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Japan's Automotive Recycling System: Evaluation Three Years after Implementation

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A large scale of unlawful dumping of ELVs in Miyako-jima, a remote island in Japan.
Photo by Kenichi Togawa in 2005.

Incinerator for auto shredded residue using the copper smelter infrastructure.
Provided by Kosaka Smelting & Refining Co., Ltd.

Michikazu Kojima ed., *Promoting 3Rs in Developing Countries: Lessons from the Japanese Experience*, Chiba, IDE-JETRO, 2008.

5.1 Introduction

Since the new Automobile Recycling Law went into effect in January 2005, it became easier to discover the distribution routes for end-of-life vehicles (ELVs) in Japan. The government, including the Ministry of Economy, Trade and Industry (METI), recently announced that the "Japan System," which is one of the most advanced auto recycling systems, has served us well in general.

However, we often asked "why?" when we read official figures on auto recycling released by the government. In this article, I would like to point out the features of Japan's ELV recycling system from the viewpoint of Japan's environmental policy and the recent international flow of recyclable materials.

In Japan, there are a total of 76 million four-wheeled vehicles in use, of which about 3.5 million units are treated as ELVs every year. In Japan in the early 1990s, problems of illegal dumping of automobile shredder residue (ASR) drew public attention and social concern over this issue increased. In the following years, a shortage in landfill capacity and corresponding price hikes in final disposal costs made the existing market-based recycling system for ELVs dysfunctional, and illegal dumping and inappropriate treatment of ELVs increased as a result. The Japanese authorities have said that in order to solve these problems, the Law for the Recycling of End-of-Life Vehicles focuses on ensuring appropriate recycling and treatment channels for material such as ASR.

According to the Japan Automobile Recycling Promotion Center (JARC), designated by the above law as the coordinating organization for the automobile recycling system, the major features of Japan's ELV recycling system are:

(1) Vehicle manufacturers and importers are responsible for the collection of three specific types of material taken from ELVs: ASR, airbags and fluorocarbon gas contained in air conditioners, which are difficult to handle properly.

(2) A recycling fee must be paid by vehicle users in advance—when they register their cars or when they purchase a new car.

(3) The handling of ELVs is monitored on the Internet in an integrated manner by an electronic manifest information system.

(4) The Japan Automobile Recycling Promotion Center, a third party organization, is assigned to manage collected ELV fees, to act as an involved party in the case of the absence of a party in charge, and to monitor ELV handling information.

(5) Operators must be registered or approved.

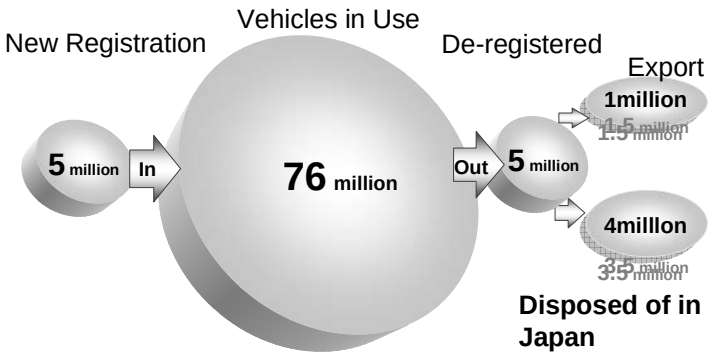
Aiming at establishing an appropriate recycling and treatment system, the law requires each stakeholder to take an appropriate role: automobile manufacturers and importers who collect and recycle three specific materials, end users who pay the recycling fees, and operators who handle ELVs appropriately and report on their performance.

On April 17th this year, JARC, designated by the above law as the coordinating organization for the automobile recycling system, released the records for automotive recycling in fiscal 2006, spanning from April 2006 to March 2007 (see Figure 1).

The JARC report suggests that Japanese vehicle users paid the advance recycling fees without complaining and that recycling operators worked diligently in handling ASR, fluorocarbons, and airbags. Specifically, the advance recycling fees deposited by vehicle users

amounted to 754.1 billion yen in fiscal 2006, making a total of 77,940 thousand motor vehicles eligible for the new recycling system at the end of their lives.

Fig. 1 Automobile Market in Japan (2000 →2006)



Source: JARC.

Since Japan's vehicle fleet stood at 79,474 thousand units at the end of January 2007 according to the Automobile Inspection & Registration Association (http://www.aira.or.jp/number/index.html), the advance payment of recycling fees has been virtually completed for all registered vehicles that exist today. Thus, the new automotive recycling system has apparently taken off with a good deal of success in spite of the general rule that most new social systems encounter a storm or two.

In addition, it has become clear that the electronic manifest information scheme designed to follow the movements of ELVs from one recycling operator to another is now in full operation to monitor, without omissions, virtually every ELV moving in the new recycling system. According to the JARC report, a total of 3,573,215 vehicles were collected as ELVs in fiscal 2006, an increase of 17% over the preceding fiscal year. Shredder residue was recovered and recycled from 3,583,770 ELVs (up 21%); fluorocarbons from 2,469,794 ELVs (up 17%); and airbags from 723,232 ELVs (up 57%) (see Table 1).

Against the above backdrop, government offices such as the Ministry of Economy, Trade and Industry have observed that the automobile recycling system is "going well." But there were some lucky turns that helped the system to make a smooth start. For one thing, there was a surge in the prices of raw materials worldwide. This has expanded demand for recycled materials, erasing at least temporarily the weak demand for recycled materials that was prevailing when the Automobile Recycling Law was being drafted.

