For Environmental Seminar in EiMAS in June

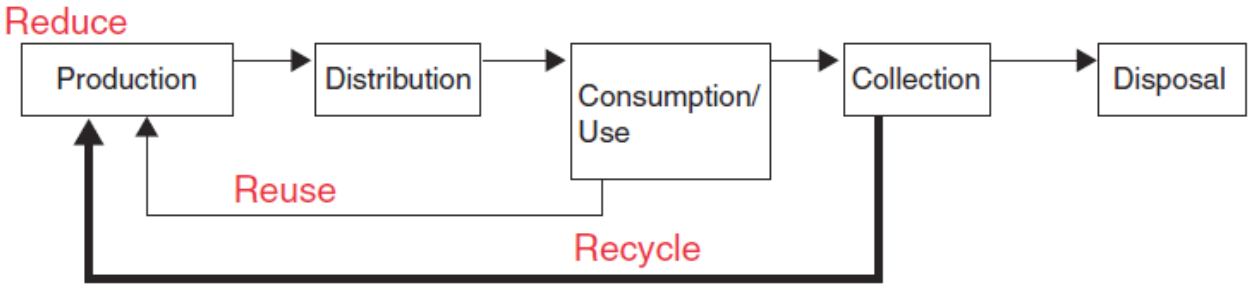
Material recycle in Japan and some examples of waste minimization practiced at sources

June 17, 2011

Japan Environmental Management Association for Industry
(JEMAI)

Contents

Laws in Product lifecycle in Japan



<Measures over various lifecycle phases>

Law for Promotion of Effective Utilization of Resources

- Resource saving in manufacturing processes
- Design for the environment (resource saving and prolonged lives of products)
- Promotion of recycling resources and reusing parts, etc.

Recycling Laws

- Containers and Packaging Recycling Law (1997) (Amended in June 2006)
- Home Appliance Recycling Law (2001)
- Food Recycling Law (2001) (Amended in June 2007)
- End-of-Life Vehicle Recycling Law (2005)
- Construction Recycling Law (2000)

Waste Management and Public Cleansing Law

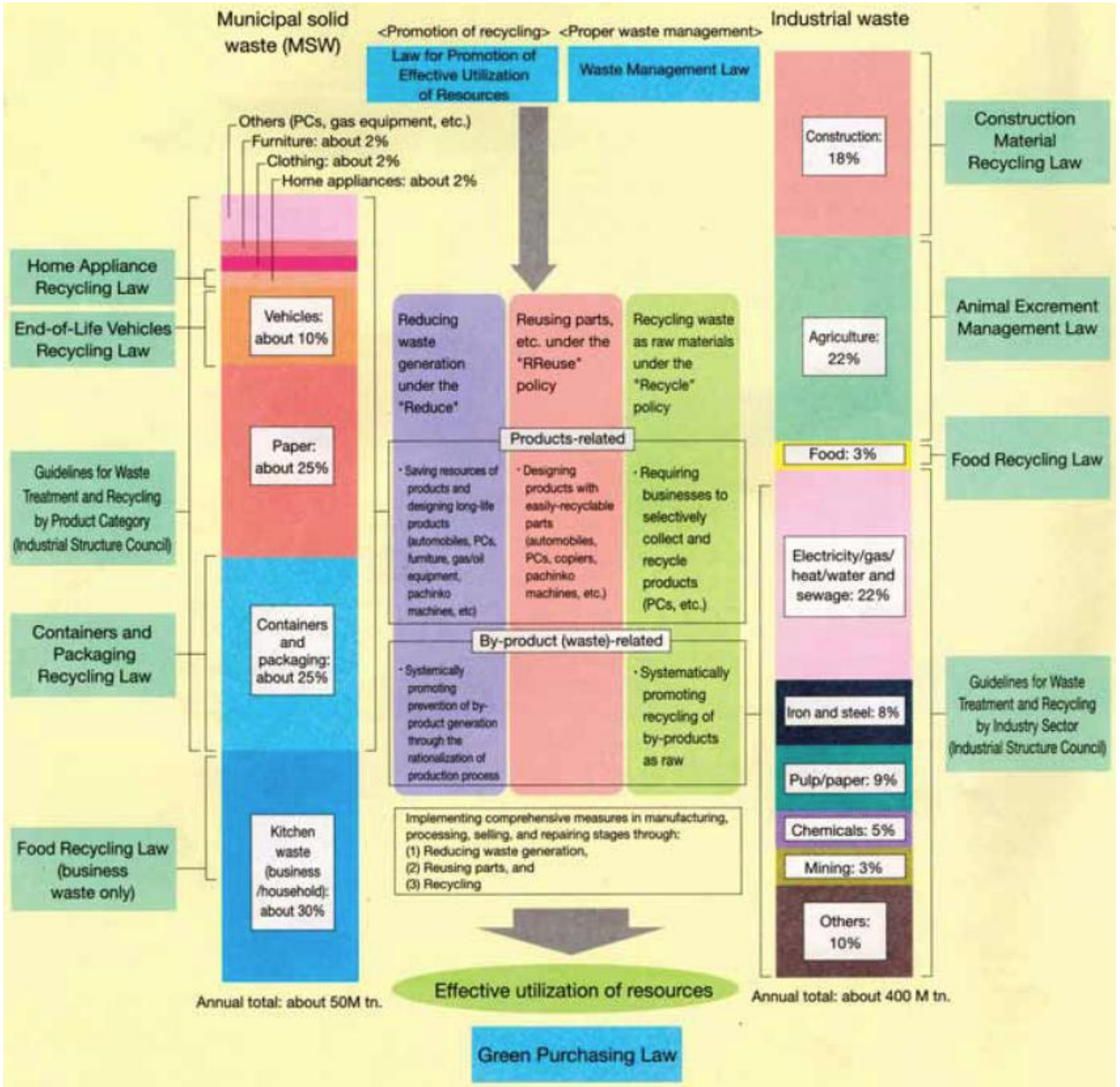
Proper waste disposal

Promotion of voluntary measures in line with guidelines issued by the Industrial Structure Council (35 items in 18 industries)nsing Law

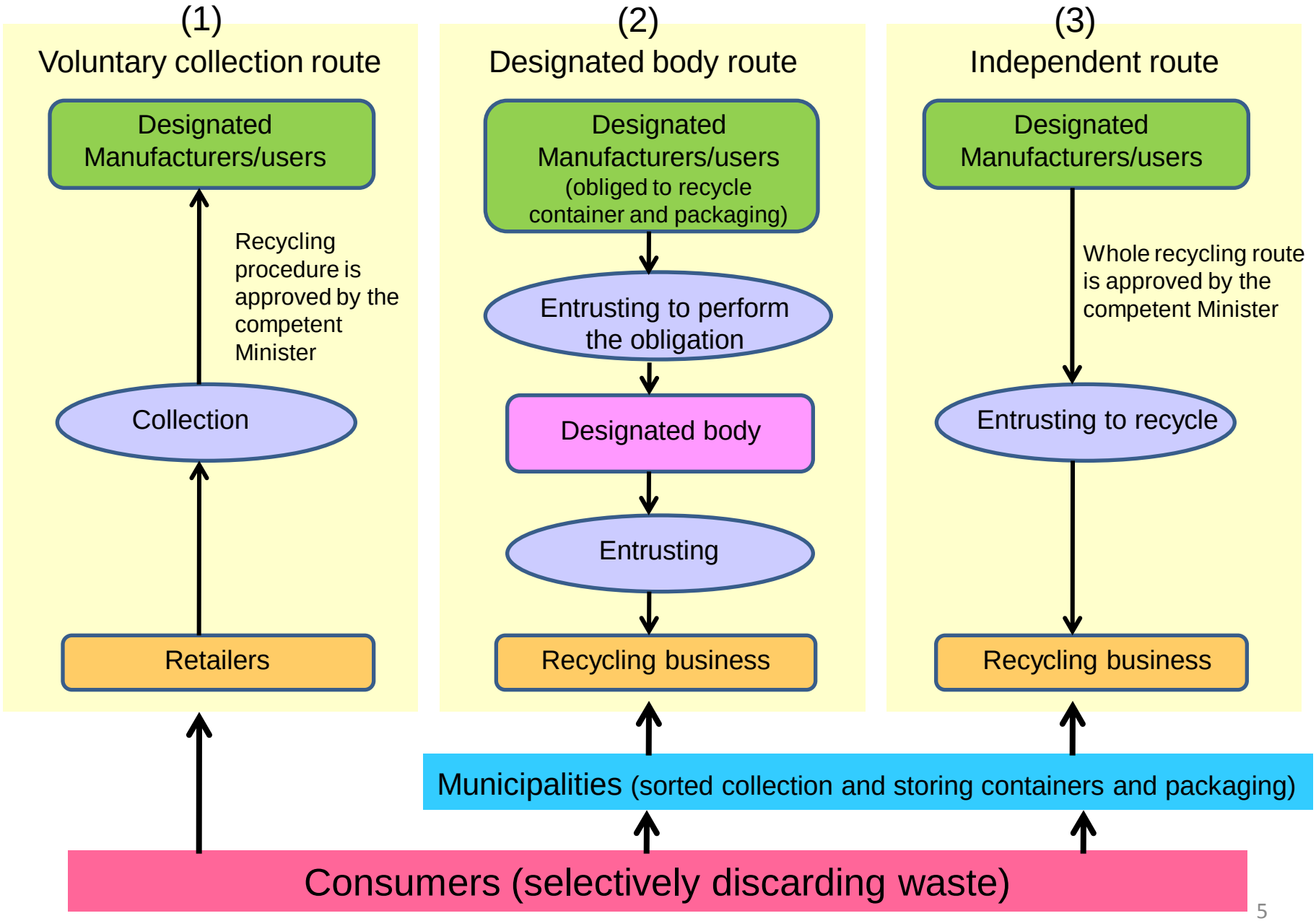
The Fundamental Plan for Establishing a Sound Material-Cycle Society

Target setting for material productivity, usage rate of recycled goods, and amount of final disposal

Laws and guidelines to control waste in Japan



Three routes of recycling



Containers and packaging recycling Law

1 Manufacturers of products that use containers and packaging

Manufacturers of food, soft drinks, alcohol, soap, paint, medicine, cosmetics

2 Manufacturers of containers

Manufacturers of bottles, PET bottles, paper bags and other bags

3 Retailers and wholesalers

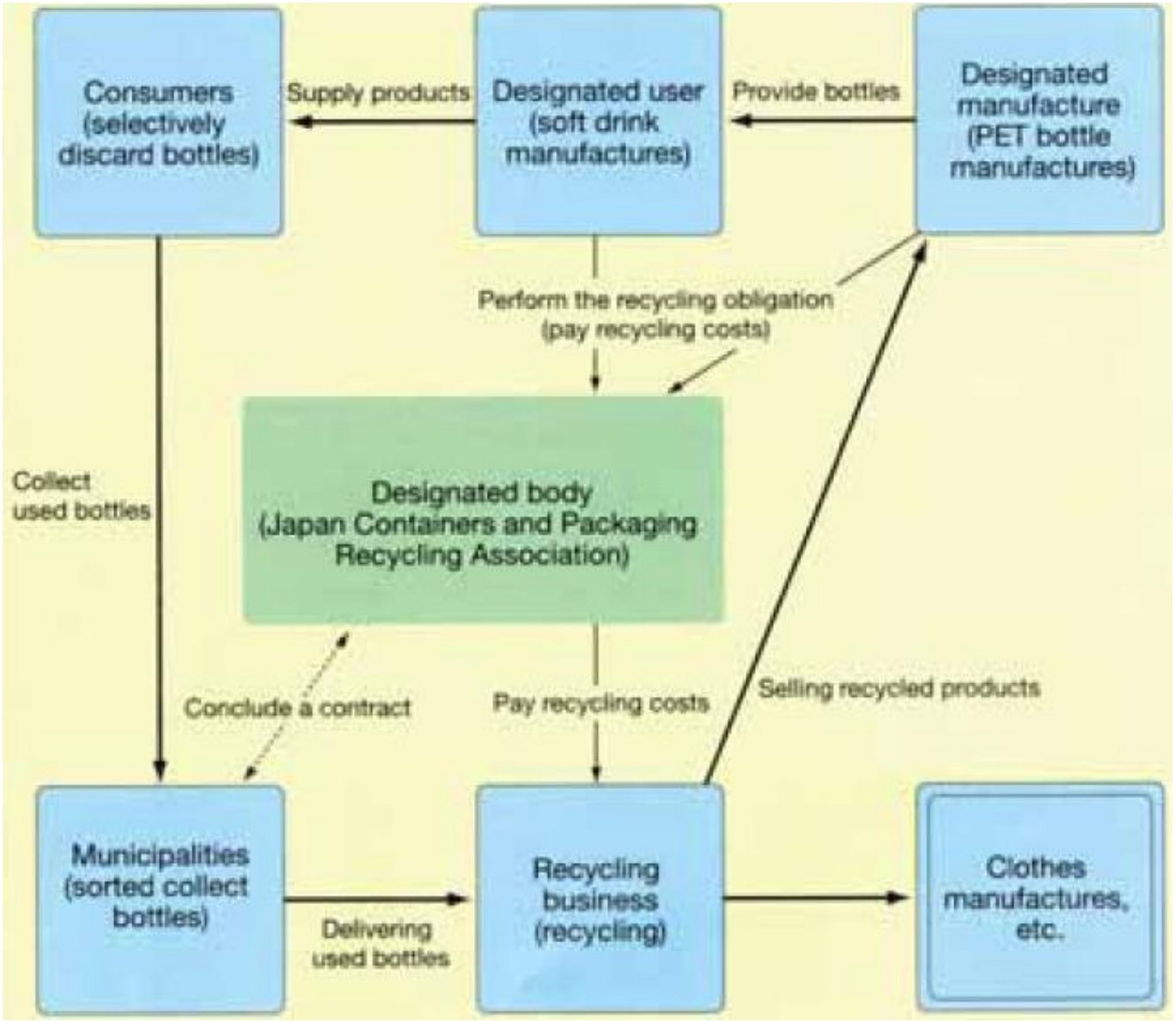
Businesses using containers and packaging when selling products

4 Importers

Businesses importing containers, importing products in containers or packaging, or using containers or packaging for imported products

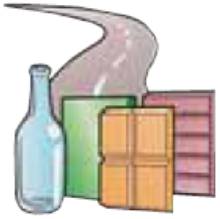
5 Schools, religious organizations, and restaurants that provide take-out services

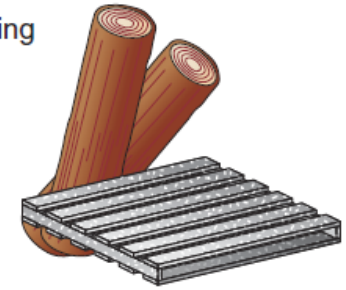
Scheme under the Containers and Packaging Recycling Law (Designated body route : PET bottles)



Methods for recycling waste from containers and packaging under the recycling obligation

Category	Recycling method	Examples of Recycled products
Glass bottles	Crushed into cullets	• Glass containers • Construction and civil engineering materials
PET bottles	Palletized, etc Polyester raw materials	• Fibers • Plastic sheets • PET bottles
Paper containers and packaging	Sorted by paper-making material + RDF Used for manufacturing construction boards of material woven from crushed recycled paper + RDF	• Paperboards • Construction materials • Refuse-derived fuel
Plastic containers and packaging Polystyrene foam trays	Raw materials for plastic products Liquefaction Blast furnace reducing agent Gasification Coal materials substitute for the coke oven Conversion into solid fuel, etc. (Note)	• Plastic products including imitation wood and palettes • Industrial raw materials•Solid fuel, etc.

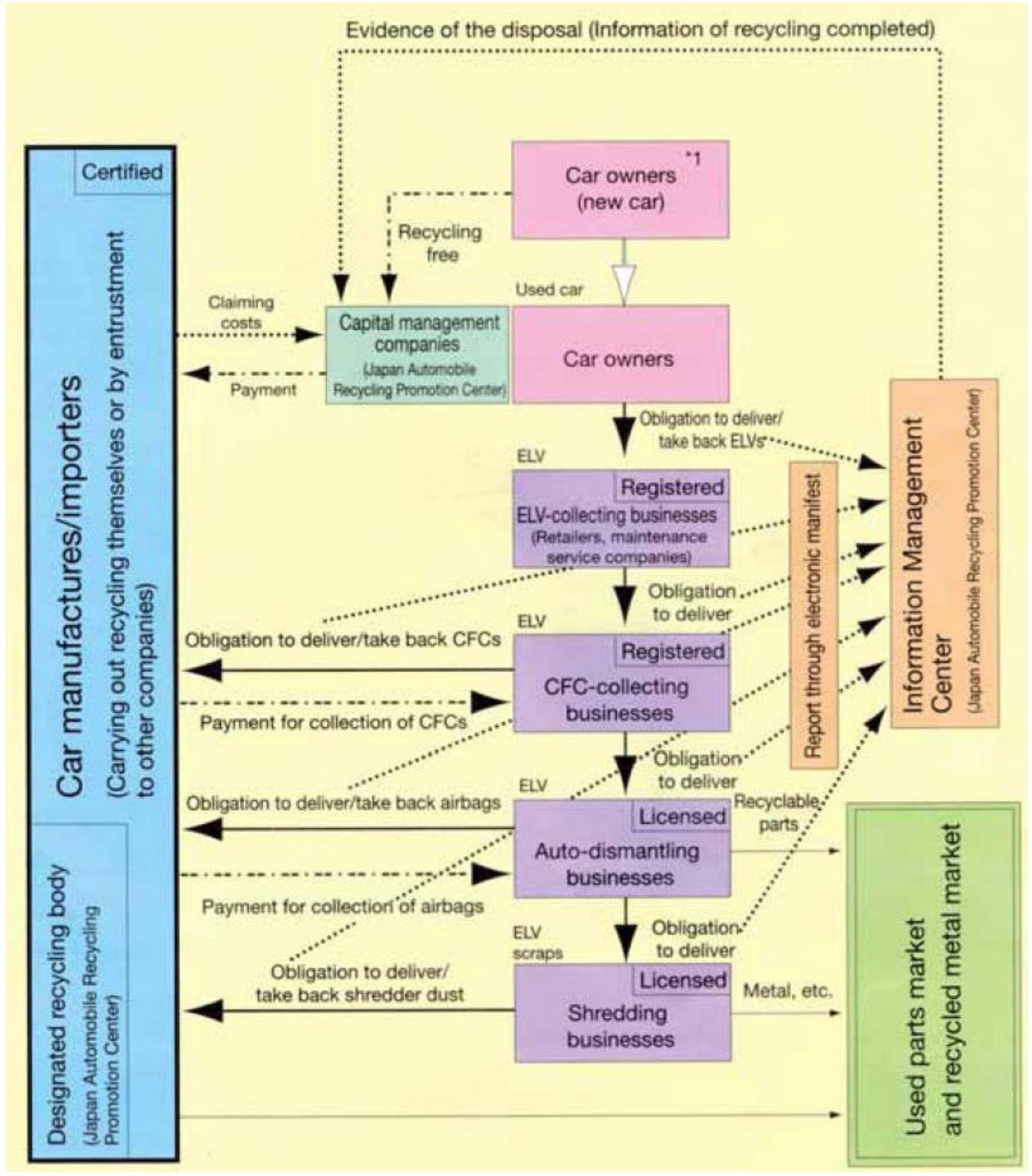




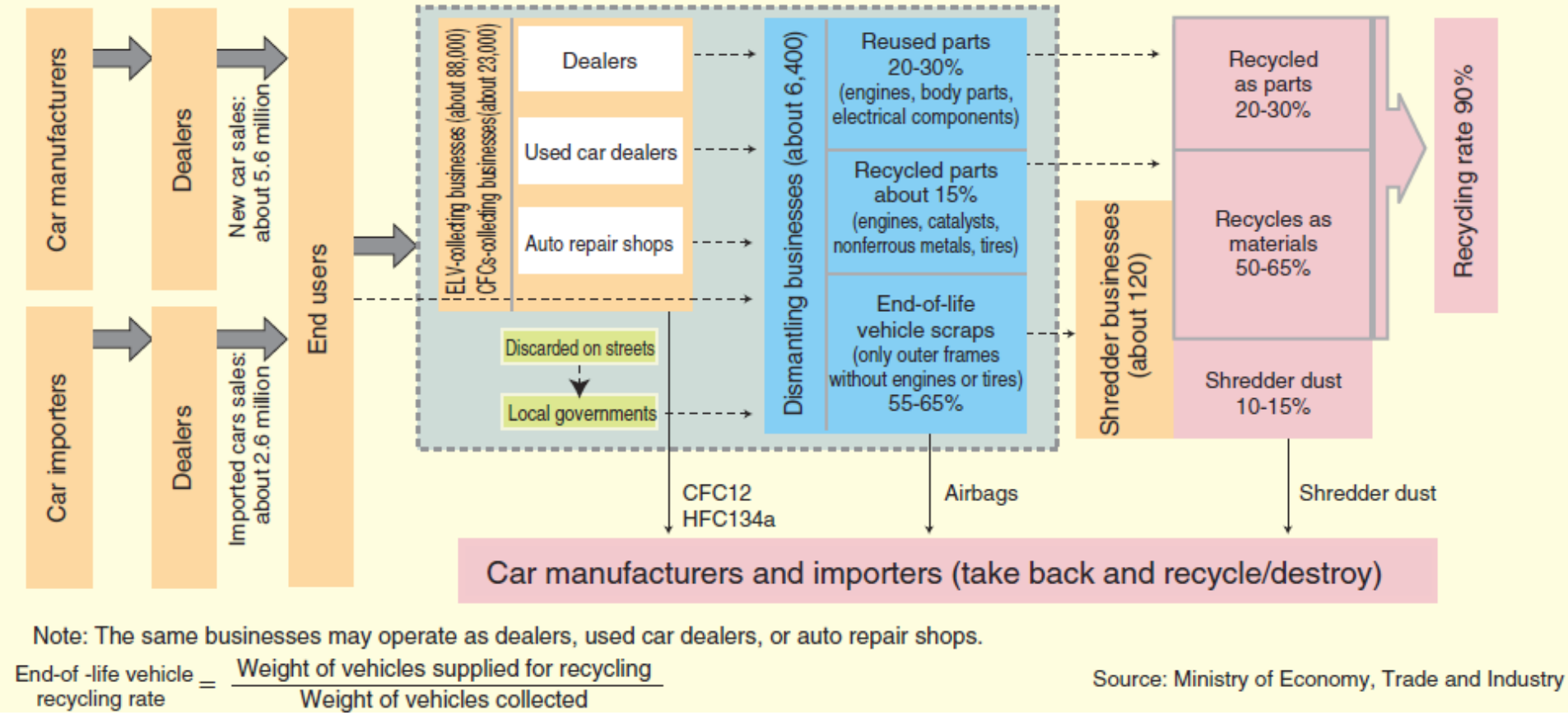
(Note) A contingent or complementary way used when smooth recycling in any other way is difficult.

* Steel cans, aluminum cans, paper cartons, and corrugated cardboard are subject to the Containers and Packaging Recycling Law, but they have yet to be subject to the recycling obligation.

