



# A Roadmap for Sustainable Waste Management and Resource Circulation in South Asia, 2019-2030



## **A Roadmap for Sustainable Waste Management and Resource Circulation in South Asia, 2019-2030**

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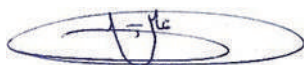
# Foreword

The South Asia sub-region includes the countries of Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka and generates 334 million tons of waste at an average of 0.52 kilogram per capita daily, including both urban and rural waste and about 57% of waste in South Asia is characterized as food and green waste. Rapid population growth and uncontrolled industrial development are seriously degrading the urban environment in many countries in South Asia. One of the most serious environmental consequences of the process of urbanisation is the ever-growing amount of solid wastes generated by cities in the countries of South Asia.

In many cities in South Asia, solid waste collection is inadequate and poor. Significant amount of the solid waste generated in urban centers is left uncollected in streets, dumped in vacant lands, drains, surface water, and marshy areas and burnt in the open air. Waste that is collected is mainly disposed off in open dumpsites, many of which are not properly operated & maintained, there by posing a serious threat to public health. Inadequate sanitation is also quite common in low-income urban rural areas in South Asia, posing threats to public health.

‘A Roadmap for Sustainable Waste Management and Resource Circulation in South Asia, 2019-2030’ report facilitates integration of the global waste management goals and priorities into the regional and national development planning and policy formulation. It identifies key priority areas/ goals for the sub-region, set measurable targets, develop actions, identify financing options, technical innovations, partnership and monitoring and reporting mechanisms. Regional and sub-regional political frameworks have a high potential in facilitating the effective translation of the global waste management goals into practical policies and concrete actions at national and local levels through providing a platform for policy dialogue, where common agenda are set, follow-up mechanism developed, and progress reviewed.

Prior to preparing this report existing data on waste management were collected from the member countries through the National Focal Points (NFP) of SACEP and the collected data were analyzed and validated through three Multi-Stakeholder Consultation Workshops arranged involving representatives from all SACEP member countries and other key stakeholders. Finally, I am confident that this report reflects the key challenges and the relevant strategic recommendations that all the levels of Governance from sub-regional, national and local can follow for a transition from waste management to resource management in South Asia.



**Dr. Abas Basir,**  
**Director General, SACEP**

# A Message from CCET

Solid Waste Management (SWM) is a universal issue affecting all the people in the world, and the sub-region of South Asia, which covers about 12% of the Asian continent or 3.5% of the world's land surface area is not an exception. Home to roughly 1.8 billion people, South Asia generates approximately 334 million tons of waste per year of which 174 million tons (57%) is organic in content. In addition to the increase in municipal solid waste, managing complex and emerging waste streams, including E-waste, food waste, construction and demolition waste, disaster waste, plastic and marine litter are also growing issues in need of attention. Across many countries in South Asia, about 80%-90% of plastic waste is inadequately disposed of, and therefore pose the risk of polluting land, rivers and oceans.

Due to a lack of effective policy and regulations, technical, financial and human resources as well as public cooperation, many countries in the sub-region are facing tremendous challenges to provide adequate waste management services. Waste collection rates are low (44%) and causing uncontrolled dumping into rivers and open spaces, resulting in severe public and environmental health problems. The most prevalent treatment methodology is landfilling, as it is the cheapest and the easiest way to dispose wastes. However, many landfills are operated as unsanitary dumpsites (75%), generating public health, and environmental risks.

Sustainable waste and resource management based on the waste hierarchy and 3R principles (Reduce, Reuse and Recycle) is increasingly gaining local, national and international attention as one of the key drivers for achieving both the Sustainable Development Goals (SDGs) and commitments under Paris Agreement, with its co-benefit approach addressing multiple development challenges whilst pushing climate actions forward through mitigating Greenhouse Gases (GHGs) and Short-lived Climate Pollutants (SLCPs) – associated with global warming and ambient air pollution.

In this regard, the Roadmap for Sustainable Waste Management and Resource Circulation in South Asia, 2019-2030, which was developed in consultation with all eight-member countries in South Asia, experts and other development partners, and adopted at the SACEP Governing Council organized in November 2019 at Dhaka, Bangladesh, is a timely and important policy document. It sets the sub-regional policy framework, including targets and practical measures towards achieving sustainable waste and resource management in South Asia. I hope that SACEP and its member countries will ensure political commitment, mobilise necessary resource and build partnership to successfully implement the Roadmap with enhanced regional cooperation. CCET would also like to strengthen our partnership with SACEP further in implementing the strategic recommendations identified in the document.



**Mr. Kazunobu Onogawa**  
**Director, CCET**

# A Message from UNEP IETC

South Asian economic growth in recent decades has been substantial. Millions of people have been lifted out of poverty and are enjoying the ability to better financially provide for their well-being. One of the unfortunate unanticipated consequences of this economic growth has been a deluge of waste. Plastic is now ubiquitous on the land, in rivers and in coastal areas. Open and uncontrolled burning of waste is adding to horrendous air pollution. However, what this report shows is that uncontrolled leakage of waste into our environment, and its impacts on our health, is not an inevitable, unintended, negative side effect of economic success. Rather, investing in waste management strategies and actions, well implemented at the household, municipal, national, and in the case of the South Asia Co-operative Environment Programme (SACEP), regional levels, can deliver wins in women's and men's health as well as their economic security and livelihoods. In November 2019, the 15th meeting of the Governing Council of SACEP reviewed and adopted this Roadmap for Sustainable Waste Management and Resource Circulation with the intention of delivering precisely these objectives.

The report does more than lay out overall objectives. It contains a very concrete list of 15 strategic targets for 2030 (section 4.3) that are fully in line with the UN Sustainable Development Goals. Furthermore, section 5.1 provides a detailed list of key measures and actions that will move SACEP countries forward towards these goals. Having adopted this roadmap together, SACEP countries are now committed to jointly achieving their vision. At future meetings of SACEP during the timeframe of this roadmap, 2019-2030, member countries will monitor progress, report on their challenges and successes, learn from each other, and work together to deliver positive outcomes for their economies, and for the health of their citizens.



**Mr. Keith Alverson**  
**Director, IETC**

# Acknowledgment

South Asia Co-operative Environment Programme (SACEP) and the IGES Centre Collaborating with UNEP on Environmental Technologies (CCET) would like to express a profound gratitude and deep regard to all those who have rendered their support and inputs to complete this publication ‘A Roadmap for Sustainable Waste Management and Resource Circulation in South Asia, 2019-2030’. Without them, it would not have been possible to shape this publication.

We are grateful to the Ministry of Forests and Environment, Government of Nepal, Ministry of Environment, Forest and Climate Change, Government of Bangladesh, and Ministry of Environment and Wildlife Resources, Government of Sri Lanka for assisting and facilitating SACEP in organising Multi-stakeholders Consultation Workshops in their respective countries and for the Ministers of Environment of the eight member states of SACEP for adopting this document during the 15th Meeting of the Governing Council of SACEP.

We would also like to acknowledge all the experts who provided their valuable inputs, thoughts and expertise during the consultative process and drafting the report, especially for Prof. Sadhan K Ghosh, Dean, Faculty Council of Engineering and Technology, Jadavpur University, India, Dr. Anurudda Karunarathna, Senior Lecturer in Environmental Engineering, Department of Agricultural Engineering, University of Peradeniya, Sri Lanka, Mr. Choudhury Rudra Charan Mohanty, Environment Programme Coordinator, United Nations Centre for Regional Development (UNCRD), Dr. Shunichi Honda, Programme Officer, UNEP IETC and Dr. Keith Alverson, Director, UNEP IETC.

Finally yet importantly, we would like to extend our heartfelt gratitude to all the participants from all eight-member countries of SACEP for attending the consultation workshops and for providing their valuable inputs, suggestions and insightful feedback for improving and strengthening this regional policy document. This document is an output of their active and involved participation. We would also like to thank to the Ministry of Environment, Japan (MOEJ) for supporting this initiative.

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# Abbreviations

CBOs	Community-Based Organisations
CCET	IGES Centre Collaborating with UNEP on Environmental Technologies
E-waste	Electronic Waste
GHG	Greenhouse Gas
MSW	Municipal Solid Waste
MBT	Mechanical Biological Treatment
MOEJ	Ministry of Environment, Japan
NGOs	Non-Governmental Organisations
NDCs	Nationally Determined Contributions
IPCC	Intergovernmental Panel on Climate Change
OECD	Organisation for Economic Co-operation and Development
3Rs	Reduce, Reuse and Recycle
RDF	Refuse Derived Fuel
SDGs	Sustainable Development Goals
SCP	Sustainable Consumption and Production
SACEP	South Asia Cooperative Environment Programme
UNEP IETC	United Nations Environment Programme International Environmental Technology Centre
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
WHO	World Health Organization
WtE	Waste to Energy



# 1. Introduction

## 1.1. Rapid Urbanisation in South Asia

South Asia, including eight countries - Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka, covers about 3.5% of the World's land surface and 12% of the Asian continent (Sarkar et. al., 2019). It has total population about 1.9 billion, which accounts about 40% of Asia's population and 23% of world population, and is expected to rise to 2.4 billion in 2050 (UN, 2019). The urban population in South Asia grew by 130 million during the period of 2001–2011, and could rise to 250 million by 2030 (Ellis and Mark, 2016). It has six of the world's megacities at present - Bangalore, Delhi, Dhaka, Karachi, Kolkata, and Mumbai. If populations continue to grow at the same speed, some other cities such as Ahmedabad, Chennai, Hyderabad, and Lahore could also join this group soon (Ellis and Mark, 2016).

