposal and waste recovered. For example, even in the UK where face-to-face interviews with the businesses are conducted to analyse the situation of C&I wastes disposal and recovered, the interviews are conducted irregularly because of the huge resources required. The last interview exercise was conducted in 2009 and the one before was in 2003.

8 Recommendations and Conclusions

- 8.1 As discussed in **Sections 5 and 6**, the shortfalls of the current methodology for estimation of MSW recovery rate are (i) the common practice of the trade in mis-reporting the quantity of domestic exported of waste plastics and (ii) the likely inclusion of processed imported waste plastics when estimating the quantity of the local waste plastics recovered for export. These shortfalls would likely result in inclusion of non-local waste plastics and over-estimation of the quantity of local waste plastics recovered for export, and thus the overall MSW recovery rate. Fluctuation in the quantity of these non-local waste plastics would lead to fluctuation of the estimated quantity of local waste plastics recovered for export, and more the import / export activities, greater the fluctuation. They are also likely the culprits leading to the fluctuation of estimated MSW recovery rates from 2006 to 2011.
- 8.2 Owing to the nature of the import / export declaration system, which is not designed for the purpose of estimation of MSW recovery rates, it is practicably not possible to determine the possible portion of non-local waste plastics in the Domestic Export figures and to adjust accordingly the quantities of waste plastics recovered for export and MSW recovery rates in the past. However, the scale of fluctuation in the quantities of waste plastics recovered and the MSW recovery rates due to the inclusion of non-local waste plastics in the Domestic Export figures might be conceptualised by comparing the estimates using the current methodology with the following approaches:
- (i) An alternative approach using the readily available dataset (v), i.e. *Quantity of Local Waste Plastics Collected by Collectors and Recyclers*, which is compiled in the annual WRS, can be used to give an indication of the lower bound estimates for the quantity of waste plastics recovered and thus MSW recovery rate. However, it should be noted that this partial value should not be adopted alone to represent the overall waste plastics recovery situation in Hong Kong due to the incomplete coverage of the WRS and non-100% response rate; and
 - (ii) Assuming zero waste plastics recovery.

8.3 The comparison is shown in **Table 1** and **Figure 3**.

Year	Estimated Quantity of Waste Plastics Recovered in Hong Kong ('000 tonnes)			Estimated MSW Recovery Rate		
	Current Methodology	Alternative Methodology	Baseline with zero waste plastics recovered	Current Methodology	Alternative Methodology	Baseline with zero waste plastics recovered
2005	644	67	0	43%	37%	36%
2006	646	134	0	46%	41%	39%
2007	820	70	0	46%	38%	37%
2008	1,024	30	0	49%	39%	39%
2009	1,211	26	0	49%	38%	38%
2010	1,577	50	0	52%	38%	38%
2011	843	136	0	48%	41%	40%
2012	317	95	0	39%	36%	35%

