

# Chair's Summary

## Third Meeting of the Regional 3R Forum in Asia

### Technology Transfer for promoting the 3Rs – Adapting, implementing, and scaling up appropriate technologies

5-7 October 2011, Singapore

#### I. Introduction

1. The United Nations Centre for Regional Development (UNCRD), the National Environment Agency of Singapore (NEA-Singapore), and the Ministry of the Environment of the Government of Japan (MoE-Japan), jointly organized the Third Meeting of the Regional 3R Forum in Asia from 5 to 7 October 2011 in Singapore. The Forum was supported by the United Nations Industrial Development Organization (UNIDO), the German International Cooperation (GIZ), the Institute for Global Environmental Strategies (IGES), Asian Productivity Organization (APO) and the Economic Research Institute for ASEAN and East Asia (ERIA). It was attended by approximately 150 participants, comprising government representatives from twenty three countries, including ten member countries of the Association of Southeast Asian Nations (ASEAN), Bangladesh, People's Republic of China (hereinafter, China), India, Japan, Republic of Korea (hereinafter, Korea), Maldives, Mongolia, Timor-Leste, and five Pacific island countries (Fiji, Kiribati, Palau, Samoa, and Solomon Islands), Subsidiary Expert Group Members of the Regional 3R Forum in Asia, international resource persons, representatives from various UN and international organizations, NGOs, representatives from the private sector, and local observers from Singapore. As a side event of the Forum, the NGO communities from Japan and Singapore shared and discussed various experiences in promoting the 3Rs towards a zero waste society.
2. The Asia-Pacific region is facing immense challenges in coping with the rapidly increasing volume and changing characteristics of urban and industrial wastes. The quantum of waste is increasing significantly due to rising population, and increasing consumption and per capita waste generation. Apart from municipal solid waste (MSW), emerging waste streams such as electronic waste (e-waste), health-care waste, plastic waste, construction and demolition waste, and household hazardous waste have become matters of concern. These wastes, if not managed properly, will have a significant adverse impact on human health, ecosystems, and resources in the region. It is also important that technologies which are chosen can be managed safely.
3. The Regional 3R Forum in Asia was established in November 2009, with the objective of becoming a knowledge networking platform for disseminating and sharing best practices, technologies and tools on various aspects of the 3Rs. The third Regional 3R Forum in Asia, focused on the key theme "Technology Transfer for promoting the 3Rs – Adapting, implementing, and scaling up appropriate technologies," with an objective to address one of the key priorities highlighted in the Tokyo 3R Statement. More specifically, the Meeting aimed to: (a) address 3R technologies, including technologies that reduce virgin material input as well as those which encourage the use of recycled resources; (b) address and identify policies and institutional frameworks for the promotion of 3Rs technologies, including those that contribute to attracting investment and promoting business to business technology transfer; (c) address and identify opportunities for collaborative actions and

partnerships including bilateral, multilateral and regional supporting mechanisms to promote 3R technology transfer.

4. In addition the Meeting discussed the “Recommendations of the Singapore Forum on the 3Rs in Achieving a Resource Efficient Society in Asia,” which is a comprehensive set of recommendations covering a wide range of sectors and issues relevant to the 3Rs and resource efficiency. This is based on the fundamental understanding that the 3Rs is intrinsically linked with resource efficiency in a variety of sectors such as agriculture, industry, urban development and energy, among others, towards transitioning to a resource efficient and green economy.

## II. Opening Session

5. Extending the sincere appreciation of the Government of Japan to the international community for their cooperation and support in the aftermath of the Great Earthquake and Tsunami Disaster in East Japan, Mr Satoshi Takayama, Parliamentary Secretary of the Environment, Japan, underscoring the 3R principles, he informed meeting participants that disaster waste is being segregated into various categories such as hazardous waste and recyclables as much as possible in order to recycle. Addressing the theme of the Third Meeting, he emphasized that efficient use of resources and reduction of waste generation are crucial to economic growth and sustainable development in an increasingly resource-deficient world. Technologies have great potential to play a major role in this respect. However, if left to the market, environmental and 3R technologies would not be widely used. Emphasizing the need for legal and institutional frameworks for the promotion of the 3Rs technologies, he introduced the Fundamental Law for Establishing a Sound Material-Cycle Society in Japan, which has led to a resource productivity increase by 38%, cyclical use rate increase from 10% to 14% and a reduction on the final disposal amount by 60% between the years 2000 and 2008.
6. Ms. Chikako Takase, Acting Director, UNCRD, emphasized the significance of the 3Rs, which offers environmentally friendly alternatives for dealing with the increasing generation of waste. They offer an opportunity to reap a number of potential benefits/co-benefits, such as GHG reduction, waste minimization, energy security, resource conservation and efficiency, protection of land and freshwater resources and public health. Moreover, the Forum offers the opportunity to contribute to the preparation process of Rio+20. One of the two main themes of Rio+20 is “green economy in the context of sustainable development and poverty eradication”. The 3Rs are inherently important and strategic in this regard. The 3R policies and programs can offer potential solutions and benefits for cities and countries to decouple resource usage and the associated environmental damage from the economic growth, thus contributing towards a green economy. Introducing the International Partnership for Expanding Waste Management Services of Local Authorities (IPLA), which was launched at CSD-19 in May 2011, she encouraged the participating countries to take full advantage of the Regional 3R Forum as well as IPLA for successful international cooperation and partnerships in building required scientific and technological knowledge base in 3Rs in the region. She also underscored the need to build the required capacity of local authorities and municipalities by fostering multi-stakeholder partnerships at the local level to deal with growing waste management issues.
7. In his opening speech, Mr Andrew Tan, CEO of the National Environment Agency, Singapore, conveyed on behalf of all participants their heartfelt wishes to the families affected by the Fukushima Crisis and expressed confidence that the Japanese nation would emerge stronger and more resilient