Concept of ELV recycling Law



Flow of recycling of End-of Life Vehicles and the current recycling rate (March 2007)



Note: The same businesses may operate as dealers, used car dealers, or auto repair shops.

$$\text{End-of -life vehicle recycling rate} = \frac{\text{Weight of vehicles supplied for recycling}}{\text{Weight of vehicles collected}}$$

Source: Ministry of Economy, Trade and Industry

Guidelines for waste treatment and recycling

(1) Guidelines by product category (35 commodities)

Paper	Glass bottles	Steel cans	Aluminum cans
Plastics	Automobiles	Motorbikes	Tires
Bicycles	Home electrical appliances	Spring mattresses	Office furniture
Carpets	Futons	Dry cell batteries, button batteries	Small secondary batteries, etc.
Lead batteries for automobiles and two-wheel vehicles	Cassette gas cylinders	Aerosol cans	Small gas cylinders
Fire extinguishers	Pachinko game machines, etc.	Personal computers and peripheral devices	Copying machines
Gas and kerosene equipment	Textile products	Lubrication oil	Electric wires
Construction materials	Bath tubs and bathroom units	Kitchen components	Cellular phones and PHS
Fluorescent tubes	Vending machines	Single-use cameras	

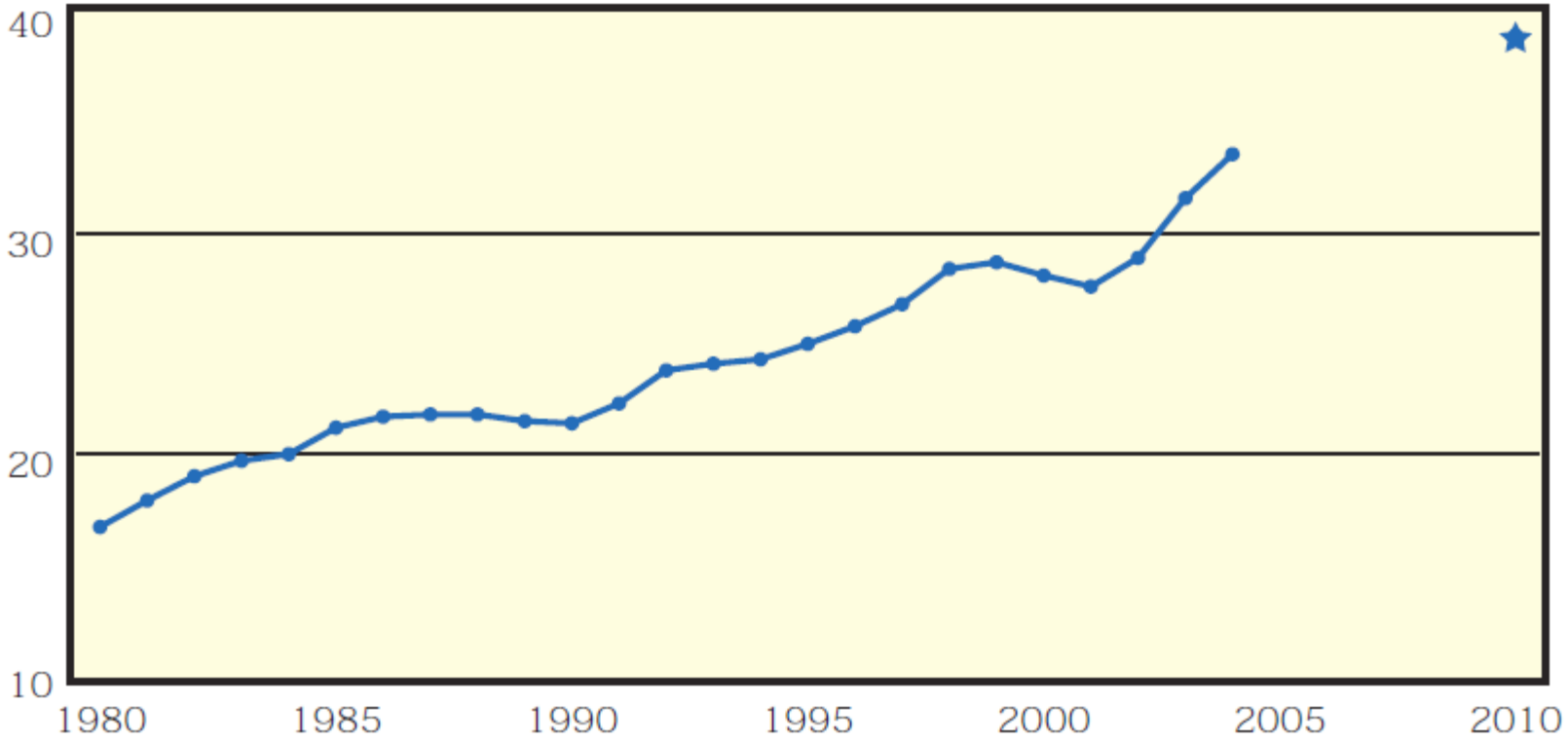
(2) Guidelines by sector (18 businesses)

Iron and steel	Paper/pulp manufacturing	Chemicals	Glass sheet manufacturing
Textiles	Nonferrous metal manufacturing	Electricity	Automobile manufacturing
Car part manufacturing	Electronic/ electric device manufacturing	Oil refineries	Distribution
Leasing	Cement manufacturing	Rubber product manufacturing	Coal mining
Gas	Factory-produced housing manufacturing		

Material productivity

(=GDP / Amount of natural resources used)

Unit : 10,000 yen/t

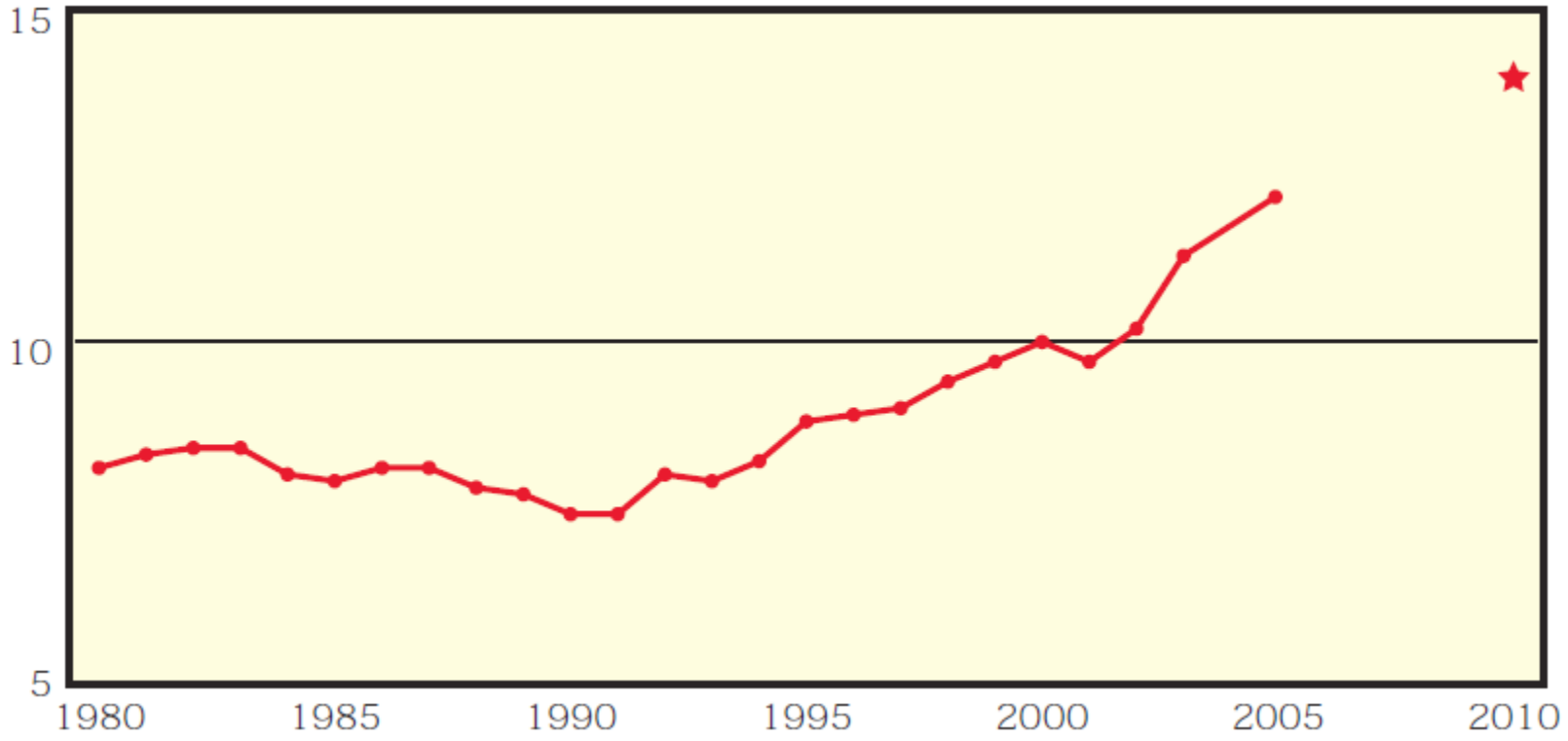


Note) It is based on the real GDP after changes in measuring the real GDP from a fixed- to chain-weighted method.

Usage rate of recycled goods

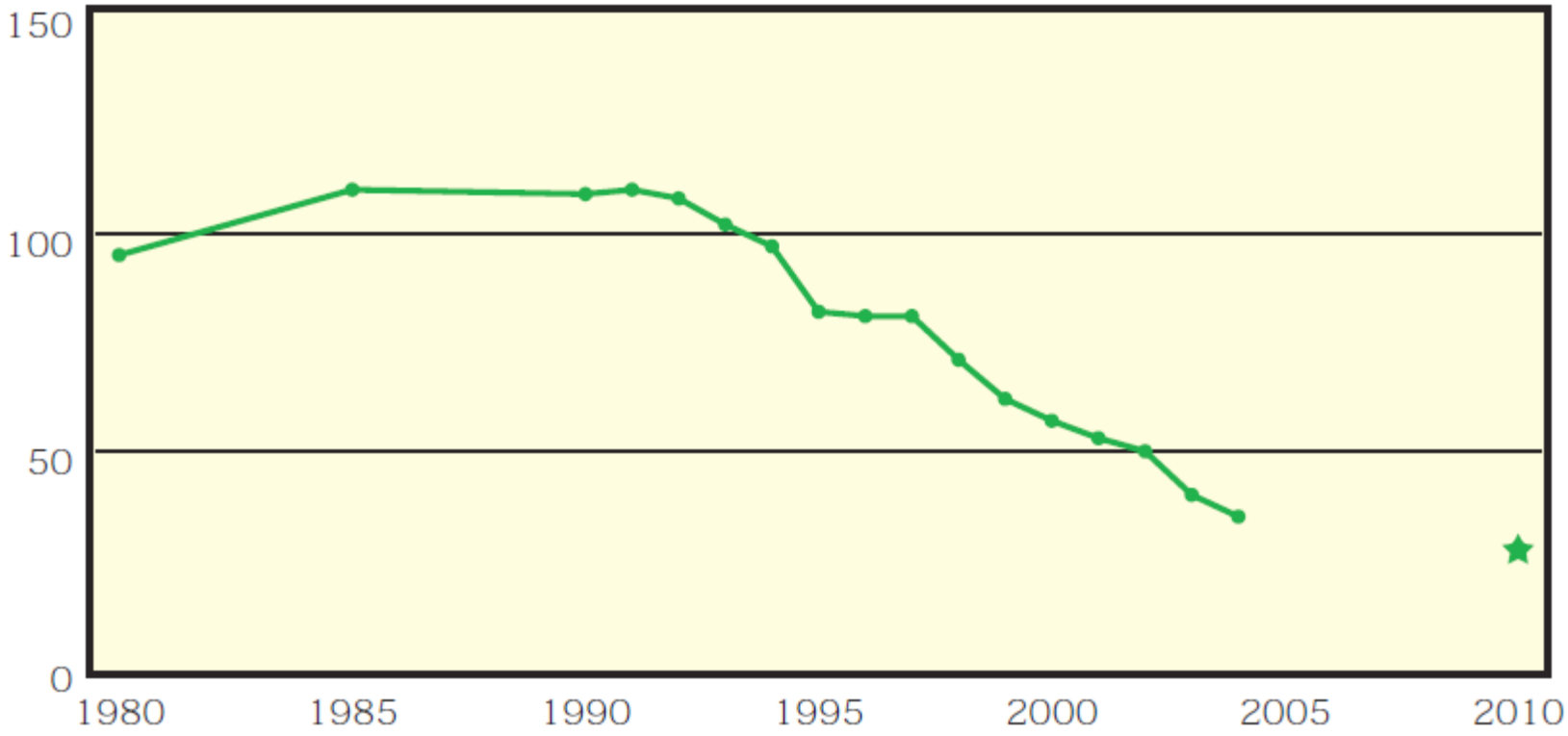
(=usage rate of recycled goods/ (usage rate of recycled goods + amount of natural resources used))

Unit : %



Amount of final disposal

Unit : Million tons



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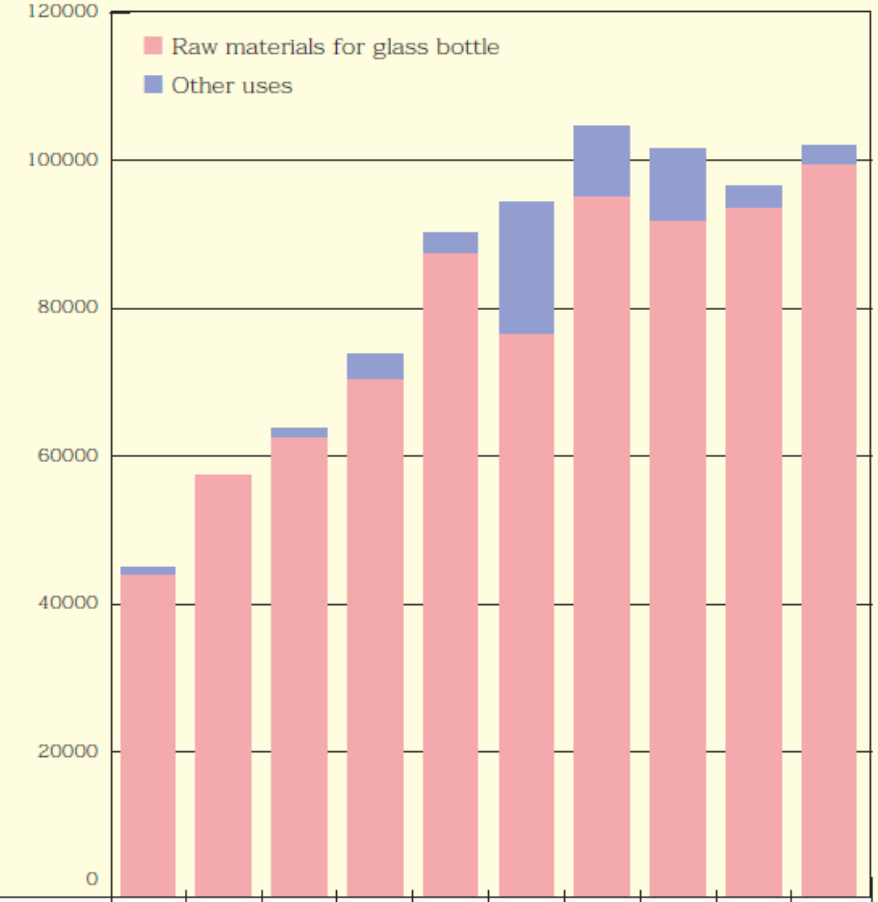
6. Effective use of various wastes at cement plant
7. Examples of waste reduction and effective use of waste at sources

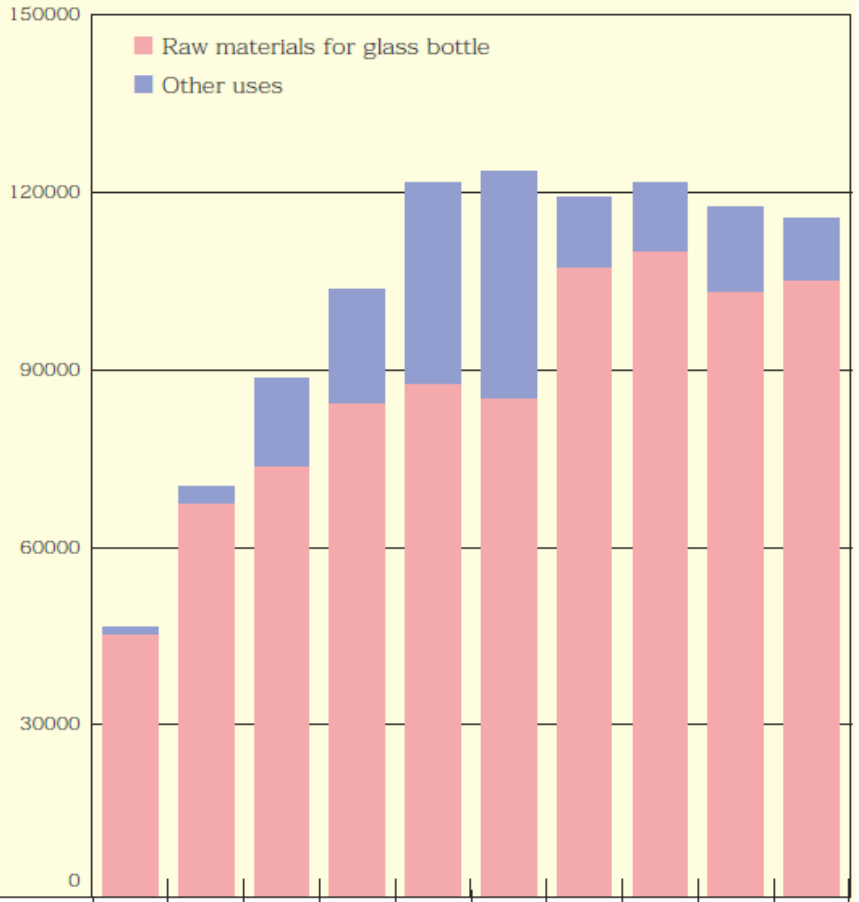
Trends in the volume of sales of containers and packaging recycled via the designated body and those of their usage (1/3)

(a) Colorless glass bottles



FY	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Volume of Sales	44,905	57,425	63,838	73,804	90,333	94,341	104,672	101,566	96,514	102,046
Raw materials for glass bottle (percent distribution)	43,926 (97.8)	56,376 (98.2)	62,501 (97.9)	70,388 (95.4)	87,429 (96.8)	76,436 (81.0)	95,006 (90.8)	91,877 (90.5)	93,472 (96.8)	99,488 (97.5)
Other uses (percent distribution)	979 (2.2)	1,049 (1.8)	1,337 (2.1)	3,416 (4.6)	2,904 (3.2)	17,905 (19.0)	9,666 (9.2)	9,689 (9.5)	3,042 (3.2)	2,558 (2.5)

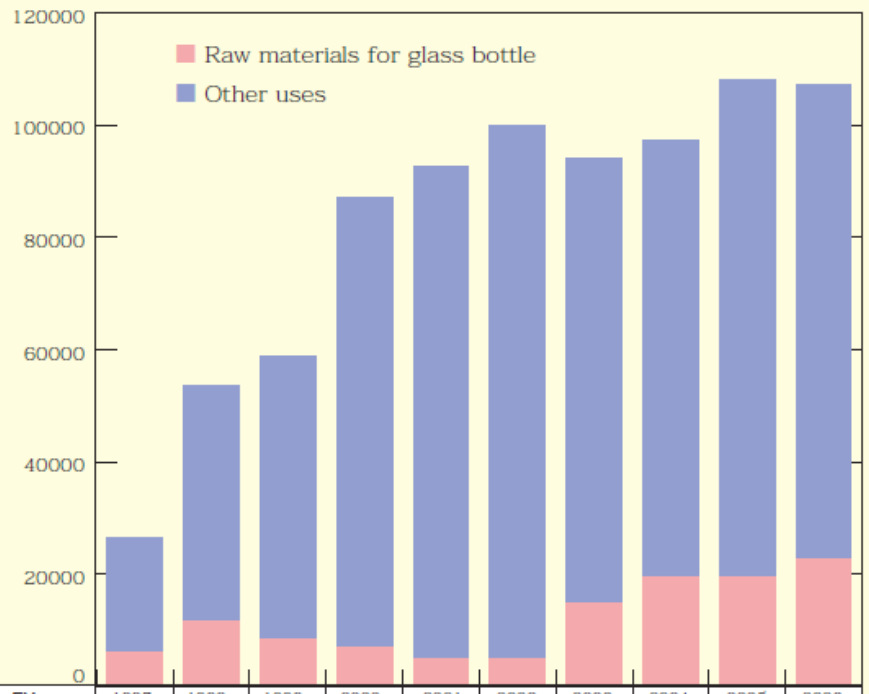
(b) Amber glass bottles



FY	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Volume of Sales	46,374	70,159	88,532	103,701	121,696	123,439	119,042	121,707	117,455	115,727
Raw materials for glass bottle (percent distribution)	45,057 (97.0)	67,189 (95.8)	73,395 (82.9)	84,297 (81.3)	87,469 (71.9)	84,885 (68.8)	107,044 (89.9)	109,756 (90.2)	102,935 (87.6)	105,051 (90.8)
Other uses (percent distribution)	1,317 (3.0)	2,970 (4.2)	15,137 (17.1)	19,404 (18.7)	34,227 (28.1)	38,554 (31.2)	11,998 (10.1)	11,951 (9.8)	14,520 (12.4)	10,676 (9.2)

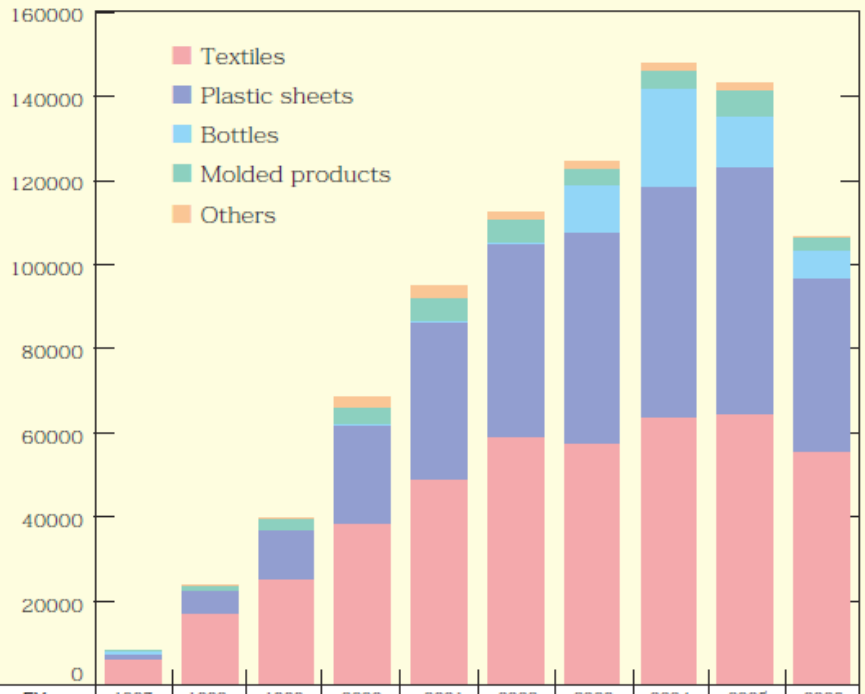
Trends in the volume of sales of containers and packaging recycled via the designated body and those of their usage (2/3)

