Determining the rational cost of product and packaging recycling (Fs) for extended producer responsibility (EPR)

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According to the provisions of the Law on Environmental Protection (LEP) 2020 and Decree No. 08/2022/ND-CP dated January 10th, 2022 of the Government detailing a number of articles of the LEP, manufacturers, and importers of several types of products (batteries - accumulators, lubricants, tires, electricity and electronics, vehicles) and some packaging (food, cosmetics, drugs, fertilizers, animal feeds, veterinary drugs, detergents, household, agricultural, medical preparations, and cement) have to take responsibility for recycling such products and packages according to required recycling rates and recycling standards with the roadmap regulated by the Government.

Accordingly, the responsibility to recycle products and packaging will be taken by manufacturers and importers of products including batteries- accumulators, tires, lubricants and packaging (commercial packaging of food, cosmetics, drugs), fertilizer, animal feed, animal medicine, detergent, and commercial cement) will be applied from January 1st, 2024; the manufacturers and importers of electrical and electronic products will carry out their recycling responsibility from January 1st, 2025; the manufacturers and importers of vehicle products will take responsibility for recycling from January 1st, 2027.

Manufacturers and importers could choose one of two options to fulfill their recycling responsibility: (1) do recycling activities by themselves or (2) make financial contributions to the Vietnam Environmental Protection Fund (VEPF) to support the recycling of products and packaging. In case manufacturers and importers choose option No.2, the contribution amount for each type of product and packaging is calculated according to the formula:

F = R x V x Fs

F *is the total amount that manufacturers and importers must pay for each type of product and package (unit: VND).*

R *is the required recycling rate for each type of product and packaging (unit: %).*

V *is the volume of products and packaging produced and imported (unit: kg).*

Fs *is a rational cost of recycling for a unit volume of product or packaging, including costs of sorting, collection, transportation, product recycling, packaging, and management costs. Administrative management to support manufacturers' and importers' recycling responsibility (unit: VND/kg).*

The determination of *Fs* will decide the implementation of manufacturers' responsibilities. The manufacturers must estimate how much they will have to do with their recycling responsibility. It is one of the factors for a manufacturer to consider whether to organize their recycling or pay for the VEPF. So, the determination of this *Fs* is conducted by what principle and by what method?

The principle to determine *Fs*

Fs is an important factor in the EPR mechanism because it derives from two goals of the mechanism.

Firstly, creating a relatively stable financial source corresponding to the number of products and packaging that manufacturers and importers put on the market to conduct or support the collection and recycling of products, packaging, and treatment of waste generated in these activities.

Secondly, it influences the process of design, production, distribution, and consumption to reduce the manufacturer's responsibility through changing product design, changing the use of packaging, using environmentally friendly materials, prolonging product life cycle, easy to collect and recycle. Fs is the factor to promote the above two goals because it will directly create funds to support the collection and recycling of packaging products when manufacturers choose to pay money to the VEPF. At the same time, it will affect the recycling market in shaping or adjusting the cost of recycling in the market. Both the above effects force manufacturers and importers to promote the second goal to reduce the amount of money they must spend to collect and recycle products and packaging.

Therefore, the principle of determining *Fs* is very important to achieve the goals of exterded producer respornsibility (EPR) as well as to ensure the feasibility of the EPR mechanism.

The first principle, in compliance with the regulation on *Fs*, whereby, *Fs* must be a reasonable and valid cost for a unit volume

of product, and packaging, including the cost of sorting, collection, transportation, product recycling, packaging, and administrative costs support the implementation of recycling responsibility of manufacturers and importers. These are the basic costs of sorting, collecting, and recycling packaging products. As for the administrative costs to support the implementation of the recycling responsibility of the importing manufacturer, this is part of the expense that is deducted to serve the management and operation of the EPR system of the National EPR Council, Vietnam EPR Office, and VEPF under the decision of the Prime Minister.

With this principle, *Fs* will tend to be higher than the actual recycling cost of the market due to the administrative costs to be considered. This regulation is intended to enforce the principle of encouraging import manufacturers to organize their recycling (either by themselves, by hiring a recycler, or by authorizing a third party to perform EPR responsibilities) and finally is a way to contribute money to the VEPF.

