

# Advancing 3R and resource Efficiency for Sustainable Development ~ Development of Regional 3R Forum in Asia and the Pacific

4th 3R International Scientific Conference on Material Cycles and Waste Management  
8-10 March 2017, New Delhi, India.

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***United Nations Centre for Regional Development***

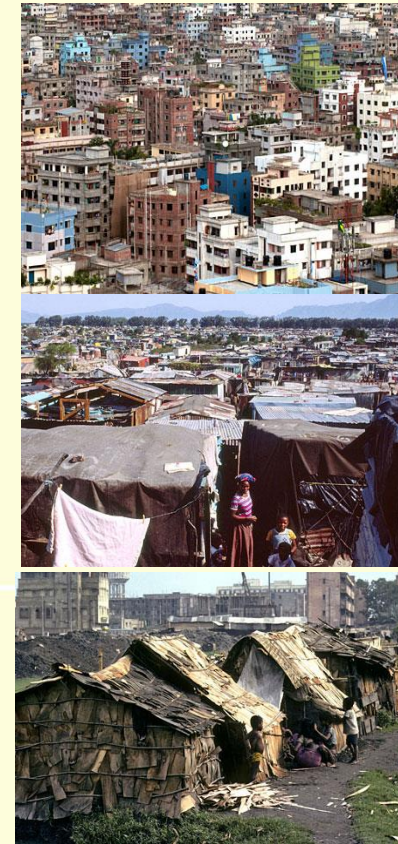
# Major 3R Policy and Institutional Gaps in Asia-Pacific

- Prevailing economic system does not provide adequate incentives for resource conservation and efficient resource allocation / 3Rs & resource efficiency are not part of macro economic policies as waste is conventionally thought of having no “economic” value.
- Prevailing production and consumption patterns do not effectively integrate resource efficiency, contributing to growing quantities of wastes that must be managed for final disposal; SMEs are major concern.
- As countries continue to grow economically and industrially, the region will generate more toxic chemicals & hazardous wastes, mostly coming from industrial, agriculture, and manufacturing processes; current waste management policies are not linked with bio-diversity conservation, protection of ecological assets, climate mitigation – fresh water, coastal & marine ecosystem, etc.
- Dedicated institutions around waste management, but not necessarily required institutional arrangements and interagency coordination (horizontal integration) around resource efficiency and circular economic development
- Weak national and local level cooperation and partnerships (vertical integration) (e.g., national urban development policy on resource efficient and zero waste cities)



# Both resource consumption and waste generation & diversification would be driven by rapid urbanization...

- ✓ Today > 50% of the world population already live in cities & urban areas; expected to be > 70% by 2050, with almost all the growth occurring in the developing world.
- ✓ 95 per cent of urban expansion in the next four decades will take place in developing world, with Asia and African alone contributing > 86%.
- ✓ Over next four decades, Africa's urban population will soar from 414 million to over 1.2 billion & Asia from 1.9 billion to 3.3 billion
- ✓ Over the next four decades, India will add another 497 million to its urban population, China – 341 million, Nigeria – 200 million, the US – 103 million, and Indonesia – 92 million
- ✓ 828 million people live in slums today and the number keeps rising.
- ✓ The world's cities occupy just 2 per cent of the Earth's land, but account for approx. 60-80 % of energy consumption, 70% GHG emissions, 70% of global GDP, consume 70% of all resources, generate 70% of global waste.
- ✓ Rapid urbanization is exerting pressure on fresh water supplies, sewage, the living environment, and public health.
- ✓ Growing vulnerability of coastal cities due to climate related disasters such as floods, storms and sea level rising



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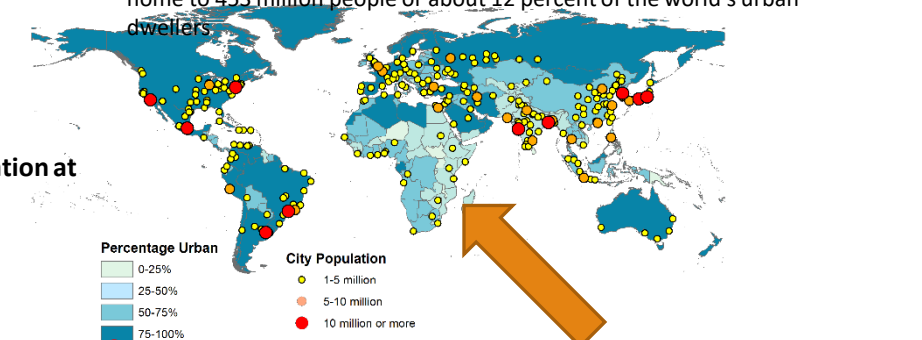
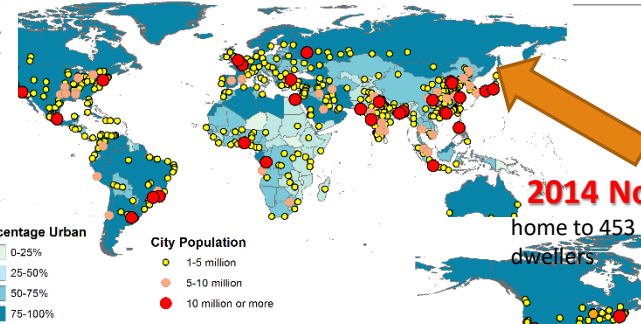
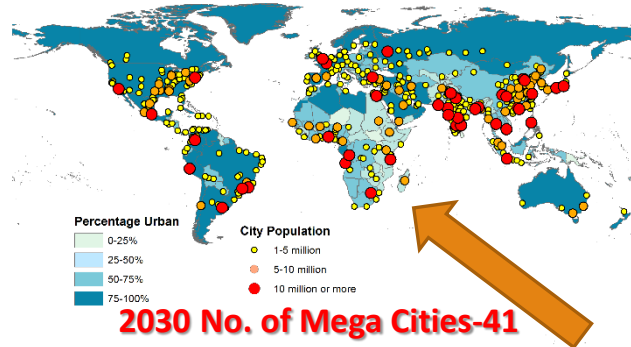
Sources: compiled from UN DESA, 2011 & United Nations, 2012, UN HABITAT, 2016  
<http://www.un.org/en/sustainablefuture/cities.shtml#overview>



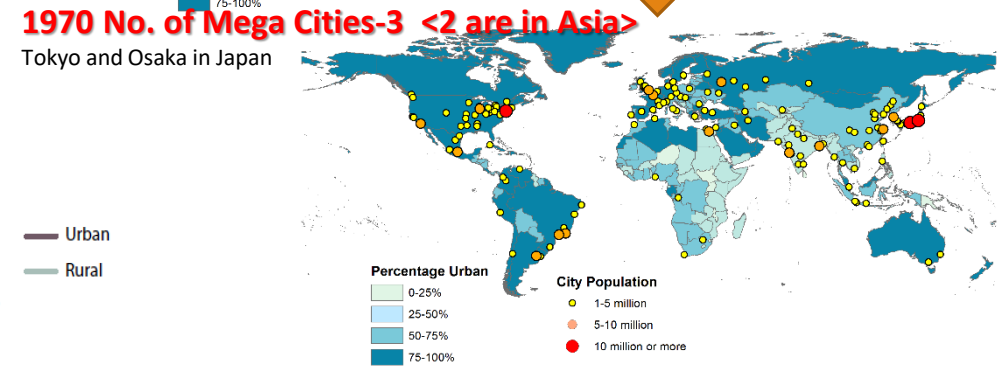
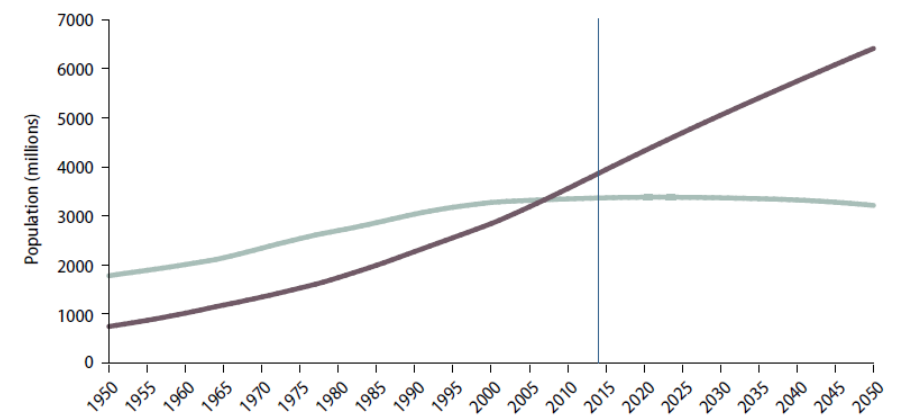
United Nations Centre for Regional Development (UNCRD)

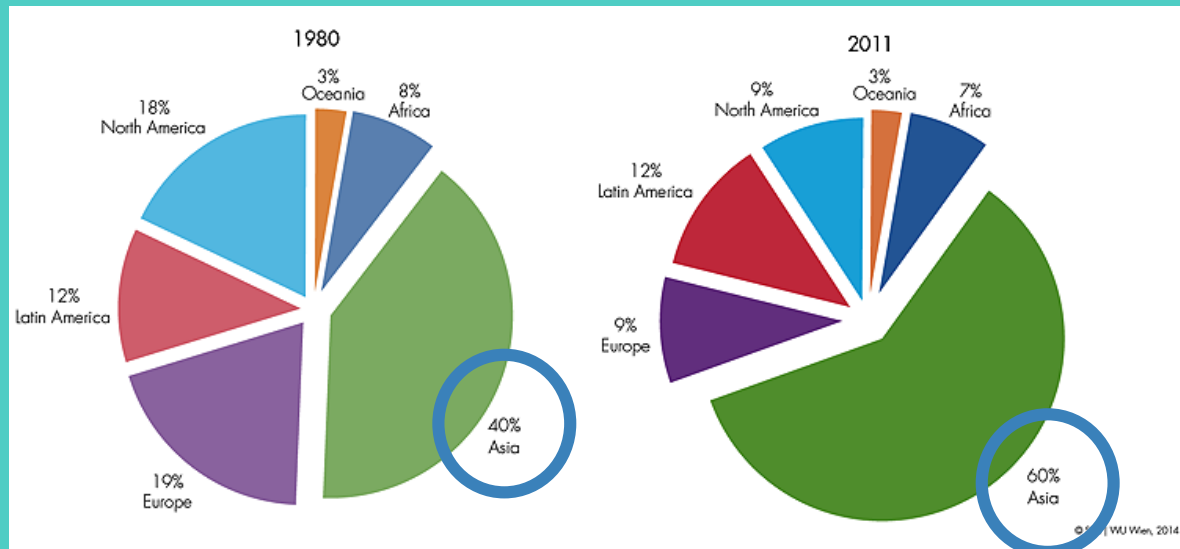
# Urbanization trends and mega-cities of Asia..

- 1) Can the current level of urban infrastructure meet various demands ~ safe drinking water, energy, housing, waste management, healthcare, employment and transport, etc.?
- 2) Is the current level or provision of 3R infrastructure and services able to cope up with the level of waste generation and diversification resulted due to urbanization?