from the episode. He underscored the growing awareness of the 3Rs among countries in the region, alongside Asia's phenomenal economic growth in the last few decades. Due to growing affluence, the rise in living standards, and emergence of more mega cities, more waste will arise in the future. At the same time, we live in an era of growing resource scarcity, concerns over the environment, and climate change that requires that we optimize resources used in production, make better use of our waste as resource, develop the right incentives for our businesses and people to practice the 3Rs, and promote 3Rs that make sense. With the First and Second Meetings of the Regional 3R Forum in Asia having raised the level of understanding on achieving a green economy, resource efficiency and a sound material-cycle society, the Third Meeting will build upon the progress made by examining Technology Transfer for Promoting the 3Rs – Adapting, Implementing and Scaling Up Appropriate Technologies, with discussions centred on the promotion of 3R technologies, the use of recycled resources, and the prospects for technology transfer, and with the market demand as a driving force.

8. In his opening speech, H.E. Dr Vivian Balakrishnan, Minister for the Environment and Water Resources, Singapore, mentioned that food, water, air, raw materials, minerals and energy will all become rate limiting factors for human development. Therefore we need a paradigm shift in the way we look at waste, treating it as a resource rather than just something to be thrown away, and implementing the concept of the 3Rs. This presents opportunities in environmental engineering, but for this to happen, people must be green conscious, companies must be socially responsible, government must invest in infrastructure, the appropriate technology must be invented and shared, and the economic incentives must be correct. In promoting 3R technologies, suitable policies and strategies to encourage the development and transfer of technologies need to be in place, and appropriate technologies adapted to suit each community's needs. Countries will also need to build partnerships with industries to develop cost-effective solutions in waste management. As an initiative to further promote dialogue and partnership, Singapore will hold the inaugural CleanEnviro Summit Singapore (CESS) from 1 to 4 July 2012, bringing together thought leaders, policy makers and practitioners to network and exchange knowledge on the challenges, opportunities and innovative solutions for a clean environment. Held alongside CESS is the inaugural WasteMET Asia, Asia's premier exhibition and conference for waste management and environmental technologies and solutions.
9. Delivering the keynote address, Dr. Luis F. Diaz, Chair, Task Group on Developing Countries, International Waste Working Group, remarked that the 20<sup>th</sup> century will probably be remembered as the age of: unrestrained consumption of resources and large contamination of our environment. From 1960 to 1970s: Attention to side effects of industrial and economic growth (*Silent Spring* by Rachel Carson and *The Closing Circle* by Barry Commoner and in the 1990s: Green Chemistry and Sustainable Development. Since 1987, many areas around the world have adopted the concept of sustainable development (as well as 3Rs): Different interpretations; different stages of implementation. Industrialized countries rely on: reduction at source, reuse, material recovery, energy recovery and sanitary landfilling (mostly 3Rs) while middle income industrializing countries use limited "formal" material and energy recovery and some sanitary landfilling, and low income countries use relatively high informal material recovery and mostly open dumps. In industrialized countries, the solid waste management industry, during the last 60 to 70 years, has evolved from on-site incineration by private individuals and businesses; some scavenging was conducted during collection and disposal. Residues were disposed indiscriminately on land and burned or into bodies of water. First "modern" sanitary landfill opened in Fresno, California in 1937. In 1991, the US EPA promulgates new criteria for sanitary landfills to be put into practice by the States. In 1996, new source performance and emission guidelines requiring that landfill gas be collected were introduced. LFG (landfill gas) to energy plants were built and energy tax credit legislation passed to encourage

the development of LFG projects. In the Asia-Pacific Region, the population has been estimated at about 3.75 billion people; the region is experiencing a rapid rate of urbanization; the generation of solid waste has also increased; the majority of countries in the region still depend on the disposal of their solid wastes in land. Global trends include: rapid population growth; high level of resource and energy use in industrialized countries; very large industrialization in large emerging economies (BRIC); increasing affluence, high levels of consumption, and; relative ease of global trade. Due to the global trends, we now have climate change due to combustion of fossil fuels; loss of biodiversity and ecosystems; loss of fertile land and growing quantities of waste generation. Keys to implementing successful solid waste management programs include: political will to solve the problem of waste management; development of realistic plans: appropriate technology (site selection, facility design), availability of resources (financial and human) for sustainable operations; availability of uses/markets (product quality); establishment of sound final disposal sites; and development of comprehensive education programs at all levels.

