

## 3.3 Materials Recycling

### 3.3.1 E-Waste Definition

E-Waste for short - or Waste Electrical and Electronic Equipment - is the term used to describe old, end-of-life or discarded appliances using electricity.

It includes computers, consumer electronics, fridges etc which have been disposed of by their original users.

"e-waste" is used as a generic term embracing all types of waste containing electrically powered components.

e-Waste contains both valuable materials as well as hazardous materials which require special handling and recycling methods.

Examples: Computers, LCD / CRT screens, cooling appliances, mobile phones, etc., contain precious metals, flame retarded plastics, CFC foams and many other substances.

### 3.3.2 Categories of e-waste

#### Large Household Appliances

Washing machines, Dryers, Refrigerators, Airconditioners, etc.

#### Small Household Appliances

Vacuum cleaners, Coffee Machines, Irons, Toasters, etc.

#### Office, Information & Communication Equipment

PCs, Laptops, Mobiles, Telephones, Fax Machines, Copiers, Printers etc.

## Entertainment & Consumer Electronics

Televisions, VCR/DVD/CD players, Hi-Fi sets, Radios, etc

## Lighting Equipment

Fluorescent tubes, sodium lamps etc. (Except: Bulbs, Halogen Bulbs)

## Electric and Electronic Tools

Drills, Electric saws, Sewing Machines, Lawn Mowers etc.

## Toys, Leisure, Sports and Recreational Equipment

Electric train sets, coin slot machines, treadmills etc.

## Medical Instruments and Equipment

## Surveillance and Control Equipment

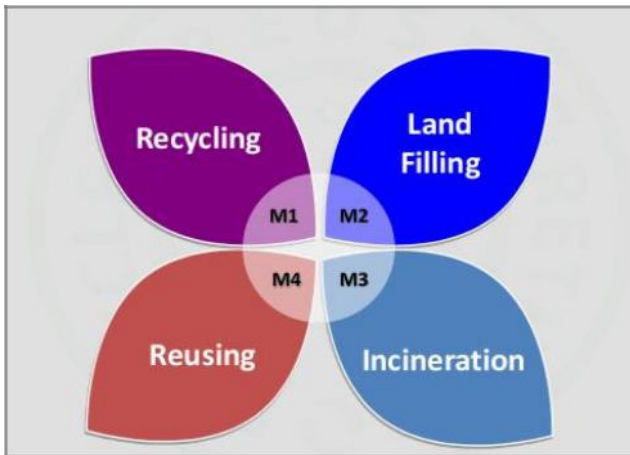
## Automatic Issuing Machines



Figure 3.2 E-waste types

### 3.4 Recycling Technologies

e-Waste management practices comprise of various means of final disposal of end-of-life equipment which have different impacts on human health and the environment. It can be distinguished between state-of-the-art recycling technologies, which comply with high environmental and occupational health standards and hazardous technologies that bear a great risk for both health and the environment and are often applied in countries, where no strict standards exist.



**Figure 3.3 e-waste disposal**

#### 3.4.1 Hazardous Technologies

##### **Incineration:**

Incineration is the process of destroying waste through burning. Because of the variety of substances found in e-waste, incineration is associated with a major risk of generating and dispersing contaminants and toxic substances.

### Open Burning:

Since open fires burn at relatively low temperatures, they release many more pollutants than in a controlled incineration process at an MSWI-plant. Inhalation of open fire emissions can trigger asthma attacks, respiratory infections, and cause other problems such as coughing, wheezing, chest pain, and eye irritation. Often open fires burn with a lack of oxygen, forming carbon monoxide, which poisons the blood when inhaled.

### Land filling:

Land filling is one of the most widely used methods of waste disposal. However, it is common knowledge that all landfills leak. The leachate often contains heavy metals and other toxic substances which can contaminate ground and water resources.

### 3.4.2 State-of-the-art Recycling Technologies

The state-of-the-art recycling of e-waste comprises three steps



Figure 3.4 e-waste management services

## **Detoxication**

The first step in the recycling process is the removal of critical components from the e-waste in order to avoid dilution of and / or contamination with toxic substances during the downstream processes. Critical components include, e.g., lead glass from CRT screens, CFC gases from refrigerators, light bulbs and batteries.

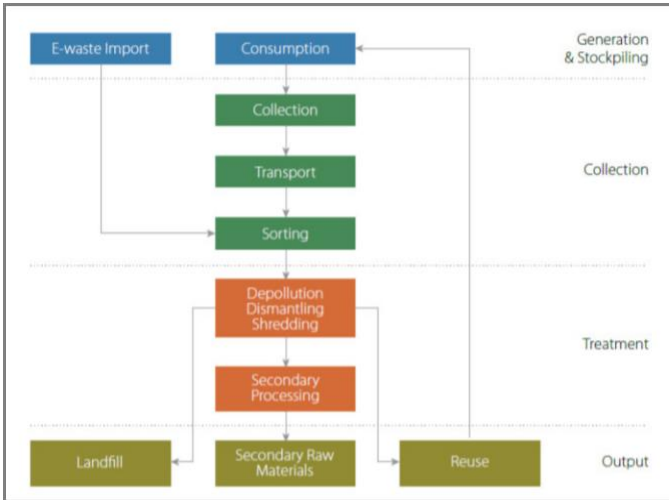
## **Shredding**

Mechanical processing is the next step in e-waste treatment, normally an industrial large scale operation to obtain concentrates of recyclable materials in a dedicated fraction and also to further separate hazardous materials.

## **Refining**

The third step of e-waste recycling is refining. Refining of resources in e-waste is possible and the technical solutions exist to get back raw with minimal environmental impact. Most of the fractions need to be refined or conditioned in order to be sold as secondary raw materials or to be disposed of in a final disposal site, respectively. During the refining process, to three flows of materials is paid attention: Metals, plastics and glass.

### 3.4.3 E-waste Management – Six Steps



**Figure 3.5 six steps to e-waste management**

### 3.4.4 Benefits of recycling

Recycling raw materials from end-of-life electronics is the most effective solution to the growing e-waste problem. Most electronic devices contain a variety of materials, including metals that can be recovered for future uses. By dismantling and providing reuse possibilities, intact natural resources are conserved and air and water pollution caused by hazardous disposal is avoided. Additionally, recycling reduces the amount of greenhouse gas emissions caused by the manufacturing of new products.