For another reason, Japan's leading companies such as Toyota, Honda, Nissan and other automakers were able to pour large amounts of their funds and human resources into the operation of the automotive recycling system through a mixture of cooperation and competition. According to an 8 December 2004 report in the Daily Automobile News, the initial investment by the Japan Automobile Manufacturers Association and the Japan Automobile Importers Association amounted to a combined total of 15 billion yen for the construction of the electronic manifest information scheme alone.

Table 1 Collection/Delivery Reports at Stages (Electronic Manifests)

Stage	No. of Collection Reports		
	Apr. 06—Mar. 07	Apr. 05—Mar. 06	FY06/FY05
Collection	3,573,215	3,048,539	117%
Fluorocarbon recovery	2,621,280	2,419,473	108%
Dismantling	3,738,877	3,167,138	118%
	(154,925)	(116,306)	(133%)
Shredding	5,848,370	4,823,812	121%
	(2,306,910)	(1,845,470)	(125%)
No. of ELVs involved in fluorocarbon recovery	2,469,794	2,155,116	117%
No. of ELVs involved in airbag recovery	723,232	462,118	157%
No. of ELVs involved in ASR treatment	3,583,770	2,597,964	121%

Note: Parentheses indicate the number of reports included on transfers within the same stage.

In this regard, EU automakers have repeatedly pointed out that the biggest problem with Japan's Automobile Recycling Law is the massive expenses charged to automakers for managing and running the recycling system. EU criticism aside, it is questionable whether Japanese automakers and importers could have provided such rigorous support without brisk vehicle sales favored by steady growth in the world economy, especially in the economies of China and the other BRICs.

The Automobile Recycling Law contains a clause which requires the law to be reviewed five years after enforcement. As this year marks the third year, discussions on possible amendment are expected to gather speed from next year on. Drawing parallels with the Home Appliance Recycling Law that was legislated in 1998, came into force in April 2001 and was reviewed in 2006, the author attempts to identify the problems and predicted amendment issues for the automotive recycling system which has been regarded by the Japanese government as "going well."

5.2 Invisible Flow of Home Appliances

In December 2006 the Japanese government received a report from an advisory council entitled "Issues in Reviewing the Home Appliance Recycling System (Review Document on Appliance Recycling)." The central issue identified in the advisory report was the invisible flow of end-of-life home appliances and measures to make the invisible flow visible. The Home Appliance Recycling Law requires all end-of-life cathode ray tube televisions, refrigerators/freezers, washing machines and air conditioners to be recycled at authorized facilities.

However, the Review Document on Appliance Recycling stated that the number of these end-of-life home appliances arriving at the authorized recycling facilities after leaving the hands of consumers is only about a half of what was initially projected. In other words, there seems to be an invisible flow of the other half outside of the home appliance recycling system.

Although possibly the projection might have been founded on erroneous calculations, concern has been raised about a considerable portion of end-of-life home appliances being directed to unknown destinations. The following is an excerpt from the Review Document on Appliance Recycling:

It is possible that this 'invisible flow' may contain a) illegally abandoned end-of-life home appliances regarded as a serious social and economic problem; b) disguised second-hand appliances exported to other countries on the strength of rising industrial material prices; c) improperly dismantled appliances, for example, those still containing fluorocarbons harmful to the environment. Although it is difficult to make the 'invisible flow' visible in its entirety, utmost efforts are needed to uncover it, identify what issues are involved, and then produce a comprehensive program to ensure the proper recycling of the designated home appliances.

With the above in mind, the advisory panel is discussing the following ten issues for amendments to the Home Appliance Recycling Law:

(1) Enhancement of measures against the illegal dumping of ELVs
(2) Promotion of environment-friendly vehicle design
(3) Promotion of the 3R's (Reduce, Reuse, Recycle)
(4) Appropriate arrangement of recycling fees
(5) Appropriate appliance items subject to the Home Appliance Recycling Law
(6) Appropriate rate of reuse as second-hand parts or reprocessed materials ("recommercialization rate")
(7) Development of an efficient collection and transport scheme for end-of-life appliances
(8) Reduction of costs for the collection and transport of end-of-life appliances in small islands
(9) Spread of information among consumers
(10) Appropriate role of the existing recycling operators

When the above issues for home appliances are overlapped with the new automotive recycling system, none of them has emerged as an urgent public issue, presumably because the automotive recycling system is providing reasonably effectively measures for the above ten issues, most of which are common to automotive recycling. Clearly, the automotive recycling system has at least two advantages over its appliance forerunner: unlike home appliances, a registration scheme has been present for motor vehicles and an electronic manifest information scheme has been created to monitor ELVs on a unit by unit basis.

It is therefore reasonable to assume that the possibility of generating an "invisible flow" is smaller for the automotive recycling system than for the home appliance recycling system. But a small possibility does not mean no possibility, and the author will explain later in this paper the undeniable presence of an "invisible flow" outside the automotive recycling system. Before moving on to this subject, however, the above issues (1), (2), (3), (4), (6) and (8) for home appliances are particularly relevant to the automotive recycling system, and comparisons need to be made with the home appliance recycling system which was launched four years before its automotive counterpart.

5.3 Illegal Dumping and Small Island Issues

According to the Review Document on Appliance Recycling, in fiscal 2004 about 170,000 units or 1% of the total number of end-of-life appliances subject to the Home Appliance Re-

cycling Law were illegally abandoned. The Ministry of the Environment estimated that the number of illegally dumped appliances had increased more than 40% from fiscal 2000 when the home appliance recycling system was yet to take off. The author nevertheless is somewhat disinclined to accept these figures at their face values, as it is extremely difficult to determine accurate numbers of illegally dumped products.

