Human, Society, Global Environment
Research Institute for Sustainability Science
大阪大学
サステイナビリティ・サイエンス研究機構
Osaka University Research Institute for Sustainability Science

Utilization of waste biomass in urban-rural context - Japanese perspectives -

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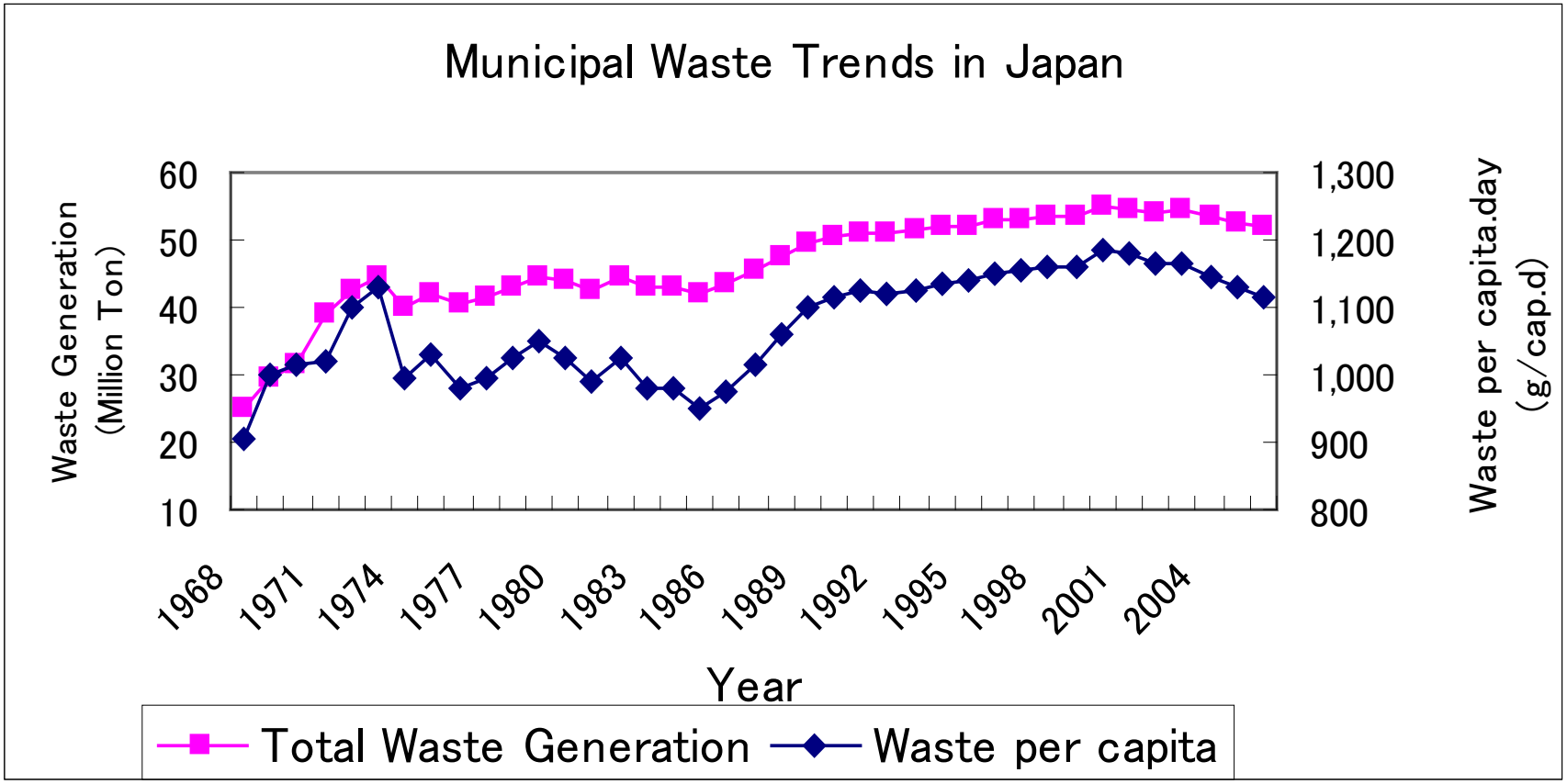
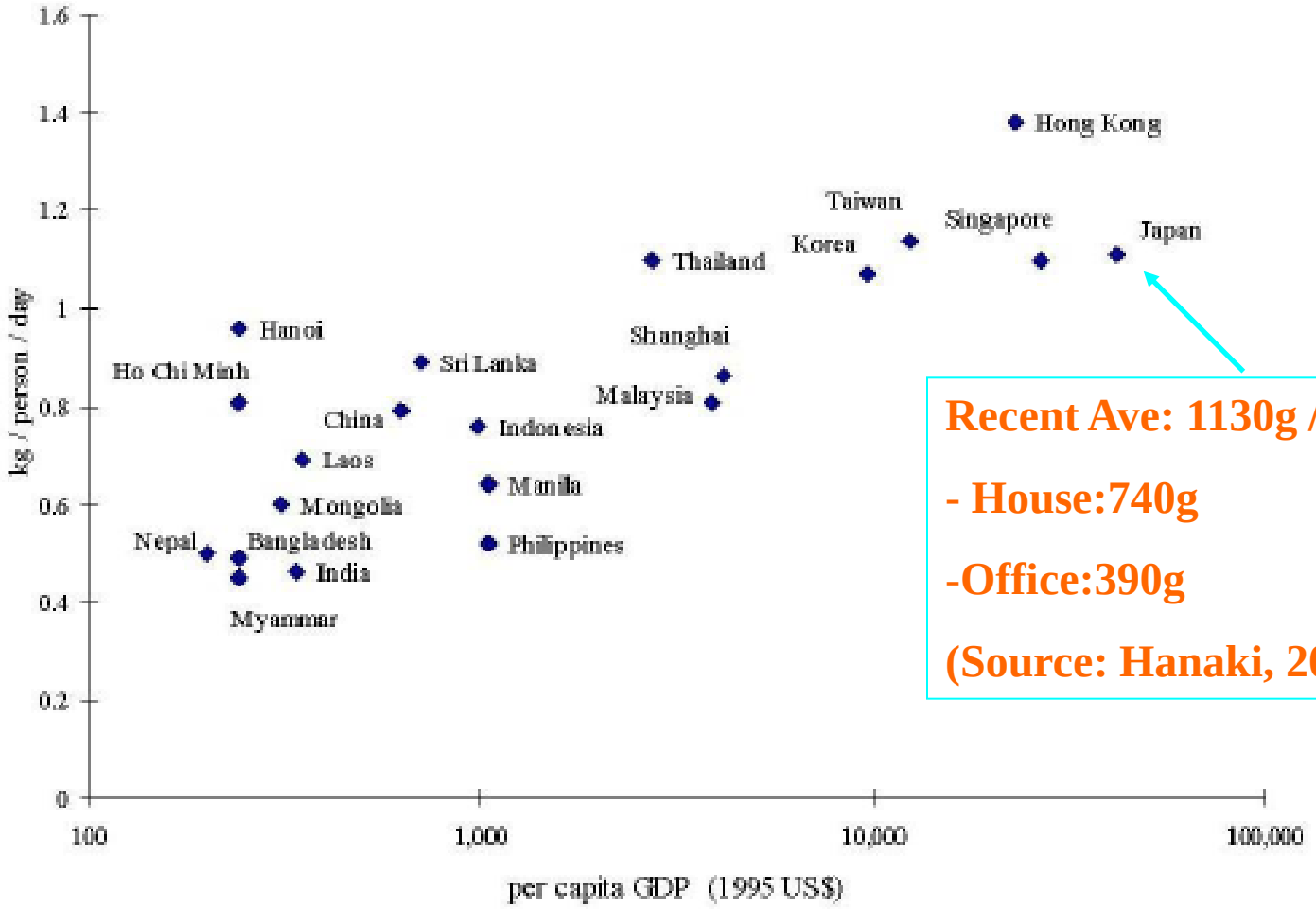
Regional Workshop on Waste Agricultural Biomass, UNEP-IETC, GEC