Table 1: Estimated MSW Recovery Rates using Different Methodologies

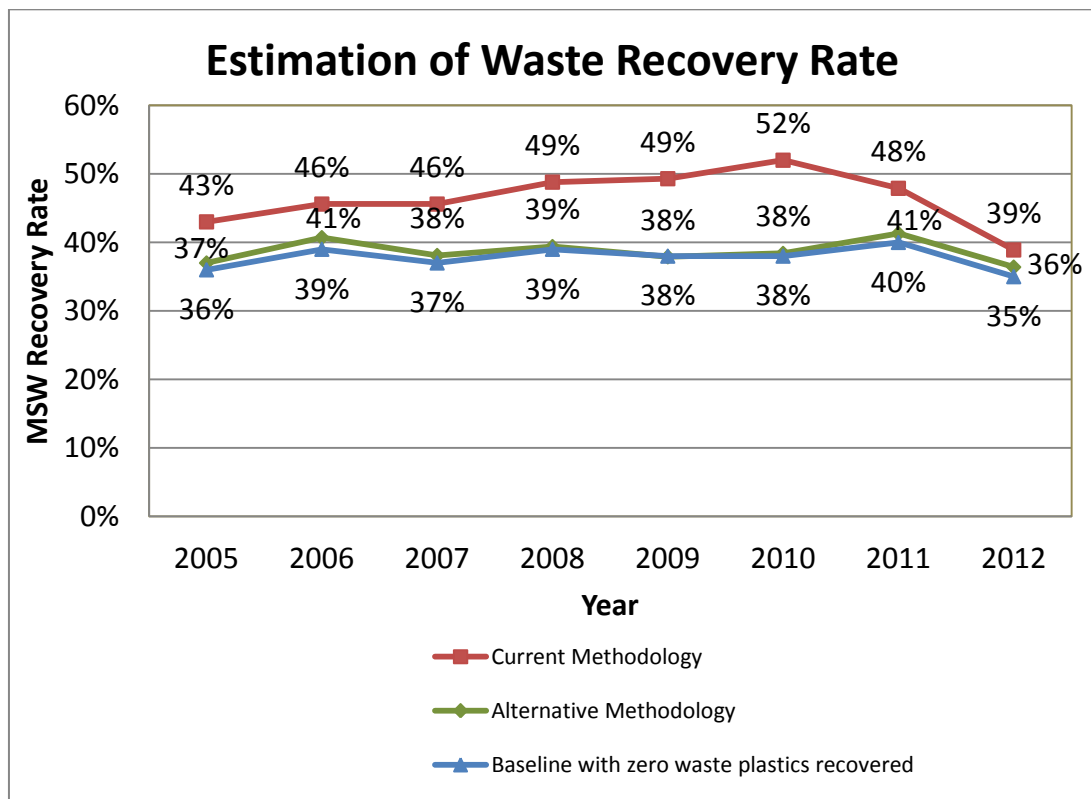


Figure 3: Graphical Presentation of MSW Recovery Rates using Different Methodologies

- 8.4 Because of the recent decrease in the import / export activities of waste plastics in Hong Kong, there has been a continuous drop in the export quantity of waste plastics since 2010. Its influence on the current methodology has also been diminished and the range of differences between the MSW recovery rates estimated by the two methodologies (i.e. current methodology and *the alternative or lower bound approach*) has been narrowed down from 14% in 2010 to only 3-4% in 2012.
- 8.5 It is therefore believed that the quantity of waste plastics recovered and the MSW recovery rate estimated by the current methodology in 2012 should reflect the actual situation in Hong Kong.
- 8.6 It is expected that a more representative quantity of local waste plastics recovered and thus the MSW recovery rate can be estimated by the current methodology with the implementation of the recommended improvement measures identified in **Table 2**.

	Datasets	Major Limitations	Suggested Measures
(a)	<i>Quantity of Waste Plastics Recycled Locally</i>	Limited coverage of EPD's Collectors / Recyclers Directory; and not 100% response rate in WRS.	(i) Mandatory registration of waste collectors and recyclers; or (ii) To enhance attraction by providing advantages and privileges exclusive to the registered collectors and recyclers and those who complete survey questionnaires.
(b)	<i>Quantity of Waste Plastics Domestic Exported for Recycling</i>	Inclusion of imported waste plastics shredded in Hong Kong.	To seek clarification from traders and exporters on the sources (imported from overseas or recovered locally) of declared quantity of waste plastics domestic exported for recycling via: (i) Supplementary questionnaire to the declaration form (Form 2); or (ii) Survey to traders and exporters who make the declaration.
		Confusions about definitions of classification for declaration.	(i) Regular refreshment courses to the traders and exporters. (ii) Produce a guideline for traders about waste classification for declaration.

Table 2: Suggested Improvement Measures to the Datasets Currently Used for Estimating Quantity of Local Waste Plastics Recovered

- 8.7 It is concluded that, as there is no other better dataset available, the current methodology of using the two readily available datasets (i.e. *Quantity of Waste Plastics Domestic Exported for Recycling* and the *Quantity of Waste Plastics Recycled Locally*) to estimate the quantity of waste plastics recovered in Hong Kong is still the most appropriate approach, though limitations of these datasets were identified.