

Towards a green economy for sustainable development and poverty reduction

An Asia-Pacific perspective



RIO+20
United Nations
Conference on
Sustainable
Development



Towards a green economy for sustainable development and poverty reduction

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United Nations Asia-Pacific Regional Coordination Mechanism

United Nations Asia-Pacific Regional Coordination Mechanism

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Foreword

At the Rio+20 sustainable development conference in June 2012, world leaders along with thousands of participants from governments, the private sector and NGOs, came together to shape how we can reduce poverty, advance social equity and ensure environmental protection on an ever more crowded planet to arrive at the future we want. The Conference outcomes and commitments made by UN Member States are expressed in *The future we want*, providing clear policy and action guidelines necessary for sustainable development.

The key issues covered at the Rio+20 conference were: the urgent need for strengthened political commitment to sustainable development; agreement to establish sustainable development goals; renewed emphasis on gender equality and women's empowerment; and a focus on partnerships to strengthen the support network for international actions for sustainable development.

Towards a green economy for sustainable development and poverty reduction is an example of the proactive and interagency collaboration that is required to meet post Rio+20 challenges. The common themes that are repeated throughout this publication are a result of bringing together contributions of specialists with institutional vision and policies from the different UN agencies in the Asia-Pacific Regional Coordination Mechanism. It highlights innovative and necessarily bold ways in which nations and agencies in the region are already moving forward in implementing the Rio+20 plans for action. A key challenge is moving beyond the narrow, short-term high economic growth strategies of the past by reinforcing the balance between the economic, social and environmental dimensions that support the development ideals of our Member Nations. We need to individually and collectively find and implement regional solutions to the critical and emerging issues of increasing population, pressure on natural resources, sustaining livelihoods, greening industry, using smart technologies and changing transport paradigms. This document highlights some solutions and presents a way forward.

Regional cooperation provides conduits towards more sustainable economic growth, closing development gaps and lifting millions of people out of poverty, while sustaining the capacity of our planet. Regional and national commitments are vital to achieve sustainable development goals, and regional fora must facilitate an open exchange of information, innovation and best practices so that commitments can be met. The Asia-Pacific region contains a high percentage of the global population, a large share of the world's natural resources and, increasingly, can use its economic, political, industrial and knowledge capacity to pave the path for more sustainable development.

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Acronyms and abbreviations

ANR	Assisted natural regeneration
APAARI	Asia-Pacific Association of Agricultural Research Institutes
APEC	Asia-Pacific Economic Cooperation
APFIC	Asia-Pacific Fishery Commission
APR	Asia-Pacific region
ASEAN	Association of Southeast Asian Nations
BCA	Building and Construction Authority
BIPV	Building Integrated Photovoltaic
BMET	Bureau of Manpower, Employment and Training
BRT	Bus rapid transit
CAI	Clean Air Initiative
CDM	Clean Development Mechanism
CDS	City Development Strategy
CER	Certified emissions reductions
CFL	Compact fluorescent lamps
CO ₂	Carbon dioxide
CRE	Commercialization of Renewable Energy
CREIA	Chinese Renewable Energy Industries Association
CSD	Commission on Sustainable Development
CSR	Corporate social responsibility
CSWS	Community Safe Water Schemes
DEES	District Energy and Environment Section, Nepal
EAF	Ecosystem-based Approach to Fisheries
EESP	Energy-efficient service provider
EET	Energy-efficient technology
EI	Economic instruments
EPR	Extended producer responsibility
ESCAP	(UN) Economic and Social Commission for Asia and the Pacific
ESL	Energy-saving lamps
FAMGS	Farmer Managed Groundwater Systems
FAO	Food and Agriculture Organization of the United Nations
FFS	Farmer Field Schools
FSC	Forest Stewardship Council
FWS	Farmer Water Schools
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse gas
GMC	Groundwater Monitoring Committees
GPOBA	Global Partnership on Output-Based Aid
HUN	Hydrological Unit Networks
ICPD	International Conference on Population and Development
ICT	Information and communication technology
IFFO	International Fishmeal and Fish Oil Organisation
IL	Incandescent lamps
ILO	International Labour Organization (UN)
IPCC	Intergovernmental Panel on Climate Change
IPM	Integrated Pest Management

IRBM	Integrated River Basin Management
IRRC	Integrated Resource Recovery Centre
IRRI	International Rice Research Institute
IT	Information and telecommunication sector
IT	Information technology
ITDP	Institute of Transportation and Development Policy
IWMI	International Water Management Institute
IWRM	Integrated Water Resource Management
LED	Light-emitting diode
LGF	Landfill gas flares
MBI	Market-based instruments
MDGs	Millennium Development Goals
METI	Ministry of Economy, Trade and Industry, Japan
MFI	Microfinancial institution
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MHFG	Micro-Hydro Functional Group
MHP	Microhydro plants
MPA	Marine protected areas
MSWM	Municipal solid waste management
MW	Megawatt
NEDO	New Energy and Industry Development Organization
NIA	National Innovation Agency, Thailand
NPR	Nepalese rupee
NRE	New and renewable energy
NTHS	National Trunk Highway System
NUTP	National Urban Transport Policy
NWFP	Non-wood forest product
PDS	Provincial Development Strategy
PECSMSE	Promoting Energy Conservation in Small and Medium Scale Enterprises
PEP	Public employment programmes
PMBC	Phuket Marine Biological Centre
PPP	Purchasing power parity
PUB	Public Utilities Board
PV	Photovoltaic
RBC	River Basic Committee
RE	Renewable energy
REDP	Rural Energy Development Programme
RET	Renewable energy technology
RIM	Asian and Pacific Regional Implementation Meeting
SAPI	Sustainable Agricultural Production and Intensification
SCG	Siam Cement Group
SDGs	Sustainable development goals
SEDA	Sustainable Energy Development Authority, Malaysia
SETC	State Economic and Trade Commission, China
SHS	Solar home system
SME	Small and medium enterprises
SPV	Solar photovoltaic
TREE	Training for Rural Economic Empowerment
UFW	Unaccounted for water loss
UNCED	UN Conference on Environment and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme

UNFCCC	United Nation’s Framework Convention on Climate Change
UNGA	United Nations General Assembly
UNIDO	UN Industrial Development Organization
UNSGAB	United Nation’s Secretary General’s Advisory Board on Water and Sanitation
UPPR	Urban Partnerships for Poverty Reduction Programme
WHO	World Health Organization
WHPRG	Waste heat recovery power generation
WIBI	Weather index-based insurance
WSI	Water-saving irrigation
WTO	World Trade Organization

EXECUTIVE SUMMARY

The United Nations Conference on Sustainable Development (UNCSD, or ‘Rio+20’) was held in Rio de Janeiro, Brazil, June 2012. Government delegations concluded negotiations in the Rio outcome document entitled *The future we want*.

The future we want calls for the United Nations General Assembly (UNGA) to take decisions on, *inter alia*: a Ten Year Financial Plan; organizing the proposed high-level political framework to replace the UNCSD; strengthening the United Nations Environment Programme (UNEP); constituting sustainable development goals (SDGs); an effective sustainable development financing strategy; and a mechanism that promotes the development, transfer and dissemination of clean and environmentally-sound technologies.

This publication highlights some of the Asia-Pacific region’s (APR) green economy initiatives and how agencies in the region are supporting the implementation of the commitments made at Rio+20. Implementation is underway: for example, the Asian and Pacific Regional Implementation Meeting (RIM) on Rio+20 Outcomes was held from 22 to 24 April 2013 in Bangkok, Thailand, and was convened by the UN Economic and Social Commission for Asia and the Pacific (ESCAP).

There is an urgent need for countries to adopt measures to transition to a green economy. Green economy policy aims to enhance convergence between the three pillars of sustainable development – simultaneous economic growth and poverty reduction, social equity and environmental sustainability. Green economy pursues improved human well-being and social equity through sustainable economic growth, whilst significantly reducing environmental risk and ecological scarcities.