True, attention to unlawful dumping practices has increased since the Home Appliance Recycling Law came into force and the government has become a more active searcher of illegally-disposed-of articles, making it possible to count some of the unlawfully abandoned appliances which would have remained unnoticed. But since Japan's home appliance recycling system adopts an after payment arrangement whereby the recycling fee (including the collection and transport fee) is paid at the time of disposing of an end-of-life appliance, the apprehension that the system will increase the incidence of illegal dumping has existed ever since the launch of the home appliance recycling system. Consequently the question of when to pay the recycling fee is deemed as a focal issue in the review of the Home Appliance Recycling Law.

Unlawful dumping is a particularly imminent issue for the numerous small islands off the Japanese mainland. The Review Document on Appliance Recycling discussed the need to equalize the amounts of recycling fees charged on these small islands and on the mainland. Currently the recycling fee charged by appliance makers averages about 2,700 yen for a television, 3,500 yen for an air conditioner, 2,400 yen for a washing machine and 4,600 yen for a refrigerator.

The fee includes the cost of shipping the end-of-life appliance to an authorized collection center. Nearly 400 of these centers exist across Japan, all on the mainland. There are no collection centers on the small islands. The consumers on the small islands are required to pay a higher fee to pay for the cost of maritime transport between the small island and the mainland. Consumers on the small islands are consequently more inclined to keep end-of-life appliances in their houses or dump them in their island environments.

On the other hand, the automotive recycling system is designed to minimize illegal dumping possibilities by adopting a prior fee payment arrangement whereby the purchaser of a new vehicle must pay the recycling fee at the time of purchase, while the owner of an in-use vehicle must pay it at the time of the first periodic inspection. Moreover, the recent surge in industrial material prices has made otherwise abandoned ELVs valuable resources to be properly recycled.

As a result, according to the Ministry of the Environment, the number of unlawful ELVs in Japan sharply declined from 126,000 units (92,000 units illegally stored + 34,000 units illegally dumped) in August 2001 to only 35,064 in March 2007. Okinawa Prefecture, consisting of many small islands, recorded 48,020 unlawful ELVs (including 28,561 units on small islands off Okinawa’s main island) and accounted for 38.1% of Japan's total number of unlawful ELVs in August 2001. Unlawful ELVs in Okinawa also rapidly declined to 1,041 units (319 units on its small islands) by March 2007 (see Table 2).

Table 2 The Number of Unlawfully Dumped ELV in Japan

	Aug. 2001	Mar. 2007
Total for Japan	126,078	35,084
Okinawa Prefecture	48,020	1,041
Total for Japan's Remote Islands	35,532	2,796
Okinawa's Remote Islands	28,561	319

Source: Ministry of the Environment, Japan.

A small island support project based on Article 106, Paragraph 3 of the Automobile Recycling Law has been underway since October 2005. The primary cause of ELV abandonment on small islands is lack of recycling facilities, making it necessary to ship ELVs to the mainland. Like the case of end-of-life appliances on small islands, ELVs on small islands are likely to be kept in open spaces to avoid paying the cost of transport to the mainland. The small island support project is aimed to fund as much as 80% of the maritime transport costs by using a surplus fund generated from the management of the recycling fee deposit collected from vehicle users. In fiscal 2006, a total of 21,419 ELVs were reportedly shipped from small islands to the mainland, and 94.5 million yen was subsidized under the support project.

One problem with the support project lies in the application of a uniform 80% subsidy rate for all cases. The project requires the recycling operators on small islands to shoulder 20% of the maritime transport cost so that they will be motivated to reduce the cost burden by streamlining the transportation work. In fact some small islands did begin pressing ELVs flat to increase the number of ELVs that could be carried on one boat. But the uniform 80% subsidy rate serves as a bottleneck. For example, if the transport cost is 10,000 yen per unpressed ELV and 3,000 yen per pressed ELV, the subsidy will amount to 8,000 yen per ELV for the former and 2,400 yen per ELV for the latter. The latter smaller subsidy may not be enough for the purchase and operation of the pressing machines.

In an island off Kyushu there was a longtime recycling operator who had acquired a shredding machine to recycling ELVs generated on his island. He was worried that if the small island support project was launched, most ELVs on his island would be bought up by recycling operators on the mainland, putting an end to his business. Since the only way for his business to survive would be to buy ELVs from the mainland, he demanded a subsidy of 80% on the cost of transporting ELVs purchased on the mainland.

Critics have pointed out that the support project runs counter to the local recycling efforts of some smaller islands. But on the negative side, it is also true that recycling operations in small islands tend to lack business competition, thus bringing out the disadvantages of a monopoly. Do recycling operations in a small-scale motor community need to be encouraged at the sacrifice of economic efficiency? The author cannot offer a valid answer.

5.4 Concept of the Recommercialization Rate

Perhaps the most dependable criterion in analyzing and comparing recycling operations is the recycling rate. But there are a number of similar but significantly different recycling criteria such as the recommercialization rate, the potential recycling rate, and the effective recycling rate. Their definitions, namely their denominators and numerators, vary from one country to another, from one recycling system to another. Regarding the recommercialization rate, the

Review Document on Appliance Recycling pointed to a possible need to: a) consider not only the quantitative but also the qualitative aspects, such as overseas demand for glass cullet and the overseas production of cathode-ray tube televisions; b) examine the appropriateness of excluding some end-of-life items from the calculation of the recommercialization rate, even though they have been recycled.

The above issue a) relates to the fact that most cathode-ray tube televisions used in Japan are produced overseas, so that there is no demand for cathode-ray tube glass materials recycled from end-of-life televisions. In this case, it would be more efficient to recover cathode-ray tubes in the overseas countries where the televisions are produced. But the transport of cathode-ray tubes is not possible unless the Basel Convention prohibiting the transit of lead and other potentially harmful substances across national borders is amended or exempted to allow the international transit of noxious substances.

