

Asia 3R Conference, 31 Oct 2006

E-waste Issues in Asia

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Summary 1

■ Inventory (domestic)

- E-waste generation is increasing both in developed and developing countries.
- Material flow is unclear in most Asian countries.
- Uncontrolled "Invisible flow" exists out of regulated recycling system, and it is likely to cause the inappropriate handling.
- Comprehensive inventory data are needed for the management.

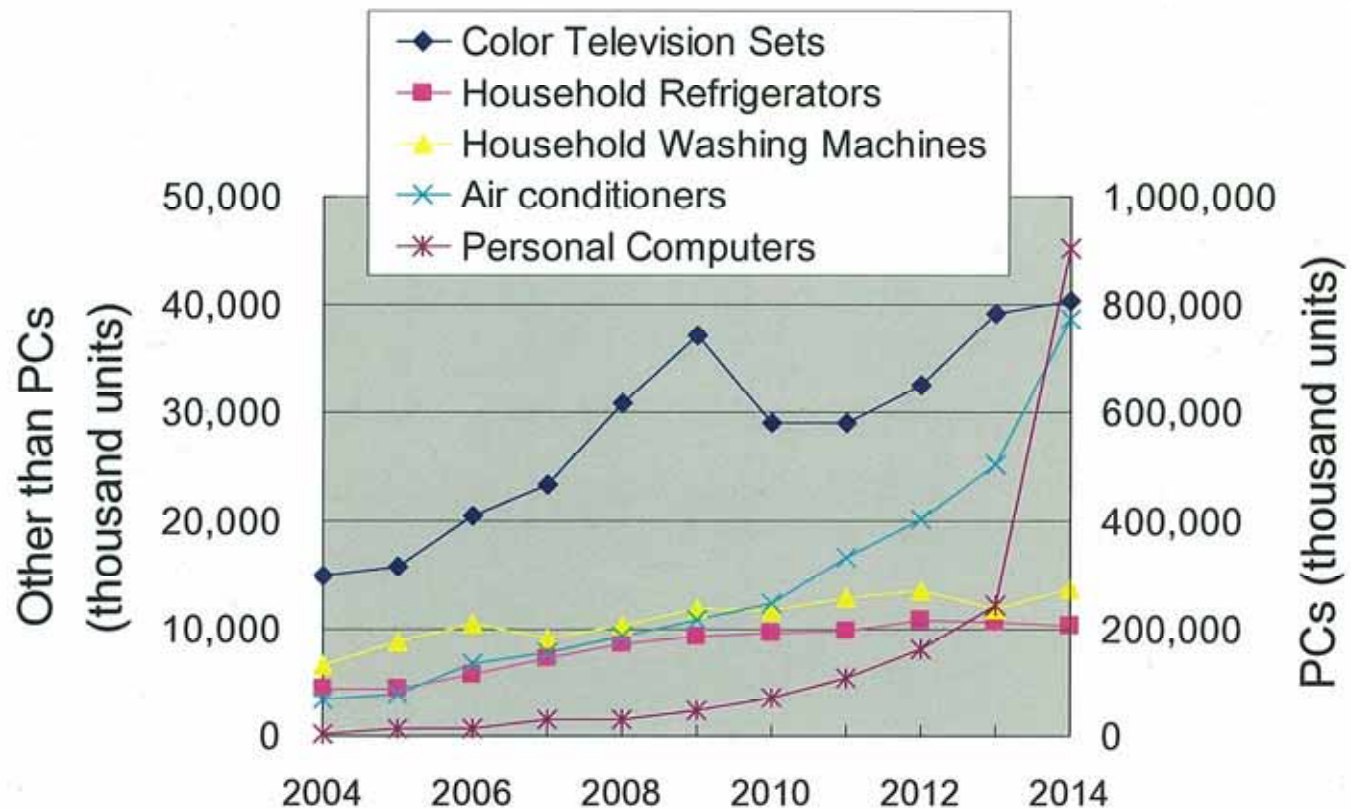
■ International trade

- International trade of secondhand products or dismantled parts/materials to Asian developing countries is increasing.
- Illegal trade such as disguise or smuggling can be found, that would lead to inappropriate reuse/recycling.
- Asian-wide cooperation is needed for identification of secondhand products and for controlling illegal trade.