Chronological Trend of Municipal Waste Generation In Japan



Data Source: Ministry of Environment, Japan

Economic Status and Waste Generation in Asian Nations and Japan



Recent Ave: 1130g /person/day

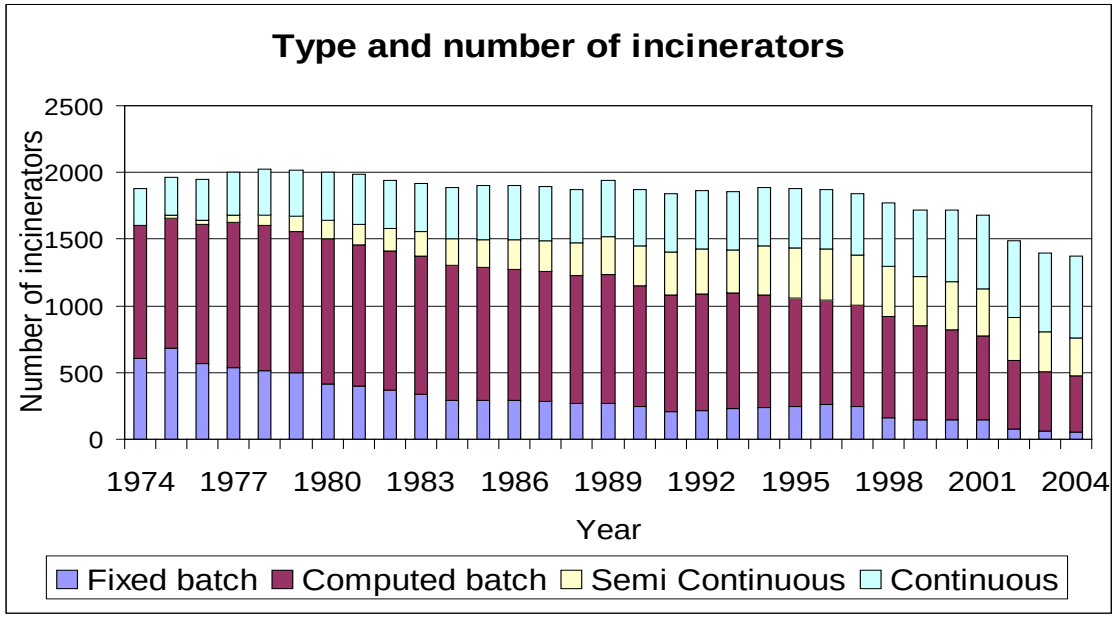
- House:740g

-Office:390g

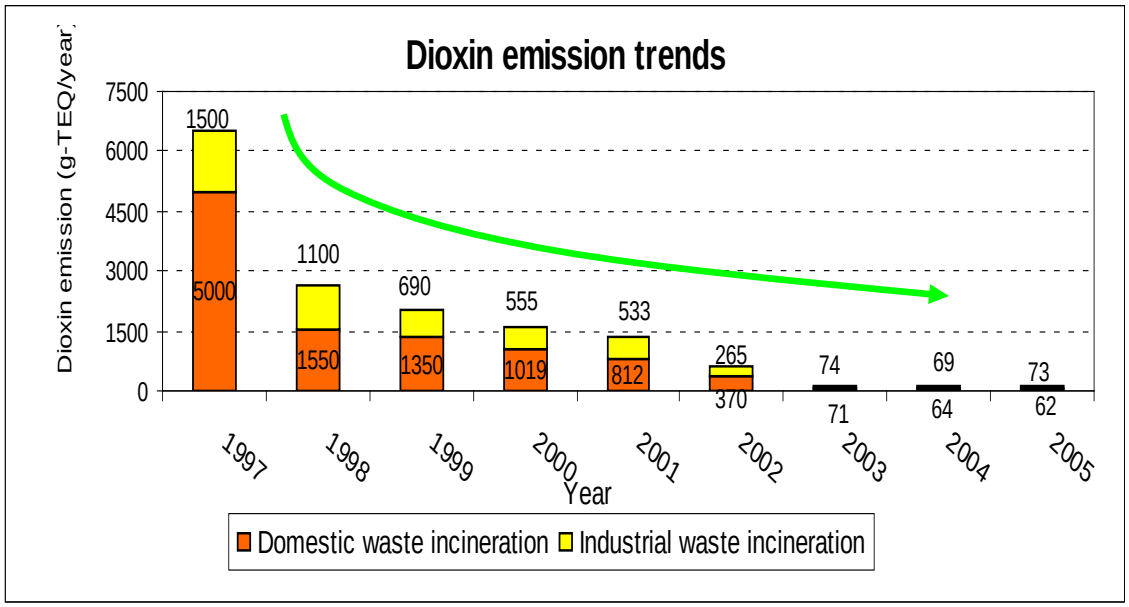
(Source: Hanaki, 2004)

Figure 3. Comparison of MSW Generation Rates and per capital GDP in Asia
Source: World Bank 1999

Incinerators Types and Dioxin emissions



Types of Incineration facilities changed.