Issue b) can be traced back to a standard laid down in the Appliance Recycling Law which says that no recycled material can be deemed a recycled item unless it is purchased on a business basis. Stated differently, if there is no market demand for reusable parts and reprocessed materials, those items are not counted in the calculation of the recommercialization rate. With many recycled materials subject to sharp fluctuations in market prices, appliance makers and recycling operators differ on whether a particular recycled material should be included in or excluded from the calculation, depending on where the price happens to stand at a particular time. Additionally, the Home Appliance Recycling Law does not define the recovery of heat and energy from end-of-life products (thermal recycling) as a mode of recycling.

In contrast, incorporating a new concept of “shredder residue input facility utilization,” the Automobile Recycling Law permits thermal recycling to be counted in the recycling rate provided that certain conditions are met. Furthermore, the Automobile Recycling Law aimed to achieve a 95% ELV recycling rate by 2015, which had been stipulated in the ELV Recycling Initiative of the automobile industry under the leadership of the Ministry of Economy, Trade and Industry in 1997. However, in actual practices, the law defines recycling targets in terms of shredder residue (ASR) rather than ELVs.

Specifically, the Automobile Recycling Law requires the shredder residue recycling rate to reach 50% by 2010, and 70% by 2015. The 70% target for the shredder residue recycling rate was derived from the 95% target for the ELV recycling rate stipulated in the EU's End-of-life Vehicle Directive. The Japanese formulators of the Automobile Recycling Law considered a shredder residue recycling rate of 70% and an ELV recycling rate of 95%, both for the target year of 2015, equal in practice because in the two cases the unrecycled leftovers that must be disposed of in landfill cannot be reduced to no more than 5% of the vehicle's weight. Despite the close connection between Japan's shredder residue recycling target and the EU's ELV recycling target, however, the EU has neither developed its universal definition of “recycling” nor has drawn a conclusion on whether or not to include thermal recycling in the calculation of the recycling rate.

The Automobile Recycling Law makes the automakers and importers responsible for recycling shredder residue in addition to fluorocarbons and airbags. The recycling of shredder residue is performed by two groups (ART and TH Team) of automakers and importers, one group led by Toyota and Honda and the other group by Nissan, Mitsubishi and Mazda. Both groups, competing to reduce recycling costs, are governed particularly by Articles 28 and 31 of the Law:

(1) Authorized shredder residue recycling under Article 28

Automakers and importers are required to collect shredder residue from shredding operators, and recycle the shredder residue into reusable materials or perform thermal recycling at authorized recycling facilities. Many of these facilities, like the municipal garbage incineration plants, are equipped with gasification melting furnaces. The metals and combustible materials recovered from the shredder residue are often used as materials and fuels at nonferrous metal smelting plants.

(2) Authorized shredder residue recycling under Article 31

Article 31 allows the designated "whole recycling" facilities to receive and recycle vehicle carcasses that have been spared from the shredding process. These facilities are often steelmaking plants producing steel from scrap iron. An important precondition for not mandating the shredding process is the complete dismantling of certain parts from ELVs bound for whole recycling.

Table 3 shows the shredder residue recycling records of six major automakers in fiscal 2005. To determine the shredder residue recycling rate, the reduction in weight of the shredder residue through recycling [B] was divided by the total weight of shredder residue collected [A]. All six automakers achieved the 2010 target of a 50% recycling rate several years ahead of the time limit. One automaker even reached the 2015 target of a 70% recycling rate ten years ahead of the target time.

Although one good reason for these impressive records is the relatively small number of ELVs funneled into the automotive recycling system in fiscal 2005 (the first year of the new system), unquestionably the dedication of automakers and other players in the recycling system deserves praise. For all six automakers, whole recycling under Article 31 covered only about 10% of total recycled ELVs in fiscal 2005 but is reportedly increasing its share at present. Because whole recycling does not generate shredder residue, it is hoped that more ELVs will be destined for whole recycling.

Table 3 ASR Recycling Records for Fiscal 2006

	Toyota	Honda	Nissan	Mazda	Mitsubishi	Fuji Heavy
ELVs treated under Act 28	828,467	289.062	549,051	172,561	285,800	174,877
Whole-recycled ELVs (Act 31)	128,234	44,184	86,389	23,112	33,088	22,140
Total	956,701	333,246	635,440	195,673	318,888	197,017
% of whole-recycled ELVs	13.4	13.3	12.4	11.8	10.4	11.2
ASR recycling rate	65.7	68.6	73.9	70.1	70.4	75.0

Source: Websites of the automakers.

5.5 Promoting Environmentally Friendly Design

The Review Document on Appliance Recycling identified the need to modify the home appliance recycling system so as to encourage the development of environmentally friendly designs for appliances, reasoning that to make efforts to design products that can easily be recycled is in full agreement with the concept of extended producer responsibility. In the author's view, however, no social consensus exists presently with respect to what constitute an environmentally friendly design. For example, there is no common answer to the dilemma between using more plastics in the vehicle to improve fuel economy and the resultant decline in the recycling rate due to the decrease in the metallic content of the shredder residue.

To clarify the design issue, this paper discusses automotive design which will facilitate recycling and will minimize the use of substances that have an environmental impact. To state the conclusion first, Japan’s Automobile Recycling Law does not provide a scheme to encourage the development of such designs. Although automaker is responsible for the design, his primary responsibility under the law is to recycle and properly dispose of shredder residue, fluorocarbons and airbags, using the prepaid recycling fee deposit paid by the vehicle user. As for the restricted use of substances that have an environmental impact, only three items are specified in the law, so that restrictions on the use of other similar substances, (e.g., heavy metals such as lead and cadmium) are being exercised voluntarily by automakers under the ELV Recycling Initiative.

