

The 3Rs and climate co-benefits in developing countries in Asia and the Pacific

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Introduction

- Global warming and climate change are recognized as serious problems threatening human survival
- In 1997, the Kyoto Protocol was adopted In 2001, the Japanese Fundamental Law for Establishing a Sound Material-Cycle Society entered into force
- In 2004, Japan proposed international collaboration on the 3Rs to enhance resource use efficiency



How can the 3Rs contribute to climate change mitigation?

Objectives of this study

1. Review the greenhouse gas (GHG) emissions from the waste sector in developing Asian countries
2. Analyze different kinds of climate benefits of the 3Rs
3. Review the 3R-related elements of national action plans on climate change in selected developing Asian countries
4. Investigate climate-friendly practices for organic waste management and their applicability in developing Asia

Estimated GHG emissions in developing Asia in 1994

Country	GHG emission (MtCO ₂ eq.)					Submitted Year
	Total	Sink	Net	MSW (CO ₂ eq.; %*)		
Japan	1263	-94	1169	27.2	(2.15%)	2006
China	4081	-431	3650	42.6	(1.04%)	2004
India	1252	-24	1228	12.2	(0.97%)	2004
Indonesia	883	-404	479	8.4	(0.96%)	1999
Thailand	325	-39	286	0.4	(0.13%)	2000
Viet Nam	154	-50	104	1.4	(0.90%)	2003
Philippines	169	-68	101	4.2	(2.51%)	1999
Malaysia	144	-69	75	21.9	(15.2%)	2000
Bangladesh	76	-23	53	1.3	(1.72%)	2002
Cambodia	60	-65	-5	0.1	(0.21%)	2002
Lao (1990)	24	-122	-98	0.2	(0.99%)	2000

* Ratio to the total emission of each nation

Sources: Compiled from the Initial National Communication submitted to UNFCCC; 4th National Communication for Japan

Waste composition in Asia

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

Note: Compiled from various sources

➤ **NB: Huge differences in waste composition between urban and rural areas in developing countries.**

What are the sources of GHG emissions from the waste sector?

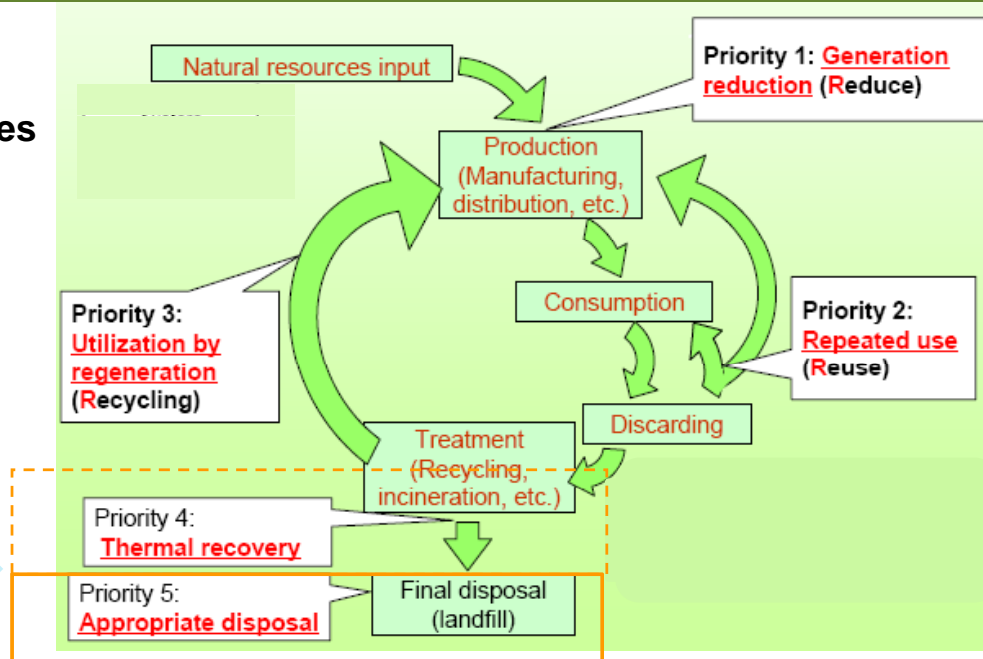
- **Emissions from waste transportation and operation of treatment facilities (fossil fuels combustion)**
- **Direct emissions from waste treatment**
 - **Methane gas (CH₄)**
 - From anaerobic decomposition of organic waste in landfills and waste dumps
 - **Carbon dioxide (CO₂)**
 - From incineration or open burning of waste containing fossil carbon such as plastics

The 3Rs are much broader than waste treatment

The 3Rs also include up-stream activities such as:

- Product re-design
- Changes in consumption patterns

The Waste Sector



Source: Kimura, 2008

How can the 3Rs reduce GHG emissions?

