

The Workshop on
“Improvement of solid waste
management and reduction of
GHG emissions in Asia
(SWGGA)”

An Introduction

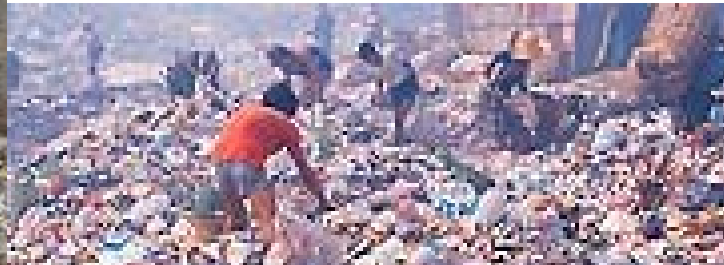
Masato Yamada, NIES

Organization

- Organized by National Institute for Environmental Studies (NIES), Japan
- Participants of 1st Workshop (other than Japanese)
 - Prof. Lee, Dong-Hoon (Korea)
 - Dr. Wang Qi (China)
 - Dr. Quan Hao (China)
 - Dr. Shirintornthep Towpryoorn (Thailand)
 - Ms. Upik S Aslia Kamil (Indonesia)
 - Ms. Bulgamaa Densambu (Mongolia)
 - Prof. Cao Thew Ha (Vietnam)

Open Dumping

- Fire
- Pest
- Odor
- Leachate
- Landslide...



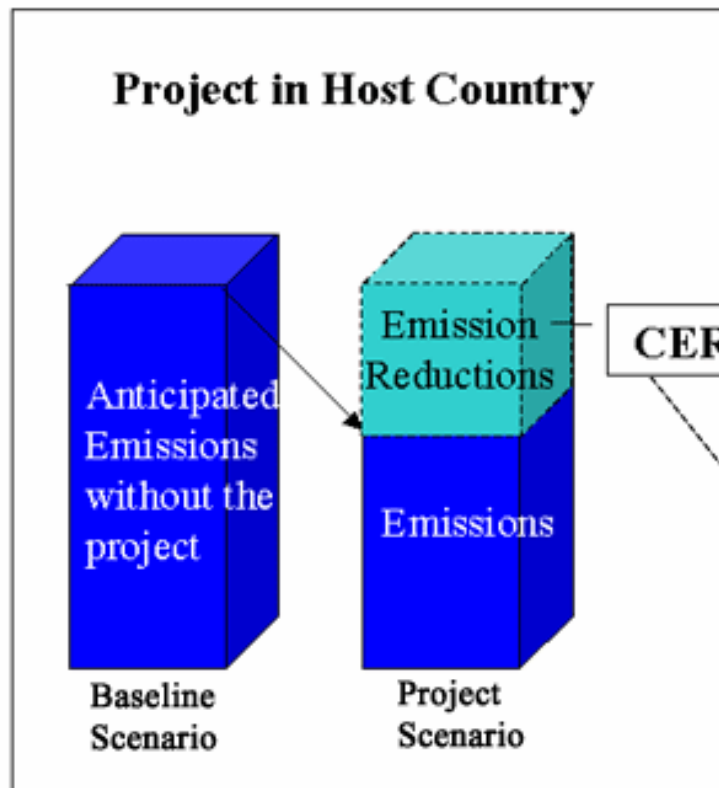
Departure from open dumping is the first step for improvement.

CDM

A new investment for environmental protection.

Host Country (Developing Country)

Total Units are not fixed

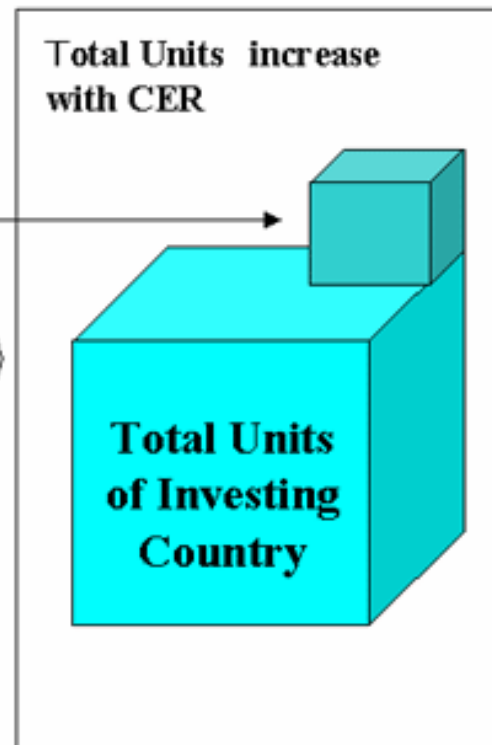


Investing Country (Developed Country)

Total Units are fixed

Transfer
(to participants of
Investing Country)

Total Units increase
with CER



※ We regard a country, in the place a project has been implemented, as a Host Country.