Even without the help of the Automobile Recycling Law, the elimination of substances that have an environmental impact from vehicles has steadily progressed, since the Japanese automakers were strongly motivated to achieve conformity with the EU's ELV Directive and RoHS Directive in order to maintain a high standard of environmental friendliness. In this regard the Japan Automobile Manufacturers Association has noted in its “Environment Report 2006” that over 70% of new 2004 models reached the fiscal 2006 target of slashing the use of lead by 90% to 185 grams per vehicle, not including the battery. The average amount of lead used in a vehicle was 1,850 grams back in 1996.

In addressing the question of whether the Automobile Recycling Law has the effect of encouraging environmentally friendly vehicle design, the author examined the relationship between shredder residue recycling costs and environmentally friendly design in an attempt to answer the question as to whether environmentally friendly designs result in a reduction of shredder residue recycling costs. The tentative conclusion arrived at is that the development of easy-to-recycle vehicles will not necessarily lead to a reduction in the cost of shredder residue recycling.

The primary reason is that unlike the Home Appliance Recycling Law, which demands the appliance makers to collect and recycle whole units of end-of-life appliances, the Automobile Recycling Law requires the automakers to collect and recycle only the shredder residue (deemed the most technically difficult item to recycle), fluorocarbons and airbags (two items about which the existing recycling operators have been less enthusiastic due to the time-consuming recovery work necessary). Accordingly, being only partially involved in the recycling of ELVs, automakers are not likely to benefit significantly from making their vehicle designs friendly to the environment.

As home appliance makers operate their own plants to carry out the entire process of recycling, they are expected to receive the full benefits of environmentally friendly designs. But in

the case of automotive recycling, the parties likely to gain most from environmentally friendly design are believed to be the dismantling and shredding operators who recycle the largest part of the ELV. Although the Automobile Recycling Law has prompted automakers to wield some clout over the existing recycling operators, the latter remain basically free to conduct their businesses in their own way as long as they do not violate the law. Consequently it is reasonable to believe that automakers are much less motivated to introduce environmentally friendly designs than home appliance makers.

Importantly, the Automobile Recycling Law assumes that: a) after removing the five designated items (battery, tires, waste oil, waste fluids, fluorescent lights) and recovering reusable or recyclable items from the ELV, the ELV is processed into shredder residue which would have been dumped into landfill sites until a few years ago; b) the quantity of shredder residue is now further reduced by applying advanced post-shredding technologies. A similar assumption is adopted in the EU's ELV Directive.

Theoretically, a promising method of reducing shredder residue recycling costs is to expand the “whole recycling” delineated under Article 31 of the Law, since whole recycling by definition does not necessitate shredding. In reality, whole recycling is performed almost totally by the producers of steel from scrap iron, and to make ELVs acceptable to these steel producers it is imperative that all the parts and components containing large amounts of copper, such as wire harnesses and motors, be completely removed. In this respect the automakers may be motivated to introduce easy-to-recycle designs with a view to encouraging whole recycling.

5.6 Promoting the 3Rs

Automakers have been active in promoting “Reduce,” as in the reduced use of substances that have an environmental impact, and also in promoting “Recycle,” as in the recycling of shredder residue by utilizing advanced post-shredding technologies. But with regard to the “Reuse” of recovered parts in new vehicles, automakers have been dormant. Probably alarmed by this situation, the Ministry of Economy, Trade and Industry in October 2006 staged a public campaign to increase the use of second-hand parts and components. The automobile industry, however, has remained stoic about initiating any “Reuse” program of its own, such as the introduction of voluntary reuse targets on second-hand parts.

Under the Automobile Recycling Law, if parts recovered from ELVs have no market value, these parts must be disposed of as industrial waste by dismantlers at their own expense. Accordingly it would be risky of dismantlers to recover parts for reuse unless there is a definite market demand for specific second-hand parts. Consequently the new automotive recycling system can be viewed as discouraging the dismantlers from recovering parts and encouraging them to maximize the generation of shredder residue.

In the new automotive recycling system, the reuse of airbags recovered from ELVs is prohibited for safety reasons, but the airbags recovered from in-use vehicles during repair and maintenance are permitted to be reused. Some dismantlers question this distinction as being a double standard. Regarding fluorocarbons, the service shop operators are permitted to replace old fluorocarbons with second-hand ones on the grounds that there has been consistent market demand for used fluorocarbons. In this author's view, the formulators of the Automobile Recycling Law made a questionable distinction between the safety of today's vehicle users and

the safety of future generations who may be harmed by increased ozone irradiations from the sky.

The most fundamental idea behind “Reduce” would be to pare down the total number of vehicles operated or to decrease the total energy consumption in the country. Since the energy consumption issue is often debated in terms of fuel economy and energy consumption per vehicle, what is needed is to address issues in terms of total quantity if the environment is to be protected on a global scale through recycling efforts. Unfortunately, the formulators of the Automobile Recycling Law failed to carry out discussions from a broader perspective.

5.7 Determination of the Recycling Fee

In view of the fact that major appliance makers had not changed their recycling fees since the inception of the home appliance recycling system, the Review Document on Appliance Recycling advised that a scheme be introduced to stimulate the lowering of recycling fees while at the same time maintaining the principle of market forces and preserving the transparency on recycling cost conditions and fee-determining factors.