The benefits of urbanisation have resulted in growth within countries and creating opportunities to improve their economies towards achieving both prosperity and livability. Average Gross Domestic Product (GDP) per capita grew by almost 56% during 2010–2018, with an average annual growth above 6% (World Bank, 2019). There has also been much progress in achieving the human development indicators in the past two decades. According to the Human Development Index (HDI), South Asia was the fastest growing region over 1990–2017, at 45.3%. This figure is higher than the progress achieved by the East Asia and the Pacific (41.8%) and Sub Saharan Africa (34.9%) (UNDP, 2018). The figure for countries in the Organisation for Economic Co-operation and Development (OECD), by contrast, grew at 14% in the same period.

These trends show some promise for reducing gaps in human development in the sub-region. The trends also show a reduction in absolute poverty from 50% of people living on less than USD 1.25 a day in 1999 to about 33% in 2010. In addition, universal access to safely managed drinking water services has also improved and is almost 90% (except Afghanistan, 78%) in South Asia. The proportion of urban population living in informal settlements or slum areas has also declined. During 2000–2014, slum populations in India, Bangladesh, and Nepal reduced by 17%, 22% and 10%, respectively, which is extremely promising (ADB, 2017).

## 1.2. Status of Waste and Resource Management in South Asia

***Despite the above benefits, economic growth and rapid urbanisation have also triggered a decline in natural resources in South Asia.*** The region has also witnessed serious air, water and land pollution. Ultimately, this affects public health and places further stress on natural capitals. For example, the maximum air quality level set by the World Health Organization (WHO) is 10 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ), per year, on average for PM 2.5. However, the concentration levels in all countries in South Asia are higher than the WHO threshold (ADB, 2017). Among them, Bangladesh ( $88.8 \mu\text{g}/\text{m}^3$ ), Nepal ( $74.3 \mu\text{g}/\text{m}^3$ ), Pakistan ( $67.7 \mu\text{g}/\text{m}^3$ ), India ( $65.7 \mu\text{g}/\text{m}^3$ ) and Afghanistan ( $63.4 \mu\text{g}/\text{m}^3$ ) were recorded as the countries with the five highest average annual mean concentrations in Asia in 2014.

In addition, the Goal 12 of Sustainable Development Goals (SDGs) encourages countries towards achieving Sustainable Consumption and Production (SCP) by using minimal natural resources, reducing use of toxic materials, and using production processes producing less waste and pollutants. According to the latest data, South Asian countries reported the lowest level of domestic material consumption per capita rate when compared to other countries in Asia and the Pacific. However, the rate of domestic material consumption per capita of all South Asian countries doubled during the period of 2000–2015 (ADB, 2017). Among them, Maldives has the highest domestic material consumption per person - 11.6 tons of materials in 2015.

***The most visible implication of rapidly urbanising South Asia is the increasing generation of Municipal Solid Waste (MSW).*** In 2016, there was about 334 million tons (average: 0.52 kg per person) of MSW generation. Of this, about 174 million tons (57%) was organic waste with high moisture content (World Bank, 2018). Therefore, waste management is a serious challenge for many countries in South Asia, mainly due to a lack of effective policy and regulations. In addition, technical, financial and human resources are facing tremendous challenges to provide adequate waste management services.

The waste collection coverage in South Asian countries is about 51%, on average (World Bank, 2018). The service coverage highly varies by county and city. Rural areas and small cities have lower waste collection coverage when compared to urban centers. Low-income or urban squatter settlements often have no official waste collection services, because these communities are considered as outside official service areas. Uncollected waste either is burned outside openly, in the streets, or enters rivers, creeks, marshy areas and empty land. This presents a serious threat to public health.

Open dumping is the common method for the final disposal of MSW in South Asia. Proper pollution control methods, such as leachate collection and treatment, landfill gas collection and even liners, are not used. Use of them would prevent public health and environmental risks (World Bank, 2018; UN Environment, AIT and ISWA, 2017; ADB and IGES, 2008). However, dumpsites are being improved in recent past. Sanitary landfills are also being built in some countries, and these facilities, which are operated by either the public or private sector.

Most countries and cities in South Asia commonly practice composting and biogas or Anaerobic Digester (AD) to manage organic waste, which is the largest portion of waste composition. Small-scale composting and biogas plants are sometimes more successful than larger-scale plants. These larger-scale and centralised plants face technical and operational challenges because of high investment and operating costs, as well as poor quality inputs. This is because waste is not separated well at source, and marketing mechanisms are not effectively established.

All countries have also shown interest and taken some actions in introducing advanced treatment technologies such as Waste to Energy (WtE) incineration, Mechanical Biological Treatment (MBT), and Refuse Derived Fuel (RDF) systems. However, there have been no substantial results yet on the successful application of these advanced technologies, except in some pilot projects in the sub-region.

In South Asia, countries have also taken some initiatives to establish 3R (Reduce, Reuse and Recycle) and SCP policies, rules and regulations at national and local levels. However, domestic policies on 3R overemphasise recycling

and processing. They are less focused on waste prevention and reduction at the beginning. For most domestic 3R policies, it is also necessary to create practical and accountability structures for proper monitoring and reporting. Strengthening legal enforcement, technical and institutional capacities of the regulators and operators are common priorities in all countries and cities. Lack of public awareness and participation are other challenges for effective implementation of the 3R policies. Therefore, it is important to improve Environmental Education (EE) on sustainable waste and resource management throughout society, both in schools and for the public.

Informal waste collection, material recovery and recycling activities are still popular in South Asia. Waste collection and recyclable materials are collected by the informal sectors in several stages of the waste management system, such as from households (during a door-to-door collection), transfer stations and disposal sites. The collected recyclables are processed at Material Recovery Facilities (MRF). Most of these facilities function simply as temporary storage centers and for manual handling, and involve poor environmental conditions and health risks for the workers. Recovered recyclable materials enter the chain of dealers or manufacturing enterprises, either located in the country or abroad.

Building strong cooperation and coordination among different stakeholders, including national and local governments, service users, Non-Governmental Organisations (NGOs), Community-Based Organisations (CBOs), private sector (formal and informal), academic and research institutes, and regional institutions and donor agencies is required. Cooperation and coordination increases the sustainability of the waste management system and sharing of financial responsibilities. In South Asia, women play an important role in the municipal waste management system (UNEP IETC and GRID-Arendal, 2019). Many CBOs and NGOs provide support to the informal sector so that women can organise themselves for better service provision and livelihood improvement.

In addition to municipal solid waste, managing complex and emerging waste streams such as plastic and marine litter, food waste, E-waste, medical/health-care waste and Construction and Demolition waste (C&D) are also becoming important issues that need urgent attention on a priority basis among the countries in South Asia. However, most countries do not have enough data on these waste streams in hand. Due to lack of capacity, and technical and policy interventions, these emerging wastes create environmental and public health issues. Thus, it is necessary to prepare an inventory of such waste streams, expand the regulatory framework, introduce appropriate technologies and innovative institutional/financial mechanisms, and build capacities of the enforcing institutions.

## 2. Time for Change - Transition towards Sustainable Waste and Resource Management in South Asia

If the current one-way or linear model of society (mass production, mass consumption and mass disposal) continues, this will lead to resource depletion of South Asia's limited natural resources and increase the volume of waste generation (ADB and IGES, 2008). Moving towards sustainable waste and resource management is therefore an urgent need in national and local policies.

Experiences from the OECD countries, especially EU states and Japan, show that they have succeeded in improving their waste management systems and gradually shift away from waste management towards resource efficiency. They have focused not only on managing waste, but also on managing the resources, which become waste. For this gradual development and transformation from waste management to resource management, these countries adopted new policy principles such as "**Waste Hierarchy**", "**Sound Material Cycle Society**" and "**Circular Economy**".