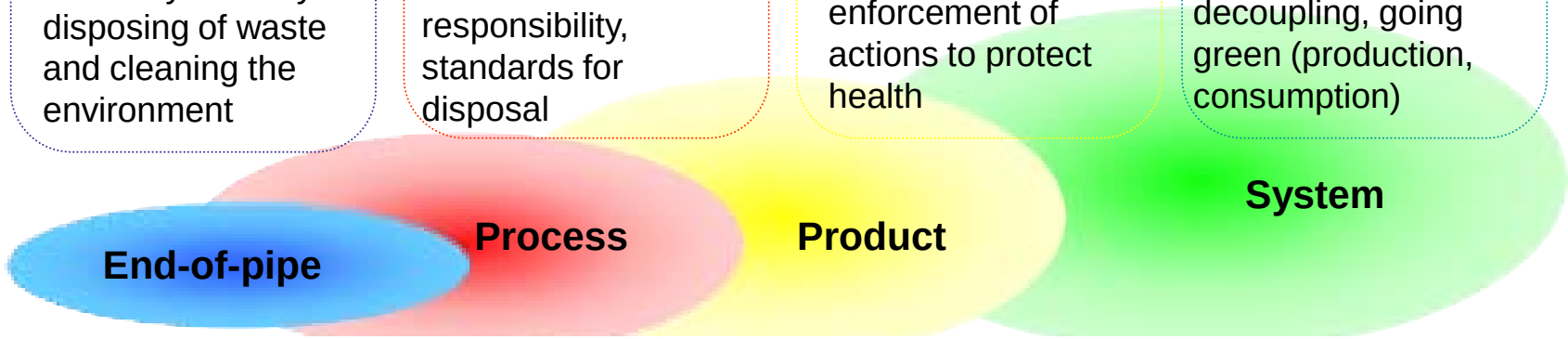


Dioxin emission has reduced drastically.

Data source: Ministry of Environment of Japan http://www.env.go.jp/doc/toukei/contents/index.html

Evolution of Environmental Policies in Japan

	End of WWII to mid 1950's	Mid 50's to late 70's	Early 80's to mid 90's	mid 90's to -
Problems/ drivers	Public sanitation due to urban migration	Increase of both domestic and industrial wastes	Lifestyle change (from uniform to diverse demand): increase in waste variety	Challenge of security and resilience, QOL, global issues (climate change, trans-boundary movements)
Policy response	**The Public Cleansing Law (1954)**	**Waste Management and Public Cleansing Law (1970)**	**Waste Management Law revision (1991-1997)**	**Fundamental law for establishing a sound material-cycling society (2000)**
Features	***"reactive"*** improving public health by sanitary disposing of waste and cleaning the environment	***"receptive"*** Waste classification, business responsibility, standards for disposal	***"constructive"*** Promotion of recycling (EOL products), enforcement of actions to protect health	***"Proactive"*** Promote sustainable lifestyle, improve QOL, decoupling, going green (production, consumption)



Yabar, H., Hara, K., Uwasu, M., Yamaguchi, Y., Zhang, H., and Morioka, T. (2009) Integrated Resource Management towards a Sustainable Asia: Policy and Strategy Evolution in Japan and China, *International Journal of Environmental Technology and Management,* Vol.11 (4) pp239 - 256,

Framework of the Implementation Plan
Sound Material-cycle Society (SMS)

The Basic Environment Law

The Basic Environment Plan

Fundamental Law for Establishing a Sound Material-Cycle Society

Fundamental Plan for Establishing a Sound Material-Cycle Society

Proper disposal of waste

Promotion of recycling

Waste Disposal and Public Cleansing Law

Law for the Promotion of Effective Utilities of Resources

Laws for promoting specific waste recycling

Law for the Promotion of Sorted Collection and Recycling **Containers and Packaging**

Law for the Recycling of Specified Kinds of **Home Appliances**

Construction Material Recycling Law

Law for Promotion of Recycling and Related Activities for Treatment of Cyclical **Food Resources**

Law for the Recycling of **End-of-Life Vehicles**

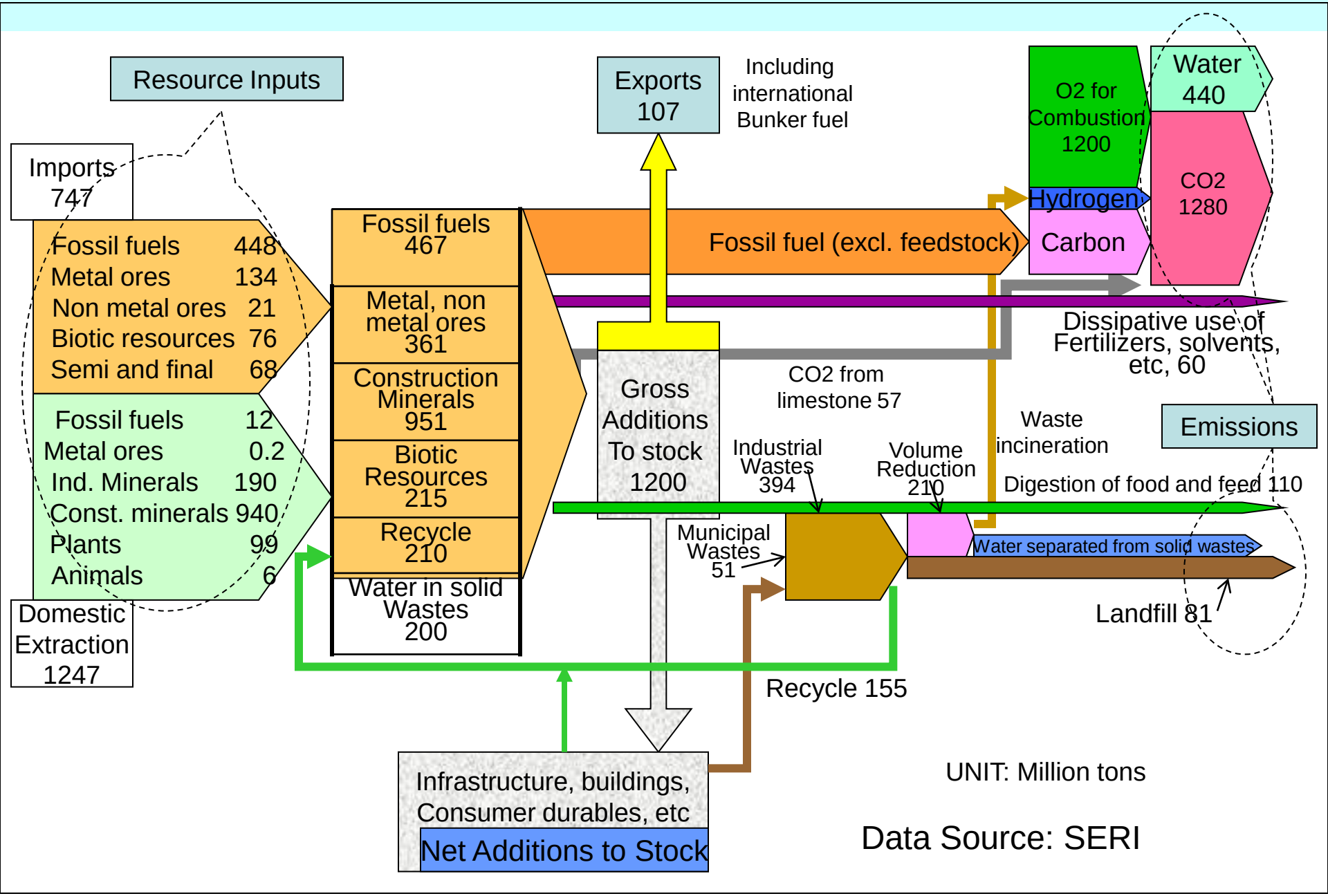
Local action plan

- Plan for Establishing Environmentally Sound Material-Cycle Society in local governments
- Promoting Eco-town Project

