



The 3Rs (reduce, reuse, recycle): an approach to sustainable solid waste management

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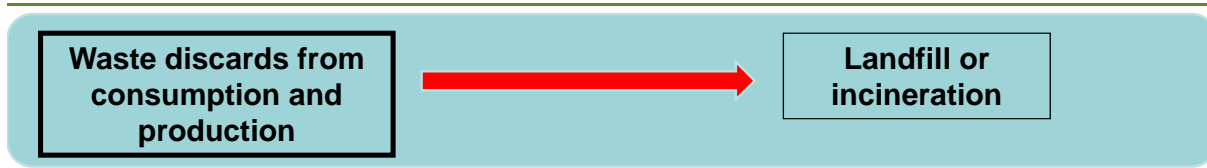
3Rs in Asia



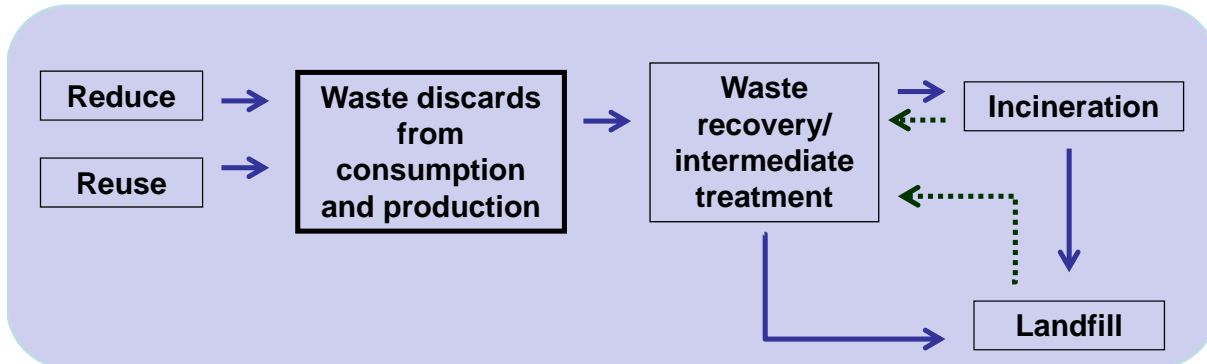
The 3Rs (reduce, reuse, recycle)

- 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

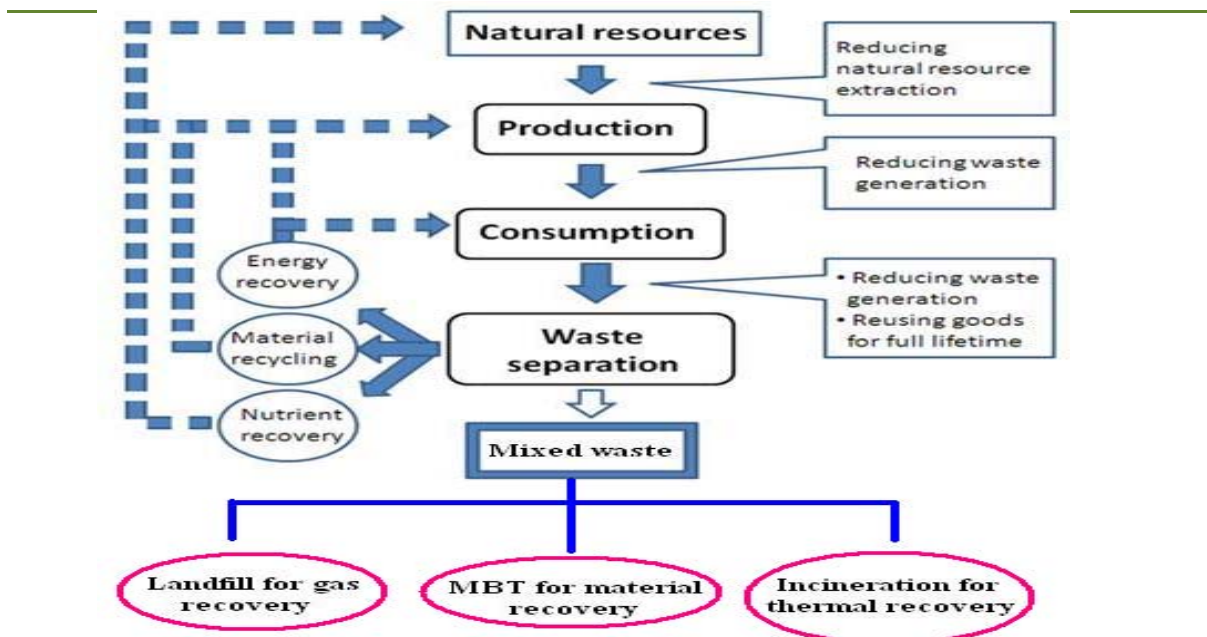
Waste flow under a conventional waste management



