Who pays, and where does the money come from?

Charge System for Recycling of WEEE in China

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1．Introduction

The production of electrical and electronic equipment (EEE) is increasing worldwide. Both technological innovation and market expansion continue to accelerate the replacement of equipment lead to a significant increase of waste electric and electronic equipment (WEEE). In view of the environmental problems involved in the management of WEEE, many counties have taken some measures to preserve, protect and improve the quality of the environment and human health as well as utilizing natural resources judiciously.

As China is a large manufacturer and consumer of electronic appliances, Chinese government has also made efforts to tackle the problem caused by the recycling and disposal of WEEE since 2001. China attempts to regulate the industry and establish a financially viable, environmentally benign and safe WEEE management system. Charge system for recycling of WEEE is an important part of the system. Charge system for WEEE needs to determine the responsibility undertaken respectively by producer, distributor, recycling business，consumer and source of funds, but they are still unclear yet in China.

Currently，the more perfect management system and pattern of charge system for WEEE have established and achieved good results in some countries and regions. But the problems facing charge system for WEEE remain to be solved in China. Much research emphasizes establish of WEEE recycling and disposal system. However, herein we pay more attention to the charge system of WEEE recycling and disposal system. Therefore, the aim of this study is to give suggestions on responsibility system and payment pattern to reference for establish of charge system for WEEE by analyzing the state of some developed countries as well as the actual conditions in China on WEEE recycling and disposal system.

The remainder of this paper is organized as follows: Section 2 shows the definition and characteristics of WEEE. Next, section 3 introduces three of the most typical system for WEEE in developed countries, then responsibility system and payment pattern in charge system for WEEE in developed countries are summarized. The status of recycling system and charge system for WEEE in China is considered in section 4 and some suggestions are put forward based on experiences of developed countries and Chinese national conditions. Finally, some concluding comments follow in the last section.

2. Definition and Characteristics of WEEE

2.1 Definition of WEEE

According to the definition given in Directive 2002/96/EC of the European Parliament (EU 2002), 'waste electrical and electronic equipment (WEEE) consists of the 9 categories that are listed in table1. It refers to the electrical and electronic products which have reached the end of their useful life and are ready for recycling or some other form of disposal.

No.	Category
1	Large household appliances
2	Small household appliances
3	IT and telecommunications equipment
4	Consumer equipment
5	Lighting equipment including light bulbs and luminaries in households
6	Electrical and electronic tools (with the exception of large-scale stationary industrial tools)
7	Toys, leisure and sports equipment
8	Medical devices (with the exception of all implanted and infected products)
9	Monitoring and control instruments

Source: Directive 2002/96/EC of the European Parliament

Table 1 WEEE categories according to the EU directive

2.2 Characteristics of WEEE

In the era of recycling stream WEEE is becoming an important waste both in terms of quantity and toxicity. It is non-homogeneous and complex in terms of materials and components. In order to develop a cost-effective and environmentally friendly recycling system, it is important to identify and quantify valuable materials and hazardous substances, and further, to understand the physical characteristics of waste.

Environmental and health effects

WEEE refers to discarded appliances, such as televisions and refrigerators, as well as a variety of associated waste products, such as electrical wiring, printed wiring boards (PWBs), and batteries. WEEE also contains a myriad of toxic components and materials that can cause significant damage to the environment and human health if recycling and disposal is unregulated. Major categories of hazardous materials and components of WEEE that have to be selectively treated are shown in Table2.

Substance	Occurrence in WEEE	Environmental and Health relevance
Chlorofluorocarbon(CFC)	Getters in CRT	Combustion of halogenated substances may cause toxic emissions
PVC(polyvinylchloride)	light-emitting diode(LED)	High temperature processing of cables may release chlorine, which is converted to dioxins and furans.
Barium	Getters in CRT	may develop explosive gases (hydrogen) if wetted
Gallium arsenide	light-emitting diode (LED)	injurious to health
Lead	CRT screens, batteries, printed writing boards	causes damage to the nervous system, circulatory system, kidneys causes learning disabilities in children
Rare earth elements	is used on the interior of a CRT	toxic when inhale screen, mixed with rare earth metals
Toner Dust	toner cartridges for laser printers	Health risk when dust is inhaled risk of explosion

Source: Directive 2002/96/EC of the European Parliament

Table 2 Hazardous substances their occurrences and impact on environment and human health

Economic benefits

Recycling of WEEE is an important subject not only from the point of treatment but also from the recovery aspect of valuable materials. For example, the US Environmental Protection Agency (EPA) has identified seven major benefits when scrap iron and steel are used instead of virgin materials. Using recycled materials in place of virgin materials results in significant energy savings (as shown in table3 and 4).