During the next few decades, the situation in the APR and policy responses will determine future sustainability and social stability. Most APR countries will likely follow one of three broad paths of development: (i) rapid economic growth; (ii) stagnation; and (iii) green economy, balancing growth and sustainability.

Most middle-income and emerging economies are likely to pursue rapid economic growth rates, overlooking critical social and ecological problems. Political, corporate and institutional conditions encourage this, taking advantage of demand for raw materials unless catastrophic problems arise (including a prolonged global recession or climate change-related events).

Low growth and stagnation is also likely in many countries restrained by weak economic performance and low priority given to social and ecological sustainability. The slow and weak recovery from the current global economic crisis may protract recession. Even with global economic recovery, low-income resource-poor countries and developed countries where economic fundamentals constrain growth remain vulnerable.

The green economy envisages changes to balance growth with social and ecological sustainability. This is increasingly the vision in the context of economic and climatic crises. Most middle-income and emerging economies can develop renewable energy, to counter increasing costs of fossil fuels and concerns over energy security. Emerging economies, if inspired by visionary leadership, empowering policies and institutional frameworks that encourage investment in science and technology can shift towards a green economy. Sustainability is, however, unlikely to receive due attention against perceived imperatives for rapid economic growth, especially in resource-rich countries and regions with weaker policies and institutions, influenced by powerful corporations and wealthy elites seeking short-term gains.

We are moving into a turbulent and an uncertain era, particularly in the contexts of future food and livelihood needs for an increasing global population, poverty and equity, and resource depletion. Sustainable development is not always measured in quantitative terms – it may reflect synergies achieved (for example in rice-fish culture); improved resource governance from social empowerment and conflict resolution (such as appreciation-influence-control and co-management approaches); and verifying good practices (like sustainable certification of agriculture, forestry, fisheries practices).

The energy sector within a green economy must first and foremost be concerned with achieving universal access to modern energy. It is agreed that the use of renewable energy technologies (RETs) and energy-efficient technologies (EETs) reduces CO₂ emissions and environmental degradation; reduces consumption of natural resources; reduces the reliance on fossil fuels and improves national energy security. It is important for governments to accord this issue high priority and develop national action plans on energy access and efficiency and promote the use of renewable energy. The UN Global Initiative ‘Sustainable Energy for All’ presents an opportunity to assist the region towards developing a green economy model for energy use.

There are many challenges for water resources including high consumption, pollution, natural disasters, scarcity, as well as poor household access to water and sanitation. Ensuring access to safe water, and water for food production is clearly articulated through the United Nations Millennium Development Goals (MDGs). Comprehensive water resource management will be one of the most difficult issues in Asia in the coming years. Such an approach must encompass all demands – industrial, agricultural and urban – on water resources. The health and welfare impacts of urban water pollution have to be tackled on two fronts: provision of safe water supply and reduction of effluents. Public and private sectors together with community participation are needed to solve this problem using a collaborative approach. FAO and ESCAP have developed a framework for action for the role of water in green growth in support of economic, food and water security. Other UN agencies such as UN Habitat, UNEP and UNDP are also actively participating in the water sectors in the APR. A key development for regional Integrated Water Resource Management (IWRM) within the APR has been the establishment of committees and bodies to promote effective coordination and transboundary collaboration on water issues, such as the Asia-Pacific Water Forum (APWF).

In the Asia-Pacific region strong economic growth in the past decades has been enhanced by rapid industrialization and contributed to reduced poverty levels, higher literacy and longer life expectancy. A critical side-effect of rapid industrialization is the rapid increase in consumption of resources, and increased generation of pollution and wastes. Sustainable development urgently requires a widespread greening of industrialization. The greening of industries has become a core determinant of economic competitiveness and sustainable growth. Efficiency improvements can be significant lever for competitive advantage, promoting energy security, creating jobs and reducing costs through increased productivity. The UNIDO Green Industry approach addresses industrial policy to increase the competitiveness of the industrial base of developing countries in the markets for green goods and services, and take advantage of the opportunities for trade and new jobs. Governments must also recognize the importance of facilitating the greening of businesses and industries with a range of policy tools such as ecotax, green skills training, ecolabelling, green investment and green procurement.

The transition to greener commercial services is occurring in varying degrees in the developed and developing countries in the APR. The economic crisis and the past experiences of economic growth without sound environmental safeguards provide an opportunity for broad policy reform in APR nations. Most of the initiatives for greening the commercial sectors have originated in the developed countries and partnerships are needed with developed countries, private sectors, research organizations and technical experts. Support from international organizations and donors can also jumpstart green growth in commercial sectors.

Greening the Information and Telecommunication (IT) sector requires adopting a product life-cycle perspective for efficient use of increasingly scarce raw materials. There are various concerns: at the primary end of the supply chain, labour conditions and environmental performance of mineral extraction used in electronic components; in the secondary phase there needs to be continuous investment in innovation and services; in the tertiary phase the imperative is efficient recycling of scarce rare earths. These are opportunities for collaboration, partnership and action from global to local levels. IT helps the poor access markets through provision of market intelligence, and investment in infrastructure should be accompanied by the development of content and services. Standards and regulations can ensure environmentally and socially safe e-waste disposal and recycling.

Green public services are most likely to be successful if they are aligned with national sustainable development priorities across economic sectors. Government expenditure can be a powerful enabler for a transition to a green economy by providing grants, loans and other incentives. Investing in capacity building and training of government and private services can build capacity to utilize green economic opportunities and implement supporting policies.

Asian countries, especially East Asian countries, are also taking a lead in the creation of green infrastructure. The implementation of green building initiatives by governments in public housing is especially important in the APR, as more rural dwellers are migrating to large cities. Some countries are also making an effort to overcome the problem of municipal solid waste management. In both developed and developing countries, a continuous effort to change public behaviour and perceptions is necessary to ensure that green public services start the process of transition to a green society.

Transport is pivotal to economic development, providing physical and economic access to markets, employment, extension services, education, health care, as well as social and political participation. However, the transport sector is currently operating on fossil fuel, which is non-renewable, finite, increasingly expensive and polluting. With appropriate enabling conditions, the private sector can also play a significant role in greening the transport sector.

Rural livelihoods are at risk from the impacts of climate change. Policies can alter the pattern of development in rural areas. Activities dependent on fossil fuel energy and other energy-intensive practices may become too costly with rising fuel prices. Many countries in the APR have already begun to implement policies and programmes that promote the sustainability of rural communities and livelihoods within the context of a green economy. These initiatives have taken the co-benefits approach of economic and social benefits with environmental sustainability and climate resilience.

Over 40 percent of the APR's population lives in cities and towns and this is expected to increase over the coming decades. Green economy concepts include making cities and towns more sustainable and livable. The challenge is to systematically identify, document, analyse, adapt and upscale such innovative solutions. This calls for legal and fiscal frameworks; financing of urban development; urban planning and design; green technologies and innovations; and human resource and institutional capacity development. Increasingly cities have to adopt integrated and coordinated, adaptive and participatory approaches to urban planning, development, management and governance.

International, regional and national organizations can share successful initiatives by providing platforms for exchange of strategies, best practices and lessons learned. The platform should not be solely government-to-government, but it should also facilitate exchange among private sectors in different countries and between private and public sectors.

Case studies in this document demonstrate a number of ways that the challenges of changes to a green economy are being undertaken by various agencies across the region addressing the issues at hand. These case studies show how progress has already been made to derive benefits across the three pillars of sustainable development, and many could be replicated in other regions, helping to bring transformation in communities and assisting regions to move towards a green economy.

1 Introduction

Green economy

Green economy is a resilient economy that provides a better quality of life for all within the ecological limits of the planet. It is low carbon, resource efficient, and socially inclusive.

Green economy report (UNEP 2011).