Local council

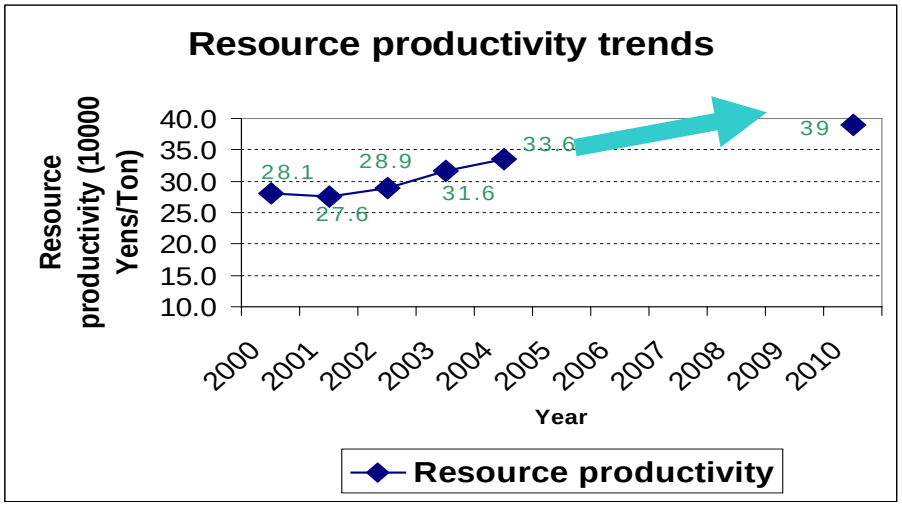
Establishing Council on Promoting Zero-waste City in Tokyo Metropolitan Area and Kyoto-Osaka-Kobe Area

Overview of Material flow in Japan

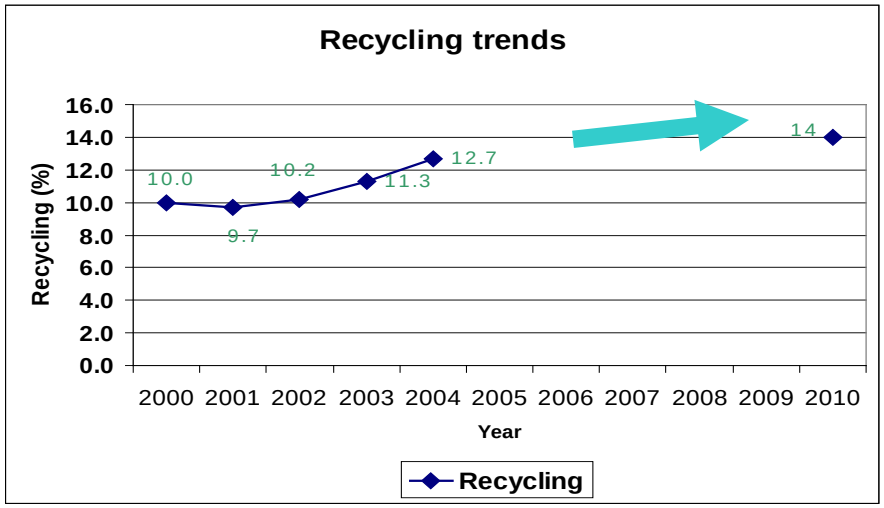


Macro Indicators to Measure the Material-cycle Society

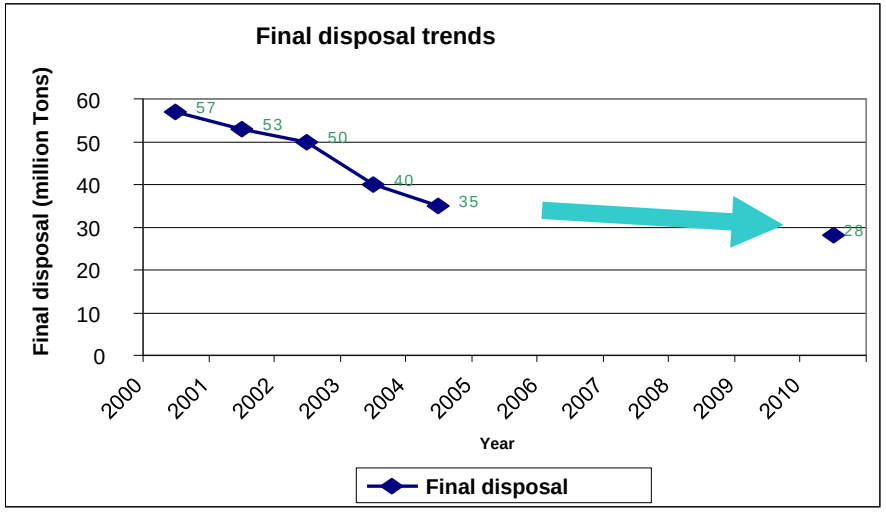
(A): Resource Productivity = GDP (Service) / DMI



(B): Recycling Rate



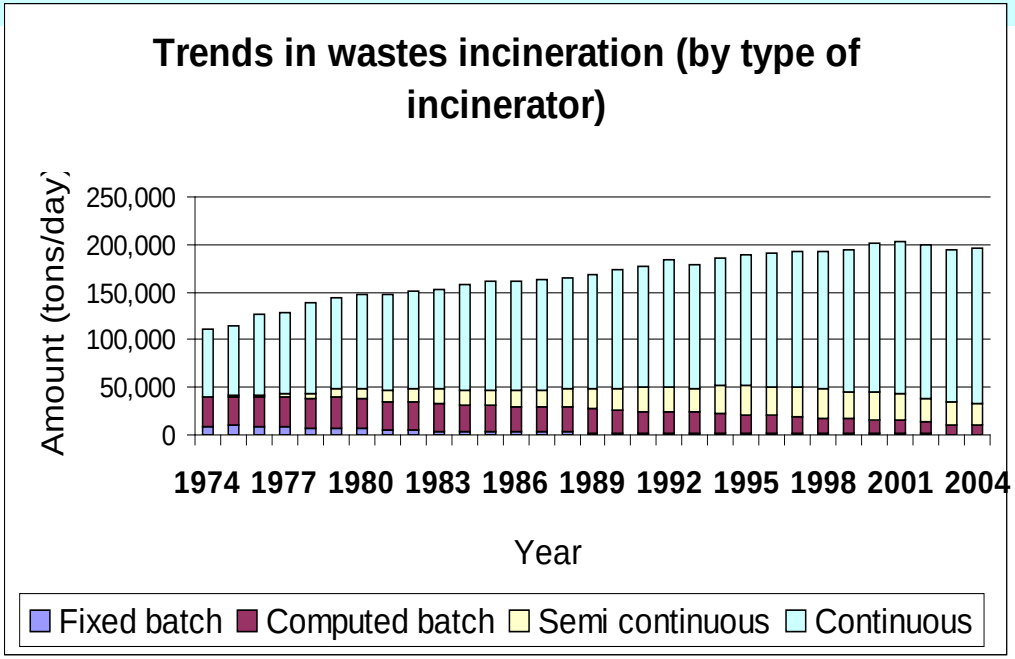
(C): Final Disposal Amount



Fundamental Law for Establishing a Sound Material-Cycle Society was revised in 2008, "**biomass utilization rate**" was included as a monitoring indicator.