Benefits	Percentage
Savings in energy	74
Savings in virgin materials use	90
Reduction in air pollution	86
Reduction in water use	40
Reduction in water pollution	76
Reduction in mining wastes	97
Reduction in consumer wastes generated	105

Source: US Environmental Protection Agency

Table 3 Benefits of using scrap iron and steel

Materials	Energy savings (%)
Aluminum	95
Copper	85
Iron and steel	74
Lead	65
Zinc	60
Paper	64
Plastics	> 80

Source: US Environmental Protection Agency

Table 4 Recycled materials energy savings over virgin materials

3. Recycling system and charge system for WEEE in developed countries

More advanced, more reasonable recycling and charge system for WEEE have formed and well developed in some developed countries. Their systems vary according to national conditions. Here, this paper introduces three of the most typical system for WEEE in developed countries, i.e. Germany, the Netherlands and Japan. Then responsibility system and payment pattern in charge system for WEEE in developed countries are summarized.

3.1 Recycling system and charge system for WEEE in Germany

Producers are obliged to the take back of collected WEEE form local authority collection points and its treatment in Germany. Consumer can also send WEEE to Manufacturer directly (as shown in Fig. 1).

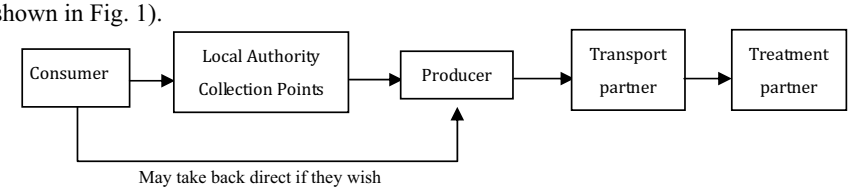

Fig. 1 German WEEE Recycling System

The fees for product take back and disposal are shared by consumer and producer in Germany. Municipalities operate and finance Local Authority Collection Points for free-of-charge take back of WEEE (this fee is paid to Municipality by consumer at ordinary times).Producer oblige the fees for transport, disposal and treatment that is caused from Local Authority Collection Points.

3.2 Recycling system and charge system for WEEE in the Netherlands

Retailers are obliged to take-back WEEE from consumers in the Netherlands. They may then transfer the WEEE to a municipal waste site, direct to the Regional sorting stations. Municipal collection sites receive WEEE and take responsibility for delivery to regional sorting stations operated by the municipalities and NVMP (The Netherlands association for the Disposal of Metal and Electrical Products).NVMP Transport contractors are responsible for the collection of WEEE from Regional Collection Station and delivery to treatment plants and recycling firms. NVMP treatment and recycling contractors are in charge of treatment of WEEE (as shown in Fig. 2).

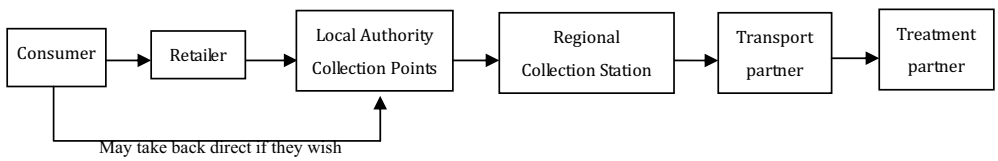

Fig.2 Dutch WEEE Recycling System

Consumers pay a visible fee on the purchase of new EE products. The fee includes a local municipal waste tax to fund general waste collection and operation of municipal sites. Consumers may return WEEE free of charge to municipal collection sites. The fee from consumers to producers is passed on by the retailer to the producer. Finally, producers pay NVMP to manage their WEEE responsibilities.

