

Municipal Solid Waste Management in Developing Asian countries -1

Janya Sang-Arun, PhD
Sustainable Consumption and Production Group
Institute for Global Environmental Strategies

1

Toyo University, 4 July 2013

Outline of the subject (2 weeks)

- Overview of municipal solid waste management in developing Asian countries
- 3R (reduce, reuse, recycle) in developing Asian Countries
- Solid waste management and climate change
- International cooperation

2

Toyo University, 4 July 2013

Overview of municipal solid waste management in developing Asian countries

Toyo University, 4 July 2013

3

Municipal solid waste (MSW)

- In general, municipal solid waste refers to trash or garbage that generated in municipal or urban area
- Sometimes, it called 'household solid waste'
- Generally, generators of municipal solid waste are residents, visitors, small business, small offices, small restaurants, small hotels, etc.
- Some countries included wastes generated from residential, commercial, industrial, institutional, construction, demolition, process, and municipal services as municipal solid waste. Some countries, however, counted only residential and small commercial and institutional waste as municipal solid waste.
- Therefore, the inclusion of generation point sources of municipal solid waste is different among countries.

4

Toyo University, 4 July 2013

Definitions of municipal solid waste (1)

- **Japan**

Based on the Waste Management and Public Cleansing Law (amendment in 2001), waste in Japan is divided into two categories:

- Municipal solid waste (MSW) refers to waste other than industrial waste.
- Industrial waste refers to waste left as a result of business activity and imported waste (carried-in waste) including ashes, sludge, waste oil, waste acid, waste alkali, waste plastics and others specified by a Cabinet Order

5

Toyo University, 4 July 2013

Definitions of municipal solid waste (2)

- Thailand (Pollution control Department, 2004)
 - Municipal solid waste is solid waste that generated by activities in municipality. It includes waste from market, residential area, commercials, businesses, institutions, service enterprises and construction sites.
 - However, it does not include hazardous and infectious waste.

6

Toyo University, 4 July 2013

Definitions of municipal solid waste (3)

- The Philippines (RA9003 Act, 2000)

Municipal waste shall refer to wastes produced from activities within local government units which include a combination of domestic, commercial, institutional and industrial wastes and street litters

7

Toyo University, 4 July 2013

Definitions of municipal solid waste (4)

- China (Lin et al, 2007)
 - Municipal waste usually includes residential, institutional, commercial, street cleaning, and non-process waste from industries. In some cases, construction and demolition waste is also included.

8

Toyo University, 4 July 2013

Composition of municipal solid waste (1)

- In general, composition of municipal solid waste is classified as follows:
 - Food waste
 - Paper
 - Plastic
 - Metal
 - Glass
 - Wood and garden waste
 - Others

9

Toyo University, 4 July 2013

Composition of municipal solid waste (2)

- In developing countries, municipal solid waste is often categorised as follows:
 - Biodegradable or wet waste: food, paper, wood and garden waste
 - Non-biodegradable or dry waste: plastic, metal, glass, ceramics, etc.
- The above classification is different from the Japanese system which mainly categorised as combustible and non-combustible. The different in common classification is due to the different in treatment technologies: while as land disposal that relied on biological degradation process is common in developing countries, incineration is common in Japan.

10

Toyo University, 4 July 2013

Composition of municipal solid waste (3)

- Often, municipal solid waste in developing countries consist of the following wastes:
 - Infectious waste: wastes from hospital and clinic that may contaminate with pathogen. This waste should not be disposed together with municipal solid waste and it should be saved disposal by incineration.
 - Hazardous waste: wastes that contain harmful substances such as battery, lamp and electric appliance. This waste contain heavy metal and some other hazardous substances. Therefore, it should not be disposed together with municipal solid waste.
 - These wastes are often discarded together with municipal solid waste due to lack of budgets and low awareness of related stakeholders (residents, municipality, generators).