Under the Automobile Recycling Law, eventually all vehicle users will be paying their recycling fees with the purchase of a new vehicle. But it is highly doubtful that when the purchasing prices of vehicles stand at 2 to 5 million yen, the purchasers will be prompted to select a model just because its recycling fee is 10,000 yen rather than the 11,000 to 12,000 yen fees charged on other models. Also, it is difficult to foresee that the recycling fee will be slashed significantly through the introduction of easy-to-recycle designs, for by far the most important automotive design principle is to ensure the safe and comfortable running of vehicles at a low production cost.

Automakers and importers are required to report their recycling balance sheets once a year. Table 4 summarizes the reported balances of shredder residue recycling in fiscal 2005. After the receipt of a balance sheet and after the confirmation of proper treatment of shredder residue, the shredder residue portion of the recycling fee deposit is paid to the automakers for the recycling work they have done. Table 2 shows both income and outlay for six major automakers for their shredder residue recycling operations.

Table 4 ASR Treatment Balances of Automakers for Fiscal 2006

	Toyota	Honda	Nissan
Receipt from fee deposit	6,263,650,936	1,955,838,038	4,168,360,089
Spending for recycling	6,311,093,506	1,915,981,327	4,003,550,859
Balance	-47,442,570	39,856,711	164,809,230
	Mazda	Mitsubishi	Fuji Heavy
Receipt from fee deposit	1,100,280,654	1,690,986,596	1,055,790,492
Spending for recycling	1,118,789,803	1,704,422,890	1,004,499,805
Balance	-18,509,149	-13,436,294	51,290,687

Source: Websites of the automakers.

The “spending for recycling” includes not only the direct cost of recycling the shredder residue, but also the initial cost of developing an electronic manifest information program to monitor the movements of funds and goods plus computer system running costs. While some automakers registered a deficit of the order of 100 million yen, one automaker recorded a profit. Nevertheless, it is doubtful if the stakeholders and the public can obtain any clear ideas about the best way to recycle from reading the balance sheet. Evidently, improvements are needed in the method of disclosing recycling information including the selection of more informative data.

5.8 Invisible Flow of ELVs

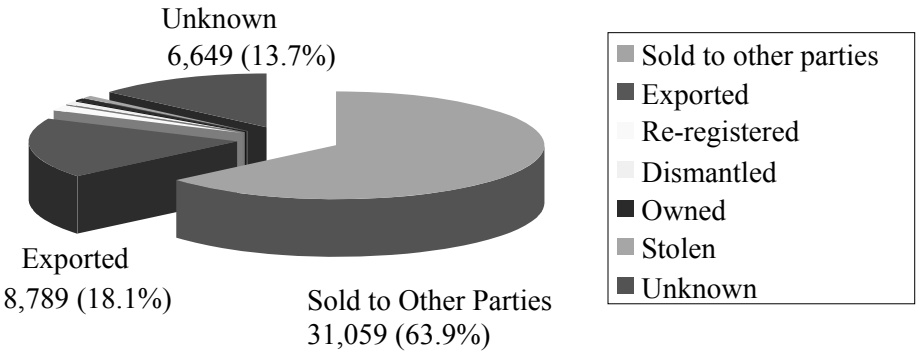
In the first year of the new automotive recycling system, the obligation to pay fees in advance and the unaccustomed operation of the electronic manifest information program apparently slowed down the entry of ELVs into the recycling system, and the “vanished one million units” became headline news. There were speculations that a good portion of them had been exported as used vehicles to avoid the high cost of recycling, while some other vanished ELVs had been unlawfully dismantled outside of the designated recycling system in order to capitalize on the rising price of scrap iron.

In July 2007, an advisory panel to the government released an estimate of what had happened to the 5.15 million vehicles that were deregistered but not reregistered during fiscal 2006—that is from April 2996 to March 2007. According to their estimate, 3.57 million units were delivered into the designated recycling system; 1.44 million units were exported as used vehicles; 0.12 million units were stored as used vehicle inventory, and 0.03 million units were possibly stolen. Admitting that these were rough estimates, government sources promised that they would continue to track down the exact destinations of deregistered vehicles.

The Japan ELV Recycling Organization, an association of dismantling operators, disclosed the results of its own investigation, reporting that a good number of temporarily deregistered vehicles in auction places were left un-transacted for over one year and that these vehicles were likely to be dismantled in an unlawful manner. Simultaneously with the implementation of the Automobile Recycling Law, Article 18 was introduced into the Road Vehicles Law whereby the Land Transport Bureaus were empowered to warn vehicle owners who keep their vehicles temporarily deregistered for over one year. While the author is interested to know how strong the “warning” will be, there has been no reported case of such a warning issued by the authorities.

Under these circumstances the government conducted a survey on the owners of a large number of temporarily deregistered vehicles in January this year. The results were released on April 10th. These owners temporarily deregistered a total of 756,184 vehicles during the first three months of the new automotive recycling system (January to March 2005), and the vehicles remained deregistered for over one year. Subtracting 167,410 reregistered vehicles, deregistered motorcycles and trailers, there were a net 572,641 questionable vehicles as of the end of March 2006. Of these, 297,578 units were lawfully recycled in the designated recycling system. But it is not considered lawful for these recycled vehicles to have been “temporarily” deregistered, since it is compulsory to “permanently” deregister vehicles bound for recycling. Then, an additional 10,000 units or so were dismantled by November 2006, making the remaining 262,100 units highly likely to have been handled illegally.