The second principle: Fs is determined based on the consideration of expense relating to the design and material composition of products and packaging. For products and packaging designed easy to collect and recycle, *Fs* tends to be lower. As mentioned above, the most important goal of EPR is to motivate manufacturers to change their designs towards environmentally friendly products that are easy to collect and recycle, so these factors must be considered when determining the *Fs*, which must be lower than the basic recycling cost of the same product and packaging brought to market. To meet this criterion, some characteristics could be determined such as the use of fewer different materials in the same product or packaging; the ease in distinguishing, classifying, and separating different materials from products and packaging; the color of product, packaging…

The third principle: Fs is determined to ensure feasibility, suitability of production and recycling practices, the development of Vietnam's recycling infrastructure, and in agreement with market principles. This is the orienting principle, ensuring that *Fs* is highly agreed upon by most manufacturers, importers, recyclers, and processors. Because *Fs* not only determines the amount that manufacturers and importers contribute to the VEPF but also greatly affects the price of collection and recycling in the domestic market.

So how to determine *Fs*?

Currently, scientific experts, manufacturers, and importers are discussing to choose a method to determine *Fs,* of which three main methods have emerged:

The first method, determining the basic level of recycling costs and advanced recycling costs is proposed by the Institute of Environmental Science and Technology (INEST), Hanoi University of Science and Technology:

- The basic recycling rational cost is the rationale determined based on the average costs in the collection process and the minimum cost in recycling to achieve the minimum recycling standard specified in column 5. Appendix XXII of Decree No. 08/2022/ND-CP.

The minimum cost in recycling to achieve the minimum recycling standard specified in column 5, Appendix XXII of Decree No. 08/2022/ND-CP is assessed by experts and recyclers as can be determined based on the quantified costs of recycling and the average technology depreciation. However, the cost of collection is problematic because it is highly dependent on transportation costs. With low mandatory recycling rates and available collection materials, the collection distance can be close; but with a high mandatory recycling rate, and the collected materials are distributed far from the central area or the recycling area, the transportation costs will increase accordingly. Therefore, determining the average collection cost will be very difficult. According to INEST's survey, the basic recycling cost for PET materials is from 17,000 VND/kg to 28,000 VND/kg.

- Advanced recycling cost is a recycling cost added to the basic rational cost, this cost is determined by the difficulty level in collection and recycling of the product (such as using a lot of materials, color use, hazardous wastes, size of packaging products, domestic recycling technology has not been met...). This is also a difficult requirement in determining advanced costs because current products and packaging are very abundant in design as well as the use of materials, and especially the design is based on consumer trends which may change frequently, it will be relatively complicated to determine additional costs.

Also, according to INEST's research, the advanced recycling costs applied to products and packaging mainly depend on the degree of convenience in collection and recycling. In France, glass bottles with non-magnetic (non-metallic) caps are subject to a 10% increase in cost; a multi-layer or multi-material packaging is charged an additional 50%, and in the case of products made from non-recyclable materials or opaque PET bottles with more than 4% filler will be charged up to 100%. The manufacturer's recycling cost for colorless PET bottles is EUR 200/ton, while for colored PET bottles, it is EUR 470/ton.

The second method, proposed by the Vietnam Packaging Recycling Organization (PRO Vietnam) and Duy Tân Plastic Recycling Company, is based on the determination of (i) The rationale of collection costs (with relevant variables up to the required recycling rate) plus; (ii) the minimum rationale of recycling cost at the recycling plant:

- Regarding the minimum rationale of cost at the recycling plant, similar to the first method, this is the cost of recycling to achieve the minimum recycling specification specified in column 5, Appendix XXII of Decree No. 08/2022/ND-CP. Duy Tân Plastic Recycling Company gave an example of PET plastic recycling, this recycling cost accounts for more than 30% of the total cost and this cost level is relatively stable and does not fluctuate much (Table 1). Thus, it is possible to determine the cost of recycling at the factory easily and achieve a high consensus from recyclers as well as manufacturers. As for the cost of collection, there will be large fluctuations depending on the distance in the collection. The reason the cost of PET collection in Duy Tân Company's report does not change much is because the current amount of PET scrap is relatively large, which can be collected near the recycling area.