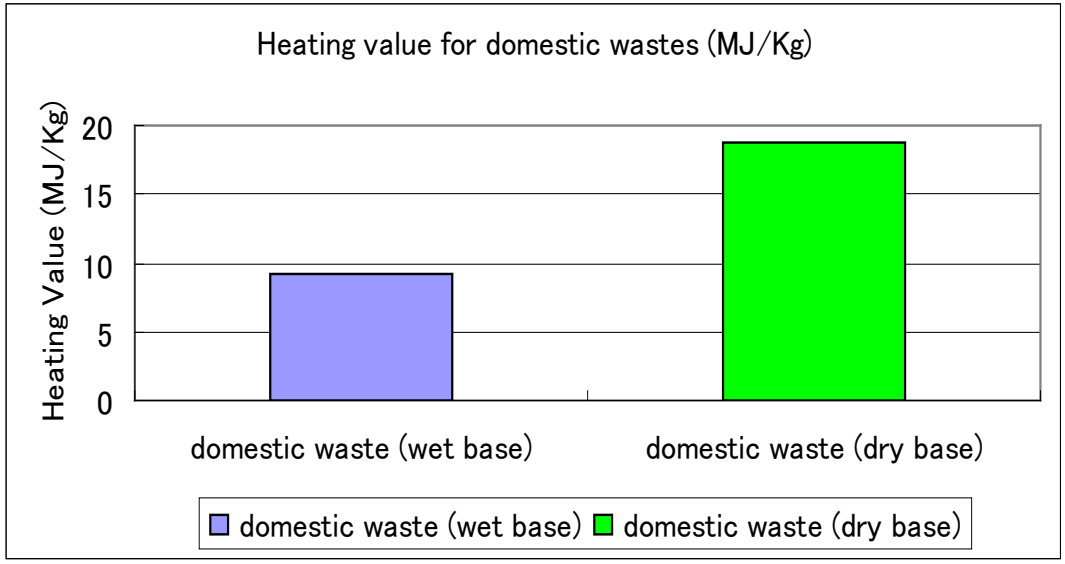
Data source: Ministry of Environment of Japan http://www.env.go.jp/doc/toukei/contents/index.html

Basic guidelines to transform wastes into energy resources



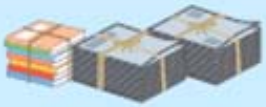
Until now, wastes have been basically incinerated, and the society as a whole has not taken advantage of the associated recovery potential (energy, industrial use, etc).

It is important to change current patterns in waste treatment to obtain the maximum benefits (environmental, economical and social) of wastes



Data source: Ministry of Environment of Japan http://www.env.go.jp/doc/toukei/contents/index.html

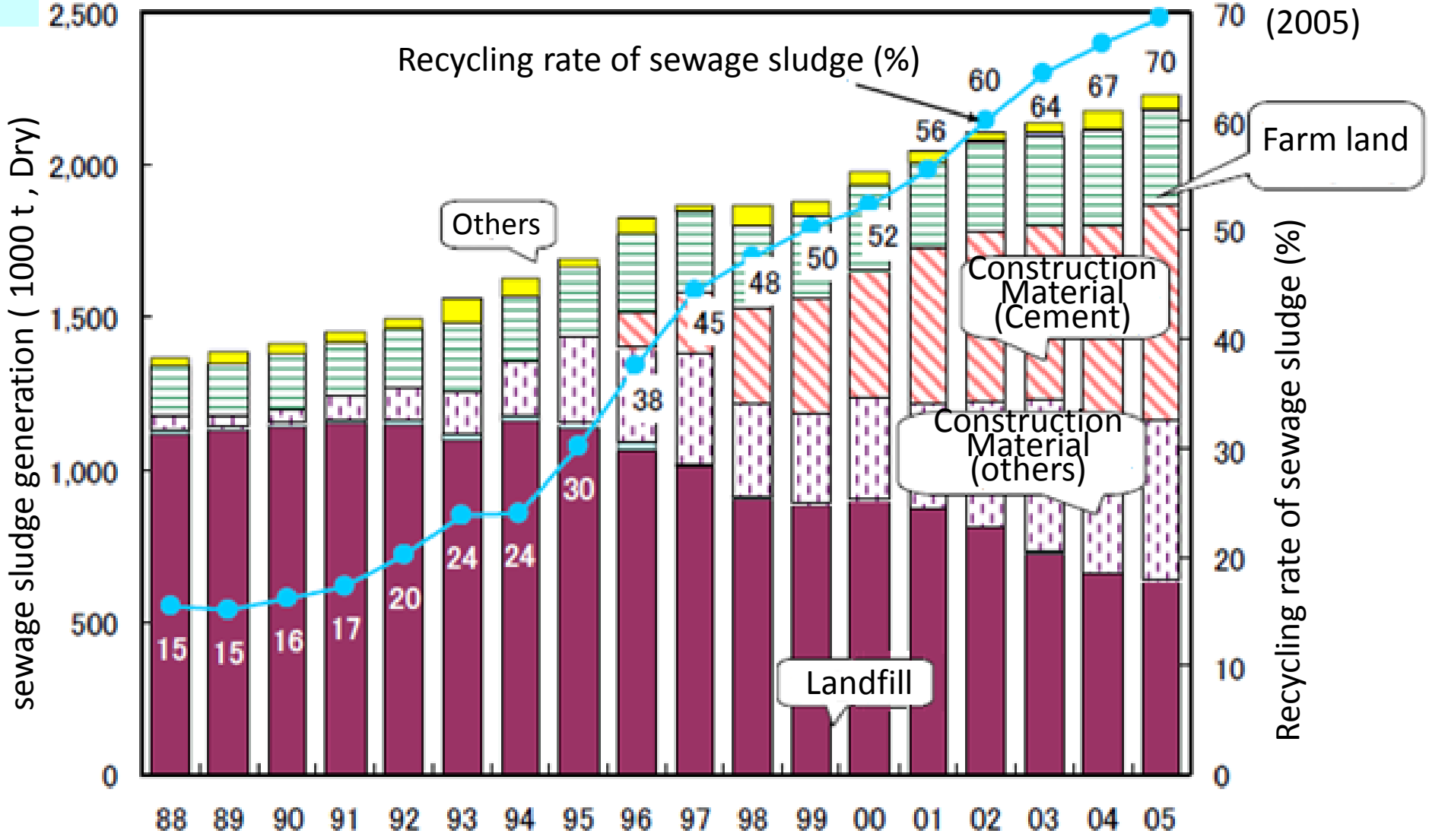
Generation and Utilization of biomass in Japan, 2005