Sustainable development has been the overarching goal of the international community since the UN Conference on Environment and Development (UNCED) in 1992. The Conference called upon governments to develop national strategies for sustainable development built on three pillars – economic, social and environmental. Green economy policies in the 1992 UNCED Rio Declaration promoted internalization of environmental costs and the use of economic instruments (Principle 16) as well as eliminating unsustainable consumption and production (Principle 8). Agenda 21 further elaborated on these principles and called for the development of national strategies for sustainable development incorporating measures for integrating environment and development, providing effective legal and regulatory frameworks, making effective use of economic instruments and market and other incentives, and establishing systems for integrated environmental and economic accounting.

Despite efforts of many governments and international cooperation to implement such strategies, continuing global economic and environmental concerns have been intensified by recent prolonged global energy, food and financial crises, and underscored by continued warnings from global scientists that society is in danger of transgressing a number of planetary boundaries or ecological limits.

With governments today seeking effective ways to lead their nations out of these related crises whilst also taking into account these ecological limits, green economy has been proposed as a means for catalysing renewed national policy development and international cooperation for sustainable development. The concept received significant international attention over the past few years as a tool to address the 2008 financial crisis and was a major theme of the 2012 UN Conference on Sustainable Development (Rio+20).

Background to the CSD and the Rio+20 conference

We, the heads of State and Government, having met at Rio de Janeiro, Brazil, from 20-22 June 2012, resolve to work together for a prosperous, secure and sustainable future for our people and our planet.

The future we want (CSD 2012).

The UN Conference on the Human Environment held in Stockholm, Sweden, in 1972, created a plan of actions linked to development and the environment, the establishment of an environment fund and UNEP as the central node for global environmental cooperation and treaty making. In 1983, the United Nations General

Assembly (UNGA) established the World Commission on Environment and Development. Its 1987 report, *Our common future*, stressed the need for development strategies in all countries that recognize the limits of the global ecosystem's ability to regenerate and absorb waste products. The Commission emphasized the links between economic development, security and environmental issues, and identified poverty eradication as a necessary and fundamental requirement for environmentally sustainable development.

The UN Conference on Environment and Development (UNCED), known as the Earth Summit in Rio de Janeiro, Brazil in 1992, resulted in the Declaration on Environment and Development, Agenda 21 (a 40-chapter programme of action) and the Statement of Forest Principles. The United Nations Framework Convention on Climate Change (UNFCCC) and the Convention on Biological Diversity (CBD) were also opened for signature during the Earth Summit. Agenda 21 called for the creation of a Commission on Sustainable Development (CSD).

At the United Nations Conference on Sustainable Development (UNCSD, or Rio+20) also held in Rio de Janeiro in 2012 government delegations concluded negotiations on the Rio outcome in a document entitled *The future we want*. It calls for UNGA to take decisions on, *inter alia*: designating a body to operationalize the Ten Year Financial Plan; identifying the format and organizational aspects of the proposed high-level political framework, which is to replace the CSD; strengthening UNEP; constituting an open working group on sustainable development goals (SDGs) to be agreed on by UNGA; establishing an intergovernmental process under UNGA to prepare a report proposing options on an effective sustainable development financing strategy; and considering a set of recommendations from the Secretary-General for a facilitation mechanism that promotes the development, transfer and dissemination of clean and environmentally-sound technologies. In addition, UNGA was called on to take a decision in two years on the development of an international instrument under the UN Convention on the Law of the Sea regarding marine biodiversity in areas beyond national jurisdiction. The UN Statistical Commission was called on to launch a programme of work on broader measures to complement gross domestic product (GDP) data and the UN system was encouraged, as appropriate, to support best practice and facilitate action for the integration of sustainability reporting. The text also includes language on trade-distorting subsidies, fisheries and fossil fuel subsidies.

This publication highlights some of the APR's green economy initiatives and how agencies in the region are, and will be, supporting the implementation of the commitments made at Rio+20 and the post-2015 development agenda. Implementation is underway, for example the Asian and Pacific Regional Implementation Meeting (RIM) on Rio+20 Outcomes took place from 22 to 24 April 2013 in Bangkok, Thailand; it was convened by the UN Economic and Social Commission for Asia and the Pacific (ESCAP).

Population and sustainable development

Unsustainable development has increased the stress on the earth's limited natural resources and on the carrying capacity of ecosystems. Our planet supports seven billion people expected to reach nine billion by 2050.

The future we want (CSD 2012).

Population growth is fundamentally linked to sustainable development; an understanding of the dimensions of the linkage is essential to green economy policy and action. Over recent years the crises of high food prices, severe energy and water scarcity have been directly related to global resource scarcity and environmental stress. These crises, together with the medium- to long-term problem of climate change, are expected to continue and will have negative effects on the world population's living conditions. Rapid population growth, which exerts pressures on natural resources and the environment, plays a role in producing or exacerbating these crises.

The Programme of Action of the International Conference on Population and Development (ICPD 1994) recognized the critical connection between population, poverty, sustainable economic growth and the environment. In particular, the Programme of Action indicates that efforts to slow population growth, reduce poverty, achieve economic progress, improve environmental protection and reduce unsustainable consumption and production patterns are mutually reinforcing. It acknowledges the usefulness of slowing population growth in countries where it is still high, noting that slower population growth has bought time for countries to adjust to future population increases, and recommends that countries that have not completed their demographic transition – the transition from high fertility and mortality to low fertility and mortality – take effective steps in this regard within the context of their social and economic development and with full respect for human rights.

Attaining universal access to reproductive health by 2015 is one of the targets of the MDGs. A primary indicator of this target is the contraceptive prevalence rate and studies have shown that family size is an issue that people in less-developed countries consider when they think about the ability of their community to adapt to climate change. The linkages between universal access to reproductive health, including family planning, and sustainable development, occur in a number of different ways.

Population growth and economic development

One basic association, long recognized in population studies, is that high fertility and rapid population growths impose more stringent demands on existing resources available for consumption, and are associated with lower per capita income (Table 1). Africa has an average per capita income of around one fortieth of North America and one twenty-fifth of Europe and has much higher fertility and population growth. The APR has seen population growth drop to below the world average while economic growth has increased rapidly. The unfolding of the demographic transition over time, especially after fertility and population growth start to decline, also has positive effects on national saving and economic growth. East Asia experienced very fast demographic transitions to low levels of fertility and mortality and vigorous economic growth from 1960 to 2010.

Table 1: Annual population growth, total fertility and GDP per capita

Regions	Average annual rate of population change (percent)		Total fertility (children per woman)		GDP per capita (USD)	
	1990-1995	2005-2010	1990-1995	2005-2010	1990	2009
World	1.52	1.16	3.04	2.52	5 680	7 208
Africa	2.53	2.30	5.62	4.64	943	1 188
Asia and the Pacific	1.62	1.09	2.97	2.28	2 039	3 488
Latin America and the Caribbean	1.71	1.15	3.02	2.30	4 049	5 394
Northern America	1.01	0.91	1.96	2.03	31 028	41 215
Europe	0.19	0.20	1.57	1.53	19 007	25 359

Sources: **United Nations**. 2011. *World population prospects: the 2010 revision*; **United Nations**. 2011. *Statistical yearbook for Asia and the Pacific 2011*.

High fertility and rapid population growth impose more stringent demands on existing resources available for consumption and saving, and tend to be associated with lower per capita income. Economic growth depends on a number of factors, including institutional and policy environments, but the available evidence indicates that lower fertility and slower population growth have made a significant, positive contributions to economic growth and development over the last several decades. While the overall inverse relationship holds for the extremes of income and demographic variables, there are variations across regions indicating the importance of other factors.

Poverty and population growth

There is ample evidence of the inverse relationship between demographic rates and economic well-being, and this relationship is also evidenced in poverty rates, one of the key MDGs. The countries with the highest poverty rates have average fertility levels of 5.4 children per woman, more than double the levels of the countries with low poverty rates. The poorest countries have population growth rates of the order of 2.5 percent per year, more than triple those of countries with very low poverty. Also, within countries, fertility, mortality and population growth rates are significantly higher in the lower income groups, and vice versa. The demographic rates among the lowest education and income groups in developing countries can be more than double those of the highest socio-economic strata.