(c) Glass bottles of other colors



FY	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Volume of Sales	26,531	53,564	58,936	87,183	92,734	100,037	94,051	97,205	108,020	107,194
Raw materials for glass bottle (percent distribution)	8,821 (33.2)	14,818 (27.7)	8,589 (14.6)	7,303 (8.4)	5,185 (5.6)	5,332 (5.3)	15,069 (16.0)	19,816 (20.4)	19,880 (18.4)	22,967 (21.4)
Other uses (percent distribution)	17,711 (66.8)	38,746 (72.3)	50,347 (85.4)	79,880 (91.6)	87,549 (94.4)	94,705 (94.7)	78,982 (84.0)	77,389 (79.6)	88,140 (81.6)	84,227 (78.6)

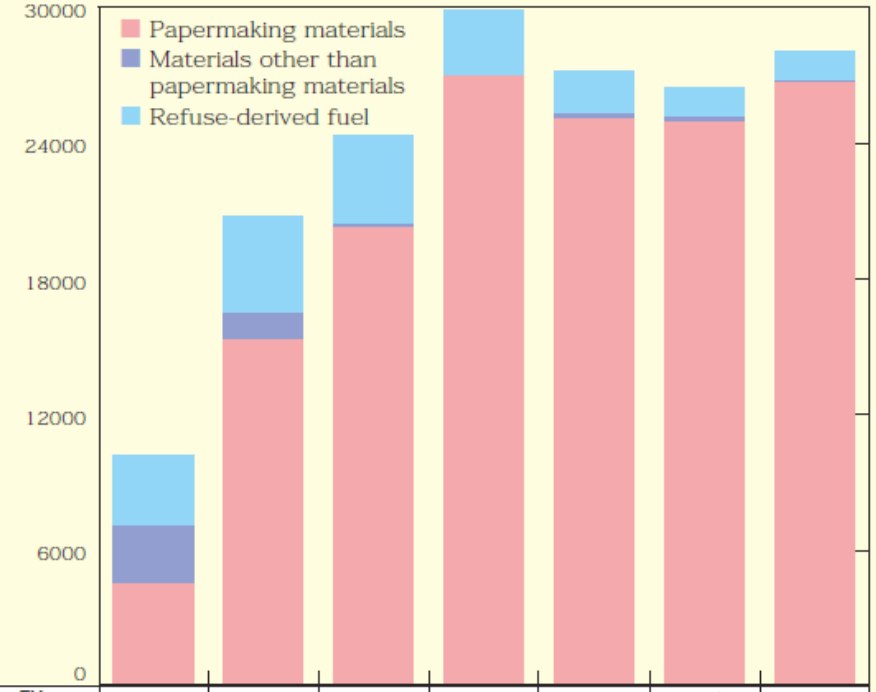
(d) PET bottles



FY	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Volume of Sales	8,398	23,909	39,605	68,575	94,912	112,485	124,298	147,698	143,032	106,445
Textiles (percent distribution)	6,077 (72.4)	16,895 (70.7)	25,188 (63.6)	38,317 (55.9)	48,659 (51.3)	58,940 (52.4)	57,445 (46.2)	63,554 (43.0)	64,103 (44.8)	55,458 (52.1)
Plastic sheets (percent distribution)	1,112 (13.2)	5,218 (21.8)	11,450 (28.9)	23,407 (34.1)	37,510 (39.5)	45,632 (40.5)	50,021 (40.2)	54,589 (37.0)	58,788 (41.1)	41,088 (38.6)
Bottles (percent distribution)	756 (9.0)	211 (0.9)	179 (0.5)	326 (0.5)	381 (0.4)	606 (0.6)	11,312 (9.1)	23,351 (15.8)	12,134 (8.5)	6,493 (8.5)
Molded products (percent distribution)	366 (4.4)	1,265 (5.3)	2,530 (6.4)	3,802 (5.5)	5,330 (5.6)	5,314 (4.7)	3,944 (3.2)	4,239 (2.9)	6,217 (4.3)	3,087 (2.9)
Others (percent distribution)	87 (1.0)	320 (1.3)	258 (0.7)	2,723 (4.0)	3,032 (3.2)	1,993 (1.8)	1,576 (1.3)	1,965 (1.3)	1,790 (1.3)	319 (0.3)

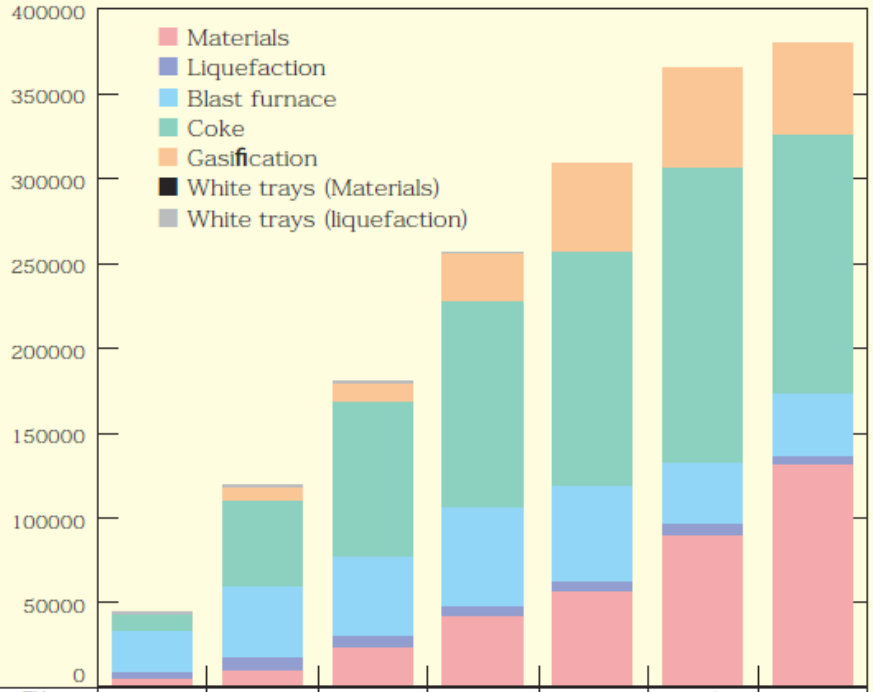
Trends in the volume of sales of containers and packaging recycled via the designated body and those of their usage (2/3)

(e) Paper containers/packaging



FY	2000	2001	2002	2003	2004	2005	2006
Volume of Sales	10,230	20,793	24,358	29,881	27,163	26,471	28,093
Papermaking materials	4,546	15,301	20,284	26,969	25,053	24,894	26,689
(percent distribution)	(44.4)	(73.6)	(83.3)	(90.3)	(92.2)	(94.0)	(95.0)
Materials other than	2,566	1,196	157	15	203	223	47
(percent distribution)	(25.1)	(5.7)	(0.7)	(*0.0)	(0.8)	(0.9)	(0.2)
Refuse-derived fuel	3,118	4,295	3,917	2,897	1,907	1,354	1,357
(percent distribution)	(30.5)	(20.7)	(16.0)	(9.7)	(7.0)	(5.1)	(4.8)

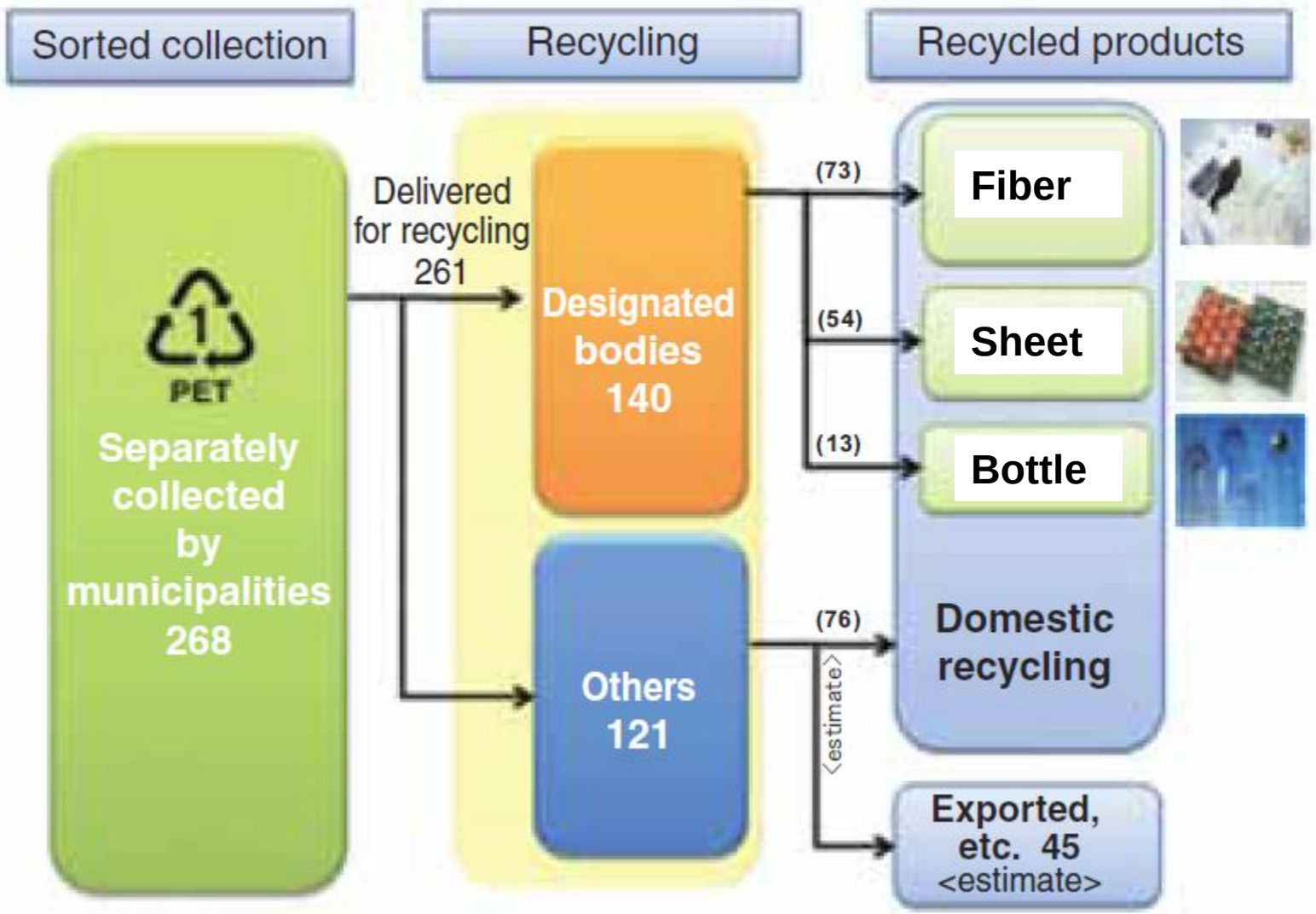
(f) Plastic containers/packaging



FY	2000	2001	2002	2003	2004	2005	2006
Volume of Sales	43,830	118,470	180,162	256,150	309,537	365,924	380,434
Materials	4,882	9,246	23,426	41,626	56,035	88,852	131,256
(percent distribution)	(11.1)	(7.8)	(13.0)	(16.2)	(18.1)	(24.2)	(34.5)
Liquefaction	3,348	7,886	6,828	5,847	6,426	6,993	4,389
(percent distribution)	(7.6)	(6.7)	(3.8)	(2.3)	(2.1)	(1.9)	(1.2)
Blast furnace	24,656	42,306	46,621	58,811	55,870	36,444	37,282
(percent distribution)	(56.3)	(35.7)	(25.9)	(23.0)	(18.0)	(10.0)	(9.8)
Coke	9,771	50,631	91,175	120,767	137,980	174,061	152,103
(percent distribution)	(22.3)	(42.7)	(50.6)	(47.1)	(44.6)	(47.6)	(40.0)
Gasification	638	7,529	11,188	28,076	52,203	58,641	54,559
(percent distribution)	(1.5)	(6.4)	(6.2)	(11.0)	(16.9)	(16.0)	(14.3)
White trays (Materials)	520	777	921	1,022	1,023	933	845
(percent distribution)	(1.2)	(0.7)	(0.5)	(0.4)	(0.3)	(0.3)	(0.2)
White trays (liquefaction)	13	95	3	0	0	0	0
(percent distribution)	(*0.0)	(*0.0)	(*0.0)	(0.0)	(0.0)	(0.0)	(0.0)

Flow of collection and recycling of PET bottles (FY2006)

Unit : 1000 tons

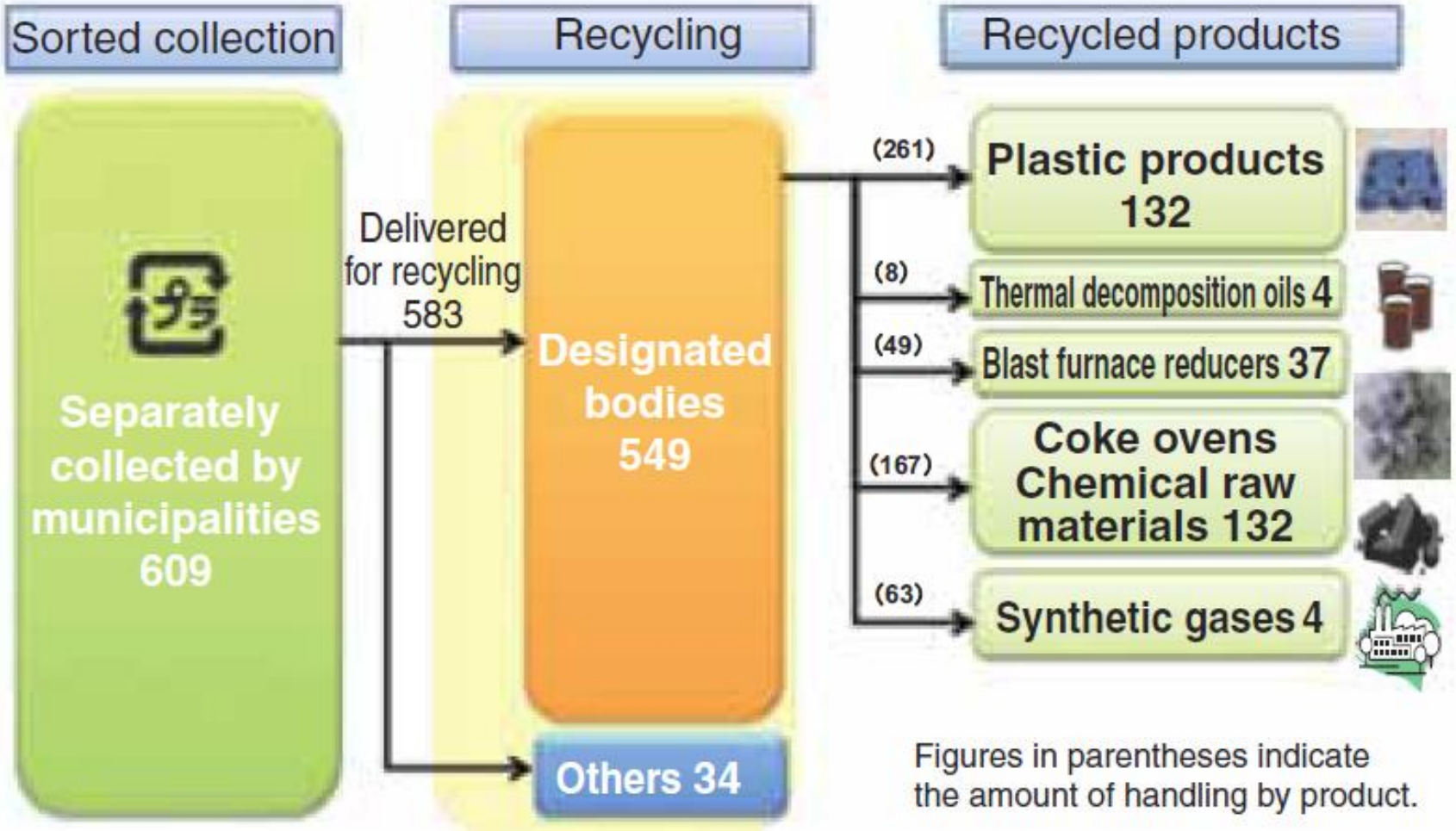


Figures in parentheses indicate the amount of handling by products

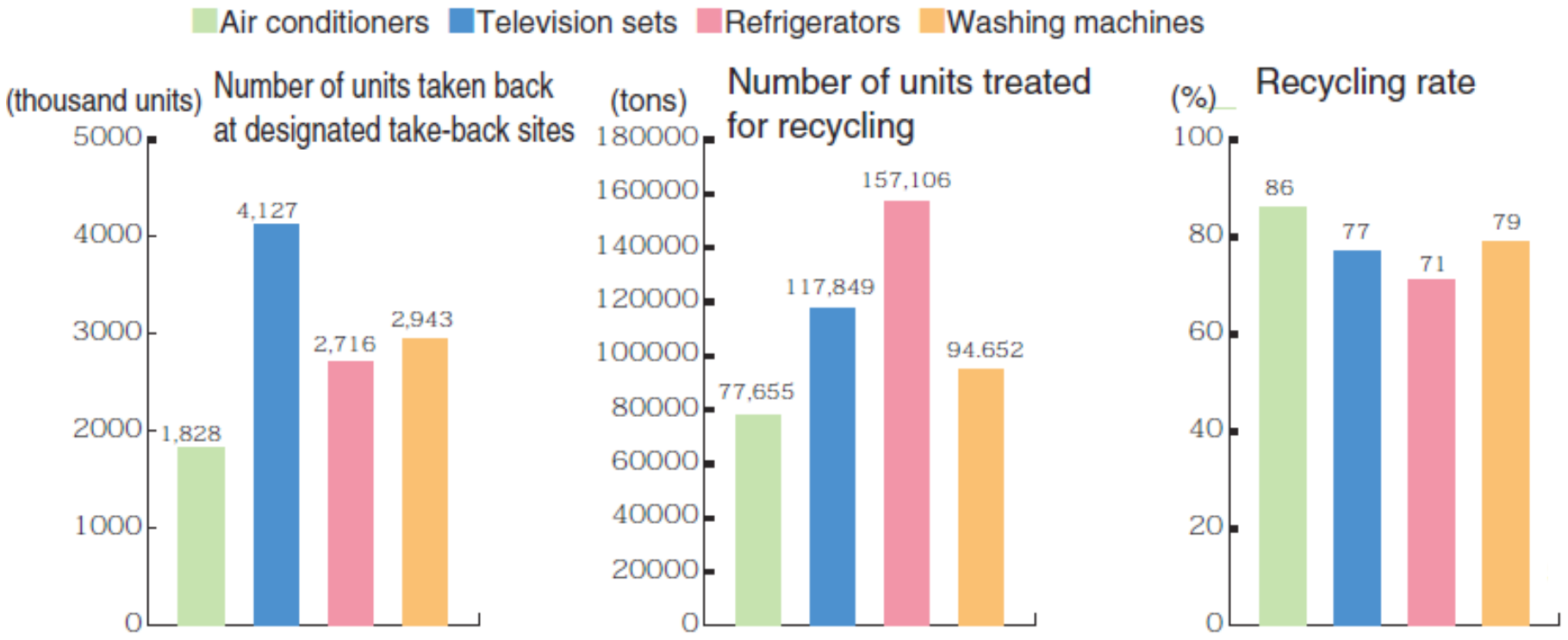
Examples of uses of recycled PET bottles

Flow of collection and recycling of plastic containers and packaging (FY2006)

Unit : 1000 tons



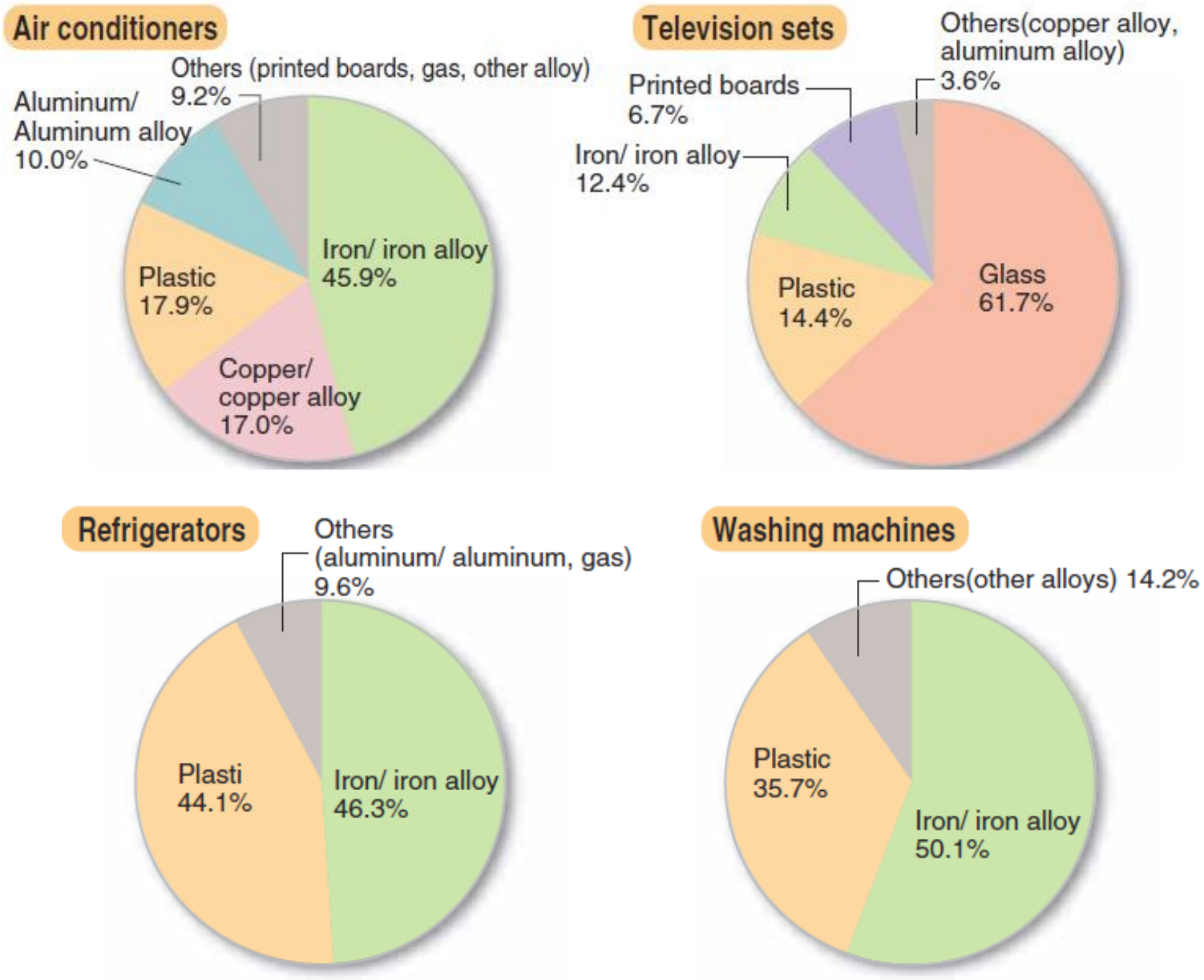
Recycling by manufacturers/importers and the designated body (FY2006)



$$\text{Recycling rate} = \frac{\text{weight of materials recycled}}{\text{Weight of units treated for recycling}}$$