Summary 2

- **Recycling system of E-waste** (skipped today)
 - Asian countries are gradually having various scheme of recycling system.
 - Newly established recovery scheme often competes with traditional flow and facilities due to the monetary transaction.
- **Environmental effects**
 - Environmental pollution is caused by uncontrolled recycling activities such as open burning of wires and cables.
 - Two types of pollution are identified.
 - **Toxic compounds**: PAH, PCB, PBDE, PCDD/DFs and heavy metals are reported for Guiyu, China.
 - **Open dumping**: Residues from uncontrolled recycling.
 - Health or risk assessment is also being carried out.
- Cooperative understanding and management should be promoted between exporting and importing countries.



E-waste generation is increasing both in developed and developing countries.

Nationwide and chronological data on E-waste generation is insufficient in Asia.

Estimation differs greatly dependent on the assumption.

Estimated E-waste generation in China

Source: Li, et al., JMCWM, Vol.8, 2006, amended by Terazono

Estimated number of Japanese home appliances generation (Unit: 1,000 units, 2003FY)

(Only) Half of generation is recovered and recycled under the recycling law.

Tasaki (NIES) for 2001-2003 (2006)

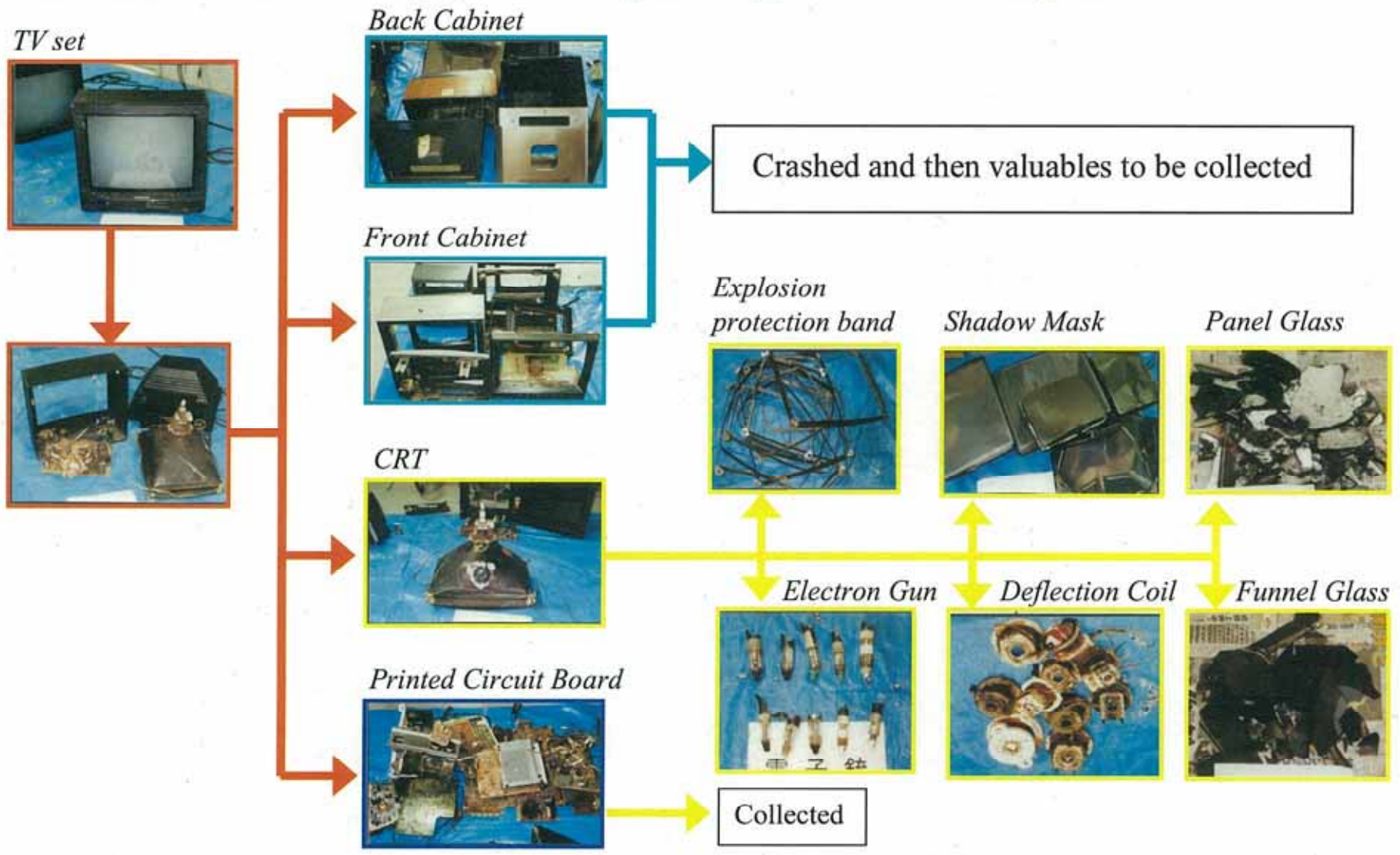
METI (2005)