The magnitude of this relationship is substantial. It is estimated that, over time, demographic change alone led to a reduction of poverty of 14 percent in the developing world between 1960 and 2000, and may lead to an additional 14 percent decline between 2000 and 2015. Except for those countries where no fertility decline is in sight in the short term, the current and projected demographic trends are, on the whole, likely to continue to facilitate the attainment of the MDGs by 2015.

In the Asia and Pacific region there has been a substantial reduction in poverty with the number of people living in extreme poverty, defined as living on less than Purchasing Power Parity (PPP) of US\$1.25/day, declining from about 1.6 billion in 1990 to about 0.9 billion in 2008. The reduction has been greatest in the subregion of East and North-East Asia. The proportion of population living below national poverty lines also fell. The poverty gap – how far the extreme poor fall below the poverty line – is highest in the poorest countries.

Table 2: Poverty, contraception and CO₂

Region	Population living in poverty (2005 US\$PPP <1.25)					Contraceptive prevalence rate	Tonnes per capita of CO ₂
	1990	1996	2002	2005	2007	Latest	2008
East and Northeast Asia	60.2	36.4	28.4	15.9	13.0	59.0	5.4
Southeast Asia	20.5	17.8	18.3	18.9	21.1	37.6	1.8
South and Southwest Asia	50.4	44.9	40.1	37.0	36.2	45.9	1.4
North and Central Asia	9.0	9.4	9.4	8.7	8.2	54.9	9.2
Asia and the Pacific	50.2	37.7	32.1	25.5	23.1	49.5	4.5

Source: **United Nations**, 2011. *Statistical yearbook for Asia and the Pacific 2011*.

There is also a link between contraceptive prevalence rate and the level of carbon emissions. Between 2000 and 2008 the amount of carbon emissions grew at 5.4 percent per year, twice as fast as the global average. Emissions are growing especially rapidly in countries with large populations, such as China and India, where the rate of population growth in 2008 was well above the regional averages. While the per capita levels of carbon emissions are still expanding rapidly in the region, the carbon intensity – the amount of emissions per unit of GDP – has been falling steadily in the APR. Policies and reforms have been adopted to reduce emissions and these are having an impact.

The relationship between family planning and emissions of greenhouse gases (GHGs) is complex. While high contraceptive prevalence is typically associated with low levels of fertility, which will result in a reduction in population growth, and thus put downward pressure on consumption, the level of carbon emissions in an expanding economy will result in higher carbon emissions per capita. At a minimum the lower population growth resulting from contraceptive programmes will result in a reduction of the upward pressure towards increased emissions.

The fast pace of consumption, the depletion of some natural resources and consequent environmental degradation affect the entire world population, but tend to impact the poor with much greater intensity. Low-income countries, and the poorer segments of the population within them, tend to use less-efficient energy sources on a per capita basis. But the higher income countries, although generally using more efficient sources and technologies, have much higher consumption levels, which contribute to environmental degradation.

A degraded environment due to desertification, soil erosion, land degradation or water scarcity, can push rural populations (whose livelihoods depend directly on these resources) further into poverty. The growth in the world's population, increasingly taking place in urban areas, combined with the expansion of the world's economy and the change in food and energy consumption, are producing impacts on the environment on an unprecedented scale. Changes in human activities during the twentieth century have generated a 14-fold increase in growth of the global economy, a 40-fold increase in industrial output, a 4-fold increase in the world's population and a 13-fold increase in the world's urban population. These changes have been associated with a 13-fold increase in energy use, a doubling of land under cultivation, a 5-fold increase in irrigated area, a 35-fold increase in marine fish catch and a 9-fold increase in water use.

Gender inequality and reproductive health

The ICPD recommendations for improving access to education and health services, including reproductive health, and the consequent reductions in fertility and population growth, can help in mitigating the effects of environmental degradation on poverty.

The 2011 *Human development report* highlighted that the poor, living in the most disadvantaged countries, suffer because they are affected most by environmental degradation and have few coping tools. The report suggested that new steps were required to reduce environmental risks and inequality, and policies for reproductive health could promote sustainability.

For example, there is considerable unmet need for contraception in the world, much of it located among the poorer countries of the world, with the highest levels of 24 percent reported for the least-developed countries. If contraceptive services were improved so that this unmet need was satisfied, it has been estimated that there would be a 17 percent reduction from 2011 levels in carbon emissions by 2050. This partly occurs because of the close relationship between gender inequality and the provision of reproductive health services. Where women can exercise their right to choose they are more likely to limit their childbearing and this has the potential to result in reductions of GHG emissions. Therefore ensuring the widest range of safe, affordable and effective contraceptives would help to promote sustainable development.

It is in the poorest countries that gender inequality is linked to poor reproductive health outcomes. Where gender inequality is greatest, women have difficulty accessing health care, including contraceptives. This is reflected in low levels of contraceptive use, high levels of the unmet need for contraceptives and high levels of maternal mortality. Under these situations promotion of sustainable development requires that both gender equality and universal access to reproductive health services be promoted.

Gender inequality is associated with poor reproductive health outcomes across a range of indicators. For the bottom 20 countries on the Gender Inequality Index the maternal mortality ratio is estimated to be 327 maternal deaths per 100 000 live births while contraceptive prevalence is only 46.4 percent. These indicators index the poor reproductive health of women who have little power to make decisions concerning their fertility. The Asia and Pacific region shares in this close relationship between the empowerment of women and access to reproductive health services. For example, South Asia has one of the highest levels of gender inequality and its contraceptive prevalence is low at only 52 percent while the maternal mortality ratio remains high at 252 deaths per 100 000 live births.

Compositional effects on sustainable development

Two components of population composition – the level of urbanization and age composition – have been linked to indicators of the use of resources. Both urbanization and population ageing will proceed rapidly in the Asia and Pacific region over the next several decades. Currently approximately 43 percent of the population of the APR lives in urban areas, one of the lowest percentages of any region. However, the rate of growth in the size of the urban population in the APR over the last two decades has been the fastest of any region of the world and is expected to continue, with the urban population expected to expand by 0.7 billion between 2010 and 2025. High levels of urbanization are associated with rapid economic growth as rural to urban migrants move to meet the demand for labour that is generated in urban areas. Rapid urbanization in the APR is contributing to increased pressure on resources and climate change through increasing the per capita amounts of waste and greenhouse gases, increasing the demand for energy, contributing to changing consumption patterns, and placing greater stress on water resources.

Changes in age composition are also related to patterns of consumption. The demographic transition in age structure is one in which the population moves from a young population, to a population characterized by a high proportion of employment age and finally to a population that has a large proportion of elderly. Most APR countries are currently in the stage of demographic transition known as the demographic dividend, where their age structure is conducive to expanded economic growth. During this period there has been upward pressure on consumption contributing to increased difficulties in any movement towards sustainable development. However, the period is fast coming to an end, and the APR is currently ageing more rapidly than any other region of the world. By 2050 approximately one-quarter of the population of the region will be aged 60 or over, an increase from the 10 percent recorded in 2010. The rapidly ageing population is a direct consequence of the rapid declines in fertility recorded in the region in the 1980s and 1990s. Population ageing typically reduces consumption and will help ease the progress towards sustainable development.

Slower population growth and an ageing population could reduce GHG emissions by 15 to 29 percent by 2050 and would have an even greater impact by 2100. Increased levels of urbanization, particularly in China and India, are both related to increases in the level of emissions by up to 25 percent, while population ageing can reduce emissions by nearly 20 percent – more than the effect of affluence – because an ageing population uses less residential energy.

