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New directions for the Japanese system of e-waste recycling

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Abstract

The Japanese government is in the process of making plans to create a new system for the recycling of small electronics appliances (audios, DVDs, mobiles, etc). t The law was approved by the t Diet in August 2012. In this paper we set out to analyse the merits and problems of the new proposed scheme by means of an e-waste flow analysis, a cost and benefit analysis and a regime actor analysis. We have taken the data for our examination from the final official report presented to the Japanese Ministry of the Environment, "*A Proposal for a Recycling System of Small electrical and electronics appliances*" (March 2012).

Keyword: e-waste, Japan,small electrical and electonics appliances

1. The background to the proposal

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The current Japanese system for the collection and recovery of electrical and electronics appliance classifies four types of appliance and their methods of collection:

(1) 4 items (TV sets, air conditioners, washing machines, refrigerators) are collected according to the stipulations of the home electrical appliances recycling law. Consumers have to pay a recycling fee at the time of disposal.

(2) PCs are collected in accordance with the promotion law for resource utilization (the 3 Rs law), but the recovery rate of the manufactured items is very low because each used PC retains its own economic value.

(3) Mobile phones are collected voluntarily by a telecommunications carrier.

(4) Other items are partly recovered by the municipality.

(see Figure1 and Table 2)

Since analog TV is being phased out, the number of the first 4 items collected has recently been increasing, but once the obsolete sets have all been collected the number will obviously decrease. At the same time, more than half of the used company PCs are reused and exported because of their market value. The other items, however, are partly recovered by the municipality and unauthorized waste collectors.

Suggestions for the recovery and recycling of the other items are consequently being proposed; three factors lie behind the proposals:

(1) metal resources are limited and their prices are rising sharply (a resource problem). (Figure 2);

(2) in non-formal cases, metals are directly disposed of instead of being recycled (environmental and resource problems);

(3) the trans-boundary movements of used appliances are a potential cause of environmental problems in the countries to which the appliances are moved.

