

# Identification of 3R policy Options

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## **Challenges for identification of resource circulation policy options / 3R policies in Asia**

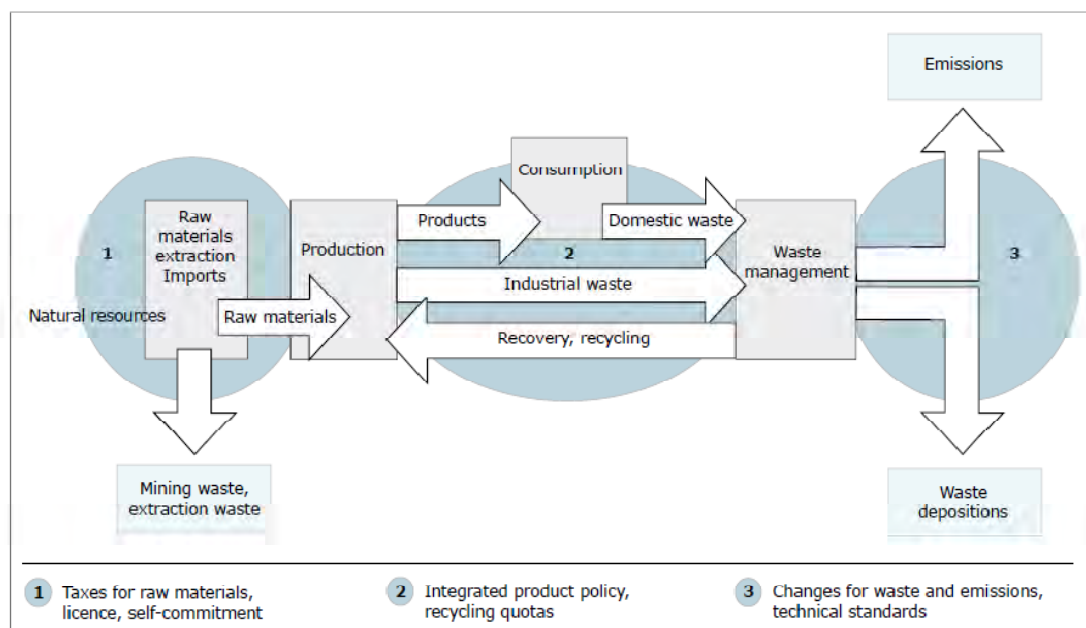
1. Identification of **stages of resource use/consumption and associated impacts**
2. Identification and description of **policy tools for improving resource circulation** from life cycle perspective of materials.
3. Identification of important materials for sustainable resource circulation in Asia
4. Identification of **associated social, economic and environmental effects** from different policy options.

# Major indicators for impact assessment of resource use at micro and macro-level

Resource use category		Product level		Economy-wide level	
Material	biotic	Material-based ecological rucksack of products	biotic	Indicators based on economy-wide material flow analysis	biotic
	abiotic		abiotic		abiotic
Water		Water-based ecological rucksack/ecological footprint of products (virtual water)		Water-based ecological rucksack/ecological footprint of national economy (including trade)	
Land use		Change in land use from product use		Change in land use (including trade-related ones)	
GHG emissions		Carbon footprints of products		National GHGs emissions ( including embodied emissions in trade )	

Source : Giljum, S., Burger, E., Hinterberger, F., Lutter, S., (2009), "A comprehensive set of resource use indicators from the micro to the macro level", SERI WORKING PAPERS, Vienna. SERI.

## Life cycle stages of resource use



Bringezu, S. (2002): Towards Sustainable Resource Management of the European Union. *Wuppertal Papers 121*, Wuppertal Institute, Wuppertal.