Source: Association for Electric Home Appliances

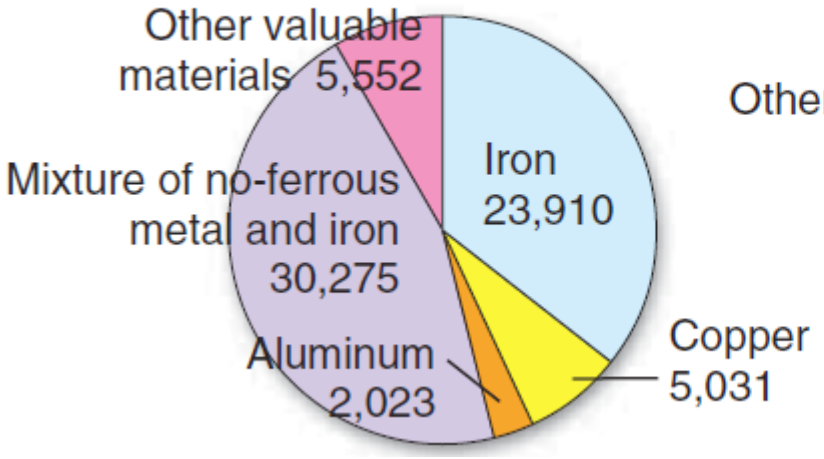
Material composition of home appliances



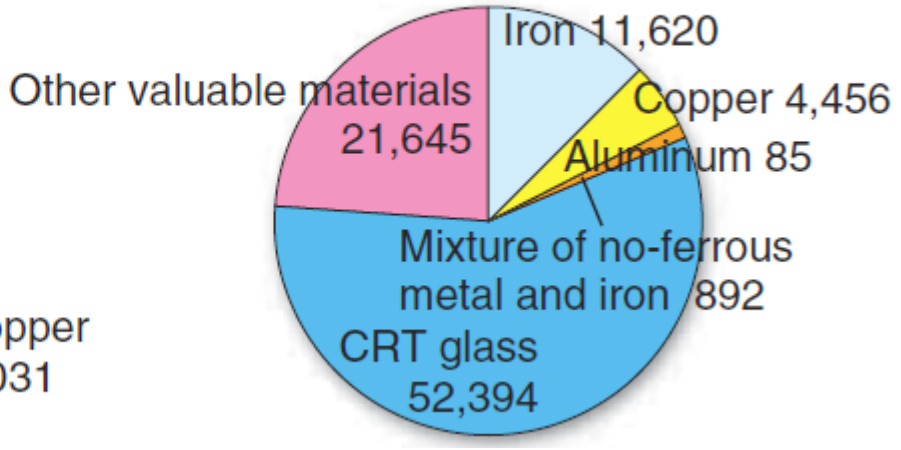
Source: Association for Electric Home Appliances

Weight of materials recycled by manufacturers/importers and the designated body (FY2006)

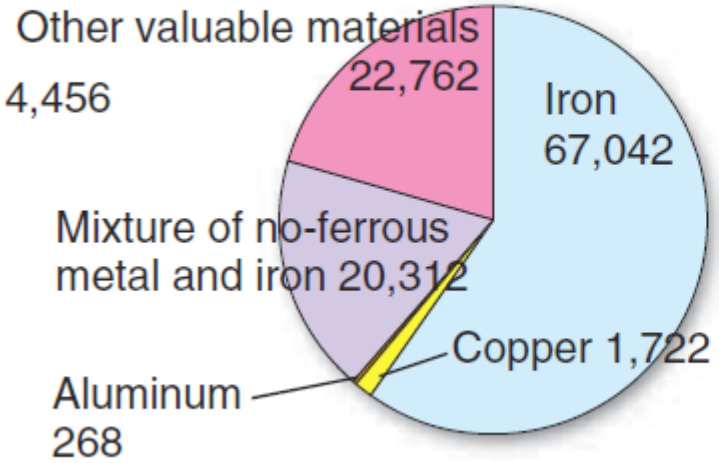
• Air conditioners, recycled: 66,791 tons



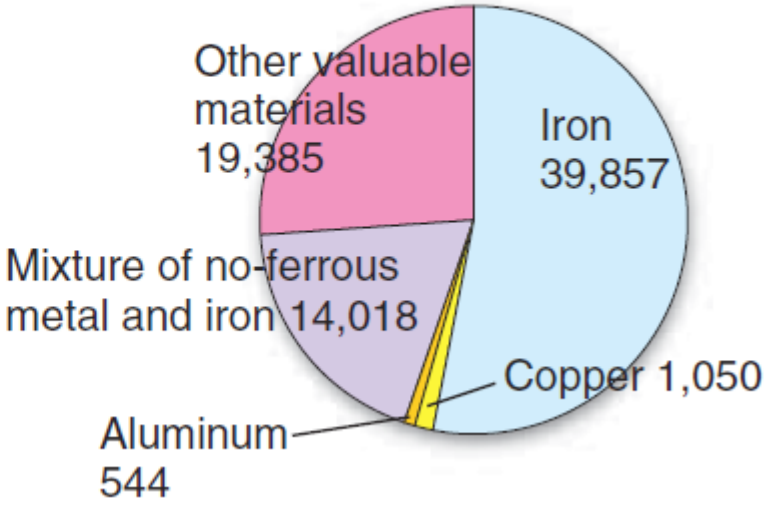
• CRT-type television set, recycled: 91,092 tons



• Refrigerators/Freezers, recycled: 112,106 tons



• Washing machines, recycled: 74,854 tons



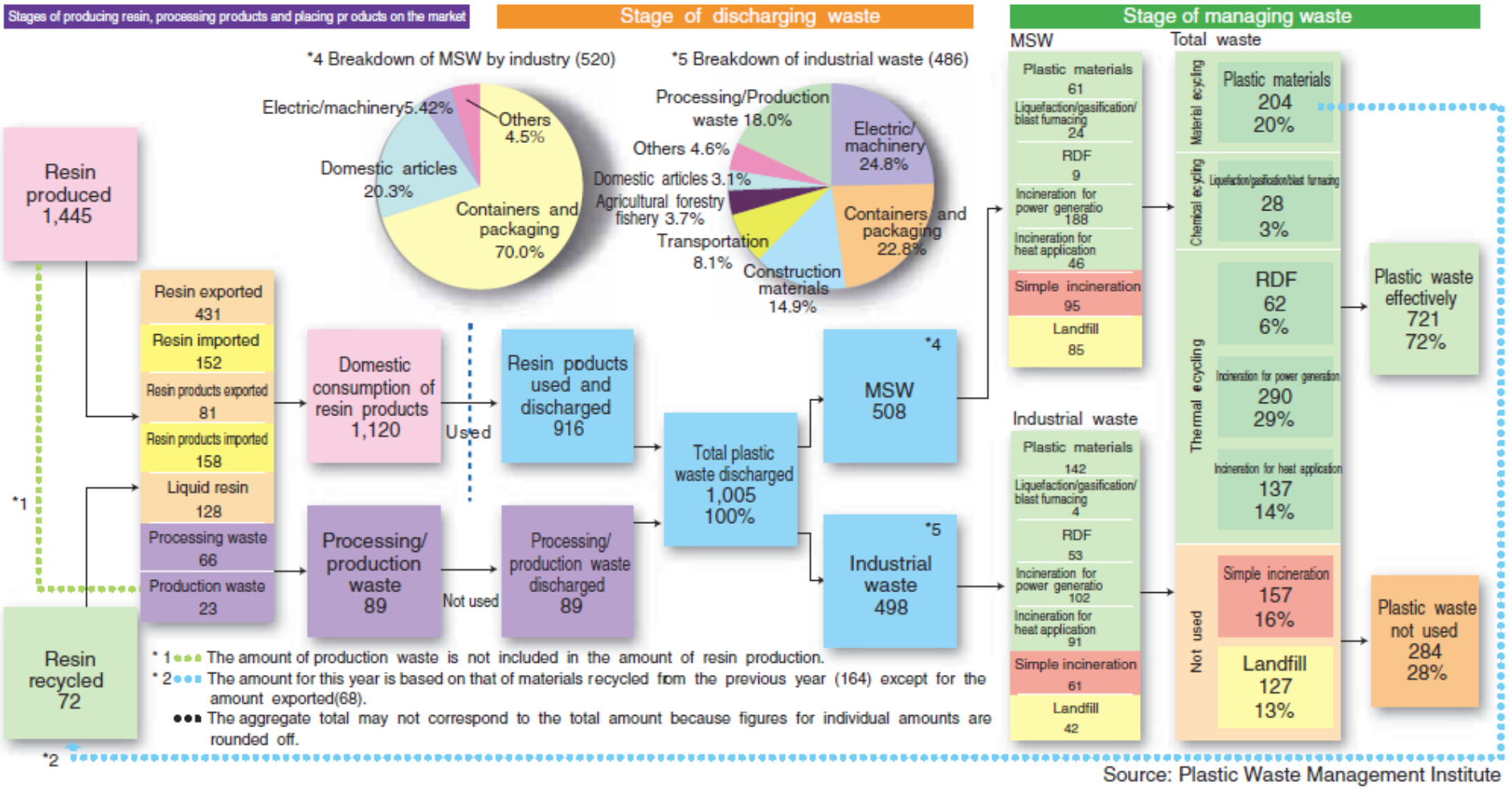
* Total weight of parts and materials that have already been treated so as to be assignable, with or without charge.

* "Other valuable materials" include printed boards and other plastics.

Source: Association for Electric Home Appliances

Flow of recycling of plastic waste (FY2006)

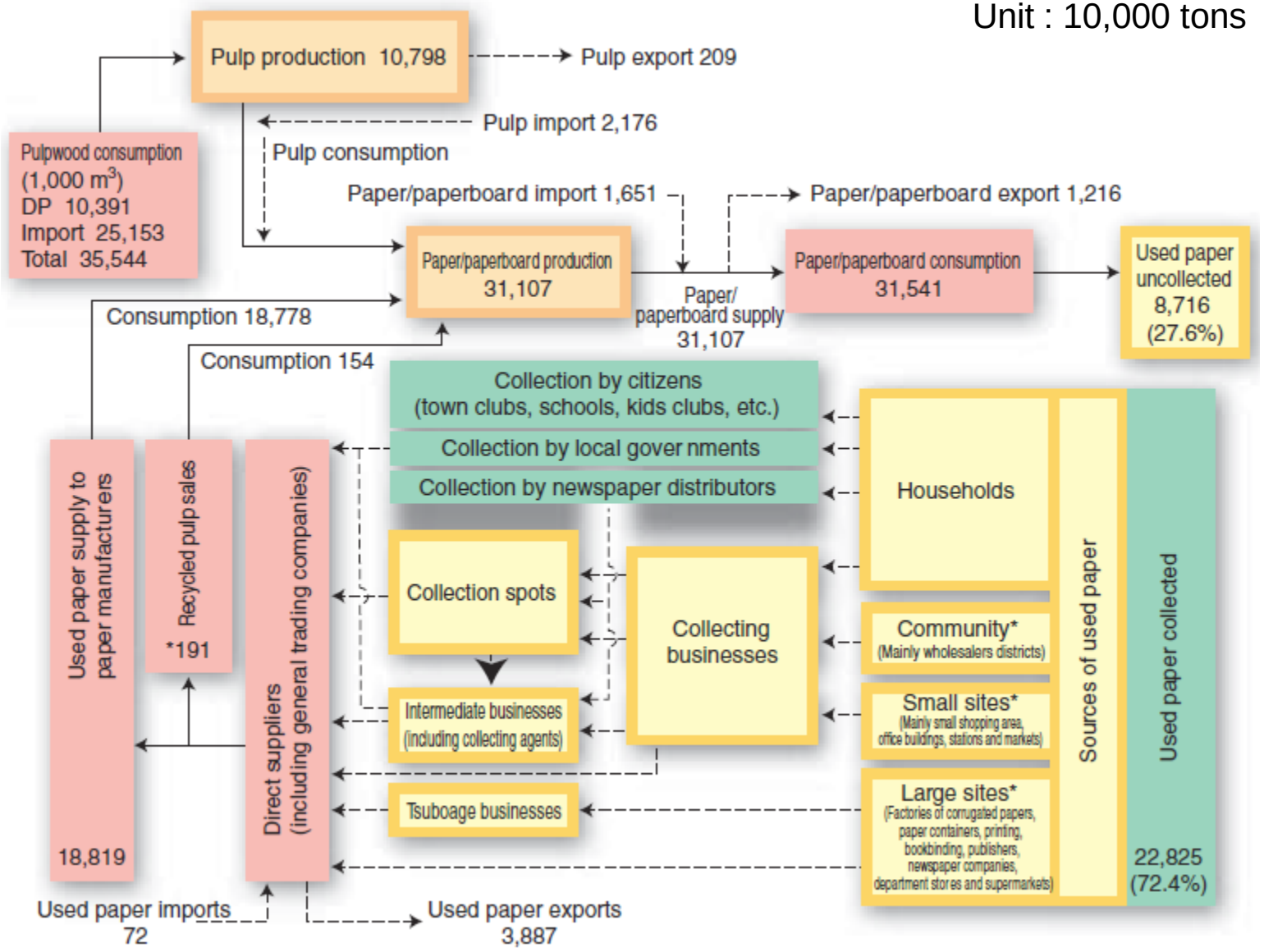
Unit : 10,000 tons



Source: Plastic Waste Management Institute

Generation and distribution of recycled paper (FY2006)

Unit : 10,000 tons



Note: Figures with * are estimated on the condition that 80% of used paper was recycled as pulp.
Source : Annual report of Paper, Printing, Plastics Products and Rubber Products Statistics,
Japanese Trade Monthly Sheet

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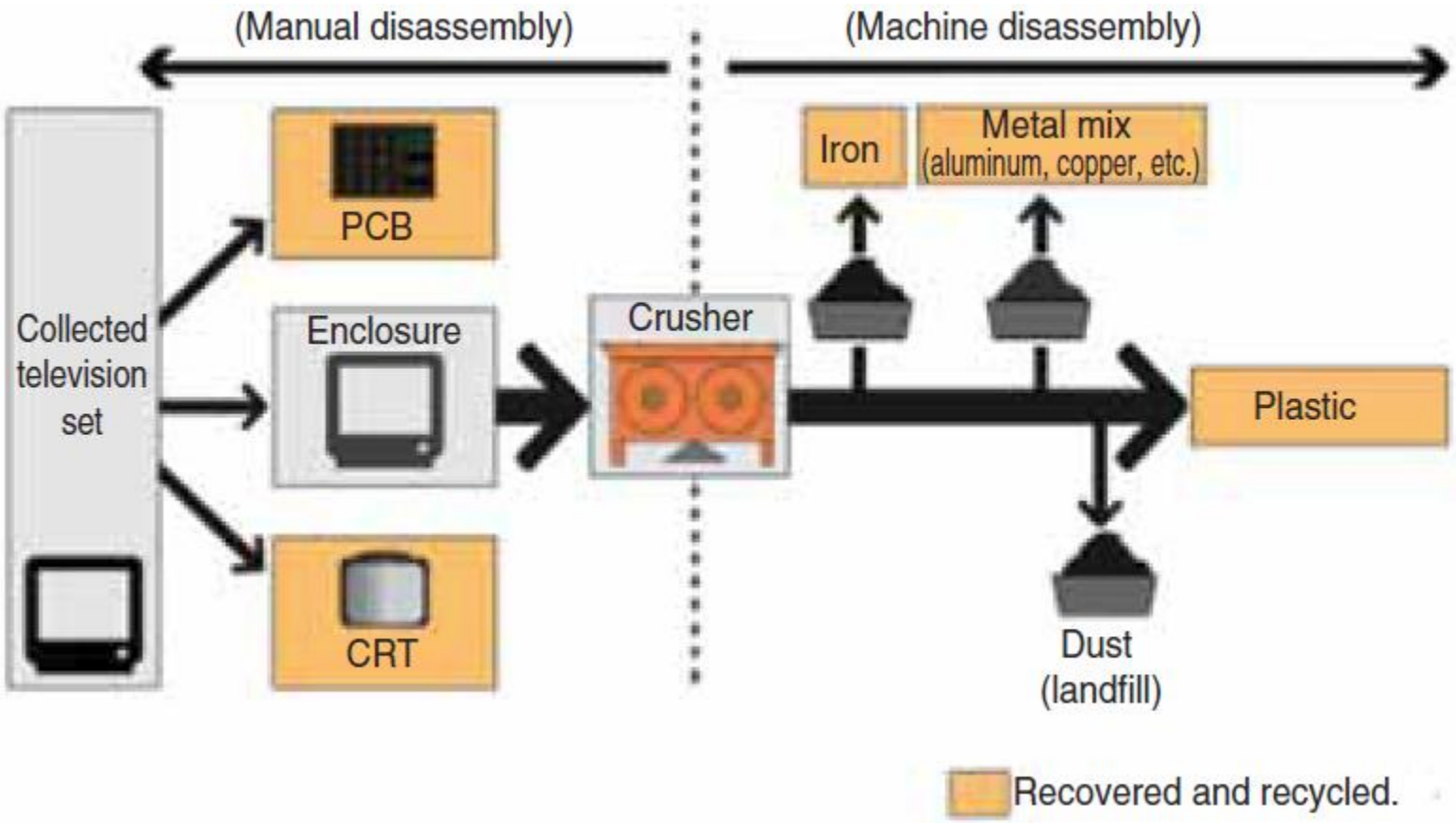
Standard processing of main four home electronics (1/4)

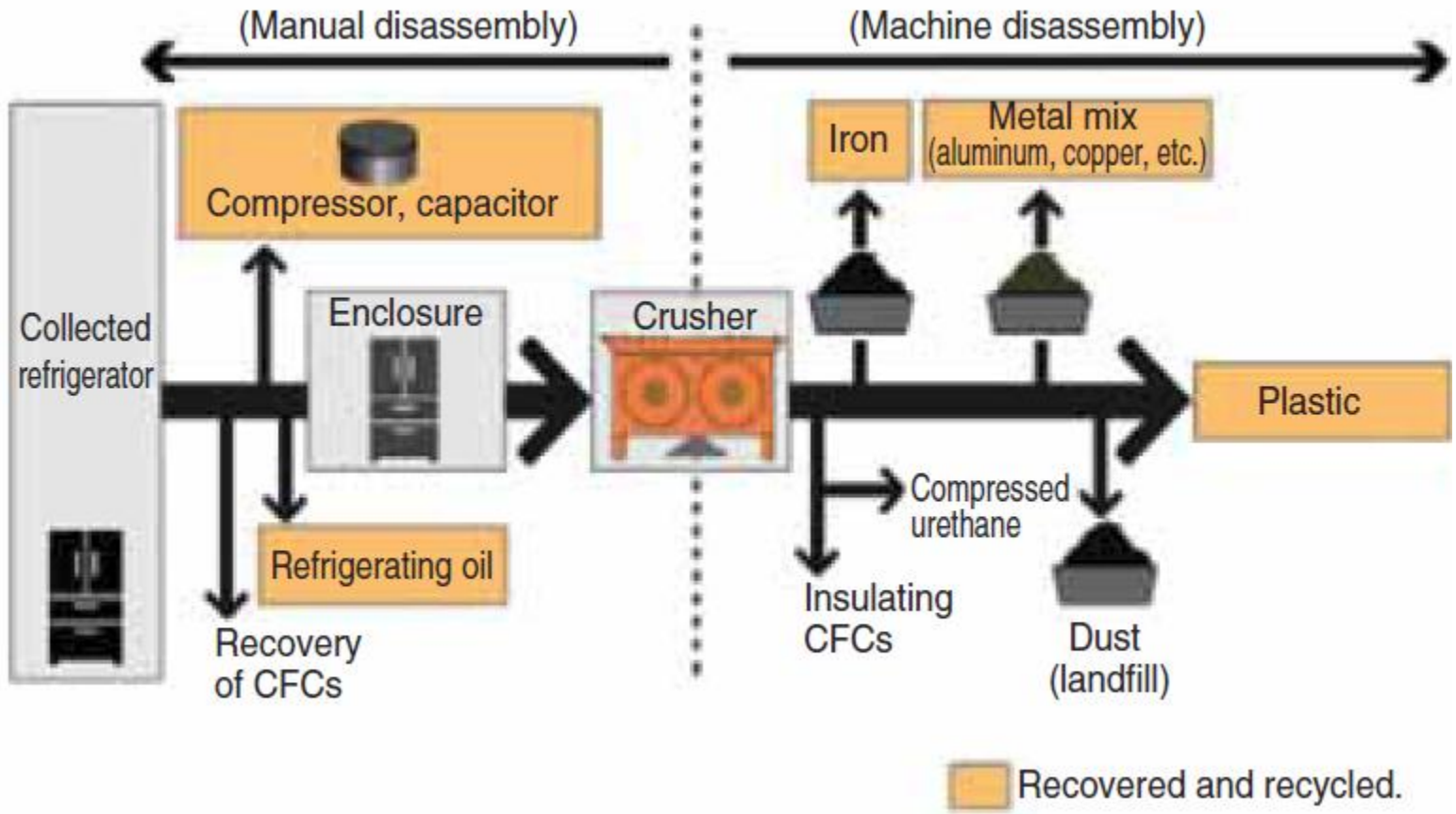
CRT-type television set



(Source: Website of the Association for Electric Home Appliances)

Standard processing of main four home electronics (2/4)