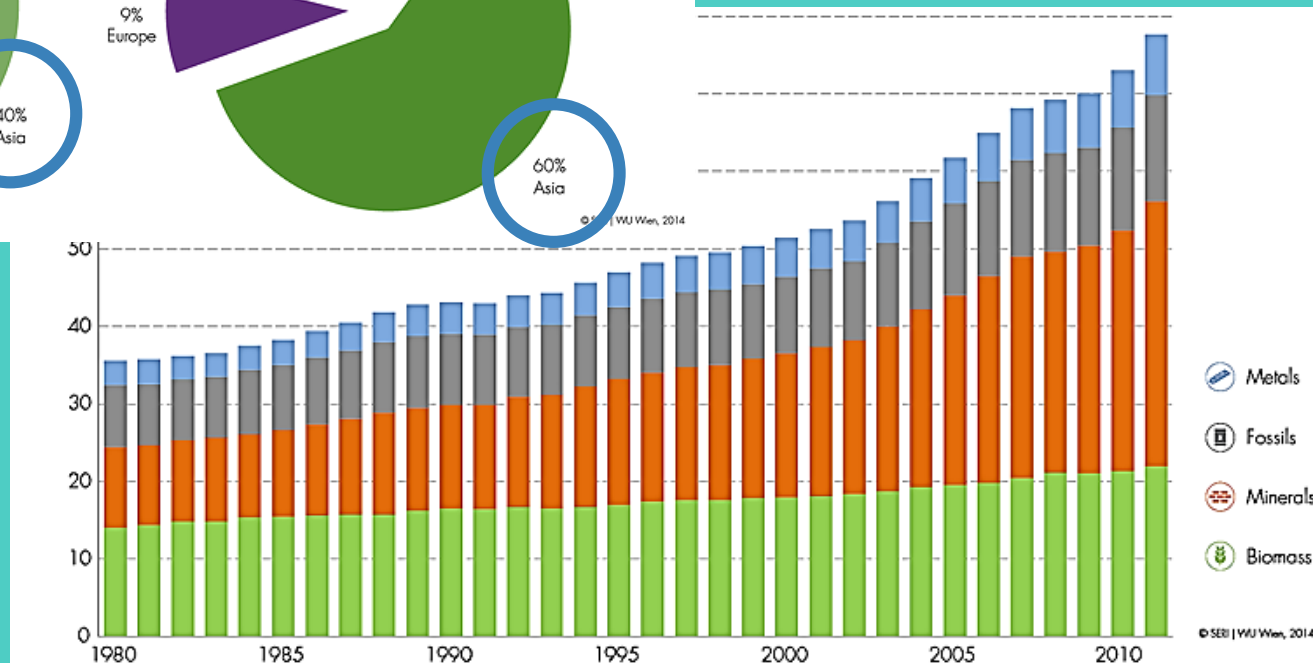


153 million people or slightly less than 7% of the global urban population at that time





*Asia consumes even more*



# Resource extraction

Material consumption for Asia-Pacific - 5.7 to 37 billion tonnes per year between 1970 and 2010

*3Rs in the context of Green Economy*

*3Rs in a broader context - not just about municipal waste management, but is intrinsically linked with resource efficiency in a wide range of sectors with an objective to reduce or eliminate the waste load for final disposal towards transitioning to a resource efficient and green economy*

*Multilayer Partnerships and Coalition as the Basis for 3R's Promotion*

*3Rs in the context of Rio+20 outcome – The Future We Want*

**Pacific countries join 3R Forum**

**1st Regional 3R Forum in Asia**  
Japan/2009

**2nd Regional 3R Forum in Asia**  
Malaysia/2010

**3rd Regional 3R Forum in Asia**  
Singapore/2011

**4th Regional 3R Forum in Asia**  
Viet Nam/2013

**5th Regional 3R Forum in Asia-Pacific**  
Indonesia/2014

**6th Regional 3R Forum in Asia-Pacific**  
Maldives/2015

**7th Regional 3R Forum in Asia-Pacific**  
Australia/2016

**Tokyo 3R Statement**

**Singapore Recommendation**

**Surabaya 3R Declaration**

**3R as an Economic Industry**

**Adelaide 3R Declaration on Circular Economy**

**Ha Noi 3R Declaration (2013-2033)**

**33 Goals** for Urban/Industrial areas, Rural areas/Biomass, New and Emerging Wastes, Cross-cutting issues

**2nd East Asia Summit - Environment Ministers Meeting (EAS EMM), Brunei, 2010**

**Endorsed Regional 3R Forum in Asia**



**2030 Agenda for Sustainable Development / SDGs**

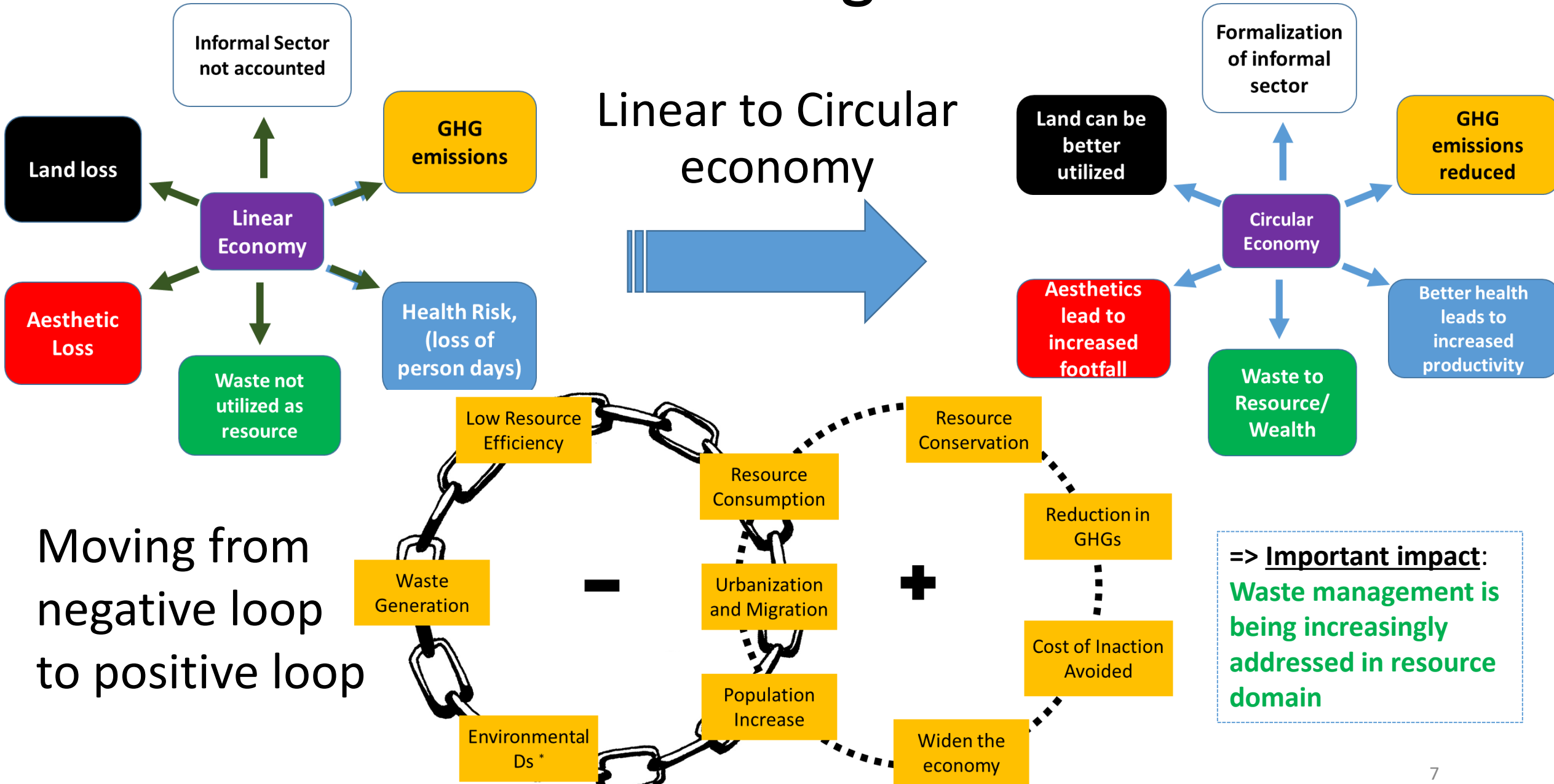
**3R for Green Economy**

**3Rs for Sustainable Cities and Human Settlement (Healthy & Safe)**

**3Rs for Coastal & Marine Ecosystem**

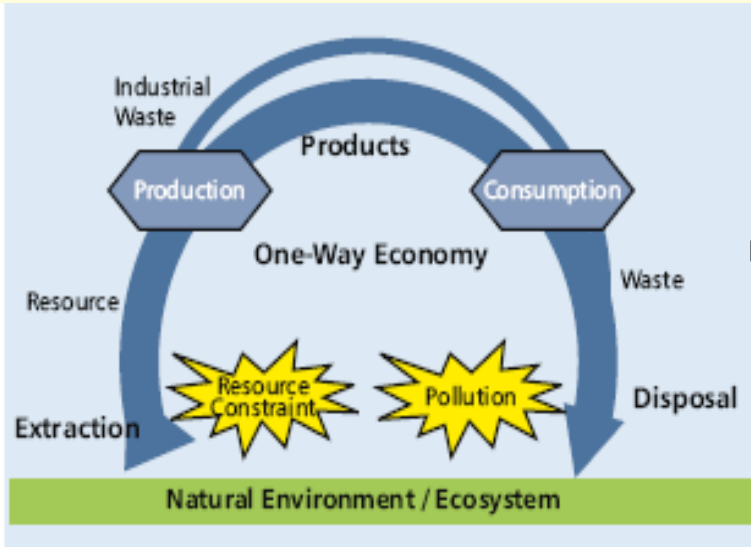
**Needs for Innovative Partnerships**

# Acts and achievements: Regional 3R Forum in AP



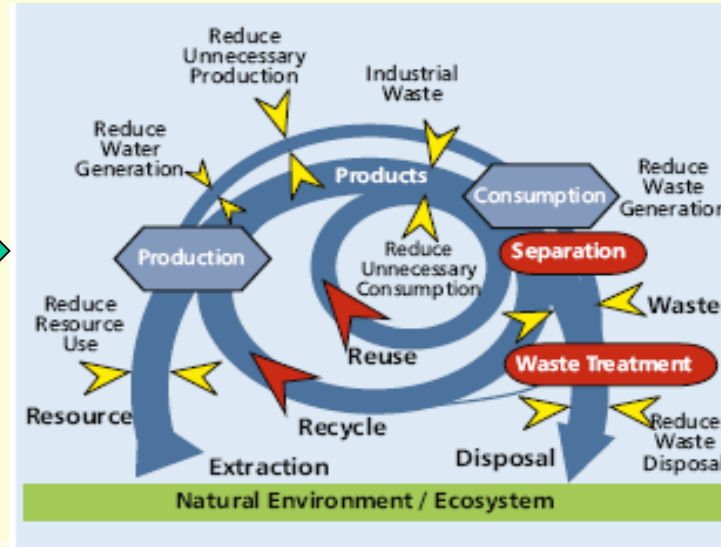
# Most of the developing economies are linear or one-way or conventional in nature...

## 1. One-way/conventional Economy



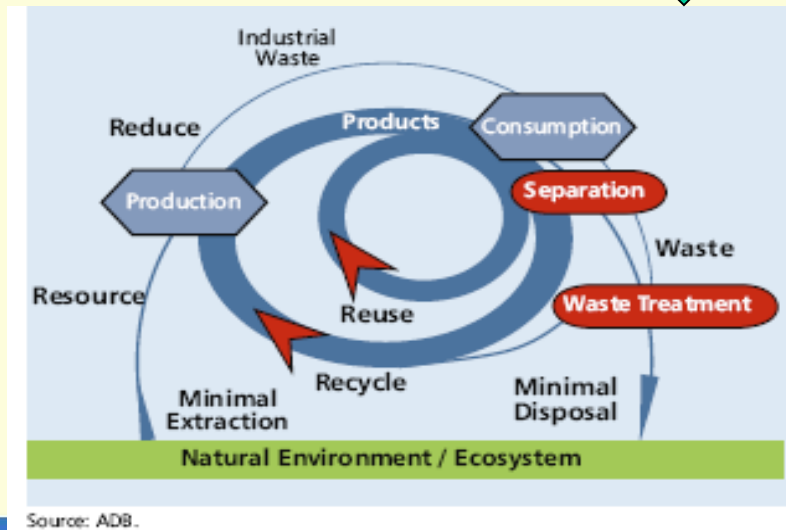
Source: ADB.

## 2. More resource efficient economy



Source: ADB.

## 3. Closed Loop Economy



Source: ADB.

1. **one way economy** -> a little effort is made to reduce the amount of materials consumed in production and hence the wastes are produced. Also little effort is made to reuse or recycle those wastes which mainly go for landfill.

=> *Absence of a science based policy for resource efficient economic development;*

2. **greater resource efficiency** -> by reducing consumption and waste of materials, and by reusing and recycling waste/byproducts minimize (per unit of product or services) – quantity of input raw material/energy /water as well as pollution /emission/environmental impact of the residual materials flow that flow to disposal sites.

