Discussion paper issued without formal editing

FOR PARTICIPANTS ONLY
26 October 2016
ENGLISH ONLY

UNITED NATIONS
CENTRE FOR REGIONAL DEVELOPMENT

In collaboration with

Australian Government,
Office of Green Industries SA on behalf of the Government of South Australia,
Commonwealth Scientific and Industrial Research Organisation, and
Ministry of the Environment, Government of Japan

SEVENTH REGIONAL 3R FORUM IN ASIA AND THE PACIFIC,
2-4 NOVEMBER, 2016, ADELAIDE, SA, AUSTRALIA

Contribution of 3Rs to achieving the Sustainable Development Goals – Science and Policy for the 2030 Sustainable Development Agenda

(Background Paper for Plenary Session 1 of the Programme)

Final Draft

This background paper has been prepared by Mr. Heinz Schandl, for the Seventh Regional 3R Forum in Asia and the Pacific. The views expressed herein are those of the author only and do not necessarily reflect the views of the United Nations.

Contribution of the 3Rs to achieving the Sustainable Development Goals – Science and Policy for the 2030 Sustainable Development Agenda

Background paper for the seventh regional 3R Forum for Asia and the Pacific, Adelaide, Australia

Heinz Schandl

25 October 2016

Introduction

This background paper has been prepared for the seventh regional 3R Forum. It assesses the contribution of the 3Rs, as outlined in the Kobe declaration and the Hanoi 3R declaration, in achieving sustainable development in the Asia and the Pacific region. It investigates the obvious contribution of sustainable materials and waste management for the SDG targets related to environmental sustainability and resource conservation and also looks into how 3R strategies can contribute to increasing the resilience of economic and social development and even create new economic opportunities that are focused on long-term outcomes and may well exceed the outcomes of the current development model.

The 3R policy community has, over the past decade, contributed an information base that can now be used to establish strategies, programs and policies that drive sustainable development of national economies in our region. The 3Rs create a link between regional economic development, environment and sustainability through practical strategies that enhance the ways in which policy makers, business leaders and practitioners think about poverty alleviation, job creation and environmental and resource conservation. This background paper situates these findings in the context of the new SDGs and demonstrates how the 3Rs will make a substantial contribution to achieving the SDG targets and outcomes.

The post-2015 development agenda

The new sustainable development agenda, agreed by all countries globally, has powerfully renewed the commitment of the international policy community to alleviate poverty and to enable all countries and people to pursue a high standard of living. This new commitment builds on large achievements over the past two decades in many parts of the world: lifting millions of people out of poverty, providing quality food, safe water, electricity, and sewerage, and ensuring educated and healthy lives for many.

These achievements have come a cost, however, of fast increasing environmental pressures and impacts that include ever-increasing demand for natural resources (materials and energy), increasing pollution and waste, climate change, deforestation, habitat change and biodiversity loss.

To address these costs of development, the new sustainable development goals give equal priority to people, prosperity and the planet and raise awareness that economic growth and human well-being are enabled, fuelled and underpinned by natural resources and well-functioning ecosystems. This is addressed in a set of goals including goal 6 (water), goal 7 (energy), goal 13 (climate), goal 14 (oceans and marine resources), and goal 15 (terrestrial ecosystems). More fundamentally, goal 12 (sustainable consumption and production) addresses the importance of processes of production and consumption with regard to resource demands, waste and emissions that coincide with products and services and infrastructure delivery. Goal 11 (cities) focuses on the important role of urban agglomerations for sustainable housing, transport and communication infrastructure. Finally, target 8.4 of goal 8 (economic growth) highlights the importance of decoupling economic growth from environmental pressures and impacts and asks for continuous improvements in resource efficiency in production and consumption at the global scale.

The environmental agenda embedded into sustainable development goals resonates with other important global developments such as the Paris climate change agreement reached in 2015 and in effect since October 2016, the decarbonisation of the energy system and resource efficiency initiative of the group of seven major economies leadership agreed in their regular meeting in Germany in 2015, and reinforced in Japan in 2016, and many efforts at regional and national scale including the sustainable natural resource use strategy of the European Union, Japan's sound materials cycle society law and PR China's circular economy promotion law.