※ We regard a project participant as an Investing Country.

LFG Recovery

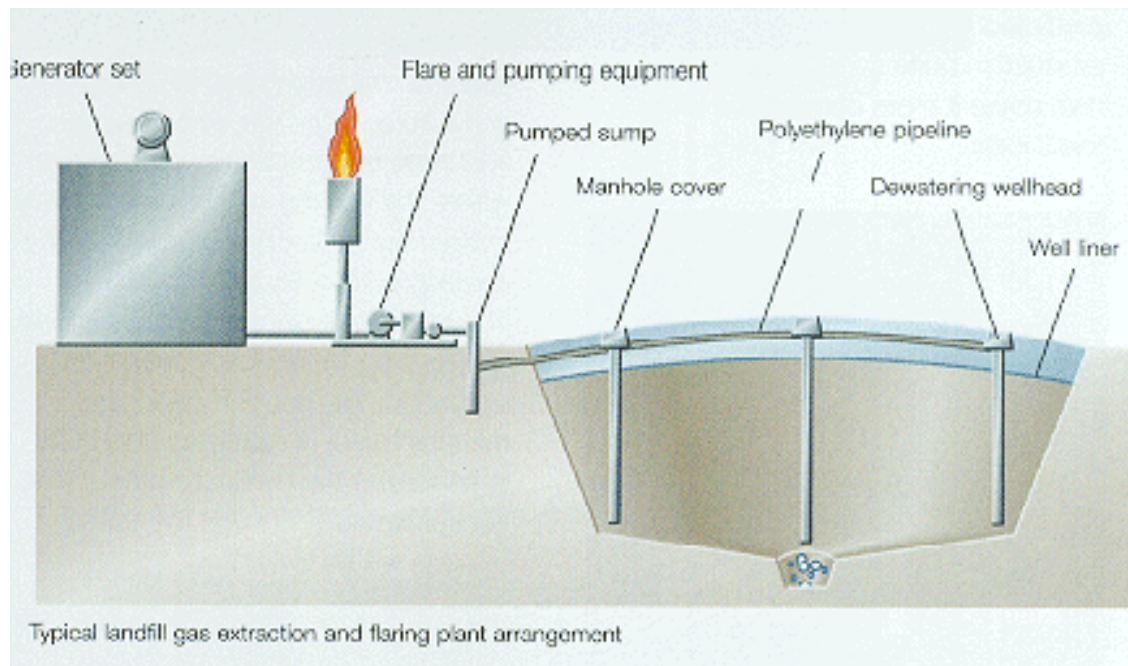
A major methodology for CDM.

Application from 1970's in western countries

LFG Recovery in 1996 (MW)

World	1385	North America	730	Mideast	0
Western Europe	573	Pacific	30	Asia	30
Eastern Europe	0	Mediterranean	0	South America	20
former USSR	0	Africa	2		

(ref.EU)



Example of
LFG Utilization
System

First Order Decay Model in 2006

IPCC guideline

$$\text{CH}_4 \text{ emitted in year } T = (\sum_x \text{CH}_4 \text{ generated}_{x,T} - R_T) \cdot (1 - OX_T)$$

LFG recovery

in situ
CH₄ oxidation

$$\text{CH}_4 \text{ generated}_T = \text{DDOC}_{\text{mdecomp},T} \cdot F \cdot 16/12$$

$$\text{DDOC}_{\text{mdecomp},T} = \text{DDOC}_{\text{ma } T-1} \cdot (1 - e^{-k})$$

$$\text{DDOC}_{\text{ma } T} = \text{DDOC}_{\text{md } T} + (\text{DDOC}_{\text{ma } T-1} \cdot e^{-k})$$

$$\text{DDOC}_{\text{md}} = W \cdot \text{DOC} \cdot \text{DOC}_f \cdot \text{MCF}$$

DOC reduction along waste stream

Aerobication of landfill

There are several points of introducing technology for reduction (not only LFG recovery).

Co-benefit in Waste Management

Future economic development will change the level of applicable technologies.