Waste flow under a 3R concept



The 3R contribution to lifecycle material management



How the 3Rs contribute to sustainable solid waste management?

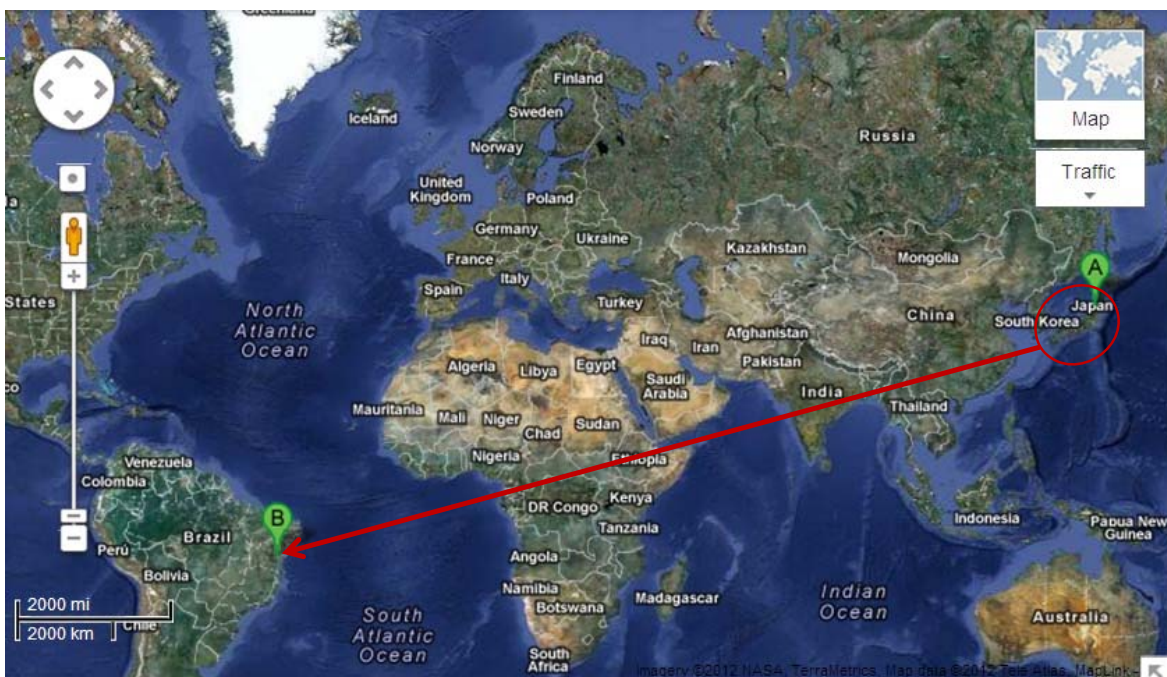
Problems of waste management in most countries

- 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.

3Rs implementation in Japan



The 3R implementation to establish a sound material cycle society in Japan

- Introducing series of national laws and action plans
- Mandatory waste separation at source to facilitating efficient recycling system
- Mandatory recycling for some types of products and waste



Examples of regulation and policy that aligned with the 3Rs and sound material cycle society in Japan