=> *science based policy for resource efficient economic development*

3. **closed-loop economy** -> nearly all waste/outputs either become inputs to other manufacturing processes or are returned to natural systems as benign emissions rather than as pollutants.

=> *science based policy for resource efficient closed-loop economic development with a high level of cooperation between science-policy-business-community*

Source: Adapted from ADB, 2011





## Success stories - Macro-economic/Development Policies Integrating Resource Efficiency and 3Rs

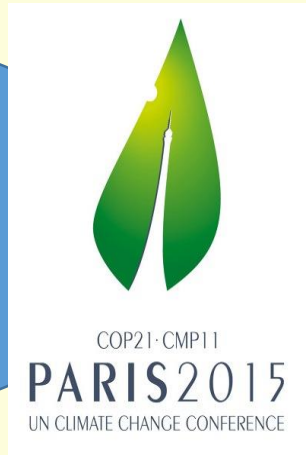
- **Japan:** Fundamental Law for Establishing a Sound Material Cycle Society (2001); New Growth Strategy (2010) which places green innovations as top of seven strategic areas; Finance initiatives to build a Low Carbon Society (providing grants, investments, financing, interest subsidies for – (i) promotion of Green Buildings, (ii) development of Low Carbon Cities, (iii) bilateral offset Credit Mechanism, and (iv) enhancement, commercialization, and R&D of Low Carbon Technologies;
- **Republic of Korea:** New Waste Management Policy towards Resource Recirculation Society (Sep'2013);
- **PR China:** Circular Economic Law (2009) led by NDRC-China; Long Term Renewable Energy Development Plan (2007); Chinese Circular Economic Law offers a long term plan for transformation that seeks to integrate economic, environmental, and social strategies to achieve high resource efficiency as the way of sustaining improvement in quality of life within natural and economic constraints; circular economy is now a trillion dollar opportunity
- **India:** National Solar Mission (3% of India's total electricity demand from solar power projects by 2022); National Mission on Enhanced Energy Efficiency;
- **Malaysia:** National Green Technology Policy (2009); Green Building Index (2009); National Renewable Energy Policy and Action Plan (2010);
- **Singapore:** Green Mark Incentive Scheme for buildings (2005); Water Efficiency Fund (2008);
- **Thailand:** Alternative Energy Development Plan and Target (2008); Thailand Climate Change Master Plan (2012–2050), etc.
- **EU:** Waste Framework Directive (2008); waste management is a public health priority as well as an economic industry, e.g., in Germany



New Urban  
Agenda  
2016



Paris  
Agreement  
2015



2030 Agenda for  
Sustainable  
Development

Nairobi  
Mandate  
2016

Addis Ababa  
Action  
Agenda 2015



Source:

[https://www.google.co.jp/search?rlz=1C1C AFB\\_enJP726JP726&espv=2&biw=1366&bih=638&tbn=isch&sa=1&q=paris+agreement+2015&oq=paris+agreement+2015&gs\\_l=img.3...29174.29974.0.30231.0.0.0.0.0.0.0.0...0...1c.1.64.img..0.0.0.M3oYmouCebY#imgrc=U5U27HmOE](https://www.google.co.jp/search?rlz=1C1C AFB_enJP726JP726&espv=2&biw=1366&bih=638&tbn=isch&sa=1&q=paris+agreement+2015&oq=paris+agreement+2015&gs_l=img.3...29174.29974.0.30231.0.0.0.0.0.0.0.0...0...1c.1.64.img..0.0.0.M3oYmouCebY#imgrc=U5U27HmOE)

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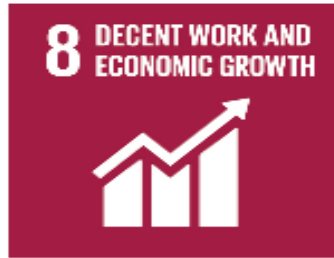


United Nations  
Regional Development (UNRDO)

The 2030 Agenda for Sustainable Development ~13 of the 17 SDGs refer to the need to sustainably manage natural resources => 3R / resource efficiency measure can provide many direct/indirect benefits



# SUSTAINABLE DEVELOPMENT GOALS



2030 Agenda for Sustainable Development	Ha Noi 3R Declaration- Sustainable 3R Goals for Asia and the Pacific for 2013-2023-, 2013	Surabaya Declaration, 2014	Adelaide 3R Declaration, 2017
Goal 6 Ensure availability and sustainable management of water and sanitation for all	<ul style="list-style-type: none"> <li>-Goal 24 Phase out harmful subsidies that favour unsustainable use of resource (raw materials and water) and energy; and</li> <li>Goal 25 Protect public health and ecosystems, including freshwater and marine resources</li> </ul>	-Government-NGO/CSO cooperation with an objective – access to safe drinking water and improved sanitation	-Promote research and development oriented industrial structures to address resource efficiency related problems
Goal 11 Make cities and human settlements inclusive, safe, resilient and sustainable	<ul style="list-style-type: none"> <li>- Goal 17 Improve efficiency and resource productivity in all economic and development sectors;</li> <li>- Goal 23 Promote green and socially responsible procurement all levels; and</li> <li>-Goal 22 Integrate 3R concept in relevant policies and programmes.</li> </ul>	-City-city and inter-municipal cooperation both at national and international levels in realizing sustainable and liveable cities through efficient waste management system.	-Promote inter-municipal or city-city cooperation to integrate different production and consumption systems
Goal 12 Ensure sustainable consumption and production patterns	<ul style="list-style-type: none"> <li>-Goal 3 Achieve significant increase in recycling rate of recyclables;</li> <li>-Goal 4 Build sustainable cities/green cities by encouraging “zero waste”;</li> <li>-Goal 10 Reduce losses on the overall food supply chain;</li> <li>-Goal 11: Promote full scale use of agricultural biomass waste;</li> <li>-Goal 13 Ensure environmentally sound management of e-waste; and</li> <li>-Goal 16 Promote the 3R concept.</li> </ul>	-Country-country cooperation in exchanging waste recovery and recycling schemes, composting schemes in rural areas; and	<ul style="list-style-type: none"> <li>-Strengthen coordination among countries and within countries to progressively adopt and implement circular economy;</li> <li>-Promote 3Rs-related science, technology and infrastructure, industry-industry cooperation, encourage green products and renewable energy programmes; and</li> <li>-Take full benefit of TFM in the areas of 3R science, technology and innovation in support of circular economic development.</li> </ul>

## ROLE OF 3R and RESOURCE EFFICIENCY IN 2030 Agenda for Sustainable Development

- ❖ **Increasing resource efficiency** can yield higher economic growth and employment and integrating decent work and inclusive growth
- ❖ **Enhancing access to** water for productive use in addition to access for domestic use and ensuring ecological sustainability
- ❖ **Supporting Policy Development** and Creating an Enabling Environment for Sustainable Consumption and Production
- ❖ Developing countries have further opportunities to **design their infrastructure and development paths** in a resource-efficient way
- ❖ Resource efficiency can reduce emissions substantially, as well as the adverse impacts from the increased material use that is required for many “**low-carbon technologies**”.



New Urban Agenda, 2016	Ha Noi 3R Declaration- Sustainable 3R Goals for Asia and the Pacific for 2013-2023-, 2013	Surabaya Declaration, 2014	Adelaide 3R Declaration, 2017
Sustainable and inclusive urban prosperity and opportunities for all	<ul style="list-style-type: none"> <li>-Goal 1 Significant reduction in the quantity of waste;</li> <li>-Goal 3 Significant increase in recycling rate;</li> <li>-Goal 4 Build sustainable cities/green cities by encouraging “zero waste” through primary goal of waste minimization; and</li> <li>-Goal 5 Encourage private sector to implement measures to increase resource efficiency and productivity.</li> </ul>	<ul style="list-style-type: none"> <li>-City-city and inter-municipal cooperation, both at national and international levels, in exchanging practical experiences and ideas in realizing sustainable and liveable cities</li> </ul>	<ul style="list-style-type: none"> <li>-Promote 3R s related science, technology and infrastructure, industry-industry cooperation, encourage green products to enhance resilience of cities;</li> <li>-Promote sustainable urban planning and practices which can lead to business opportunities; and</li> <li>-Encourage diversion of waste from landfill to recycling and recovery facilities, energy recovery and sound management.</li> </ul>
Environmentally sustainable and resilient urban development	<ul style="list-style-type: none"> <li>-Goal 17 Improve resource efficiency and resource productivity in all economic and development sectors;</li> <li>-Goal 19 Enhance national and local knowledge bas and research network on 3Rs and resource efficiency; and</li> <li>-Goal 22 Integrate 3R concept in relevant policies and programmes</li> </ul>	<ul style="list-style-type: none"> <li>-multi-sector partnerships and collaboration in policymakers and promotion of sustainable business model, involving the public, private and business sector; and</li> <li>-government-NGO/CSO cooperation with an objective to reduce waste management costs and increase municipal cost savings to divert for other essential socio-economic priorities.</li> </ul>	<ul style="list-style-type: none"> <li>-Support science and evidence-based policy makers to improve economic prosperity enabled by resource efficiency;</li> <li>-Promote research and development oriented industrial structures to address resource efficiency;</li> <li>-Facilitate environmentally sound management of disaster waste; and</li> <li>-Call upon multilateral development banks, bilateral and multilateral donors and development agencies and partners.</li> </ul>

Source: 2030 Agenda for Sustainable Development, 2015

New Urban Agenda 2016, Hanoi 3R Declaration 2013 and Adelaide 3R Declaration 2017

High Relevance

Moderator Relevance

Low Relevance



## RESOURCE EFFICIENCY AS KEY ISSUE IN THE NEW URBAN AGENDA 2016

- ❖ **Strengthening the sustainable management of resources**, including land, water, energy, materials, forests and food with particular attention to the environmentally sound management of all waste.
- ❖ **Transition to a circular economy** while facilitating ecosystem conservation, regeneration, restoration and resilience in the face of new and emerging challenges.
- ❖ **Promoting the conservation and sustainable use of water** by rehabilitating water resources.
- ❖ **Promote environmentally sound waste management** and to substantially reducing waste generation by reducing, reusing and recycling waste, minimizing landfills and converting waste to energy “**best environmental outcome**”.
- ❖ **Making sustainable use of natural resources** and focusing on the resource efficiency of raw and construction materials.

Source: New Urban Agenda 2016



## RESOURCE EFFICIENCY AS KEY ISSUE IN THE NEW URBAN AGENDA 2016

- ❖ **Establish national and city-level policies that support sustainable infrastructures**, that aims to reduce environmental impacts and drastically improve resource efficiency and productivity.
- ❖ **Promote investment in innovative urban infrastructures**, implementing financial mechanism that result in more efficient use of resources.
- ❖ **Adopt equity as a fundamental principle in all infrastructure developments** link them to practical measures such as new green jobs and employment.
- ❖ **Adopt the new approaches to sustainable infrastructures that are being developed**, material flow analysis to increase awareness in sustainable use of resources and urban metabolism.
- ❖ **Establish challenges and targets for sustainable urban infrastructures**, provide a understandable framework for assessing progress towards more sustainable resource use.