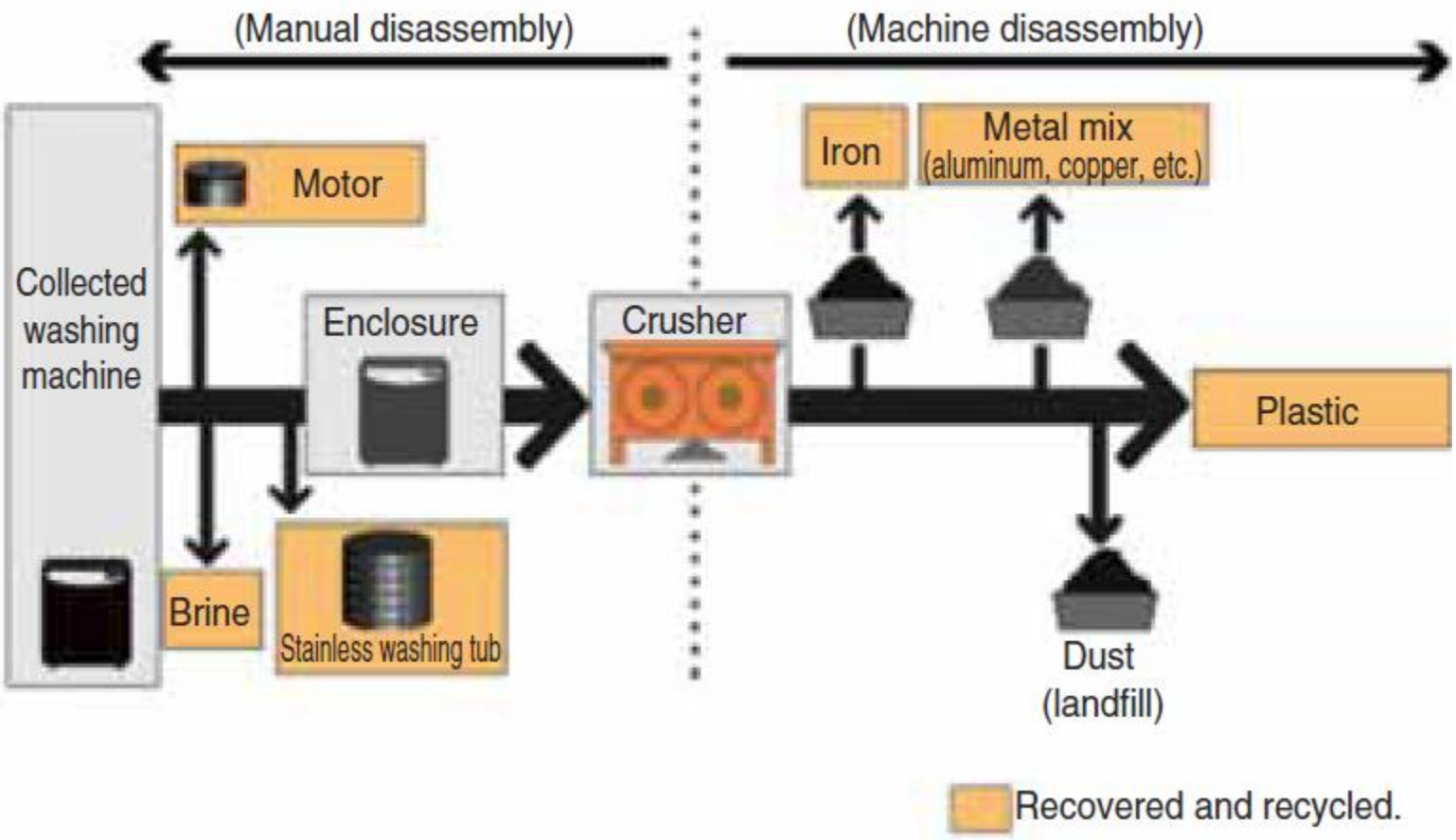
Refrigerator and Freezer



(Source: Website of the Association for Electric Home Appliances)

Standard processing of main four home electronics (3/4)

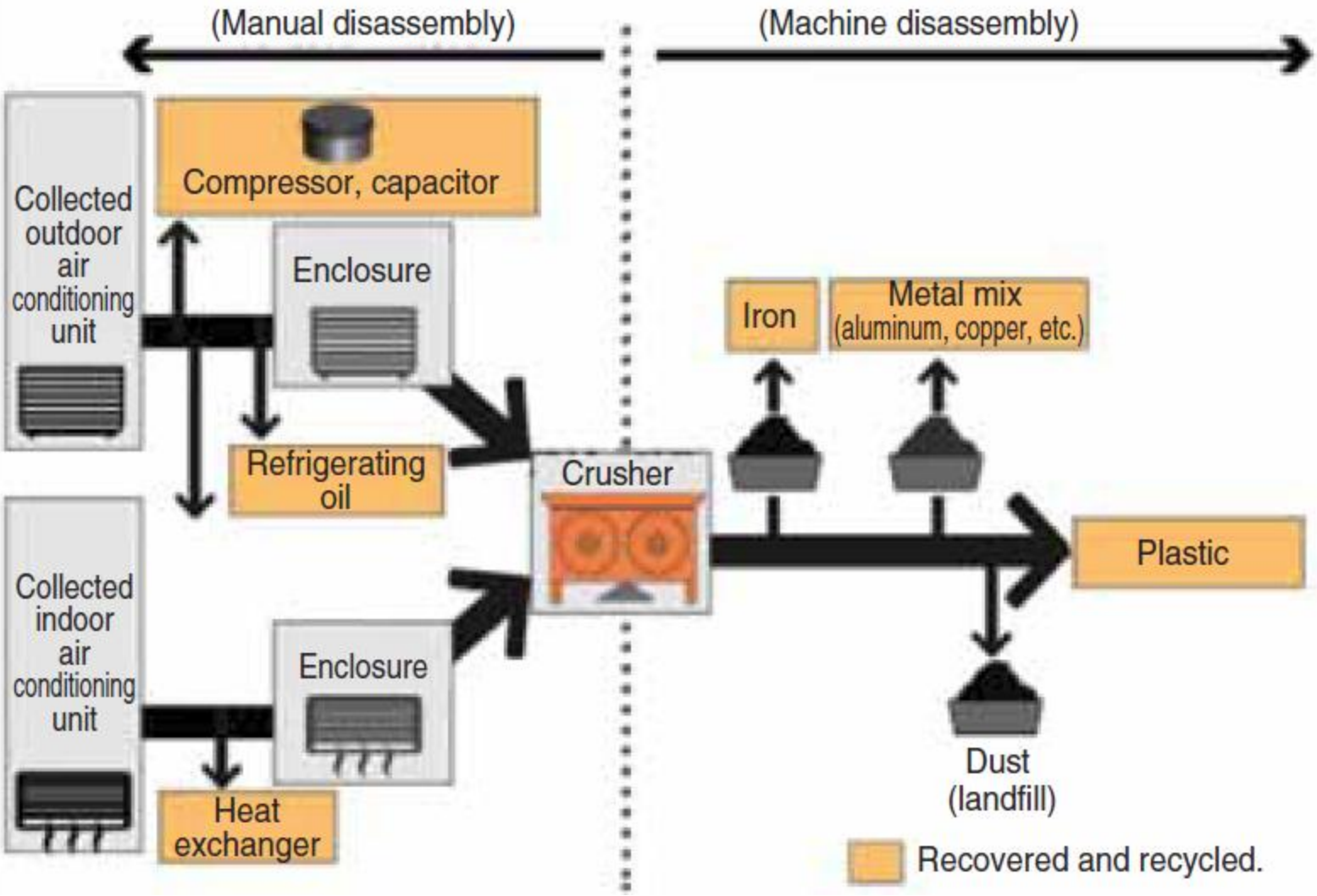
Washing machine



(Source: Website of the Association for Electric Home Appliances)

Standard processing of main four home electronics (4/4)

Air conditioner



(Source: Website of the Association for Electric Home Appliances)

Example of recycle of home electric equipment

Recycle

Others
・corrugated paper
・glass
・brass screw

Returned products

Cancelled and/or expired home distributing Panel of electricity

Dismantle

Reuse

Others
・corrugated pad
・Attachments(wire)
・Plastic cover
・Base(no color change)

Landfill

Expired Equipment
(90% is expired)
Others
・rubber parts

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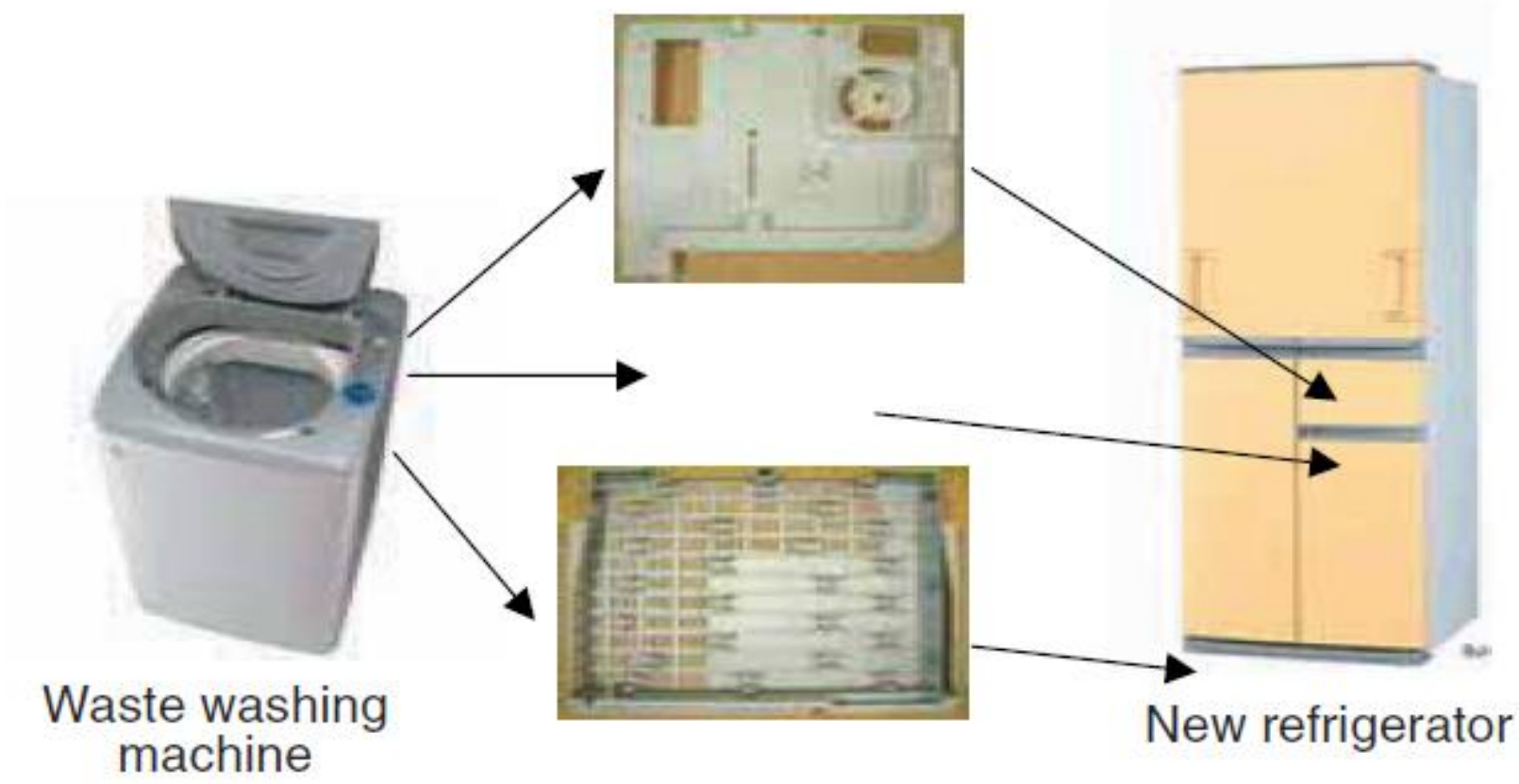
Examples of advanced recycling schemes

Material recycling example – Waste washing machine tub to new product

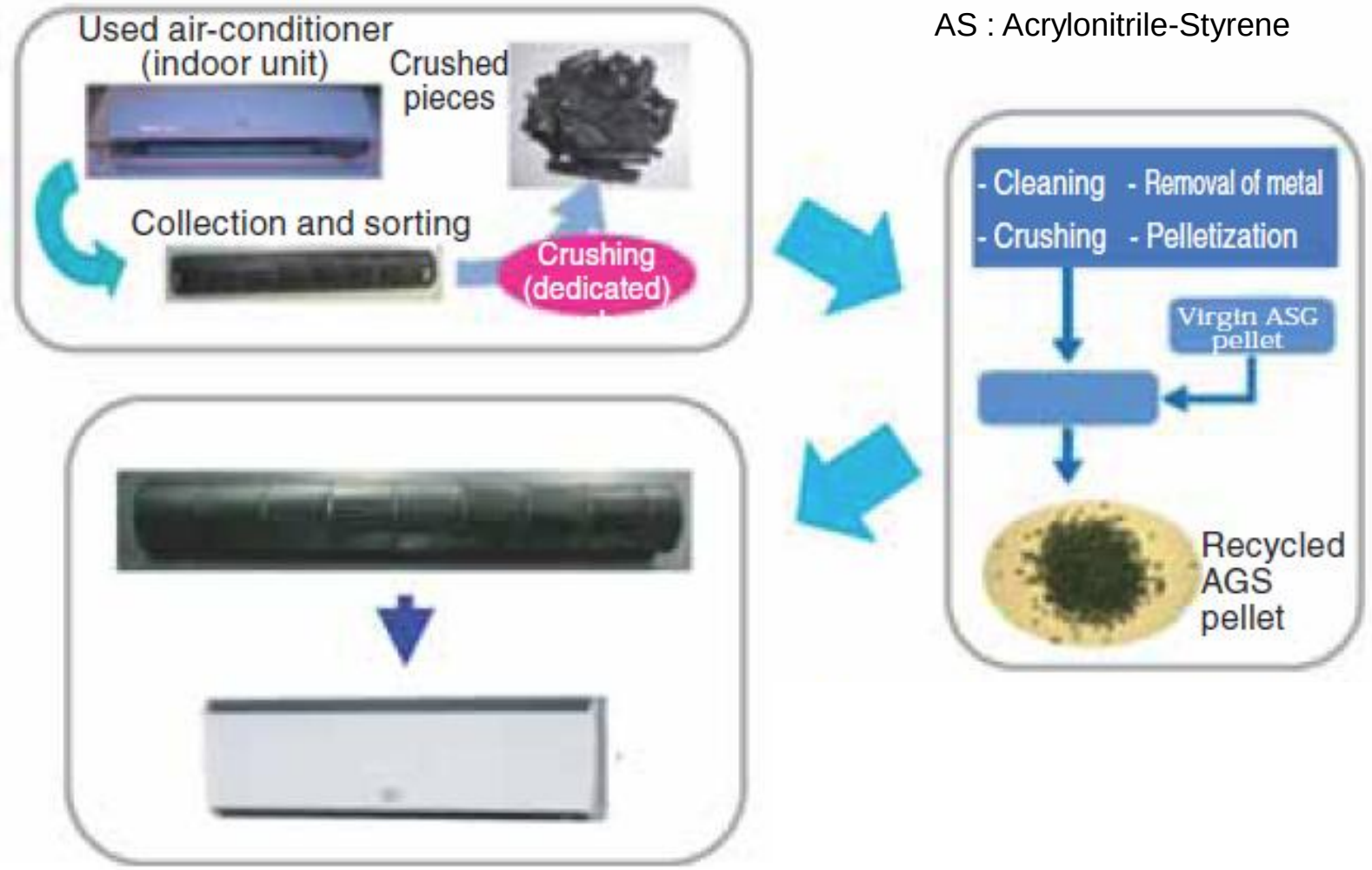
"Self-circulation material recycling"

Material recycling example – Waste washing machine tub to new product

"Recycling to other home electric appliance"



“Self-circulation material recycling of glass-reinforced AS resin(ASG)”



AS : Acrylonitrile-Styrene

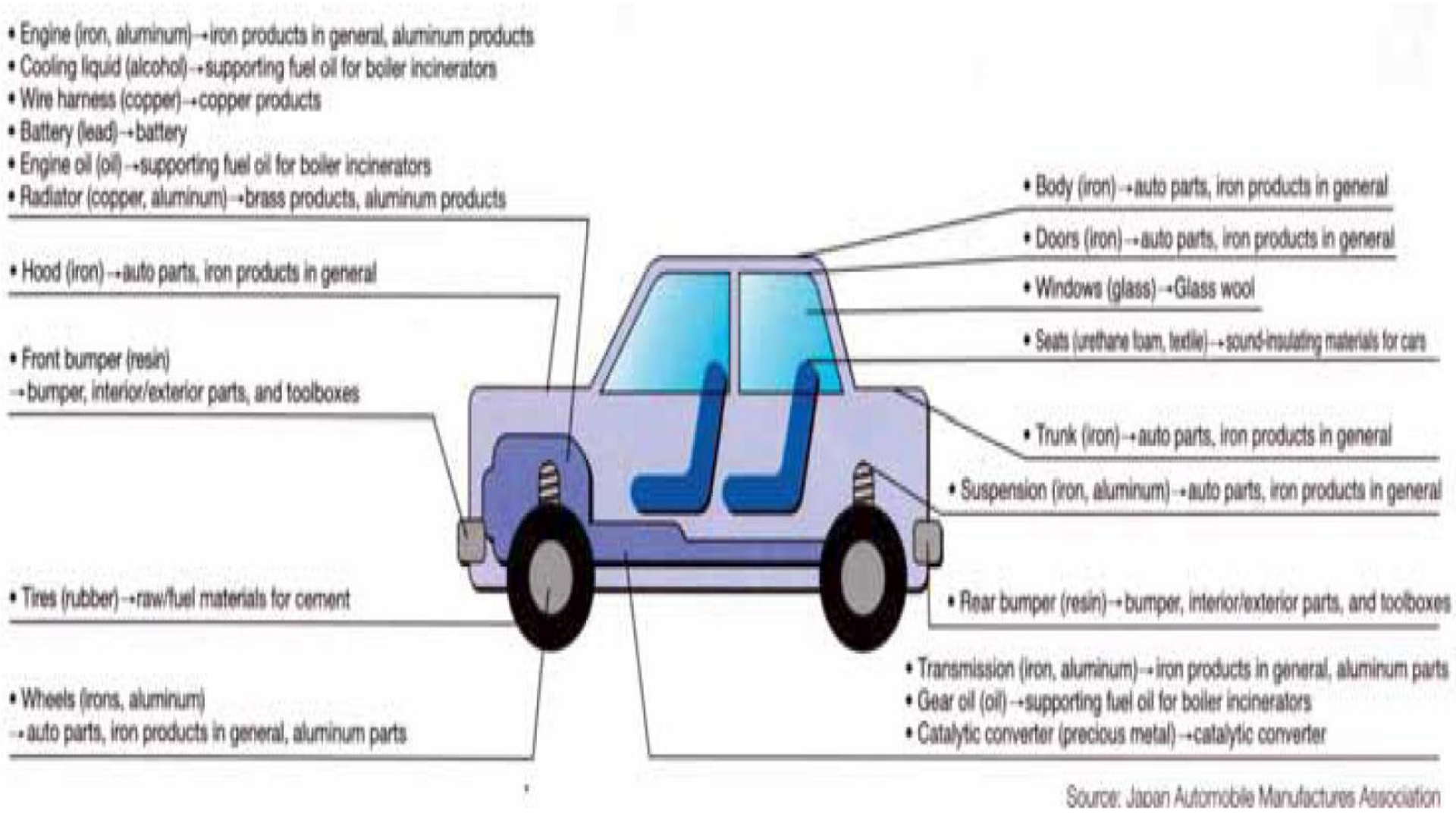
Source: Report from the basic policy WG, Waste prevention and recycling subcommittee, Environment committee, Industrial structure council

Recycling-oriented chair

(DfE : Design for Environment)

Recycling uses of ELVs

(Law on Recycling of End-of-Life Vehicles)

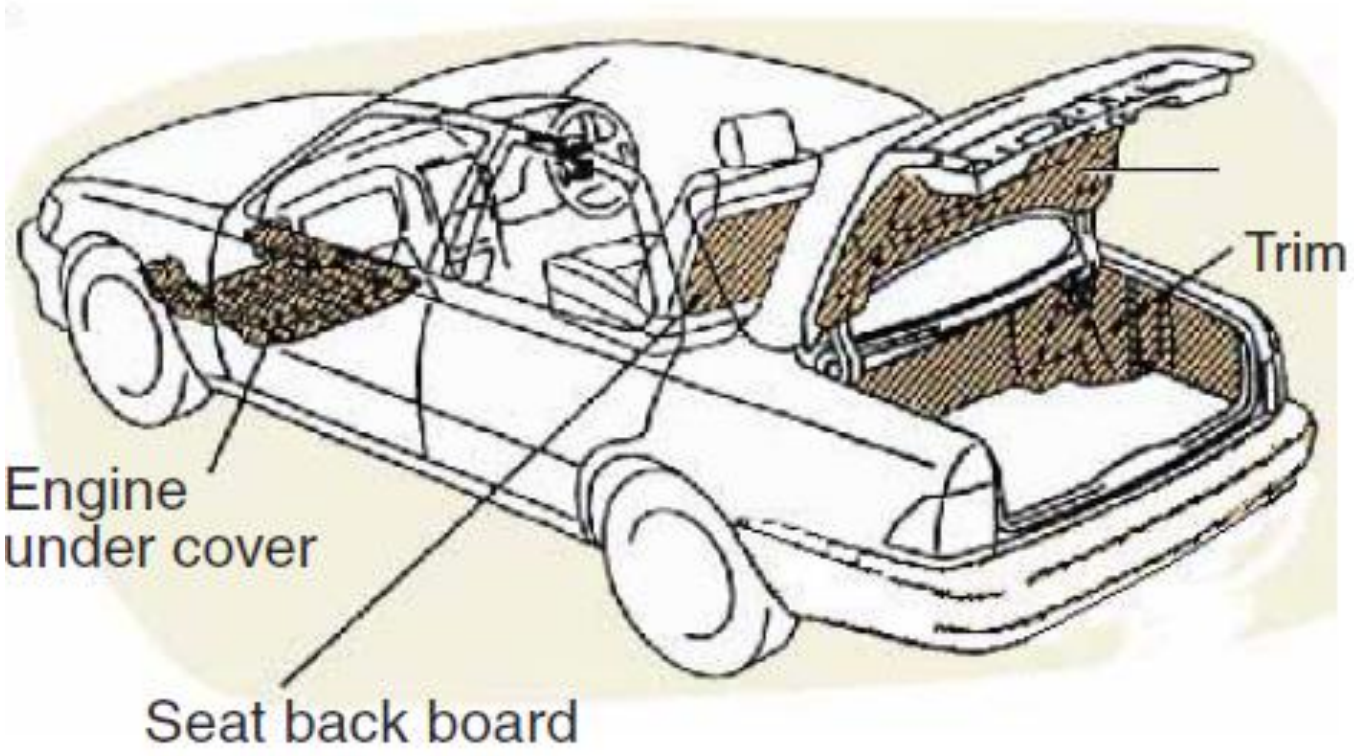


Source: Japan Automobile Manufactures Association

Examples of advanced recycling systems - Automobiles

Example – 1

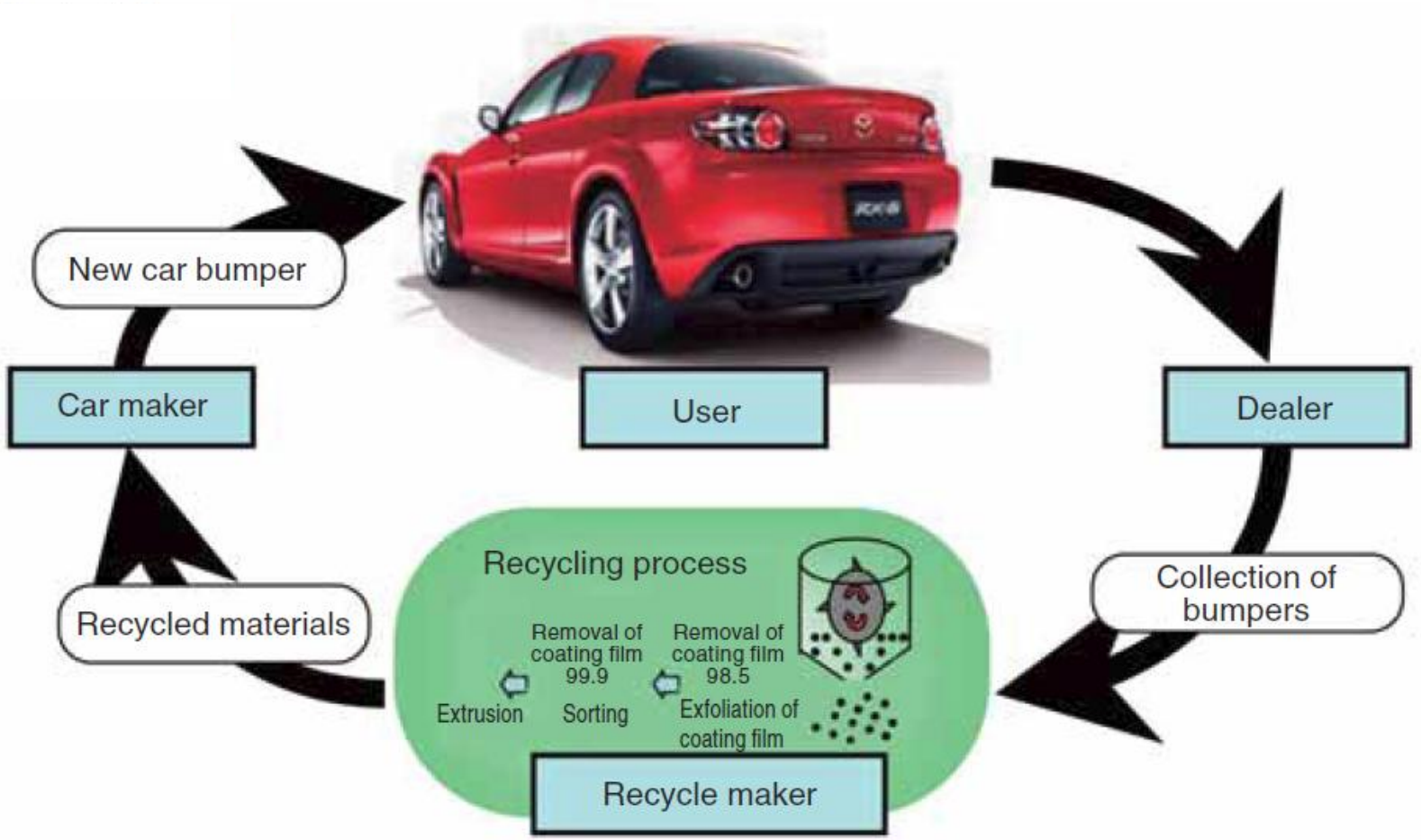
Recycling plastics collected from bumpers are reused as raw materials for producing car parts.