Basic environment law Full enforcement 8/94

Fundamental law for establishing a sound material cycle society

Promulgated in 2001

Waste management and public cleansing law

Promulgated in 1971, last amendment in 2002

Law for the promotion of effective utilisation of resources

Promulgated in 1991, last amendment in 2000

Container and packaging recycling law

Full enforcement 4/00

Home appliance recycling law

4/01

Food recycling law

5/01

Construction material recycling law

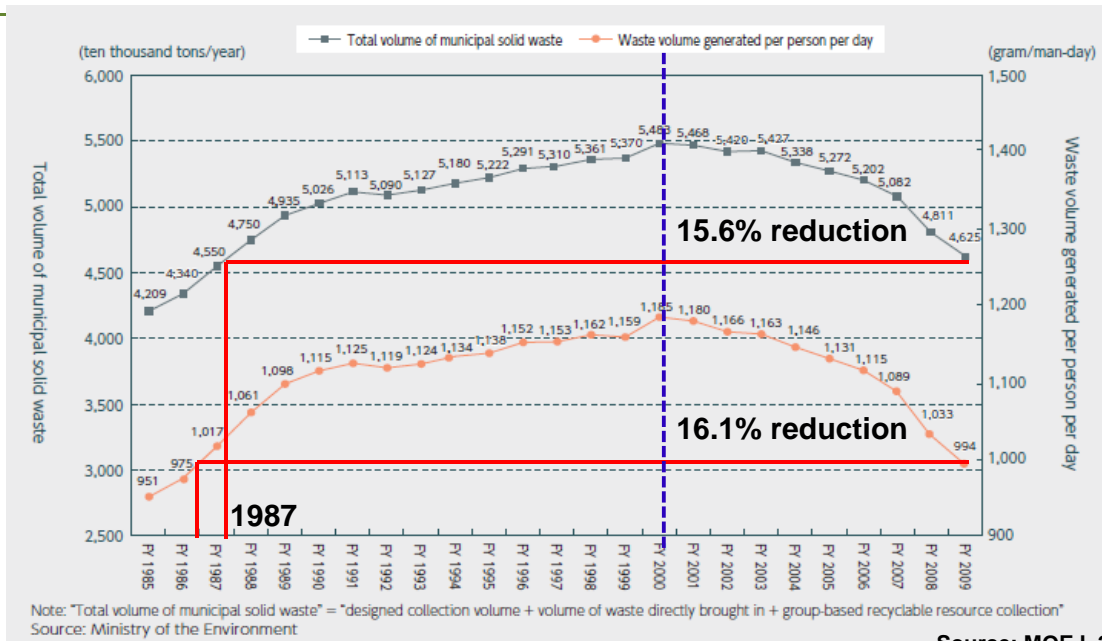
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Automobile recycling law

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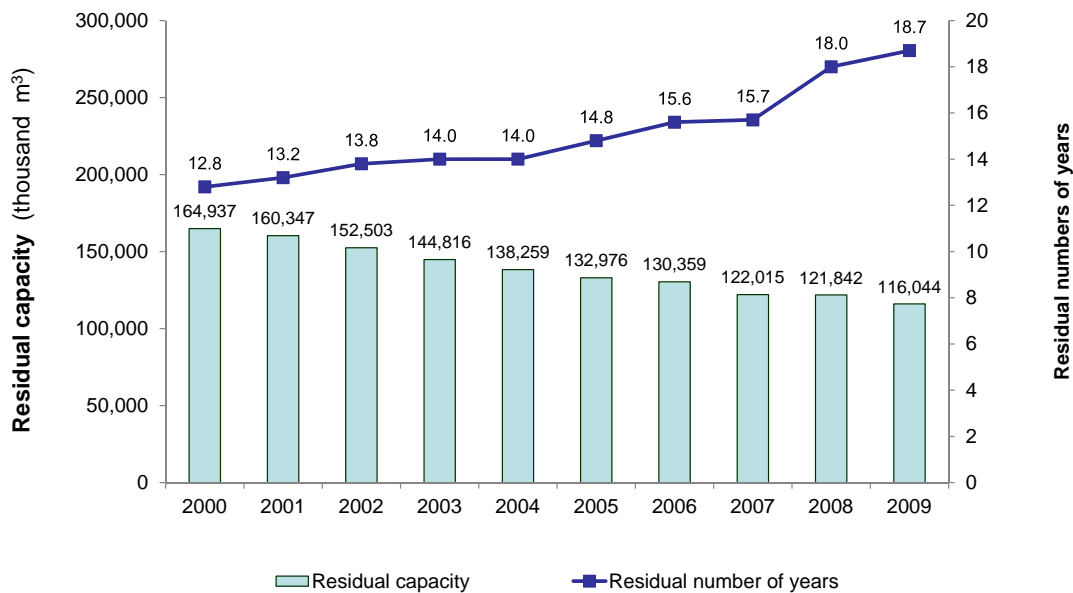
Law on promoting green purchasing

