

# **Introduction of an example on circular economy**

## **Recycling of Used Home Appliance under the Act on Recycling of Specified Home Appliance in Japan**

15/12/2021



Association for Electric Home Appliances

# Recycling home appliances in Japan

# Recycling Home Appliances in Japan

The Home Appliance Recycling Law  
came into effect on April 1, 2001



12 million large home appliances  
are recycled per year !



Refrigerators

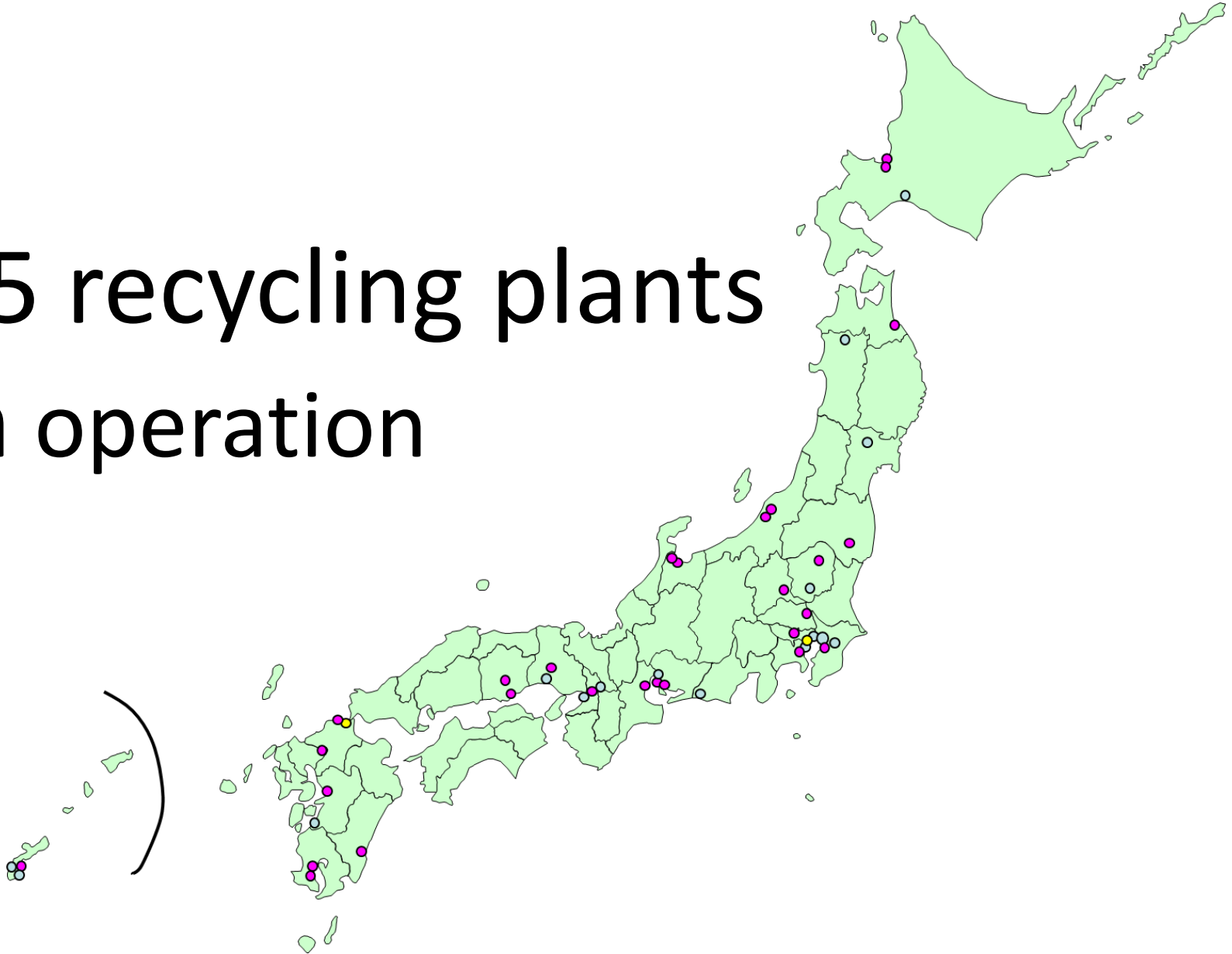
Washing machines

TVs

Air conditioners

# Recycling Home Appliances in Japan

45 recycling plants  
in operation



# Purpose of the Home Appliance Recycling Act

- Effectively use the "recyclable resources" contained in home appliances.



**Achieve both at the same time**



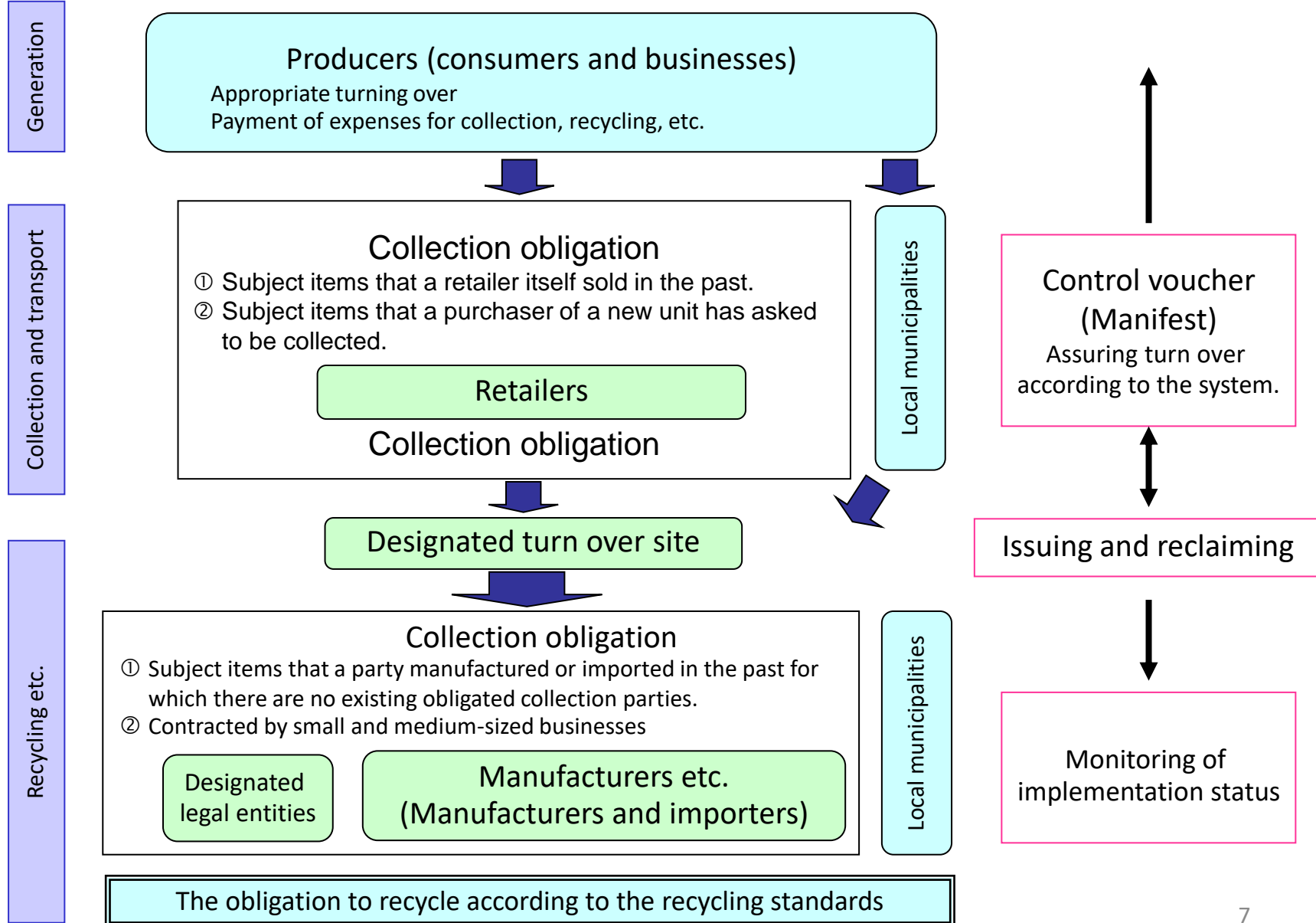
- Process the recyclable resources appropriately so that there is no harm to the living environment.