Final Disposal Technology

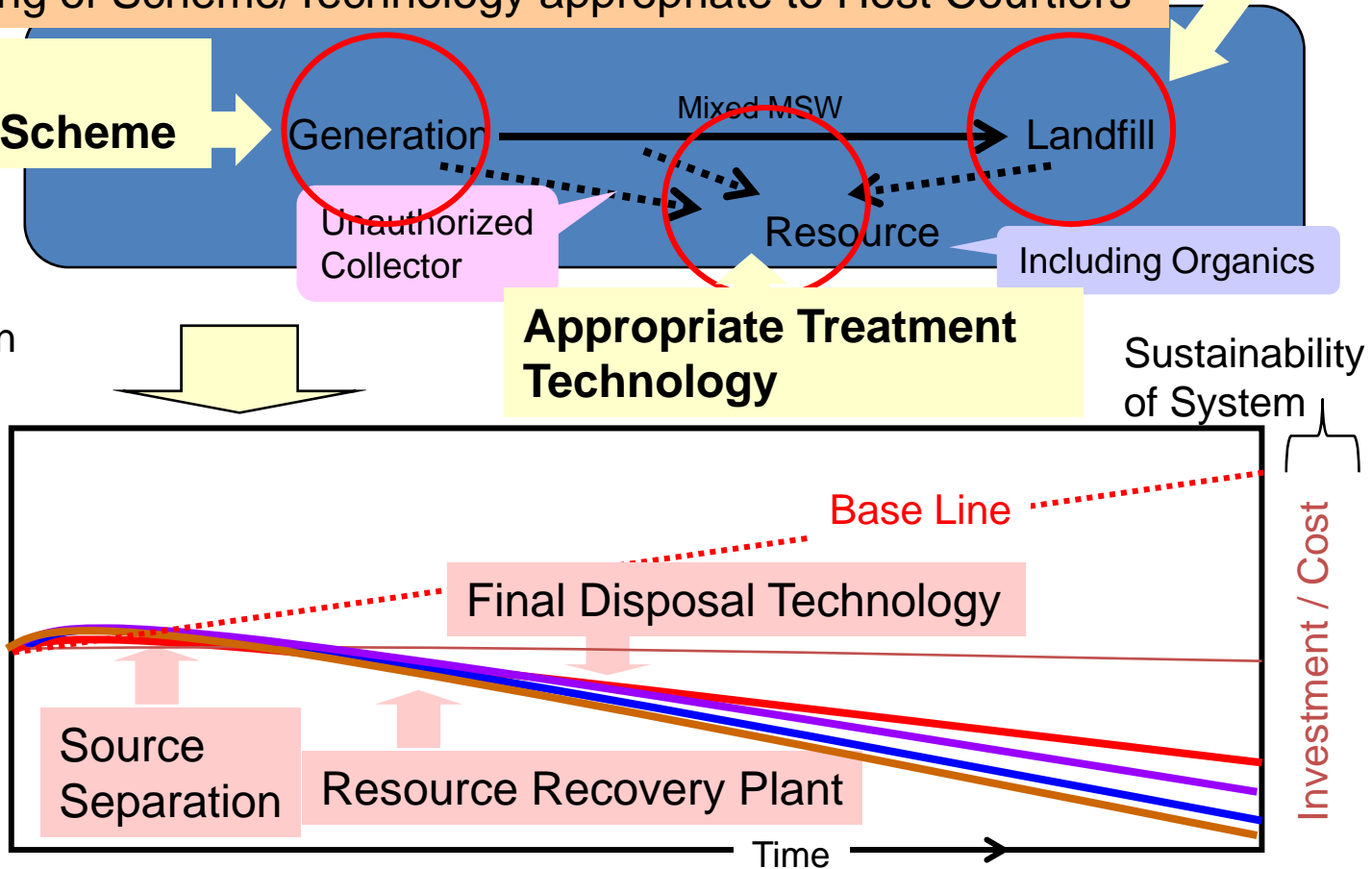
Stepwise Introducing of Scheme/Technology appropriate to Host Countries

Resource Recovery Scheme

Real and substantial merit for developing countries are;

Win-Win Situation

Disposal Mass
Disposal Hazardous Materials
Load to water and air
GHGs Emission



Sustainability of System

Development of New Procedure on Reduction of GHGs Emission by Improvement of Waste Stream Management, not only by Introducing New on site Plants.