Increasing levels of consumption of goods and services, and the intensive use of energy and natural resources, have been part of economic development and have led, historically, to important improvements in the living conditions of large segments of the population. However, population growth leads to increased resource consumption, which has a negative impact on poverty. While economic development, increased incomes and higher consumption levels are the main causes of resource depletion at the global level and in developed countries, in developing countries, by comparison, both economic development and population growth are the sources of past and future consumption of resources. Although developed countries have much higher levels of per capita energy consumption and GHG emissions, most of the future increase in GHGs is likely to originate in developing countries as they continue to expand demographically and economically.

The composition of the population also has impacts on efforts to promote sustainable development. The geographic distribution of the population, reflected in increased rates of urbanization, is a response to economic opportunities that are concentrated in urban areas. This can lead to increased pressure on the environment and inefficient use of resources. Policies designed to enhance capacities of local authorities to plan for increased population growth in urban areas will contribute to sustainable development.

The deceleration of population growth observed in many developing countries that results from reduced fertility levels can make tangible contributions to poverty reduction and environmental sustainability. Policies that support lower levels of population growth through the provision of safe, acceptable, efficient and affordable contraception can help reduce the high levels of the unmet need for contraception and should be supported. Once population growth is slowed then policies of lower growth can be sustained. This in turn reduces pressure on natural resources, reduces poverty and can reduce GHG emissions.

2 Agriculture and livestock

Challenges and opportunities

The present paradigm of intensive agricultural production cannot meet the challenges confronting us today. In order to grow, agriculture must learn to save. Sustainable intensification means agriculture that conserves and enhances natural resources, uses an ecosystem approach that draws on nature, and applies appropriate external inputs at the right time, in the right amount.

Jacques Diouf (FAO 2011).

The green revolution in agriculture swept much of the developing world during the 1960s, saving an estimated 1 billion people from famine, mostly in the APR. Using high-yielding crop varieties, irrigation, agrochemicals and modern management techniques, farmers in developing countries increased food production from 800 million tonnes to more than 2.2 billion tonnes between 1961 and 2000.

However, these achievements have come at a price. In many countries, decades of intensive cropping have degraded fertile land, depleted groundwater, provoked pest outbreaks, eroded biodiversity and vital ecosystem services, such as natural biological control, and polluted soil and water. As the world population rises to a projected 9.2 billion in 2050, developing countries must double their food production to ensure food security to some 2.5 billion rural people. They have to overcome a series of challenges to do so, importantly, declining growth in the yields of major cereals, increasing competition for land and water, declining soil fertility, rising fuel and fertilizer prices, and the impact of climate change.

Agriculture depends on socio-economic and environmental production factors. It can be a vehicle of economic growth, providing materials for the rest of the economy and the sources of bioenergy. It can also cause environmental harm. Lessons learned from agricultural transformation in the APR are:

- Sustainable total factor productivity is the main source of agricultural growth;
- In the poorest countries, agricultural growth is the main engine of poverty reduction; and
- The integration of small farmers into modern value chains can contribute to food security and poverty reduction.

Conservation agriculture, for example, can save the hidden cost of repeated ploughing, such as degraded soil structure as well as loss of nutrients, moisture and productivity. It can reduce crop water needs by 30 percent, energy costs by up to 60 percent and increase yields substantially. Precision irrigation produces more crops from fewer drops; precision placement and timing of fertilizer applications doubles the amount of nutrients absorbed by plants; and Integrated Pest Management (IPM) helps conserve natural biological control and avoids pest resistance by eliminating the indiscriminate use of pesticides. This new paradigm

of Sustainable Agricultural Production and Intensification (SAPI) can be summed up as a ‘save and grow’ strategy.³

SAPI involves agricultural practices that conserve and enhance the utilization of natural resources through an ecosystem approach that draws on nature’s contribution to crop growth – soil organic matter, water flow regulation, pollination and natural biological control of pests – and applies appropriate external inputs at the right time, in the right amount and in the most effective manner. It represents a major shift away from the homogeneous- and technology transfer-driven model of agricultural production towards knowledge-specific and often location-specific farming systems that enhance soil fertility, reduce erosion and conserve water use, and are more resilient to natural and economic uncertainties. Green economy agriculture based on SAPI consists of several technologies.

Sustaining soil fertility

Reducing the use of fuel, fertilizer and water in the face of increasing demands on agriculture is a key challenge for developing countries with growing populations. Conservation agriculture aims to achieve sustainability, profitability and, consequently, improved farmers’ livelihoods through the application of three principles: minimal soil disturbance, permanent soil cover and crop rotation. It promotes ‘no tillage farming’, which can reduce production costs by 15 to 20 percent and fuel consumption by up to 75 percent. It can offset GHG emissions by increasing soil organic carbon by about 450 kg/ha per year, resulting in improved fertility and moisture retention. Farmers have increasingly adopted conservation agriculture systems over the past 25 years.

Precision irrigation

There is a growing pressure to reduce the environmental impacts of irrigation including soil salinization and nitrate contamination of aquifers. Knowledge-based precision irrigation that provides reliable and flexible water application, along with deficit irrigation and wastewater-reuse, is a major component of SAPI. Eliminating subsidies that encourage farmers to waste water is important, especially in rainfed areas where climate change threatens millions of small farms. Increasing rainfed productivity depends on the use of improved, drought-tolerant crop varieties and water-saving management practices.

Whole farm planning

A holistic approach to farm planning and management can minimize adverse impacts through the mapping of land, water and soil conditions, and controlling farm traffic and drainage. It can generate other benefits, for example, better field operations under adverse weather conditions, and improved soil and water conservation. Community and group farm business arrangements – such as cooperative farming, contract farming and machinery pooling – enable larger-scale holistic farmland management.

Reducing pesticide use

Reducing health risks and farming costs through IPM is a widely recognized green farming technique. IPM involves careful consideration of all available pest control techniques and the integration of measures to discourage the growth of pest populations. It limits pesticides and related interventions to economically justifiable levels and, at the same time, reduces risks to human health and the environment. IPM emphasizes growing a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms. It has been promoted by FAO for more than 20 years as a part of good agricultural practices.

³ FAO. 2011. *Save and grow – a policymakers’ guide to sustainable intensification of smallholder crop production*. Rome, FAO.

Integrated crop and livestock systems

Integrated crop and livestock systems offer a win-win strategy with greater productivity and enhanced soil fertility. Mixed crop-livestock, livestock-fish, fish-crop, poultry-fish and other multispecies approaches enhance the nutrient efficiency of agro-ecosystems compared to monocropping. In many industrialized areas, livestock farming and crop production become more and more specialized and separate, which leads to environmental problems like nutrient accumulation and leaching in areas of high livestock intensity. Without a link between crops and livestock, soil fertility can fall. In dry areas, such as the Loess Plateau of northern China and in South Asia, returning manure to fields improves forage and feed resources for livestock.

Biogas as a response to livestock waste pollution

The production of energy from biogas, as a response to livestock waste pollution and as a source of improving rural energy access, has expanded in many countries over the years, particularly in China and Viet Nam. Besides avoiding pollution and providing energy, biogas technology is also a source of organic fertilizer rich in nitrogen, phosphate and potash. Both large- and small-scale composting and the production of biofertilizers from agroprocessing and urban green waste have been rising, driven by improved commercial viability against the rising costs of chemical fertilizers. The trend can be accelerated by developing solid waste management in urban, peri-urban and agro-industrial areas, and by raising awareness of 'green' products among farmers and consumers.

Genetically-improved cereal varieties

Genetic improvement has accounted for some 50 percent of the increase in cereal yields over the past few decades, but about 75 percent of plant genetic resources has also been lost. Crop and livestock biodiversity improves food security by increasing and stabilizing yields and through the provision of nutrient-rich, balanced and diverse diets; it also builds resilience to environmental stresses and may help to cope with climate change impact. The maintenance and adaption of genetic pools to changing environments creates the basis for future breeding approaches.