### **III. The 3R technologies for resource efficient society and economy**

10. Decoupling of economic growth from resource consumption is a necessary condition to achieve a resource efficient and sustainable society and economy. Technology transfer and the 3R paradigm is an excellent vector for this purpose. The implementation of 3R technologies must be considered as a continuous improvement process.
11. The contribution of 3R technologies to a resource efficient society and economy goes beyond solid waste management. Originally, the 3R paradigm - Reduce, Reuse and Recycle focused on the product level and a considerable amount of attention was given to recycling. However, in order to move towards a resource efficient society and economy, a shift of focus towards entire product life cycles must take place. Although this shift is already in progress in some areas, some countries have yet to initiate this process.
12. Applied at the industry level, the 3R paradigm can be understood as: (i) reduction of resource inputs (including energy, water and raw material), (ii) use of renewable sources of energy and material, and (iii) re-design of products to lower the amount of material they contain and the energy they use during their lifetime.
13. Government is the driving force behind this paradigm shift in elaborating and implementing adapted measures and strategies. The interest and needs of all stakeholders, including government, private and informal sector and the local community are considered when applying 3R technologies. Sound Material Cycle Society and the Circular Economy are good examples of governmental initiatives promoting 3R technologies.
14. Generally, many 3R technologies have proven to be beneficial from the social, economic and environmental points of view. These benefits include creation of green jobs, higher resource efficiency that generally provide direct financial and climate benefits. Given that the large portion of municipal solid waste in Asian countries is organic, contribution to GHG reduction could be significant if it is treated using appropriate technologies. Replication and scaling-up of these successes are still representing a challenge in some developing countries.
15. The identification of the required 3R technology is based on the local specificities. Robust baseline data based on resource flow analysis is needed to develop sound 3R technology plans. Successful 3R technologies should thus be adapted before being implemented. It applies especially for Small Island

Developing States (SIDS) where land and resources are limited. The selected technology must only be implemented if it is economically profitable, beneficial for the environment and adapted to the local social conditions.

16. The involvement of the private sector as well as the ownership by the recipients of the 3R technology transfer is a key factor ensuring the sustainability of an action.
17. Practically, some examples of 3R technologies applicable to various industrial sectors include nanotechnology, organic/green chemistry, biotechnology, information technology and renewable energy. 3R technologies also include low cost solutions such as better housekeeping.
18. On a regional level, Asian countries should eliminate open dump sites and move to sanitary landfills equipped with landfill gas collection systems, thus contributing to the reduction of Green House Gas (GHG) emissions. The high content of organic matter in Asian waste should foster the production of compost that can be used as organic fertilizer instead of chemical substances.
19. South to South knowledge sharing is a strategy for small countries to get valuable information applicable to their own circumstances. Adequate technical and human resource capacity development for collection and safe treatment of toxic and hazardous wastes, including household waste, medical waste, and e-waste must be conducted.
20. The development of eco-industrial zones and clusters could give greater emphasis in encouraging circular use of resources, where wastes and by-products of one enterprise becomes a resource for another. In addition, development and transfer of environmentally sound 3R technology represent a great opportunity to create environmental support service companies. Enterprises specialized in environmental related services represent an essential sector of activity that must be promoted and supported in developing countries.
21. Developing countries have the potential to leapfrog over old, outdated technologies and adopt innovative technologies based around the 3Rs. Continued monitoring and dissemination of the best practice technologies to implement the 3Rs approach will help to ensure that the 3Rs will take their rightful place in a resource efficient society and economy.
22. Biomass waste in rural areas represents a huge, largely neglected, opportunity to recover energy and raw materials from waste. Economic, social and environmental benefits can be achieved by utilizing biomass waste (such as reduced GHG emissions, reduced deforestation for firewood, and replacement of extraction of virgin materials, improvement of soil condition).
23. The need for developing and continuous updating of hazardous waste inventories is an important first step towards managing these waste streams. It is important to develop waste generation factors and substitutes to hazardous substances in order to manage the waste problems in developing countries.

#### **IV. Policy and institutional framework for promoting transfer of 3R technologies**

24. With a major shift in paradigm of solid waste management from waste management into resource efficiency, there is an increasing opportunity in market development for recycling and environmental technologies. Technology plays an important role in promoting 3R practices. Effective policies that support the adaptation, implementation and diffusion of 3Rs technologies would contribute towards the national development goals as well as the Millennium Development Goals (MDGs), mitigating climate change and improving the overall environment and economy of developing countries, and also contribute to the transition to a green economy in the context of sustainable development and

poverty eradication.

25. Although there are many successful voluntary initiatives from members of the private sector such as take-back of used products, market economy and voluntary initiatives from the industrial sector alone cannot be a major driving force for successful technological transfer and diffusion both within a country and between countries. Experience of Japan shows that a comprehensive policy framework such as EPR (Extended Producer Responsibility)-based recycling policy covering total environmental costs of life cycle of products is needed to make the business and technologies viable in the market of the 3Rs. Such policies shall ensure low cost, no free riders, and cost recovery to maximize the benefits from the 3R practices.
26. Policies are needed to create conditions that enable the private sector to be active in the 3R technology markets. Similarly, policies are essential to address social concerns such as poor working conditions and serious environmental pollution observed often in small-scale recycling activities in developing Asia. The experience of Kawasaki city shows that a combination of industrial and environmental policy are useful in establishing industrial infrastructure for recycling and the market needed for successful 3R technology introduction.
27. Governments need to select and introduce a set of policy instruments, addressing the specific contexts of the countries, in order to promote 3R technology transfer, adaptation and diffusion. Potential policy interventions may include: taxes and charges (e.g. pollution fees, landfill charges, volume-based waste fees, carbon taxes, environmental taxes, luxury goods taxes, value added tax); subsidies and tariffs (e.g. export and import tariffs on energy-intensive products, removal of fossil fuel subsidies, rebates for green procurement); standards and target setting ( e.g., mandatory targets specified in cleaner production or energy efficiency laws, voluntary targets by business associations); information-based policies (independent certification, eco-labelling, product content and production information, independent testing and verification, producer and consumer education, and social marketing); and technology research and development.
28. Successful cases of technology transfer and adaptation on the 3Rs in Asia are often characterised by low-cost, labour-intensive technologies and the transferring agent taking some responsibilities of operation, and through FDI (foreign direct investment), PPP (public-private partnership), and BOT (build, operate and transfer). Appropriate policy framework and legislation will support successful adaptation and operations of 3R technologies and facilities by creating greener jobs, avoiding nuisance, and providing information on proven technologies.
29. Cost-effectiveness of the 3R technologies currently available are mostly based on economies of scale. Thus, small countries such as SIDS face increasing cost due to technological gaps associated with the relatively small quantity of waste and the available treatment technologies. In view of the economies of scale and other local conditions and limitations such as land scarcity, regional or sub-regional cooperation for recycling non-hazardous general waste could be a possible option that can be explored, with specific attention to SIDS.
30. Challenges and barriers associated with technology transfer and adaptation are mainly those related to the lack of proper and reliable information, data, and communication for proper assessment including policy concepts, local conditions, local business risks, waste compositions, size of markets, major stakeholders, estimation of technological capacity and operation, expected environmental impact, and amount of collected recyclables. Thus, 3R policy shall be pursued along with improved information gathering at the national and local levels. Credible and transparent information on successful and failed pilot projects shall be documented and made available regionally. Decentralized information sharing is needed to make it available to support the decisions of local operators and

