Management of E-waste Recycling System in Korea

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Contents

I  
**Legal System of E-waste in Korea**
- Eco-Assurance System

II  
**Structure of E-waste Recycling**
- Introduction to KAEE
- E-waste Collection and Recycling Performance

III  
**Operating Case of a Recycling Center**
- Introduction to Metropolitan Recycling Center
- Recycling Process and Technologies
I. Legal System of E-waste in Korea

Eco-Assurance System
I. Legal System of E-waste in Korea

Eco-Assurance System

Background of the System

Increase in amount of waste due to mass production and mass consumption in society

1991
Separate collection of garbage
- Cleaning managed by local gov. office
- Collection of waste, Market based trade for valuable waste

1993
Deposit refund system
- Designation of recycling business operator
- Opposition to Infra of deposit refund

1995
Volume base fee system
- Fee paid for large size waste
- Responsible collection and treatment by local government with fee

Improving value of waste as resources and need to change to a resource circulation society

EPR system
(2003.01)
System establish For Methodical management of E-waste and vehicle

Eco-Assurance System
(2008.01)
Eco-Assurance System

Concept

- For recycling can be encouraged *methodical management of e-waste and vehicle* by life cycle approach of products
- If this is not achieved, imposition has be paid by the interested parties, which will exceed the amount of recycling cost

- Precautionary policy
  - Eco-friendly design
  - Restriction of the use of hazardous substance
  - Improvement of quality of the materials and structure
  - Achievement of recycling possible rate

- Recycling policy
  - Environmental Preservation
  - Reinforcement of facility standards
  - Set up of recycling Methods and standards
  - Achievement of recycling goals

- Recycling / Reuse
- Products part
- Consumption part
Eco-Assurance System

Summary of Eco-Assurance System in Electronics

Related Laws

✓ ‘Act on the promotion of saving and recycling of resources’ (2003.1, EPR)
✓ ‘Act on resource recycling of electric electronic equipment and vehicles’ (2008)

Items

✓ Refrigerator, Washing machine, Air-conditioner, TV, PC, Audio, Mobile phone, Printer, Copying machine, Facsimile, etc. (10 items)

Role and duty of different parties

✓ Eco-Assurance system is not for the producer to take entire responsibility but for the government administration, local autonomous entity, producer and consumer to play a role.

Methods of Execution (in present)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>92.8%</td>
<td>7.1%</td>
<td>0.1%</td>
</tr>
</tbody>
</table>
II Structure of E-waste Recycling

- Introduction to KAEE
- E-waste Collection and Recycling Performance
Established in September, 2000, for environmental preservation and materialization of a resources recirculation society through collection and recycling of waste electronic and electric products.

2000.6 : voluntary agreement on producer’s recycling responsibilities.
2003.1 : Introduction and execution of EPR system. (law on saving resources and encouraging recycling)
2003.6 : Constructed MRC (Metropolitan Recycling center).
20012.present : Establishment and operation of national recycling network.

Regular members : 118 manufacturing and import companies including Samsung and LG Electronics
Associate members : 59 recycling companies including Narae R/C
Introduction to KAEE

Main Business

1. Mutual aid businesses to collect and recycle E-waste
   - Build and operate the national collection and recycling system.
   - Mutual aid businesses in line with EPR system.

2. New technology development & International exchanges
   - Expand development of new recycling technologies and supply to the nationwide.
   - Arrange the international environmental countermeasures such as FCCC.

3. Investigation and research of Recycling statistics
   - Establish systematic statistics for each category and item.
   - Investigate the actual collection and recycling levels.

4. Operation of recycling Field program
   - Operate field programs for the government, NGOs, foreign relevant institutions and children at all times.
Main target of Eco-Assurance system is collecting enough quantity in items from producers and 232 local authorities in nationwide.

About 10% of ‘hidden flow’ resources are gradually in reducing trend.
Collection and Recycling Network

Collection System

- 100 logistics centers nationwide / 3,300 distributing agencies
- Additionally, e-wastes discharged are collected by 232 local autonomous authorities.

Recycling System

Through advanced recycling centers in seven regions in nationwide and 59 recycling co-worker, that are encouraging environment-friendly recycling.