biomass	annual output	state of utilization
animal manure 家畜排せつ物 	x 10^4 ton 約8,900万トン	non-use 約10% / use 約90%
food waste 食品廃棄物 	約2,200万トン	未利用 80%
waste paper 廃棄紙 	約1,400万トン	
Black liquor パルプ廃液 (乾燥重量) 	約1,400万トン	
sawmill residuals 製材工場等残材 	約 500万トン	約10% / 約90%
wooden construction waste 建設発生木材 	約 460万トン	約60%
forestland residuals 林地残材 	約 370万トン	
sewage sludge 下水汚泥 (濃縮汚泥ベース) 	約7,500万トン	約64% / 約36%
non-eatable organics 農作物非食用部 (稲わら、もみがら等) 	約1,200万トン	約30% / 約70%

Source: MAFF

Utilization of sewage sludge

2,227,000 DStons (2005)



Utilization of sewage sludge as energy resources covers only 7% of total.

Source: Ministry of Land, Infrastructure and Transport

Backgrounds of sewage sludge management in Tokyo

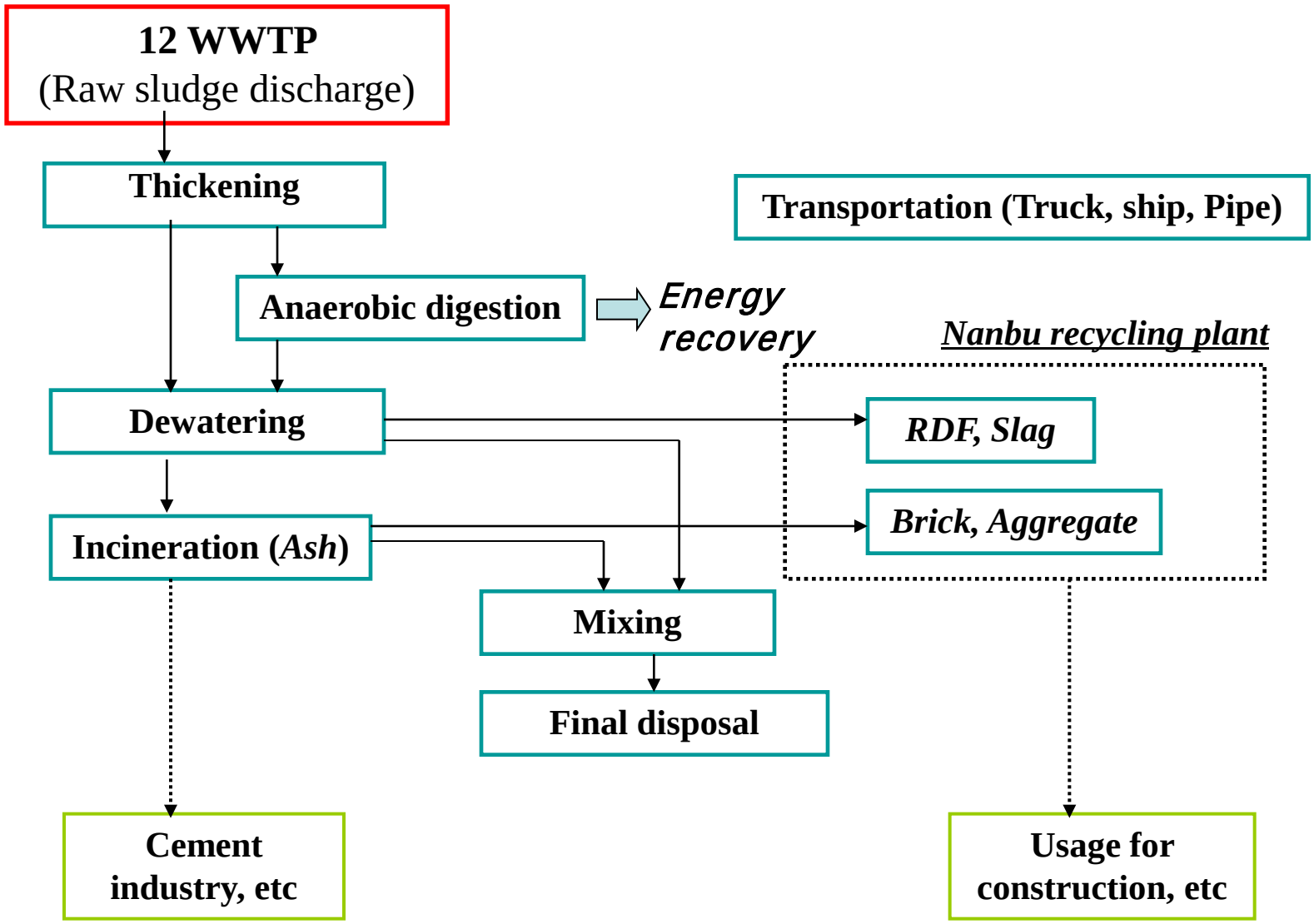
- The volume of raw sewage sludge has been Increasing steadily.
- Tokyo has historically suffered from limited capacity of final disposal site.
- No agricultural use, composting use

Sewage management system has been designed to reduce the sludge volume eventually disposed in final disposal sites