# Appliances That Are Subject to the Home Appliance Recycling Act

The items that are subject to the Home Appliance Recycling Act are the ones that meet the **four conditions** below from among the electrical equipment used in homes and they are mostly home appliances.

- ① Items that are difficult for local municipalities to recycle, etc.
- ② Items which highly require recycling.
- ③ Items for which their design and the selection of parts, etc. have an important effect on recycling.
- ④ Items which are suitable for collection by retailers because they are delivered.

# Overview of the Home Appliance Recycling Act



# The Separation of Roles in Home Appliance Recycling

## Consumers/Business operators (Dischargers)

Discard in the proper manner.  
Pay recycling and collection/transport fees.

## Home appliance stores (Retailers)

**Collect** products that are no longer used.

- The collecting store sold the product in the past
- When a new similar product is purchased at the collecting store

**Turning over** to home appliance manufacturers

## Home appliance manufacturers (Including recycling plants)

**Collect** from home appliance stores

**Recycle** in a secure and safe way  
**(Recycling)**



# Fees and Separation of Roles

**Roles of home  
appliance stores**

**Roles of home appliance  
manufacturers**



# How Manufacturers Can Fulfill Their Responsibilities

① Outsource to a third-party

② Recycle by themselves

# Recycling standards

	Air conditioners	CRT TVs	LCD/Plasma TVs	Refrigerators/ Freezers	Washing Machines/ Dryers
Recycling standards	80% or higher	55% or higher	74% or higher	70% or higher	82% or higher

Only material recycling is applicable.  
Not applicable for thermal recycling

Furthermore, only items that can be sold for value are eligible.  
(If it cannot be sold, it is not included.)

# What is Recycling?

(Definition)

**Article 2.** With respect to machinery and equipment that has been discarded, "recycling" according to this act includes the two following actions.

1. The act when a party separates parts and/or materials from discarded machinery and equipment, and uses them as parts or materials of a product.
2. The act when a party separates parts or materials from discarded machinery and equipment, and processes them into a state in which they can be transferred to another party, with or without compensation, who will use them as parts or materials of a product.

Separating parts and/or materials



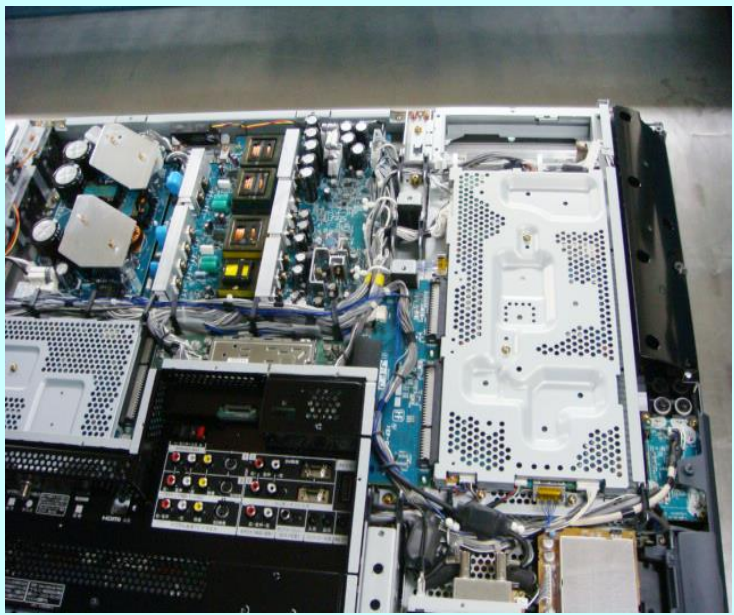
Processing materials into a sellable state



# The Design for Environment (DfE) Initiative

# DfE Example (TVs)

To simplify disassembly, modern TVs are designed with a reduced number of screws

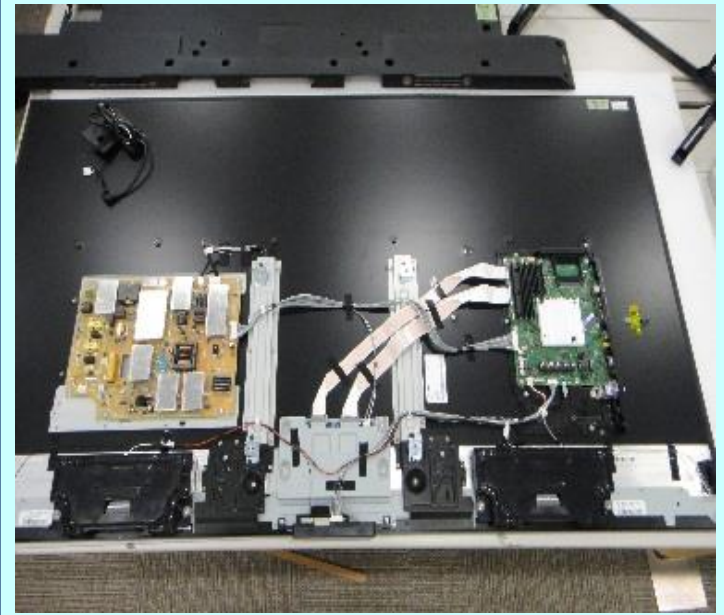


2005 model, 42"

Weight: 44 kg

No. of screws: 392

No. of circuit boards: 20



2017 model, 65"