<table>
<thead>
<tr>
<th>Region</th>
<th>Capacity (ton/yr)</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metropolitan</td>
<td>21,000</td>
<td>Yongin</td>
</tr>
<tr>
<td>Chungcheong</td>
<td>22,000</td>
<td>Asan</td>
</tr>
<tr>
<td>Yeongnam</td>
<td>20,000</td>
<td>Chilseo</td>
</tr>
<tr>
<td>Honam</td>
<td>20,000</td>
<td>Jangseong</td>
</tr>
<tr>
<td>Jeju</td>
<td>2,000</td>
<td>Jocheon</td>
</tr>
<tr>
<td>Gyeongbuk</td>
<td>18,000</td>
<td>Yeongcheon</td>
</tr>
<tr>
<td>North of Gyeonggi</td>
<td>14,000</td>
<td>Yangju</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>117,000</strong></td>
<td><strong>7</strong></td>
</tr>
</tbody>
</table>
# Collection and Recycling Performance

**Notice**: Air-conditioners come under refrigerators / C.P: Main body including batteries


**Recycling Performance per Year**

- **E-wastes have been collected and recycled are over 120,000 tons per year.**
Performance to Contribute for Green Growth (2000~2009)

**Recycling volume Per person**
- '00: 29,272 ton
- '05: 79,888 ton
- '09: 115,601 ton
- Total: 270,000 ton

**Resource recovery**
- Fe: 404,000 ton
- Non-Fe: 37,000 ton
- Plastics: 180,000 ton
- Etc: 92,694 ton
- Total: 720,000 ton

**Reduction of CO₂**
- Ref: 256,000 ton-CO₂
- W.M: 196,000 ton-CO₂
- TV: 100,000 ton-CO₂
- A.C: 16,000 ton-CO₂
- Total: 620,000 ton

**Energy saving & job creation**
- Energy saving: 118,111 TOE
- Job creation: over 100 people per year
Operating Case of a Recycling Center

- Introduction to Metropolitan Recycling Center
- Recycling Process and Technologies
### Introduction to MRC (Metropolitan Recycling Center)

#### Outline of MRC

<table>
<thead>
<tr>
<th>Part</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
<td>Refrigerator, Washing machine, Air conditioner, etc.</td>
</tr>
<tr>
<td>Capacity</td>
<td>21,000 ton/yr</td>
</tr>
<tr>
<td>Site</td>
<td>Area: 25,000 m$^2$, Building: 5,540 m$^2$</td>
</tr>
<tr>
<td>Reproduced Materials</td>
<td>Fe, Cu, Al, Plastic, etc.</td>
</tr>
<tr>
<td>Main equipment</td>
<td>Shredder, Separator, Urethane separator, CFC treatment, etc.</td>
</tr>
</tbody>
</table>

#### Area and Collecting Routes

![Map showing collecting routes](image)

#### Recycling Status of Collected Items (MRC, 2011 as a standard)

<table>
<thead>
<tr>
<th>Item</th>
<th>Refrigerator</th>
<th>Washing machine</th>
<th>Etc.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Unit: thousand]</td>
<td>159</td>
<td>75</td>
<td>43</td>
<td>277</td>
</tr>
</tbody>
</table>
Introduction to MRC (Metropolitan Recycling Center)

Composition of Main Items Collected

- **Refrigerator**
  - Recycling rate: 80.66%

- **Washing machine**
  - Recycling rate: 93.44%

- **Air-conditioner**
  - Recycling rate: 68.98%

- **Small appliance**
  - Recycling rate: 85.59%
Recycling Process & Technologies

Recycling Process

- Refrigerator
  - Pretreatment (Manual)
  - First Shredder
  - Second Shredder
  - Urethane compressor

- Washing machine
  - Pretreatment (Manual)
  - Shredder
  - Magnetic separator
  - Air separator

- Air-conditioner & Small appliances
  - Pretreatment (Manual)
  - Assemble parts & case detachment

Materials:
- Cu (Copper)
- Al (Aluminum)
- Fe (Iron)
- Ref. Plastic
- W.M Plastic
- Ref. Plastic
Recycling Process & Technologies

Photographs of main equipments

Shredder
Compressor of Urethane
Separator of CFC, Oil
Magnetic separator
Gravitation separator
Pneumatic separator
Recycling Process & Technologies

CFC (Chlorofluorocarbon) Recycling Process

- CFC treatment in A.C, Ref.
- CFC extraction at pretreatment
- Separation storage of R11, R12
- Re-use by refrigerant supplement

PCBs (printed circuit board) Recycling Process

- Separation of PCBs
- Shredding of PCBs
- Melting - smelter
- Extraction of valuable metals

- Valuable metals (Au, Ag, etc.) are included PCBs
- But, PCBs have to be in special management because of hazardous materials such as Pb.
## Main Products with Purity in MRC

**Collection of Valued Reusable Materials**

<table>
<thead>
<tr>
<th></th>
<th>Fe</th>
<th>Al</th>
<th>Plastic</th>
<th>Etc. Non-Fe</th>
<th>Etc.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7,190</td>
<td>201</td>
<td>4,668</td>
<td>577</td>
<td>2,460</td>
<td>15,096</td>
</tr>
</tbody>
</table>

[Unit: ton/yr]

## Degree of Purity

- **Fe**: Purity 98%
- **Synthetic resin**: Purity 95%
- **CFC(R12)**: Purity 92%
- **Cu**: Purity 95%
- **Al**: Purity 95%
- **Urethane**: Purity 90%
Thank you~