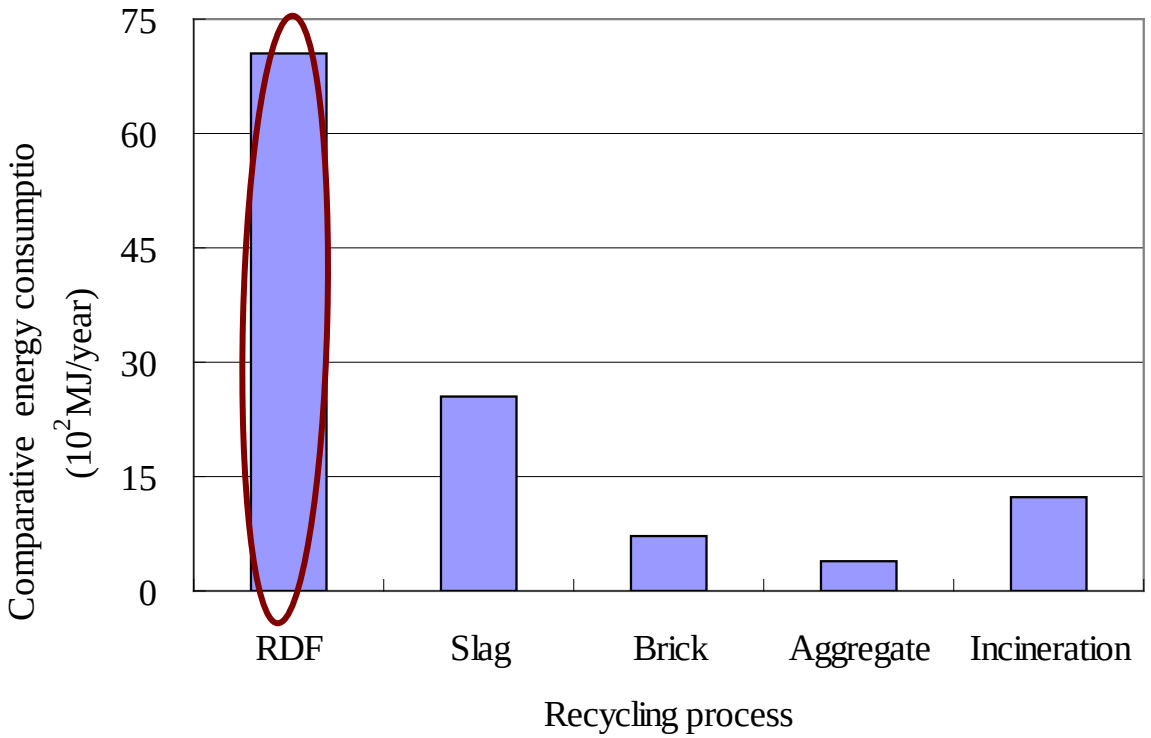
For reducing the amount of final disposal

- Incineration has been facilitated.
- Sludge recycling (Brick, Aggregate, Slag, RDF) has been tested.
- Utilization of ash in cement industry as raw material for cement (after 1997)

Summarized sludge management system in the Tokyo 23 Wards area

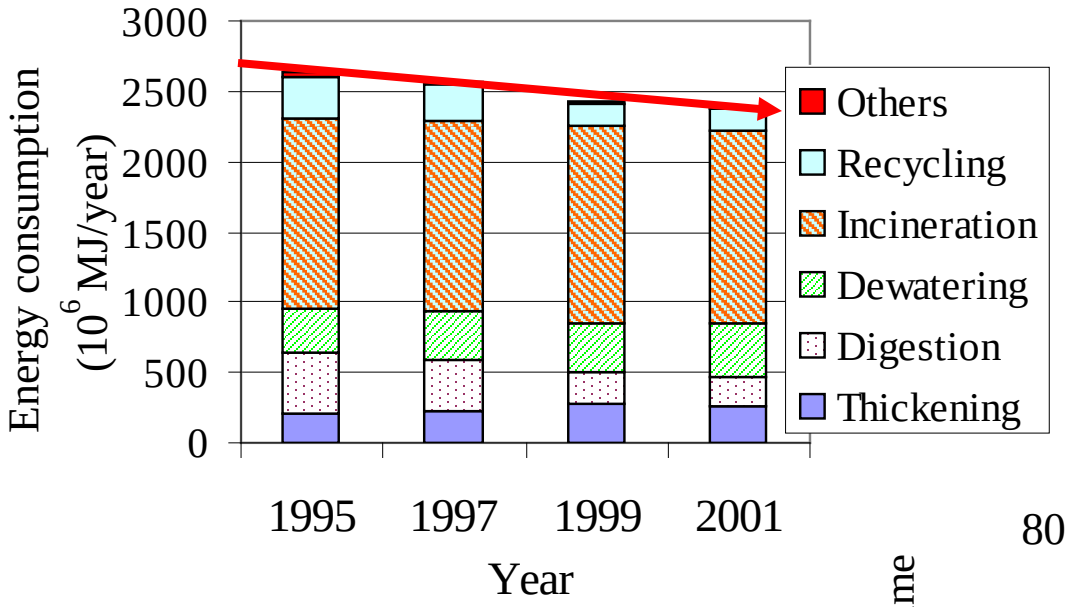


Comparative energy consumption in each recycling process



Hara, K and Mino, T. (2008). Environmental Assessment of Sewage Sludge Recycling Options and Treatment Processes in Tokyo, Waste Management, Vol 28 (12), pp. 2645-2652

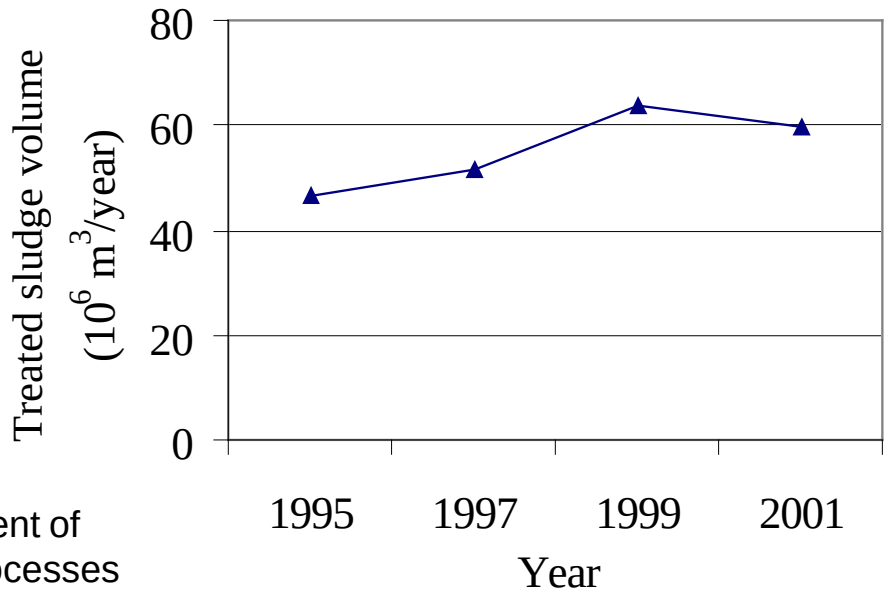
Energy consumption



Total energy consumption shows a tendency to decrease.

Note: ”Others” is the sum of mixing, transportation and final disposal process.

Raw sludge volume has been increasing.