11

Toyo University, 4 July 2013

- Food waste



12

Toyo University, 4 July 2013

- Plastics



13

Toyo University, 4 July 2013

- Paper



14

Toyo University, 4 July 2013

- Glass



15

Toyo University, 4 July 2013

- Metals



16

Toyo University, 4 July 2013

- Wood and garden waste



17

Toyo University, 4 July 2013

Waste composition in developing Asia countries

Waste composition	Developing Asia* (%)	Japan** (%)
Food	31-74	34
Plastic	5-17	13
Paper	4-20	33
Metal	0.1-6	3
Glass	0.2-7	5
Others	2-55	13

* Compile from various sources

** OECD, 2002

Toyo University, 4 July 2013

Municipal solid waste generation in developing Asian countries

Country	Solid waste generation (million ton/yr)	Waste generation per urban capita (kg/day)	Waste composition (%)					
			Food	Paper	Plastic	Metal	Glass	Others
China	120	1.15	50	15	10	3	3	19
India	42	0.40	40	5	4	1	2	48
Indonesia	23	0.76	74	10	8	2	2	4
Thailand	15	1.10	64	8	17	2	3	6
Viet Nam	13	0.40	49	2	16	6	7	20
Philippines	11	0.50	33	19	17	5	3	23
Malaysia	9	0.90	49	17	10	2	4	18
Bangladesh	6	0.50	70	4	5	0.1	0.3	20.6
Cambodia	0.5	0.34	66	3	14	1	1	15
Laos	1.2	0.75	60	15			15	10

19

Toyo University, 4 July 2013

Notes:

- Waste composition is changing over time due to seasonal change and change of consumption
- Municipal solid waste in developing Asian countries is increasing due to increasing of consumption (increasing of income) and change of lifestyles.

For instance, waste generation in Thailand increased from 29,540 ton/day in 1994 to 40,332 ton/day in 2007 (PCD, 2007). Waste generation in China was already almost twice that of 1994 (Yamada, 2007).

- Waste separation at source is not systematically practice

20

Toyo University, 4 July 2013

Waste collection service in developing Asian countries

- Municipality or local government unit is responsible for waste collection and disposal.
- Most municipalities and local governments provide collection service by them, but some contract private company to collect the waste.



21

Toyo University, 4 July 2013

Examples of waste collection services in Cambodia and Thailand

Responsibilities	Cambodia	Thailand
Waste collection service	Private company	Local government/ private company
Collection of waste fee	Private company	Local government
Investment in waste disposal facility	Local government/ private company	National/local governments
Waste disposal site management	Local government/ private company	Local government/ private company
Purchasing for waste disposal fee*	Private company	Local government

*Private companies in Cambodia pay disposal fee to the local governments. Private companies in Thailand receive waste disposal fees from the local governments.

22

Toyo University, 4 July 2013

Waste collection and disposal fee (1)

- Some countries subsidise for waste collection and disposal services such as Thailand, India, etc. However, Thailand charge small amount of waste disposal and collection fee from residents which does not reflect the real cost. For example, some municipalities charge only 60 Japanese yen per month from each household but the waste treatment cost about 1,800 Japanese yen per ton of waste.

23

Toyo University, 4 July 2013

Waste collection and disposal fee (2)

- Some countries do not fully subsidise for waste collection and disposal such as Cambodia, Laos, etc. Therefore, the collection and disposal services depend on the amount of waste fee which relatively small. Therefore, the coverage of collection is relative low and the disposal site is improper managed.