3.3 Recycling system and charge system for WEEE in Japan

Japanese WEEE take back system is a consumer/retailer based system. Retailers are primary actors to be responsible for collecting the end-of-life products from household to regional collection stations. Upon the request of consumers, the retailers are responsible for accepting a) an old appliance when selling a similar new product (old-for-new), and b) an old appliance that they themselves have sold. For other products not collected by the retailers, but municipalities and designated legal entities. The government appointed the Association for Electric Home Appliances (AEHA) is appointed as a designated legal entity by government. With regard to collection, designated legal entities collect products from remote areas in response to the request of municipalities governing the area or of local residents themselves. Producers have the obligation to establish the regional collection stations and transfer the discarded products to recycling plants. Producers also have the responsibility to recycle their products themselves or delegate their responsibility to the third party (as shown in Fig. 3).

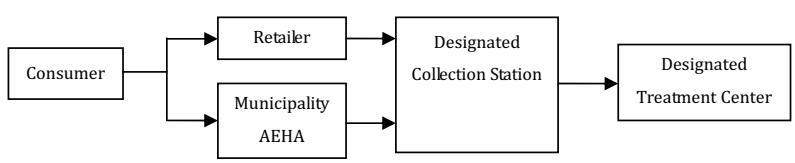

Fig.3 Japanese WEEE Recycling System

For the recycling of WEEE, the consumers pay for the collection at the time of disposal (end-user-pays). The consumers also must buy a recycling ticket (available at post offices and retail stores), which they provide to the collection agent to demonstrate the recycling fee. The fee is announced by those who are physically responsible for collection. This fee also covers the management of the regional collection stations. The cost associated with the physical responsibility of the producers (establishment of regional aggregation stations and transport of discarded products from the regional aggregation stations to recycling plants) is covered within the recycling fee.

3.4. Summing up charge system for WEEE in developed countries

Based on the above analysis on 3 typical systems for WEEE in developed countries, responsibility system and payment pattern in charge system be summarized as follows.

3.4.1 Responsibility system for WEEE

Government Responsibility: State is responsible for all costs of collection and recycling for WEEE by establish fund and collect taxes.

Producer Responsibility: Producers are responsible for all costs of the collection and recycling of their products at the end of usable life.

Consumer Responsibility: Consumers pay the recycling fees for WEEE at the time of buying or abandonment.

Multi-party Responsibility: Government, producers, 3PL and consumers all share the costs of collection and recycling for WEEE.

3.4.2 Payment pattern for WEEE

To consumers, the payment pattern can be classified into 2 main types, per-payment and post-payment.

Per-payment method (pension style) means consumers pay the recycling fees, at time of sales, to recycle returned end-of-life wastes.

Post-payment method means consumers pay recycling fees at time of discharging end-of-life products.

"Pre-payment" (pension style) is superior to post-payment scheme in prevention of illegal dumping. If we have to pay recycling fees when we return end-of-life products, we may fall into temptation to damp them illegally to avoid payment of fees. There are other aspects where post-payment is better than pre-payment. For calculability of recycling fees, under pre-payment scheme, especially for durable products such as electric appliances, how producers can accurately calculate recycling fees in many years thereafter when they sell products today? There are various factors affecting future recycling fees, which are technology innovations, fluctuations of disposal fees, price of natural resources etc. It is almost impossible to estimate them correctly.

4. Recycling system and charge system for WEEE in China and suggestions

There are many difficulties in the course of establishment of charge system for recycling WEEE in china. Of course we can learn from the experience of other countries, but never copy. This section analyzes the current situation of recycling for WEEE and updated policy of government in China. Then some suggestions on charge system are put forward based on

experiences of developed countries and Chinese national conditions.

4.1 Recycling system and charge system for WEEE in China

At present, the WEEE recycling and disposal is typically disorganized in China. There are many avenues to collect the WEEE, such as Municipal collection sites, individual collectors, secondhand market and retailer etc. Then WEEE are resold or disposed by registered/unregistered treatment enterprises.

Individual collectors formed the main channel for WEEE collection. Few of them cared much about the recycling enterprises qualification except for few of multinational companies which have strong environmental consciousness. But they can give consumers a good price because of low cost when waste is collected. As a result, recycling companies which have advanced technologies, facilities and special qualifications are in the inferior position during bidding and cannot collect enough raw materials. Lots of WEEE flowed into individual collection companies which have not necessary labor and environmental protection measures and facilities. Serious environmental pollution problems often occurred.