	CRT-TV	Ref	Was. Mach.	Air Con.	Total
Domestic EOL appl.	8,640	3,940	4,110	4,010	20,690
Recycling at recycling facilities	40.8%	65.1%	59.0%	40.8%	10,150 (49.0%)
Recycling at disposal facilities	20.0%	26.5%	32.6%	37.2%	5,620 (27.1%)
Export	38.1%	7.3%	7.5%	19.7%	4,670 (22.6%)
Illegal dumping	1.0%	0.9%	0.7%	2.1%	240 (1.1%)
Disposal by municipalities	0.1%	0.2%	0.1%	0.1%	30 (0.1%)
Domestic EOL appl.	9,080	3,460	3,390	2,940	18,860
Recycling and disposal in Japan	39%	85%	82%	74%	11,510 (61%)
Export as secondhand	61%	14%	18%	26%	7,350 (39%)

"Invisible flow", figures are unclear, especially for export.

Export of TV is significant in "Invisible flow".

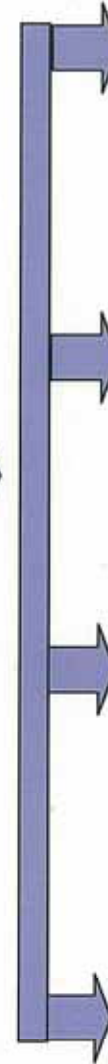
Dismantling a CRT-TV set at recycling facilities under home appl. recycling law in Japan



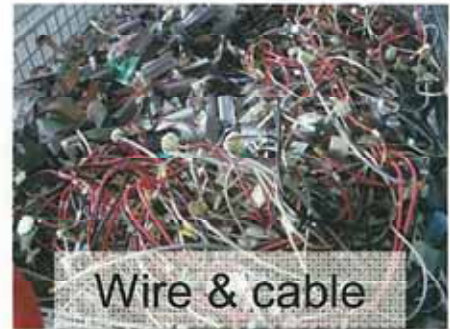
Dismantling of PCs and OA instruments at recycling facilities in Japan