Source: New Urban Agenda 2016

Adapted from [http://web.unep.org/ietc/sites/unep.org.ietc/files/Key%20messages%20RE%20Habitat%20III\\_en.pdf](http://web.unep.org/ietc/sites/unep.org.ietc/files/Key%20messages%20RE%20Habitat%20III_en.pdf)





The Paris Agreement 2015	Ha Noi 3R Declaration- Sustainable 3R Goals for Asia and the Pacific for 2013-2023-, 2013	Surabaya Declaration, 2014	Adelaide 3R Declaration, 2017
Article 5 Reducing emissions from deforestation and forest degradation and sustainable management of forests	- Goal 30 Number of 3R related projects linked to Climate Change and Biodiversity;	-NA-	-Promote optimal use of resources, to preserve natural capital; and -Ecological budgeting
Article 7 Enhance sustainable management of natural resources	- Goal 3 Improve and Implement measures to increase resource efficiency and productivity; -Goal 22 Existence of national 3R task force; and -Gola 17 Improve resource efficiency and resource productivity	-country-country cooperation in exchanging valuable experiences and ideas, transferring knowledge and technologies, including development of collaborative projects on 3R infrastructure development	-Support science and evidence-based policymakers to improve economic prosperity by resource efficiency, sustainable natural resource management; and -Strategies and tools to reduce, reuse and recycle natural resources in production, consumption and other lifecycle stages
Article 11 Capacity building aim to address gap and needs both current and emerging	-Goal 8 Build local capacity of both current and future practitioners to enable the private sector; -Goal 20 Regional, Bilateral and Multilateral approaches, actions and measures on capacity building; and -Goal 19 Enhance national and local knowledge base and research network on 3Rs and resource efficiency.	-a multilayer partnership in order to provide capacity-building for disaster response and strengthen community resilience	-Call upon bilateral and multilateral development banks to provide necessary capacity building and support for instituting circular economic development approaches; and -Develop institutional capacity as well as promoting government and international collaborative research projects

# ROLE OF 3R and RESOURCE EFFICIENCY IN THE PARIS AGREEMENT 2015

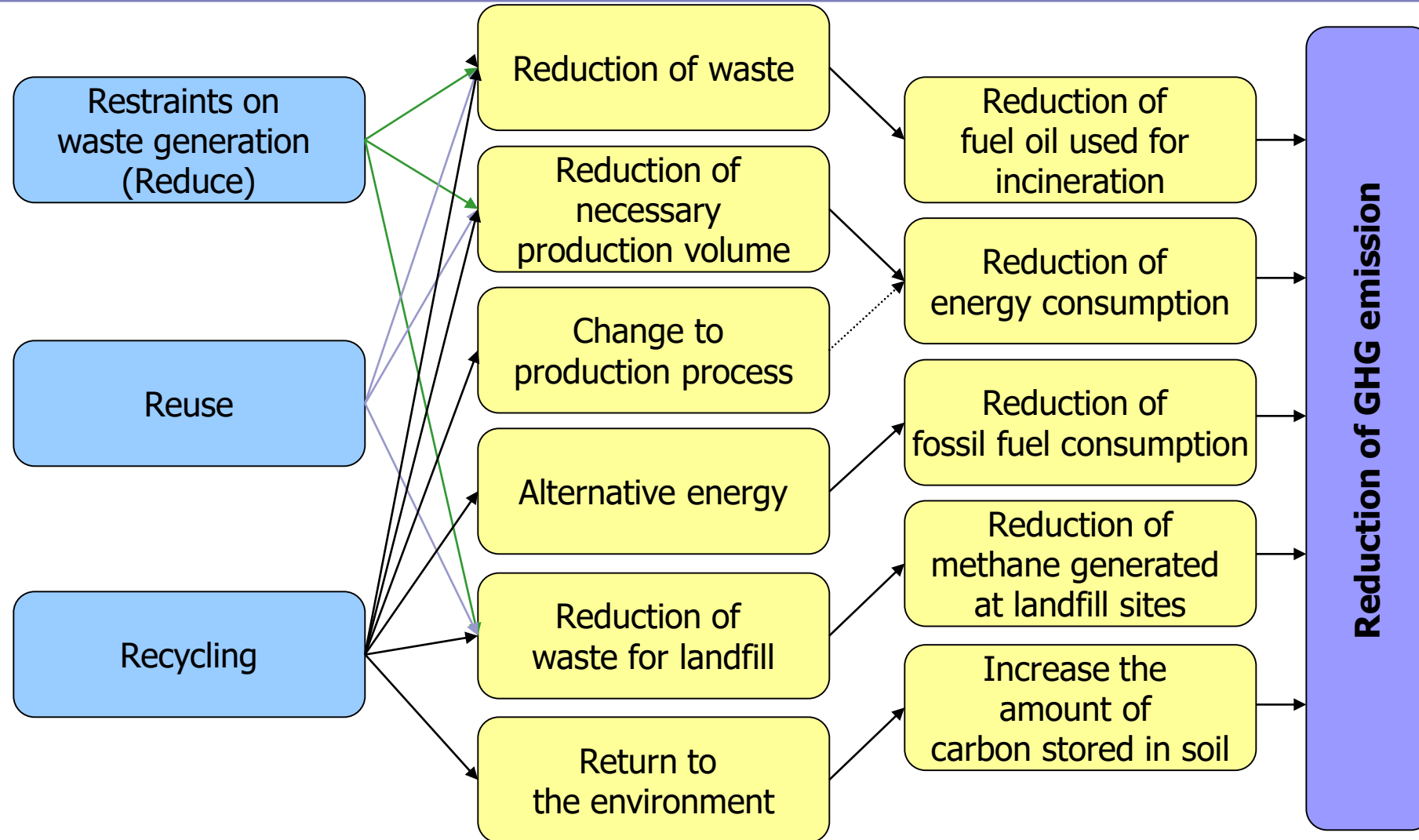
- ❖ **Reducing and recycling waste** are equally as important as other leading climate solutions
- ❖ **Reducing the use of energy** during manufacturing process
- ❖ **Stopping** of landfilling sites
- ❖ **Reduce emissions from waste-** opportunity to sell “improved” waste with better and effective technologies
- ❖ Implement **zero waste solutions** to reduce greenhouse gas emissions
- ❖ Climate solutions move toward a “**Circular Economy**”

Source: The Paris Agreement 2015

Adapted from :<http://www.waste360.com/waste-reduction/what-does-paris-climate-agreement-say-about-waste>



Every production, consumption, and waste management practice generates GHG from the process (directly) and through energy consumption (indirectly), but waste management policies do not often integrate climate consideration?





# Addis Ababa Action Agenda (Finance) (2015) and 3R objectives

Investment	3R Goals related to Investment
Public service	Improvement of public health, water and sanitation through the investment to public services for waste management (G12,13,14,16,24,25,32)
Environment	Reducing waste or efficiently using natural resources Restore ecosystems in reducing pollution by hazard control Combating climate change by reducing wastes (G12,13,14,18,25,26)
Industrialization	Resource and energy efficiency and productivity through recycling and waste to energy Industrial symbiosis and standard such as ISO 14000 (G5, 6, 7, 8, 9, 15, 23)
Technologies	Closing technology gaps to promote recycle and resource efficiency Waste Management Technology with health and safety aspects (G5, 6, 7, 8, 9, 15, 23)
Infrastructure	Waste Treatment Infrastructure including recycling, material flow accounting, energy efficiency schemes (G17)

# Nairobi Mandate (Trade 2016) and 3R objectives

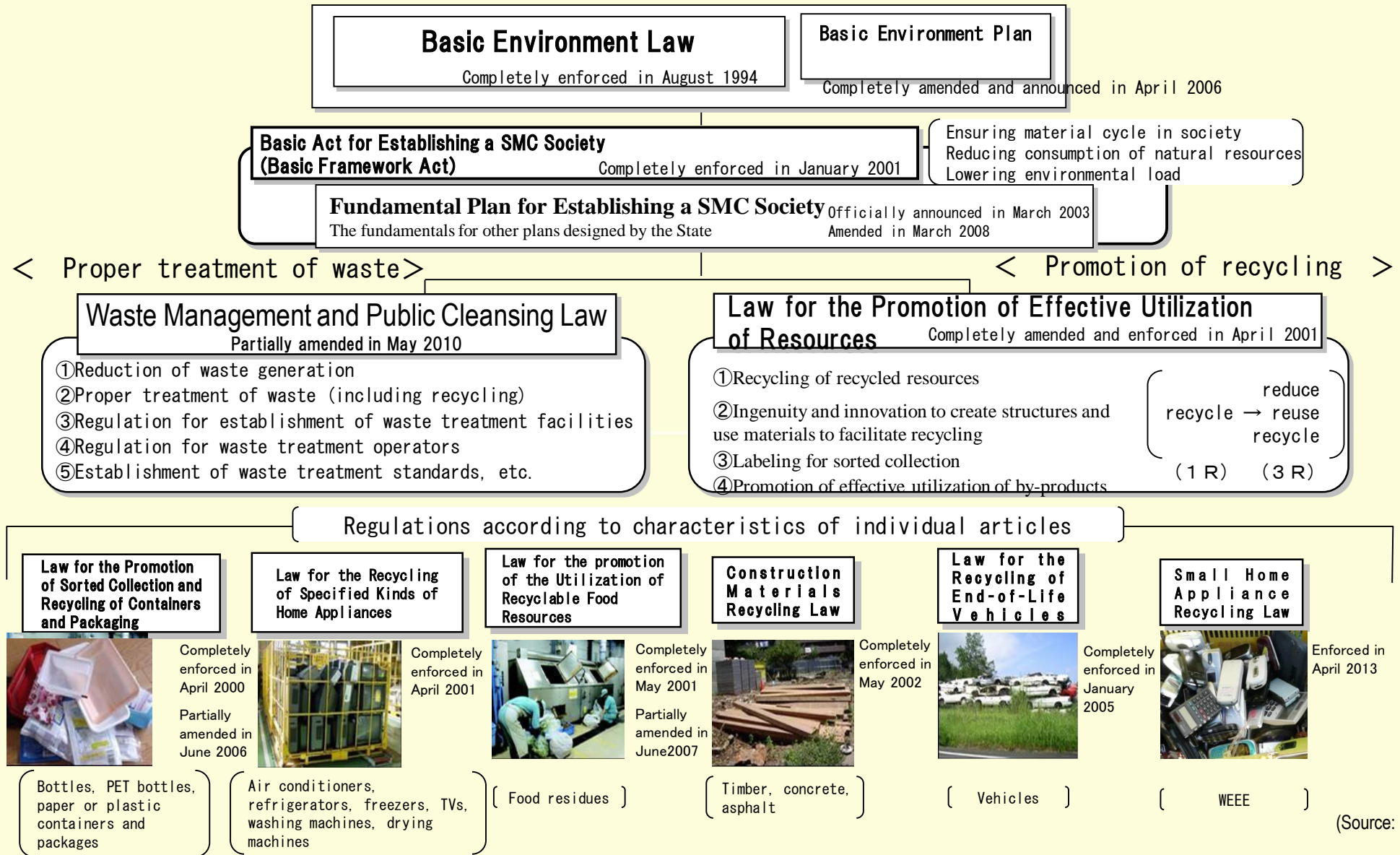
## Nairobi Maakifiano / 33 Goals of Hanoi 3R Declaration

Trade related themes	MSW				Industrial 3R					Rural 3R		New and Emerging waste					3R cross cutting issues																	
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Multi-lateralism															█				▨	█			▨	█	█	█	█	▨	▨	█		▨		
Trade investment					▨	█	▨	▨					█	█	█		█	▨	▨						█	█		█	▨	▨	▨			
Economic transformation and cooperation					▨	█	▨	▨				▨	▨	▨	█	▨	█		▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	
2030 Agenda in Trade				▨	▨	▨					▨			█				▨								█	█	█						

# Nairobi Maakifiano (Trade 2016) and 3R objectives

Trade themes	3R Goals related to trade
Multilateralism for trade and development	Effective taxation to prevent from illegal exploitation of natural resources Greater transparency in commodity markets in tax administration systems to eliminate illegal waste emission and disposal Eco-labels/eco-labeling schemes in trade (G15, 20, 23, 24, 25, 26, 29)
Trade investment, finance and technology	Technology to produce higher quality and greater range of products to reduce loss and wastes Foreign direct investment and trade for environmentally sound technologies. (G6, 13, 14, 15, 17, 23, 24, 26)
Economic transformation and cooperation	Industrialization structural transformation, the development of productive capacities and diversification with EPR (G6, 15, 17, 29)
Implementation and follow-up for Sustainable Development Agenda	Improving living standard toward 2030 Agenda in balancing the economic, social and environmental pillars Eliminating illegal activities of open dumping and pollution (G14, 24, 25, 26)

# Japanese Legal framework for establishing a sound material-cycle (SMC) society



(Source: Courtesy of MoE-Japan)