### **Waste Hierarchy**

*The waste hierarchy indicates an order of preference for action to reduce and manage waste. The hierarchy captures the progression of a material or product through successive stages of waste management. It represents the latter part of the life cycle of each product. The aim of the waste hierarchy is to extract the maximum practical benefits from products and to generate the minimum amount of waste. Different versions of the waste hierarchy have been adopted by different countries. They are all basically similar. For example, the European waste hierarchy refers to the five steps: (i) Prevention (preventing and reducing waste generation), (ii) Reuse and preparation for reuse (giving the products a second life before they become waste), (iii) Recycle (any recovery operation by which waste materials are reprocessed into products, materials or substances. Products could be the original product or have another purpose. This includes composting but does not include incineration), (iv)*

*Recovery (some types of waste incineration based on a political non-scientific formula to upgrade less inefficient incinerators, and (v) Disposal (processes to dispose of waste, such as landfilling, incineration, pyrolysis, gasification and other finalist solutions) (EU, 2019).*

### **Sound Material Cycle Society**

*A society in which the consumption of natural resources are conserved and the environmental load is reduced to the greatest extent possible. This is made possible by preventing or reducing the generation of waste and by promoting proper cyclical use and disposal of products. It presents images such as the "slow lifestyle in which goods of quality are used with care", "environmental conservation-oriented manufacturing and services", and "establishing a system of appropriate cyclical use and disposal of waste" (MOEJ, 2008).*

## 2.1. Waste and Sustainable Development Goals (SDGs)

Application of the above policy and planning principles in sustainable waste and resource management in South Asia can also bring various social, economic and environmental benefits. It can contribute to achieving most of the targets set in the Sustainable Development Goals (SDGs). Waste and resource management has strong linkages to a range of development issues such as public health, environment and climate change, poverty reduction and livelihood, food and resource security and sustainable production and consumption. The importance of political leadership and integrated actions are significantly strengthened when waste management is viewed as an entry point to address these development issues, many of which are difficult to tackle in isolation (Premakumara and Amanuma, 2018). Thus, improving waste management, setting appropriate targets and monitoring mechanisms will contribute significantly to attaining the SDGs and other regional as well as global targets on waste management (UNEP IETC and ISWA, 2015).

## 2.2. Waste and Climate Change

Sustainable waste and resource management also contributes to reducing our environmental footprint. It can lead to significant reductions in Greenhouse Gas (GHG) emissions. About 60% of the initially proposed Nationally Determined Contributions (NDCs) by the signatory nations on climate represent waste actions (Taibi & Konrad, 2018). According to the Intergovernmental Panel on Climate Change (IPCC), the direct contribution of the solid waste and wastewater sectors to GHG emissions is 3–5% based on 2010 data (IPCC, 2013). Out of this total, about

### Circular Economy

*A circular economy aims to redefine growth, focusing on positive society-wide benefits. It involves gradually decoupling economic activity from the consumption of limited resources, and designing waste out of the system. Based on a transition to renewable energy sources, the circular model builds economic, natural, and social capital. It is based on three principles: remove waste and pollution from the design, keep products and materials in use, and regenerate natural systems. Transitioning to a circular economy is not just about reducing the negative impacts of the linear economy. It also represents a systemic shift that builds long-term resilience, generates business and economic opportunities, and provides environmental and societal benefits. The model is separated into technical cycle and biological cycle. Consumption happens only in biological cycles, where food and biologically-based materials (such as cotton or wood) are input back into the system through processes like composting*

*and anaerobic digestion. These cycles regenerate living systems, such as soil, which provide renewable resources for the economy. Technical cycle recover and restore products, components, and materials through strategies like reuse, repair, remanufacture or (if there is no other option) recycling (Ellen Macarthur Foundation, 2019).*

97% are due to methane emissions and equally split between methane generated from landfills sector and from wastewater sector. However, this estimation does not account for emission reduction achieved through recycling. It is estimated that global GHG emissions could be reduced by about 10–15% by landfill mitigation and diversion, energy from waste, recycling, and other types of improved solid waste management. If waste prevention (based on life cycle assessment) is included, the reduction rises to 15–20% (UNEP IETC and ISWA, 2015). Use of secondary raw materials for industrial production rather than using of virgin materials can significantly reduce GHG emissions due to reduction of direct energy consumption in the production process. For example, the reduction is 35% in glass production, 50% in paper and steel production, over 70% in plastic production, and over 90% in aluminium production. This also affects upstream processes such as mining, processing and transport of primary raw materials (UNEP, 2017).

The world is also now focusing on Short-Lived Climate Pollutants (SLCP), such as black carbon emissions. It is estimated that 40% of black carbon emissions is caused by open burning of biomass (including open burning of urban waste and agricultural waste), and 60% is caused by energy sources (including power plants, industry, transport and residential fuel use). Black carbon has a much higher global warming potential (GWP) or CO<sub>2</sub> equivalent, especially over a 20-year period (Premakumara et.al., 2018). Therefore, waste management plans need to include how to control methane from landfills and black carbon from open burning and transportation of waste (Menikpura & Premakumara, 2018).

### 2.3. Waste and Other International and Regional Environmental Agreements

In addition to the above global goals and climate agreements, such as SDGs and NDCs more actions on sustainable waste and resource management in South Asia is also an important part of implementing other regional and multilateral environmental agreements. Some of them are (UNEP, 2017):

- Basel Convention on the Transboundary Movements of Hazardous Wastes and their Disposal
- Rotterdam Convention on Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade
- Stockholm Convention on Persistent Organic Pollutants
- Vienna Convention for the Protection of the Ozone Layer
- Montreal Protocol of the Vienna Convention
- International Conference on Chemicals Management
- Strategic Approach to International Chemicals Management (SAICM)
- Minamata Convention on Mercury
- Resolutions related to waste management adopted at the UN Environment Assembly (UNEA)

The urgency of addressing sustainable waste and resource management in South Asia is also discussed in some of the past regional co-operation agreements and frameworks adopted by the regional institutions and programmes, concerning environmental protection, food security, power and energy generation, poverty reduction, technology transfer and trans-boundary issues. Some key regional activities are:

- ***The Dhaka Declaration on Waste Management of 2004***, which recognises the environmental imperative to promote more effective waste management systems ‘with special attention to addressing the needs of the poor’.
- ***The SAARC Action Plan on Climate Change of 2008***, which listed waste management as one of the priority

areas for nationally appropriate mitigation actions where regional sharing of best practices could be useful.

- ***The SAARC Convention on Cooperation on Environment 2010*** also included waste management among a list of 19 areas for exchanging best practices and knowledge, and transfer of eco-friendly technology.
- ***The summary statement of the South Asia Sustainable Consumption and Production Forum 2016*** also acknowledges the importance of achieving SCP in the region, and recommends the SACEP Governing Council to provide continuous support and guidance.
- Since the launch of the Regional 3R Forum in Asia and the Pacific in 2009, policy issues and priorities on sustainable waste and resource management have been widely discussed among member countries. Some declarations were agreed on, such as the ***Hanoi 3R Declaration – Sustainable 3R Goals (2013)***, and ***Indore 3R Declaration of Asian Mayors (2018)***.
- ***Regional Seas Programme (South Asian Seas Programme administered by SACEP)***, which has been developing and implementing Regional Action Plans on Marine Litter, including capacity building for effective management, promoting public awareness and strengthening cooperation among governments, NGOs, and other stakeholders.

### 3. The Process of Development of the Roadmap

Development of this roadmap is a result of an intensive consultation process facilitated by the South Asia Cooperative Environment Programme (SACEP) and the IGES Centre Collaborating with UNEP on Environmental Technologies (CCET). It was supported by the United Nations Environment Programme International Environmental Technology Centre (UNEP IETC) and the Ministry of Environment, Japan (MOEJ). The roadmap involves the participation of all eight-member countries in South Asia.

Preparations began with an introductory meeting at the Eighth-3R Forum in India, April 2018 where the Deputy Minister, Ministry of Environment, Maldives and the Minister, Ministry of Works and Human Settlements, Bhutan raised the importance of having a sub-regional roadmap to improve waste and resource management in South Asia.

This idea was discussed and further refined with the international community at the 5<sup>th</sup> session of CED, United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) in Bangkok, November 2018. It was attended by a panel of experts from UNEP, UNESCAP, and SACEP, Government of Japan and member countries (representatives from Bangladesh), as well as specialists from academic, civil society and businesses.

After these initial meetings, basic data were collected and consultative meetings were arranged involving relevant representatives from all member countries and other key stakeholders, including international agencies, research and academic institutions, private, business sectors and civil society groups. Some of the key events were:

- **First Sub-regional Workshop in Kathmandu, Nepal, March 2019.** Here, available data on waste management and priority areas were discussed for drafting a roadmap.
- **Second Consultative Workshop in Dhaka, Bangladesh, July 2019.** Here, a draft status report of waste management in South Asia and an outline of the roadmap were discussed in more detail. A consensus was partially reached in writing the roadmap. Participants also discussed the specific issues of waste management in thematic sessions. These included waste separation, bio-waste management, marine and plastic waste management, open disposal and burning of waste, and financial, institutional and technical matters. The discussions further identified the importance of moving from a linear model of waste management to a more sustainable model based on ‘circular economy’, ‘sound material-cycle society’ and ‘sufficiency economy’.
- **Third Sub-regional Workshop in Colombo, Sri Lanka, September 2019.** During this meeting, both reports were reviewed and finalised by the member countries for submission to the 15th Meeting of SACEP Governing Council in Dhaka, Bangladesh in November 2019.
- **The 15th Meeting of the Governing Council of SACEP, November 2019,** reviewed and adopted the Roadmap for Sustainable Waste Management and Resource Circulation in South Asia, 2019-2030 and required all member countries to take measures for its implementation and reflection in formulating national and local waste management policies regulations and strategies.