Changes in MSW generations after introducing the 3Rs

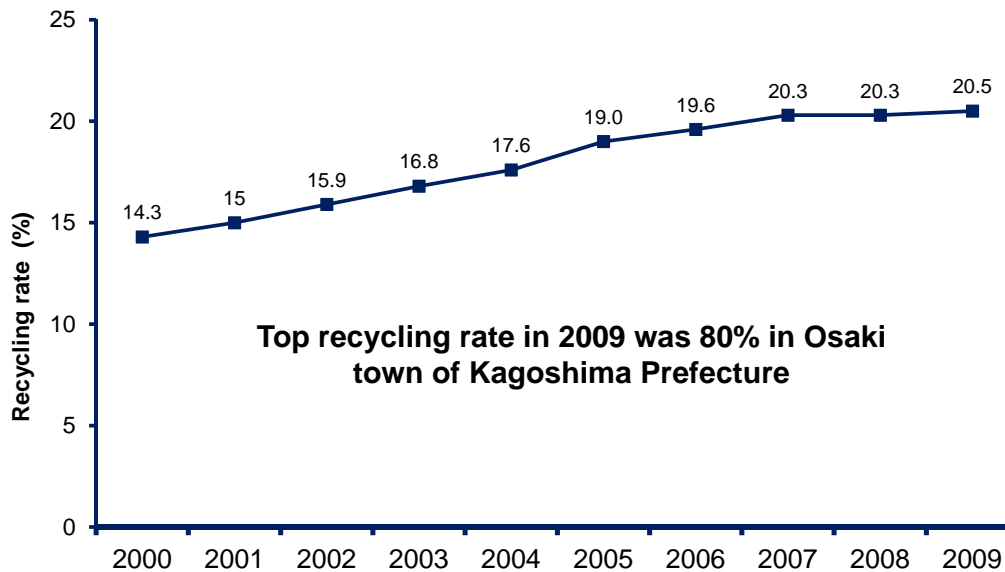


Source: MOEJ, 2012

Changes in residual lifetime of landfill in Japan



Changes in recycling rate of municipal solid waste in Japan



Changes in cost for MSW management in Japan

Year	Total cost (billion JPY)*	Cost per head (JPY/person/yr)*	Cost per tonne (JPY)*
2000	2,371 (47.4)	19,700 (394)	56,329 (1,127)
2004	1,934 (38.7)	15,200 (304)	36,236 (725)
2008	1,817 (36.3)	14,200 (284)	37,766 (755)

* Values in (..) are Brazil Real

3R implementation in Thailand (developing country)



3R implementation for establishing a recycling society in Thailand

- **Announce national policy to promote implementation of the 3Rs, but no legislation**
- **Implementation at local level by initiatives of municipalities**
- **Promoting community based recycling activities in collaboration with waste buyers and recycling companies**
- **Achieving 23% recycling rate due mainly to recycling business that operated by private (informal) waste management sectors (waste pickers, waste buyers, recycling company)**

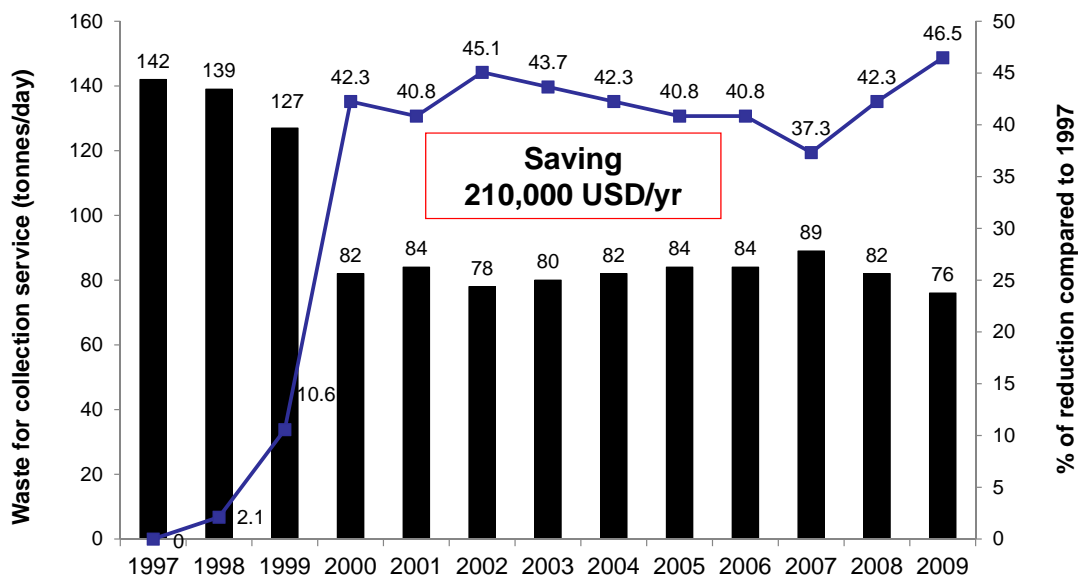
3R implementation for establishment of recycle society in Phitsanulok, Thailand