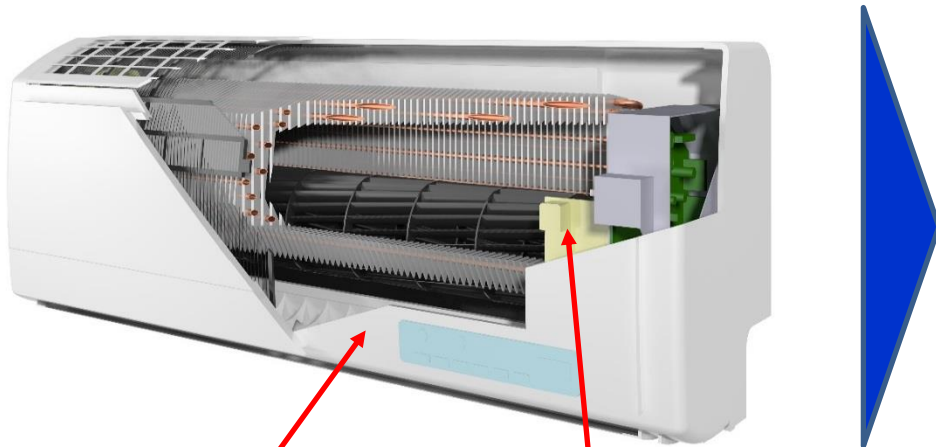
Weight: 21 kg

No. of screws: 80

No. of circuit boards: 3

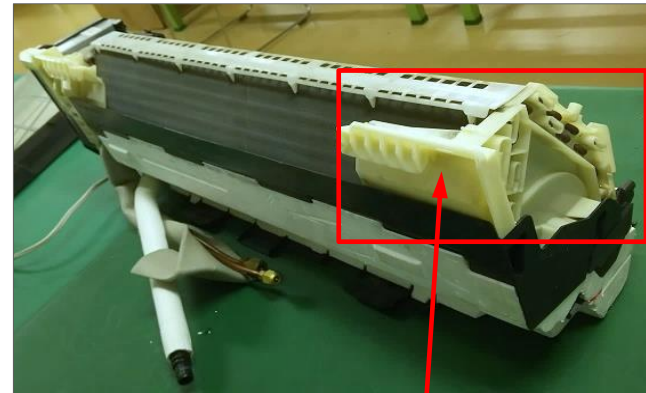
# DfE Example (air conditioners)

To simplify reusing plastic, use of different types of plastic is reduced



Indoor unit cover material: **PS**

Heat exchanger holder material: **ABS**



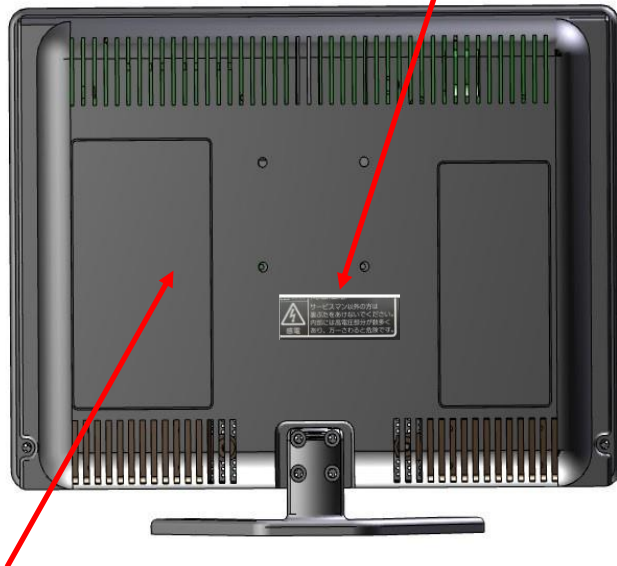
Heat exchanger holder material: **PS**



# DfE Example (LCD TVs)

To simplify material recycling, the labels on the rear cover are made of the same material as the cover itself.