implementers of the 3R activities.

31. In addition to the attention given to recycling technology, further collaborative research as well as strengthened international financial schemes should be geared to address reduce and reuse aspects, and prevention of hazardous waste generation.
32. As priorities of technology development for the next decade, the meeting noted the following: proper treatment and reduction of bio-waste and organic waste, waste-to-energy, sanitary landfill, e-waste management, and ELV (end of life vehicles) management.
33. Government initiatives as well as NGO activities for training and skills development are encouraged to enable individuals engaged in informal 3R activities to be integrated into formal waste management activities and be provided with decent working conditions. Social policies need to be enforced to prevent children's engagement in recovery activities at disposal sites.
34. At the global level, the Basel Convention is promoting shift in emphasis from waste management to resource management as reflected in the theme of the tenth meeting of the Conference of Parties which is on "Prevention, Minimization, and Recovery of Waste" and the new Strategic Framework, 2012-2021. Implementation strategies would focus on partnership and synergies at the regional and international levels.

## **V. Enabling market conditions to foster business-to-business technology transfer**

35. There is a strong need to create and expand markets for environmentally friendly products/eco-products produced using 3R technologies, which would give strong signals encouraging wider use of 3R technologies by private sector. The market is the key to growth of 3Rs technologies. Markets will drive technology development, adaptation and adoption.
36. Most economies rely on the free market system to ensure the efficient use of resources. However no market operates perfectly. This creates room for governments to intervene by formulating necessary market-based mechanisms and policies that favour promotion of the 3Rs through fostering business-to-business technology transfer.
37. Technology suppliers could be encouraged to make efforts to make 3R technologies affordable by reducing costs, for instance by investing in research and development for low cost technologies.
38. Four elements to create market and encourage investors:1) infrastructure development and its accessibility; 2) development of regulatory framework and policy guidelines including financial instruments favouring the 3R market 3) recognition of businesses active in the 3Rs by way of green awards/certificates; and 4) awareness creation among consumers. Thus, governments should drive strong information campaigns to create demand and therefore encourage investment.
39. Companies implementing 3R technologies, green procurement policies, or other 3R initiatives should be acknowledged via a grading system based on their performance. For example, different grades could be assigned to companies attaining different stages or levels of the 3Rs. Consumers are a key driver to generate markets for green products.
40. Provision of one stop shop service should be considered for catering to 3R entrepreneurs such as national 3R focal points/information clearing house and organizing study tours and demonstration projects. The focal points can also help emerging entrepreneurs acquire funding support from international organizations.
41. Healthy competition in waste management services and recycling activities may create favourable

market conditions for promoting 3R technology development. Fast tracking of licensing and permits will facilitate the transfer of 3R technologies and business opportunities.

42. Business associations and employers organizations could play key roles to make information on 3R technology more accessible to the SMEs. These organizations could also play a major role in multistakeholder discussions involving government, employers, workers, academics and communities to create green jobs.

## **VI. The 3Rs in a green economy**

43. The meeting noted a number of good initiatives in the region at national policy on the promotion of 3Rs and resource efficiency such as: Japan's comprehensive laws and programs towards establishing Sound Material Cycle Society; Circular Economic Policy in China that aims to integrate economic, environmental, and social strategies to achieve high resource efficiency as a way of sustaining improvement in quality of life within natural and economic constraints; Korea's green growth initiative and National Resource Recirculation Master Plan (2011-2015); 3R Fund in Singapore; development of national 3R strategies in Viet Nam, Bangladesh and Indonesia; Energy Efficiency Forum in the Philippines; to mention a few. At the regional level, some of the initiatives include creation of the 3R Knowledge Hub, Asia Resource Circulation Research Group which aims to build required information and knowledge base to facilitate sound policy development at local and national level.
44. However, in many Asian countries the prevailing production and consumption patterns represent a major challenge as they are not adequately oriented towards resource efficiency, resulting in growing quantities of wastes that must be managed for final disposal. The meeting also noted that as industrial economies continue to grow, the region will generate more toxic chemicals and hazardous wastes, mostly coming from industrial, agriculture, and manufacturing processes, but current waste management policies and programs are not effectively linked with resource conservation and ecosystem protection.
45. Governments, of both developing and developed countries, could move away from fiscal stimulus packages that directly or indirectly promote unsustainable production and consumption, by earmarking most of the stimulus funding for environmental technologies and infrastructure such as eco-towns, eco-industrial zones, and knowledge centers. It is therefore important that national governments play a catalytic role in fostering technology transfer and diffusion to deal with both existing and new emerging issues such as e-wastes, plastics in marine environment, and oil and lubricants, among others.
46. The 3Rs could provide a useful basis for Asian countries to make a transition to more resource efficient economies. The 3Rs is intrinsically linked with resource efficiency in a wide range of sectors in such as agriculture, industry, transport, energy, forestry, fishery, urban development, among others, towards transitioning to a resource efficient economy, thereby green economy. In this regard, 3Rs need to be mainstreamed in national development agenda, including environmental, social, and economic plans, policies, strategies and programs.
47. 3Rs, with emphasis to resource efficiency measures, could help Asian countries in a number of ways such as: tackling local environmental problems (land, water, air); GHG reduction; national energy security; preserving natural capital and avoiding resource conflicts; improving economic competitiveness of firms and business operations; minimizing waste disposal costs (as end-of-pipe