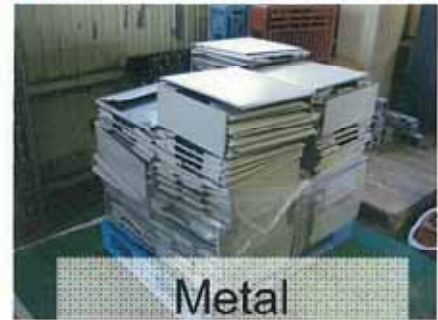
Dismantling and separation by hand



Print Circuit Board



Wire & cable

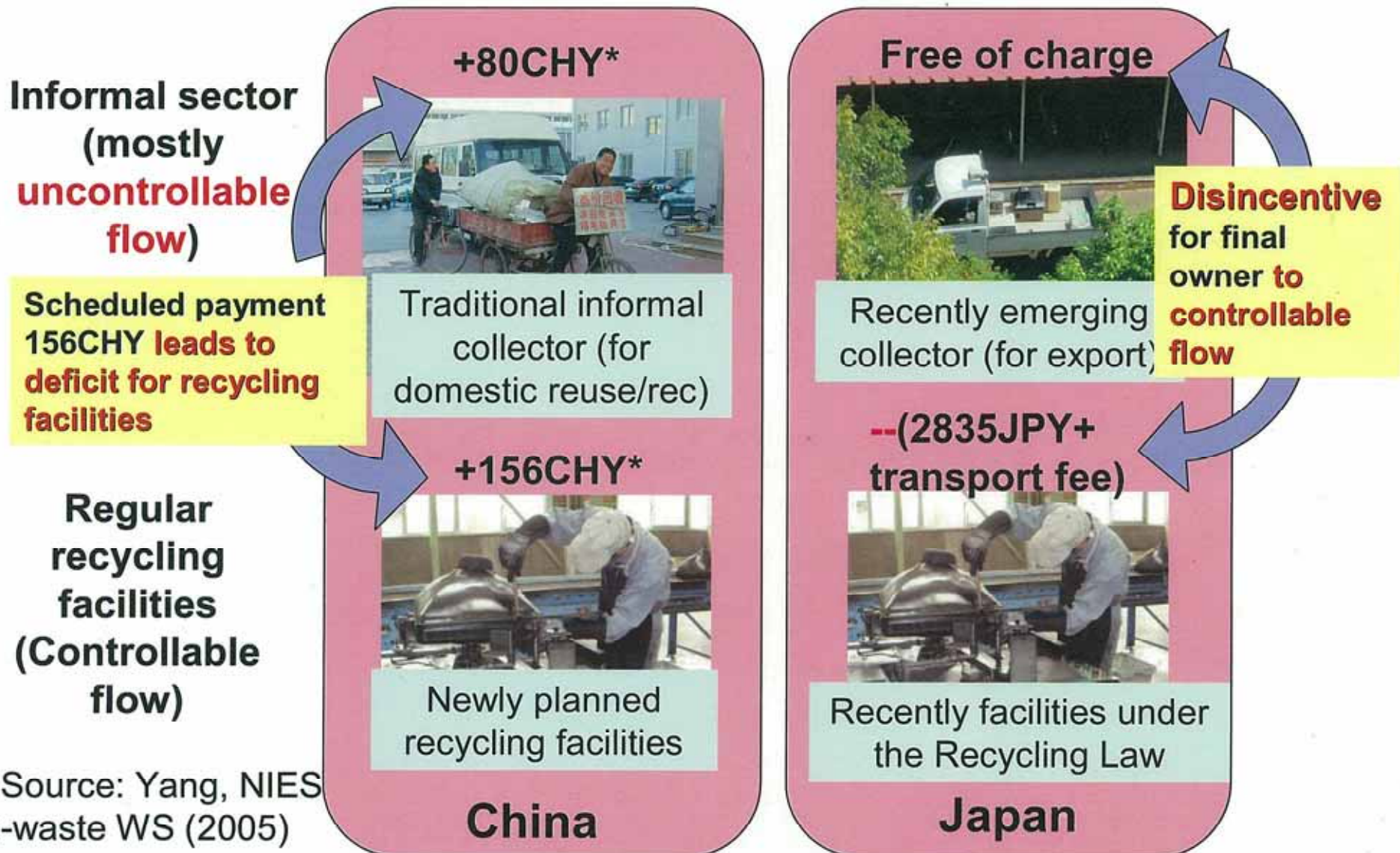


Metal



Plastic

Charge for a final owner to discard home appliances (e.g. TV)



* Source: Yang, NIES E-waste WS (2005)

Estimation of recovered materials (valuables) and waste (non-valuables) at home appliance recycling facilities in Japan for 2002 (unit: tons)

