How Regulated Recyclable Wastes (RRW) are Selected Under the 4-in-1 Recycling Program

This handout focuses on selecting RRW items, principles of evaluation, and the latest research and newly proposed RRW items for the 4-in-1 Recycling Program.

Protocols for Selecting RRW

Before a specified item is defined as RRW, several requirements need to be fulfilled: (1) preliminary studies for current status of domestic and international existing recycling programs, (2) advance preparations, such as defining of the items being considered for addition to the list of RRW, conducting an inventory of the manufacturers and importers of the items under consideration, estimating of the quantity of new products being generated and reaching their end-of-life annually, evaluating the rates at which these items would be collected and recycled, evaluating the capability and capacity of recycling plants to handle additional RRW items, estimating the costs of collection and recycling of new RRW items, and identifying how these materials should be collected for recycling, and (3) discussions, consultations, and public hearings.

(1) Preliminary studies for current status of existing recycling programs

a. Investigate current status of existing RRW in Taiwan, including quantities and rates of collection, recycling fees, and regulations.
b. Analyze the current status of the recycling and management of the potential new RRW item including relevant laws, the list/items of recyclable wastes, recycling achievements, and how recycling progress in Taiwan compares to the results of programs in other countries.

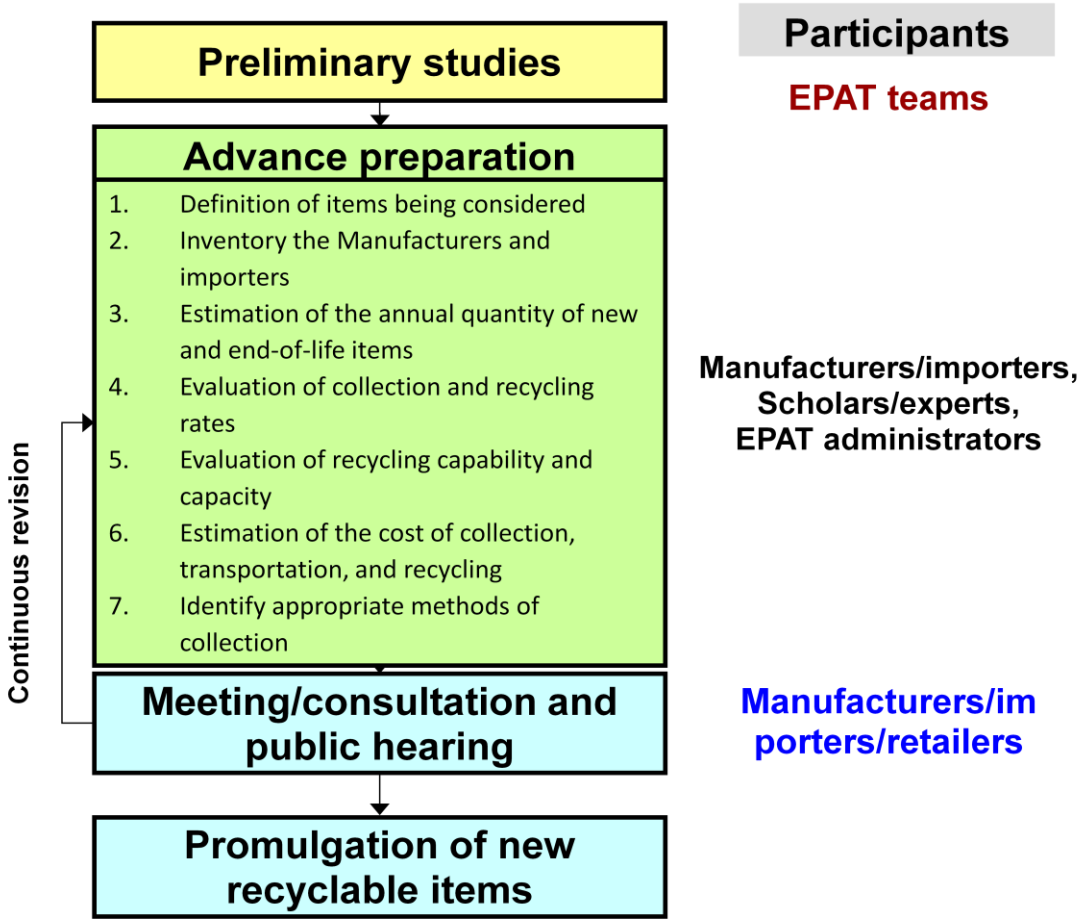

Figure 1 Protocol for selecting RRW

(2) Advance preparations

a. The items being considered for addition to the list of RRW should be defined to prevent disputes or confusion.
b. Inventory the manufacturers and importers of new RRW products.
c. Estimate the quantity of new RRW products manufactured domestically and imported.
d. Estimate the quantity of end-of-life RRW generated annually.
   The simplest way to estimate the quantity of end-of-life RRW products is to assume all products of one category have the same lifespan, which is defined by the Directorate-General of Budget. For example, the lifespan of an audio system is defined as 5 years, and therefore the end-of-life quantity of audio systems in 2011 is

equal to the quantity of new products in 2006. This estimation is applicable for certain RRW categories that include a large variety of products.

For other types of products which may have variable life spans, end-of-life quantities are calculated based on questionnaire and sales data. These data are used to estimate the distribution of life spans, or "End-of-Life Probabilities" (ELPs) for any given product. End-of-life quantities are then estimated by multiplying the ELP value and the quantity of new items put on the market for each year that the item was sold, and summing the results. An example of an ELP data set is shown in Table 1. The formula for this method of estimating end-of-life quantities is as follows:

End-of-life quantity in the Tth year

= (Quant. of new product in (T - 11) year × ELP in the 11th year)

+ (Quant. of new product in (T - 10) year × ELP in the 10th year)

+y……

+ (Quant. of new product in (T - 1) year × ELP in the 1st year)

Table 1.

Life span* (year)	Video/VCD/DVD Player ELPs
1	1.5%
2	8.7%