24

Toyo University, 4 July 2013

Coverage of waste collection service in major cities in Lao PDR in 2009

	Vientiane Capital	Luangprabang	Savannakhet	Champasak
Estimated waste generation in municipal area (tonnes/day)	300	50	42	60
Collection and disposal in landfill (tonnes/day)	180	30	30	25
Coverage (%)	60	60	70	42

25

Toyo University, 4 July 2013

Coverage of waste collection service in major cities in Cambodia in 2009

City	Area (km ²)	Population (persons)	Waste generation (tons/day)	Per capita waste generation (kg/person/day)	Waste collection (%)	Residents pay for waste collection service (%)
Phnom Penh	290	1,325,681	1,200	0.91	84%	80%
Battambang	140	143,656	100	0.70	51%	<20%
Siem Reap	473	174,265	115	0.66	100%	N/A
Kampong Cham	162	63,771	50	0.78	70%	10%
			Sum = 1,465	Average = 0.86	Sum = 1,206	

26

Toyo University, 4 July 2013

Waste collection trucks (1)



- Many of waste collection trucks in Cambodia and Lao PDR are old and some donated by Japan

27

Toyo University, 4 July 2013

Waste collection trucks (2)



28

Toyo University, 4 July 2013

MUNICIPAL SOLID WASTE DISPOSAL IN DEVELOPING ASIA

- Open dumping is common practices in many cities.