There appears to be almost universal agreement that achieving the SDGs for nine billion people by 2050 will be a major policy challenge. On the other hand there is ample evidence that there are many cost-effective options for decoupling in the short and medium terms in construction and housing, transport and mobility, agriculture and food, heavy industry, energy and water. In the long term, decoupling promises to deliver better economic, employment and environmental outcomes compared to business as usual.

There are now a myriad of policy programs aiming to achieve decoupling of economic activity from growing natural resource use, waste amounts and emissions. They include the 10 years framework of programs for a

sustainable consumption and production, green economy, low carbon development and green growth, circular economy and the 3Rs (reduce, reuse and recycle). These policy programs focus on different aspects and entry points for achieving decoupling. They are nevertheless to be seen as complimentary in their effort to reduce the resource, energy and emissions intensity of economic activities to achieve greater well-being for more people at much lower environmental cost.

Measuring environmental sustainability – the what?

Environmental sustainability refers to the long-term viability of the interrelationship between society and economy and the environmental systems that deliver services to socio-economic processes. Natural resources – materials, energy, water and land – are required as inputs to all processes of production and consumption of goods and services, and waste and emissions are unintended side effects of socio-economic processes. On the input side the timely availability and affordability of natural resources is the main issue and supply bottlenecks and depletion of certain resources can put strain on well-functioning production systems. On the output side an overload of waste and emissions on the absorptive capacity of ecosystems to reintegrate those flows into natural processes is the main issue and if overloaded impacts such as pollution, acidification and eutrophication of soils and water bodies, and climate change, will occur. These impacts reduce the amenity of cities and landscapes and create specific risks for ecosystems and human health.

Table 1. Linkages between environmental pressures and impacts

Problem	Mechanism	Pressures
Climate Change	CO_2, N_2O and CH_4	Energy consumption, land use, material flows
Acidification	SO_2, NH_4 and NO_x	Energy consumption, land use
Eutrophication	Bio-accessible phosphorus and nitrogen	Land use
Biodiversity loss	Intensive agriculture and forestry	Land use, material flows, global trade
Soil erosion	Agricultural and forestry practices	Land use
Water protection	Industrial effluents and municipal waste water	Land use, energy consumption
Waste problems	Manufacturing and households	Material flows
Depletion of natural resources	Non-renewable and renewable	Material flows, energy use and land use
Health risks	Toxic substances	Biological activity

Economic processes are measured and monitored through systems of national accounts which deliver headline indicators such as, for example, gross domestic product or the trade balance and more detailed information on specific economic activities at the sector or product level. Complementary systems for natural resources, waste and emission accounts have been established more recently and are summarised in the system of environmental and economic accounts (SEEA) framework. SEEA relies on satellite accounts for natural resources, waste and emissions that also deliver headline indicators that can be shown alongside economic headline indicators and provide detailed information as well.

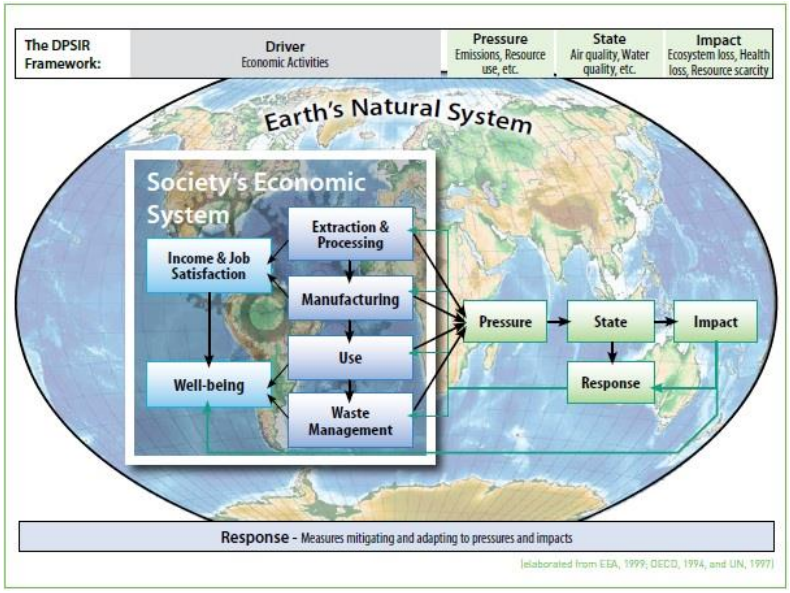
One of the main advantages of environmental satellite accounts is that they rely on a uniform currency – tonnes, joules, and hectares – and a uniform theory of socio-economic metabolism and the physical laws of thermodynamics. Full complementarity with the economic accounts achieved through the SEEA framework ensures their relevance for informing policy and measuring policy effectiveness.