- For a better understanding of the variation in collection costs, let's look at PRO Vietnam's Report on this issue. Accordingly, for each mandatory recycling rate, the cost of recycling will increase in proportion to the increase in the mandatory recycling rate. It can be seen that, with a mandatory recycling rate of 10%, in the first column, the recycling cost of PET is 651 VND/kg, this cost increases in the next columns because the recycling rate increases by 10 % per column, to column 6 with a mandatory recycling rate of 60% (this is hypothetical since the current mandatory recycling rate for PET packaging is 22%) has increased 6 times.

According to the PRO Vietnam Report, the reason is due to the increase in transportation costs in a larger area resulting from the search for materials far from the recycling area. However, it can be calculated how much the collection cost will increase for every 10% increase. For PET, the first 10% of the recycling cost is 651 VND/kg; the next 10%, the recycling cost is 1,303 VND/kg, increasing to 200%; also the next 10% increase by 300% over the first 10%; The next 10% increase by 400% compared to the first 10%…, so it is possible to determine the collection cost based on the rate to be collected to determine relatively accurately the cost of collection (Table 2). This is a method that can be considered to apply, as it will avoid disagreements in determining *Fs* because it is a scientific and practical method.

The third method: Determine the cost of recycling based on revenue and adjustment factor proposed by INEST, this is a method based on the expected profit ratio and revenue of the recycler, according to that, *Fs* still has to take into account the recycling and collection costs and consider the material properties for example *Fs* will be determined based on the sum of the

Table 1. Recycling costs for PET plastic packaging in 2022

2022	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	Ave	Ratio %
Cost of collection, classification and transportation VND/kg	16,000 won	16,000 won	16,500	17,300	17,850	17,950	18,000 won	17,700	16,500	16,500	16,900	17,200	17,033	
Loss rate	33%	32.40%	24.40%	26.60%	23.50%	35.00%	40.40%	42.70%	27.80%	38.60%	34.00%	35.00%	33%	
Total cost of raw materials VND/kg	21.245	21,184	20.526	21,909	22,044	24,238	25.278	25.262	21.094	22.869	22,646	23,220	22,626	66.40%
Recycling cost VND/Kg	9,975	10,500	10,300	9,900	10,700	9,850	10,100	10,250	11,000 won	11,500	10,350	9,000 won	10.285	30.20%
Environmental treatment cost VND/kg	1,000 yen	1,250	1,300	950	1,150	1,050	1,450	1.230	1.140	1.230	980	1.020	1.146	3.40%
Total cost (No profit, interest) VND	32.220	32,934	32.126	32.759	33.894	35.138	36.828	3,742	33.234	35,599	33,976	33.240	34.057	14%
Primary PET plastic VND	28.543	31,360	32,977	31,801	32,267	34.055	29,890	31.115	29.155	27,685	25.480	24.010	29,861	

▲ *Source: Mr. Huỳnh Ngọc Thạch - CEO of Duy Tân Plastic Recycling Company*

Table 2. Packaging recycling cost rationale according to the required recycling rate