- Based on a voluntary basis
- Reducing use of plastic bag by using reusable containers for shopping and carrying food
- Campaign to encourage residents separate recyclables for sale
- Collaborating with waste buyers
- Promoting household organic waste composting
- Implementing a mechanical-biological treatment (MBT) and segregation of plastic from MBT for pyrolysis (liquid fuel-diesel, gasoline)



Photo: Suthi Hantrakul

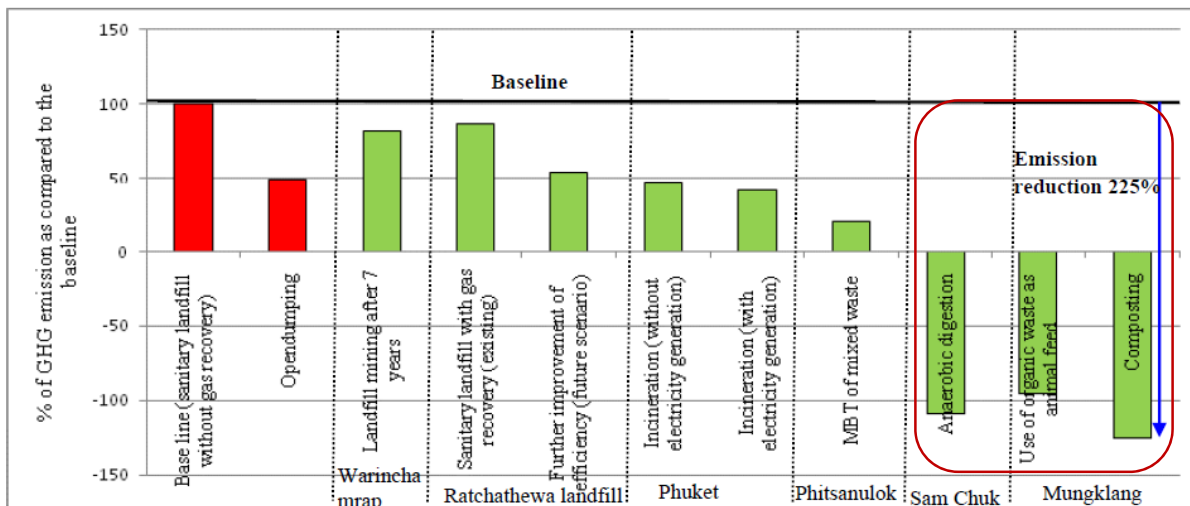
Changes in MSW generations after introducing the 3Rs in Phitsanulok, Thailand



3R's contribution to climate change mitigation

Sectors	Climate co-benefits
Waste	<ul style="list-style-type: none"> - Reduced methane emissions from landfill - Reduced carbon dioxide emissions from burning of plastics
Energy and transport	<ul style="list-style-type: none"> - Reduced emissions from energy use in the process of resource extraction, agriculture, good production and distribution, and waste transportation and treatment - Reduced emissions from fossil fuels by using energy recovered from waste
Industry	<ul style="list-style-type: none"> - Reduced emissions from industrial processes by reducing product demand - Reduced emissions from chemical fertilizer production
Agriculture	<ul style="list-style-type: none"> - Avoided nitrous oxide emissions from farmland by reducing use of chemical fertilizer - Increased soil carbon sequestration
Land use change and forestry	<ul style="list-style-type: none"> - Reduced emissions from mining and deforestation

GHG emissions from different waste treatment technologies in Thailand- LCA perspective



Baseline for mixed waste management is sanitary landfilling of mixed waste without gas recovery.