# 4. Going Forward - A Roadmap for Sustainable Waste and Resource Management in South Asia

## 4.1. Overarching Objectives

This roadmap aims to set the regional policy framework, including clear targets and practical measures to achieve the sustainable waste and resource management in South Asia and put the incentives in place to motivate the change by national actions, networking, knowledge and technology sharing as well as mutual learning among member countries in the sub-region. Some of the key goals of the roadmap are:

- To minimise negative impacts on the environment, economy and society,
- To minimise waste generation and maximise the resource efficiency across the product lifecycle.
- To synergise local, national, sub-regional efforts in implementing waste and resource management related goals and agendas, including SDGs, NDCs, and others.
- To strengthen a bilateral and multilateral cooperation, research and mutual learning within the sub-region on sustainable waste and resource management.

## 4.2. Strategic Principles







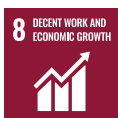















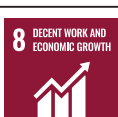



The complexity of waste and resource management has led to the identification of a number of strategic principles of environmental policy and sustainable development. Key strategic principles that are discussed and accepted as guiding for developing the roadmap:




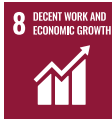









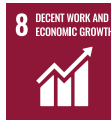




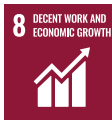






- **Prevention and Precautionary** - prevent waste from occurring in the first place and manage it better when it does based on waste hierarchy.
- **Polluter Pays Principle** - those who generate waste should bear the cost of managing it so that it does not pose risks to human health and the environment.
- **Extended Producer Responsibility Principle** - those who place products on the market will take greater responsibility of end of life products for environmentally sound disposal of the products.
- **Sustainability and Affordability** - self-sustained and full cost recovery
- **Sustainable Partnership** - Partnership building among all key stakeholders, including public, local government, private and civil society. Integration of community based and informal sector activities.
- **Equity** - ensure gender mainstreaming, elimination of child labour, and worker safety in waste management industries.
- **Sustainable Consumption and Production (SCP)** - the consumption and production cycle should be re worked to put it on a sustainable basis.
- **Life-cycle Approaches (LCA)** - examine a product and its passage through distinct stages of a lifecycle – from the very beginning; extraction of raw materials, manufacture, packaging, transport, distribution, sale, use and end-of-life, when it enters into the waste management system and the later phases of the waste hierarchy.
- **Resource Efficiency** - rethink the lifecycle of a product from the perspective of the resources that go into each stage since losing resources as waste is inefficient

- **Cleaner Production** – The continuous application of an ‘integrated environmental strategy’ to processes, products and services to increase efficiency and reduce risks to humans and the environment aims as resource co-efficiency but also explicitly addresses and strives to reduce the use of hazardous substances in products and their production processes, and generation of emissions.
- **Eco-design and Eco-innovations** - focusing on design features, which incorporate an extension of the product use period designed for disassembly, repair or upgrading (Thus phasing out components that prevent reuse or recycling) and constructing a product from materials that can serve as inputs to another process.
- **Collaboration and Cooperation** - networking among stakeholders and mutual learning within the sub-region and elimination of illegal traffic of waste in the sub-region.

### 4.3. Strategic Targets

The roadmap also sets a number of strategic targets to drive towards a sustainable waste and resource management in South Asia. Key targets are set to achieve by 2030.

Targets to be Achieved by 2030	Potential SDGs Achievements
1. Ensure adequate, safe and affordable waste management service for all	   
2. Achieve 10% waste reduction target by 2030 - based on 2019 per capita waste generation at national level	 
3. Double resource productivity by 2030 - based on 2019 baseline data	   
4. Achieve 100% segregated waste collection at source	   
5. Achieve zero open dumping and open burning	   
6. Achieve 50% reduction of food-losses and food-waste	   
7. Phase-out the disposal of all organic or bio waste, recyclable, energy-recoverable, and waste which has alternative use in landfills	   

Targets to be Achieved by 2030	Potential SDGs Achievements
8. Phase-out the use of single-use plastics	  
9. All plastic packaging placed on the market to be recyclable, reusable or compostable	  
10. Reduce marine plastic pollution of all kinds	 
11. Achieve environmentally sound management of domestic hazardous waste including domestic chemical waste, domestic medical waste and electronic waste (E-waste), etc.	   
12. Reduce industrial waste generation, increase resource recovery and environmentally sound treatment and disposal	   
13. Establish a baseline data on waste management, monitoring and reporting mechanisms at national and sub-regional levels	 
14. Establish common facilities for management of special waste such as industrial waste, E-waste, medical waste, Construction and Demolition Waste (C&D Waste), hazardous waste	   
15. Enhance public procurement of products produced from secondary resource materials	  

# 5. Key Strategic Measures

## 5.1. Measures for Sustainable Waste and Resource Management

Sustainable waste and resource management require a gradual or phase-based approach. At the early stage of improvement, waste management systems can focus more on providing affordable waste collection service for all along with environmentally sound disposal practices. However, to manage the waste in a more resource efficient manner applying waste hierarchy is important.

- Improve waste collection services for all
- Establish a proper system to make the waste sorting mandatory, citizen-friendly.
- Increase resource recovery and recycling
- Take organic or bio-waste out of landfills
- Accelerate the introduction of economic incentives for waste management
- Encourage industries to apply cleaner production methods and technologies to reduce waste
- Establish effective enforcement and regulatory systems to prevent waste burning, littering, illegal dumping and illegal import and export (trans-boundary)
- Research and application of appropriate alternative technologies for waste treatment including MBT, RDF and Waste to Energy (WtE)
- Exploring new ways to ease the environmental impacts of landfill sites
- Encourage waste producers and managers to implement the waste management hierarchy in respect of hazardous waste.
- Integrate informal sector, community-based activities and Small and Medium Enterprises (SMEs)
- Establishing national standards for resources recovered from waste

### Key Measures

- 1) Improve waste collection, transport and disposal services** – The improvement of waste management system can be started from securing affordable waste collection and transportation services for all. Particularly urban low-income or informal settlements, peri-urban and rural neighborhoods that are often lack the service. The collected waste should dispose in final disposal sites that have at least minimum standards of measures to control environmental pollutions and public health conditions.
- 2) Mandatory waste separation at source** – Introduce mandatory waste separation at source, promote householder and business participation for waste separation and ensure that high levels of quality recyclable or compostable materials are available for reprocessing. The introduction of waste separation can be started from establishing a

simple waste categories, such as dry, wet, domestic hazardous and residuals and gradually increased the number of categories based on the awareness of the citizens and the availability of recyclable systems.

- 3) Encouraging householders to minimise waste at source and recycle more** – Maximise the value of reforms by encouraging behaviour change alongside them. Promote innovative measures such as providing rewards or recognising national, local and individual (householders and businesses) efforts to minimise waste and increase recycle rates. Such incentives and nudges, when they accompany good services and communications can make a real difference to people’s engagement in recycling. Explore new ways to engage positively with the public about recycling, building on the work of charities and NGOs.
  
- 4) Improving recycling rates by ensuring dry recyclable materials collection system from all households and businesses** – Introduce non-binding performance indicators for the quantity of materials collected for recycling and minimum service standards for recycling. Take new actions, including where necessary legislating to ensure that businesses present recycling waste separately from residual waste for collection, and publish or make available information on what is recycled. Investigate these service options alongside other measures to help cut costs, particularly for SMEs. As part of establishing a core set of materials for collection, review the effectiveness of current arrangements for reporting of quality, and for determining when a separate collection is necessary to achieve high quality. This will also take into account reforms to the packaging waste regulations and changes to provisions on technical, environmental and economic practicability in the new Circular Economy Package. Compared to recovering recycle materials from households, recovering recyclables from the commercial/ institutional/ industrial sectors is easier to operate and less costly. Thus, waste separation and recycling programmes can be started from commercial/ institutional and industrial sectors and gradually expand to other sectors.
  
- 5) Improving recycling rates in urban areas by working with business and other stakeholders** – Work with relevant authorities, organisations and stakeholders to review collection models for densely populated commercial and residential areas/ districts (high-rise buildings or urban housing-schemes) to improve recycling and reduce costs whilst maintaining frequency of collections needed to protect local amenity. This could include piloting shared domestic and business collection rounds or zoned collection services. Engage with property owners and estate managers to promote recycling in Houses in Multiple Occupation (HMOs) and other properties where they have responsibility for waste management arrangements. Work to align with the National Planning Policy for waste and planning practice guidance with the Resources and Waste Strategy and continue to maintain building regulations guidance to support its objectives; Work with transport hubs and other destinations such as hospitals and universities to promote effective and high-quality recycling (including on-the-go).
  
- 6) Facilitate organic-waste separation at source** – Whilst some national and local authorities in the region have already set policies and programmes to manage organic-waste collection and recycling schemes, the the majority of organic-waste is still ends up at final disposal sites along with other residual waste. Extending separate organic-waste collections to more households should increase recycling and composting rates and divert organic-waste from incineration or landfill. This will result, in particular, for local authorities that so wish, in the adoption of a two-stage organic-waste source sorting implementation plan. A first step that aims to ensure the collection of

organic-waste from the places comparable to household organic-waste (markets, restaurants, community canteens, etc.). Then a second step to roll out this source sorting to household bio-waste.