Examples of advanced recycling systems - Automobiles

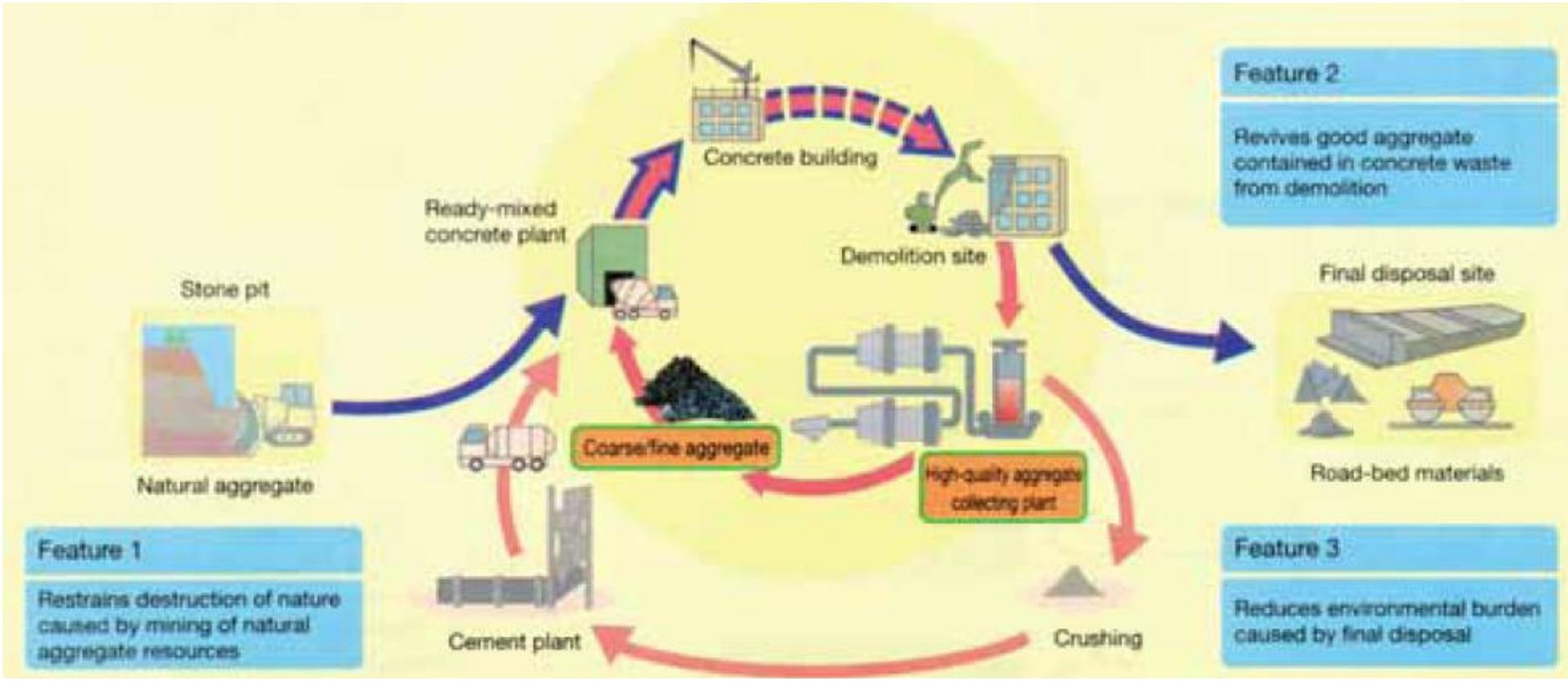
Example – 2

Recyclable plastics collected from bumpers are reused as raw materials for manufacturing bumpers



(Source: Data by the Basic Policy WG, Waste Prevention and Recycling Subcommittee, Environment Committee, Industrial Structure Council)

Examples of recycled of concrete aggregate



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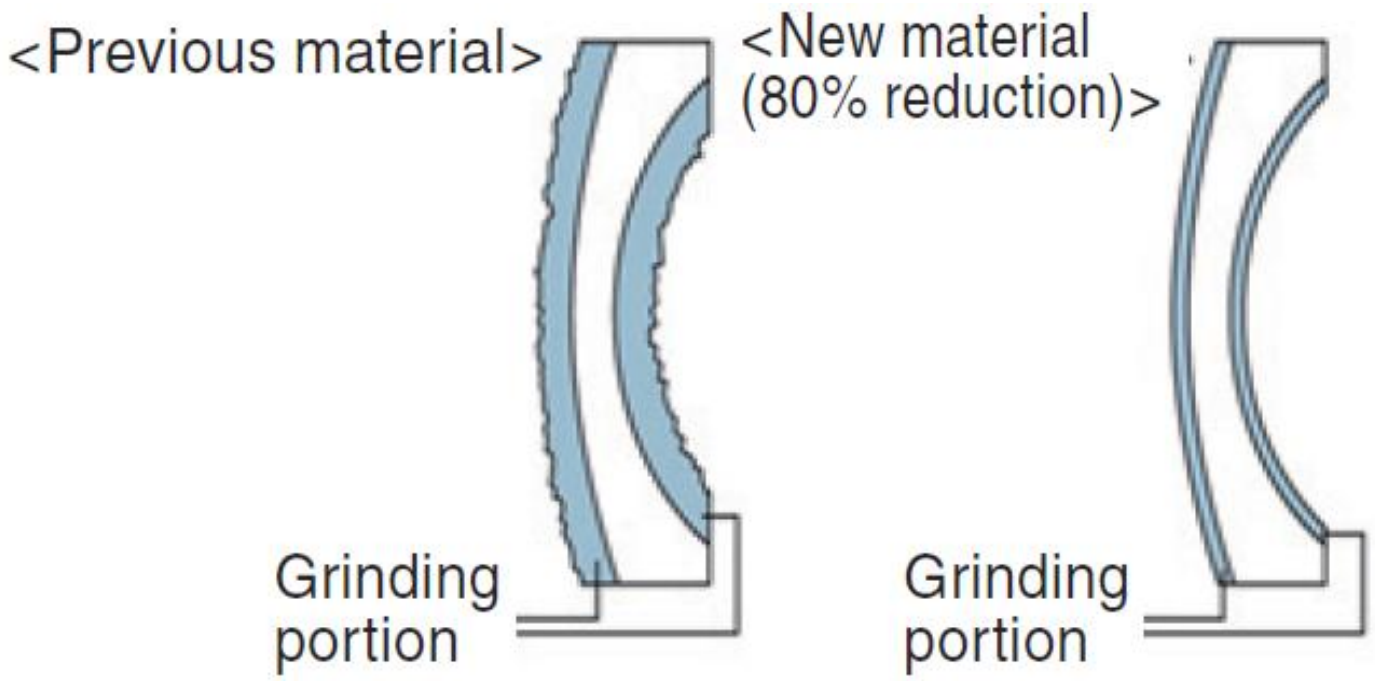
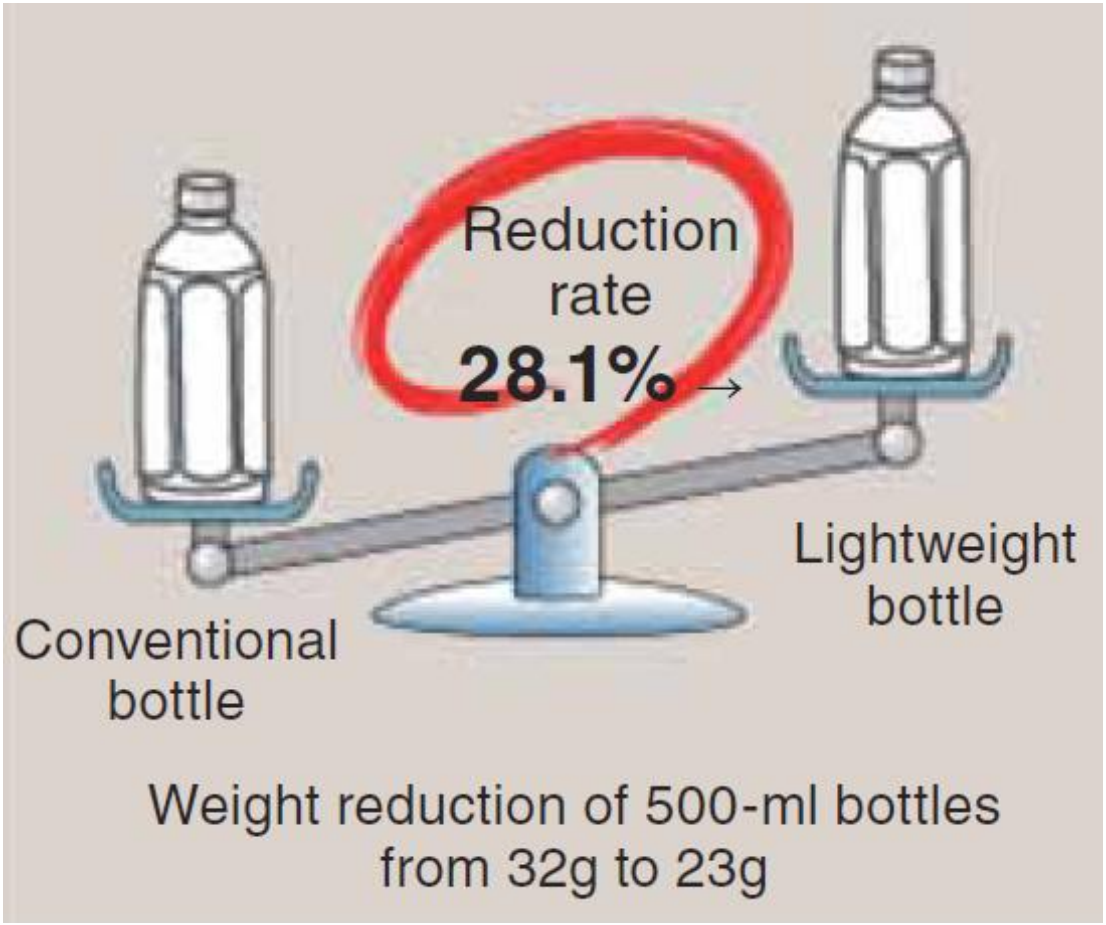
Reduction of material consumption by changing process (Glass lens)



Weight reduction of PET bottles



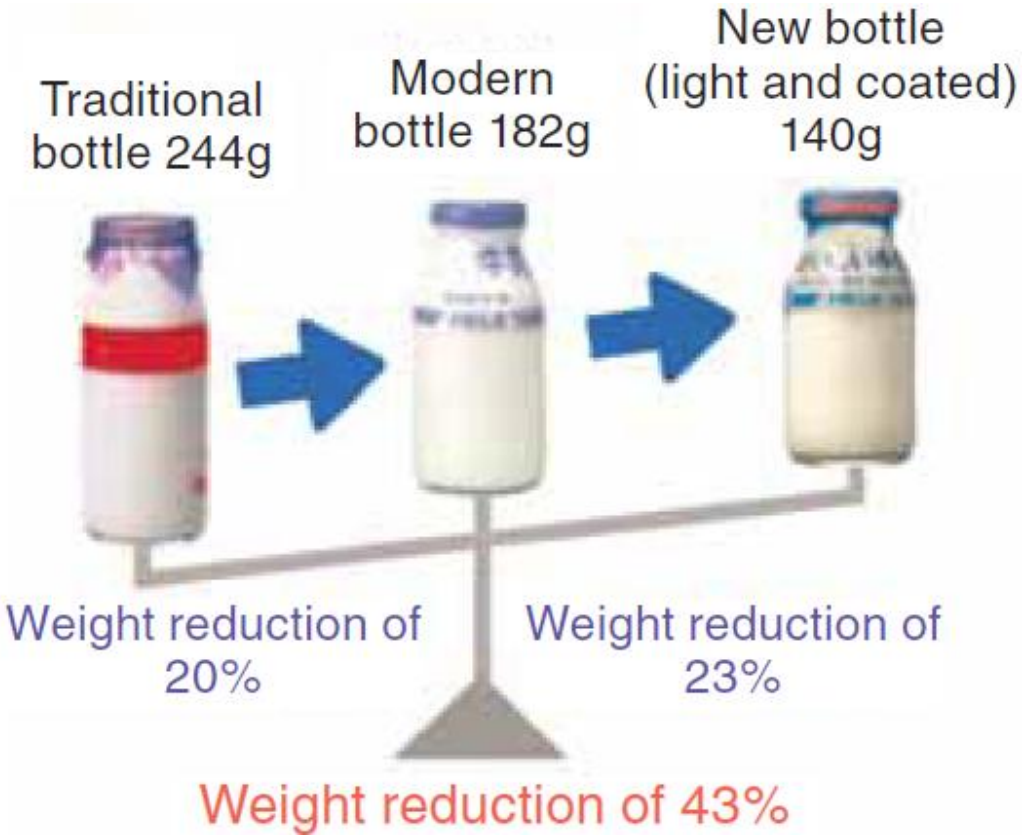
Source : Website of the council for PET bottle recycling

Percentages of weight reduction of PET bottles

Manufacturer	Bottle type	Reduction	Percentage
Ajinomoto	500-ml bottle for Amino Vital	32g → 26g	18.8%
Kewpie	500-ml bottle for mineral water	32g → 27g	15.6%
Kirin Beverage	2-liter bottle	63g → 42g	33.3%
Suntory	500-ml bottle	32g → 23g	28.1%
Toyo Seikan	1500-ml bottle	59g → 51g	13.6%
Nichirei	500-ml bottle for Acerola C Water	32g → 28g	12.5%
Coca-Cola Japan	2-liter bottle	55g → 48g	12.7%

Source : Generated from “Appendix 19” provided by the 23rd container and packaging recycling WG of the waste prevention and recycling subcommittee, Environment taskforce, Industrial structure council (Website of the counsile for PET bottle recycling)

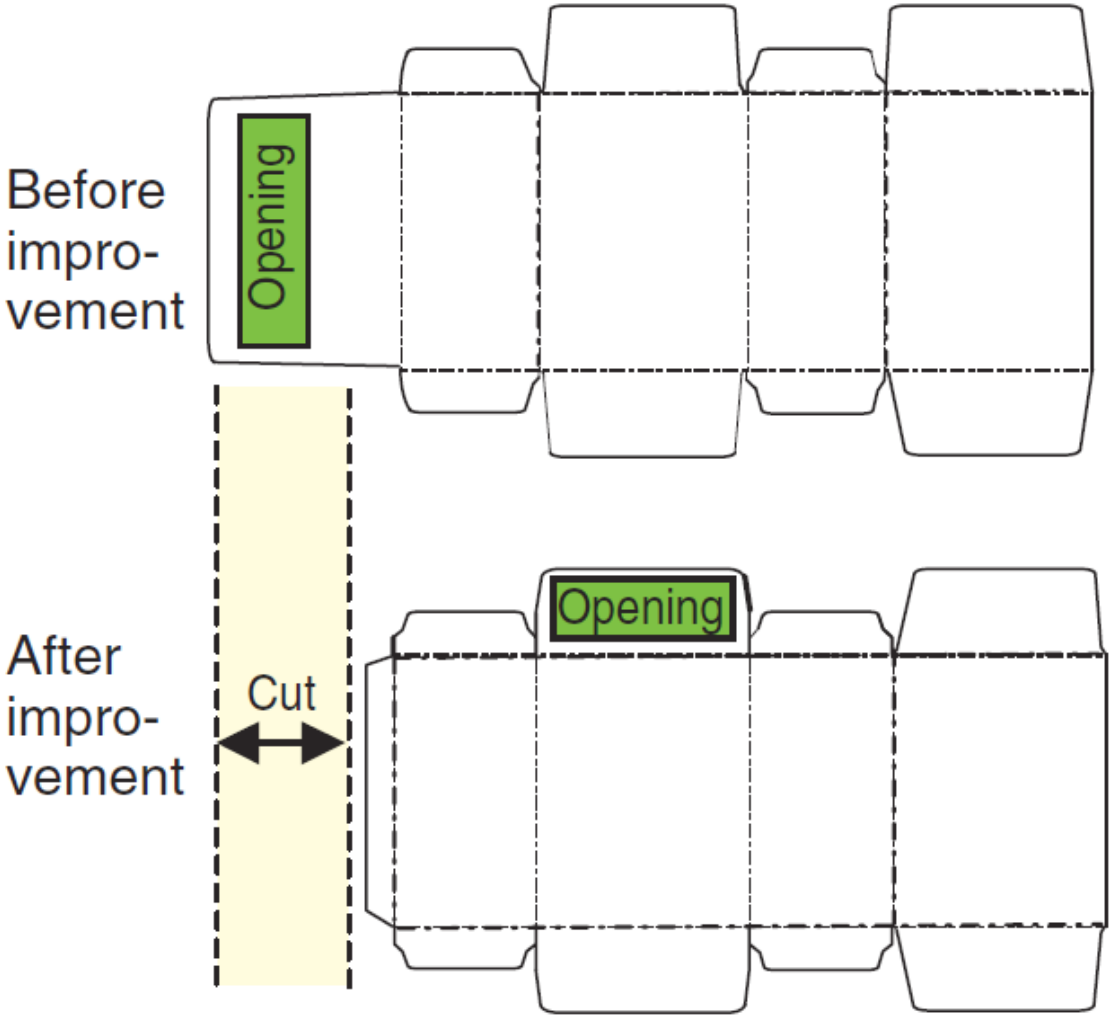
Weight reduction of 200-ml milk glass bottles



	Average reduction per bottle	×	Shipment ('03)	=	Saved resource
Large beer bottle	[591g ('97) - 549g ('03)]	×	97,700 tons	=	40,900 tons
200ml milk bottle	[244g ('97) - 225g('03)]	×	151,000 tons	=	29,000 tons

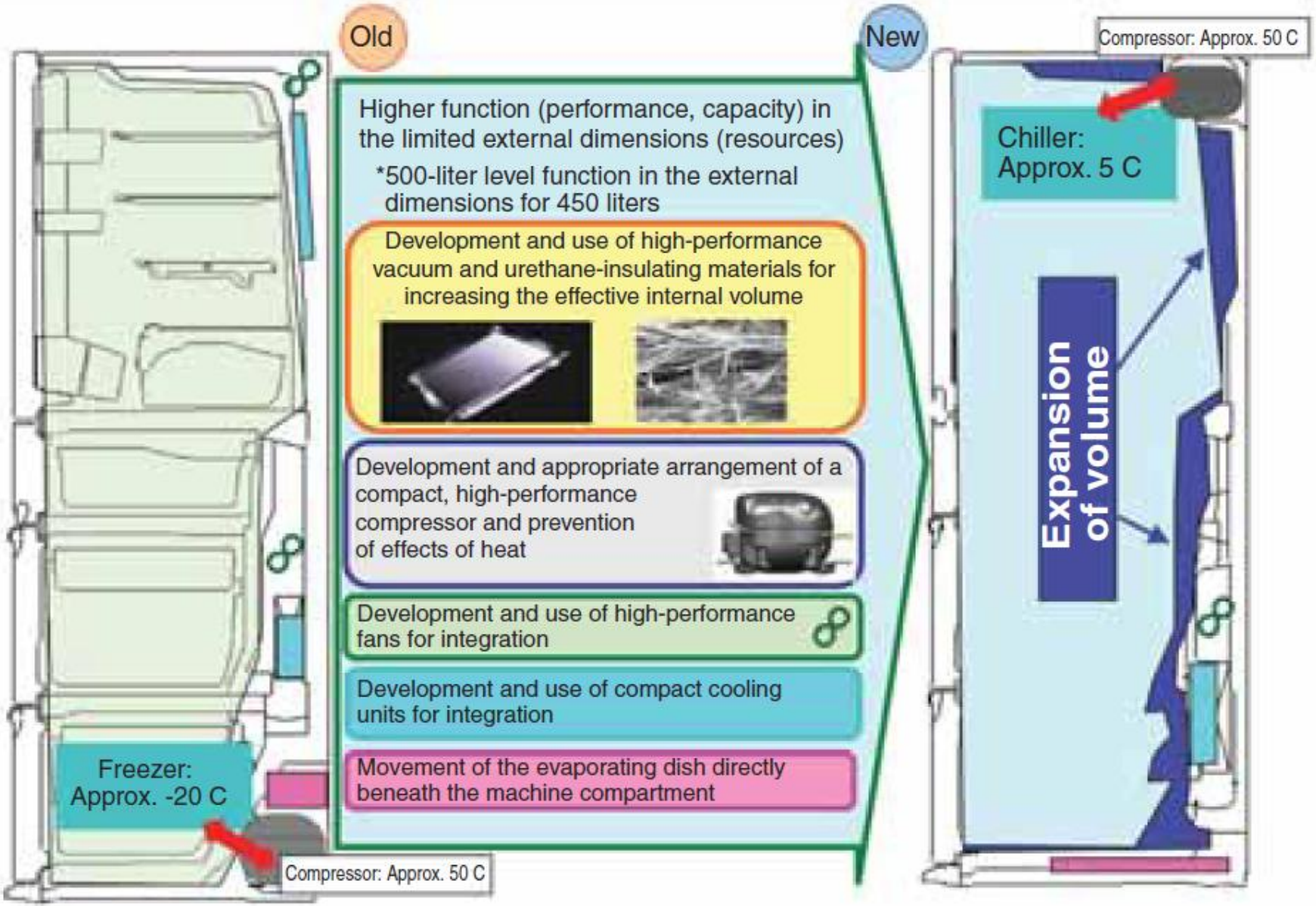
Source : Glass bottle recycling promoter association