Toyo University, 5 July 2012

Burning at disposal sites is sometimes practices to reduce volume of waste



30

Toyo University, 4 July 2013

Often self-disposal in backyards and public spaces is practiced



31

Toyo University, 4 July 2013

More than 50% of disposal sites are not well developed



32

Toyo University, 4 July 2013

Houseflies outbreak is found seriously in some cities

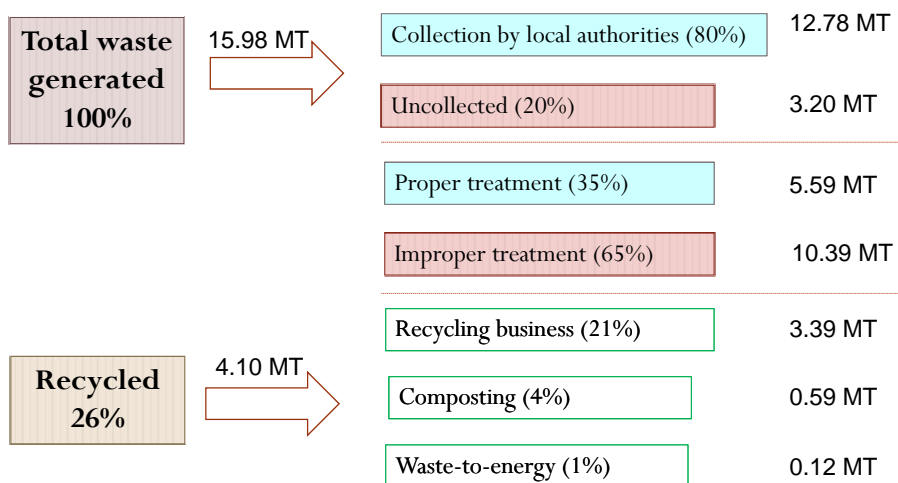


33

Toyo University, 4 July 2013

Example of municipal solid waste management

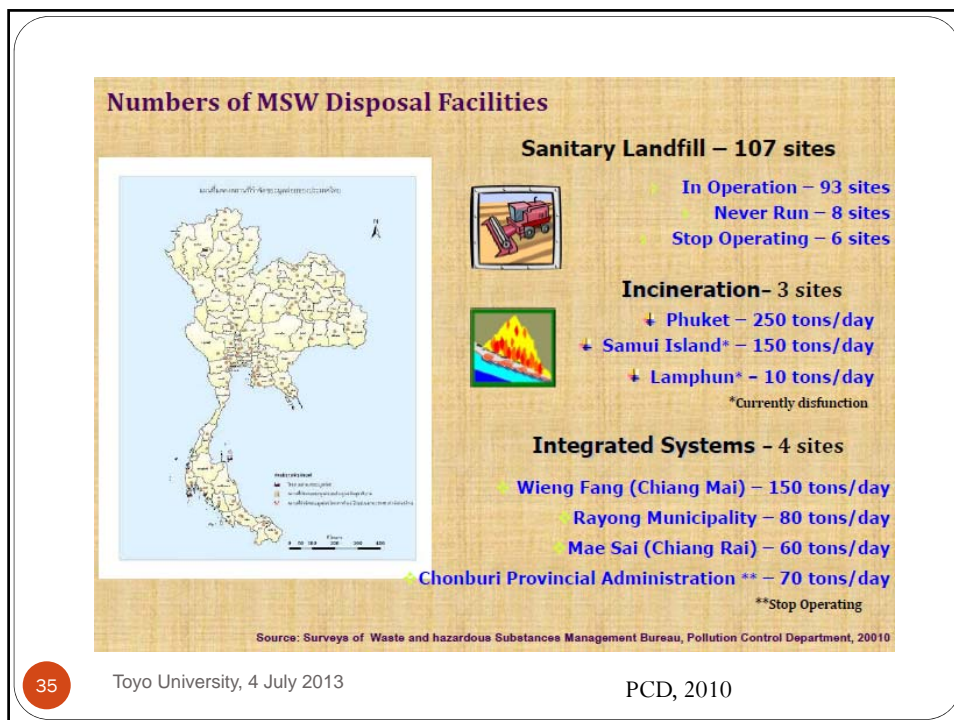
- Thailand



34

Toyo University, 4 July 2013

Source: PCD, 2012



3Rs (reduce, reuse, recycle) in developing Asian Countries

The 3Rs (reduce, reuse, recycle)

- An approach to minimise resource consumption in the level that sufficient for basic need (reduce), use goods and materials until it can't be repaired or fixed to perform its function (reuse), and reprocess the materials that being discarded into new products (recycle).
- An approach that increasing resource efficiency, and contributing to sustainable consumption and production, and millennium development goals, etc.
- An approach to minimise waste to final disposal site

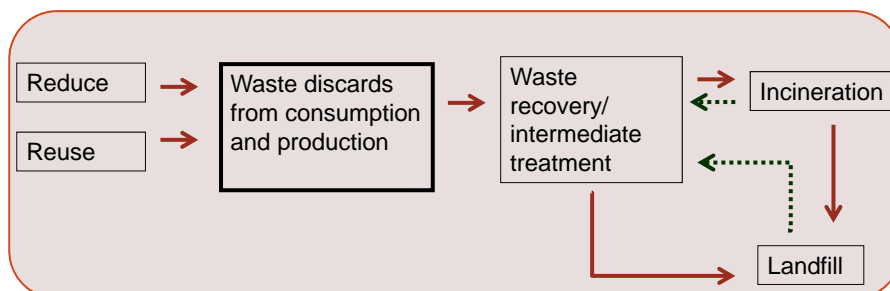
37

Toyo University, 4 July 2013

Waste flow under a conventional waste management



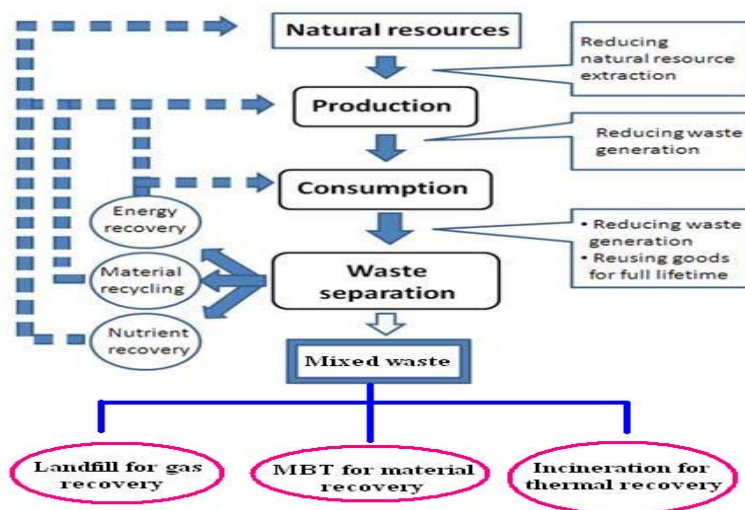
WASTE FLOW UNDER A 3R CONCEPT



Toyo University, 4 July 2013

38

The 3R contribution to lifecycle material management



39

Toyo University, 4 July 2013

MBT: Mechanical biological treatment

How the 3Rs contribute to sustainable solid waste management?