disposal is a sunk cost with no financial return); developing new business opportunities; green jobs (in areas of resource recovery, recycling, WtE schemes, green chemistry, biotechnology, nanotechnology, and renewable energy); and pursuing social benefits, which are essential elements in a green economy.

## VII. The way forward

48. The countries should work towards realizing a firm commitment and agreement to effective 3R promotion in Asia. Towards this end, the Forum unanimously agreed on the *Recommendations of the Singapore Forum on the 3Rs in Achieving a Resource Efficient Society in Asia (see Annex)*, which is a comprehensive set of recommendations covering a wide range of issues relevant to the 3Rs and resource efficiency, which builds upon the Tokyo 3R Statement and subsequent deliberations during the meetings of the Regional 3R Forum in Asia, and urges Asian countries to transition to a green economy.
49. The International Partnership for Expanding Waste Management Services of Local Authorities (IPLA), a CSD registered partnership, could be a potential vehicle to foster technology transfer, by linking the local authorities and municipalities with engineers and experts, private sector, and the international community to bridge the currently prevailing technology and information gap. IPLA could be strengthened to address the needs of local authorities and municipalities that are the key actors in sustainable waste management. IPLA could take benefit of other existing knowledge networks such as 3RKH. In the meantime, efforts should also be made to enhance effectiveness and outreach of such existing initiatives.
50. A dedicated fund for the promotion of the 3Rs to encourage resource efficiency, resource conservation, waste minimization, and recycling projects is needed. A regional, multi-donor 3R Fund similar to the Climate Investment Funds, should be initiated specifically for preparation and implementation of national 3R action plans.
51. New and emerging waste streams such as electronic waste, plastics in the marine environment, oil and lubricants require special national and international actions aiming at a high rate of recovery region-wide. These waste streams need to be addressed through appropriate programmes and environmentally sound technologies to promote material and energy recovery (WtE). There is a need to strengthen the capacities of existing regional/sub-regional organizations in addressing these issues in Asia and the Pacific countries, in particular in assisting the SIDS.
52. Green procurement policies promote market demand for eco-products and therefore drive the adoption of 3R technologies. It is therefore needed to encourage the adoption of green procurement policies in the public as well as in the private sectors. This requires adequate cooperation among relevant government ministries/agencies (e.g., Ministries of Environment and Ministries of Industry) and the private sector.
53. Relevant ministries, in collaboration with international organizations and aid agencies, should facilitate pilot and demonstration projects in key sectors to generate awareness among the SMEs and other stakeholders on the beneficial aspects of the 3Rs and resource efficient technologies.
54. International cooperation and technology transfer should not only focus on the application of mature technologies, but also support research for the development of new technologies suitable in the local context that are practical, scalable and replicable, in addressing new and emerging waste streams, including R&D on the economic life and recyclability of electronic products. The project

formulation should take into account the scale of projects that are attractive enough for businesses to make necessary investments.

55. In order to enhance and streamline the 3R market, countries may consider developing and harmonizing industrial standards for 3R products within the region or sub-region.
56. Countries should put efforts in enforcing occupational health and safety standards for workers engaged in 3R activities, especially those in the informal sector. Provision of training and capacity building to formal and informal sector workers should be considered to enhance their capacity to play an effective role in 3R activities.
57. Countries should consider incorporating 3R concepts at all levels of education. In addition, develop specific 3R curricula for professionals and practitioners who can cater to the private and government sectors.
58. Governments should promote policies and programmes favourable to business to business technology transfer with due consideration to safeguarding intellectual property rights (IPR) and patents.
59. Governments could consider Extended Producer Responsibility (EPR) systems in collaboration with the business and manufacturing sectors in order to ensure proper management of end-of-life products and to provide incentives for product redesign, as appropriate. Countries may further explore the potential of EPR at the national and regional level as appropriate.
60. Governments should develop 3R infrastructure and services, such as eco-towns, eco-industrial zones, and knowledge centers, through public-private partnerships (PPP).
61. Regional and international cooperation should be strengthened to address the transboundary movement of used products and waste related to the 3Rs, taking into account the provisions of the Basel, Stockholm and Waigani Conventions.
62. Considering the important contribution that 3R policies, programmes and technologies could make in achieving resource efficiency in all of the essential sectors in a *green economy* (industry, service, agriculture, transport, energy, construction, tourism, forestry, fisheries, waste management, and water, among others), there is a need to consider a sectoral approach in mainstreaming the 3Rs.
63. The United Nations Conference on Sustainable Development (UNCSD), Rio+20, to be held in Rio de Janeiro, Brazil, from 4 to 6 June 2012, will focus on two themes: (a) green economy in the context of sustainable development and poverty eradication; and (b) institutional framework for sustainable development. The Chair's Summary would be submitted as regional input to Rio+20 for discussions and deliberations to address 3Rs need in a broader context encompassing integrated approach and resource efficiency towards the green economy.
64. Delivering the concluding remarks, Mr. Andrew Tan, CEO of the National Environment Agency, Singapore, emphasized the role of economic incentives, market demand, and policy frameworks in the promotion of the 3Rs. He also articulated the concept of industrial symbiosis, where the recycling of waste from one industry complements the resource needs of another, which stimulates the demand for eco-products and the capacity of eco-industries. He opined that governments can foster this development by encouraging the establishment of standards, codes of practice, and guidelines. Mr Tan also pointed out the importance of sound frameworks and dynamic, coordinated approaches in the response towards new and emerging wastes. To make the next leap towards a more resource-efficient society, a paradigm shift towards design and production processes in the approach to the 3Rs is needed.