Label Material: **Paper**



Rear cover material: **PS**

Label material: **PS**



Rear cover material: **PS**



# Recycling process of our plants

# Process at home appliance recycling plant

## ① Manual disassembly



Shredding

## ② Separating Fe, Cu, Al



③ Mixed plastic residue  
approx. 30wt%  
of input

# ① Selecting Materials for Recycling by Manual Disassembly

Before being placed in the crusher, recyclable materials are sorted

**Air conditioning**



**TV**



**Refrigerator**



**Washing machine**



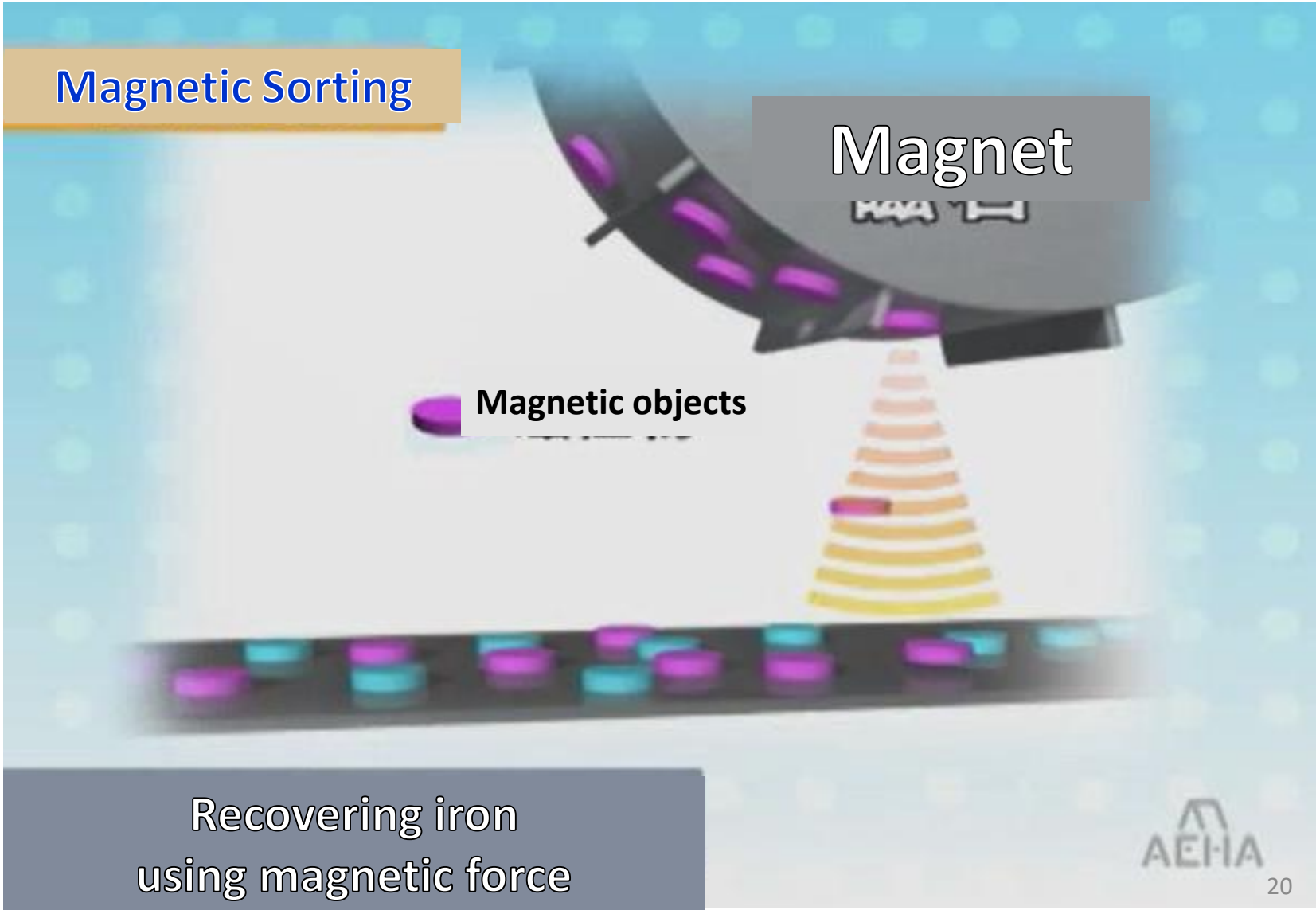
## ② Removing Iron with Magnet

Magnetic Sorting

Magnet

Magnetic objects

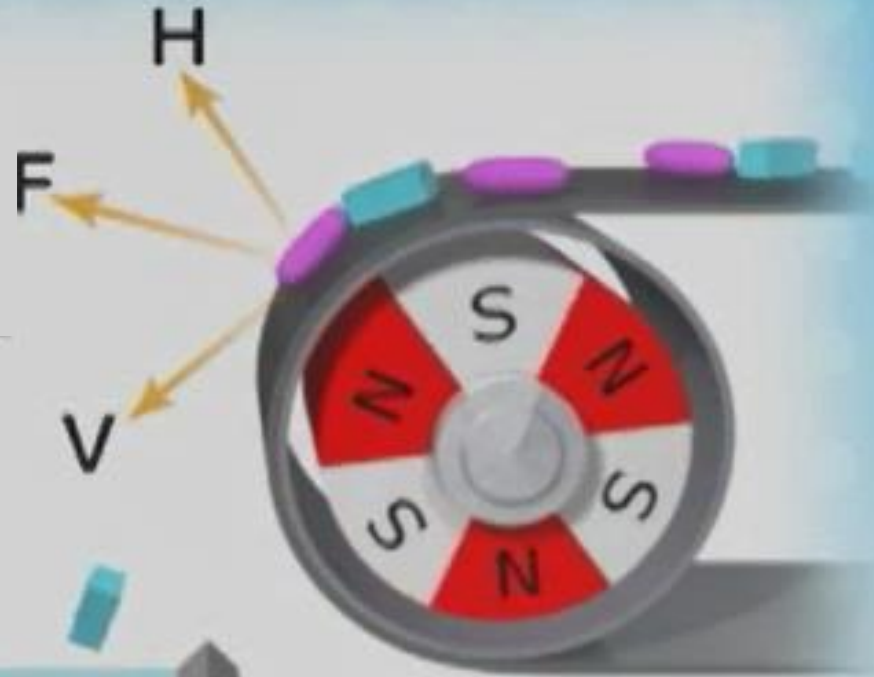
Recovering iron  
using magnetic force



## ② Using Induced Electromotive Force to Separate Nonferrous Metals

### Eddy Current Separator

H = Centrifugal Repulsion  
V = Tangential Propulsion  
F = Resulting Direction

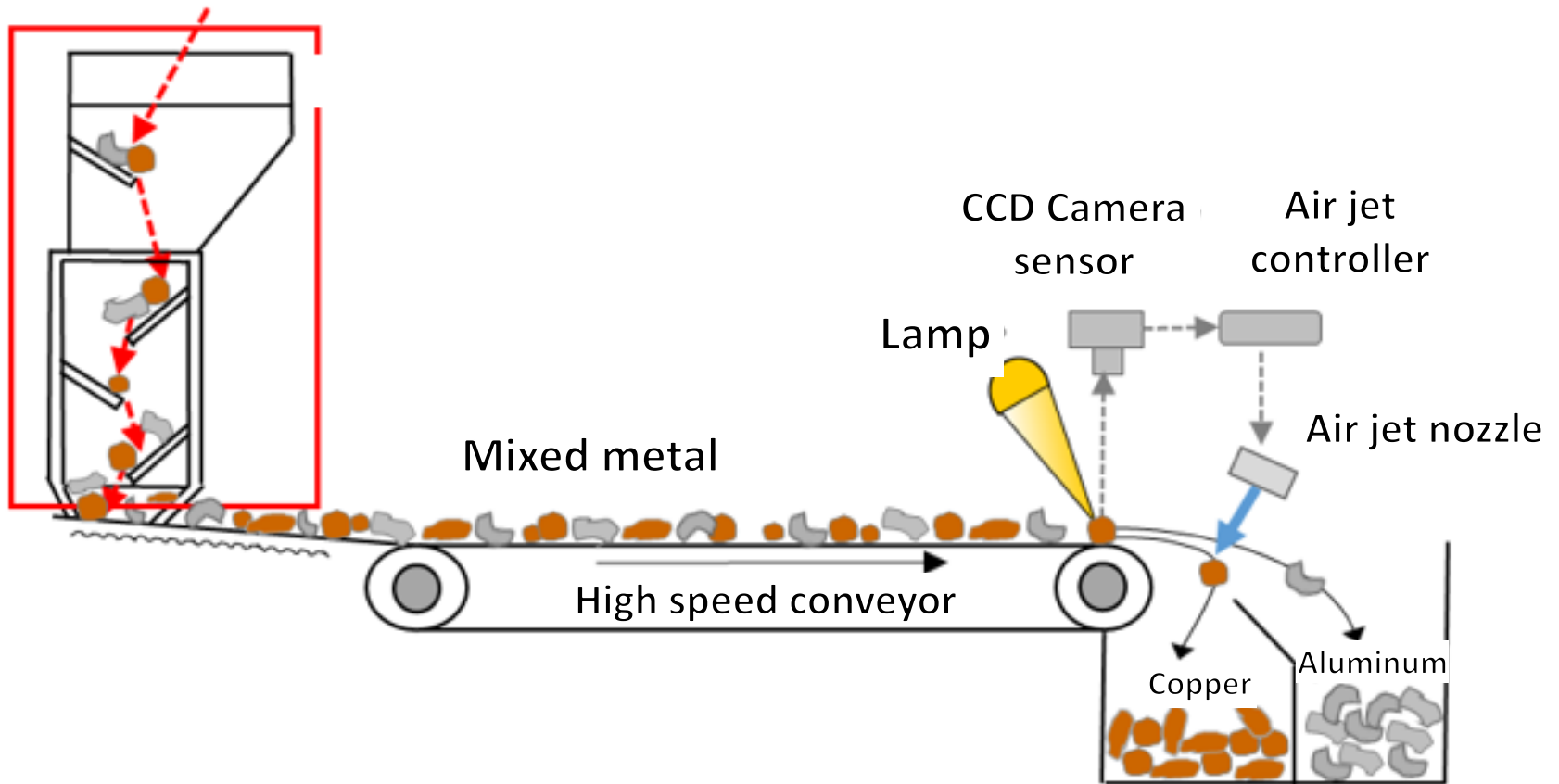


Collects copper and aluminum  
using differences in conductivity  
of various materials

Nonferrous metals  
(Copper, Aluminum)  
Plastics.

## ② Sorting Nonferrous Metals (Copper, Aluminum)

Sorting copper and aluminum by color





### ③ Residual shredded plastics

Most of it is plastic, but it contains some metal and foam packing.