Effective Investment and self sustained management

Topics

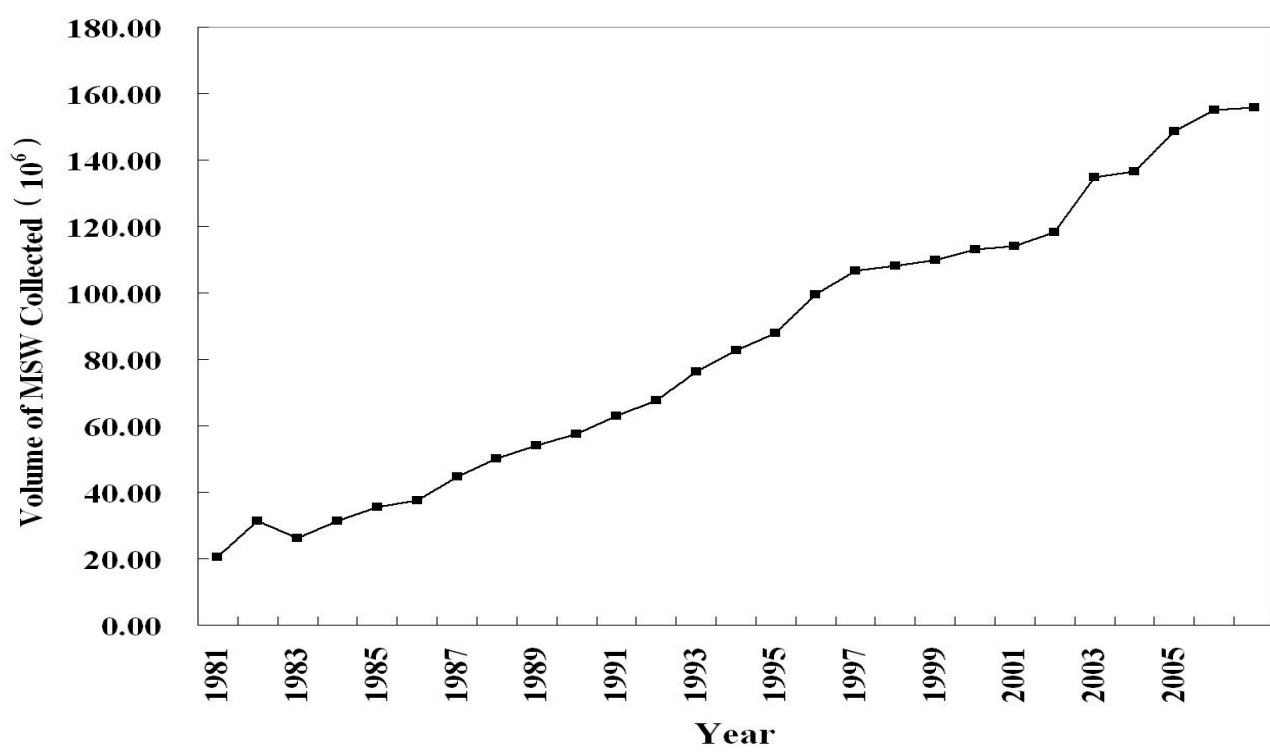
1. Is the **2006 IPCC Guidelines** applicable for the estimation of the landfill methane emissions from regional projects in Asia?
2. *What are **appropriate technologies** for waste management and GHG reduction in Asia?*
3. *How to estimate **sustainability** of waste management in Asia?*



The 1st workshop was held on 18th, January 2007 at Yokohama.

Finding at the 1st Workshop

- Overall, waste is increasing in many Asian countries.



MSW Generation in Chinese City

Finding at the 1st Workshop

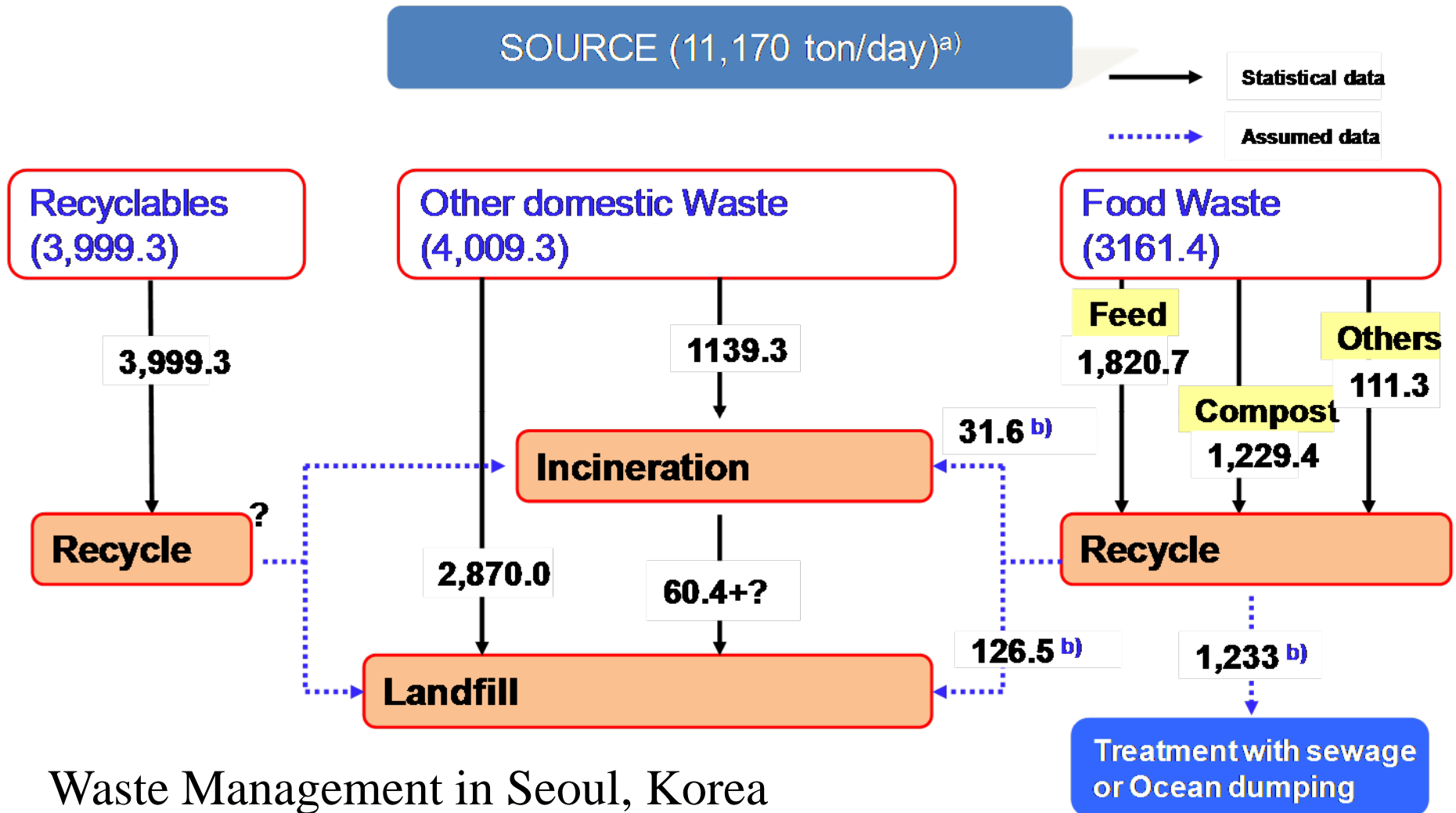
- Big cities vs. Other areas
 - Generation, composition, management of waste