Agroforestry

Agroforestry systems include shrubs and trees in animal production or crop production systems that mimic natural ecosystems. Agroforestry systems can be found at all levels of agricultural intensity for example in: (i) intensive cash crop systems (cocoa, tea or coffee cultivation using shade trees in India, Indonesia and Papua New Guinea); (ii) as contour strips in maize/soybean systems in China, the Philippines and Australia; (iii) as mixed forest-like fruit and crop gardens and plantations in Sri Lanka and Southeast Asia; and (iv) as silvopastoral systems of oil-palm or coconut and grazing livestock in Southeast Asia and the larger Pacific islands. Often, agroforestry systems include non-food uses like timber and biofuel.

Grazing livestock

Livestock farming has been integrated in various Asian societies because it is the only process that can convert the energy in grassland vegetation to an energy source directly available to humans. Sustainable pasture and rangeland management means grazing the optimal number of animals at the optimal time or season. This requires preserving community knowledge, adapted native species and management systems in traditional herding areas such as the trans-Himalaya zone and western China; and highly productive, resilient forage varieties for improved intensive pasture use such as in dairy farming. Regulation of access rights and rotational grazing to balance livestock numbers with healthy pasture are key tools for sustainable rangeland production.

Developing value chains

Value chains that link rural producers through the changing requirements of domestic and international markets with the increasing numbers of urban consumers can bring together the green economy pillars of economic, social and environmental benefits. The driving factors are the increasing demand for quality, safe food and avoiding biological hazards such as transboundary diseases and spread of noxious species that result in public health, economic costs and environmental damage. Building the capacity of developing Asian countries to meet sanitary and phytosanitary requirements has helped connect farmers to higher-value markets, while increasing their protection from pest and disease outbreaks such as highly pathogenic avian influenza. The experience with agrofood safety development is similar; farmers, farm cooperatives and agribusiness using recognized or certified farm food safety or organic practices become approved suppliers in both domestic and export markets and society in general gains health benefits and better environmental management systems.

Green agriculture progress in the APR

Eradicating hunger has become more challenging and complex in the APR, due to rising and volatile food and fuel prices, climate change impacts and the growing use of food crops for biofuels. The APR is home to 62 percent of the world's food insecure (578 million people), representing almost no change in absolute numbers despite 20 years of economic growth. Of that total, 91 percent lives in India, China, Pakistan, Bangladesh, Indonesia and the Philippines.

Changes made to increase food production throughout the region have focused on higher-yielding varieties of wheat, rice and maize in high-potential areas, and promoted homogeneity. This system of genetically uniform varieties grown with high levels of irrigation, fertilizers and pesticides, often replaced natural capital such as locally-adapted seed, recycled organic matter and traditional integrated farming systems. The rapid increase in fertilizer use has now reached a plateau, while cereal production is still rising as other improved practices are adopted (Figure 1). Pesticide consumption is likely to show a similar trend to fertilizer, although sufficient regional data are not available.

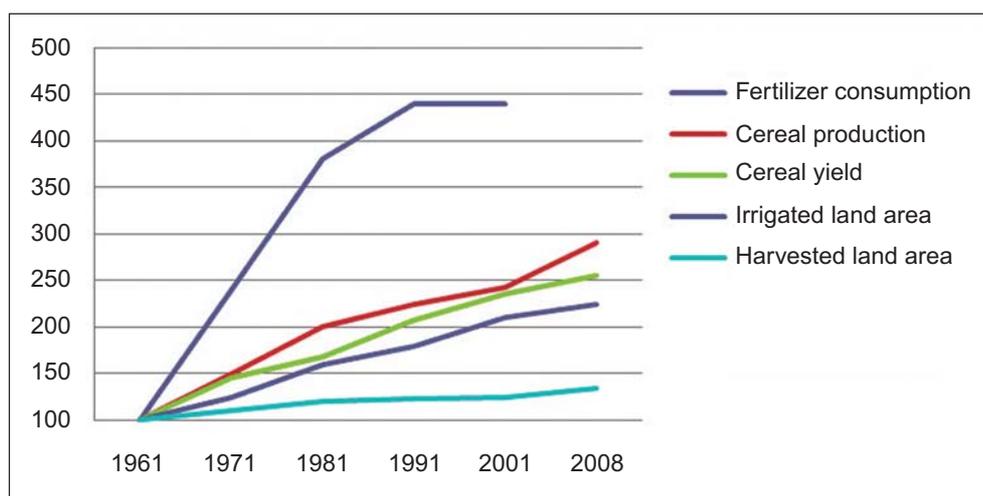


Figure 1: Indicators of crop production intensification, 1996-2008 (Index 1961 = 100)

Source: FAO. 2011. FAOSTAT statistical database (<http://faostat.fao.org>).

In moving towards more sustainable agriculture, policymakers need to have information to assess trends, challenges, threats and policy impacts. The priority has been on monitoring output and input requirements, rather than environmental and social impacts other than food security. Progress is slow: for example, more than 60 percent of APR countries surveyed report fertilizer use, but only about 10 percent report pesticide use (Table 3).

Table 3: Monitoring the greenness of agriculture

APR	Number of countries	
	Reported	Not reported
Land use	15	32
Fertilizers	20	27
Pesticides	5	47

Source: FAO. 2010. 23rd session of the Asia-Pacific Commission on Agricultural Statistics.

FAO is beginning to promote the collection and assembly of indicators related to greening agriculture, and posits the following examples:

- *Changes in area harvested of annual crops* – indicator of expansion of agriculture onto more environmentally-sensitive lands or into forested areas;
- *Changes in land-use patterns* – indicator of soil capital impacts;
- *Concentration of livestock production activities* – indicator of potential surface and groundwater contamination;
- *Fertilizer use per hectare of crop land* – indicator of the potential for ground- and surface water contamination (Figure 2); and
- *Pesticide use* (active ingredient) – indicator of potential environmental and health risk.

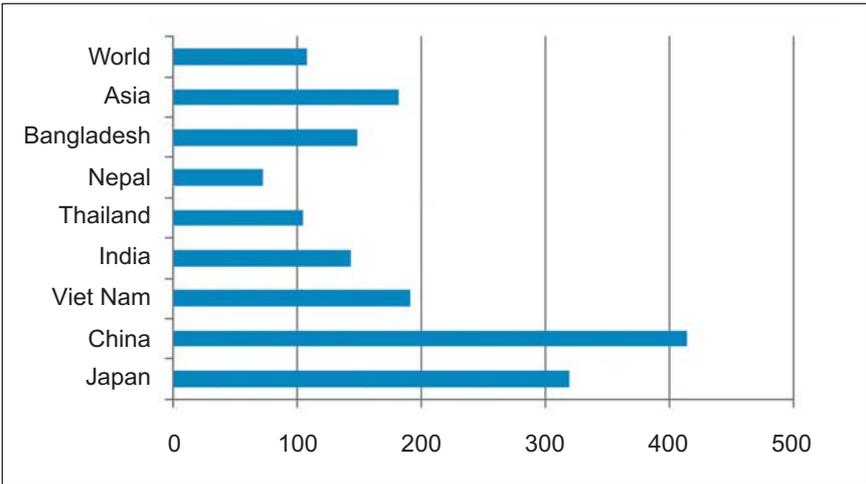


Figure 2: Average rates of mineral fertilizers used, 2008-2009 (kg nutrients used per hectare of agricultural land)

Source: FAO. 2011. FAOSTAT statistical database (<http://faostat.fao.org>).

The APR has made significant progress towards better pesticide management. Phasing out problematic pesticides was a significant step for many countries. Indonesia banned 25 pesticides in 1986 due to an outbreak of brown plant hopper, and subsequently rapidly adopted IPM for rice. China banned several highly-toxic organophosphates and carbamates for local use in 2005/06, based on food safety concerns. This was a bold and difficult move because China was a major regional

consumer and producer of pesticides, with some 3 000 cottage industry companies involved and organophosphates comprising 50 percent of the China domestic pesticide market at the time. Subsequently China banned their production, which had a flow-on impact: Cambodia, Lao PDR and other pesticide importers had to adapt. China has recently banned other highly toxic pesticides and other countries have followed suit. Through these regulatory actions, many products now conform to World Trade Organization (WTO) regulation, resulting in China and other regional countries experiencing a major positive impact on agricultural exports.

