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At the Frontline of Plastic Recycling

## Reassessment of the "Containers and Packaging Recycling Law" 10 Years After Enactment, and Status of the "Automobile Recycling Law" 1 Year and 3 Months After Enactment

This report deals with two recycling-related statutes, and highlights the findings of a council convened to reassess one law while outlining the status of the other law since it recently went into effect.

First, now that 10 has gone by since the "Containers and Packaging Recycling Law" was enacted and went effect in 1995, a council of stakeholders was convened to consider and reassess the law. Here we provide a summary overview of the topics that were considered by the council. Next, we will review the status of the "Automobile Recycling Law" now that it has been in effect for 1 year and 3 months, and focus particularly on Automobile Shredder Residue (ASR), one of the three items covered by the statute (ASR, airbags, and CFCs). We will outline the progress made so far in ASR recycling and describe an ASR processing plant.

### I .Agenda of Deliberations to Reassess the "Containers and Packaging Recycling Law" After 10 Years

As landfills and other final deposition sites are nearing capacity, Japan has sought to address this looming critical situation over the past few decades not by specifying how wastes should be disposed of (landfills and so on) but rather by defining a framework

of *three Rs*-reduce, reuse, and recycle-that focuses attention on our precious resources. In this approach, waste is regarded as a resource that is indispensable for building of a sound recycling-oriented society, and all societal stakeholders including national and local

governments, companies, consumers, and citizens' groups alike must share responsibility for promoting reuse.

### Sorted Trash Collection and Recycling: Mandatory Since Passage of the "Containers and Packaging Recycling Law" in 1997

Greater diversification of life styles and sheer convenience have led to a rapid increase in the use and consumption of plastic containers and packaging, which has greatly increased the amount of household trash. However disposal of these increased volumes in landfills depends on finding acceptable disposal sites. The growing difficulty of locating such sites near urban areas led to a fundamental shift in thinking, and the concept of recycling trash and regarding it as a resource has now been embodied in law with the enactment of the "Containers and Packaging Recycling Law" in 1997.

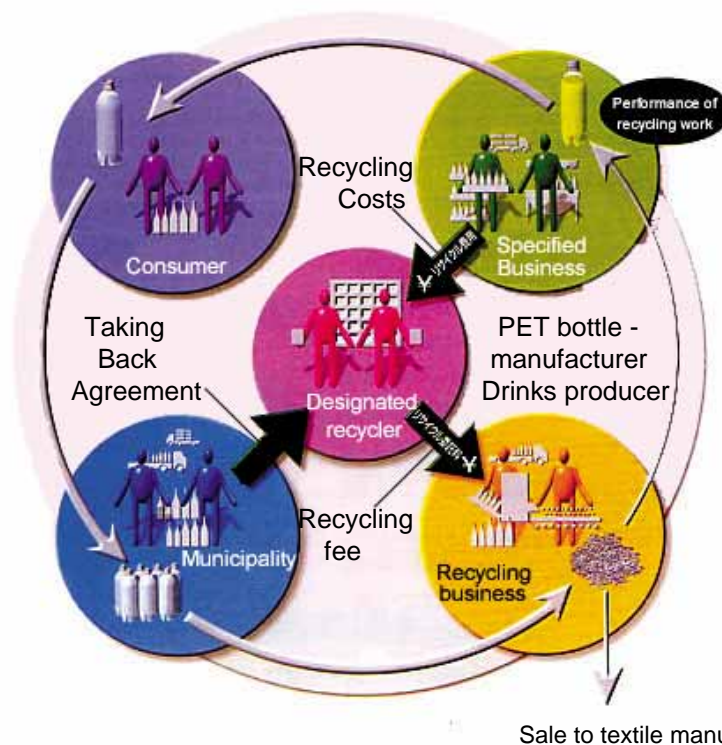
Initially the law covered aluminum and steel cans, glass bottles, PET (polyethylene terephthalate) bottles, beverages cartons, cardboard and other paper-based containers, and wrapping and packaging paper, then the list of recyclables was extended in April 2000 to include other kinds of plastic containers and packaging. There is now a clear allocation of shared responsibility of all relevant societal actors to support the recycling

system that has been put into place: consumers are responsible for sorting the household trash items covered by the law, local governments are charged with collecting trash that is sorted by type, and companies\* are obligated to recycle the different wastes separated according to sorting standards. (\* Companies here refers more specifically to companies that sell products that use containers, companies that manufacture and import containers, and companies that use materials for product packaging.)