Another important framework for analysing society/economy and nature interrelations is the Driving Force, Pressure, State, Impact and Response (DPSIR) framework which allows information, data and indicators to

be organised into distinct domains of economic drivers (such as economic growth, population growth and employment growth) with environmental pressure including material, energy and water use, land use and the generation of waste and emissions. Pressures are changing the state of the environment and lead to changes in water, soil and air quality resulting in environmental impacts. The environmental impacts are linked to pressures upon the environment through well understood processes. Every step in the DPSIR framework, in principle and if monitored, allows for policy responses to occur that may change the overall drivers of economy and population in the future.

Box 1. The DPSIR framework linking the socio-economic system to the environmental system and natural resources

The DPSIR framework has been used by the United Nations, the European Environment Agency and the OECD to align environmental and economic indicators with policy responses within one unified framework. DPSIR responds to the common phenomena of long and unstructured list of indicators by systematising the available information.



Once information is structured in the DPSIR framework relationships between drivers, pressures and impacts can be explored and several efficiency indicators can be established. DPSIR also allows to link state and impacts with planetary boundaries.

The DPSIR sequence also allows for a more detailed analysis of decoupling. This may involve the relationship between drivers and pressures or impacts, or the relationship between pressures and impacts across a whole economy or for specific economic activities such as transport, housing or food. This scheme is also extremely useful to better understand the tensions and potential trade-offs between development and environment that are built into the 17 goals and 159 targets of the SDGs. The overwhelming majority of SDG targets are either drivers or policy responses. The responses refer to a large extent to institutional settings that enable the driver to occur and to a much lesser extent aim to reduce the environmental intensity of human well-being.

A much smaller number of targets refer to pressures, changes in the state of the environment and impacts. Pressure indicators are most represented in goal 12 (sustainable consumption and production) which is also most directly related to the notion of the 3Rs (reduce, reuse and recycle).

Table 2. The SDGs and the DPSIR framework

	Driving Forces *Socio-economic and socio-cultural forces driving human activities*	**Pressure** *Stresses that human activities place on the environment*	**State** *The condition of the environment*	**Impact** *Effects of environmental degradation*	**Response** *Policy responses*
Goal 1 **'POVERTY'**	❑❑❑❑			❑	❑❑
Goal 2 **'HUNGER'**	❑❑❑❑		❑		❑❑❑
Goal 3 **'HEALTH'**	❑❑❑❑❑❑❑❑			❑	❑❑❑❑
Goal 4 **'EDUCATION'**	❑❑❑❑❑❑				❑❑❑❑
Goal 5 **'GENDER EQUALITY'**	❑❑❑❑			❑❑	❑❑❑
Goal 6 **'WATER'**	❑❑	❑	❑❑		❑❑❑
Goal 7 **'ENERGY'**	❑	❑			❑❑
Goal 8 **'ECONOMIC GROWTH'**	❑❑❑❑❑	❑			❑❑❑❑❑❑
Goal 9 **'INFRASTRUCTURE'**	❑❑❑❑	❑			❑❑❑
Goal 10 **'INEQUALITY'**	❑❑❑❑❑				❑❑❑❑❑
Goal 11 **'CITIES'**	❑❑❑❑		❑	❑	❑❑❑❑
Goal 12 **'SCP'**		❑❑❑❑			❑❑❑❑❑❑❑
Goal 13 **'CLIMATE'**					❑❑❑❑❑
Goal 14 **'OCEANS'**		❑❑	❑	❑	❑❑❑❑❑
Goal 15 **'ECOSYSTEMS'**			❑❑❑❑❑	❑	❑❑❑❑❑❑
Goal 16 **'PEACE'**					
Goal 17 **'PARTNERSHIP'**					