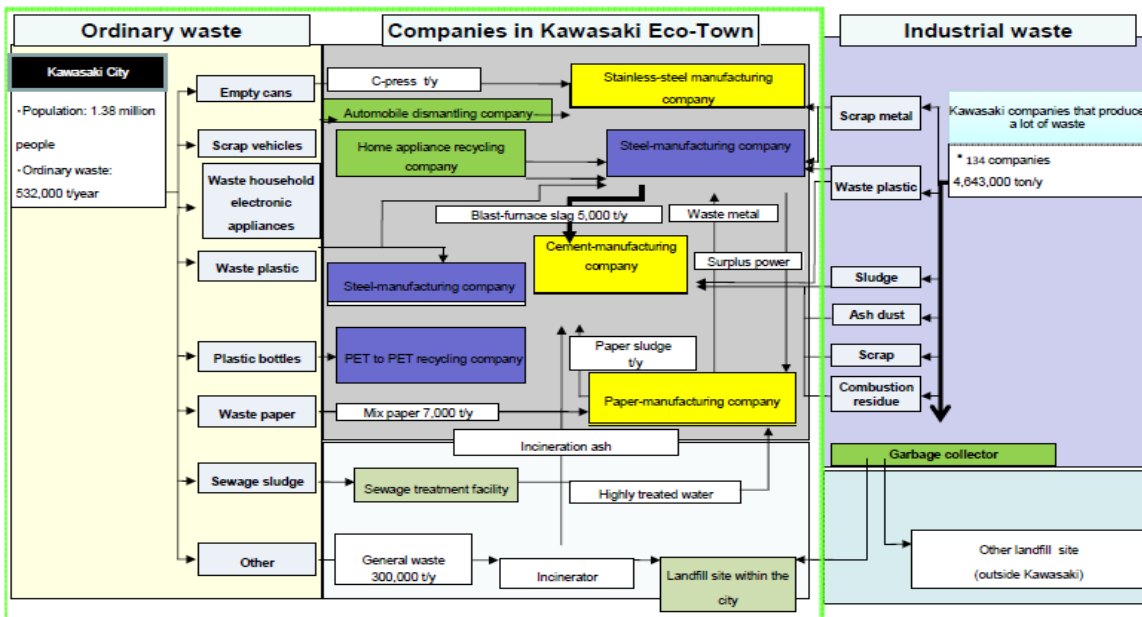
**Green Purchasing Law** (The State takes the initiative to promote the procurement of recycled items)

Completely enforced in April 2001

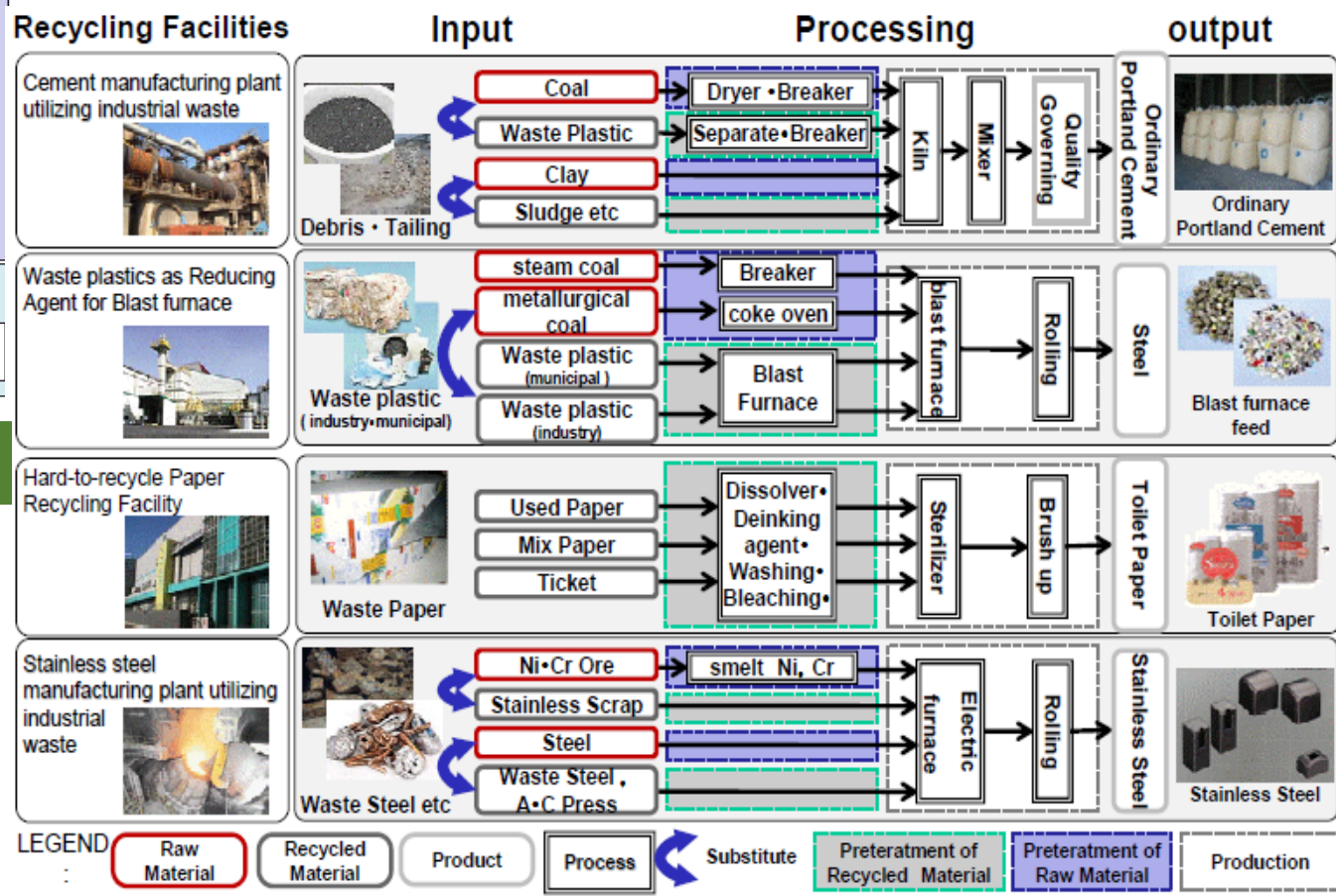




# Kawasaki Eco-Town where economy and environment are integrated to create sustainable business opportunities...



## Formation of a Regional Network for Resource Recycling



### Key Features of Kawasaki Eco-Town

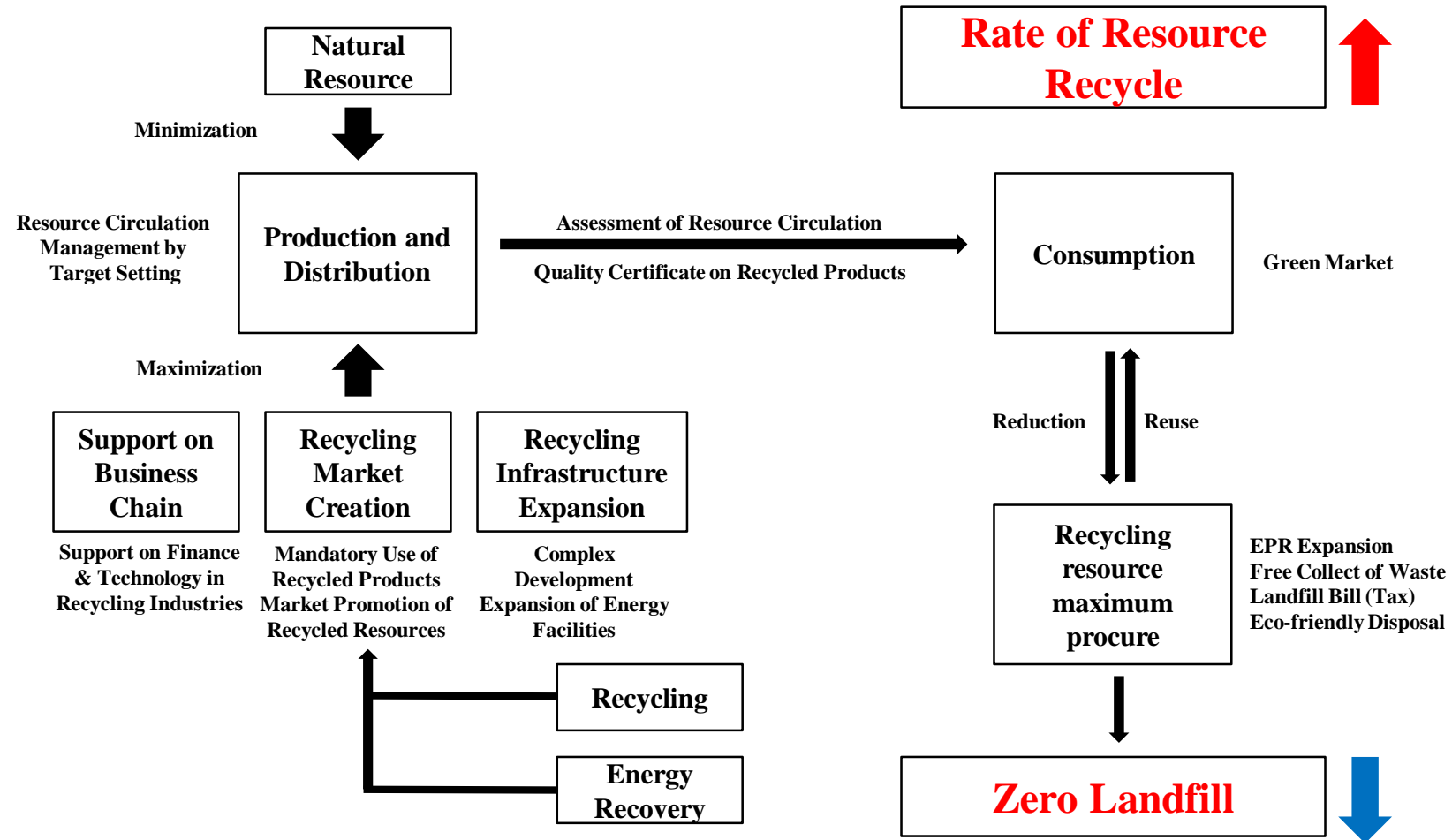
1. revitalization through environmental technologies accumulated in traditional industries
2. Industrial symbiosis through a regional network for resource reuse/recycling
3. local private companies take their own initiative in environmentally sound business operations and contribute to preventing local and global environmental pollution.
4. strong collaboration between R&D industries and private companies on environmental technologies
5. international cooperation in technology transfer

### Quantified material accounting for Symbiosis in Kawasaki

# Korean Prospect of Waste Management in Future

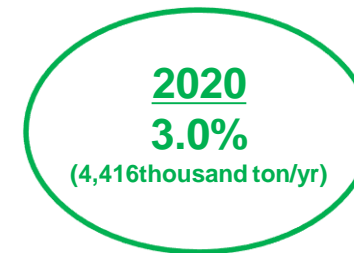
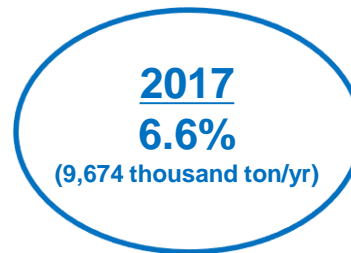
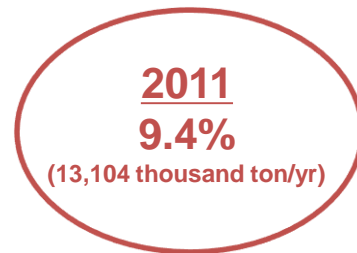
## ▪ New Waste Management Policy

### ▪ Structure of Resource Circulation Society (RCS)



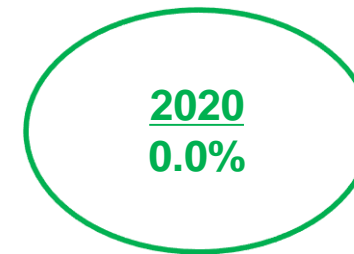
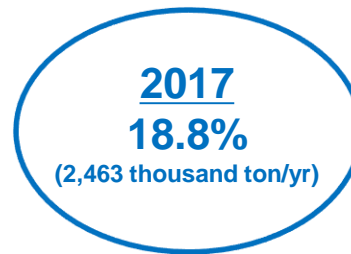
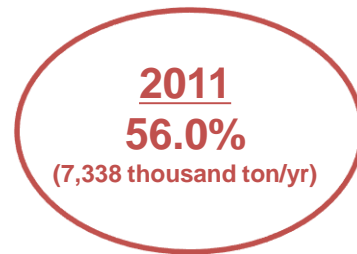
- **New Waste Management Policy (Goals)**

- Landfill Rate of Waste in Overall



※ Landfill rate of household waste of developed country is 0.42% in Germany, 0.97% in Sweden, 3.8% in Japan based on 2010  
So, those countries actually achieved the landfill zero of recycling available resource

- Landfill Rate for Recyclable Waste



# Waste-Freshwater Nexus in India – 3R offer many win-win solutions - business opportunities in waste sector for water security and improved health condition in India



❑ The Energy and Resources Institute in New Delhi has estimated that **by 2047**, waste generation in India's cities will increase **five-fold to touch 260 million tones per year**.