The baseline of organic waste utilisation is sanitary landfilling of organic waste without gas recovery

Source: Sang-Arun et al, 2012

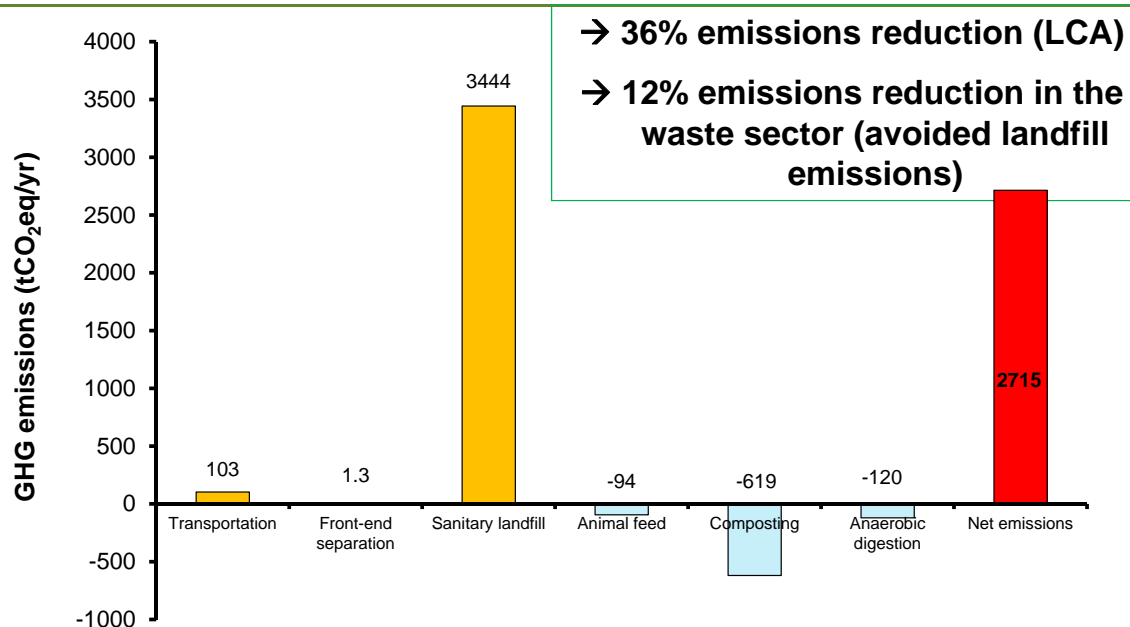
GHG emissions from recycling activity in Thailand – LCA perspective

Type of recyclables	GHG emissions from recycling ¹ (A)	GHG emissions avoidance from virgin process ¹ (B)	GHG emissions avoidance from sanitary landfill (C)	Net emissions from recycling*
				(D) = (A)-(B)-(C)
(tCO ₂ -eq/tonne of waste)				
Paper	1.27	0.97	2.38	-2.08
Plastic	2.15	1.90	0	0.25**
Aluminium	0.39	12.47	0	-12.08
Steel	1.10	2.95	0	-1.85
Glass	0.57	1.03	0	-0.46

Remarks: ¹Menikpura, 2011;

*Plastic recycling in Japan is more climate friendly than incineration.

Example of GHG emissions from integrated waste management system in Muangklang Municipality



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

Keys to success

- **Strong commitment of the leader and top decision maker**
- **Regular public communication and sharing information including public consultation**
- **Begin with small scale and enlarge it later**
- **Continuity of the program**
- **Participation of all stakeholders (complete cycle/chain)**
- **Campaign and public events for mass participation**
- **Be Positive! Be creative!**

Conclusion

- **3Rs (reduce, reuse, recycle)** is a sustainable approach that can contribute to sustainable solid waste management and other global issues such as sustainable consumption and production, resource saving, climate change, poverty reduction, and so on.
- 3Rs is applicable to any country, however the level of implementation could be varied depending on the readiness and conditions of each locality.
- 3Rs is highly relevant with public participation, thus it would take sometimes for campaign and raising awareness of the locals.
- 3R implementation could be on a voluntary basis or mandatory basis depending on suitability of each country or city. In addition, any stakeholders can take initiatives.