## Associated environmental impacts of life cycle stages of resource use

Stages of resource use		Example of environmental impacts
Extraction	<ul style="list-style-type: none"> <li>•Extraction of raw materials and natural resources (primary resources) from the environment including mining.</li> <li>•Interaction between modern economic-social systems relying on resource consumption and ecological systems</li> </ul>	<ul style="list-style-type: none"> <li>•Destruction and pollution of natural environment fro resource extraction and pre-treatment.</li> <li>•Generation of massive residues</li> </ul>
Production	<ul style="list-style-type: none"> <li>•Refining and processing of pre-treated primary resources. Manufacturing, assembling, or packaging of the products.</li> <li>•Interaction between modern economic-social systems relying on resource consumption and services provided by industrial systems</li> </ul>	<ul style="list-style-type: none"> <li>•Generation of hazardous industrial wastes and by-products</li> <li>•Shortage of landfill</li> </ul>
Consumption	<ul style="list-style-type: none"> <li>•Usage and consumption of the products. Related to marketing and life-style.</li> <li>•Interaction between modern economic-social systems and resource use</li> </ul>	<ul style="list-style-type: none"> <li>•Generation of solid wastes from household and business facilities</li> </ul>
Recycling and waste management	<ul style="list-style-type: none"> <li>•Collection, treatment of, and resource recovery from wastes and post-consumed products.</li> </ul>	<ul style="list-style-type: none"> <li>•Pollution from unsound waste management and inappropriate recycling</li> </ul>

## Necessary macro-indicators for evaluating effectiveness of policy intervention

Stages of resource use	Expected necessary macro-indicators
Extraction	<ul style="list-style-type: none"> <li>•Indicators to show changes in total input of primary resources to production stage, progresses of substitution of primary resources with inputs of secondary resources by policy intervention.</li> <li>•Indicators such as TMR or ecological rucksacks to show hidden resource consumption and waste generation in relation pre-treatment and refining primary resource use inputs</li> </ul>
Production	<ul style="list-style-type: none"> <li>•Indicators to show change in ratio of secondary materials in necessary inputs for production, changes in utilization of by-products/wastes from production stage, or changes in total amount of industrial waste generation by policy intervention.</li> </ul>
Consumption	<ul style="list-style-type: none"> <li>•Indicators to show changes in amount of solid waste generation from household and business facilities by policy intervention</li> </ul>
Recycling and waste management	<ul style="list-style-type: none"> <li>•Indictors to show ratio of final destination of post-consumed products (ratio of landfill, incineration, formal recycling, and informal recycling etc.).</li> <li>•Indicators to show changes in associated impacts from change in final destination.</li> </ul>

## Example of policy tools

Stages of resource use	Example of policy tools
Extraction	<p><u>Primary Resource Tax</u></p> <ul style="list-style-type: none"> <li>• <i>Putting high price to virgin/primary materials</i></li> <li>• Expected effect: reduction of primary resource use and increase use of secondary material.</li> <li>• Possible negative impact: Possible increase in illegal mining and import to avoid tax. Possible competitive disadvantage of industries in the countries with this policy.</li> </ul>
Production	<p><u>Extended Producer Responsibility</u></p> <ul style="list-style-type: none"> <li>• <i>Shift cost of waste treatment and recycling from governmental sector to producers</i></li> <li>• Expected effect: DfE to reduce amount of waste by improving recyclability and reuse of parts. Improved waste management and effective recycling. Appropriate cost sharing among stakeholders for post-consumed products</li> <li>• Possible negative effect: Increased export of recyclables/end of life products/secondhand products from countries introduced the policy. Inequality of sharing final treatment cost among countries.</li> </ul>

## Example of policy tools

Stage of resource use	Example of policy tools
Consumption	<p><u>Product choice editing</u></p> <p><i>Removal of products based on indicators such as LCA and ecological rucksack</i></p> <ul style="list-style-type: none"> <li>• Expected effects: Expansion of market for DfE products</li> <li>• Possible non-tariff barrier</li> </ul> <p><u>Source separation of waste and collection of recyclables</u></p> <p><i>Charge of responsibility of waste separation to consumers and business facilities</i></p> <ul style="list-style-type: none"> <li>• Expected effects: Reduction of waste management cost. Reduction of amount of final waste treatment. Promotion of resource recovery from waste.</li> </ul> <p>Possible negative impacts: Increase in cost for waste collection due to more frequent collection.</p>
Recycling and waste management	<p><u>Discharge-based treatment fee for urban solid waste</u></p> <p><u>Landfill tax</u></p> <p><u>Land fill ban of specific items</u></p> <p><u>Subsidy to recycling industrial cluster</u></p>

## Existing indicators to evaluate the effectiveness of resource circulation policy

- a) Change in total waste generation
- b) Change in ratio of final destination of post-consumed products
- c) Indicators to show environmental, economic and social impacts at national level based on changes in a) and b)