Problems of waste management in most countries

- The rate of waste generation is increasing greater than capacity of local governments (skills and budget), especially in developing countries.
- Increasing social resistance to new landfill and incineration projects.
- Increasing concerns on environmental impacts including greenhouse gas emissions and resource depletion.



The 3Rs can contribute to reducing waste for collection and transport to final disposal site.

Lifecycle environmental impacts from the 3Rs is much lower than landfill of unsorted waste.

40

Toyo University, 4 July 2013

The 3R policies in developing Asian countries

- 3Rs for Improved solid waste management policy
 - National 3R strategies, integrated solid waste management
 - Philippines, Malaysia, Viet Nam, China, Cambodia, Bangladesh, Indonesia, Thailand, etc.
- 3Rs in climate change mitigation action policy
 - Avoiding GHG emission from the waste sector
 - China, India, Indonesia, Thailand, the Philippines, etc

41

Toyo University, 4 July 2013

Reduce

- Ban or application of polluter pay principle for use of shopping plastic bag
 - China, India
- Promote use of biodegradable shopping bag or use of reusable shopping bag/basket



42

Toyo University, 4 July 2013

- China: put name's sticker on drinking bottles at official meetings



43 Toyo University, 4 July 2013

Reuse, Repair, refill



Toyo University, 4 July 2013



45

Toyo University, 4 July 2013



46

Toyo University, 4 July 2013

Waste for charity

- Malaysia



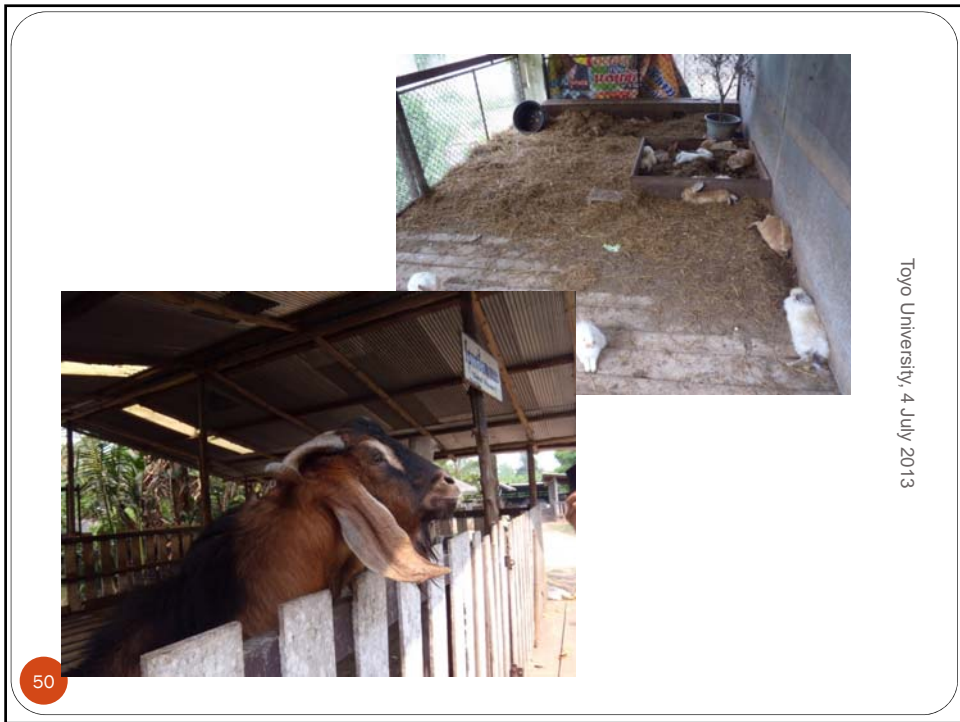
47

- Food waste collection for animal feed in Thailand



48

Toyo University, 4 July 2013



Recycle, recovery

- Recycle in developing Asian is based on market value of recyclable waste
- Contribution from informal sector is significant since the governments do not have budget for establishment of facilities