Area	Population	Waste generation (tons/day)	Waste generation rate (kg/cap/day)
1 Bangkok	5,844,607	9,350	1.6
2 City and Pattaya	12,203,425	14,661	1.2
21 Central- Western region	3,585,595	4,650	1.3
22 Northern region	2,264,406	2,825	1.25
23 North-east region	3,239,281	3,134	0.97
24 Eastern region	1,246,151	1,901	1.53
24 Southern region	1,867,992	2,151	1.15
3 Outside City	44,871,653	17,930	0.4
	63,655,458	41,941	0.66

Waste
Generation
in Thailand

Finding at the 1st Workshop

- Different status of waste management



Waste Management in Seoul, Korea

Finding at the 1st Workshop

- Open dumping and improper landfills

Зураг 18. Хог хаягдал.



Зураг 23. Дархан сумын "Хойд хог"-ийн цэг дээр махан овоо босжээ.



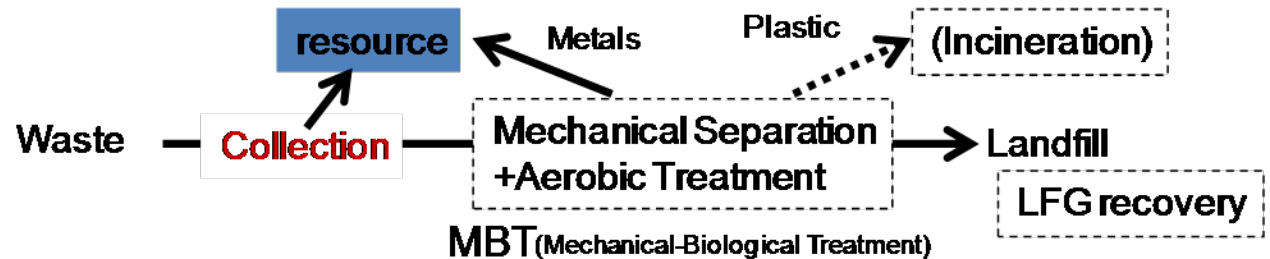
Gambar 2 & 3: Sampah yang menggunung tanpa diolah, tanpa dilengkapi pengelolaan gas metan dan leachet akan mencemari lingkungan. (Dok: TB L. Sony & BS/KLH, 2006).



Finding at the 1st Workshop

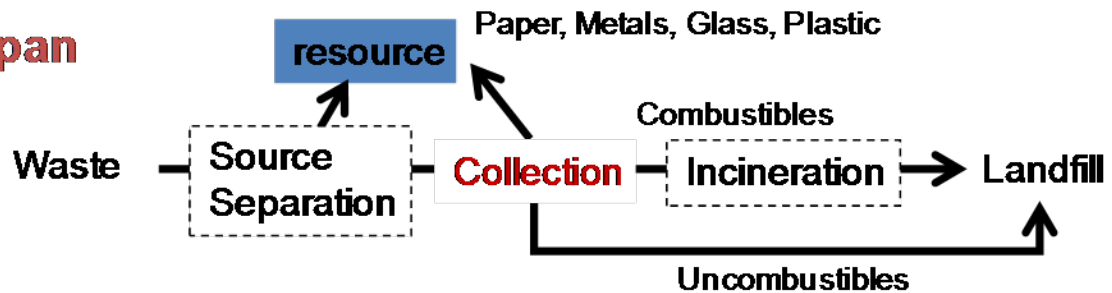
- Waste pickers or recyclers as part of waste stream

Western Countries



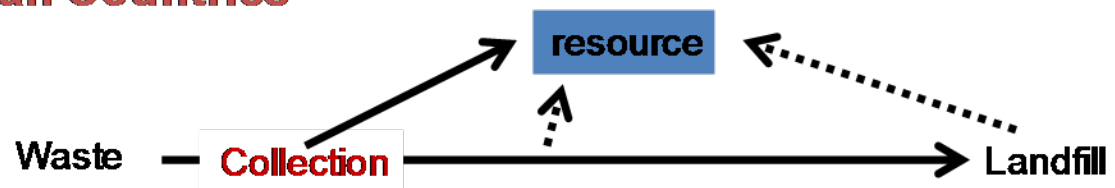
“Mechanical Separation” should be applicable to waste with low water content.