65. The meeting welcomed the official announcement of the Ministry of Natural Resource and Environment (MONRE) of the Government of Viet Nam for hosting the Fourth Regional 3R Forum in Asia in Hanoi.

## **Recommendations of the Singapore Forum on the 3Rs in Achieving a Resource Efficient Society in Asia**

### **(Annex to the Chair's Summary)**

#### *- Preamble -*

**Resource efficiency** aims to minimize: net resource inputs (raw materials, energy, water, etc.) to unit production and services; and pollution and waste at the same time. By improving resource efficiency, countries can tackle local environmental problems, address climate change, ensure energy security, preserve natural capital, improve economic competitiveness, and pursue social benefits. **The 3Rs** calls for a shift of focus from end-of-pipe solutions and disposal practices, and promotes waste minimization and cyclical use of materials in the economy. The 3Rs and resource efficiency, together would envisage a thriving society that exists within nature's resource constraints and its ability to assimilate waste – ultimately contributing to the promotion of green economy<sup>1</sup>.

**Recommendations of the Singapore Forum on the 3Rs in Achieving a Resource Efficient Society in Asia** is a comprehensive set of recommendations, covering a wide range of sectors and issues relevant to the 3Rs and resource efficiency. It is based on the fundamental understanding that the 3Rs is not just about waste management, but is intrinsically linked with resource efficiency in a wide range of sectors such as agriculture, industry, and energy, among others, towards transitioning to a resource efficient and green economy.

It is also envisaged that the Recommendations of the Singapore Forum would provide a meaningful basis for advancing the 3Rs principles and technologies towards achieving a resource efficient society in Asia.

#### *- Recommendations of the Singapore Forum on the 3Rs in Achieving a Resource Efficient Society in Asia -*

### **A. 3Rs in the Urban/Industrial Areas**

#### **1) 3Rs in municipal solid waste (MSW)**

With the rapid growth rate of urban population and with the growing economy, the Asian region will be generating an immense amount of MSW in the coming decades. While the quantity of MSW is increasing, the composition of MSW is getting more diverse and complex due to presence of new

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<sup>1</sup> While there is no unique, internationally agreed definition of the concept of “green economy,” the concept broadly carries the promise of a new economic growth paradigm that is friendly to earth's ecosystem and can also contribute to poverty alleviation (UN DESA, UNEP and UNCTAD, 2011). Green economy is “an economy that not only improves human well-being and lessens inequality but also reduces environmental risks and ecological scarcities,” i.e., an economy that is “low carbon, resource efficient and socially inclusive” (UNEP 2011).  
*Third Meeting of the Regional 3R Forum in Asia, 5-7 October 2011, Singapore*

and emerging waste streams such as e-waste, chemical and hazardous waste. Wide scale open dumping of waste without being properly segregated causes a wide range of health and environmental problems adding a critical dimension to the urban management issues, such as water supply, sanitation, wastewater treatment, sewerage system, and drainage.

While the primary focus should be laid on waste prevention and minimization in the first place, MSW offers a significant source of material recycling, renewable energy, waste-to-energy and composting with involvement of low cost and affordable technologies and integrated systems. By utilizing waste as resource, MSW could bring various co-benefits (e.g., GHG reduction, waste-to-energy, improvement of the soil condition, employment creation by thriving recycling industry, etc.). Countries could consider the following.

- Introduce economic instruments that provide incentives to reduce the waste (e.g., volume-based collection fee systems, landfill taxes, and deposit-refund schemes).
- Utilize organic waste as a valuable resource with an objective to reduce landfill requirements; resource efficiency and energy recovery; and reduction of GHG emissions. To reap these co-benefits, promote segregation of MSW at source and minimization of household hazardous waste that will ensure safe handling, biodegradability and more effective use.
- Going green can be profitable through the expanding market of environmental goods and services. Government authorities should promote recycling markets which could reduce landfill areas and investment on waste processing plants.
- Set up institutional and financing mechanisms and required infrastructure for recycling specific materials, with the involvement of citizens, recycling industry, and end-users of the recycled products. Promote entrepreneurship to stimulate waste recycling as a business.
- When introducing recycling systems/technologies, assess economic and technical feasibilities, adaptability, as well as the market demand of a particular recycled material or product to be made from waste.
- As a third of the world population is affected by water scarcity, the critical importance of improving water availability and use, which is central to all the other dimensions of sustainable development, should not be ignored. Government authorities should put concerted efforts to develop waste policies linked to issues of freshwater resources.
- In harmony with international labour and health standards and required working conditions, develop policies, programmes, and regulatory measures to ensure decent work and livelihood security of workers in the informal sector by mainstreaming them into modernized, safe and environmentally sound waste management systems.
- Introduce, implement and enforce quality, occupational and environmental health and safety (EHS) standards for recycling processes and recycled goods to ensure safety and health of the workers as well as consumers/users. This will also help in establishing a market that is under regulation.