# Principle of separation

## Residual shredded plastics

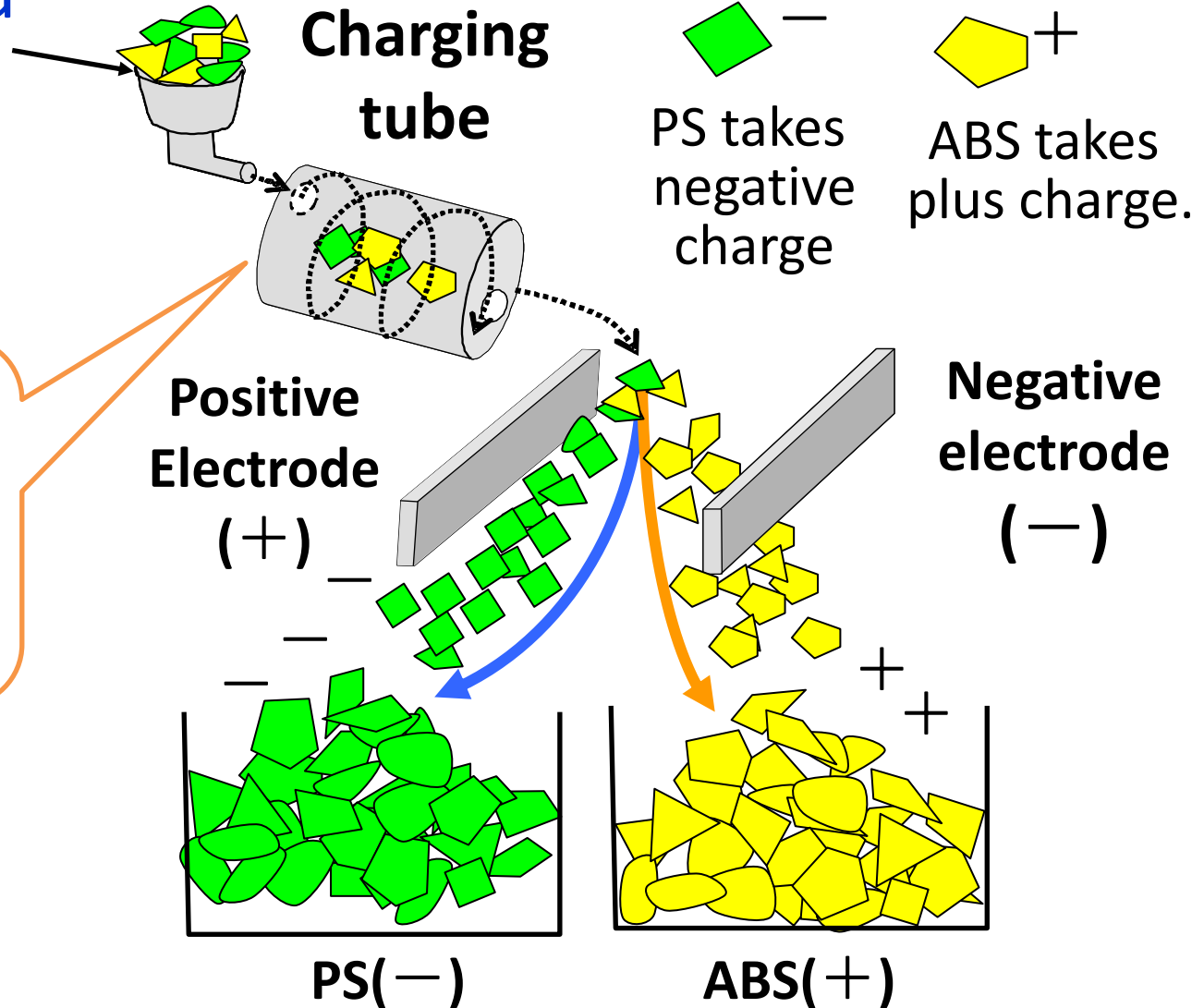
Target  
plastics  
(PP, PS, ABS)

Specific gravity	Main ingredients	Weight ratio
$\rho < 1.0$	PP	approx. 40%
$1.0 \leq \rho < 1.1$	PS ABS	approx. 30%
$1.1 \leq \rho$	Heavy plastics PVC, POM, PC	approx. 30%



# Electrostatic separation

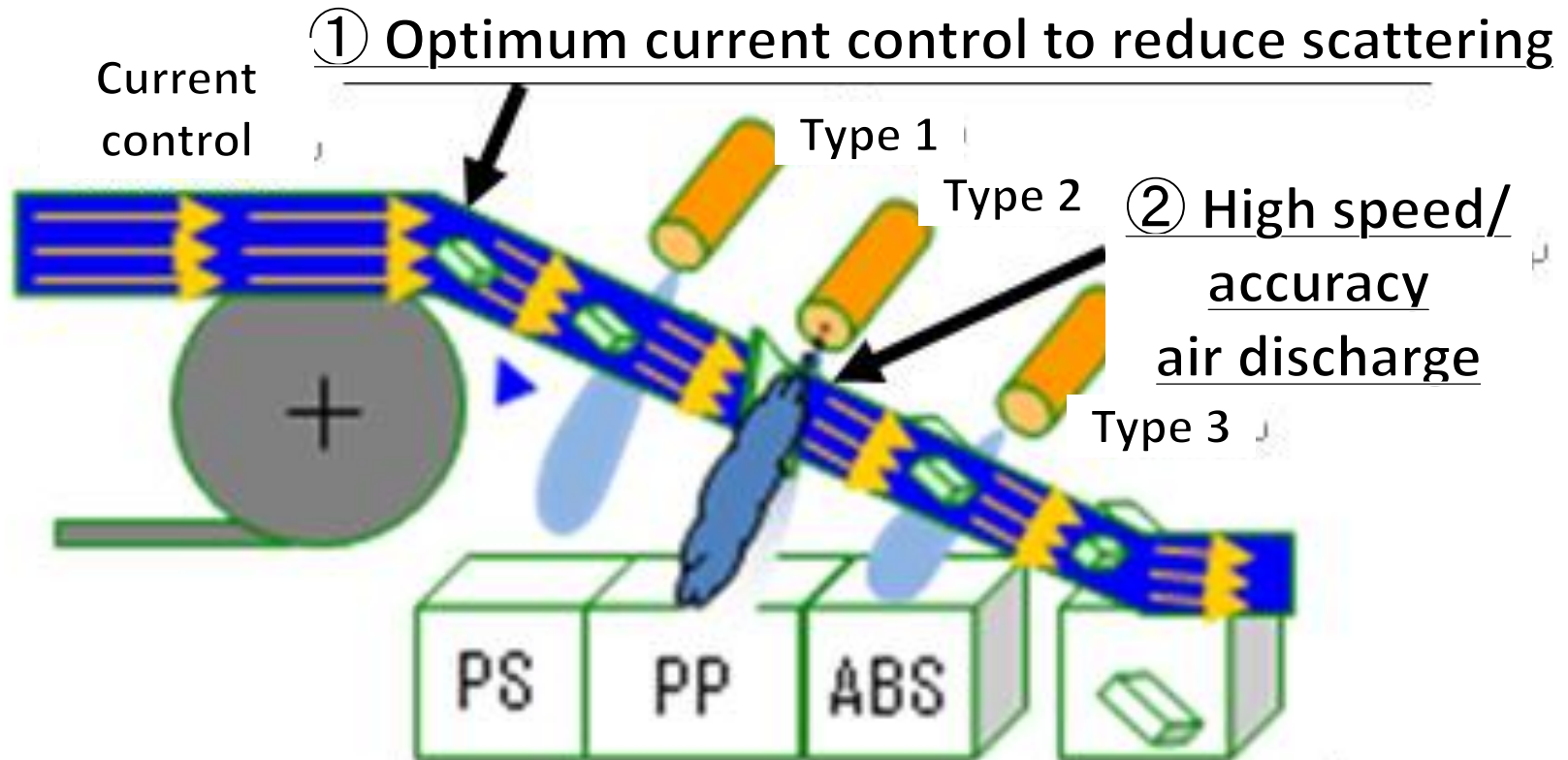
PS, ABS mixed plastic flakes



ABS and PS are frictionally charge in the charging tube.