Fig. 2 Survey of the Owners of a Large Number of Deregistered Vehicles by METI in 2007



This government survey was aimed at the 453 owners of more than 100 temporarily deregistered vehicles, involving a total number of 56,652 temporarily deregistered vehicles. The collected survey responses concerned 48,592 units, giving a reply rate of 85.8%. The results on the destinations of temporarily deregistered vehicles were: 31,059 units (63.9%) sold to other parties; 8,789 units (18.1%) exported; 810 units (1.7%) reregistered; 538 units (1.1%) dismantled; 374 units (0.8%) owned; 373 units (0.8%) stolen; 6,649 units (13.7%) unknown (see Fig. 2). How should we interpret these figures?

Taking into consideration the opinions of recycling experts, the author interprets that a large portion of the doubtful 262,100 vehicles were improperly handled. For example, although the survey results did not indicate the names of purchasers, the vehicles sold to other parties were most likely dismantled in an unlawful manner. As for the exported vehicles, only a small percentage of them underwent the mandatory "deregistration due to export" which will have entitled the deregistering parties to reimbursement of vehicle tonnage tax and the recycling fee. The desire to export without seeking rightful reimbursements seems to suggest the exercise of illicit exporting practices.

The 538 dismantled vehicles are also questionable unless their transactions are documented by a vehicle transaction paper, hardcopy manifest and fluorocarbon coupon, which form the triple document set required prior to the implementation of the new automotive recycling system. Since these documents were invented to track down recycling violators, the present surveyors should have investigated whether the respondents can produce the set of three documents. Further, the surveyors should have checked if the 538 dismantled vehicles had been permanently deregistered before dismantling. On top of this, adding the "unknown" 6,649 units and the 8,060 units on which no reply was given by the respondents, the fate of roughly 25% of the vehicles covered by the survey is completely in the dark. One would hope for a follow-up investigation on these missing vehicles.

In short, some 260,000 vehicles can be suspected of illegal ELV treatment, as these vehicles were not properly deregistered. The Road Vehicles Law requires the owners of a temporarily deregistered vehicle to notify the authorities of its loss, dismantling or dysfunction within 15 days, and a maximum fine of 300,000 yen is imposed for failing to do so. Since there have been no reported instances of this fine being charged, it is reasonable to assume that very little effort has ever been exerted to penalize people for violations of the temporary deregistration and new recycling schemes.

The respondents to this government survey were mainly dealers in new vehicles (45%) and leasing companies (18%), while vehicle auction companies accounted for only 0.93%, despite their expanding share in the distribution of ELVs. Encouragingly, the Ministry of Economy, Trade and Industry has announced its intention to conduct a similar investigation during the current fiscal year in order to reach a broader variety of ELV-related parties.

5.9 The New Trend in Auto Recycling: Preserving Rare Metals through ELV Recycling

In the face of shrinking profits caused by the diminishing number of ELVs, dismantlers are eager to elevate the profitability of their dismantling services for each ELV. As a promising profit booster, growing attention is being focused on the rare metals found in ELVs. As a melting pot of Japan's state of the art technologies, motor vehicles contain good amounts of rare metals. Platinum, palladium, tantalum and indium among other rare metals are used in the microcomputers for controlling vehicle operation, in the catalytic converters for reducing exhaust emissions, in the liquid crystal displays for navigation systems, and in chassis parts like brakes and suspensions.

What is important, the prices of rare metals on the international market have been on a sharp rise in the past few years while the world's production of rare metals is concentrated almost exclusively in Russia, China and South Africa. According to a government estimate, Japan’s stock of rare metals amounts to no more than 30 days' use. Since rare metals are indispensable materials, particularly in the advanced information technology industry, voices are increasing in both the government and private sectors for a lessened dependence on rare metal imports by stepping up recovery and recycling of them from end-of-life products.

In fact it may be time to reappraise the importance of manually dismantling and recovering automotive parts containing rare metals. A “precision dismantling” option is defined in Article 31 of the Automobile Recycling Law with a view to minimizing the amount of vehicle carcasses bound for shredding. Carefully focused dismantling now looks beneficial, not only to reduce the amount of shredder residue, but also to recover rare metals and other valuable resources from ELVs, provided that automakers disclose the exact contents of automotive parts to dismantlers.

Similarly, in order to preserve rare metals, there are increasing questions about the ongoing export of ELVs as used vehicles to Russia, the Middle East and elsewhere under the market principle, and it may be time to review the feasibility of exporting vehicles that owners regard as having reached the end of their service life, and the necessity of funneling these used vehicles into the ELV recycling system so that these indispensable materials can be reused within Japan.

5.10 The Polarization of Recycling and the Formalization of Informal Sectors

During the first year of Japan's current automobile recycling system that came into effect in January 2005, the number of used vehicles that were recorded entering the recycling system as ELVs was one million units less than the projected annual ELV turnover, thus inducing the media to come up with the headline, “the vanishing of one million vehicles.” Two primary factors seem to have been at work behind this surprise incident.

The first factor relates to the prior payment of recycling fees. The automobile recycling system makes it mandatory for the recycling fee to be paid (1) by the purchaser of a new vehicle at the time of purchasing, (2) by the owner of an in-use vehicle at the time of the nearest in-use inspection or (3) at the time the vehicle is scrapped if its ownership is to be ended before the nearest inspection. In the cases of (1) and (2) the recycling fee is collected by the vehicle dealer and the service shop operator, both authorized fee collectors. But in the case of (3), owners presumably have the leeway to discard their vehicles without paying the recycling fee. (Due to the short interval between mandatory in-use inspections, vehicle owners classified under (3) would fade away within two to three years from the inception of the new automobile recycling system.)