What this analysis shows is that achieving the human development objectives of reducing poverty and hunger, providing universal education and health and ensuring access to water, electricity and other vital resources will massively increase most of the pressure indicators relating to natural resources, emissions and waste. In fact, generalising the average resource use of high-income countries – which is already 25 tonnes per capita and 10 times as high as least-developed countries' material use – would more than triple global resource use from currently 80 billion tonnes to 225 billion tonnes. The decoupling effort required to stay within the limits of what resource supply systems can provide and ecosystems can absorb and avoiding increasing conflict over competing land use will require large investments in new policies and business incentives that can deliver decoupling of human well-being and environmental pressures and impacts.

The decoupling hypothesis says that:

- it is possible for economic growth to continue while reducing natural resource use and environmental impacts in relative or absolute terms;
- in the short term there are many cost-effective opportunities for greater resource efficiency that will offset wholly or partially any costs incurred in this decoupling;
- in the medium to long term decoupling will generate higher economic growth than would occur on current trends of inefficient resource use, environmental destruction and climate change.

There are different reasons for decoupling, however. Decoupling may occur as a side effect of economic maturation and structural change from primary sectors, to manufacturing, to services. Since services generally have a lower material intensity than primary economic activities or manufacturing, overall the economic efficiency of material use will improve as a free dividend.

A second reason for decoupling can be outsourcing of material- and waste-intensive processes to third countries which has been a trend in many high-income countries that increasingly rely on resource-intensive imports from abroad.

3R policies aim for decoupling enabled by innovation, changes in technology and design, and transitioning to less resource-intensive infrastructure and industrial processes. This is the form of decoupling which contributes to improvements in overall environmental performance and should be the main objective of government efforts.

A plethora of policy programs to achieve environmental sustainability

There is no lack of policy programs that aim to reduce the environmental burden of production and consumption in Asia and the Pacific. The existing policies are often well integrated with national development plans, though contradictions among different aspects of the plans are not always dealt with. The available policy programs, moreover, often overlap in intent and sometimes in strategies but are also complementary in the sense of focusing on certain aspects of the economy – resource use and ecosystems interplay. Policies, national strategies and road maps exist for Sustainable Consumption and Production, Green Economy and Green Growth, and Low Carbon Development.

The notion of Sustainable Consumption and Production (SCP) figures most prominently in the context of the SDGs with a standalone goal for SCP. Originating from the UN Conference on Environment and Development in Rio De Janeiro in 1992 and reinforced by the Marrakesh process in 2003 and the formulation of the 10 Year Framework of Programs, SCP has since focused on policy programs and instruments that support the eco-efficiency of production and require extended producer responsibility, ask for sustainable procurement by governments, and promote responsible consumption by households and sustainable infrastructure.

In a similar vein, but focusing on planning and investment, green growth and green economy policies aim to establish green production infrastructure, green products, and green cities and urban infrastructure. The leading idea of the green economy is to reduce investment in brown sectors and economic activities and increase investment in green sectors such as, for example, disinvesting in fossil-fuel based energy generation and investing in renewable energy generation. For medium income economies this could mean changing existing investment decisions. Low income countries will rely on financial development support to build the green economy. The notion of Green Growth was first introduced by ESCAP and was reinforced in UNEP's plea for a Global Green New Deal formulated in the aftermath of the Global Financial Crisis. UNEP's strategy was to encourage countries to focus their economic investment plans, designed to kick-start the economy, on green sectors and activities to earn a double dividend of new employment and economic growth, plus resource efficiency, waste minimisation and greenhouse gas abatement.