3	6.9%
4	5.1%
5	39.3%
6	6.6%
7	8.7%
8	9.7%
9	0.0%
10	13.8%

* Data from questionnaire

e. Evaluate the potential rates of collection and recycling.
   i. Potential collection rate: for new RRW items, we use the current collection rate of other similar items as the predicted collection rate.
   ii. Potential recovery rate: this is the ratio of total weight of recyclable parts/material to total weight of the product. The practical dismantling procedure would be an issue of discussion with recyclers.

f. Evaluate the capability and capacity of recycling plants to handle additional RRW items.
   i. Capability: for example, most recycling plants in Taiwan are capable of recycling WEEE except for special substances like fluorescent powder and liquid crystal panels.
   ii. Capacity: we propose to first investigate whether existing recyclers have the capacity to handle potential new RRW. For example, according to 2010 statistics, our capacity for WEEE recycling is 330,360 tons/year. Nevertheless, the actual recycling volume is less than 90,000 tons (< 30%), so a large amount of capacity exists to recycle additional WEEE items.

g. Estimate the cost of collection, transportation, and recycling.
   Based on existing recycling fee rate formula and survey data, the total cost of collection, transportation, and recycling a potential new RRW item can be estimated. The purpose of the estimation is to provide a quick reference of fee rate for manufacturers and importers of new RRW products so that they have some basis to choose an appropriate recycling program.

h. Identify appropriate methods of collection.
   Under the Waste Disposal Act, RRW may be collected by municipal collection teams, private collectors, or through retailers' takeback programs.

(3) Contact relevant enterprises and call for advisory meetings and public hearing.
   After prioritizing items for addition to the list of RRW, Environmental Protection Administration Taiwan (EPAT) will contact relevant

producers, retailers and recyclers in person or by phone and call advisory meetings. The purpose of meetings is to the scope of products, price, sales volume, recyclers' capability and capacity, and likelihood that recyclers will accept the new RRW items. When the draft regulation is complete and a preliminary announcement has been made, EPAT has to invite all relevant associations and industries for a public hearing.

Principles of Evaluation for New Recyclable Items Selection

In evaluating potential items for regulation under the 4-in-1 Program, EPAT considers environmental impact as the primary factor. If certain items may cause serious pollution if recycled or disposed of improperly, they should be prioritized for regulation and be recycled with higher subsidies. On the other hand, if an item does not cause severe pollution, it can be recycled by the existing recycling market without subsidy. Figure 2 shows how the combination of environmental impacts and residual values after recycling can influence the decision to regulate an item as RRW. Items that are most frequently chosen for regulation are those with high potential for environmental impacts and low potential for being recycled for profit by regulated enterprises. Additional factors influencing the decision to regulate may include (1) high household usage, (2) large quantity of waste generation and (3) feasibility of regulation.