		Air-conditioners	CRT-TV sets	Refrigerators	Washing machines	Estimation Total
Recovered Materials	Iron	16,183	2,152	53,362	25,061	96,758
	Copper	1,517	1,304	222	1,203	4,246
	Aluminum	0	55	0	0	55
	Mixed metals Total	38,555	22,869	21,783	12,330	95,538
	(Mixed metal parts)	33,907	19,924	19,058	11,829	84,718
	Metal Total	56,255	26,380	75,368	38,593	196,596
	Plastics	8,169	12,912	19,693	11,027	51,800
	Glass	0	50,512	0	0	50,512
	Total	64,424	89,803	95,061	49,620	298,908
Recycling ratio		89%	94%	64%	70%	77%
Wastes		7,585	5,331	53,601	21,433	87,950
Total		72,009	95,134	148,662	71,053	386,858

Mixed metal parts could be separated further. Recent emergence of transboundary movement, i.e. mixed metal parts are exported instead of separated domestically.

Waste plastics are more separated recently, due to its market condition. This contributes to raise recycling ratio.

Material flow of (brand-new and secondhand) television sets among Japan, China and Hong Kong in 2001



Japan imports many brand-new TV from China and exports secondhand to HK. But final destination is not clear from trade statistics.

Brand-new TV Import

Chinese Data
 To Japan: 3,172,729 (New/Secondhand)
 From Japan: 38,104 (New/Secondhand)

Japanese Data
 From China: 3,116,626 (New), 7,518 (Secondhand)
 To China: 17,810 (New), 30,423 (Secondhand)

From Hong Kong: 2,903 (New/Secondhand)

Hong Kong Data
 From China: 6,179,192 (New/Secondhand)
 To China: 221,355 (New/Secondhand)

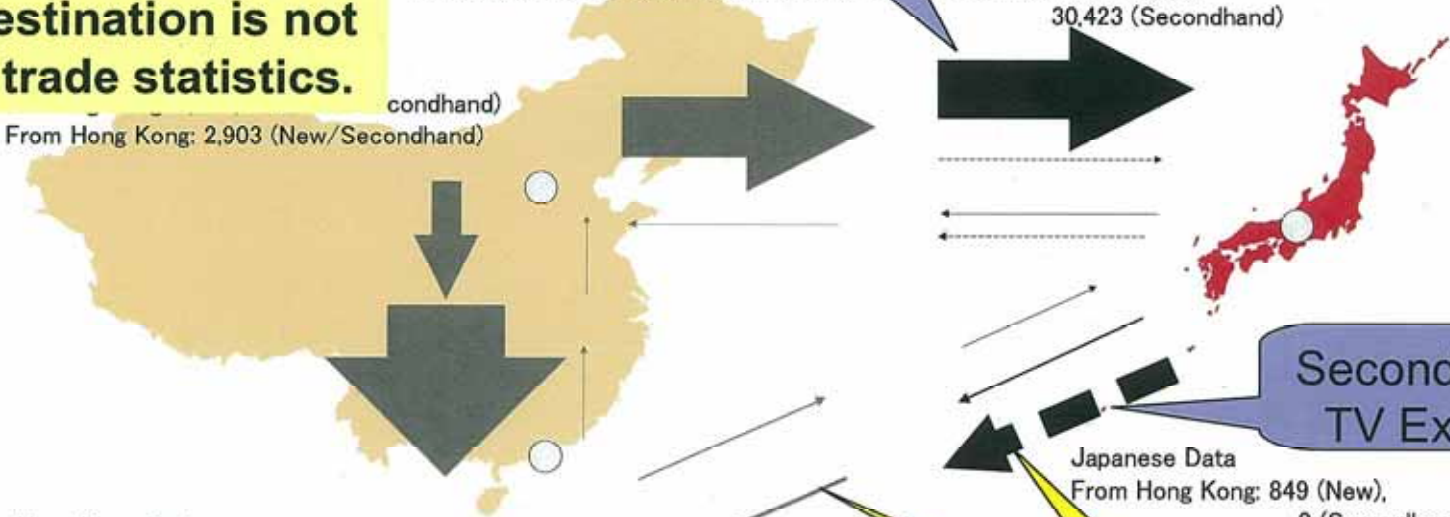
Hong Kong Data
 To Japan: 87,761 (New/Secondhand)
 From Japan: 187,876 (New/Secondhand)