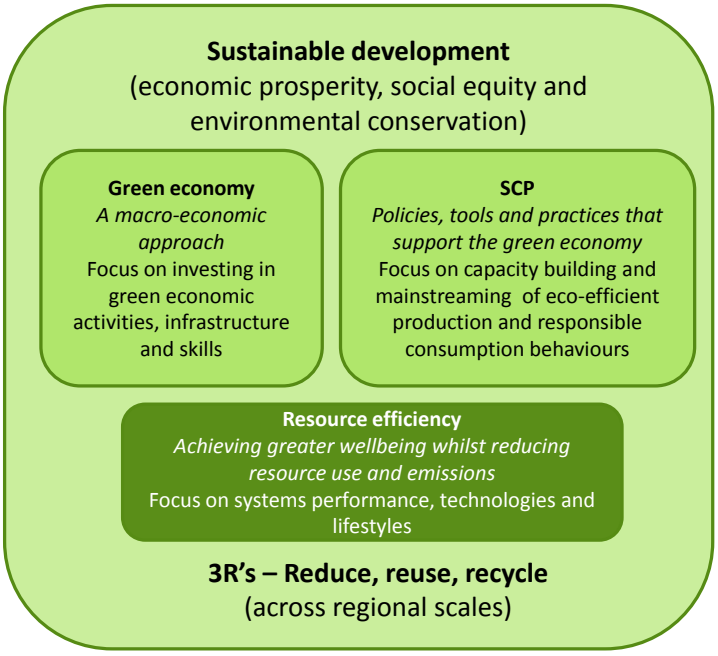


Figure 1. A family of policy frameworks to support sustainable development

In combination, the macro-economic approach of green economy, investing in green economic activities, infrastructure and skills, and capacity building and technical support for policies tools and practices that focus on eco-efficient industrial systems, eco-industrial parks in cities, and responsible consumption behaviour of governments and households would enable national economies to transition towards decoupling. This would allow increases in resource efficiency at the level of the macro-economy to achieve greater levels of well-being while reducing resource use and emissions. The notion of resource efficiency, or eco-efficiency, focuses

on improved systems performance, innovative technologies and environmentally responsible lifestyles. Green economy, SCP and resource efficiency are all means by which to achieve sustainable development.

The special contribution of the 3Rs lies in the domain of sustainable management and use of materials, and the management of waste, taking a whole of life cycle approach. The 3Rs are important at regional scale where they may contribute to regional economic development. All policy frameworks taken together aim to deliver to the overall objective of sustainable development.