Japan



“Incineration” has been selected due to sanitation of waste with high water content.

Asian Countries



“resource” includes organic materials with high water contents for composting.

Structures of
Municipal Solid
Waste Stream

Finding at the 1st Workshop

- Statistics on waste stream (generation, composition and treatment/disposal/recovery) should be fundamental.

However,

- There are no common or comparable format for **waste statistics in Asia.**

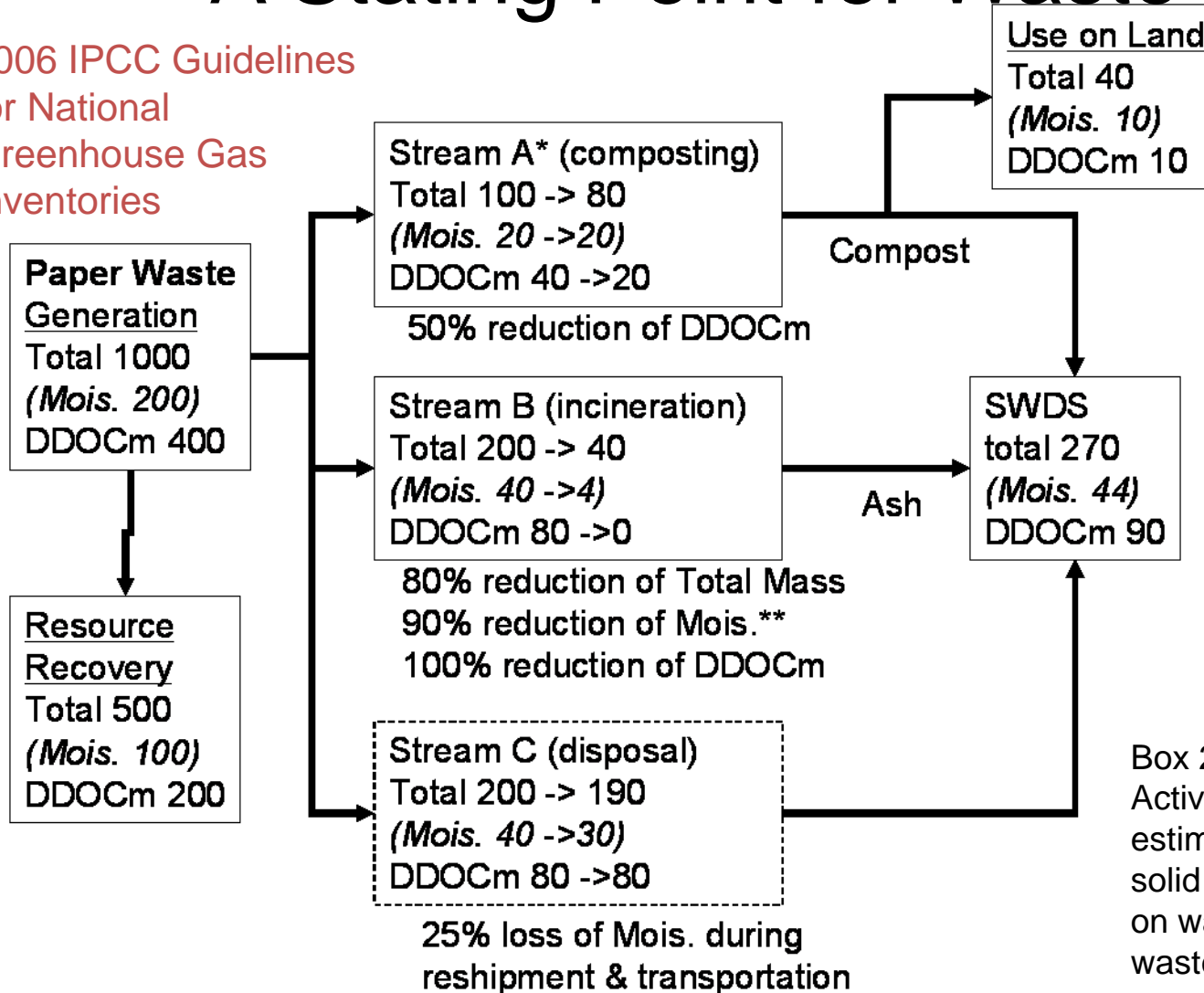
Construction of Asian waste statistics will be one of our major topic throughout this workshop.