- 7) Recovery of all quality of organic-waste to drive the circular economy** – Work across governments on opportunities to promote synergies between organic-waste and renewable energy to support decarbonization of transport, heat and power. Carry out and publish a review of policies to support organic-waste recycling through biogas and composting to maximise the benefits of these treatment options whilst managing the risks. Ensure that where appropriate farms continue to use biogas as a treatment option for managing on-farm waste and recycling nutrients into energy and digestate that can be applied back to land. Strengthen the existing standards for recycling-based fertilisers and take care not to degrade the value created thanks to sorting by mixing uncontaminated organic matter (raw or sorted at source) with lower quality organic waste. Encourage the use of fertilisers from renewable resources in agricultural production, the development of the procedure to remove the waste status of fertilisers produced from high-quality recycling processes, and the revision of the display and labelling of fertilisers and crop boosters to better highlight agronomic qualities, origin and process of composts and digestates from the circular economy compared to other forms of fertilisers. Clear communications by local authorities and waste managers can play a key role in achieving this. It is also important that quality standards for compost and digestate are fully adopted and that they are regularly reviewed to see if they are fit for purpose or can be improved with evidence. Work with the Environment Agencies and industries to ensure what put on the market adds value, meets required environmental and quality standards and is applied correctly to minimise environmental impacts.
- 8) Accelerate the collection of recyclable packaging, plastic bottles and cans** – The system should significantly increase voluntary collection, particularly at the initiative of local authorities, as a priority in areas where collection rates are low. There are also plans to carry out experiments in using deposit schemes for plastic waste collection and recovery. For example, deploy “social waste deposit schemes” in communities that wish them as these create an incentive to return waste, as each new bottle, which is collected, contributes to the financing of a great environmental, health or charity cause. Voluntary organisations and communities will be allowed to issue calls for projects to select the collection and management operators in order to choose the most appropriate solutions for their needs, especially in the densest urban areas. These solutions can also use digital technologies, social innovation, the collaborative economy or automatic bottle and can recovery machines. To finance these operations, local authorities will receive specific support per ton collected from approved producer responsibility organisations in the packaging sector.
- 9) Adapt new tax systems to make waste recovery and recycling are cheaper than incineration and disposal** – To make waste prevention and recovery less costly within the public waste management service, reduce VAT for the prevention, separate collection, sorting and material recovery of waste. This reduction will also cover the acquisition of biodegradable and compostable bags in compliance with the standards in force for the separate collection of bio-waste and the acquisition of technical solutions for local composting. A consultation on the planned increase in tariffs of the “waste” component of the General Tax on Polluting Activities (GTPA). A multi-year implementation scheme will be necessary in order to give operators the time to adapt. It will also involve refocusing the GTPA’s objective in relation to the hierarchy of waste processing, by proposing, a schedule for

the elimination of the reduced GTPA tariffs, which either contradict the objectives for sorting at source and the recovery of bio-waste or contradict other elements of the GTPA, or otherwise have no direct link with the purpose of the tax, while maintaining a specific tariff for incineration which has high energy performance. All local authorities that are taking a real step towards the circular economy will see their costs reduced. GTPA exemption for “incineration with energy recovery” for certain waste that must be eliminated by law and for which recycling is prohibited, such as, for example, waste from health care activities that present a risk of infection, waste containing Persistent Organic Pollutants (POPs) and creosote-treated woods.

**10) To encourage sorting and avoid waste, facilitate the deployment of other financial incentives for waste collection**

– Set the pricing of the service-based on the quantity of waste produced (price paid based on the number of days that a full bin was put out for collection, obligation to leave waste in pre-paid bags, weighing of bins during waste collection, etc.). Reduce the administrative burden on local authorities for the implementation of pricing incentives by allowing their proceeds from the pricing initiatives. Introduce systematic invoicing between local authorities based on the quantities of waste collected or processed and prohibit flat-rate billing when the necessary information is available, so as not to negate the prevention and sorting efforts of citizens and local authorities. Organise the sharing of feedback and best practices for the deployment of pricing incentives, particularly in terms of implementation in urban areas, and strengthen support for councils in the deployment of pricing incentives. National authorities should prepare regulations for fee settings including a methodology and guidelines for cost calculation.

**11) Encourage waste producers and managers to implement the waste hierarchy in respect to industrial, chemical and hazardous waste**

– Set the new requirements of the Waste Framework Directive that relate to the management of industrial, chemical and hazardous waste. Implement these new requirements in a way that strengthens record keeping mechanisms and furthers the applications of the waste hierarchy whilst minimising any additional burdens on businesses. The development of clear guidance on the Best Overall Environmental Option (BOEO) for these problematic wastes would promote the adoption of waste management practices that make sure hazardous chemicals in wastes do not pose a continuing risk to human health and the environment and do not end up contaminating secondary raw material streams. Work with producers and waste management companies and consider how can encourage producers to implement the waste hierarchy in respect to hazardous waste alongside actions to implement the BOEO for these problematic wastes. This may include seeking views on requiring producers of industrial, chemical and hazardous waste to report annually on how much hazardous waste they produce, send for recycling or recovery, send for disposal and the steps they have taken to drive the management of hazardous waste up the waste hierarchy.

**12) Explore new ways to ease the environmental impacts of legacy landfill sites**

– Landfilling has been a mainstay of waste management for over a century. Sites vary widely by age and waste composition. Waste already deposited in the landfill will continue to pose a risk to the environment for many years. Conduct a scoping study into ways that can deal with the issues legacy landfills create and will be undertaking research and analysis to support new approaches to landfill aftercare management. Working with industry, local authorities, and other partners, to provide clarity around surrender criteria, explore potential alternative sources of revenue, and optimise passive landfill management technologies.

**13) Research and development of appropriate technologies for waste treatment before landfill** – Waste to be managed in the most appropriate way to ensure that environmental impacts are minimised, and that the resource value extracted is maximised. Some of the key technologies are sending it for energy recovery, exporting it as Refuse-Derived Fuel (RDF), and landfilling it. Attempt to extract recyclables from this waste where the technology exists to do it, although the quality of this material tends to be poor. Landfill is the least preferred option given its environmental impact and long-lasting nature.

**14) Develop a national waste management strategy and/ or implementation plan to facilitate the transition from waste management to resource management** – A centrally led approach accompanied by public consultations and local endorsement are required to make this change happened. Respective authorities need to introduce national policies, legislation, standards and financial mechanisms. Local (regional and municipal) waste management plans should be prepared in line with these national strategies/ plans to guide local implementation. When building new infrastructure and facilities, local governments should be encouraged to follow the adopted plans to ensure cohesive development of the sector across the whole country. Inter-municipal cooperation in service provision should be promoted and could be supported by the central government through a variety of guidance tools and incentives, such as access to land and financial resources for capital investment.

**15) Strengthen institutional and human capacity** – At national level, a line ministry such as Ministry of Environment or Ministry of Urban and Regional Development is typically assigned with the responsibilities to develop policies, draft legislation and oversee waste management in the country. Typically, key functions of the line ministry are policy formulation, legislative drafting, preparing of national waste management strategies and plans, preparation of national standards and guidelines, including clear definition of municipal waste and its functions as well as stakeholders responsibilities, setting up of waste information and database, monitoring and enforcement, especially EPR schemes, and coordination among key stakeholders. At local level, local governments prepare local waste management plans, issue municipal regulations in line with national regulations, and implement them in cooperation with service providers, waste generators and other stakeholders. Small municipalities with low capacity require a lot of guidance to advance their waste management systems and capacity building could be provided by an association of municipalities through networking and mutual learning among members.

**16) Establish a platform for dialogue with among key stakeholders** – Establish a consultative group as an ongoing platform to review and make recommendations for sector reforms. Such consultative groups should be broad-based and comprise representatives of essential stakeholders.

## **5.2. Measures for Sustainable Production**

Addressing sustainable production at the upper stream is essential to make it possible in achieving sustainable waste and resource management. In a context of growing demand for raw materials and stress on natural resources, it is essential to be more efficient in the way of use the limited natural resources and to rethink the way design and make new products. Evidence suggests that it can be avoided about 80% of the damage happened to the environment from better production, such as application of eco-design, the choice of recycled materials vs virgin materials, less chemical used, and sustainable packaging, distribution and sold to consumers (Murray, 2013). However, this requires



those who produce products to the market, which later become waste to take greater responsibility for the costs of management and disposal for those products - introducing Extended Producer Responsibility (EPR).