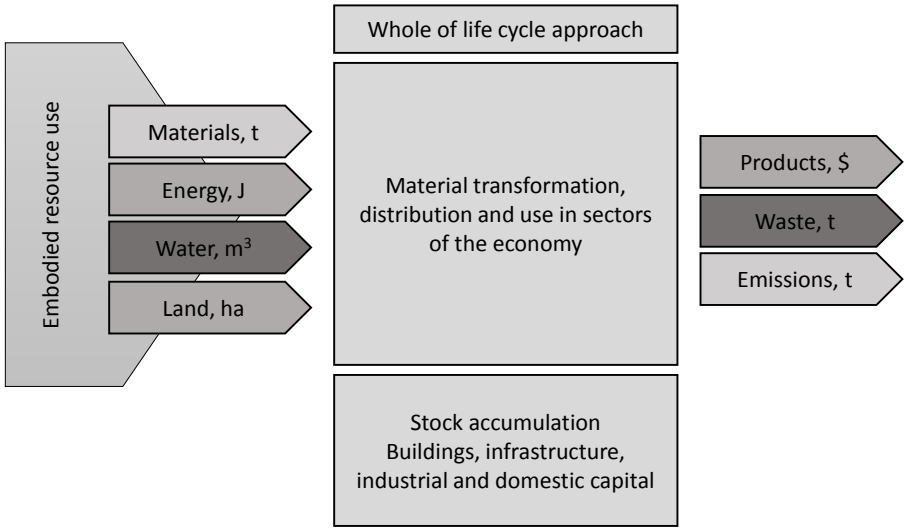
Explaining the 3Rs

The notion of the 3Rs entered the high level policy agenda in 2008 with the endorsement of the Kobe 3R action plan through the leadership of the G8 economies. The 3R policy framework starts by recognising that compounding waste amounts, if not treated properly, accelerate environmental impacts related to waste flows with negative repercussions for air, soil and water quality. Managing waste in the 3Rs approach is, however, situated in a broader understanding of waste flows in the context of the whole life cycle of natural resources, from cradle to grave. The 3R approach acknowledges that ignoring the immense value of waste flows for recovery and recycling would put additional pressure on resource supply systems. If the global economy solely relies on virgin materials, it would push resource extraction and the related economic and energy cost of resource extraction beyond limits and the added value that can generated from secondary materials would be missed.

From the very beginning the 3Rs focused on the whole life cycle of natural resources, considering the potential for material recycling in the context of material systems and heat recovery in the context of energy systems. The concept included taking a global view by focusing on trade of materials and wastes and incentivising collaboration and technology transfer between developed and developing economies to achieve the best possible outcomes at the global scale with regard to resource conservation, waste minimisation and low carbon development.

Box 2 Natural resource accounting

Natural resource accounts link resource inputs and outputs to the economic process using a common currency for every resource domain. The 3R's focus on the material interaction, i.e. a representation of the physical economy in terms of primary material input and output of products, waste and emissions. This information is provided by material flow accounts (MFA).



MFA is compatible to the economic accounts and has become a standardised approach used by the OECD, the European Statistical Office, the UNEP and several national governments. MFA provides a comprehensive data analysis framework from which headline indicators but also detailed data can be derived.

The concept of the 3Rs also recognises the very large economic potential of resource and heat recovery activities. These would involve highly skilled labour and high salaries and hence could drive a next wave of innovation in the global economy.

In essence, the 3Rs are concerned with the management of materials and waste through their whole life cycle from extraction, transformation, and consumption to disposal, i.e. the industrial metabolism. Information about waste and materials (including emissions) is acquired through material flow accounts. Primary materials enter the economic process through extractive sectors of the economy – agriculture, forestry, fisheries, mining and quarrying – and are also imported. Materials processing goes through many stages and involves energetic and structural (material) use.

Biomass and fossil fuels are mainly used for energetic purposes to provide endo- and exosomatic energy, i.e. they enter either the food production system or the energy generation system. Only small amounts of biomass and fossil fuels are used for structural purposes such as timber in construction or for furniture, or fossil fuels as a feedstock for plastics. That limits the potential for recycling to composting of biomass, and the reuse of timber and recycling of plastics. A very important issue for biomass and food systems is the large amount of waste that occurs during the life cycle from farm to plate of about close to 40%, which, if reduced, would have important implications for reducing land requirements for agriculture, inputs of fossil fuels and fertiliser, transport requirements and waste flows.

Metals and non-metallic minerals have structural and material uses in the economy for a large variety of products including cars and appliances and also for construction of buildings, transport and communication infrastructure. All metals are well suited for recycling in principle and so is glass. For some bulk metals such as steel, recycling rates are high and above 80%. For specialty metals, however, recycling rates may lie below 5% signalling substantial space for improvements through better collection, separation and investment in recycling technologies. Non-metallic minerals such as sand and gravel for concrete production are suitable for reuse but most often at a diminished usability, i.e. down-cycling.

3Rs in practice contribute to greater circularity of the economy in terms of material use and depending less on a throughput of materials. Recent research, however, shows that currently only about 6% of all materials processed in the global economy are recycled and contribute to closing the loop and a circular economy.