Data on Solid Waste Management

- Waste Generation (weight/generator/time)
- Waste Composition (percentage of garbage, paper, plastics, metals...)
- Physicochemical Property (ex. water content/ Ignition loss/ ash content, calorific value, content of carbon/ nitrogen/ sulfur/ chlorine/ heavy metals/ dioxins...)
- **Waste Stream** (rate of collection, resource recovery, land disposal, incineration...)
- Cost/ Revenue

Waste and Substance Flow in Stream - A Starting Point for Waste Study-

2006 IPCC Guidelines
for National
Greenhouse Gas
Inventories



* Compost can be produced not only by paper but also by other organic component of waste such as food, sludge and wood. In this figure, however, changes of mass attributed to paper waste is considered solely.

** Incineration itself can reduce most of moisture. However ash will be re-wetting due to avoid the fly loss during transportation and loading on SWDS.

Box 2.1: An example of Activity data collection for estimation of emissions from solid waste treatment based on waste stream analysis by waste type

Values in each box explain weight of total mass and compositions of waste as ton, kg or so on.

Waste Generation (Rate)

- source and property of data?-

- **Method for Estimation:** Weighing every truck on a scale/ Sampling, Number of truck, or Revenue from fee...X Population, Economic Drivers or Trends...
- **Unit of Mass:** Weight or Volume (X Density)
- **Basis of Measurement:** Wet (flesh) or Dry (after pretreatment)
- **Time of Estimation:** Annual, Some years interval or Some case studies...

Waste Composition

- common categories?-

2006 IPCC Guidelines for National Greenhouse Gas Inventories

- food waste
- garden (yard) and park waste
- paper and cardboard
- wood
- textiles
- nappies (disposable diapers)
- rubber and leather
- plastics
- metal
- glass (and pottery and china)
- other (e.g., ash, dirt, dust, soil, electronic waste)

Excluding bone/
shell?

Including leave and
straw for packaging?

Including bamboo?

These should be
divided for recycling
management?

Excluding synthetic fabric?

Natural or synthetic?

Soft or hard? Usage?

Iron/ Copper/ Alminium...?

Ash is a large part in some countries.

Physicochemical Property - quality of data?-

- Method of sampling (representativeness)
- Method of pretreatment (drying, grinding, mixing, extracting...)
- Analytical method (common or experimental?)
- Statistical parameters (average, range...)
- Denominator of unit (dry/wet weight, volume, pieces...)
- Purpose of Analysis (for treatment/ disposal/ recycling, assessment of pollution/ risk/ GHG emission/ energy/ resource...)

Other factors

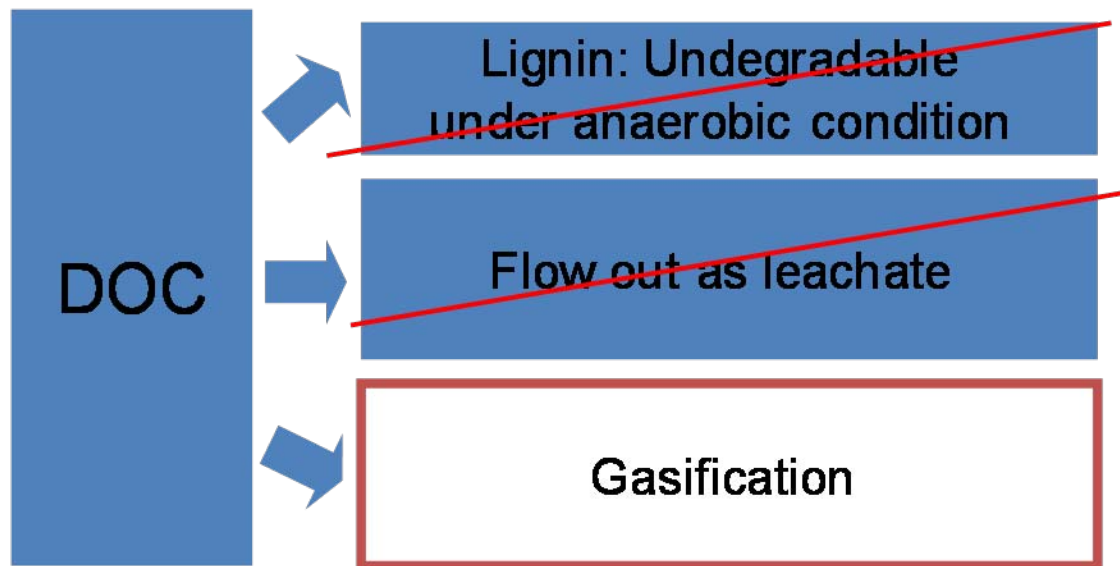
- Background information (nature, economy, industry, culture...)
- Legal/economical framework
- History of waste management
- Description of facilities and sites for waste management (transportation station, treatment plant, landfill...)