## 2) 3Rs in industrial sector

The industrial sector is a major contributor to the Asian economy and its contribution to GDP is growing. The region's industry sector is characterized with micro, small and medium enterprises, which typically lack required resources, environmentally friendly technologies, and skilled human resources. This results in consumption of large amounts of input raw material, energy and water, together with large amounts of waste and pollution per unit volume of production. In many Asian countries, current industrial policies and regulations do not adequately take into account resource efficiency as a measure to prevent and minimize waste and pollution, including GHG emission in the first place. The countries could consider the following.

- Develop policies and provide necessary support and incentives that encourage the private sector to implement resource efficiency measures. Such efforts will be advantageous for the industries, including small and medium enterprises (SMEs), as it will result in cost savings and better international competitiveness. Through the coordinated effort of the Ministry of Environment, the Ministry of Industry, and other related ministries, mainstream resource efficiency into the national industrial policies and programmes, set specific targets and create legal frameworks.
- Governments should promote recycling of waste from one industry as a resource for another (industrial symbiosis), through, for example, supporting the establishment of eco-industrial parks, science parks, and research/university networks. More R&D, knowledge sharing, including technology transfer among various actors is needed to enhance learning and knowledge transfer on 3R related technologies.
- Develop local capacity, including capacity of employers' organizations and trade unions, to implement energy and resource efficient technologies in industry sector, including capacity for conducting technology assessments/evaluations of appropriate technologies as well as the capacity for practicing such technologies.
- Specific curricula should be developed for universities and business schools to provide the next generation of practitioners with the necessary technical skills and future business leaders and policymakers, in-depth knowledge to help foster green industry.
- Encourage market development for eco-products through various incentives that ultimately promote sustainable production and consumption.
- Encourage industries to not only address their own environmental practices but also that of their associated suppliers and vendors to ensure that the environmental standards they have adopted internally are consistently maintained/followed by their suppliers, thus promoting the greening of the supply chain.
- Encourage the establishment of industry code of practices that provide broad guidelines to firms for a management approach that addresses issues of resource efficiency, thereby environmental sustainability, as part of core business decision making. Implement awareness campaigns to sensitize industries and private sector on corporate social responsibility (CSR).
- Develop proper classification and inventory of hazardous waste as a prerequisite towards sound management of hazardous waste.

### 3) New and emerging wastes

New and emerging waste streams, such as e-waste and plastics in the marine environment require special attention, and must be addressed through appropriate programmes, multi-stakeholder partnerships and environmentally sound technologies to promote material and energy recovery. There is a growing concern on plastic waste, which is not biodegradable, accumulating in coastal and marine environment, causing threats to the marine species and ecosystem. The countries could consider the following.

- Consider addressing plastic and hazardous waste issues as part of integrated coastal zone management (ICZM), through coordinated efforts among local government and administrative authorities, coastal zone management authorities, and tourism authorities.

Large amount of e-waste generated in the world ends up in a few numbers of developing countries for the purpose of reuse, refurbishment, recycling, and recovery of precious materials. E-waste has become an important health and environmental issue, as recycling electronic goods involves exposure to dangerous heavy metals such as lead, mercury, cadmium etc. which can be toxic to human and ecosystems. The countries can consider the following.

- Establish proper institutional infrastructures for collection, storage, transportation, recovery, treatment and disposal of e-waste at regional and national levels. Such infrastructure should be integrated into existing waste collection schemes. Develop public-private-community partnerships to encourage the establishment of formal e-waste recycling and disposal enterprises.
- Establish appropriate regulatory procedures to control illegal exports of e-waste and to ensure their environmentally sound management. In this regard, proper testing of used or end-of-life electronics and electrical equipment prior to export should be encouraged to declare the presence of hazardous components as well as the functionality of the equipment.
- Introduce awareness raising programmes and activities at all levels on issues related to health and safety aspects of e-waste in order to encourage better management practices.
- Establish formal standards, certification systems and licensing procedures for recycling and disposal enterprises to ensure safety and environmentally sound processing of e-waste.
- Implement 'extended producer responsibility' (EPR) mandating producers, importers and retailers with the cost of collecting, recycling and disposal of e-waste. Thorough investigation into the problems and challenges of implementing EPR should be conducted to overcome any obstacles.

## B. 3Rs in the Rural Areas

### 4) 3Rs in the agricultural sector

Though agriculture is the key economic sector in many Asian countries and utilizes around half of the land area, biomass waste generated in the agriculture sector remains largely underutilized. Given the poverty, food security, and issues like heavy dependence on carbon fuels in many Asian countries, the efficient utilization of agriculture as well as livestock waste can provide a number of opportunities, and socioeconomic and environmental benefits. The countries could consider the following.