❑ The CSE survey, released earlier this year, shows that **70-80 percent** of India's wastewater was ending up in its rivers and lakes. **"We are drowning in our excreta,"** Sunita Narain, Director of CSE.



## 3R Developments in Asia: Informal Resource recovery and recycling



- ❑ Nearly **80 percent** of the river's pollution is the result of raw sewage. The river receives **more than three billion liters of waste per day**.
- ❑ **Highly contaminated** leachate seeps untreated into groundwater, a source of drinking water....

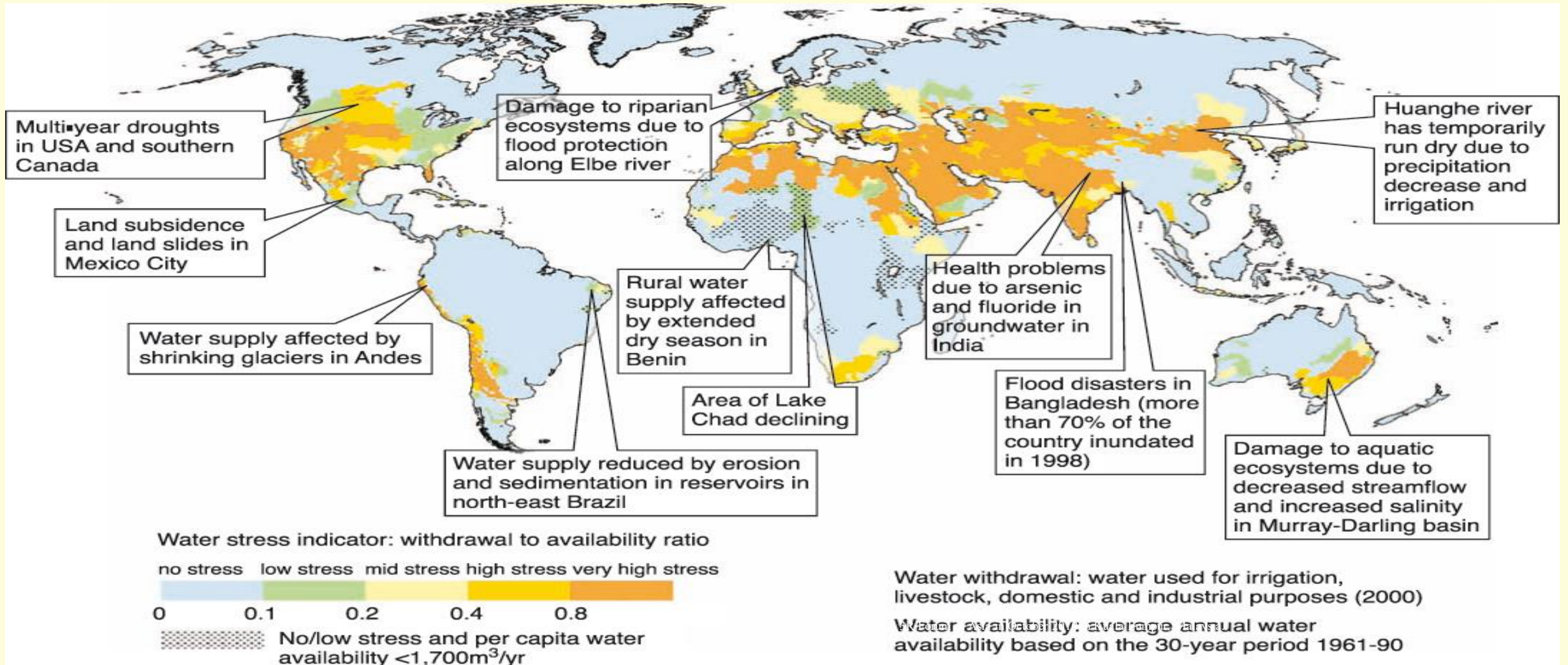
**Clean India Mission (Swachh Bharat Abhiyaan) and 100-smart cities programme by Prime Minister Narendra Modi offer tremendous business opportunities in waste sector for water security of India**

## Need for change and attitudes to view “Waste” as “Resource”

- Link between “waste” and “resource” is not well understood /waste is traditionally thought of having no value.
- Too much emphasis on “downstream” waste management limiting many business opportunities.
- Limited efforts on “upstream” resource management and waste reduction aspects

# Degradation of water resources – it is critical to look into waste-fresh water nexus

By the year 2025, as much as two-thirds of the world population may be subject to moderate to high water stress.



Source: Water Stress Map generated by World Meteorological Organization 2008 based on data available at Alcamo *et al.* (2003)

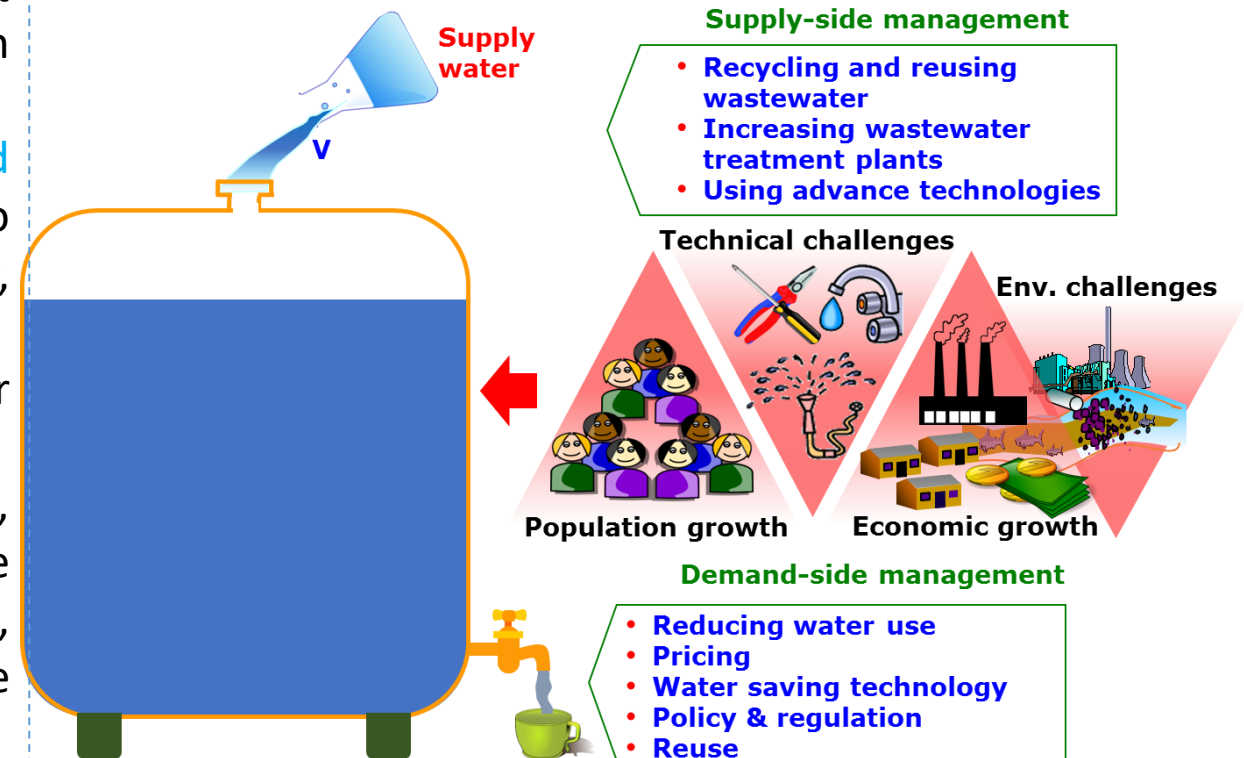


# Response for both Water-Demand and Supply Side Issues

- ❑ Water **drives the economy** (food-energy-transport-manufacturing/production-as well as service sector like tourism) is dependent on water;
- ❑ Water is the resource **used across all supply chains**, but wastewater is the largest untapped waste category in industries;
- ❑ Water security **policies should promote investing and incentivizing the “reduce, reuse, recycle”** systems, and has to cover the holistic urban water cycle inclusive of water supply, treatment, reuse application;
- ❑ Requires **closed-loop system technological innovations** for water saving and reclaiming and reuse of wastewater;
- ❑ **Installation of a recycling and reuse infrastructure** (for example, construction of new wastewater treatment plant, dual pipe system for distributing recycled wastewater in houses, retrofitting of water saving appliances etc.) may also be promoted via these institutions;
- ❑ Expanding a range of **financial services opportunities** -both public funding and private financing; and
- ❑ Solutions for **smart wastewater management** must be socially and culturally appropriate.

Source: Co-Chairs' Summary of Sixth Regional 3R Forum 2015

3Rs in the context of water, offer effective tools for both demand and supply side management



Adapted from Mr. C. Visvanathan presentation, Presented at Sixth Regional 3R Forum in Asia and the Pacific 2015

## Plastics issue – vast implications on coastal and marine environment



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Source: <http://surfingindia.net/>



© Still Pictures

Source of photos: UNEP,

<http://www.unep.org/regionalseas/marinelitter/publications/gallery/default.asp>

- Plastics carry hazardous chemicals in marine environment (e.g., PCBs)
- More than 200 species of animals are known to have ingested plastic debris, including birds, fish, turtles and marine mammals.
- Transfer of chemicals from ingested plastics to biological tissue has been confirmed (bio-magnification).
- Micro-plastics (size < 5 mm) in coastal and marine environments is a critical problem, including bio-accumulation of hydrophobic persistent organic pollutants (POPs) like PCBs, DDTs, HCHs and others from the plastics through ingestion or food-chain (fish to fish and fish to people),

(Source: Prof. Hideshige Takada and 6<sup>th</sup> Regional 3R Forum in AP, 2015)

# Plastics waste and resilience nexus...

## *Unclogging Jakarta's Waterways*

- Estimated population of over 10 million people:
  - 20% of city's daily waste ends up in local rivers and canals
- City administration is dredging its 17 rivers and canals for the first time since 1970s due to waterways being 70% blocked, a central contributor to the city's chronic flooding problems



(Source: The New York Times, October 2016)



# Key messages of 6<sup>th</sup> Forum, 2015 – 3R as an economic industry can provide many potential solutions for building smart and resource efficient cities

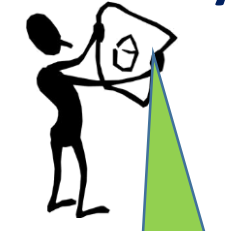
1. In a smart city or **community, science, policy and businesses are closely tied to each other for their own success and survival.**
2. Eco-towns such as Kawasaki, Kitakyushu and others where economy and environment are integrated to create sustainable business opportunities progressively build strong **science-policy-business link and interdependency.**
3. Government policies supporting **R&D-oriented industrial structure and environmental efforts by companies** are critical to foster sustainable urban businesses in 3R areas.
4. Sustainable waste management can lead to highly profitable business opportunities if national, local governments or urban local bodies create enabling policies, institutions, partnerships and investment regime for **expanding market of environmental goods** (equipment, technologies, eco-products, green energy, etc.) and services.
5. **3R as an economic industry offers competitive solutions to many environmental issues and benefits to cities and communities provided 3Rs and resource efficiency are integrated into the macro-economic development policies** (e.g., circular economic policy of China).
6. As 3R and resource efficiency can provide important complement to achieving many of the SDGs and targets, local and national governments should consider **science-based policy making for achieving a win-win situation** (in terms environmental, social and economic benefits) of through 3R solutions.