Weight reduction of paper containers and packaging



Source : Cases of 3R improvement in paper containers and packaging, December 2007
(Paper containers and Packaging promotion councile)

Expansion of available volume in the same dimensions



Source : Material from basic policy WG, Waste prevention and recycling subcommittee, Environment taskforce, Industrial structure council

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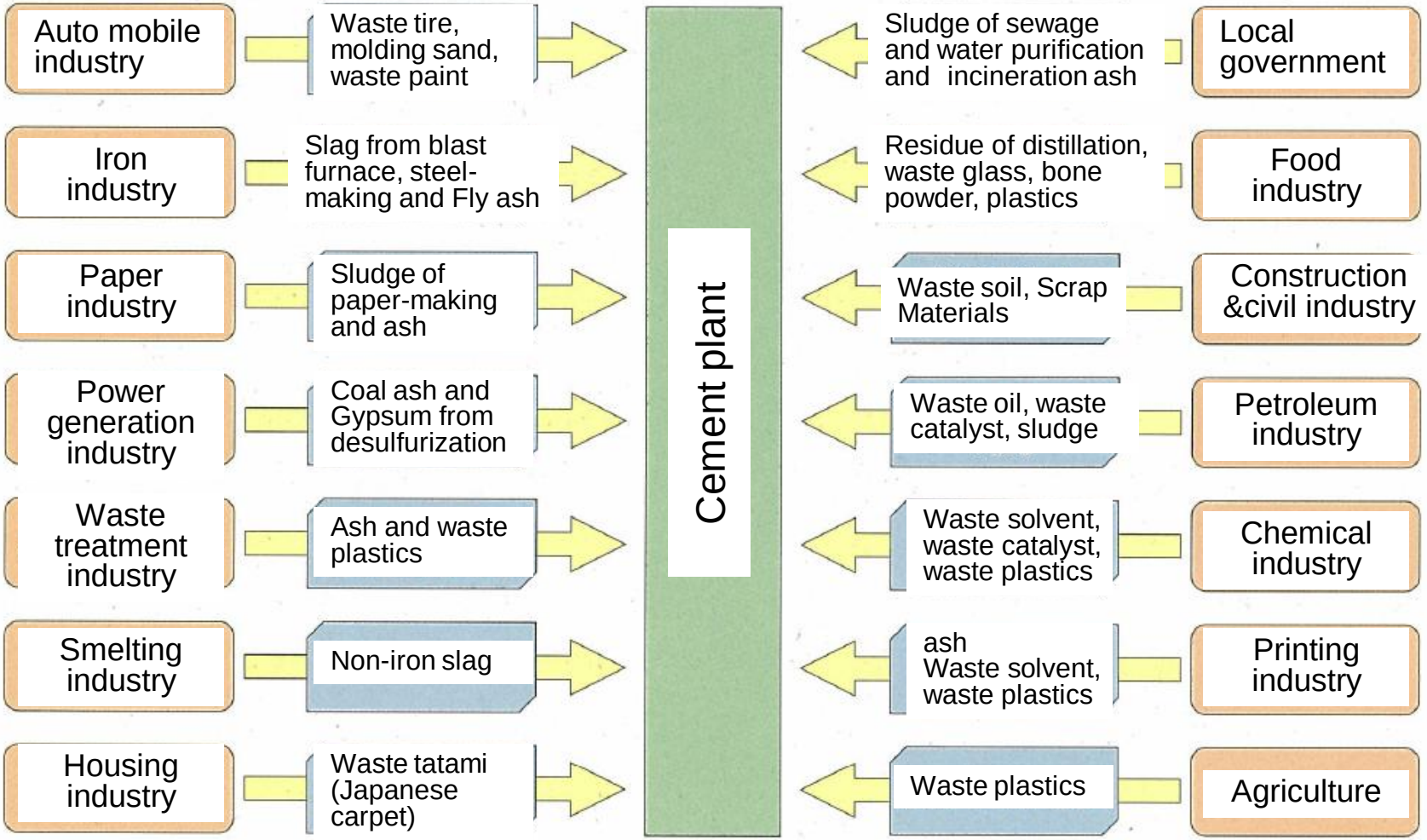
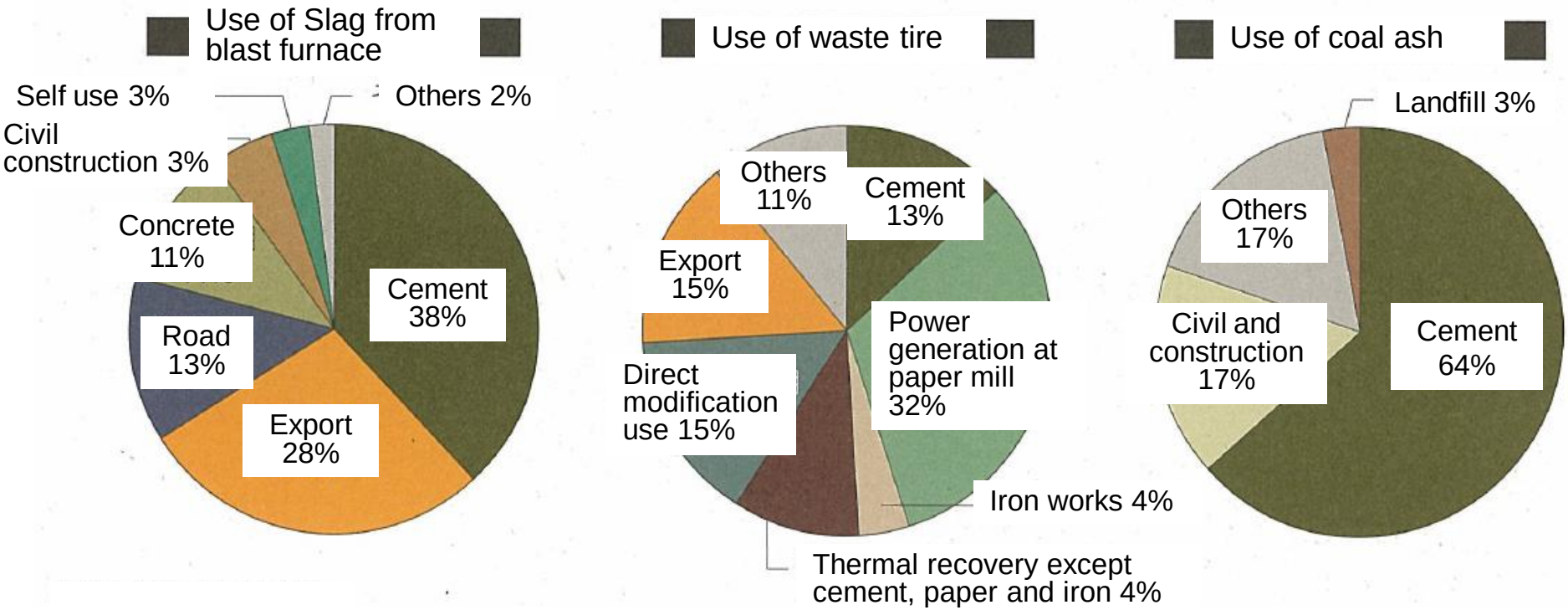
Use of various wastes and by-products for cement production



Source : Japan cement association

Main waste and by-products utilized for cement production



Source : Japan cement association

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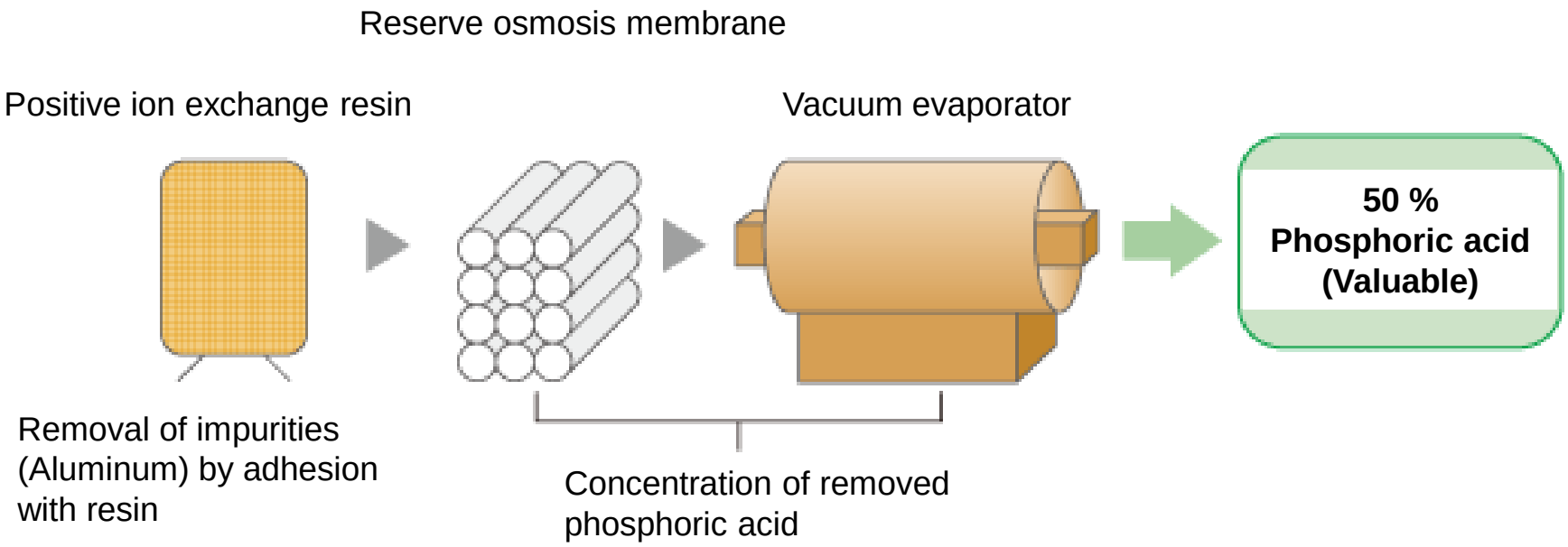
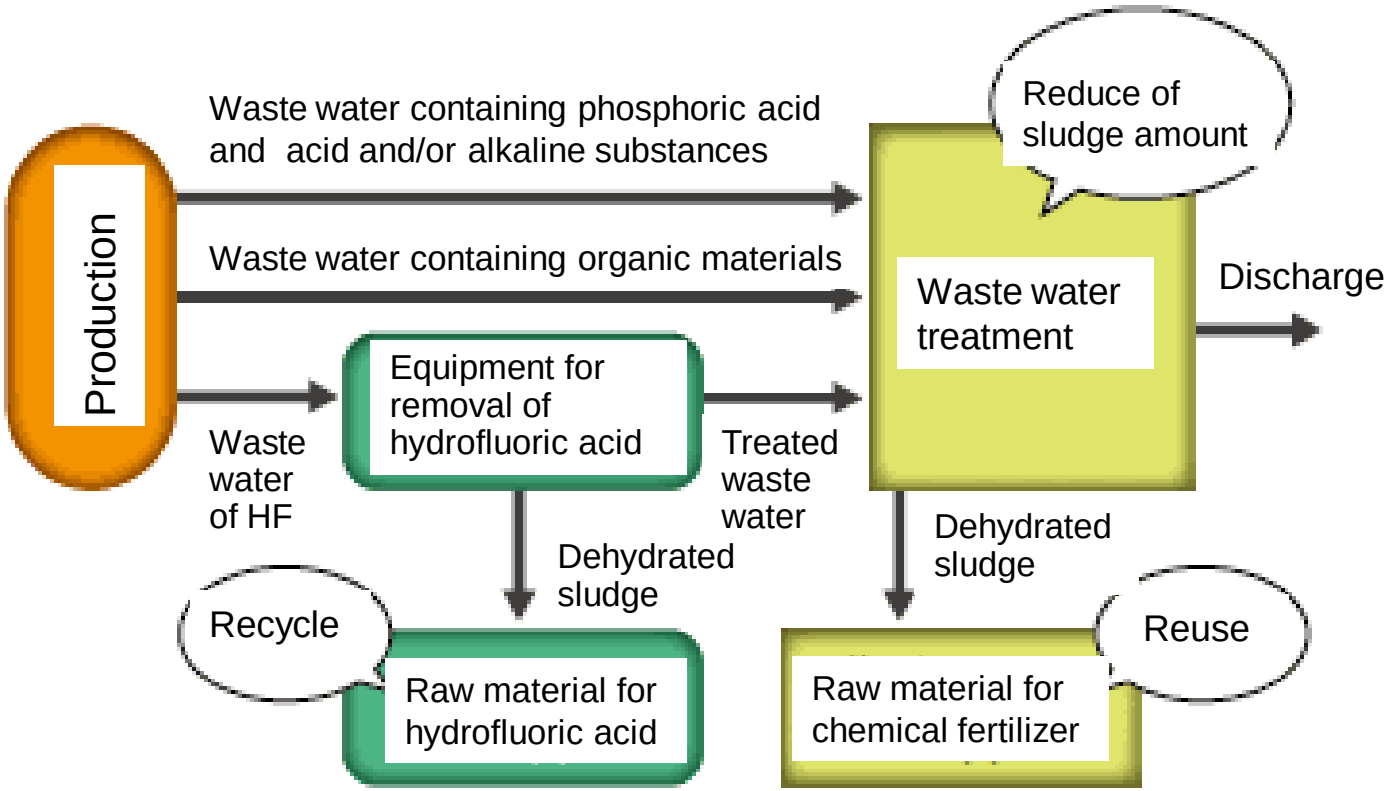
Removal system of phosphoric acid from waste water of liquid crystal panel production



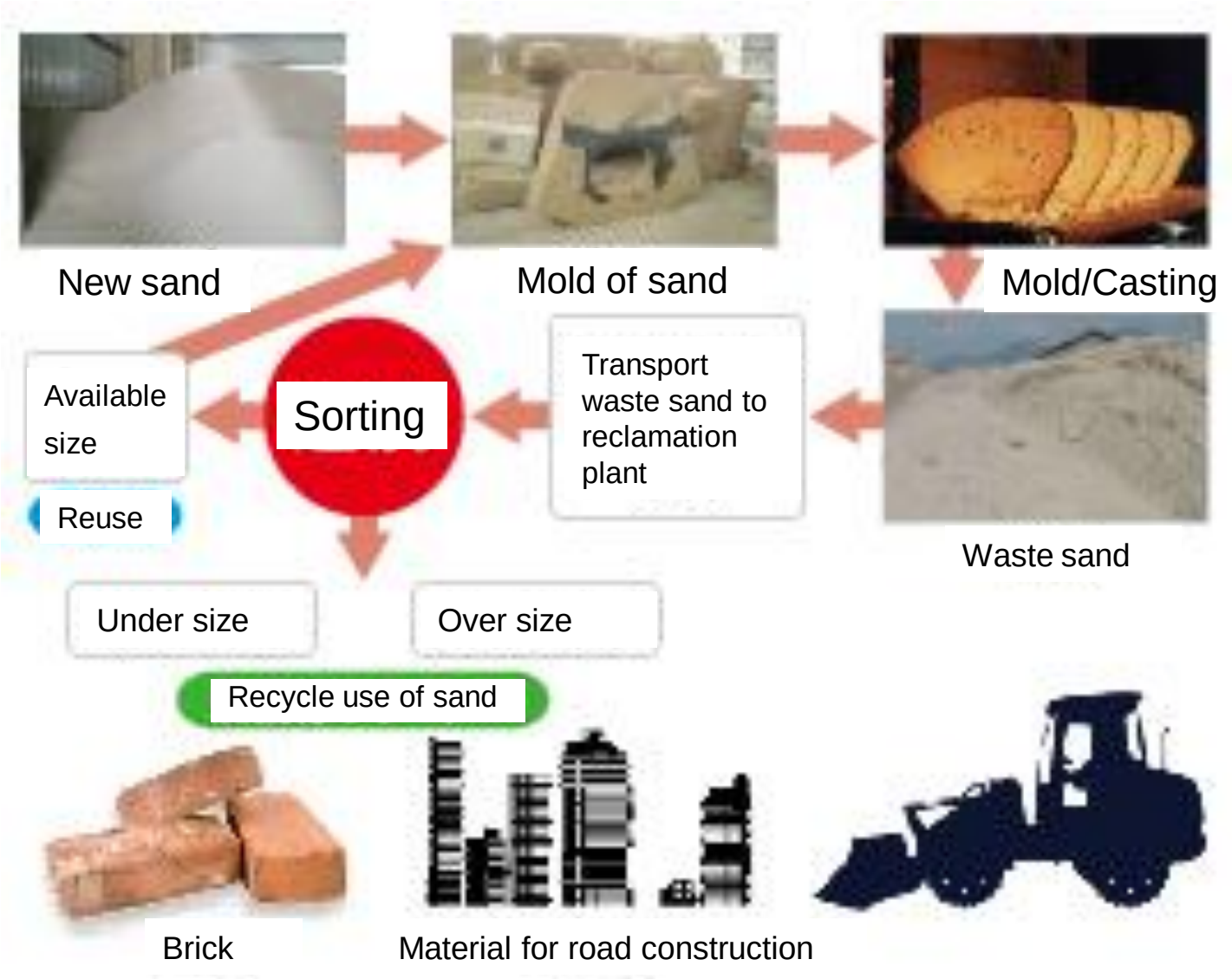
Recycle of the sludge of waste water treatment from the production of liquid crystal display production to fertilizer

Waste water treatment flow



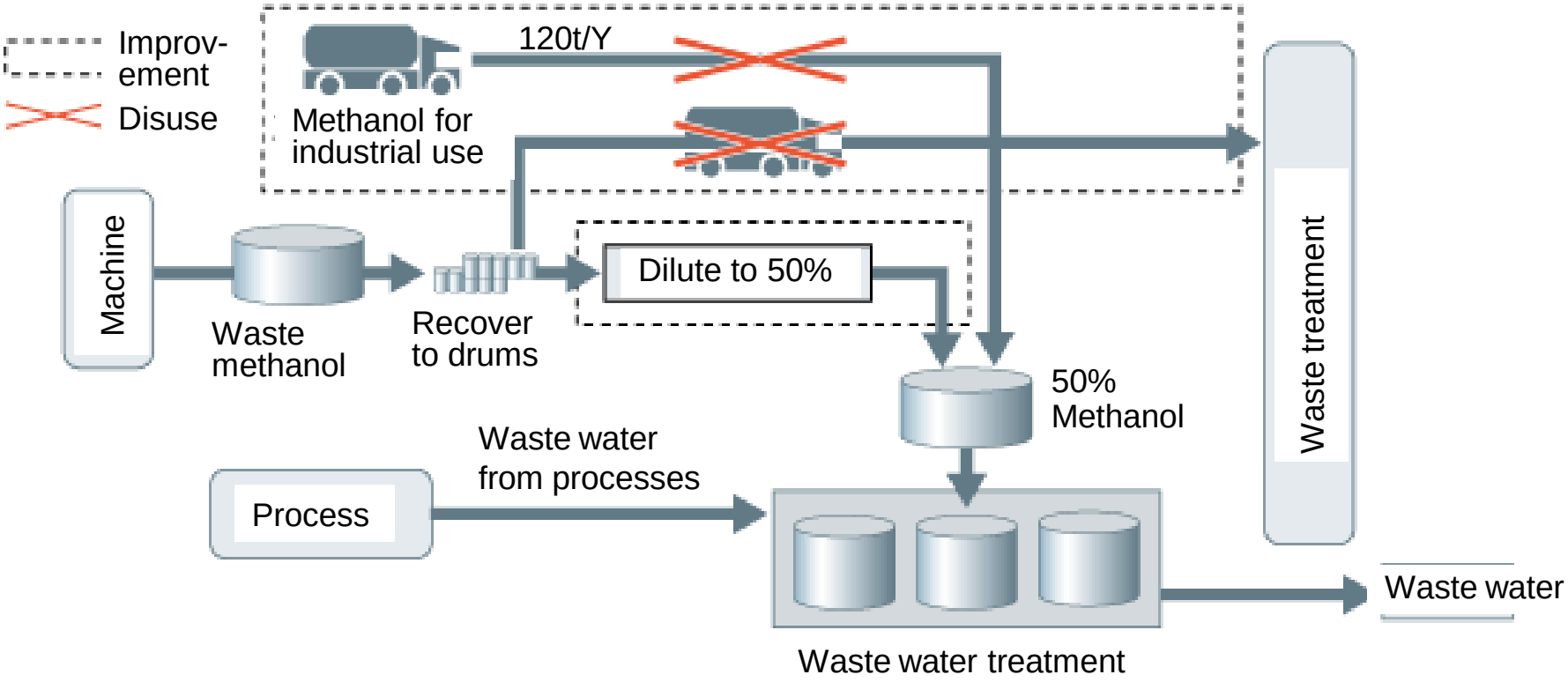
(source : Toshiba mobile display co.,Ltd.)