### Change in total waste generation

- There is a methodology to calculate it by using a correlation between waste generation/capita and GDP or GDP/Capita. For example, Yoshizawa et. al. (2006).
- When it comes to individual waste/material streams, it is a rather complicated issue because of lack of data, especially in Asia. It may be possible to a rough estimate by using ratio of waste categories in the selected countries/areas

Country	Waste Categories (average percentage of wet weight)					
	Organic	Paper	Plastic	Glass	Metal	Others
Bangladesh (urban)	70.0	4.3	4.7	0.4		20.6
PRC (using coal)	65.0	9.0	13.0	2.0	1.0	10.0
PRC (using gas)	41.0	5.0	4.0	2.0	1.0	47.0
Indonesia (urban)	65.0	13.0	11.0	1.0	1.0	9.0
Japan	17.0	40.0	20.0	10.0	6.0	7.0
Korea, Republic of	31.0	27.0	6.0	6.0	7.0	23.0
Malaysia	43.0	24.0	11.0	3.0	4.0	15.0
Philippines	41.0	19.0	14.0	3.0	5.0	18.0
Singapore	44.0	28.0	12.0	4.0	5.0	7.0
Thailand	40.9	12.1	10.9	6.6	3.5	17.2
Viet Nam	49.0	2.0	16.0	7.0	6.0	20.0

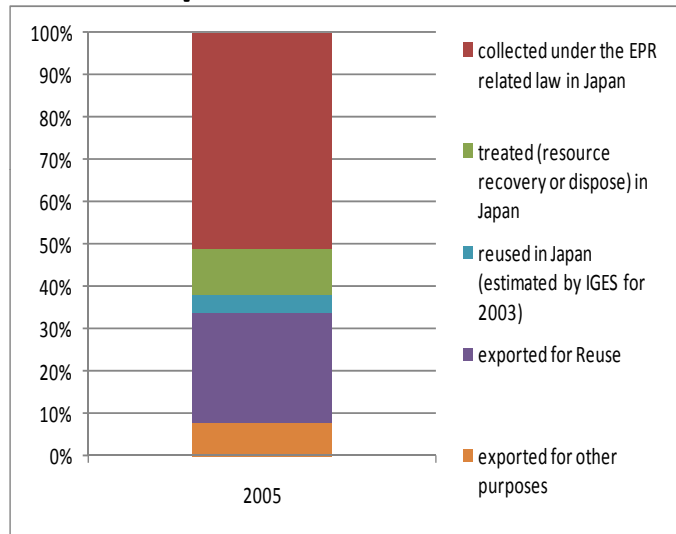
PRC = People's Republic of China.

Source: Compiled from information in 3R Knowledge Hub Secretariat, 2007, *Gap Analysis in Selected Asian Countries*, Bangkok: Asian Institute of Technology.

Source: ADB and IGES (2008)

# Change in ratio of final destination of post-consumed products

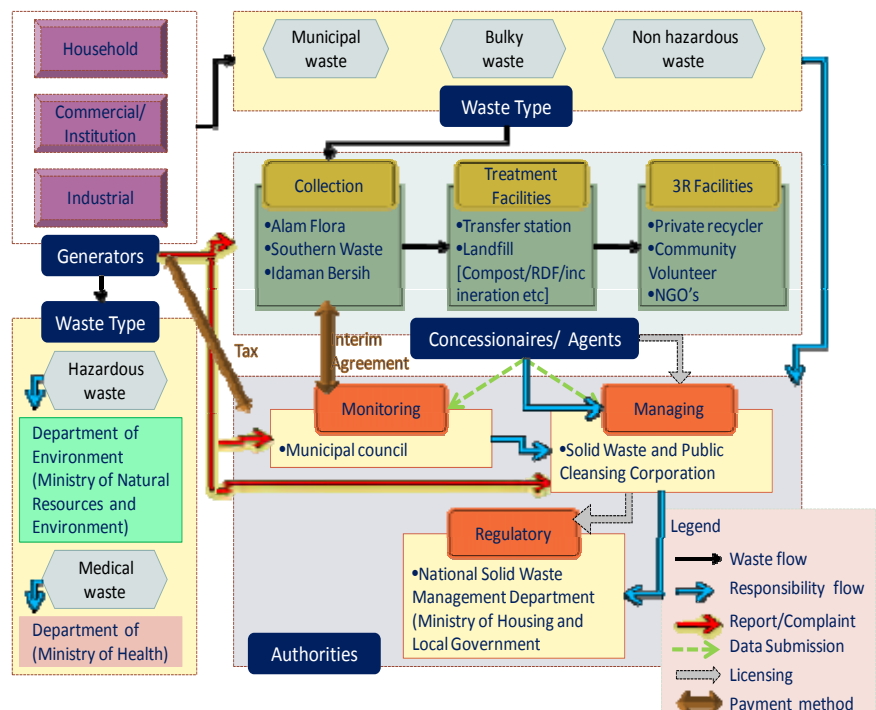
- Typical final destination can include; a) direct landfill treatment, b) incineration, c) storage, d) formal recycling and resource recovery, e) export as recyclables, f) reuse as secondhand goods in domestic market, g) reuse as secondhand goods, i) informal recycling, j) illegal dumping, k) illegal export
- This kind of analysis might be possible for countries with statistics such as Japan, RoK, etc.