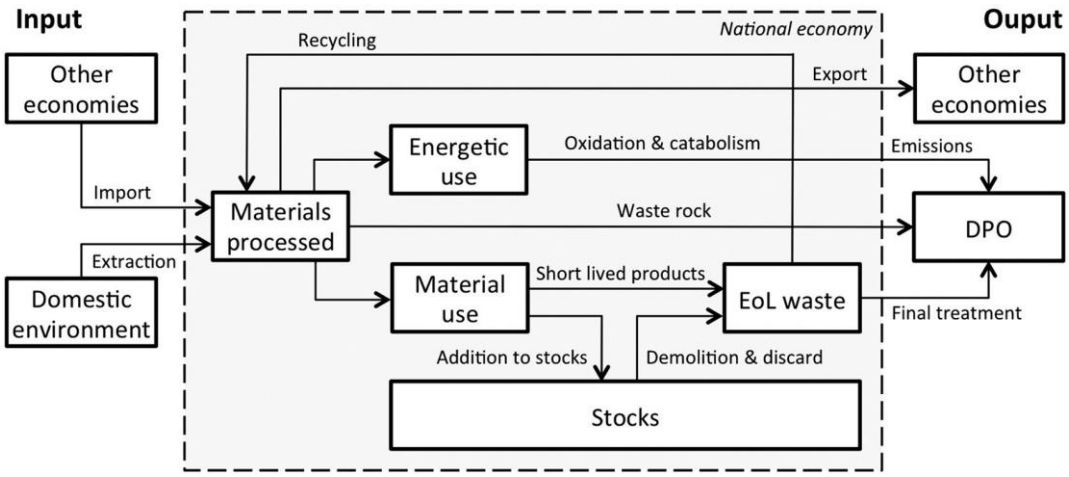


Figure 2. Framework for assessing circularity of the economy using MFA

There are two main barriers to enhancing circularity. These are the still rapidly increasing stocks of buildings and infrastructure, which accumulate materials, and growing demand for fossil fuels which are not available for resource recovery either. Continuing population growth and increases in urban populations lead to growing demand for urban infrastructure. If the lifetime of buildings and infrastructure could be increased substantially it would reduce the pressure on primary materials for construction. Shifting the energy system to renewable energy generation capacity will reduce the use of fossil fuels which are not suitable for recovery; currently their vast use reduces the circularity of the economy.

Considerable improvements in recycling rates are possible. To do this would require eco-friendly design of products, buildings and infrastructure to increase their lifetime, to provide equivalent services with lower

material and energy use, and to facilitate repair, reuse, product upgrading, modularity and remanufacturing, component reuse and recycling.

Specific contribution of the 3Rs – beyond environmental outcomes

The 3Rs promise to contribute to the sustainable development of urban areas and industrial systems. The reuse and recycling options explored through the 3Rs will create economic and employment opportunities in regions through the introduction of eco-industrial parks and industrial symbiosis networks, and the establishment of eco-towns. New industry clusters will emerge that capture wealth potential from waste, contributing strongly to regional prosperity. Recycling facilities and businesses will add to traditional waste management and create new job opportunities.

To capture opportunities for sustainable development it will be useful to start with principles, rules and values that can guide business, community and personal decisions about the collective and personal use of resources and assets. The new SDGs provide countries with a comprehensive set of principles, objectives and targets that can be grouped under four broad headings of economic, environmental, social and governance principles. They can potentially lead to ecological, social and business efficiencies. Good governance and well-established institutions are the main mechanism to achieve or improve these efficiencies.

There are at least four key enablers of regional development which determine the nature of development and how environmentally sustainable it might be. These enablers include institutions and governance, capital investment in strategic infrastructure, catalytic processes such as networks, and business enterprises and market penetration. To contribute to the SDGs existing enablers need to be reviewed and reshaped in response to environmental challenges, opportunities identified and risks that may potentially exist for sustainable development. In order to address the substantial dual objectives for improving material standards of living in harmony with the environment, outcomes may focus on how to improve the existing enablers through capacity building for improving governance and institutions. New investment or redirection of existing investment will be required to build strategic infrastructure to support 3R outcomes. Existing networks need to be utilised and new networks need to be established to foster the development of catalysts, i.e. organisations or individuals and leadership capacity, to bring together resources, factors of production and finance to invest in projects and services that enable 3R implementation.

The SDGs require no less than a paradigm shift from the traditional growth model to a new sustainable development paradigm. The traditional model involves profit maximisation, resource-intensive production and consumption concentrated in large urban industrial centres, fossil-fuel based energy, large centralised production systems, and the notion of growth first and cleaning up the environment later. The new paradigm is based on the premise of viable, long-term growth, conserving natural resources in production through material and energy efficient technologies and smaller distributed centres of production, a shift to renewable energy and a focus on reuse, recycling and conservation of natural resources. This new paradigm acknowledges that the economic system, environment and natural resources are mutually interdependent, that natural resources are exhaustible and often irreplaceable, and that resource efficiency and waste minimisation will ensure the long-term viability of economic activity.