Finding at the 1st Workshop

- Applicability of the IPCC Waste Model

DOC_f : Fraction of DOC that can decompose

Leached out DOC is not sure.



Generally the amounts of DOC lost with the leachate are low (less than 1%) and can be neglected in the calculations. (2006 IPCC Guideline)

Is this explanation realistic in Asian Countries?

Co-benefit in Waste Management

Future economic development will change the level of applicable technologies.

Final Disposal Technology

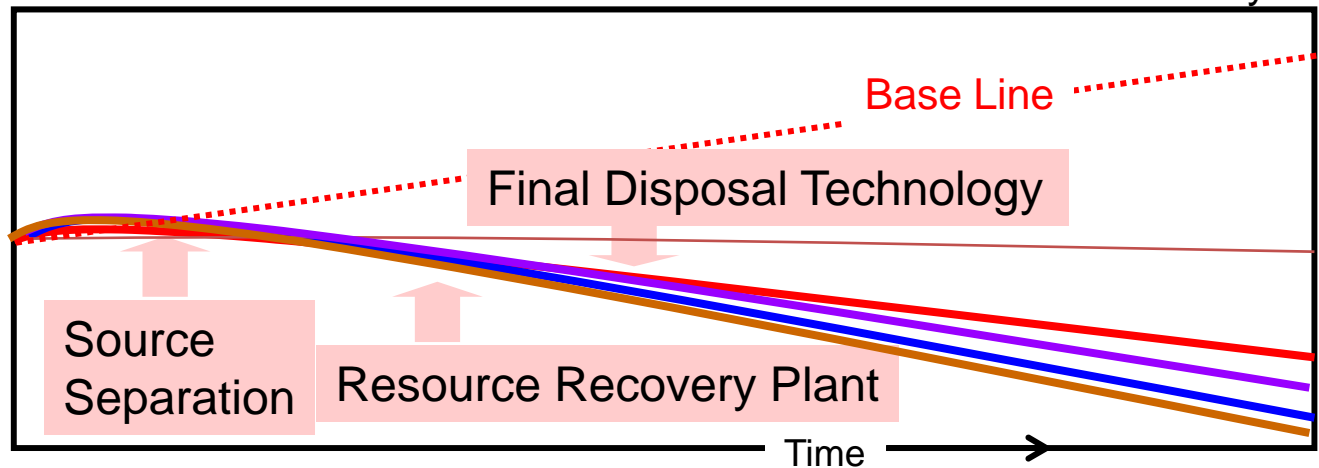
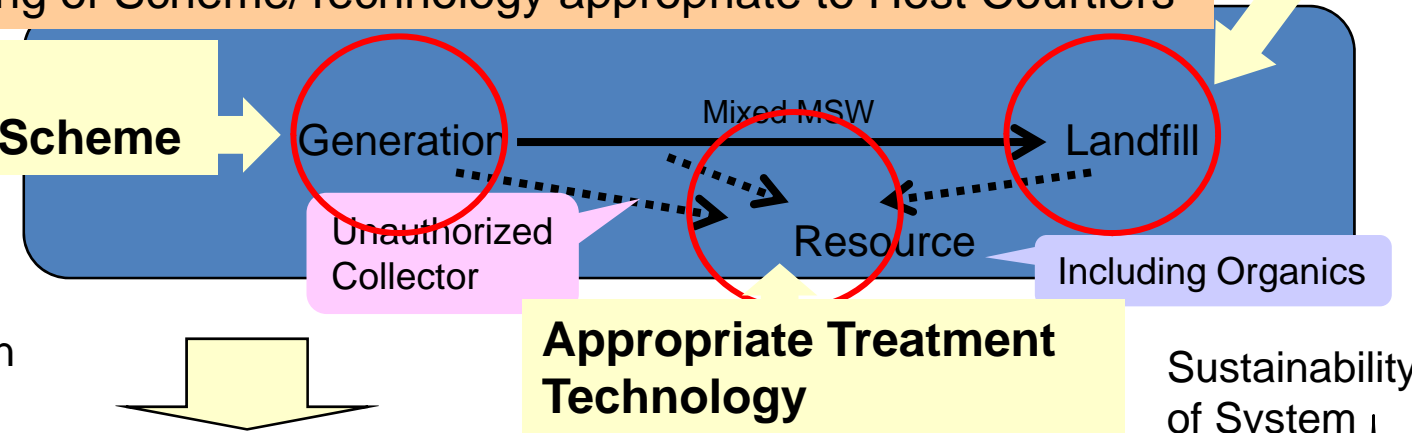
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Development of New Procedure on Reduction of GHGs Emission by Improvement of Waste Stream Management, not only by Introducing New on site Plants.

Effective Investment and self sustained management

The 2nd workshop will be held at
Fukuoka in February 2008.

*What are **appropriate technologies** for waste
management and GHG reduction in Asia?*

**We are welcome participants from
Malaysia!!**

Thank you for your attention.