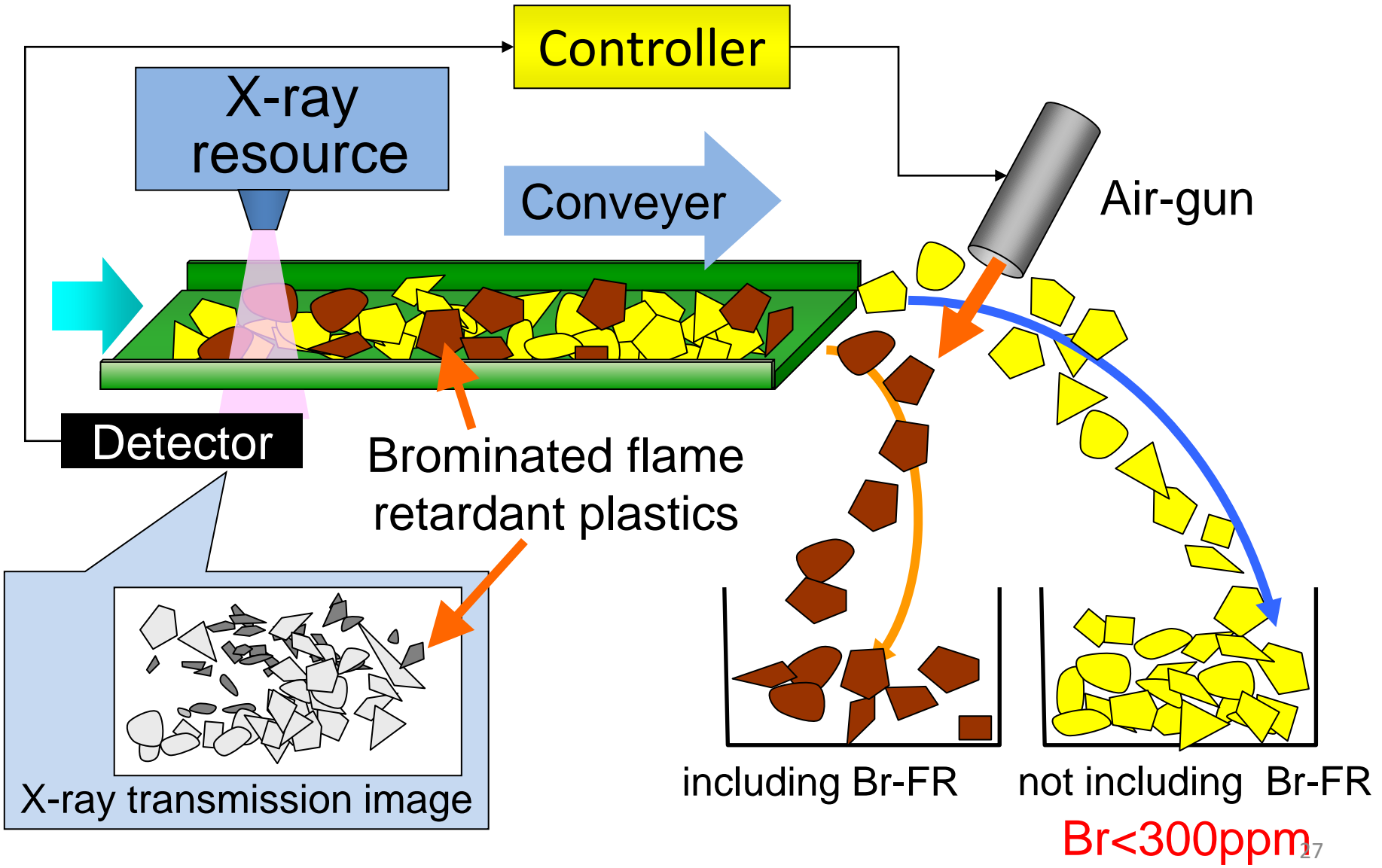
# Example of a newly designed machine

Using near-infrared screening to separate plastics by type



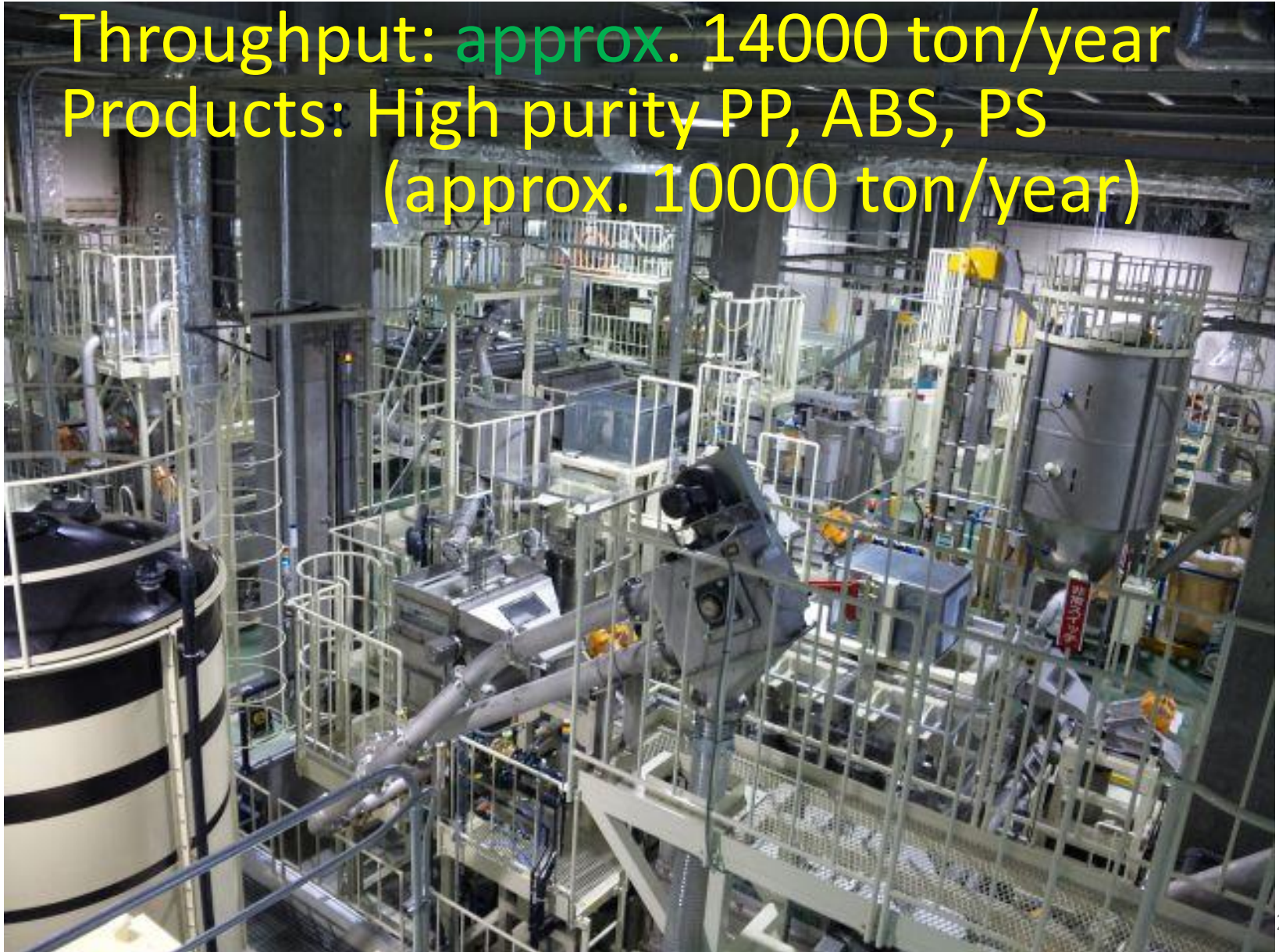
③ High speed/accuracy sorting by processing 3 types at the same time