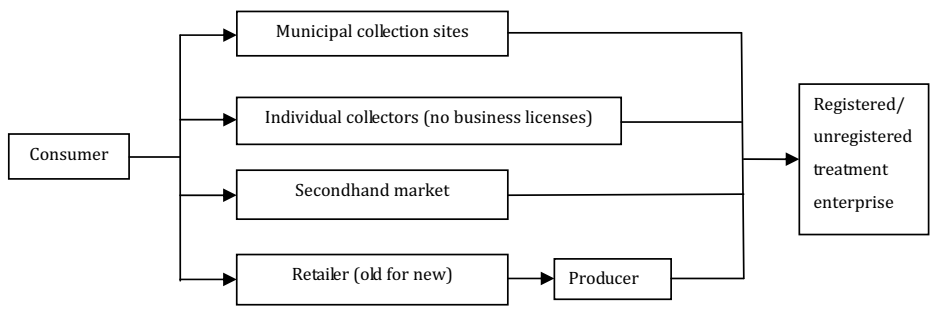

Fig.4 Chinese WEEE Recycling System

On 25 February 2009, the State Council issued the Regulations on the Recycling and Treatment of Waste Electrical and Electronic Equipment in their final form (China WEEE). The China WEEE, which will enter into force on 1 January 2011, sets out the responsibilities of relevant parties, supervision and management and legal liabilities. The nation practices the system of multi-channel recovery and centralized processing for waste electrical and electronic products. The nation implements the system of licensing for recovery processing of waste electrical and electronic products. The nation sets up a fund for recovery processing of waste electrical and electronic products which will be used to subsidize recovery processing of waste electrical and electronic products. Manufacturers of electrical and electronic products, and consignees or agents of imported electrical and electronic products shall perform their duty in making contribution to fund for recovery processing of electrical and electronic products in accordance with relevant rules.

4.2Suggestions on charge system of WEEE recycling system in China

4.2.1Responsibilities of relevant parties

In the light of present situation, the modernized large scale production day by day along with the electrical and electronic product industry, but the electrical and electronic product market competition day by day intense so that the electrical and electronic product profit margin is more and more low to manufacturer. And Chinese consumers traditionally look at their obsolete electronic appliances as valuable goods and they would prefer selling them to get some money back rather than paying for the treatment of the waste. It is also an impractical

plan if the government or 3PL bears the cost. So the best strategy is adopting responsibilities of multiple parties with respect to government, producer and consumer. The cost of recycling WEEE involved will be shared among multiple parties.

Government

The electrical and electronic manufacturing industry has become one of the pillar industries in the country. And government can get economic benefits from tax. So the government establishes a fund for the disposal of WEEE to be used as allowance for the recovery and disposal of WEEE.

Producer and retailer

Producer and retailer sell the electrical and electronic product at a profit. They must report the sales of electrical and electronic product to relevant department. They need to perform their obligations of contributing to the fund for WEEE disposal according to the sales of electrical and electronic product.

Collection and treatment enterprise

Chinese Collection and treatment enterprise of WEEE are in their beginning stage, and they not formed marketization and industrialization yet. Therefore they can get the allowance for the recovery and disposal of WEEE from government. At the same time, they are obligated to declare the operation, such as quantities of recovery and treatment.

Consumer

Consumers benefit from using electrical and electronic product. Therefore, they are not the subject of financial resources, but they deserve to bear a part of recycling fees.

4.2.2 Payment pattern

In China, consumers traditionally think of the waste electrical and electronic product as valuable goods and they sell them to get money back. In addition, citizens do not realize yet the importance of recycling electrical and electronic product. It is difficult to realize if consumers pay recycling fees at time of discharging end-of-life products. And it is also likely to cause illegal dumping of wastes. Therefore, the payment pattern prefers pre-payment method to post-payment method that suits national conditions. It should taken making reasonable recycling fee into the payment system in practice.

5. Conclusions

China faces great pressure to tackle WEEE problem. Chinese Government has strived to solve those problems from both management policy aspects and technical aspects. Government seeks for establishment of recycling system for WEEE, which is efficient, good to environment and suit to condition in China. The charge system is an important part in collection and recycling of WEEE. Based on the current status of WEEE recycling system and charge system in developed countries, and considering the current status of WEEE recycling system and charge system as well as the actual situation of current social and economic development in China, some suggestions about responsibility system and charge pattern are proposed to provide references for constructing of system of recycling WEEE in China.

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