- Set minimum requirements for eco-design to encourage resource-efficient and economically viable product design
- Invoke the Extended Producer Responsibility (EPR) principles for packaging and other products, ensuring that producers pay the full net costs of managing waste at end of life
- Eco-innovation to produce better with less use of non-renewable resources, incorporating more recycled raw materials, in particular for plastics
- Manage chemicals sustainably and address barriers to reuse and recycling posed by their use
- Create jobs and meet training needs for new occupations or new skills in the circular economy

## Key Measures

**17) Setting minimum requirements through eco-design to encourage resource-efficient product design** – Eco-design is a way of designing products, which takes a preventative approach to protecting natural resources by considering whole lifecycle impacts. A minimum requirement for eco-design can be set to reduce energy consumption and include eco-design requirements in production regulation for resource efficiency, taking into account the potential to design for disassembly, repair and recyclability. Also, look at eco-labelling and address the presence of harmful chemicals in products to ensure they neither end up in secondary products, where they may pose a high risk due to increased exposure, nor prevent recycling altogether owing to their presence in the waste stream.

**18) Introduce EPR to ensure producers pay the full net costs of managing waste at end of life** – EPR incentivises producers to design their products to make it easier to be reused, dismantled and/or recycled at end of life. The application of EPR schemes can start from popular waste streams, such as packaging waste, End-of-Life Vehicles (ELV), and Waste Electrical and Electronic Equipment (WEEE) and gradually apply for other waste streams such as textiles, bulky waste, certain materials in the construction and demolition sector, batteries and vehicle tyres. This list is not fixed and does not exclude the potential to review and consult on EPR for other waste streams if these are identified as being of equal or higher priority.

**19) Incorporate eco-innovations including more recycled raw materials into products while ensuring their quality, traceability and genuine safety for citizens** – Promote more practical and voluntary commitments including target volumes for the integration of recycled plastic material resulting from waste in the following sectors as a first step: packaging, building, automotive, electronics and electrical equipment. Making new products from recycled materials (or secondary raw materials) can cause less harm, using less water and energy, and generating lower carbon emissions. When create new markets for recycled materials, it can make recycling more economically viable. Other ways to boost economically viable recycling include cutting the use of

hazardous materials during production, such as the phase-out of Persistent Organic Pollutants (POPs). Setup sub-regional approach to strengthen the standardisation of methods that assess chemical safety throughout the product lifecycle based on strong scientific evidence. This will support the mutual acceptance of data to identify and share information on emerging concerns and new approaches to risk assessments.

**20) A support productive investment manage resources more sustainably** – To improve the competitiveness of the businesses of incorporating raw materials from recycling and replacement by renewable resources, by means of mass mobilisation of available public financial tools and private finance through green finance tools such as green fund type and green bonds. New tax systems can also apply to encourage manufacturers to produce more sustainable packaging and in turn create greater demand for recycled material. For example, tax will apply to plastic products such as packaging containing less than 30% recycled plastic and the revenue collected from these measures can invest in further action to address the issues surrounding single-use plastics, waste and litter, to help improve the waste system.

**21) Manage resources more sustainably** – Commit to a programming plan for resources that are deemed to be the most strategic, accompanied by an ambitious industrial policy for the recovery of materials, especially critical metals, contained in waste. Establish “benchmark values” representing the cost of the use of these strategic resources to society as a whole (environmental damage, resource scarcity), in order to integrate them into the evaluation of public policies in the same way as has been done for carbon and air pollution. Develop tools to enable businesses who so wish to establish a “materials inventory” based on the model of the “greenhouse gases inventories”. Countries can produce <<material flow inventories>>, in particular by disseminating available methodological tools more widely and encouraging regions to broaden the role of waste monitoring bodies accordingly.

**22) Adapt professional skills for better production at the national and sub-regional levels** – Identify the specific skills needed for certain occupations in the circular economy and take greater account of the needs of the circular economy in the vocational training programmes. Create certifications or “skill blocks” (units of a professional qualification) recognising the skills that contribute to the circular economy to enhance the value of these jobs, particularly in the area of the repair and reuse of products. Support SMEs that are in the social and solidary economy, in the development of their professions. Support elected representatives and local authorities in the development of local circular economy strategies by improving their knowledge of the issues related to the circular economy and, more particularly, the recycling of bio-waste and plastics. One way to support to innovate and achieve such capacity at sub-regional level is by establishing and supporting clusters of them to come together to share knowledge and good practices with other counterparts.

### **5.3. Measures for Sustainable Consumption**

The transition to circular economy and sustainable society, consumers deserve to know more about how they can unlock hidden value for themselves, and for the good of the environment. Thus, it is required to setting up an enabling policy environment and instruments that will help consumers to identify and access more sustainable products, extend the lives of them and help for recycling when it’s time to dispose. This requires access to information to enable consumers to inform their consumption choices by taking into account the environmental impacts at all stages of the

product life cycle.

- Incentivise more sustainable purchasing
- Phase-out single-use plastics and products where there is a clear case for it and alternative exist
- Combat food waste
- Provide consumers with better information on the sustainability of their purchases
- Lead by example through public procurement
- Create sustainable jobs in the repair sector, particularly from the social and solidary economy

## Key Measures

**23) Incentivising consumers to purchase sustainable products** – Provide opportunities for consumers to take right decisions and incentivise them to do so, including using taxes and charges where appropriate. For example, by consulting on extending and increasing the carrying bag charge. The success of the carrying bag charge demonstrates the difference even relatively small incentives can make. Therefore, look at the relative costs and benefits of different approaches, including taxes, charges and other policy instruments such as regulations or bans. In principle, incentive mechanisms help consumers to make the right choice, rather than banning items outright. However, there may be some cases when a ban is appropriate as part of a wider strategic approach, such as unnecessary single-use plastic items (carrying bags, problematic packaging materials, plastic straws, stirrers and cotton buds).

**24) Providing consumers with better information on the sustainability of their purchases** – In certain circumstances, the most appropriate policy tool is to provide consumers with better information to enable them to make responsible and sustainable purchases. One way of doing this is through ecolabels, which is used around the world to show that a product or service meets a certain standard of environmental performance. Certification marks provide a level of trust for consumers and aim to reduce dubious ‘green washing’ by manufacturers and brands. Ecolabels exist for a range of products and cover a range of environmental impacts from production to design to disposal. Also, draw links between ecolabel schemes, EPR and other relevant fiscal measures. For example, under EPR for packaging, it can be required producers to ensure that packaging items are clearly labelled as to whether or not they can be recycled. It will also explore whether consumer labels should identify the level of recycled content within the packaging.

**25) Extending product lifetimes through guarantees and warranties** – A guarantee is usually a free promise by the manufacturer or retailer to fix or replace the problem, whereas an extended warranty is offered on a voluntary basis, and usually at a premium, by manufacturers, covering consumers against the cost of repairs and replacements. Wider use of such systems can promote resource efficiency and circular society. They will encourage manufacturers to design and manufacture products that last longer and will support re-use and repair activities. Explore the role that guarantees and warranties that can play in ensuring products stay in use longer and

maintain their value. It will also consider options including mandatory disclosure of expected product lifetimes, mandatory extended warranties, and incorporating warranties into labelling. In conjunction with industry and other stakeholders, explore reform to consumer rights, laws and eco-design legislation to make use of these systems where the market is not delivering the necessary outcomes.

**26) Increase the number of actors and actions in reuse, repair and remanufacture sectors in the economy –**

Enable consumers whether individuals or businesses to use their services rather than throwing away a product and buying a new one, while boosting the life of products and role of the social and solidary economy within these activities. For this to happen, all consumers must be able to find affordable spare parts and technical advice, or access affordable repair services. Manufacturers should also be prepared to take products take-back products and return them to their original state, if feasible – a process known as ‘remanufacturing’, which benefits both the economy and society. This requires a better organisation of the repair sector to make it more competitive and easier for consumers to access. Include the mapping of repair, reuse and functional economy services into the specifications of producer responsibility organisations and make this information available to the public as open data so that start-ups can offer applications to promote, in particular, the development of digital platforms to facilitate networking of repairers and contact with consumers.

**27) Prioritise waste reuse and repair in national and sub-regional waste and resource management planning policies –**

It is important that the national and sub-regional planning policies for waste and resource management continues to embrace thinking on circular economy, sound material-cycle society, sufficiency economy, and integrates resources and waste management to maximise reuse in accordance with the waste hierarchy. Set reuse, re-deployment and repair targets in the national and sub-national waste and resource management policies and actions. Set rates for the provision of collected products to social and solidary economy operators. Set rates or insertion jobs to waste collection and treatment operators that have a contract with or a financial investment from a producer responsibility organisation. Another way of extending lifespans is to embrace retail models, which provide services or rent out products – thereby sharing resources, and facilitating repairs and upgrades.

**28) Sustainable procurement and greening commitments by governments –**

Sustainable government procurement and green commitments can help to generate less waste, and also increase demand for more resource-efficient goods and services and stimulate innovation. The government is committed under the Greening Government Commitments to buy more sustainable and efficient products and services with the aim of achieving the best long term, overall value for money.