# Removal of brominated flame retardant plastics



# Commercial plant

Throughput: approx. 14000 ton/year  
Products: High purity PP, ABS, PS  
(approx. 10000 ton/year)

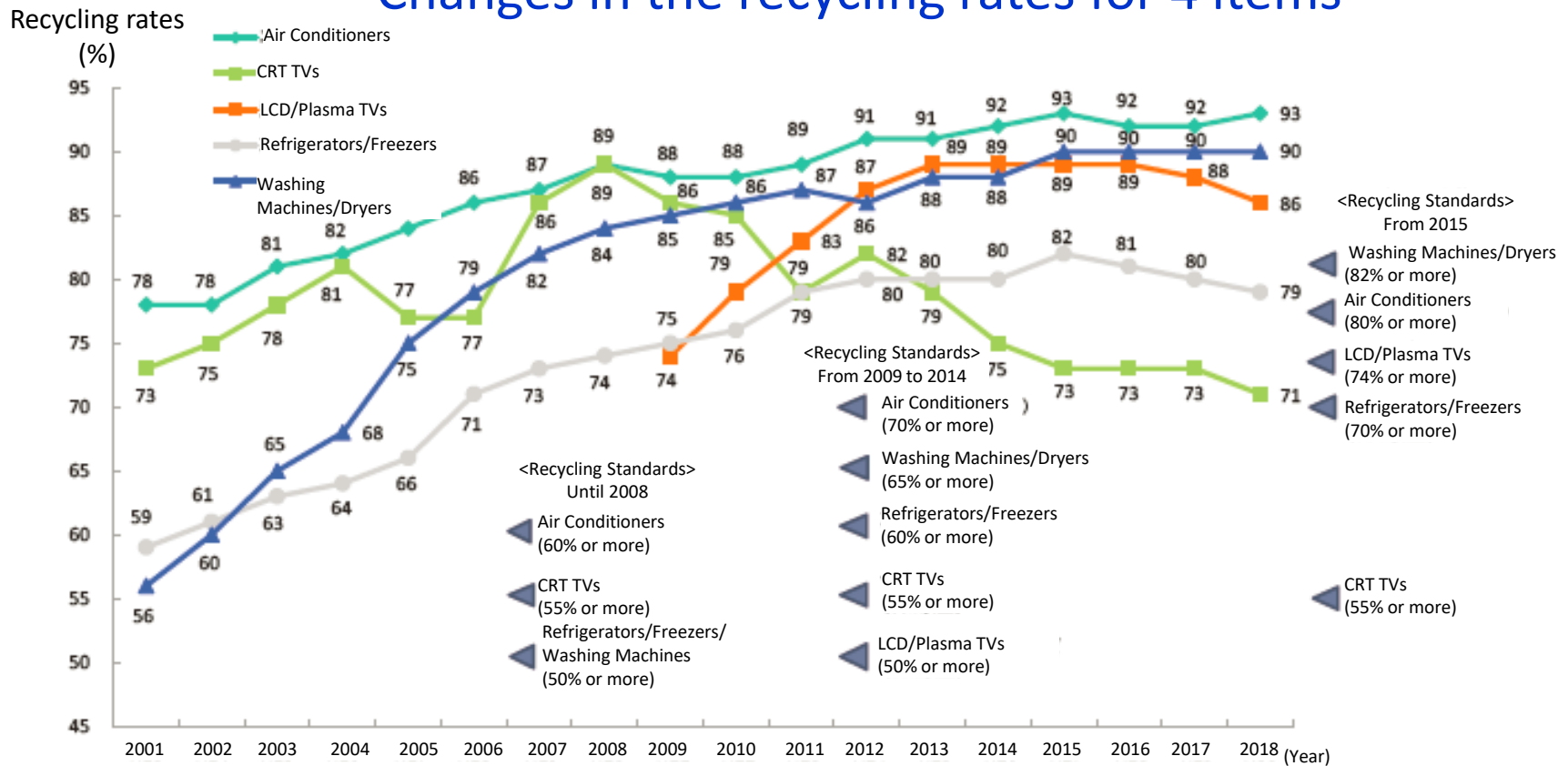




# Changes in Recycling Rates for Home Appliances

Thanks to various initiatives, the recycling rates have increased considerably

## Changes in the recycling rates for 4 items

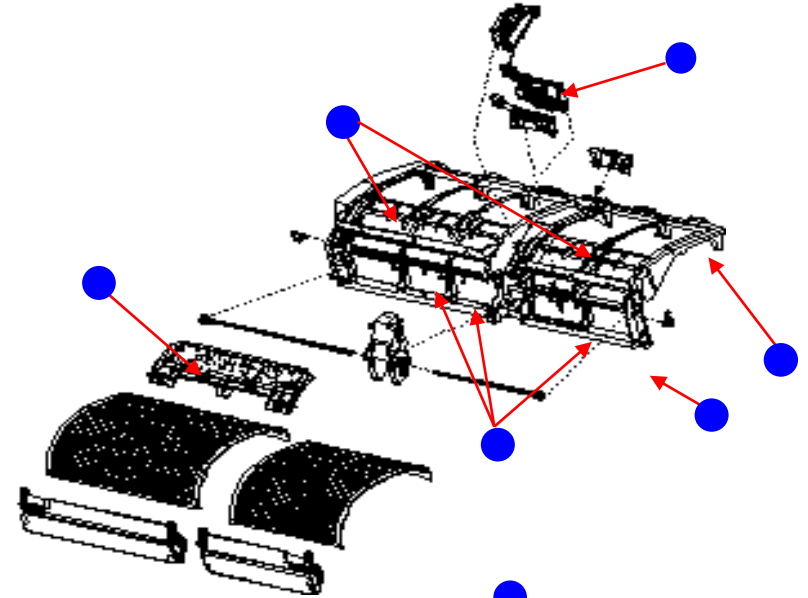


Not including thermal recycling

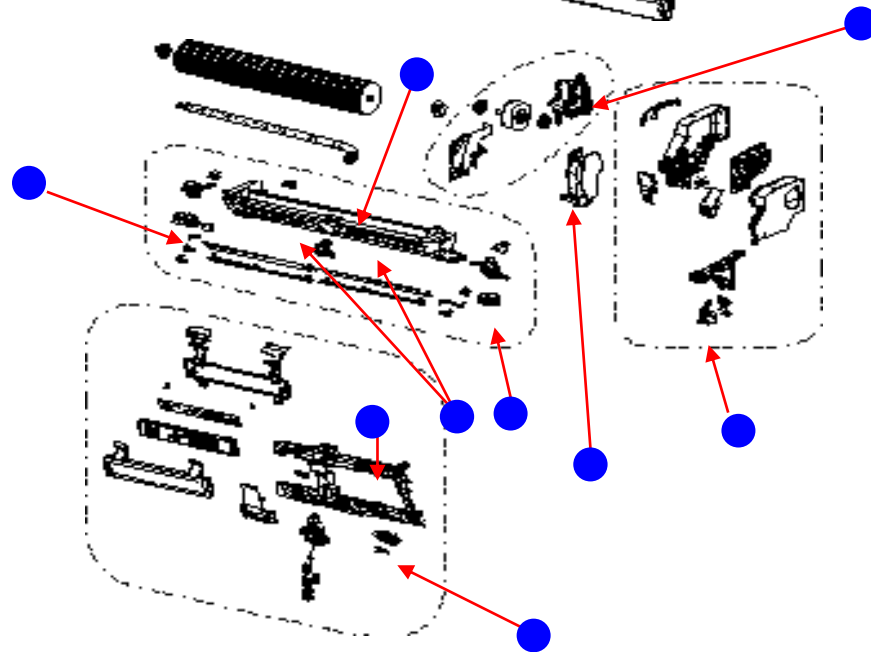
# Utilization of Recycled Materials

# Utilization of Recycled Materials (Air conditioners)

## <Air conditioner>

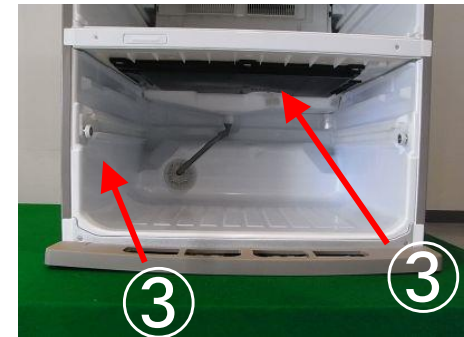