Building this recycling system will increase the recycling rate, reduce the quantity of waste destined for final disposal, raise peoples' awareness of the importance of recycling, and continues to be a fundamental issue of national importance.

### Revisions to the Law

A decision was made to reexamine the provisions of the "Containers and Packaging Recycling Law" ten years after it went into effect, so a Council was set up consisting of all the stakeholders including experts in the field, representatives from local governments, companies, and consumer groups. The Council summarized their findings in a recommended course of action that was submitted to the government. A revised "Containers and Packaging Recycling Law" was enacted in June 2006 based on the Council's recommendations.



Container and packaging recycling system (in the case of PET bottles)

Source: Ministry of Economy, Trade and Industry

A number of definite positive effects were observed over the ten years that the law was in effect including a trend toward fewer plastic containers (except PET bottles) and a reduction in the quantity of waste destined for final disposal. But at the same time, other issues emerged regarding how the costs of sorted collection should be allocated, the responsibilities of local governments and companies, how more efficient collecting systems (collecting routes) should be implemented, how to deal with companies that do not meet their recycling obligations (free riders), dealing with exporting of discarded PET bottles, and a host of other issues. Guided by the "Basic Law for Promoting the Creation of a Recycling-oriented Society"\* that is closely related to all the other recycling laws, the Council deliberated for a year and a half on these issues, and that is the background of the reassessment that the Council submitted to the government. (\* The "Basic Law for Promoting the Creation of a Recycling-oriented Society" was enacted in June 2000 as a basic framework for working toward comprehensive, planned waste recycling solutions, while promoting the formation of recycling-oriented society in step with other recycling-related statutes.)

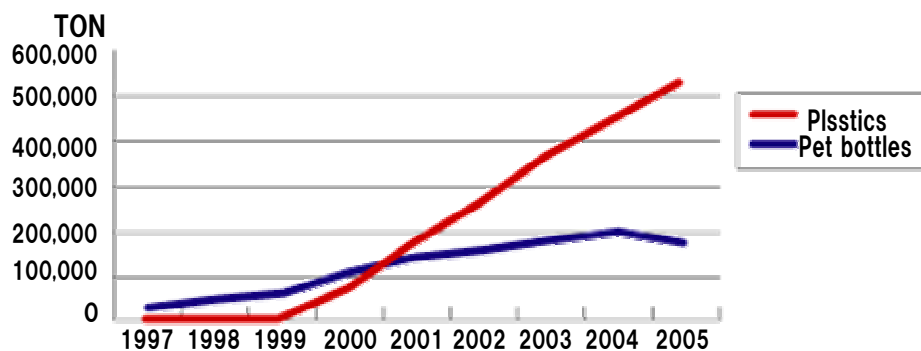
The specific concerns addressed by the Council are summarized as follows:

- How to promote *reduction* and *reuse* (two of the *Three Rs*) based on regional plans for promoting a

recycling-oriented society and local government plans for sorted collection of trash.

- Moving forward to achieve a recycling-oriented society by promoting all three principals of the three Rs (emphasis has been on *recycle*, but *reduce* and *reuse* are also fundamentally important).
- Creating greater cooperation among all the stakeholders including national and local governments, companies, and consumers.
- How to achieve greater cost efficiencies that are fairly allocated across society as a whole.
- How to promote voluntary initiatives among companies that use more than a defined volume of containers and packaging in the form of status reports detailing their efforts and progress toward minimizing waste.
- Set up a scheme for shifting some of the costs for sorting and storing wastes from local governments to companies.
- Prevent free-riding by increasing the penalties for companies that fail to meet their recycling obligations (dealing with companies that do not pay their fair share of processing costs).
- Clarify policies toward recycling of discarded PET bottles that are exported to other countries.
- While as yet still limited, add provisions dealing with energy recovery through recycling of plastic containers and packaging.

Current status of sorted trash collection by local governments



## Council Deliberations

The Chairman who presided over the Council deliberations reassessing the "Containers and Packaging Recycling Law" was Takashi Gunjima, Professor of Economics at Doshisha University. Here are excerpts from an interview with Professor Gunjima where he highlights the main concerns of the Council sessions.