1. Reduction of direct emissions from the waste sector

- Reduced disposal of **organic waste** in simple landfills
→ reduced CH₄ emission
- Reduced burning/incineration of **plastics**
→ reduced CO₂ emission
- Reduce **energy use for waste transportation** and operation of waste treatment facilities (landfill & incineration)

How can the 3Rs reduce GHG emissions?

2. Reduction of GHG emissions from other sectors

- Reduce and reuse activities can **decrease the demand for new products** and therefore also the energy use for production and distribution of new products
- The 3Rs can **reduce the use of virgin natural resources** and the emissions related with extraction, transportation and processing of those resources
- Recovery of energy from waste can **reduce the demand for fossil fuels**

How can the 3Rs reduce GHG emissions?

Examples of recycling and reduction of GHG emissions

Products		GHG emission (kgCO ₂ eq/ton of product)		
Reference	Recycled	Reference	Recycled	Reduction
Virgin plastic	Plastic profile	2,866	172	2,695 (94%)
A mat (virgin polypropylene)	A mat (recycled textile fibre)	2,182	115	2,067 (95%)
Virgin steel	Recycled steel	2,174	440	1,734 (80%)
25% recycled glass	59% recycled glass	463	362	101 (22%)

Source: Korhonen and Dahlbo, 2007

Substantial GHG emission reductions can be achieved through recycling

How can the 3Rs reduce GHG emissions?

- **Agriculture sector**
 - Use of compost instead of **chemical fertilizer** can reduce the GHG emissions from fertilizer production
 - Use of compost instead of chemical fertilizer is also expected to reduce nitrogen oxide emissions from farmland
 - Use of compost can increase the **carbon storage** in farmland (sequestration)
- **Land use change and forestry sector**
 - Reduced demand for virgin resources can **reduce mining** activity in forested areas
 - Use of organic waste for soil improvement can preserve or enhance land productivity and thus **reduce deforestation**

Recognition of the 3Rs in national climate strategies

Country	National climate change policy	Indication to waste sector	3Rs approach to climate change
China	2007	Yes	Reduce, Recovery, Utilization
India	2007	Yes	Recycling
Indonesia	2007	Yes	5Rs for industry & 3Rs for domestic waste
Thailand	2008	Yes	3Rs
Bangladesh	2008	Yes	No
Cambodia	2000	Yes	No
Philippines	1999	One word	No
Malaysia	2000	No	No
Lao	2002	No	No
Viet Nam	2003	No	No

Organic waste management with climate benefits

Management option	Use of leftover food	Animal feed	Composting	Anaerobic digestion	Fuel briquette
3Rs category	Reduce	Reuse	Recycling	Recycling	Recycling
GHG reduction in other sectors	Agriculture, Food industry	Feed industry	Agriculture, Synthetic fertilizer industry	Energy, Agriculture, Synthetic fertilizer industry	Energy, Forestry
Required waste quality	Very high	High	Medium	Fair	Fair
Potential project scale	Household	Community	Household to large scale	Household - large scale	Household - large scale
Investment	Low	Low	Medium - high	High	Medium - high
Examples of practicing countries	China, Thailand	Cambodia, China, Thailand	Bangladesh, Cambodia, Indonesia,	India, Thailand	Cambodia, Philippines

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Overall observations and recommendations

1. The 3Rs are practiced in most countries in developing Asia but only **four countries** currently include the 3Rs in their national climate change mitigation plans
2. **Organic waste is the main source** of direct GHG emissions from waste sector in developing Asia
3. Several **3Rs options for organic waste management** exist, however these techniques are not yet widely adopted and insufficiently promoted
4. Therefore, strategies to improve 3Rs practices for organic waste should be developed, based on local circumstances
5. However, the **indirect climate benefits of the 3Rs are huge** and need to be given much more consideration

Thank You For Your Attention



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CDM and the 3Rs

- The Clean Development Mechanism (CDM) is a funding mechanism which aims at facilitating development projects with low negative climate impacts
- However, the current CDM system is most suitable for supporting large-scale end-of-pipe waste treatment technologies, such as landfill gas recovery
- Composting and anaerobic digestion can be registered as CDM projects, but projects based on many small-scale facilities are not easy to include
- The current design of CDM gives incentives for developing countries to implement end-of-pipe technologies instead of promoting the 3Rs
 - Bangladesh is planning to develop new landfills in big cities with methane gas recovery

IGES perspective on 3Rs & climate change research

1. Action research promoting organic waste management for food and energy security in Cambodia, Lao and Thailand
2. Field and policy research on 3Rs practices and strategies to extend the practices nationwide in selected countries
3. Policy research on 3Rs practice for GHG reduction
4. Policy research on the potential to apply 3Rs practice for CDM