**29) Cutting Down on Food Loss and Food Waste –**

Food waste cause for damaging environment and Costs money. UN Sustainable Development Goal 12.3 target thus seeks to halve global food waste at consumer and retail levels by 2030. Together, these commitments support the broader ambitions to eliminate avoidable waste by 2030 and to work towards eliminating food waste to landfill by 2030. A new approach is needed including a preparation of national and sub-regional roadmap for food waste management and which includes mandatory targets for food waste prevention, develop a new food surplus and waste hierarchy, promote awareness of the issue by appointing a new food surplus and waste champions, and support for cross-sector collaboration through sub-regional agreement. The Agriculture Bills can also introduce sector-specific statutory codes of contractual conduct

to protect producers from exposure to unfair practices which are often the cause of viable produce going to waste, food labelling.

### **30) Collaboration to solve global waste issues, beginning with a focus on marine plastics and waste plastic management in developing countries**

– Badly managed resources not only present a serious threat to the world's ecosystems and economies, but also to human health. This is particularly true in developing countries, in which there are an estimated two billion people living without waste collection and three billion people without controlled waste disposal. The impacts of this can be disastrous, for example by facilitating the spread of infectious diseases. Around nine million people per year die of diseases linked to mismanagement of waste and pollutants – twenty times more than die from malaria – 92% of which occur in low and middle-income countries. With just twenty countries responsible for over 80% of the plastic debris discarded into the ocean, we need to work internationally to solve the problem. Increasing the extent and improving the quality of waste management is one of the most important immediate steps towards doing so. Supporting development of country action plans and investable solutions through the South Asia Marine and Plastic Waste Management Action Projects. Supporting member countries to tackle marine pollution and reduce plastic waste, including appropriate technologies. Research and innovation to tackle plastics and manufacturing pollution. Improving the quality of plastics exported for recycling through Basel and Stockholm Conventions, launching a call for evidence in 2019. Better managing waste to reduce risks from chemicals without hampering the functioning of secondary materials.

## **5.4. Measuring Progress - Research, Data, Monitoring and Evaluation**

A Quality research, data, information, and insight are essential for evidence-based policymaking. However, in reality, data is currently patchy and unreliable in most of our countries. Although there are pockets of in-depth knowledge, there are few systems in place for systematising, collating and converting this knowledge into data. Lack of data hampers the proper functioning of market incentives and stifles those trying to become more resource-efficient. Without measure, without manage it – and this lack of basic data prevents us from reaping the benefits of resource efficiency. This data will not only support policy-making in central governments but will help businesses make better investment decisions and tell local planners where additional waste treatment capacity is really needed. Data on waste collected by local authorities has radically improved through the creation of Waste Data Flow. It has also enabled comparisons to be made of performance in different parts of the country, helping local authorities to make improvements. The data management can be started from municipal waste and expand to commercial, industrial, construction and demolition, medical and other wastes.

- Develop shared vision and new approaches to data collection
- Moving away from a focus on waste towards a focus on resources
- Integrate weight-based targets and reporting with impact-based targets and reporting
- Strengthen partnership with academic and local stakeholders to ensure data on a regular basis
- Develop a suite of indicators to measure progress
- Set comprehensive but proportionate monitoring, evaluation, and reporting (local, national and regional)

## Key Measures

- 31) Continuing to work with all partners and stakeholders to develop a shared vision and bold new approach to data on resources and waste** – Government acknowledges the seriousness of this national deficiency in data, and that a bold new approach is needed. The governments cannot tackle this matter alone, however has a role to play in bringing stakeholders and key players together in pursuit of the greater vision. For this, central and local governments need to take a stronger leadership and coordination role where that is required to drive progress, work closely with the Office for National Statistics and others to improve national datasets, work with the Environment Agency to ensure information and knowledge supplied to them by resource users, waste-producing businesses and the resources and waste industry is collected and stored in ways which enable data to be created and shared whilst respecting confidentiality, work with local authorities so they continue to report high-quality waste data on behalf of local communities, and work with other resource and waste sector to ensure data captured routinely in collecting, treating and disposing of waste can be safely shared without compromising confidentiality or market positioning.
- 32) Moving away from a focus on waste management towards a focus on resources management** – South Asia should fundamentally shift the focus of monitoring away from waste and towards resources, including a refocusing on measuring waste higher up the waste hierarchy. This will help government to understand how to better support the shift towards a more circular economy in which products and materials are reused, repaired and remanufactured. Importantly, it will also help businesses make better decisions, for example by considering relative carbon emissions from reuse rather than disposal of a product, or from constructing a new, energy-efficient building versus upgrading and repairing an existing building.
- 33) Maintaining the coverage and quality of data** – Waste Data Flow is the popular methodology that local authorities utilised to collect data on waste management. It helps to understand of how much waste was produced, treated and disposed of. An online system can develop to use for statutory reporting of targets and undertake periodic reviews. Make necessary improvements to Waste Data Flow so it continues to provide a user-friendly service and valuable data.
- 34) Working with tech firms to develop innovative digital solutions for tracking waste and consulting on options to mandate the digital recording and sharing of waste movement data** – Currently, there are very few data on business and industrial waste and available data also come from a patchwork of sources. Ensure the consultation takes account of national reporting requirements as well as a focus on tackling crime.
- 35) Integrate weight-based targets and reporting with impact-based targets and reporting, focusing initially on carbon and natural capital accounting** – Practical and measurable indicators should be developed to measure progress, though it is hard to establish some of these indicators immediately because the data does not yet exist. In addition, given the long-term nature of the strategy, new indicators might become more relevant in future years, for example, metrics based on natural capital or other environmental or social impacts. Thus, develop new indicators and metrics that help to understand and act more in line with our strategic aims, focusing particularly on greenhouse gas emissions and natural capital: a principle supported by a number of stakeholders.

**36) Plan of evaluation and monitoring** – Where policies are implemented through regulation, monitoring and Post-Implementation Review (PIR) is required. PIR is a process to assess the effectiveness of a regulation after it has been implemented and operational for a period of time. A PIR provides the analysis required to establish whether, and to what extent, the regulation has achieved its original objectives, has objectives which are still valid, is still required and remains the best option for achieving those objectives: and can be improved to reduce the burden on business and its overall costs. We will learn from the findings of PIRs as we design new policies and amend existing ones.

# 6. Strategic Recommendations

To better accomplishment of the roadmap and successful transition from waste management to resource management in South Asia, the following strategic actions are proposed at different levels.

## South Asia sub regional Level

- Raise the priority among the 3Rs of waste reduction above reuse and recycling and incorporate concepts of circular economy/ sustainable production & consumption/ cleaner production/ pollution prevention into waste management strategy and programs
- Change the perspective of waste management to be seen as an integral part of the manufacturing process and as an investment opportunity rather than a sunk cost.
- Include emerging waste (plastic waste, E-waste and medical waste etc.) into the waste management strategy and programs
- Establish a new coordination mechanism/ knowledge hub/ knowledge center for information, best practice and knowledge exchange, training/ capacity building and technical support.
- Build and strengthen networks among national governments, municipalities, industry, and NGOs for the exchange of relevant experiences with technology and institutional development within the region as well as voluntary evaluation, monitoring and reporting.
- Link with existing regional networks and programs that are already working at some level of 3R – e.g., cleaner production, green productivity, eco-efficiency, etc.
- Ask international aid agencies to raise their priority for funding 3R programs and projects, including pilot and demonstration projects of proven technology, and not to sponsor polluting technologies.
- Ensure market for recycled materials - in countries where such utilisation is not possible, there may be regional cooperation for off-take by industry.

## National Level

- Raise the priority of sustainable waste management and 3R-related policy within the national development policy.
- Establish stable and effective national enabling policy with fiscal enabling support.
- Establish a national strategy in each country with a holistic approach covering upstream and downstream issues.
- Implement new or improved legislation on the 3Rs that complements pollution control regulations.
- Develop and implement specific policies and regulations for each waste stream.
- Develop national action plans for specific waste sectors jointly among key stakeholders.
- Establish clear targets for waste reduction and recycling for key waste areas.
- Establish clear guidelines for implementing 3R programs.
- Development capacity of national and local governments to implement 3R.
- Promote collaboration among municipalities, the business sector, and NGOs/CSOs.
- Promote the exchange of industrial waste from one industry as inputs for other industries through information sharing as a starting point for a more comprehensive program on industrial 3Rs.



- Establish environmental education and information services/ promote environmental education and public awareness
- Invest in research and development for technology adaptation.

### **Local Level**

- Raise the priority of sustainable waste management and 3R-related policy within local policy.
- Establish a local strategy for each city with a holistic approach covering upstream and downstream issues.
- Implement new or improved local legislation on the 3Rs that complements pollution control regulations.
- Develop local action plans for specific waste sectors jointly among key stakeholders.
- Establish clear targets for waste reduction and recycling for key waste areas.
- Promote collaboration among all local stakeholders including business sector, academic, and NGOs/CSOs.
- Involve the informal sector as a stakeholder and integration into the formal waste management system
- Disseminate existing success stories on the 3Rs to local agencies.
- Build public awareness of the environmental and health risks from wastes and the options for mitigation of risks through the 3Rs.
- Waste management should be sustainable in operations by imposing user fees on polluter or household.