The second factor has to do with the electronic manifests into which dismantlers and other recycling operators are required to enter data on the ELVs they have handled so that the administrator of the recycling system can monitor the flow of ELVs from entrance to exit. What is significant is that an overwhelming majority of recycling operators, the dismantlers in particular, are small businesses belonging to the so-called "informal sector." When the author interviewed dismantlers about 15 years ago, the owner of a dismantling firm confided: "In this industry we do business without issuing receipts."

Under the current recycling system, however, electronic manifests record the number of ELVs handled by each dismantler to single-digit figures, enabling for example the automakers to check if the dismantlers are properly recovering the airbags and air conditioning refrigerant as required by the Automobile Recycling Law. Consequently it is no longer possible for dismantlers and other recycling operators to outsmart the tax office.

Going back to the "vanishing one million ELVs" in 2005, the first year of the new recycling system, a persuasive explanation for the massive disappearance is that recycling operators saw the last chance for them to remain informal before the new system firmly spread its roots. Specifically, one way of derailing many ELVs from the system's track is believed to have been the sale, rather than the recycling, of ELVs to traders who exported them as used vehicles. Another way is considered to be temporary vehicle deregistration, which allows recycling operators to lawfully keep ELVs out of the recycling system, whereby the deregistered ELVs were secretly dismantled for a handsome profit in the bullish scrap market.

In the current automotive recycling system, unlike the home appliance recycling system which makes the producers responsible for the entire work of recycling the end-of-life appliances, the automakers are required to recycle or properly dispose of only three items—ASR, fluorocarbons and airbag—and the dismantlers are in effect hired by the automakers to recover the three items from all ELVs. The automakers are expected by the public to instruct their hired dismantlers to work properly, since the recycling system provides "traceability" for individual ELVs in the recycling channel, using electronic manifests.

On top of the data available from the electronic manifests, the automakers are now demanding that the recycling operators show more evidence of their compliance with the Automobile Recycling Law. One industrialist dubbed the close watching of recycling operators by the automakers as "privatization of surveillance." These are reasons why recycling operators in Japan are finding it difficult to remain informal.

While the current automotive recycling system is proving successful at home in Japan, evidently the system is manifesting its ineffectiveness when it comes to ELVs exported as used vehicles to other countries, where there is no guarantee of proper recycling at the end of their

service life. This problem was foreseen at the drafting stage of the Automobile Recycling Law, but officials at the Ministry of the Environment responded that all that Japan could do was to hope for proper recycling efforts by importing countries.

The situation is somewhat different for end-of-life home appliances, which have been exported in large quantities to developing countries. For example, in China and Vietnam, numerous cottage factories exist to recover whatever salable materials are contained in end-of-life home appliances, also known as “e-waste.” Practically all the dismantling work is done manually by low-waged workers in unhealthy conditions that lack safety and environmental considerations.

But when it comes to ELVs, no cottage factories seem to exist in the importing countries. A typical movement of Japanese used vehicles in Southeast Asia is: use in the more affluent coastal regions first; then, displacement to and use in the less prosperous inland regions as repairs are repeatedly carried out; finally the engines are removed for nonautomotive uses while the destinations of the vehicle carcasses are unclear. Haphazard abandonment of scrapped vehicles may be a problem only in the industrialized nations, perhaps not in less-developed countries where large unused spaces exist.

Thus, the author observes a polarization taking place in the global automotive recycling scene. At one pole are industrialized countries like Japan where the automakers are, in practice, trying to formalize the informal recycling operators under the banner of Extended Producer Responsibility. At the other pole are the countries importing used vehicles, but having no or only a rudimentary automotive recycling system. Such polarization does not seem helpful in the evolution of the world community into a sustainable society.

As recycling is a labor intensive undertaking, there are market forces encouraging the flow of scrap from more-developed to less-developed countries where wages are low. Years ago, Japan under the leadership of former Prime Minister Koizumi proposed the 3R's (Reduce, Reuse, Recycle) initiative aimed to moderate the international flow of e-waste and other scrap. In one instance that lead to the Japanese initiative, medical waste requiring special anti-contagion treatment at home was exported from Japan to other countries in the disguise of a general scrap shipment. In another instance, certain plastic waste was unlawfully exported to China, causing all exports of plastic waste to be stopped temporarily.

Recognizing the importance of attaining transparency in the flow of waste across borders, Japan subsequently proposed the creation of an international recycling system that will have traceability and accountability built in. But since informal sectors continue to be the main recycling force in most countries, it is highly questionable whether this will allow scrap that has landed and moved about in another country to be traced. Apparently it will take more time before countries are ready to discuss an economical and environmentally friendly system for sharing the recycling work among themselves.

5.11 Conclusions

The author has introduced the features and current circumstances of Japan’s new ELV recycling system. The author has also drawn attention to the aforementioned increase in the exports of used vehicles from Japan. Will the exported vehicles be properly recycled in the importing countries? While Japan’s new recycling system can be considered highly efficient with regard to the recycling of shredder residue, fluorocarbons and airbags, the same system

becomes totally ineffective when it comes to vehicles exported from Japan. In this connection, at the 7th International Automobile Recycling Congress staged in Amsterdam in March 2007, two lecturers called for efforts to encourage the proper treatment of used vehicles exported from Europe to Africa. In this context, the author highlights the polarization taking place in the global automotive recycling scene. The author hopes that recycling issues involving exported vehicles will be discussed internationally as soon as possible.

Acknowledgments
This paper is a revised version of my presentation at the Third Automotive Recyclers International Round Table Meeting, June 16, 2007 in Tokyo, Japan, and at the Resource Recycling Forum—Taiwan ’07, on October 3, 2007 in Taipei. Thanks are due to Mr. Hirotaka OHKI, Senior Managing Director of JARC for his valuable help.