## Need for This Ten-Year Reassessment

"Ten years after enactment, it was necessary to reassess the "Containers and Packaging Recycling Law" and identify issues that have since emerged. In moving toward a recycling-oriented society, it was particularly important to consider how reduction and reuse-two of the three Rs-can be promoted, the compatibility of the "Containers and Packaging Recycling Law" with other related domestic laws, Japan's transformation as a consumer society, and how Japan's "Containers and Packaging Recycling Law" might contribute internationally considering waste reduction efforts in other countries." Prof. Gunjima also stressed that "in sorting out these issues, the principle of reduction, one of the three Rs (reduce, reuse, and recycle) that is the basis of the "Containers and Packaging Recycling Law," has a particularly important role to play in reducing environmental impact, and certainly should be included in the course of action recommended by the Council." "Companies too, as manufactures of consumer products, must seek ways to minimize waste and achieve reduction in cooperation with local governments." "Revisions to the "Containers and Packaging Recycling Law" should encourage companies to minimize waste and take steps to implement high-quality recycling while providing a framework promoting awareness of what can be done from the consumers' standpoint.

## Local Government Processing Costs

"A major theme of the Council deliberations revolved around the sorted collection costs borne by local governments. First we had to determine just what these costs are." This issue had been postponed

"because the cost-effectiveness was uncertain as a result of the different degrees of effort by different local governments and the fact the accounting methods are significantly different from ordinary corporate accounting."

On the other hand, the Council "also considered whether the current allocation of costs for separation, collection, and recycling of trash which is borne most heavily by the local governments is about right just the way it is." On this issue, "the consumer groups strongly supported the idea that companies should pick up more of the processing costs from the standpoint of Extended Producer Responsibility (EPR)." "Talks on this point addressed how much reduced waste reduction of burden on the local governments might be achieved if some of the cost burden (not all processing costs but a portion depending on circumstances) was shifted to companies, and how consumers might react if some of these costs were added to the cost of products in implementing EPR, but the talks were confined to just one approach." "EPR also has its limitations, so in order to come up with the best allocation of costs, it is necessary for all the stakeholders to be heard and cooperate in figuring out how taxpayer costs can be reduced."

## Priority Concerns of These Deliberations

Prof. Gunjima observed that "while keeping a close eye on the legal systems and trends in other countries, the contributions that Japan's "Containers and Packaging Recycling Law" can make both domestically and in the international sphere was discussed." He also stressed that "all parties involved through the life cycle of a product should share responsibility to reduce environmental impacts, and the idea that consumers too (as producers of waste) should bear some responsibility, at least in the form of voluntary initiatives, must also be taken into consideration.

## Assessment of the "Revised Containers and Packaging Recycling Law" Five Years From Now

Prof. Gunjima noted that "in our discussions we were well aware of the EU's strategy of dealing with issues as separate themes. The vision of the direction

waste recycling policy should take over the next ten years in the EU applies to all parties involved in the life cycle of the product and emphasizes 'what people should do' and 'what people can do.' Note in particular the transition from 'recycling by different plastic items' to 'recycling by different materials.' If this approach is implemented, it will affect Japan in no small degree. In the assessment five years from now, advanced Refuse Paper and Plastic Fuel (RPF) and combustible wastes as cement-producing fuel energy recovery technologies will be recognized as practical recycling methodologies the same as mechanical recycling and feedstock recycling today, so there will be ongoing discussions

regarding the extent these methods reduce environmental impacts based on life-cycle assessment (LCA) and other scientific perspectives." "It is highly likely that question of how to deal with biodegradable plastics will also come up for discussion."

Another issue that will be tackled in the future, Prof. Gunjima noted that "the OECD countries are seeking more efficient use of expenditures at the policy-making and system-planning stages for reducing environmental impacts, and the development of solutions that have a real effect on improving the environment. To obtain these objectives, objective assessment and careful examination capabilities are critically important."

## II. Status of the Automobile Recycling Law 1 Year and 3 Months After Enactment and Report on an ASR Processing Plant

### Onsite Report From Dowa Mining: ASR Processing Based on Refining Technology

As of March 2006, the "Law on Recycling of End-of-Life Vehicles"-also known as the "Automobile Recycling Law"- had been in effect for 1 year and 3 months. It is estimated that close to 5 million vehicles reach the end of their useful life every year in Japan. About a million of these end-of-life vehicles (ELVs) are exported as used vehicles, but the material from the remainder of these vehicles must be processed in such a way as to mitigate their impact on the environment.