Zero emission by the recycling system of waste sand for molding

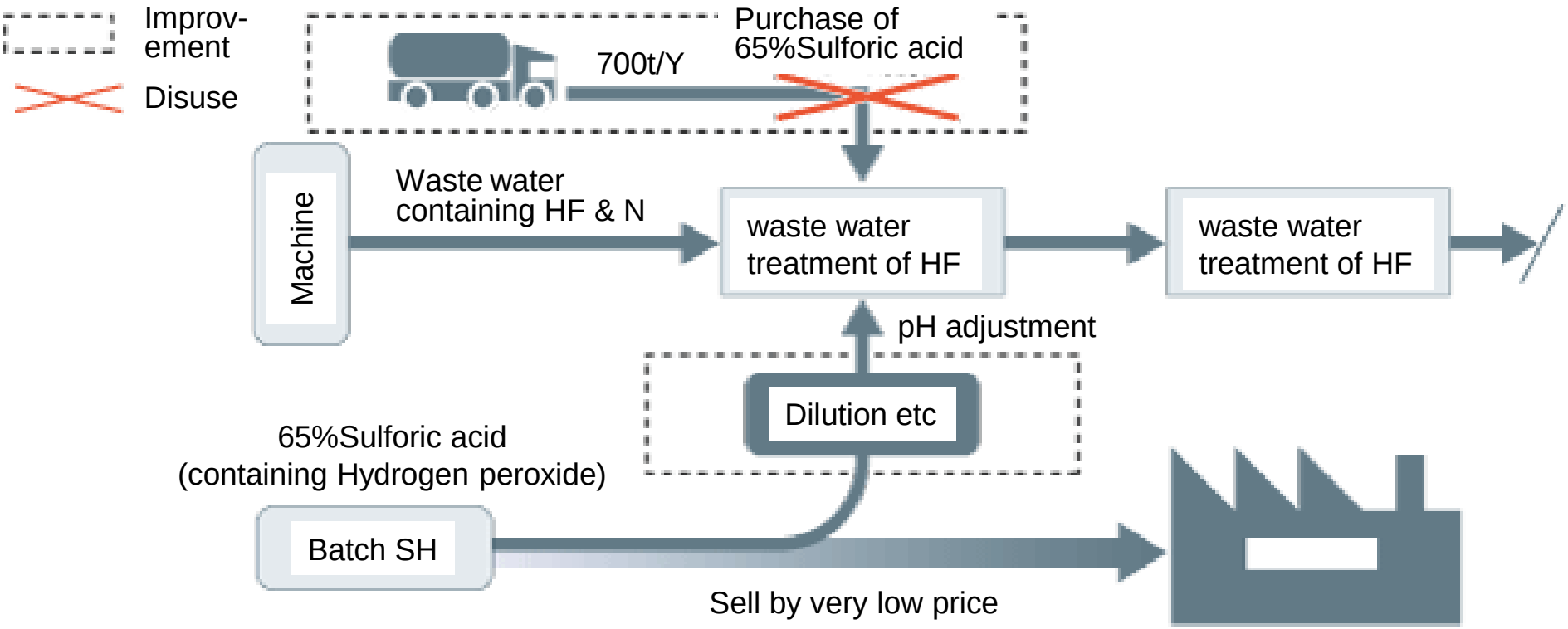


Source : Toshiba power systems company

Recovery and reuse of waste methanol



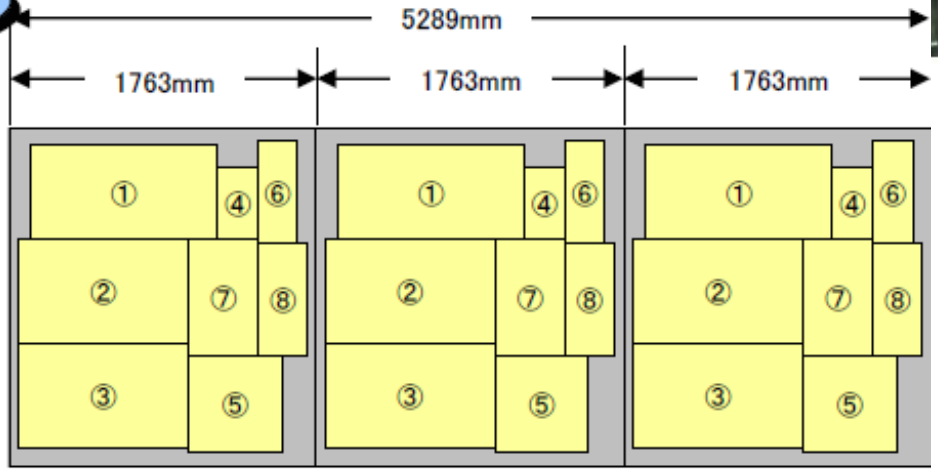
Reduction of consumption of new material (Sulforic acid)



Material saving of vacuum insulation at cutting process of a sheet

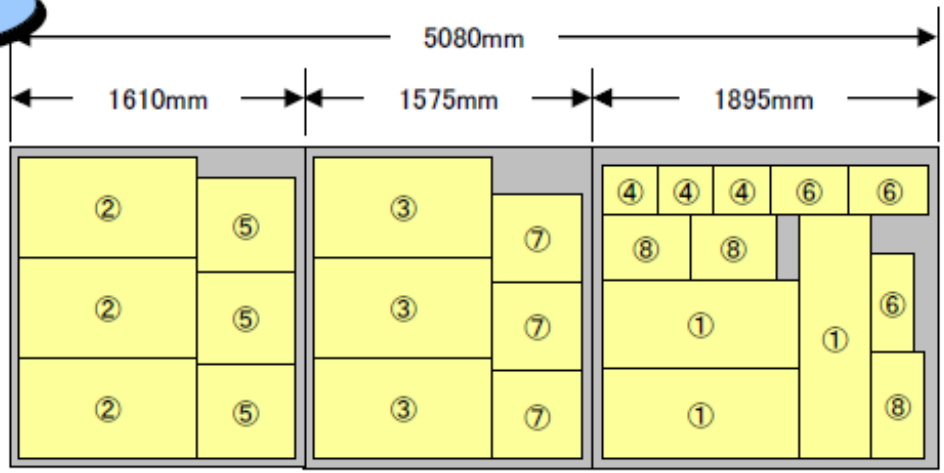
Before

Efficiency of material use : 86 %
Operator decided trimming pattern.

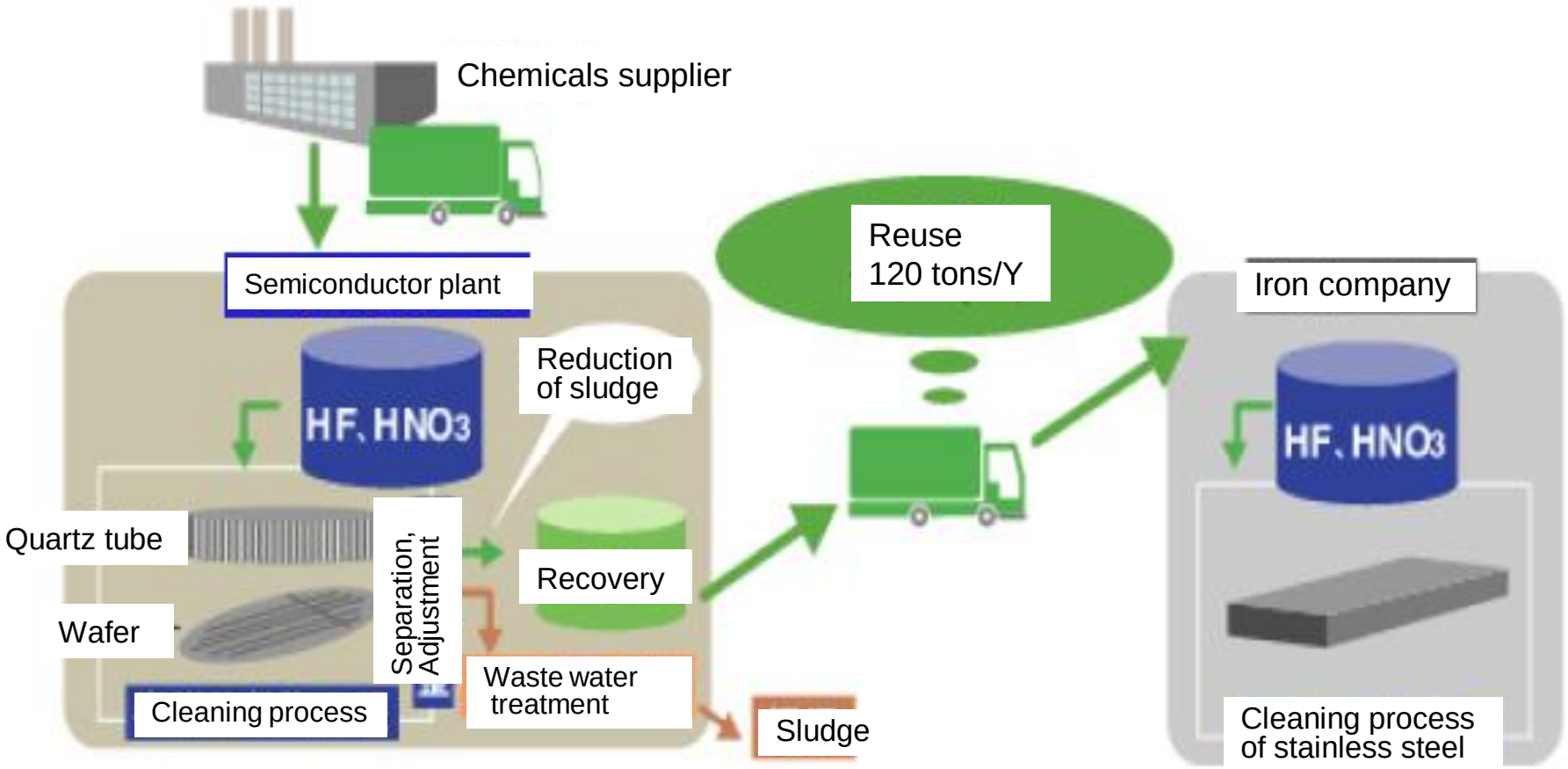


After

Efficiency of material use : 93 %
trimming pattern are decided with PC calculation.

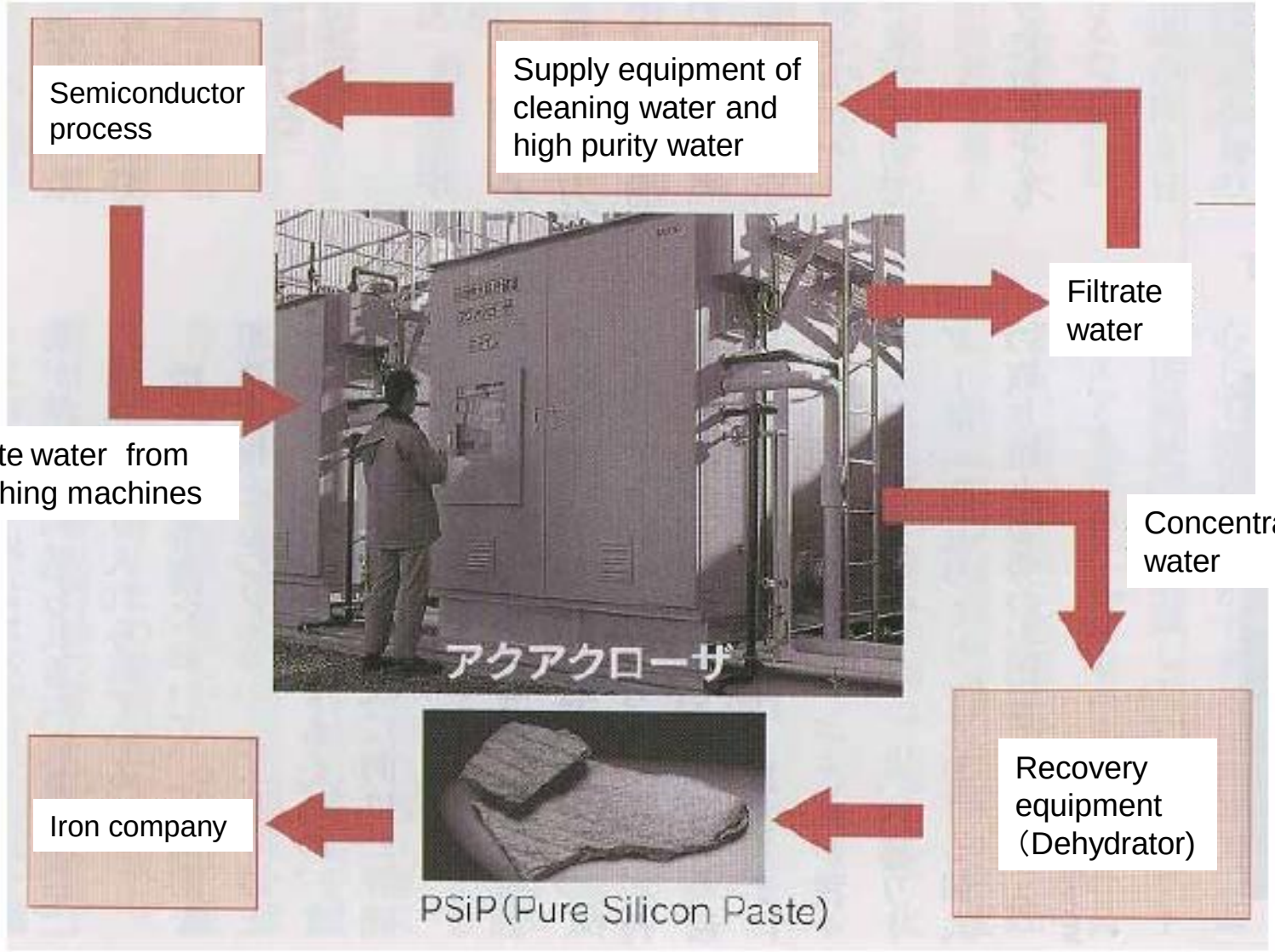


Reuse of recovered HF & HNO3 at an iron company

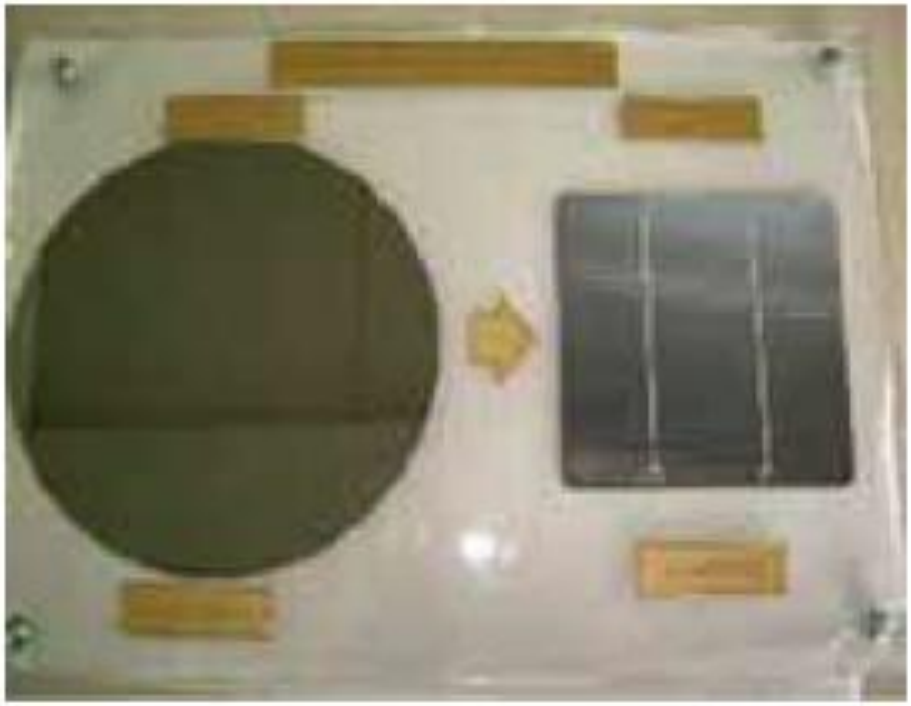


Reduction of sludge : 300 tons/Y,
Reduction od CO_2 emission : 52 tons/Y(by LCA)

Recovery of Silicon and reuse of water from polishing process waste water



Recycling of off-spec wafer for semiconductor to solar cell for solar panel



Left : Waste wafer, Right : Solar cell

Advertising panel using solar cell

Waste water recycle at plating plant

Water consumption

70 m³/D

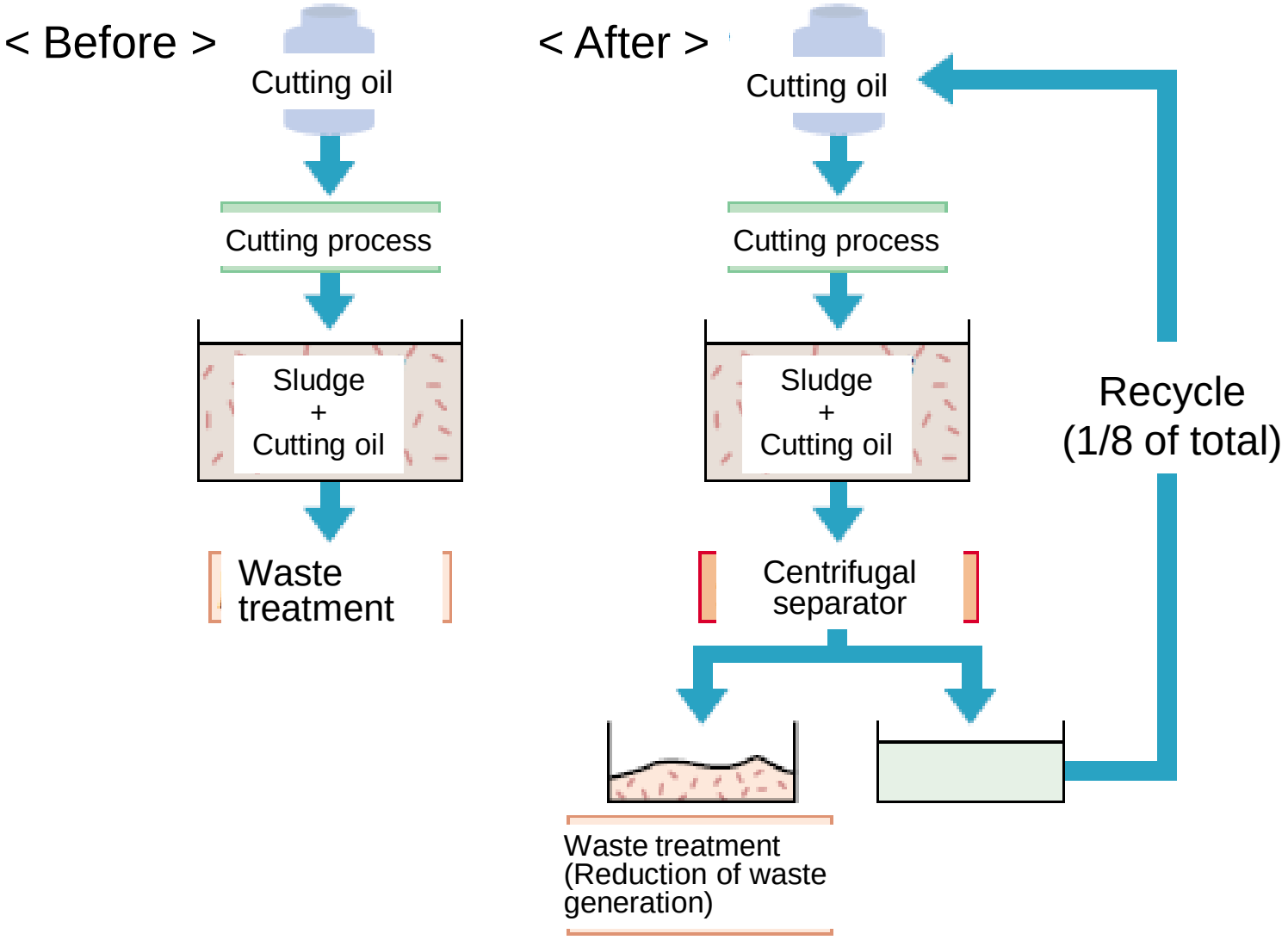
Reuse

Recovery

Filtration with RO

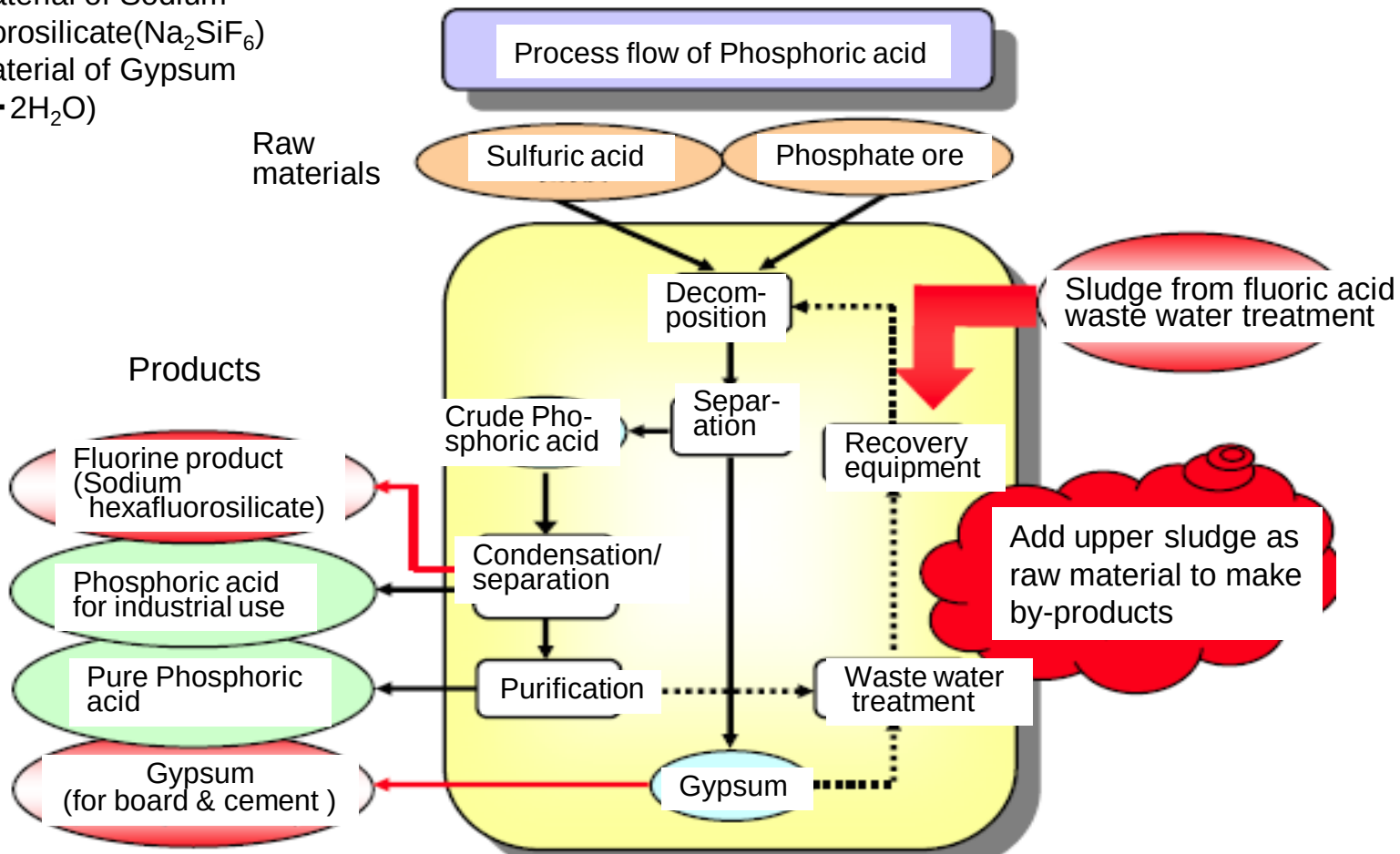
RO : reverse osmosis membrane filter

Recycle use of cutting oil (oil for cutting of metal)



Recycling of sludge from fluoric acid waste water treatment (main component : CaF_2)

F : Raw material of Sodium hexafluorosilicate(Na_2SiF_6)
Ca : Raw material of Gypsum ($CaSO_4 \cdot 2H_2O$)



Main components of Phosphate = $Ca_9(PO_4)_6 \cdot CaF_2$ + SiO_2

Products = Phospho-ric acid (H_3PO_4) + Gypsum ($CaSO_4 \cdot 2H_2O$) + Sodium hexafluorosilicate (Na_2SiF_6)

Thank you for your attention !!