Typical destination of post-consumed 4 home appliances  
Source: Compiled by IGES based on estimation by METI and MOEJ (2008)

# Change in ratio of final destination of post-consumed products

- Even in the countries such as Malaysia with relatively formal management mechanism and with data collection, data is difficult to attain since there is no integration among data collected by waste management contractors etc.



Waste management system of Malaysia  
Source: Compiled by IGES

# Associated social, economic, and environmental impacts for final destinations of post-consumed products

- If environmental, social, and economic impacts from final treatment technologies and methods can be understood, it may be possible to estimate associated impacts from different policy options.

## Examples:

- Environmental impact : GHGs, air pollution, water pollution, soil pollution
- Social impact : Poverty (income distribution), income per capita
- Economic impact : change in GDP

## Summary-1

Stages of Resource Use	Examples of environmental impact	Examples of resource circulation p.	Expected effects of policy intervention	Existing indicators
Extraction	<ul style="list-style-type: none"> <li>•Environmental degradation and pollution</li> <li>•Generation of large amount of residues</li> </ul>	<ul style="list-style-type: none"> <li>• Primary resource tax</li> </ul>	<ul style="list-style-type: none"> <li>• Substitute of primary resources by secondary materials</li> <li>• Reduction of total input of primary resources to production stage</li> </ul>	<ul style="list-style-type: none"> <li>•TMR</li> <li>•Ecological rucksack</li> </ul>
Production	<ul style="list-style-type: none"> <li>•Generation of hazardous industrial wastes and by-products</li> <li>•Shortage of landfill</li> </ul>	<ul style="list-style-type: none"> <li>• Industrial waste landfill tax</li> <li>• Product-recycling policies based on EPR</li> </ul>	<ul style="list-style-type: none"> <li>• Increase in use of secondary materials in resource input for products</li> <li>• Increase use of by-products and wastes in production process (EIP)</li> <li>• Decrease of industrial wastes</li> </ul>	<ul style="list-style-type: none"> <li>•Amount of industrial waste generation</li> <li>•Ratio of utilization of metal scraps in metal used in products</li> </ul>

## Summary-2

Stages of Resource Use	Examples of environmental impact	Examples of resource circulation p.	Expected effects of policy intervention	Existing indicators
Consumption	<ul style="list-style-type: none"> <li>• Generation of solid waste from household and business facilities</li> <li>• Increase use in throw-away products</li> </ul>	<ul style="list-style-type: none"> <li>• Choice-editing</li> <li>• Source separation and collection of recyclables</li> <li>• Amount-based waste management fee</li> </ul>	<ul style="list-style-type: none"> <li>• Reduction of waste from household and business facilities</li> <li>• Better and efficient sorting of recyclables</li> </ul>	<ul style="list-style-type: none"> <li>• Amount of urban solid wastes generated</li> <li>• Composition of household wastes</li> </ul>
Recycling and waste management	<ul style="list-style-type: none"> <li>• Air, soil and water pollution from inappropriate treatment</li> <li>• Informal and inappropriate recycling</li> </ul>	<ul style="list-style-type: none"> <li>• Landfill ban for specific post-consumed products</li> <li>• Subsidiary to recycling industrial clusters</li> </ul>	<ul style="list-style-type: none"> <li>• Change in final destinations of post-consumed products</li> <li>• Social, env. Econ. Positive effects</li> </ul>	<ul style="list-style-type: none"> <li>• Ratio of final destination of post-consumed products</li> </ul>