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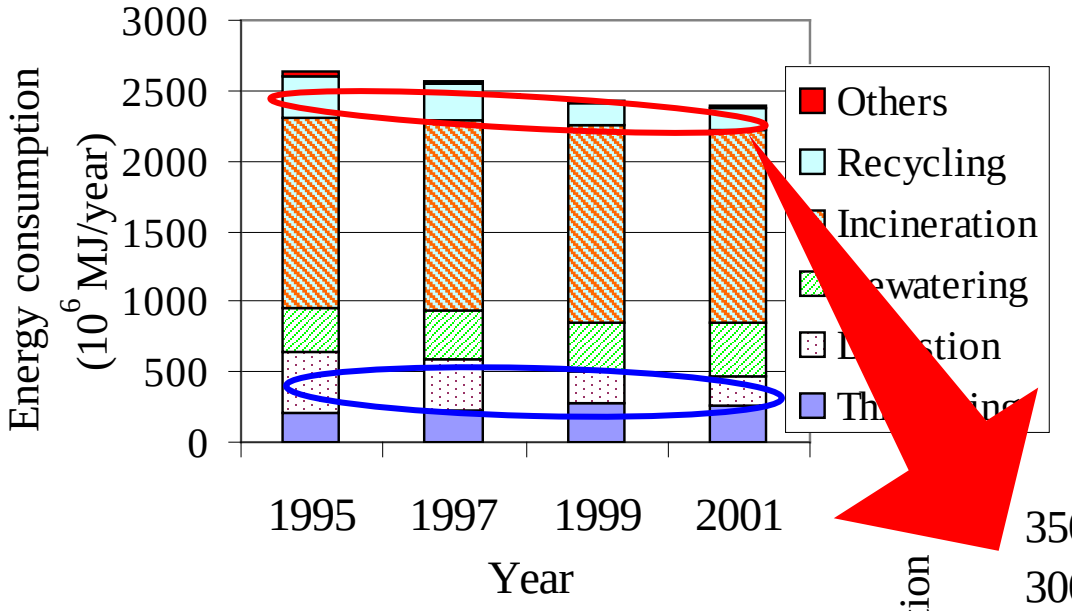
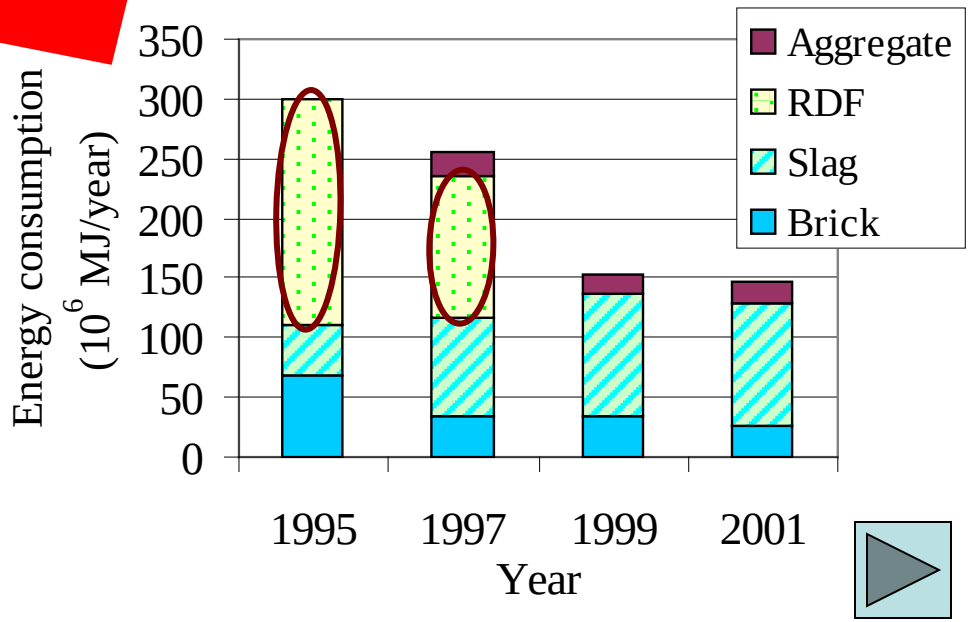
Energy consumption in recycling process

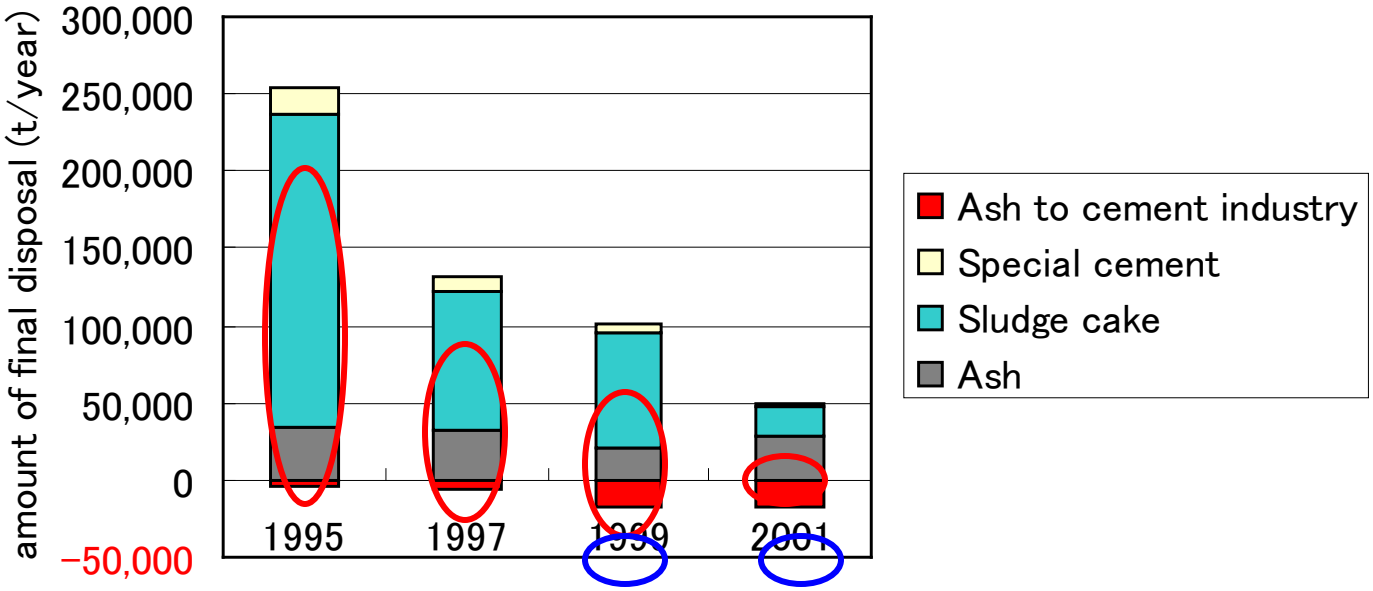


This reduction can be mainly explained by reduction in recycling and digestion process.



RDF process which constituted the largest part in 1995 and 1997, was scrapped after 1997.

Amount of final disposal



Due to the increase of incineration ratio, the amount of final disposal decreased significantly.

Utilization of ash in cement industry started after 1997.

New perspective in sewage sludge management in Tokyo (Japan)

- Shift to energy efficient material use, such as cement production.
- Re-evaluation of sewage as an energy source (i.e. methane production), in the era of global warming.
- Integrated management with other wastes such as household wastes

Some remarks

- Utilization of biomass in urban and rural areas is an essential policy direction to develop a sustainable society (with sound-materials cycle society and low-carbon society, combined.)

- Institutional design for integrated approaches is indispensable in promoting biomass utilization.