Japanese Data
 From Hong Kong: 849 (New), 0 (Secondhand)
 To Hong Kong: 95,725 (New), 1,483,455 (Secondhand)

Secondhand TV Export

At HK as transit (or transshipment), secondhand TV is re-exported to China mainland, South-East Asia, Mideast and Africa

Mismatch



Another example of transboundary movement (Boarder between China and Vietnam)

Despite the prohibit of
secondhand appl import
by Vietnam, Illegal
smuggling is still found.
(CN->VN)

As for print circuit board,
inverse movement is
found. (VN->CN)



Photo by Dr. T.Shinkuma
(2006.9)

Exporting Harm

The High-Tech Trashing of Asia



November 20, 2005

The Basel Action Network (BAN)
Electronic Waste Recycling (E-Waste)

John L. Searles
E-Waste Recycling (E-Waste)

Famous house-scale E-waste recycling sites in China



Shantou,
Guanzhou

Taizhou,
Zhejiang



Guiyu (貴嶼鎮)

Feb, 2006, visited by Terazono

Shantou City





**Separation of PCs and other
E-waste on the road**

Photo: Terazono (2006)



**Usual scenery of **print circuit
board heating** for removing
IC-chips and Pb at Guiyu**

Photo: Yoshida (2004)



Removing valuable parts and metals



Effluents after Cu recovery



Storage at river side



**Crushing and
Cu recovery (no photo)**



**Open dumping of
pulverized residues**

Open dumping of E-waste
recycling residues and residential
waste along the river at Guiyu



Natural burning

Possible main pollution of **toxic compounds** for E-waste



**Wires and cables
(Cu, PVC, BFR, etc)**



Open burning

PCDD/DFs

Tentative open burning test shows PBDE emissions at open burning 50,000 times more than appropriate burning. Hirai et al. (2005)



**Print circuit board
(Au, Pd, Cu, Pb, BFR, etc.)**



Heating

Pb and other metals to air and respiratory organs



Acid treatment

Cu, Pb, other metals and PCDD/DFs to water/sediment and soils

Existing report for environmental pollution at Guiyu, China

	Air	Water & Sediment	Soil	Human
PAH		514 μ g/kg-dry (Duck pond)	593 μ g/kg-dry (Printer roller dump site)	
PCB		743 μ g/kg-dry (River sediment)	102 μ g/kg-dry (Printer roller dump site)	
PBDE		32.3 μ g/kg-dry (River sediment)	1140 μ g/kg-dry (Plastic burnt site), 1169 (Printer roller dump site)	
PCDD/DFs			32600 and 2690 pg-TEQ/g-dry (river bank close to ash)	Hair 25.6 and 16.4pg-TEQ/g-dry (Hair)
Heavy metals		Cu 528mg/kg-dry Pb 316mg/kg-dry (River sediment)	Cu 496 and 712mg/kg (Burnt plastic and printer roller dump sites, res) Pb 190mg/kg-dry (Printer roller dump site)	

Urgent investigation would be needed, considering the actual open burning of wires and print circuit board heating at E-waste sites

Source: Leung and Wong, et al., JMCWM, Vol.8 (2006), except for comment



We welcome your participation.
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The Second NIES Workshop on E-waste

- Date: Nov 23, 2005
- Place: Tokyo
- Topics:
 - To share the latest info on E-waste among researchers mainly from Asia, especially on **recycling system** in each country, **inventory**, **international trade**, and **environmental effect**.
- Invited speakers:
 - China, Hong Kong, India, Korea, Switzerland, Taiwan, USA/UNU, Vietnam, Japan



The Third NIES Workshop on E-waste

- Date: Nov 17-18, 2006
- Place: Epochal Tsukuba
- Topics:
 - To share the latest info about E-waste among researchers mainly from Asia, especially on **Toxic/Resource potential** of E-waste, **inventory**, **Reuse**, and **EPR**.
- Invited speakers:
 - China, Germany, Hong Kong, Indonesia, Korea, Malaysia, Sweden, Thailand, Vietnam, Japan