# References

ADB (2011): Toward sustainable municipal organic waste management in South Asia: A guidebook for policy makers and practitioners, ADB, Philippines. <https://www.adb.org/sites/default/files/publication/29082/sustainable-waste-management-south-asia.pdf>

ADB (2017): Key Indicators for Asia and the Pacific – 48<sup>th</sup> Edition, ADB, Manila. ISBN 978-92-9257-911-1 (Print), 978-92-9257-912-8 (e-ISBN). <https://www.adb.org/publications/key-indicators-asia-and-pacific-2017>

ADB and IGES (2008): Towards Resource-Efficient Economies in Asia and the Pacific, ADB, Philippines. <https://www.adb.org/sites/default/files/publication/29809/resource-efficient-economies-2008.pdf>

ADB, IGES and UNEP (2006): Promoting Reduce, Reuse and Recycling in South Asia: Synthesis Report of 3R South Asia Expert Workshop in Kathmandu, Nepal, 30 August – 1, September 2006, ADB, Philippines. [https://iges.or.jp/en/publication\\_documents/pub/policyreport/en/454/00\\_fulltext.pdf](https://iges.or.jp/en/publication_documents/pub/policyreport/en/454/00_fulltext.pdf)

Ellen Macarthur Foundation (2019): Circular Economy System Diagram, <https://www.ellenmacarthurfoundation.org/circular-economy/concept>

Ellis, P and Mark R (2016): Leveraging Urbanization in South Asia: Managing Spatial Transformation for Prosperity and Livability. South Asia Development Matters. Washington, DC: World Bank. doi: 10.1596/978-1-4648-0662-9

EU (2019): Directive 2008/98/EC on waste (Waste Framework Directive), <https://ec.europa.eu/environment/waste/framework/>

IPCC (2013). Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Stocker, T.F., D. Qin, G.-K. Plattner et al. (Eds.). Cambridge, United Kingdom and New York, NY, U.S. <http://www.ipcc.ch/report/ar5/wg1/>

ISWA (2009): Waste and Climate Change: ISWA White Paper. - ISWA, Vienna, Austria,

Menikpura, N., & Premakumara, D. G. J. (2018). User's Manual - Emission Quantification Tool (EQT) for Estimating Short Lived Climate Pollutants (SLCPs) and Other Greenhouse Gases (GHGs) from Waste Sector, IGES and CCAC. [https://ccet.jp/sites/default/files/2018-12/User%20Manual\\_EQT%20version%20II\\_June%202018.pdf](https://ccet.jp/sites/default/files/2018-12/User%20Manual_EQT%20version%20II_June%202018.pdf)

MOEJ (2008): The Basic Act for Establishing a Sound Material-Cycle Society. <https://www.env.go.jp/en/laws/recycle/12.pdf>

MOEJ (2013): Hanoi 3R Declaration: Sustainable 3R Goals for Asia and the Pacific for 2013 – 2023. <https://www.env.go.jp/recycle/3r/en/declaration/hanoi-declaration.html>

Murray, B (2013): Embedding environmental sustainability in product design, Product Sustainability Forum, <http://www.wrap.org.uk/sites/files/wrap/Embedding%20sustainability%20in%20design%20%20-%20final%20v1.pdf>

Nurul Amin, ATM (2017): Country Chapter: The People’s Republic of Bangladesh, UNCRD. [http://www.uncrd.or.jp/content/documents/5685\[Nov%202017\]%20Bangladesh.pdf](http://www.uncrd.or.jp/content/documents/5685[Nov%202017]%20Bangladesh.pdf)

OECD (2016): Extended Producer Responsibility: Updated Guidance for Efficient Waste Management, OECD, Paris

Premakumara, D.G.J, and Amanuma, N (2018); Governing Integrated Solid Waste Management: The Case of San Carlos, Philippines, pp. 59-92, in Governance for Integrated Solutions to Sustainable Development and Climate Change: From Linking Issues to Aligning Interests, IGES, Hayama

Premakumara, D.G.J; Menikpura, S.N.M; Rajeev K. S; Matthew H; Albert, A. M; Eligio T. I; Maria Delia, C. M. V; Liz C. S (2018): Reduction of greenhouse gases (GHGs) and short-lived climate pollutants (SLCPs) from municipal solid waste management (MSWM) in the Philippines: Rapid review and assessment, Waste Management, 80 (2018), 397-405, <https://doi.org/10.1016/j.wasman.2018.09.036>

SAARC (2008): SAARC Action Plan on Climate Change

SAARC (2010): SAARC *Convention on cooperation on environment*. Signed during the 16th SAARC Summit. Thimphu, 28–29 April 2010. <https://www.saarc-sec.org/index.php/resources/summit-declarations/18-sixteenth-saarc-summit-thimphu-2010/file>

SACEP (2016): South Asia Forum on Sustainable Consumption and Production. <http://www.sacep.org/pdf/Main-Page/Right-Side/2016/October/2016-10-12/Briefing-note-to-SCP.pdf>

SACEP (2017): Marine Environmental Pollution: Challenges and Opportunities in South Asian Seas Region, Colombo. <http://www.sacep.org/pdf/Reports-Technical/2017.05-Marine-Environment-Pollution-Challenges-and-Opportunities-in-South-Asian-Seas-Region.pdf>

Sarkar, M, Karmakar, G, Mahalanabis, S (2019): South Asian Literature, Culture and Society: An Interpretative Exegesis, Akhand Publishing House, First edition, 316 pages

Taibi, F.-Z. and Konrad, S. (2018): Pocket Guide to NDCs under the UNFCCC. – NDC Partnership, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Eschborn, German

UN (2019): World Population Prospects 2019, online edition, Department of Economic and Social Affairs, Population Division. <https://www.un.org/development/desa/publications/world-population-prospects-2019-highlights.html>

UNCRD (2018): Indore 3R Declaration of Asian Mayors on Achieving Clean Land, Clean Water and Clean Air in Cities. <http://www.uncrd.or.jp/content/documents/6781Final%20Indore%203R%20Declaration-11April%202018.pdf>

UNCRD, IGES and MOEJ (2018): State of the 3Rs in Asia and the Pacific: Expert's Assessment of Progress in Hanoi 3R Goals. [http://www.uncrd.or.jp/content/documents/6777\[full%20document\]%20State%20of%20the%203Rs%20in%20Asia%20and%20the%20Pacific.pdf](http://www.uncrd.or.jp/content/documents/6777[full%20document]%20State%20of%20the%203Rs%20in%20Asia%20and%20the%20Pacific.pdf)

UNDP (2018): Human Development Indices and Indicators 2018 - Statistical Update, UN Plaza, New York. [http://hdr.undp.org/sites/default/files/2018\\_human\\_development\\_statistical\\_update.pdf](http://hdr.undp.org/sites/default/files/2018_human_development_statistical_update.pdf)

UNEP (2017): Asia Waste Management Outlook, UNEP. [http://wedocs.unep.org/bitstream/handle/20.500.11822/27289/Asia\\_WMO.pdf?sequence=1&isAllowed=y](http://wedocs.unep.org/bitstream/handle/20.500.11822/27289/Asia_WMO.pdf?sequence=1&isAllowed=y)

UNEP and CSIRO (2011): Resource Efficiency: Economic and Outlook for Asia and the Pacific, UNEP. Bangkok. <http://wedocs.unep.org/handle/20.500.11822/7950>

UNEP and ISWA (2015): Global Waste Management Outlook, UNEP. [https://wedocs.unep.org/bitstream/handle/20.500.11822/9672/-Global\\_Waste\\_Management\\_Outlook-2015Global\\_Waste\\_Management\\_Outlook.pdf?sequence=3&isAllowed=](https://wedocs.unep.org/bitstream/handle/20.500.11822/9672/-Global_Waste_Management_Outlook-2015Global_Waste_Management_Outlook.pdf?sequence=3&isAllowed=)

UNEP IETC and GRID-Arendal (2019): Gender and waste nexus: experiences from Bhutan, Mongolia and Nepal, UNEP, [https://gridarendal-website-live.s3.amazonaws.com/production/documents/:s\\_document/511/original/GenderAndWaste\\_lores.pdf?1570449985](https://gridarendal-website-live.s3.amazonaws.com/production/documents/:s_document/511/original/GenderAndWaste_lores.pdf?1570449985)

UNEP, Switchasia, IGES and CSIRO (2013): Capacity Building and Policy Needs Assessment for Sustainable Consumption and Production, UNEP, 2013, Bangkok. <https://www.switch-asia.eu/resource/capacity-building-and-policy-needs-assessment-for-sustainable-consumption-and-production/>

UNESCAP (2017): Analysing Resource Efficiency Transitions in Asia and the Pacific, United Nations, Bangkok. [https://www.unescap.org/sites/default/files/publications/Analysing%20Resource%20Efficiency%20Transitions\\_arunjab\\_13\\_3\\_2018.pdf](https://www.unescap.org/sites/default/files/publications/Analysing%20Resource%20Efficiency%20Transitions_arunjab_13_3_2018.pdf)

World Bank (2018): What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050, the World Bank Group, Washington

World Bank (2019): The World Bank in South Asia: Overview, <https://www.worldbank.org/en/region/sar/overview>





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