Examining the period from January 2005 to March 2006, it is estimated that about 4 million vehicles were disposed of, but regarding the three designated items covered by the Automobile Recycling Law-Automobile Shredder Residue (ASR), CFCs, and air bags-only 2.68 million vehicles were processed for ASR, which represents only 67% of the estimated number of discarded vehicles during the period (figures based the report "Status of Payments to Automakers" prepared by the Japan Automobile Recycling Promotion Center).

### During this period the Japan Automobile Recycling Promotion Center paid out ¥15.7 billion to the automakers to cover ASR processing costs.

Over this same period from January 2005 to the end of March 2006, users paid recycling fees (advance disposal surcharges) on approximately 49.44 million vehicles for a total amount of ¥470.2 billion. In terms of when the fees were paid, about 15% were paid when registering new vehicles, about 79% was paid when bringing vehicles in for vehicle inspections, and 6% was paid when vehicles were discarded.

Now turning to recovery of the three items designated for recycling over the same time frame, we find that ASR was recovered for approximately 2.68 million vehicles, airbags recovered on 440 thousand vehicles, and CFCs recovered for about 2.05 million vehicles, for which the automakers were compensated ¥15.7 billion, ¥800 million, and ¥4.3 billion, respectively (figures courtesy of the Japan Automobile Recycling Promotion Center).

The smooth implementation of the recycling system is generally attributed to Japan's vehicle registration system involving mandatory vehicle inspection procedures and ELV procedures when vehicles are discarded.

### **Transformation of Dowa Mining to a Major Player in the Recycling Business**

A number of companies are now involved in the processing and recycling of Automobile Shredder Residue (ASR), but in this report we will highlight the processing plant run by Dowa Mining Company in Okayama.

Dowa Mining has a long history in the metal refining industry, and the company leveraged its accumulated expertise and technology in developing and running an ASR energy recovery plant. Once end-of-life vehicles (ELVs) are disassembled, the ferrous and nonferrous metals and catalytic materials from engines, chassis, transmissions, tires, batteries, and so on are separately recycled. About 80% of the materials contained in discarded vehicles is readily recovered and recycled, and many companies have sought to develop the technologies for recycling the remaining 20%,

which is equivalent to about 700 thousand tons of material a year. Among these companies, Dowa Mining leveraged its refining technology expertise and constructed an ASR energy recovery plant in Okayama that has attracted widespread interest across the industry for its success in recovering rare metals and energy in the form of steam heat.

Leveraging its original expertise in metal refining, Dowa Mining has branched out into electronic component materials (cell phones and printed circuit boards), metal machining including plating, metal surface special machining, thermal processing, and a host of other new business areas. Symbolizing the company's diversification into new areas, Dowa Mining pooled its resources and expertise to build an advanced ASR energy recovery plant that began full scale operation in 2005.

### **ASR Energy Recovery by Leveraging Metal Refining Technology**

Dowa Mining's ASR energy recovery facility at its Okayama plant uses fluidized bed combustors, and began full-scale operation about the same time that the Automobile Recycling Law went into effect. The plant



ASR processing facility at Dowa Mining's Okayama plant

has the capacity to process 3,000 tons of shredder dust including ASR a month.

Here we will briefly consider the ASR processing steps at the plant. In the preprocessing phase, shredded fragments containing a mixture of steel, aluminum, copper, and glass are sorted and the material recovered. Rare metals and impurities are removed in this preliminary sorting. This suppresses the production of clinkers in the fluidized bed combustors, which enables the fluidized bed combustors to operate effectively and continuously for long periods (about three months of continuous operation).