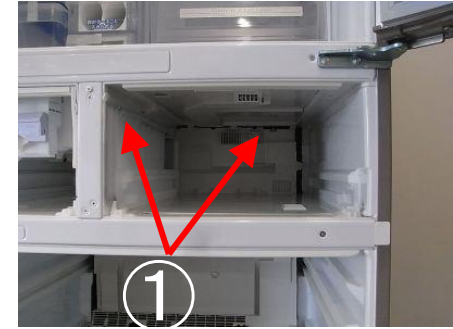
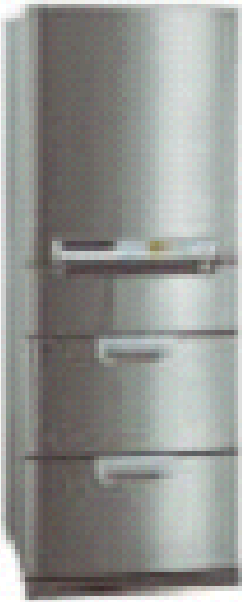


- Parts using recycled plastics



# Utilization of Recycled Materials (Refrigerators)

## <Refrigerator>



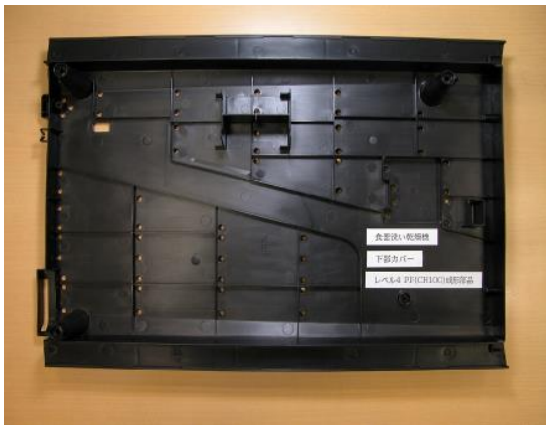


# Utilization of Recycled Materials (Other Home Appliances)

<Dish washing machine>



Base cover



<Cleaner>



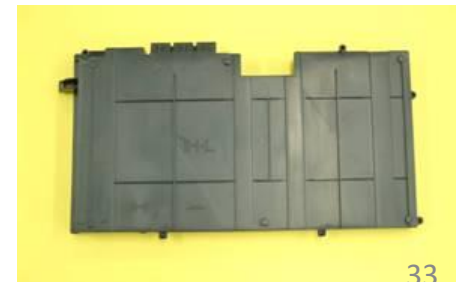
Motor cover (FR)



<IH cooking heater>

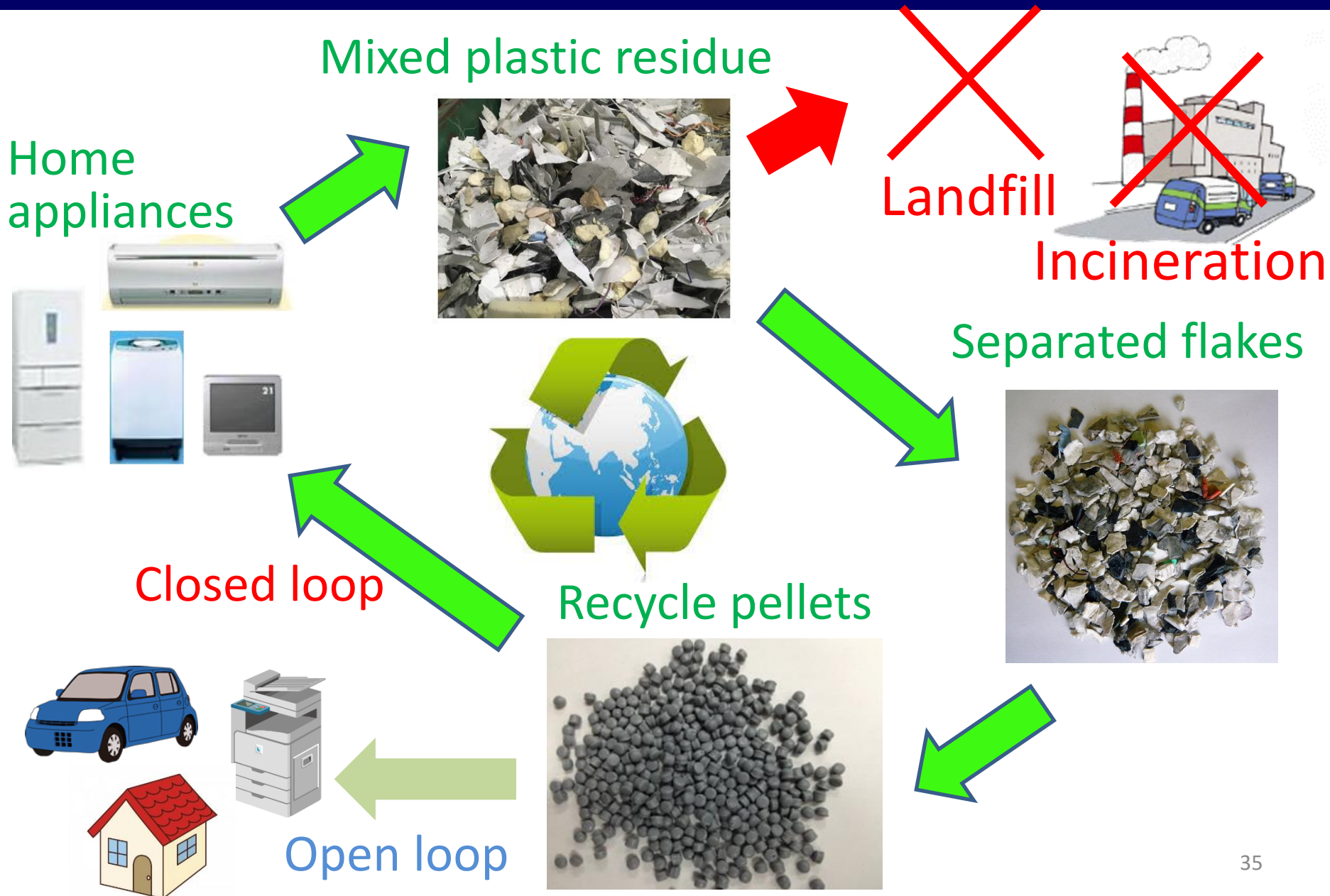


PCB holder (FR)



the future of extended producer's  
responsibility.

# What We Are Aiming for





Finally

Work together to create a society with  
zero emission