Conclusions for policy

Achieving the sustainable development goals based on current systems of production and consumption would lead to severe stress on resource supply systems and the global climate, which may eventually undermine the success of the SDGs and fail with regard to targets that address natural resource use (materials, energy, water) climate (emissions) and ecosystem health. Business as usual cannot be generalised to 9 billion people on the planet. A scenario of ever-increasing resource use, waste and emissions also threatens the resilience of economic development of the Asia-Pacific region with regard to resource supply security and the economic cost of pollution and climate change.

A new economic development model is required, especially for the populous region of Asia and the Pacific, based on sustainable consumption and production to allow for the well-being of a large number of people at

minimal environmental pressure and impact. In this context, the 3Rs are an important policy framework for reducing primary resource requirements and waste flows, to focus on reuse of products and resources, and for recycling end of life products to enhance the circularity of the economy and reduce reliance on primary resources.

The Hanoi 3R declaration outlines strategies and programs for governments to implement and guidelines for working with the business community to enable human well-being at much lower environmental cost. 3R policies and programs can contribute to the SDGs across the board but at the core relate to those targets that address materials and waste (and emissions), that is, targets 12.2 and 12.5 and target 8.4 of resource efficiency.

The 3Rs focus on the material and waste flows that fuel the economic system. Countries need to develop policy frameworks, and policy monitoring and evaluation capacity. This would need to include national data on material flows, waste and emissions, and indicators for material intensity, per-capita material use and per-capita waste flows to report progress with regard to the relevant SDG targets. Data and indicators would need to cover both territorial and footprint of consumption perspectives.

Box 3. The New UNEP IRP Material Flow and Resource Productivity Data Set

The International Resource Panel of UNEP provides MFA data and indicators that can be used by countries to assess the material use at the national level.

A **coherent account of material use in the global economy** and for every nation, complementary to the System of National Accounts

A **large data set covering 40 years** (1970–2010) and most countries of the world. Direct and consumption-based material flow indicators for seven world regions and for individual countries, covering total usage, per capita use and material use per US$.

Data is available at UNEP Live http://uneplive.unep.org/

The new information will **help identify opportunities, risks and vulnerabilities related to the global supply of primary materials** and show the potential for efficiency gains and reductions in material use in the global economy

The Asia-Pacific Office of UNEP provides detailed data for economies in Asia and the Pacific which include materials, energy, and water and carbon emissions. The information is summarised in a report and data is available online at http://www.unep.org/roap/Activities/ResourceEfficiency/IndicatorsforaResourceEfficient/tabid/1060186/Default.aspx

SDG targets provide direction but are fairly vague in terms of the ambition required. This will allow countries to set their own targets based on past performance and ambitious goals. It would be advisable for countries to identify targets for material efficiency, for per-capita material use and for per-capita waste going to landfill as well as a target for material recycling. The Japanese set of targets for the Sound Material Cycle Society policy could serve as a blueprint for deciding on a set of indicators and targets.

Implementing the 3Rs can make a major contribution to the economic viability and prosperity of regional economies through the establishment of eco-industrial parks, eco-towns and recycling infrastructure.

It will require well-designed policies to enable and incentivise resource efficiency and waste minimisation to become a major part of business practice of governments, cities, businesses and households. This will include institutions and governance for 3R development, capacity strengthening, financing of 3R activities and projects and 3R-ready infrastructure, and also will rely on networks that can serve as catalysts for experiments and innovation to improve existing processes and design new processes of production and consumption.

CONTACT US

t 1300 363 400
+61 3 9545 2176
e csiroenquiries@csiro.au
w www.csiro.au

FOR FURTHER INFORMATION

Heinz Schandl
t +61 2 6246 4345
e Heinz.Schandl@csiro.au