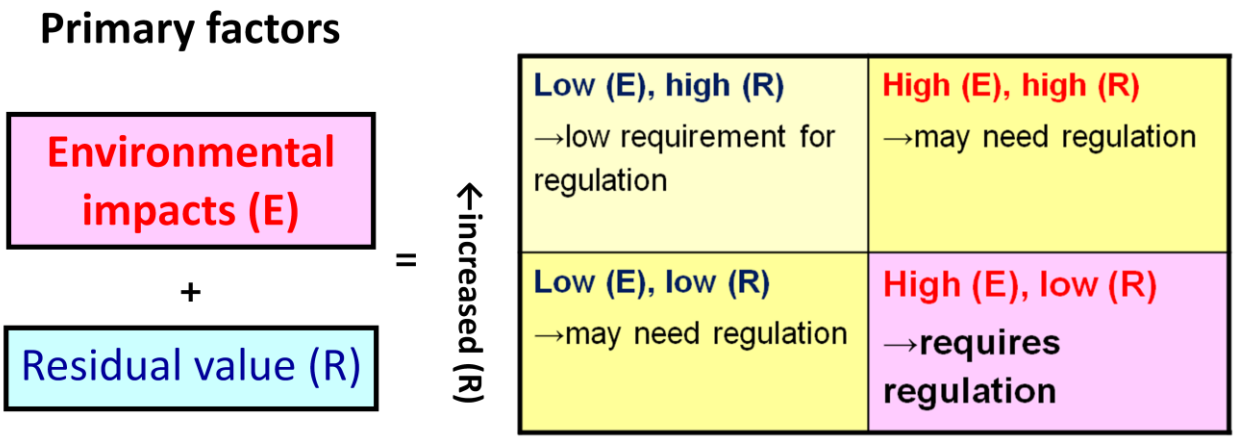

Figure 2 Principles of evaluation for new recyclable items selection

Latest Research and Newly Proposed RRW Items

The authors of this handout were commissioned by EPAT to determine which WEEE items could be added to the list of RRW. Based on the latest research commissioned by EPAT, certain WEEE items have been given high priority for regulation under the 4-in-1 Program: (1) cassette tapes, CD and MP3 players and recorders, VHS, VCD and DVD players and recorders, dehumidifiers, telephones and fax machines.

The collection models for these priority WEEE items are suggested as follows:

(1) Players and recorders: since the variation is large between products and residual value is low, the interest of recycling on the market is low. It would be challenging for municipal collection teams to justify collecting these items for recycling. Since several manufacturers showed their acceptance to pay recycling fees, the subsidy is then available as the incentives for collectors/recyclers to carry out collection. We have proposed to list players and recorders as RRW.

(2) Telephones: since the residual value after recycling is low, most private companies refuse to collect these items for recycling. If the waste items are collected by municipal collection teams, there are no downstream treatment facilities readily available for large volumes. Further, due to market selection (ex. increasing popularity of mobile phones), the number of manufacturers and importers has diminished from a few hundred to a few dozen. Listing the item as RRW would put pressure on existing manufacturers and importers. However, the trade association has agreed to collect waste items on an administrative contract basis; therefore, it was proposed to list telephones as wastes to be recycled by manufacturers and importers on an administrative contract basis.

(3) Dehumidifiers: with the high residual value for common products with compressors, the domestic recycling rate of dehumidifiers is high. We suggest that municipal collection teams collect them for recycling and recommend listing these items as RRW only when it is necessary.

(4) Fax machine: there are unifunctional and multifunctional fax machines which have additional capabilities such as printing and scanning. The former has fair residual value and declining market share, so in the near future there might be no manufacturers or importers paying recycling fees if the unifunction fax machine

is listed as RRW. Multifunction machines have been listed as RRW if a printing function is incorporated. We suggest that unifunction fax machines are appropriate for municipal collection teams to collect and recommend listing these items as RRW only when it is necessary.