- Improve infrastructure to reduce losses in the entire food supply chain (production, post harvesting and storage, processing and packaging, distribution), thereby increasing the quantity and improving the quality of products that reach the consumers.
- Promote efficient use of biomass and reuse of agriculture biomass waste involving minimal or no processing. For example, rice husks can be applied directly for soil mulching instead of burning, to achieve a number of co-benefits (reduced GHG emission, food security, low labour input and investment).
- Promote recycling of agriculture biomass waste and livestock waste. Where appropriate, waste-to-energy technologies, including anaerobic fermentation, should also be explored through partnerships at various scales, which will not only contribute to energy security but also to sustainable livelihoods in rural areas.
- Promote, where appropriate and feasible, the production of high-value products from biomass. The use of other organic waste together with biomass could also be promoted in order to produce value-added products, such as animal feed.
- Assess economic and technical feasibilities, adaptability, as well as the market demand of a particular product to be made from biomass and livestock waste (e.g., compost).
- Promote agricultural policies in harmony with the 3R principles. Through the coordinated effort of the Ministry of Environment, the Ministry of Agriculture, Ministry of Energy, and other related ministries, develop national waste management strategies, policies and programmes with effective link to sustainable agriculture (including livestock and fisheries), food security, and rural employment generation.

## C. Cross-cutting Issues

### 5) Partnerships for moving towards zero waste

Moving towards zero waste is inherently a multi-stakeholder process, which calls for partnerships within and between communities, businesses, industries, and all levels of government. With the diversification of waste streams as well as the growing presence of chemical and hazardous and toxic elements in the general waste stream, the complexity and daunting nature of waste

management challenges therefore require a more extensive collaboration and partnerships among those stakeholders. Partnerships combine the advantages of the private sector (dynamism, access to financial resources and latest technologies, managerial efficiency, and entrepreneurial spirit, etc.) with social concerns and responsibility of the public sector (public health and better life, environmental awareness, local knowledge and job creation, etc.). The countries could consider the following.

- Promote partnerships as the basis for sustainable waste management and as an alternative in which governments and private companies assume co-responsibility and co-ownership for the delivery of solid waste management services.
- Governments should develop appropriate policy frameworks and conducive climate for fostering partnership that provide win-win solutions for public utilities and the private sector. Such partnerships could lead to savings in municipal budgets, while the private sector may use this opportunity to convert waste into environmentally friendly products and energy.
- Use international partnerships and mechanisms, such as the International Partnership for Expanding Waste Management Services of Local Authorities (IPLA), effectively, as means to share knowledge, technologies, best practices and models in the area of 3Rs, integrated solid waste management, and resource efficiency.

#### **6) Enhance knowledge base(KB) & research network**

Governments can play an instrumental role in linking the scientific community and the private sector to encourage collaborative relationships, interactive learning, information exchange, and coordination in the area of the 3Rs and resource efficiency, which will contribute to stimulating innovation and transfer of knowledge and technologies to achieve international competitiveness. By supporting and strengthening such networks, Governments can, in turn, receive suggestions and input from these key stakeholders for developing and improving national policies and programmes in the area of the 3Rs/resource efficiency. Local and national networks can be further strengthened by effectively linking them with existing international networks related to the 3Rs/resource efficiency. The countries could consider the following.

- Facilitate an effective and dynamic linkage among government, private sector, and scientific community to enhance national and local knowledge base and research network on the 3Rs, through the provision of, for example, support for joint collaborative research and development, conference and seminars, introduction of policies to encourage mobility of researchers between the public and private sector, etc.
- Set up mechanisms whereby government can receive constructive feedback from citizens, private sector, and scientific community for developing and improving policies to support 3R technology development, transfer, adaptation, and implementation.
- Support and strengthen local and national networks by effectively linking them with existing international networks and forming regional networks to leverage the wealth of expertise available.

## 7) Public awareness

Sustainable consumption can be a powerful driver to encourage sustainable production by industries. Public awareness is therefore critically important, to improve the citizens' understanding on the beneficial aspects of the 3Rs leading to their active participation in the 3R activities. On the other hand, consumer behaviours are largely affected by the waste management system. The countries could consider the following.

- In collaboration with NGOs and local governments, improve public awareness on the beneficial aspect (health, environment and employment) of 3Rs, and the potential negative impacts of improper waste management on global climate and local environment.
- Introduce the concepts of the 3Rs, sustainable production and consumption, and resource efficiency as part of environmental education programmes at all levels, including primary, secondary and higher education.
- To support the behavioural change of the citizens, promote 3R actions by, for example, introducing economic instruments that encourage waste minimization, and introducing/improving recycling systems for segregated waste.

## 8) Institutional arrangement

The 3Rs is a concept that goes beyond conventional waste management; it is a holistic approach for resource management and resource efficiency in production, distribution and service. The potential benefits of the 3Rs could be reaped by mainstreaming and integrating the 3Rs into the policies and programmes of relevant ministries and agencies. In most cases, the 3Rs are often being dealt with by one single or focal ministry (e.g., the Ministry of the Environment, the Ministry of Local Government or Ministry of Urban Development). The countries could consider the following.

- Integrate the 3R concept in relevant policies and programmes of key ministries and agencies such as the Ministry of Agriculture (including Forestry and Fisheries), Ministry of Industry, Ministry of Energy, Ministry of Transport, Ministry of Finance, etc., towards transitioning to resource efficient economy.
- Strengthen inter-ministerial coordination to avoid inconsistencies among sectoral policies in promoting the 3Rs and resource efficiency.
- Promote green procurement across all line ministries, thereby creating and expanding markets for environmentally friendly goods and products.
- Work towards a gradual phase out of subsidies that favour unsustainable use of resources and energy, in order to free the funds of the national budget which can in turn be used in support of efforts to improve resource/energy efficiency and in implementing the 3Rs.
- Integrate the 3Rs into new economic development models such as circular economy, by promoting indicators of resource efficiency.