FAO is working with developing APR countries to strengthen pesticide regulation. For example, the government of Lao PDR recently updated pesticide registration including placing a ban on the dangerous, but widely used herbicide paraquat. In Viet Nam and Cambodia, FAO has assisted in strengthening plant protection and agricultural material laws to bring them into line with WTO requirements.

As incomes increase and urban society grows, dietary habits are changing in many Asian countries. Demand for livestock products has grown in recent decades; for example in China and India meat consumption has grown at a rate of 5 percent and dairy products at a rate of 3.5 to 4 percent annually. Increase in livestock production has led to competition for use of land for food or animal feed production. Intensive livestock production systems have resulted in pollution from manure – traditionally used either as fertilizer or as biofuel – which is increasingly being addressed through win-win treatment and recycling technologies in countries bordering the South China Sea. Green economy needs innovations (including reviving old innovations) to efficiently use economic and natural resources, reduce pollution and benefit society.

Regional progress has been made to develop, commercialize and regulate biotechnologies, particularly biocontrols (for example entomopathogenic fungi and nematodes), bio-activators (such as soil bacteria, fungi and mycorrhiza) and biofertilizers (especially from agro-industrial and municipal waste). Thailand, for example, has some 500 laboratories in rural communities, staffed by enterprising farmers and local government support staff; the government provides initial stock, quality assurance certification and regulation. Further development requires more private sector investment. The government role is in regulation (quality, safety and efficacy), enabling environment (patent etc.) and stimulating commercialization. The ASEAN Secretariat has established a project to support a regulatory environment for biocontrols.

While genetic improvement generated by research institutions underpinned the green revolution, the new ‘Save and Grow’ paradigm is characterized by action research, participative evaluation, farmer-level conservation of varieties, genetic resource management and recognition that lack of good practices at the farm level is often a more significant constraint to yield than crop and livestock genetics. Regional improvements in wheat productivity are being organized by the Asia-Pacific Association of Agricultural Research Institutes (APAARI) and other partners. Country capacity development for speedy release of new crop varieties and participatory varietal selection and seed production have been initiated in the Democratic People’s Republic of Korea and in Myanmar. The international non-government organization (INGO) SEARICE is implementing a project through a regional network of NGOs aimed at conserving and improving indigenous rice varieties using selection based on local preferences and action research. The International Rice Research Institute (IRRI) institutionalized participative evaluation of new releases and is developing water-saving rice practices, which not only reduce water use, but also allow sustainable production in underexploited areas of South Asia and strengthen resilience of certain crops to climate change.

Increasingly adopted in South Asia, Southeast Asia and East Asia, the system of rice intensification promotes intermittent irrigation and drainage, which stimulates soil biology and root development, resulting in fertilizer efficiencies, reduced GHG emissions as well as increased yields. A leaf colour chart, developed by IRRI and widely applied in Bangladesh and elsewhere in Asia, is

a simple and popular innovation for rice growers to determine optimum timing for application of nitrogen fertilizer.

A number of green initiatives, including the Save and Grow paradigm, were recognized at the 31st FAO Regional Conference for Asia and the Pacific in 2012. To mitigate climate change impacts and support planning and informed decision-making, a five-year multidonor trust fund programme was established: Mitigation of Climate Change in Agriculture. A pilot project has begun in Viet Nam to test the integration of mitigation-promoting techniques into agricultural practices in a smallholder context and to establish communities of practice. The programme is investigating ways of upscaling existing integrated food energy systems and farmers are learning how to integrate cropping, livestock, forestry and fisheries activities to produce food, biogas and biofertilizer. Regional initiatives are also being taken on: (i) formulating and disseminating a regional strategy on climate change adaptation and mitigation in the crop, livestock, forestry, fisheries, land and water subsectors; (ii) developing and applying guidelines on the formulation of relevant national strategies; and (iii) establishing a regional cooperation network.

CASE STUDIES

Case study 1: Minimum tillage potato production using the IPM approach

Pesticide use in vegetable production among smallholder farmers in Asia remains unnecessarily high. Concerns over health and pollution, rapid increase in pest resistance to agrichemicals, resurgence of and secondary pest outbreaks caused by indiscriminate use of pesticides call for safer and more sustainable plant protection strategies. Climate change is facilitating the spread of invasive pest species, often prompting farmers to use more pesticides. Asia is facing challenges of overuse and misuse, inappropriate labelling, product quality issues, environmental pollution and serious health hazards to farmers and consumers. These concerns for domestic and export markets provide momentum for further development and application of integrated IPM as part of good agricultural practice promotion efforts.

FAO has been working with Asian governments, civil society organizations and the private sector to develop robust IPM strategies for a range of economically important cereal, fruit and vegetable crops during the last decade. IPM programme countries include Bangladesh, Cambodia, China, Indonesia, Lao PDR, Nepal, Philippines, Thailand, Viet Nam, and Timor-Leste. The standard training approach employed in all FAO regional IPM programmes is the ‘Farmers Field School’ approach. Farmers Field Schools are ‘schools without walls’ which are held in farmers’ fields. Typically, a group of about 25 to 30 vegetable farmers meet on a weekly basis and grow and study together using a vegetable crop of local relevance and choice from sowing to harvest.

For example in Thailand, despite heavy use of pesticides, farmers could not control the diamondback moth (DBM), *Plutella xylostella*, in brassica. The Thai Government with technical and financial support from the FAO-IPM and a DANIDA-funded IPM project proceeded in 2005 to introduce the DBM parasitoid *Diadegma semiclausum* from the Cameron Highlands in Malaysia according to internationally agreed guidelines. Whereas *D. semiclausum* established easily in organic farms in Chiangmai highlands, its introduction for establishment in intensively sprayed crucifer production areas in the Phetchabun highlands needed careful planning in conjunction with IPM Farmer Field School training. Within five years of release the parasitoid insects had spread to over 800 ha, and farmers reduced pesticide for DBM from 20 applications to two applications per crop.

Potato is an important food crop in Viet Nam, which is increasingly providing raw materials for the food-processing industry and stable income to the smallholder farmers in the Red-River Delta region. However, increasing labour costs have been one of the major causes for sluggish growth. To address the issue, FAO initiated an innovative pilot project implemented by the Viet Nam National

IPM Programme/Plant Protection Sub Department to promote rice-potato farm system development. The project was implemented in Thai Giang village, Thai Thuy District and Vu An village, Kien Xuong District in Thai Binh Province with guidance from the Thai Binh DARD and PPSD from 2009 to 2011. A series of action research activities was carried out comparing potatoes grown using rice stubbles as mulch (minimum tillage) and compared with normal soil-mulched potato (normal tillage). Results from three years of study revealed that minimum tillage performed better than the normal tillage treatments for all variables studied (Table 4 and Table 5).

Table 4: Cost saving for potato minimum tillage (in Vietnamese dong)

Labour cost components	Minimum tillage (VND)	Normal tillage (VND)
Land preparation	2 700 000	8 100 000
Planting	5 400 000	8 300 000
Collecting rice straw	2 800 000	0
Taking care of field	10 800 000	18 900 000
Spraying	2 800 000	5 600 000
Harvesting	5 400 000	8 300 000
Total costs	22 900 000 ≈ US\$1 145	49 200 000 ≈ US\$2 500

Source: FAO Regional IPM Programme in Asia.

Table 5: Improved profit from minimum tillage

Indicators	2009		2011	
	Minimum tillage	Normal tillage	Minimum tillage	Normal tillage
Yield (tonne/ha)	22.50	20.30	22.45	20.08
Unit price VND '000	7	7	7.5	7.5
Income VND '000	157 500	142 100	170 625	150 600
Expense VND '000	44 600	63 000	66 082	88 005
Profit VND '000	112 900 ≈ US\$5 645	79 100 ≈ US\$3 955	104 543 ≈ US\$5 227	62 595 ≈ US\$3 130

Source: FAO Regional IPM Programme in Asia.