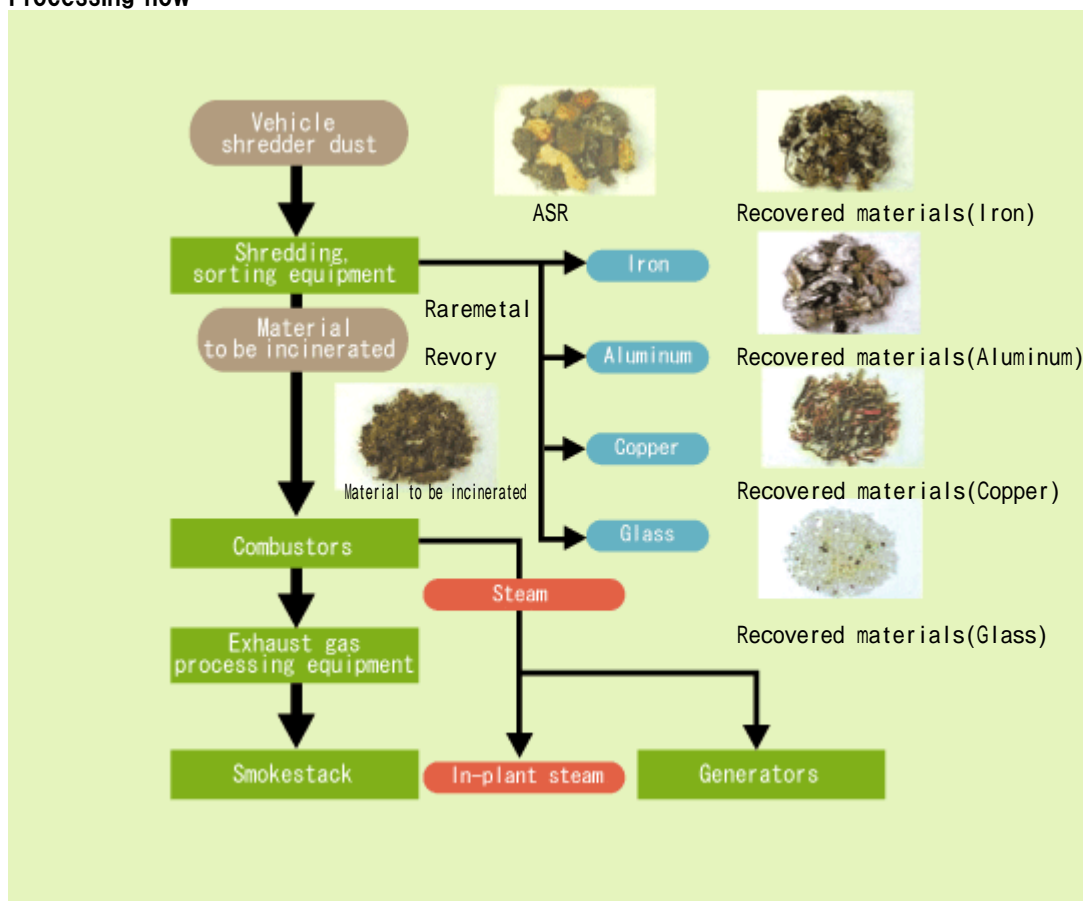
Clinkers are very disruptive because, when they fall into the combustors, this throws off the fluid balance which adversely affects the silica sand (fluid sand) and

causes the fluidized bed combustors themselves to lose functionality and quit working. It was this critical expertise of how to suppress the production of clinkers that was most important and distinguishes Dowa Mining's Okayama plant.

Another distinguishing feature of the plant is that the amount of shredder dust fed to the fluidized bed combustors is always constant. Generally when steam is used for power generation, the amount of shredder dust being processed has to be adjusted upward because the amount of steam is constant, but at the Okayama plant it is just the opposite.

The steam temperature of boilers at the plant ranges from 350-400 °C. All this steam heat is recovered and used to heat the plant, with the remainder used to

### Processing flow



generate electric power. Although the amount of power generated fluctuates, it provides around 40% of the power used by the plant, and virtually 100% of the steam is used by the plant.

Shredder dust crushed and sorted in the preprocessing is fed into the fluidized bed combustor and incinerated with heating values typically ranging from 3,500 to 4,000 kcal. Gases in the fluidized bed combustor are approximately 600-650 (using silica sand). The gases are then transported to a secondary combustion chamber where they are applied to a waste heat boiler at a temperature of about 900-950 . Finally, the 400 waste gas is sent to a cooling tower where temperatures are brought down to about 180 . Ash trapped in a bag filter before the waste gas is released cannot currently be mixed into cement, but this approach is currently being investigated.

## Challenge of Ensuring Stable Amounts of ASR

Processing capacity of the Okayama plant is about 15 tons an hour or 11,000 tons a month of ground up and sorted feedstock in the preprocessing (including non-ASR material), and about 4 tons an hour or approximately 2,800 tons a month of recovered energy, but again not all of this energy is generated by ASR.

Currently the amount of ASR being produced is less than was originally projected, so the amount of ASR that can be outsourced to domestic ASR processing plants has also fallen off. The Okayama plant was also affected by the trend, and currently has modified its operations to process other types of wastes besides ASR.



ASR (Automobile Shredder Residue)



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