## R & D/Engineering



### Energy Efficiency



Energy service companies (energy audit, energy efficient system design /equipment manufacturing, specialty engg. services, etc.)

Nano tech market: more than US\$1 trillion



### Green Chemistry & Nano Technology

- cosmetics, baby lotion, computer chips, paints, medical equipments, etc.

### Water Efficiency

- Water saving devices
- distribution efficiency
- Zero leakage,
- Waste water treatment,
- Rain water harvesting, etc.



### Waste-Water-reuse for urban agriculture practices

- Water purification technologies, waste water treatment (ecological engineering: constructed wetlands for pre-treatment of urban run off water & river water)
- Distributed sewage treatment systems, etc.



### Green Buildings

- Engineering, design & construction materials



### Sustainable Transportation

- ITS, IFS, BRT, Railways, walkways & bicycle ways
- Fuel efficiency measures
- Vehicle I/M
- Alternative fuels, PPP for urban transport. etc.



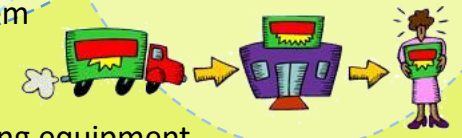
### Bio-economy (high value processing/conversion of biomass)

- Bio-products
- Bio-energy
- Bio-Engineering
- Landscape trimming, etc.



### Sustainable Farming Support Companies

- Efficient water & nutrient management system
- Water & nutrient delivery system
- Biomass energy company
- Energy efficient cultivating, harvesting, hauling equipment
- Compost industry (e.g. Dhaka Community-based Composting System)
- Roof top agriculture (urban greening) for food security



Synthetic fibers/oil, bioplastics, materials from fiber by-products, composts, animal feeds, bio-chemical

### Resource Recovery/3R



CH4 & fertilizer from animal manure /sewage sludge with anaerobic or aerobic digesters, refused-derived fuel (RDF), etc.

## Urban Services and Supplies

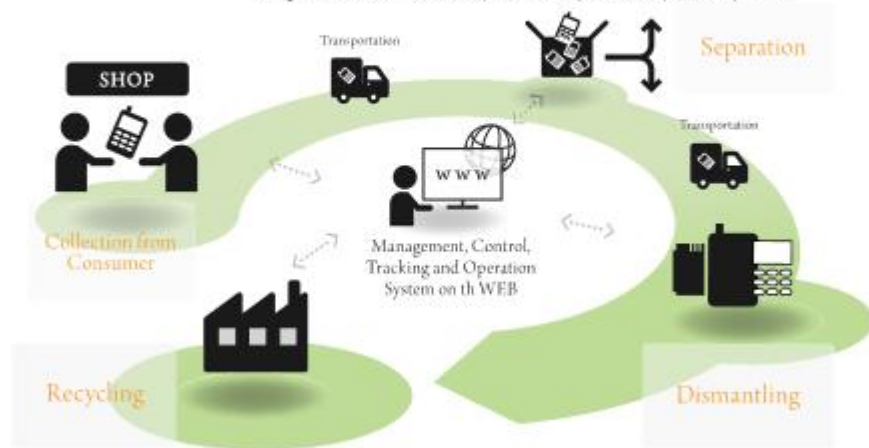
# Economic opportunities in

## waste electrical and electronic equipment (WEEE)

- ❖ E-waste is estimated to reach 50 Mt by 2018, with a growth rate of up to 5 per cent per year.
- ❖ The top three Asia-Pacific countries with the highest e-waste generation in absolute quantities are PR China (6 Mt), Japan (2.2 Mt) and India (1.7 Mt).
- ❖ E-waste can provide an alternative source of raw materials for the manufacturing industry, thus reducing the need for extraction of natural resources and at the same time reducing associated environmental impacts.

### Domestic Mobile Phones Recycling Business in Japan

A Japanese mobile phones carrier has a program to recycle used mobile phones, which are collected directly from end users with the following system. Recycling technology and logistics management from 2,400 collection points in this system are all provided by JEPLAN.



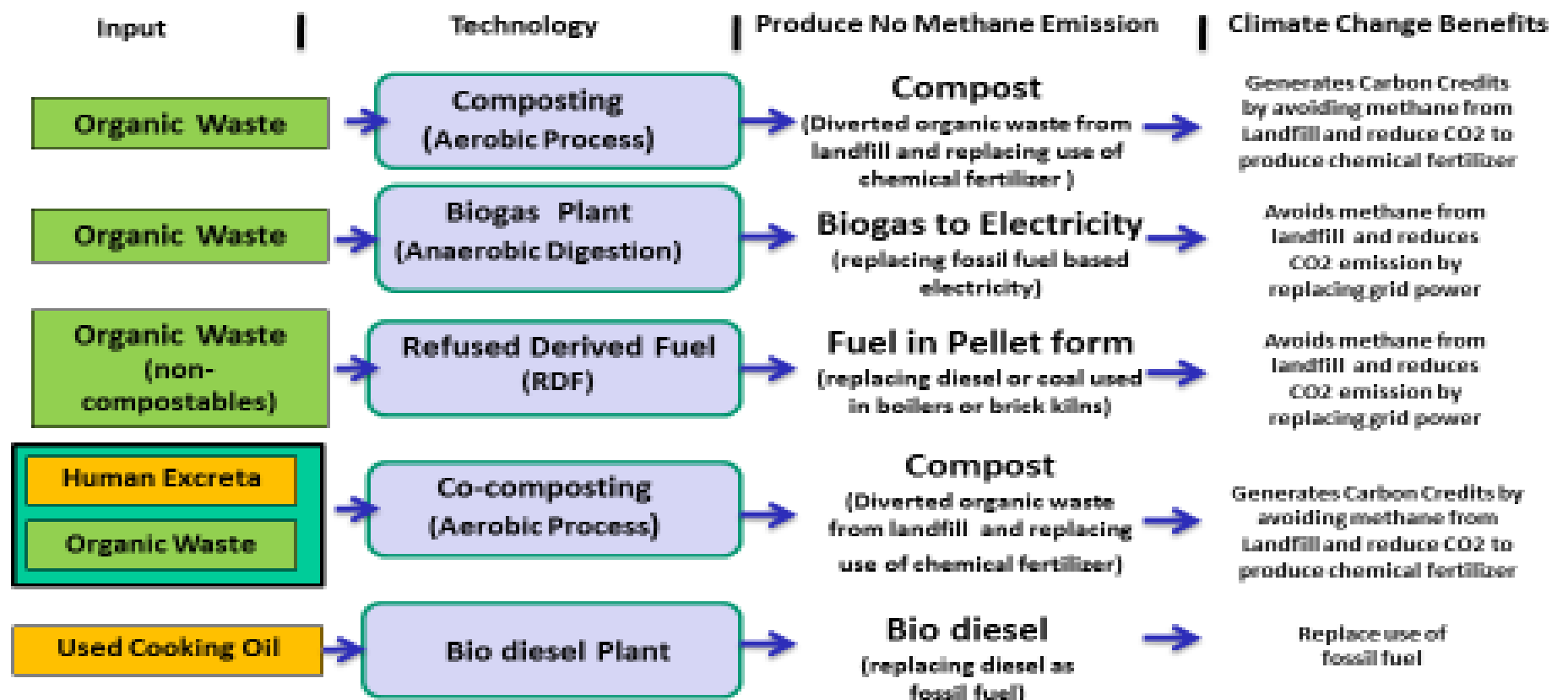
Source: Co-Chairs' Summary of Sixth Regional 3R Forum 2015



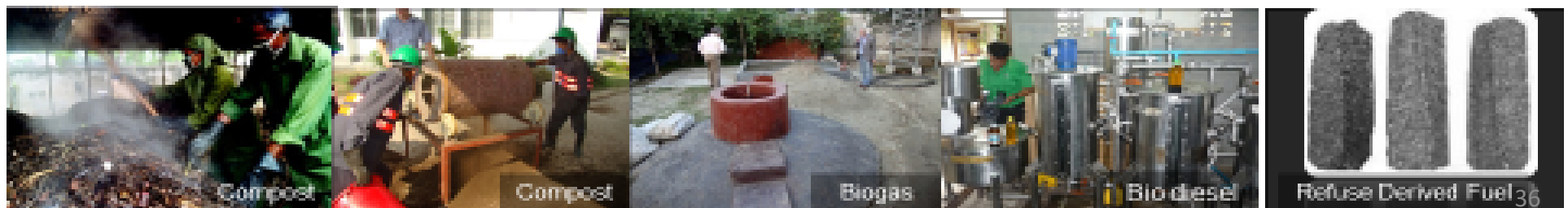
# 3R approach: Waste to Resource to Economy

## Waste to Resource Approach with **Integrated Resource Recovery Center (IRRC)**

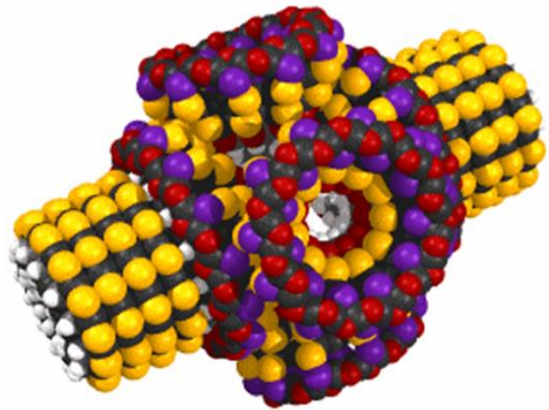
Best Example of Replicate model in Asia-Pacific countries



In Partnership with UNESCAP, Waste Concern is Replicating the Model in Asia Pacific Countries



# Advanced business opportunities in Nanotechnology (waste prevention/treatment/3Rs)



Macroscopic  
Microscopic  
**NANO**  
Molecular

Nanotechnology is the **second coming of the industrial revolution** that seizes the initiative of **technology capital** in the world. One of the main obstacles to achieving the goal will be **to control, reduce, and ultimately eliminate environmental and environmental related problems** associated with this technology; the success or failure of this new use may well **depend on the ability to effectively and efficiently address these environmental issues.**

Nano-remediation has been most widely used for groundwater treatment, with additional extensive research in wastewater treatment.

## Nanotechnology – the promise

(nano market growth to 1 trillion € over the next 10 years)

Fields of application potential:

- **Membrane filtration** (drinking and wastewater)
- **Anti-microbial nanoparticles** for disinfection and microbial control
- **Removal of arsenic and heavy metals**
- **Nano sensors** for water quality monitoring

## Nanomaterials Waste Streams

- Pure Nanomaterials Manufactured (e.g., Carbon Nanotubes)
- Nano By-products with organic or inorganic
- Liquid Suspensions Containing Nanomaterials
- Items Contaminated with Nanomaterials (e.g., Wipes/PPE)
- Solid matrixes with Nanomaterials

## Nanomaterials during disposal/recycling

- Intrinsic Toxicity (for example Arsenic or Cadmium)
- Recyclability Properties such as thermal, mechanical, chemical properties of nano composites.

Source: Musee, N. Nanowastes and the environment: Potential new waste management paradigm. Environment International, 37: 112-128, 2011.

Source: Theron, J.; J. A. Walker; T. E. Cloete (2008-01-01). "Nanotechnology and Water Treatment: Applications and Emerging Opportunities". Critical Reviews in Microbiology 34 (1): 43-69. doi:10.1080/10408410701710442. ISSN 1040-841X. Retrieved 2014-07-29

Source: Dr. Lou Theodore, July 2006 Symposium on Nanotechnology and the Environment: Waste Management of Nanomaterials: Biography

# Advanced business opportunities in Green Chemistry (waste prevention/treatment/reduce)



Green chemistry, also called **sustainable chemistry**, is a philosophy of **chemical research and engineering** that encourages the design of products and processes that **minimize the use and generation of hazardous substances** in the manufacturing process.

## Aiming

- Making chemical products that do not harm either our health or the environment,
- Using industrial processes that reduce or eliminate hazardous chemicals, and
- Designing more efficient processes that minimize the production of waste materials and decreases the amount of non-renewable energy used.