Figu

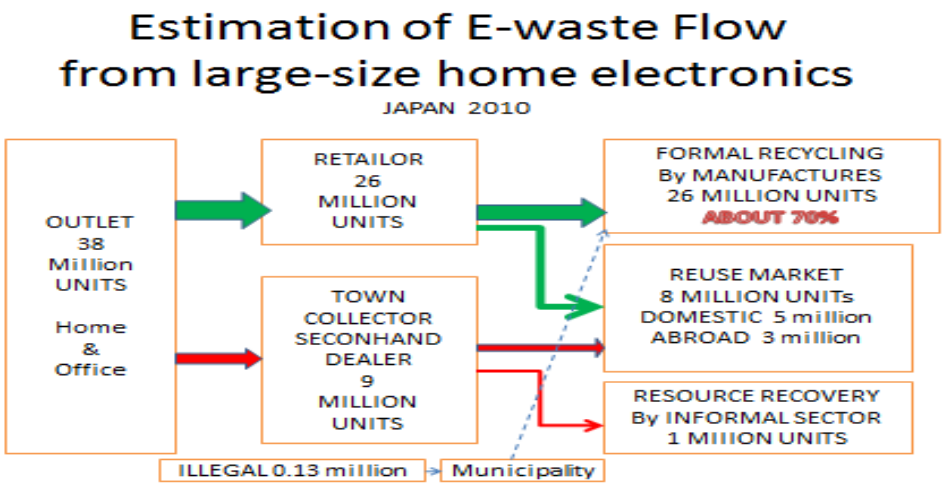


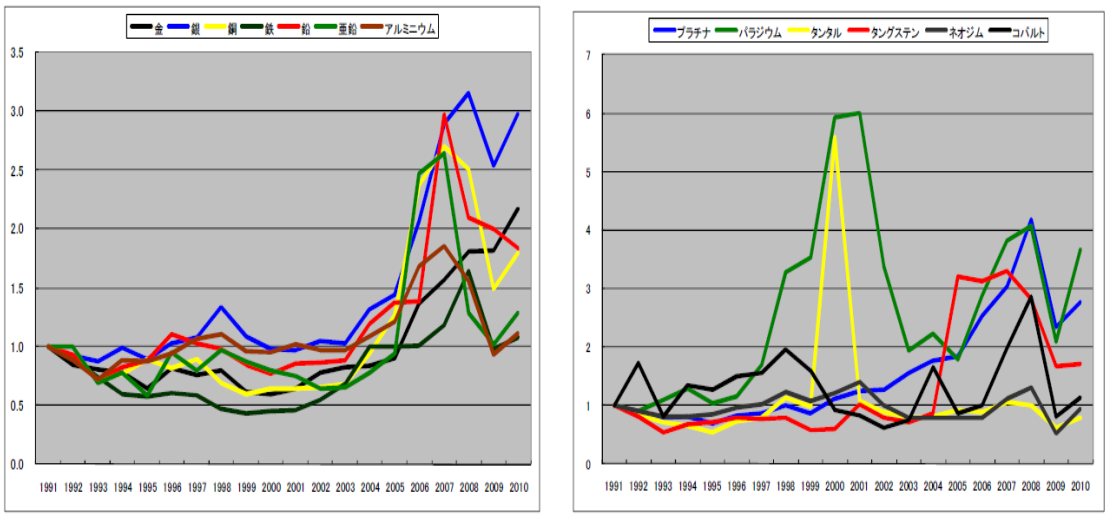
Table1 metals contained in e-waste

Small scale e-waste: Be, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Br, Mo, Ru, Ag, Cd, Sb, Te, Cs, Ba, Ta, Tl, Pb, Bi, Hg

4 big items (TV, air conditioner, washing machine, refrigerator): Hg, As, Sb Pb Zn, Sn, Cd, Cr, Sb

Automobile: Li, Ni, Co, Nd, Dy, Pt, Pd, Rh, Cr, Mn, Ni, V, Co, W,Mo, Ga, Ta, Ti, Zr, Nb, In

Figure 2 the price hiking of metals



The estimated total amount of metals present in the discarded used small house appliances comes to about 279 thousand ton per year, which has the value of 84.4 billion JPY. Yet even if all the potential metals are recovered, they will constitute only a tiny proportion of the domestic metal demand, amounting, for example, to only 6.4% of the gold required, 3.7% of the silver, 9.4% of the tantalum (see Table 3).

Table 2 present situation of metal recycling from used electrical goods in Japan

	Volume/ton	Recycling law	Promotion Law for Utilization	Guide Line	iron	Al	Base metal	Precious metal	Rare metal	Recovery And recycling
4 items	10-100mil.	●		●	○	○	○	○	○	Home electrical appliance recycling law
PC	Under 0.10mil.		●	●	○	○	○	○	○	Promotion law for utilization
Copy machine	Under 0.01			●	○	○	○	○	○	voluntary
Mobile	Under 0.01			●	○	○	○	○	○	voluntary
Others	10-100mil.			△	○	○	○	○	○	Partly recovery by municipality

Table 3 a comparison of the metals contained in used small-scale e-waste and the domestic demand for metals

		Domestic Demand Ton	Small scale house appliance					
					Mobile		PC	
			Ton	domestic	Ton	Domestic	ton	domestic
Base Metal	Fe	94291000	230105	0.2%	418	0.0%	16845	0.0%
	Al	4002000	24708	0.6	50	0.0	3914	0.1
	Cu	1763000	22789	1.3	1001	0.1	2730	0.2
	Pb	251000	740	0.3	19	0.0	220	0.1
	Zn	489000	649	0.1	44	0.0	70	0.0
Precious Metal	Ag	1870	68	3.7	10	0.6	21	1.1
	Au	166	10	6.4	1.9	1.2	4.5	2.7
Rare Metal	Sb	7666	117	1.5	2.3	0.0	3.5	0.6
	Ta	360	33	9.4	3.2	0.9	14.9	4.1
	W	4000	33	0.8	27	0.7	1.1	0.0
	Nd	7000	26	0.4	18	0.3		
	Co	16260	7	0.0	2	0.0		
	Bi	682	6	0.9	0.7	0.1	0.8	0.1
	Pd	131	4	3.1	0.5	0.4	2.1	1.6