51

Toyo University, 4 July 2013

Waste pickers in landfills



52

Toyo University, 4 July 2013



53

Toyo University, 4 July 2013

Living on and nearby landfills



54

Toyo University, 4 July 2013

Children needs to help their parents



55

Toyo University, 4 July 2013



56

Toyo University, 4 July 2013



57

Toyo University, 4 July 2013



58

Toyo University, 4 July 2013

Waste pickers in town



59

Toyo University, 4 July 2013

Transport of recyclable waste



60

Toyo University, 4 July 2013



61

Toyo University, 4 July 2013



62

Toyo University, 4 July 2013

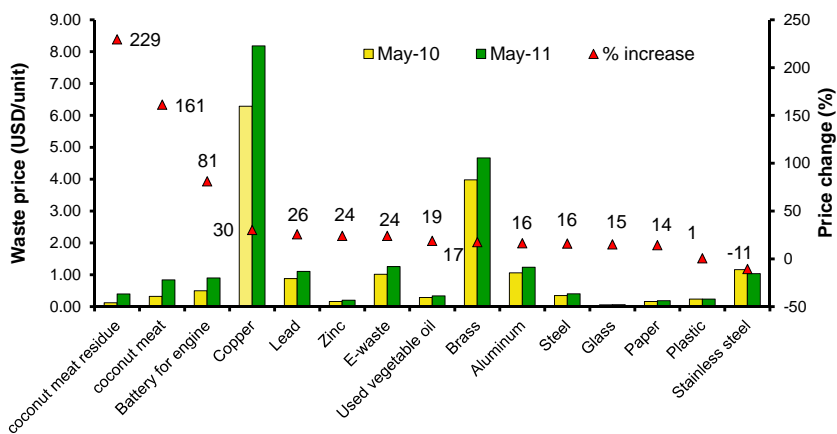
Waste buyer shop



63

Toyo University, 4 July 2013

Price of recyclable materials tends to increase



Note: Domestic price of recyclable materials in Thailand (Wongpanit's price)
1 unit = 1 kg for most of materials expect for E-waste and glass

64

Toyo University, 4 July 2013

Waste recycling in slum



65

Toyo University, 4 July 2013

Home work & Test (1)

1. Please search on internet or newspaper and select a case study of waste reduction and reuse from 1-2 cities in developing countries list their policies or activities on waste reduction and reuse (3 scores)

City name:Country.....

List of activities on 3Rs (waste reduction, reuse and recycle)

- a)
- b)
- c)
- d)

2. How much you generate waste on average per day? How you can reduce your waste generation rate? (3 scores)

Current waste generationkg/day

List of activities that you intend to do for reducing waste generation

- a)
- b)
- c)
- d)

66

Toyo University, 4 July 2013

Home work & Test (2)

1. Please read the article '**sustainable management of organic waste: the need for coordinated action at national and local levels**':

http://pub.iges.or.jp/modules/envirolib/upload/4099/attach/PB_21E_final.pdf

- Please list what you have learnt from this article (at least 6 issues with brief explanation for each in English; 3 scores)

2. Please read the article '気候変動に配慮した廃棄物管理に向けて : 統合型都市廃棄物管理の可能性'

http://pub.iges.or.jp/modules/envirolib/upload/4156/attach/PB_24_J_0116.pdf

- Please list what you have learnt from this article. (at least 6 issues with brief explanation for each in English; 3 scores)