❖ Prevent waste rather than treating it

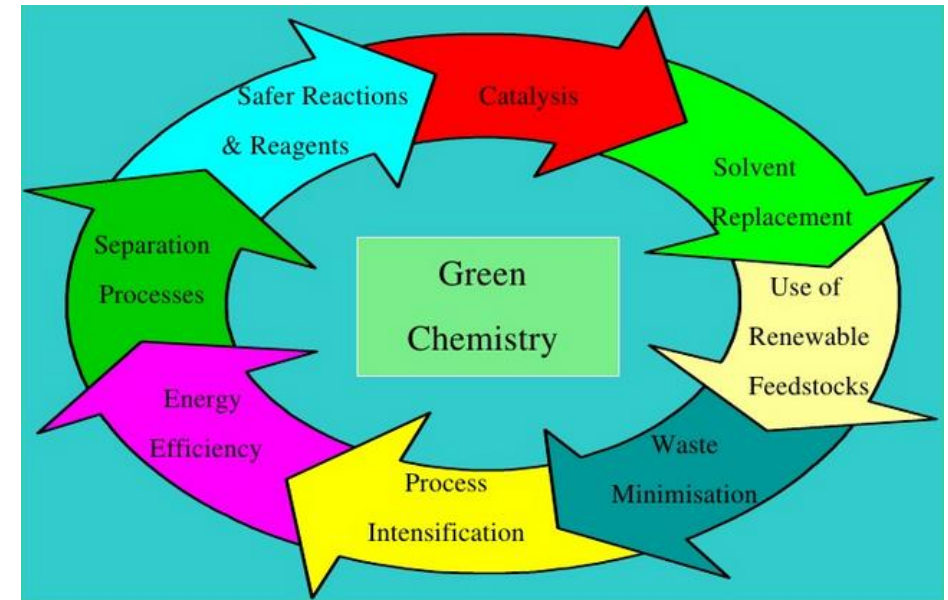
❖ Use renewable source of energy

## Reducing lead pollution

- Replacing lead in paint with safe alternatives, and
- Replacing tetraethyl lead with less toxic additives (e.g., “lead-free” gasoline).

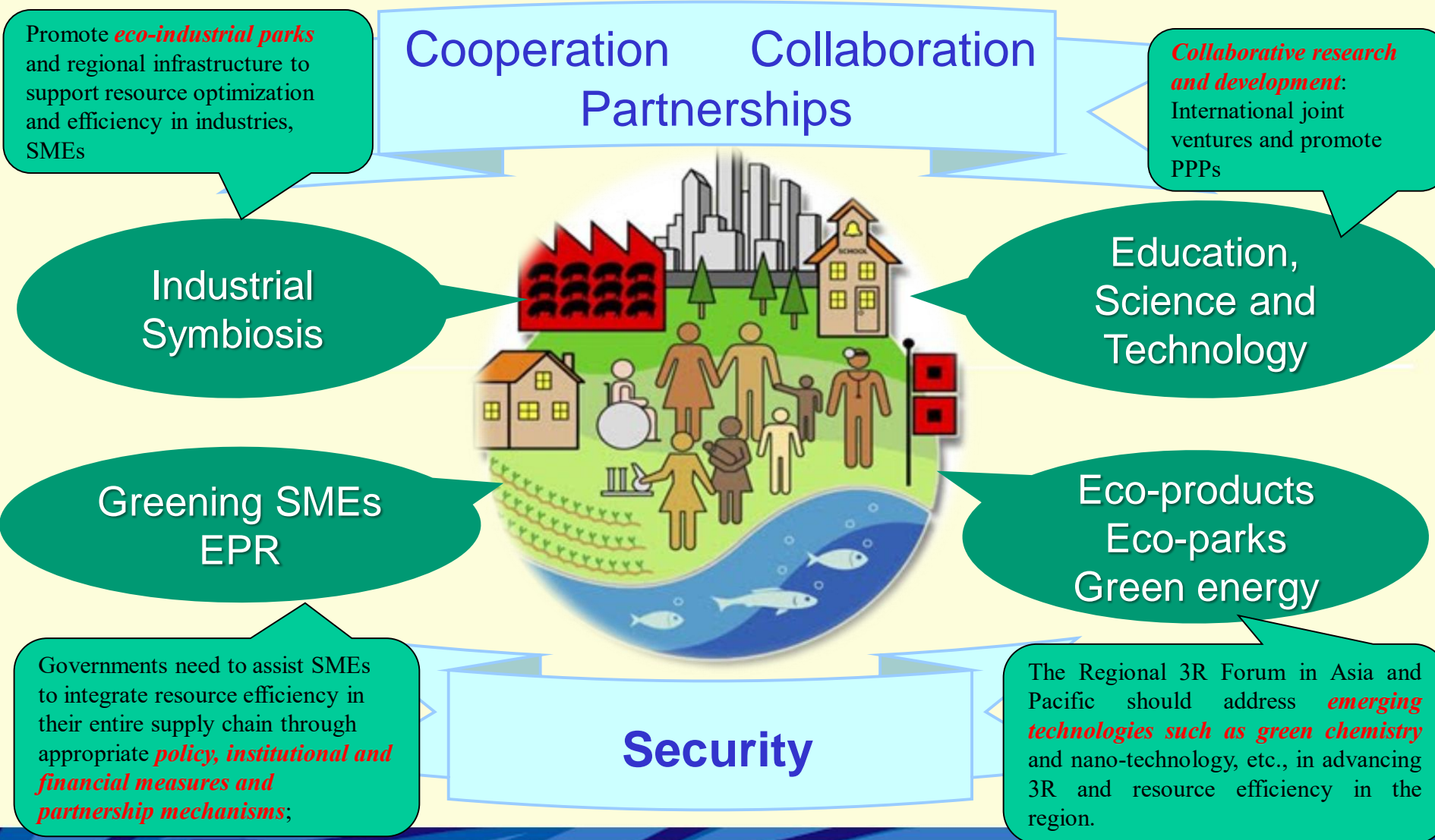
## Chemical foams to fight fires

- A new foam called **Pyrocol FEF** has now been invented to put out fires effectively without producing the toxic substances found in other fire-fighting materials.

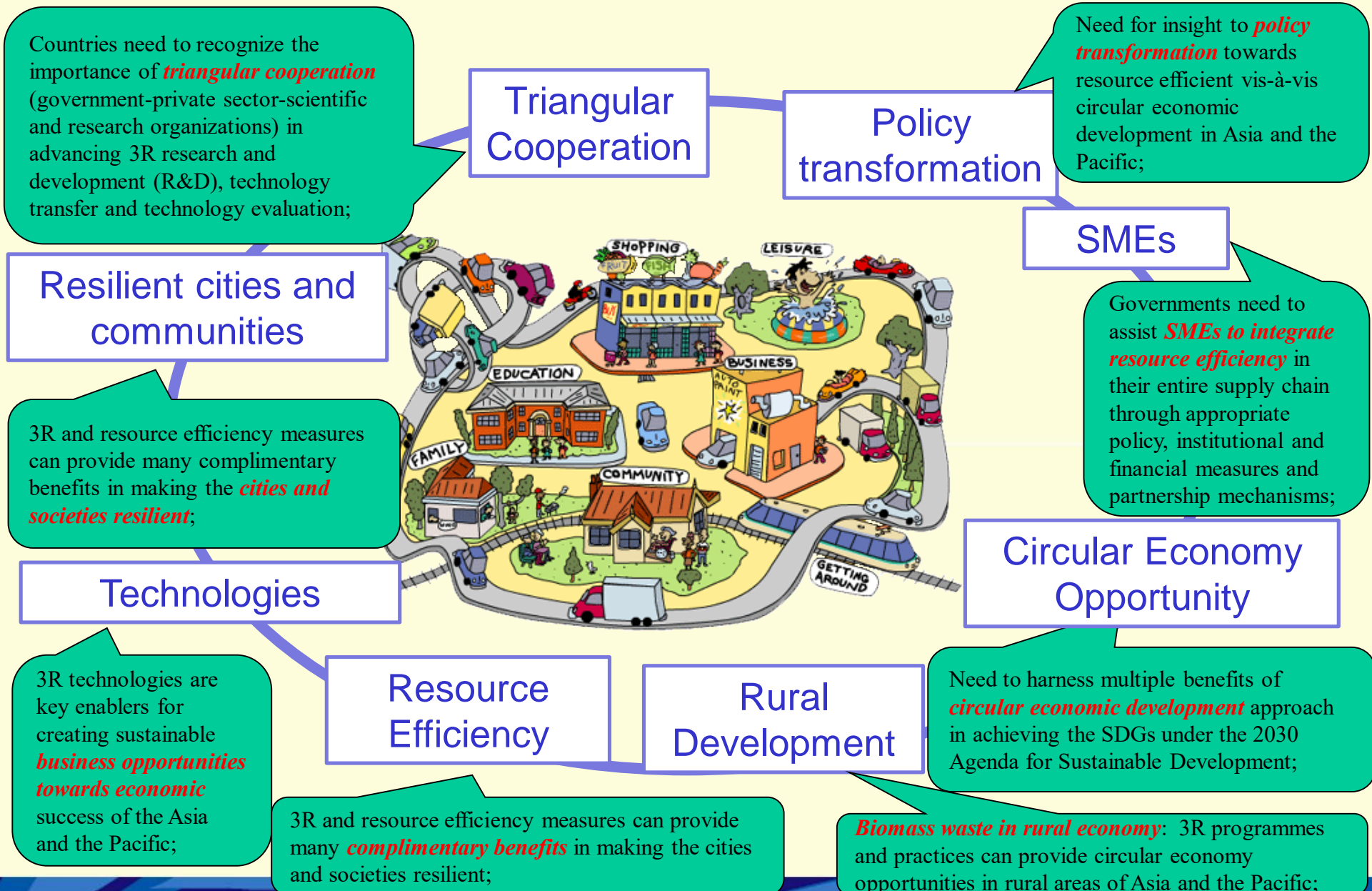


# Key Findings of the 7<sup>th</sup> Regional 3R Forum in Australia (2016)

- Development and Security -



# Key Findings of the 7th Regional 3R Forum in Australia (2016)





# Adelaide 3R Declaration on the Promotion of Circular Economy (2016)

1. Progressively adopt and implement circular economy plans, a **whole-of-value chain approach**
2. Promote eco-industrial parks and regional infrastructure to support **resource optimization and efficiency in industries, SMEs**
3. Enabling policies to promote partnerships, investment atmosphere to **expand markets for environmental goods**
4. **Diversion of waste from landfill to recycling and recovery facilities**; end-of-pipe waste disposal is a sunk cost
5. Drive a **science, innovation and technology based culture in overall policy setting** and development agendas
6. Promote **networks of innovation and national innovation centers** for resource efficiency
7. Promote government and international **collaborative research projects in the areas of strengthening basic statistics, material flow and waste accounting and analysis, and material and waste footprint analysis and resource productivity analysis**
8. Promote **research and development (R&D) oriented industrial structures** to address resource efficiency related problems in industry sector
9. Encourage **industry-industry cooperation** (so that by-products circulate fully in the local production system), **green products and green consumerism, renewable energy programs**
10. Promote **inter-municipal or city-city cooperation** to integrate different production and consumption systems in the region so that resources or by-products circulate among the industries and urban systems within the same region
11. Develop reuse and recycling infrastructure for **environmentally-sound management of disaster waste**
12. **Bilateral/multilateral cooperation** for human resource development, financing, knowledge and technical know-how

Source: Adelaide 3R Declaration adopted at 7<sup>th</sup> Regional 3R Forum in Asia-Pacific, 2-4 November 2016, Adelaide, SA, Australia



# Welcome to 8th Regional 3R Forum in Asia and the Pacific

*Theme: Achieving Clean Water, Clean Land and Clean Air through 3R and Resource Efficiency – A 21<sup>st</sup> Century Vision for Asia-Pacific Communities*

**Venue:** Hyderabad, India (tbc)

**Date:** 18-21 December 2017 (tbc)

**Co-organizers:** Ministry of Urban Development (MoUD), Government of India; Ministry of the Environment, Japan; and UNCRD