2. The flow estimation of used electrical goods

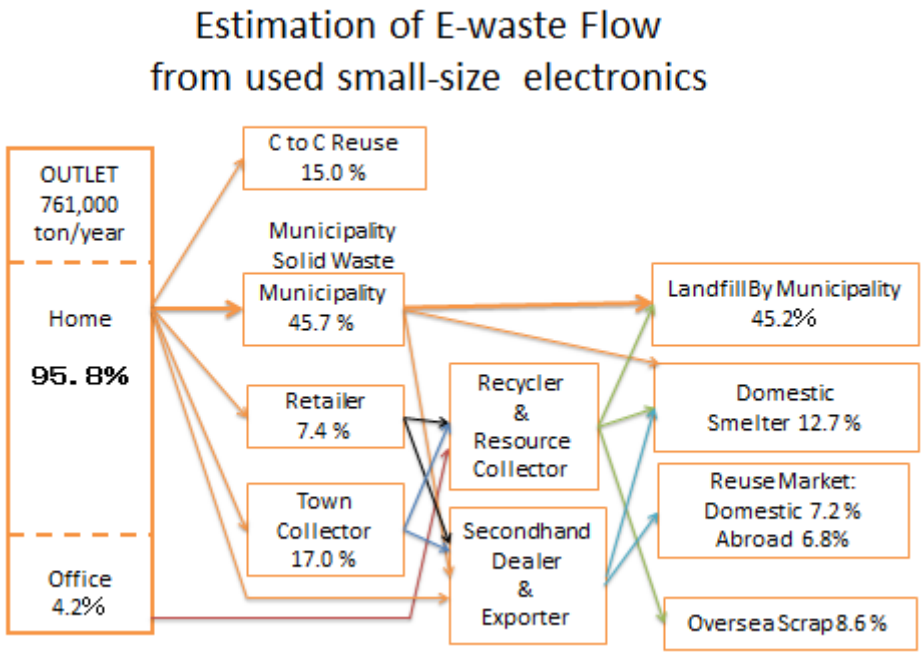
Total used small electrical goods are generated 761,00ton /year.
(1) 95.8% of which come from home
(2) 45.8% of which collected by municipality and landfill
(3) 10% is picked up from municipality deposit
(4) Office used goods are treated as industrial waste
(5) Domestic reuse and recycling is up to 20%
(6) Oversea reuse and recycling is 15%

Table 4 used small house appliance with a storage rate of over 30%

Attachments of small house appliances (remote control, keyboard, mouse, modem, plug)	60%
Clock, watch	59%
Mobile phone	52%
Video, DVD,	39%
Electrical cooking machine	35%
Flash-light	34%

Lighting	34%
Camera	31%
Music player	31%
Calculator	30%
Game machine	30%

Figure 3



3. The proposal of new scheme

Against this background, a new scheme for the recycling of small electronics appliances has set up the following targets:

(1) The stable recovery and supply of specified metals (90 items are listed as potential targets);

(2) An extension of the lifetime of final disposal sites;

(3) The appropriate treatment of harmful substances.

The main points of the proposed system and the actors who will carry it out are

(1) the municipality, who will encourage optional recovery of small house appliances by setting up collection boxes or stations,

(2) retailers, who will cooperate with the municipality over recovery,

(3) waste treatment facilities and recyclers under contract to the municipality, who will carry out

appropriate recycling with a wide area permit authorized by the government,

(4) manufacturers, who will be encouraged to suit their designs to the needs of the environment,

(5) central government, which will set the standards, permits and regulations for trans-boundary movement, through means of a subsidy to the municipalities to build the infrastructure.

On the basis of a cost-benefit analysis of used small house appliances, we examine ~~calculate~~ that in case 1 (20 items, 30% recovery), case 4 (20 items, 20% recovery), case 5 (20 items, recovery 50%) and case 9 (excluding area under-population), the benefit per cost will appear to be over 1. All other cases, however, seem to be under 1. This means that only in the cases of over 20% ~~will~~ 20 items recovery will make sense.