Packaging Type \ Required recycling rate	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Carton packaging (VND/kg)	434	869	1.303	1.737	2.172	2.606	3.040	3.475	3,909	4.344
Mixed paper packaging (VND/kg)	1.334	2,669	4,003	5.338	6,672	8,006	9,341	10,675	12,009	13.344
Aluminum packaging (VND/kg)	465	930	1.396	1.861	2.326	2.791	3.256	3,722	4.187	4.652
Packaging of iron and other metals (VND/kg)	536	1.072	1.608	2.144	2,680	3.216	3,752	4.288	4.824	5.359
Hard PET packaging (VND/kg)	651	1.303	1,954	2.605	3.257	3,908	4,560	5.211	5,862	6.514
Hard HDPE, LDPE, PP, PS packing (VND/kg)	886	1,772	2,658	3.544	4,430	5.316	6,202	7,088	7,973	8.859
Hard EPS packaging (VND/kg)	2,000	4,000	6,000	8,000	10,000	12,000	14,000	16,000	18,000	20,000
Rigid PVC packaging (VND/kg)	1,450	2,900	4.351	5.801	7.251	8.701	10.152	11,602	13,052	14.502
Other hard plastic packaging (VND/kg)	1.088	2.176	3,264	4.352	5,440	6.528	7.616	8.704	9,792	10.880
Single packaging of soft materials (VND/kg)	1.116	2.233	3.349	4.466	5.582	6,699	7.815	8,931	10.048	11.164
Soft multi-material packaging (VND/kg)	1.295	2,590	3.885	5.180	6.475	7,770	9.065	10.359	11,654	12,949
Bottles, jars, glass boxes (VND/kg)	593	1.186	1,779	2.372	2,965	3.558	4.151	4,744	5.337	5,930

▲ *Source: Mr. Fausto Tazzy - Vice President of PRO Vietnam*

recycling cost norms of each material contained in the product (Table 3). For example, in bottled water, if the manufacturer declared a way to attract materials, there are 2 types of plastic: PET and PP (because the labeling material is attracted to the cap): PET volume accounts for 80%; PP accounts for 20%: then the Fs of PET will be 80% of the PET recycling rate plus 20% of the PP recycling rate. This method only calculates the cost of recycling in the factory, the calculation of the collection cost will be balanced by the recycler based on determining the balance between profit and cost of recycling in the market to make a decision.

With this method, the most important thing is to determine the expected profit ratio and revenue of the recycler. This will be easily determined according to market principles through quotations or bidding. However, the agreement on the rate of expected profit and revenue will not be fair to recycling facilities with different levels of technology and products.

▲ *Tires are one of the products that manufacturers and importers must be responsible for recovering and recycling*

Table 3. The determination of recycling rational costs based on revenue

Packaging Type / The costs	Material Type				
	Waste PP granules	PE	ABS	PC	POM
Price of recycled plastic pellets, VND/Kg	15,000-18,000	15,000-23,000	35,000-40,000	55,000-60,000	40,000-50,000
Cost of buying raw materials	30%-40%	30%-40%	30%-40%	30%-40%	30%-40%
Electricity costs	10%-15%	10%-15%	10%-15%	10%-15%	10%-15%
Chemical cost	-	-	-	-	-
Other costs	3%	3%	3%	3%	3%
Equipment depreciation	5%	5%	5%	5%	5%
Tax	10%	10%	10%	10%	10%
Labor cost	10%	10%	10%	10%	10%
Shipping costs for purchasing raw materials	40%	40%	40%	40%	40%
Shipping costs for selling products	1-2%	1-2%	1-2%	1-2%	1-2%
Rental cost	10%	10%	10%	10%	10%
Average profit	10 - 15%				
The lowest acceptable profit	3 - 5%				

▲ *Source: Assoc. Prof. Dr. Nguyễn Đức Quảng, Institute of Environmental Science and Technology (IEST), Hanoi University of Science and Technology*

Regardless of the method used, currently, the cost of recycling is still dominated by the cost of collecting scrap, to serve the existing private collection system. This is the difference between Vietnam compared to EPR systems in other countries, especially Europe (EU). In the first stage of implementing the EPR mechanism, the recycling cost norm should still consider the cost structure of scrap collection to ensure the maintenance of the collection system in terms of social security. When the system of waste classification and collection at source is built in localities according to the provisions of the Law, there will be an adjustment related to the waste collection cost of the recycler.

Another main issue is the determination of the transportation cost in the total recycling price. In a certain area, the cost of transporting recycled products and packaging is quite fixed and according to the shipping price bracket of the market. When you want to increase the amount of recycling, you may have to expand the collection area and from there, the transportation cost may be higher. To solve this problem, a second method can be consulted so that a high consensus can be reached from recyclers, collectors, manufacturers, and importers. However, it is also necessary to refer to the advanced recycling cost calculation according to the first calculation method to ensure the goal of EPR as described above ■

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