Table 5 cost-benefit analysis of used small house appliances recycling

	Case1 20 items 30%	Case 2 20 items 5%	Case 3 20 items 10%	Case 4 20 items 20%	Case 5 20 items 50%	Case 6 Self Treatment 30%	Case 7 Rare metal 30%	Case 8 50 items 30%	Case 9 Excluding Area-under Population 30%
Profit To Actors	1.03 billion JPY	-1.11	-0.004	0.55	1.85	-11.41	-0.60	-4.08	1.08
Total Benefit 20 years	14 Billion JPY	-15	-5.4	7.5	25.2	-155.1	-0.82	-55.5	14.7
Cost 20 Years	4.2 Billion JPY	4.2	4.2	4.2	4.2	4.2	4.2	4.2	3.6
B/C Analysis	B-C= 9.8 B/C= 3.35	B-C= -19.2 B/C= -3/6	B-C= -9.6 B/C= -1.29	B-C= 3.3 B/C= 1.78	B-C= 21 B/C= 6.01	B-C= -159.3 B/C= -37.09	B-C= -12.4 B/C= -1.96	B-C= -59.0 B/C= -13.26	B-C= 11.1 B/C= 4.09
Metal Recover	0.59 Billion	0.1	0.2	0.39	0.98	0.59	0.82	1.55	0.47

	JPY								
TMR reduction	0.32 Million ton	0.051	0.11	0.21	0.53	0.31	0.47	0.73	0.26
Extending Final Disposal	9800m3 /Year 0.00085%	1600 0.0014	3300 0.0028	6500 0.0056	16000 0.014	9800 0.00085	9800 0.00085	40000 0.035	7900 0.0068
Control Hazardous Material	Effective	effective	effective	effective	effective	effective	Effective	effectiv e	effective
Cost/benefit	B>C	?	?	B>C	B>C	?	?	?	B>C

The proposed scheme and its further implementation contain a number of problems:

(1) the 4 big house appliances (TVs, air conditioners, washing machines, refrigerators) will be recovered and recycled under different schemes (consumers will have to pay the recycling cost),
(2) the producers' responsibility (EPR) is not clear,
(3) municipalities will have to bear the new financial and environmental burdens of recovery and sorting,
(4) the recycling companies will have to bear the risks of metal price fluctuation.

Table 6 proposed list of target small household appliance to recover

Item	Weight Kg/unit	Generated Units (thousand)	Generated Units ton	Contained Metals JPY/kg	Scheme Already existed	Profit per year Million JPY Each together		Infor- mation security	listed

PC note	2.1	6696	13995	721	◎	265	-	○	
mobile	0.1	26022	3643	1699	○	149 149	◎	○	●
PC desk	8.2	5013	40906	263	○	-169		○	
Digital camera	0.2	10508	2312	1180		-249 373	◎		●
Game machine	3.0	3617	10995	315		-359 472	◎		●
Video camera	0.3	1503	421	1224		-435 520	◎		
Flash memory	0.1	5095	408	919		-445 547	◎		●
PHS	0.1	977	82	2538	○	-448 569	◎	○	●
Tape recorder	0.2	5455	976	789		-450 592	◎		●

Other item continues

4. Conclusion

A new recycling scheme for small electronics appliances has set goals for stable metal recovery and supply (90 items have been listed as targets), for extending the lifetime of final disposal sites, and for the appropriate treatment of harmful substances.

The proposed scheme for a revised system and the responsible actors specifies that municipalities will carry out optional recovery of small house appliances by installing collection boxes or stations, retailers will cooperate with municipalities over the details of the recovery, waste treatment facilities and recyclers under contract with municipalities will carry out appropriate recycling with a wide area permit granted by the government, manufactures will seek to design goods in harmony with the environment, while the central government will set the standards, issue the permits and enforce the regulations for trans-boundary movement through subsidies to municipalities for creating the appropriate infrastructure.

The scheme faces several challenges: the cost of collection & treatment of the waste metals, fluctuations in the price of metals, the new system's economic feasibility, and clear designation of those who will bear the responsibility for ensuring the harmonization of the 4 large-size items.

Reference:

[1] MOE (Ministry of the Environment), Japan (2012), "A Proposal for a Recycling System of Small electrical and electronics appliances".

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