LESSONS LEARNED

One of the most important lessons is the need for *farmers* to become IPM experts. With minimum tillage, due to the use of mulch, herbicide use was halved, labour input was reduced by 192 person days per hectare, and net profit increased by about 40 percent. Utilizing ecological resources and empowering farmers with knowledge achieves economic, social and environmental outcomes.

Case study 2: Water-saving rice systems in South Asia

It is estimated that on a global scale by 2025, 15 to 20 million ha of currently irrigated rice will suffer water shortage, with downstream impacts on food security and farm livelihoods. The problem is likely to be further exacerbated by climate change impact and competition for water. The erratic distribution of rainfall and uncertainty in setting, withdrawal and duration of the monsoon (rainy season) necessitate water-saving technologies and rice varieties capable of giving stabilized performance under fluctuating environmental conditions.

The development and dissemination of water-saving rice production technologies in Bangladesh, India, Nepal and Pakistan was supported⁴ where productivity and profitability of rice farming were affected by drought and water shortage. There were five key activities:

- (i) Development and multiplication in regional countries of new water-saving rice production technologies based on improved varieties and identification of aerobic (dryland) rice yield decline;
- (ii) Improved water-saving technologies validated and disseminated in farming communities;
- (iii) Strengthened national capacities to develop and disseminate water-saving rice production technologies; and
- (iv) Establishing a well-functioning regional research network for water-saving rice technologies.

The longer-term impact on food security will be through improved rice productivity and sustainability in water-deficient and drought-prone areas of South Asia. The immediate outcomes were: (i) enhanced rice productivity in water-deficient regions; (ii) improved water use efficiency in rice production; and (iii) self-sustaining national research capacities to develop water-saving rice technologies. IRRI launched a regional network to exchange breeding lines and information on best practices for farmers. The regional network facilitated dissemination of varieties suited to water shortage situations, helped develop standardized protocols for evaluation and developed measures for weed control and suitable cropping rotations in each of the participating countries.

New varieties with at least 20 percent yield increase over current varieties in water-deficient seasons were developed for aerobic and alternate wetting and drying (AWD) production systems, and disseminated to the participating countries, where they have been participatorily evaluated by farmers and breeders. Yields under AWD were confirmed in comparison with a full water regime using a regime of 15-cm water depth, hand weeding and pre-emergent herbicide. Varieties were identified that show resistance and tolerance to nematodes and *pythium*, the main causal organisms of yield decline. Farmer trials demonstrated that with the selected varieties and technology training, water saving of 20 to 25 percent under AWD and 30-35 percent under aerobic situations were realistic and achievable, with a yield gain of 20 to 40 percent above current varieties in a water-

Table 6: Capacity for water-saving rice technology

Impact/outcome	Unit	Quantity
Evaluated for drought tolerance	Advanced lines	42 464
Evaluation under non-stressed and stressed aerobic conditions	New lines	1 127
Evaluation under flooded and stressed lowland conditions	Advanced lines	1 104
Participatory evaluation and handover to farmers	Best varieties	
Bangladesh		284
India		828
Nepal		482
Pakistan		238
Yield increase above existing varieties	Percent	20-40
Water saving under AWD	Percent	20-25
Water saving under aerobic conditions	Percent	30-35
Farmers trained	Persons	>200
Country scientists trained	Persons	68

Source: Project completion report, ADB RETA 6276-REG. 2011.

⁴ ADB RETA 6276-REG: Development and Dissemination of Water-Saving Rice Technologies in South Asia.

deficient situation. Awareness was strengthened about the significance of water-saving technologies among stakeholders. Information on water saving was disseminated to many farmers through in-country training in four participating countries. Senior agronomists in participating countries were made aware of the importance of water-saving technologies. Both farmers and rice breeders in each participating country recognize the value of water-saving technologies to reduce their vulnerability to yield loss due to water shortage, and adoption rate is high.

Rice breeders in each country now have the basic research capacity to further develop water-saving technologies, including an understanding of the on-farm practices and have a seed bank of the best performing varieties. Elite breeding lines suitable for different countries in aerobic as well as AWD system were released by national seed registrars as commercial varieties for general cultivation in Nepal, India and Bangladesh. Farmer field trials resulted in large-scale adoption of new lines, especially in Bangladesh.

LESSONS LEARNED

Water-saving rice production is not a mature technology, and requires continued substantive effort in breeding, local adaption and dissemination. Large-scale farmer trials and participatory evaluation are essential to demonstrate to farmers the benefits of water saving technologies to enhance adoption of varieties. Large-scale seed production and distribution in collaboration with public, private sectors and NGOs will ensure that benefits reach every poor farmer. There is potential to extend to other Asian countries which are at risk of water stress in rice production.

Case study 3: Managing livestock waste – East Asia

Population growth and increasing wealth and urbanization taking place in East Asia are driving the rapidly growing demand for animal products. Untreated waste from large-scale intensive animal production accounts for 28 percent of pollution.⁵ The five-year (2006-2011) Livestock Waste Management in East Asia Project⁶ was designed to finance the costs of moving from the 'business as usual' approach to a strategic framework for livestock production development which is not only economically but also environmentally sustainable.

At the beginning of the twenty-first century, China, Thailand and Viet Nam alone accounted for more than half the pigs and one-third of the chickens in the world and the concentration of pig and poultry production in the coastal areas is a major source of nutrient pollution of the South China Sea. Along the densely populated coast, pig density often exceeds 100 animals per square kilometre and huge nutrient runoff is severely degrading seawater and sediment quality in one of the world's most biologically diverse shallow water marine areas, causing 'red tides' and threatening fragile coastal, marine habitats including mangroves, coral reefs and sea grasses.

The nature of livestock operations differs markedly among the countries. In China (Guangdong Province) half of the pigs are still produced in operations with fewer than 100 animals, although large-scale industrial operations are growing rapidly; almost one quarter of the pigs in Guangdong are produced on farms with more than 3 000 animals. In Thailand, three-quarters of pig production is now produced on large, industrial farms with more than 500 animals, while in Viet Nam very small producers with just three or four pigs account for 95 percent of production. Nevertheless, the issue of waste management is common to all three countries, and they all share a coastline with the South China Sea, so the project developed a set of common activities.

⁵ China: Air, Land, and Water – Environmental Priorities for a New Millennium, World Bank 2001.

⁶ Implemented by FAO and other partners with funding under World Bank's Country Assistance Strategy for China (CAS 25141-CN), for Thailand (CAS 25077-TH) and for Viet Nam (CAS 27659-VN).

Demonstrations showed workable solutions to reduce livestock waste pollution caused by concentrated livestock production. These solutions focused on recycling the nutrients present in pig manure for other agricultural activities such as cropping and fish farming, as well as on reducing excess nutrients in manure, in particular nitrates and phosphates, through a combination of settling and storage or incorporation into biomass. The environmental effectiveness of biodigestion as a means to reduce the organic matter content of effluents and generate renewable energy (i.e. biogas) was co-promoted.

Enforcement of existing regulations on waste management was generally ineffective. Therefore targeted policy and strategy development included improving the policy and regulatory framework for environmentally sustainable livestock production in each country to encourage farmers to adopt improved manure management practices. Collaboration between countries and exchange visits by regulators and pig industry representatives facilitated awareness, as well as local-level engagement of farmer groups, local communities, NGOs, government agencies and other stakeholders, complemented by public awareness building to mobilize local community pressure. Strategy also addressed developing and testing approaches for widespread replication of manure management practices in relation to farm scale, affordability, operational capacity, material availability, public health risk mitigation and compatibility with the waste-handling methods used by local communities. Incorporation into the GHG emission mitigation objective coupled with financing under the Clean Development Mechanism (CDM), one of the carbon finance mechanisms defined in the Kyoto Protocol, provided finance. Investment subsidy of up to 40 percent to farmers was an appropriate incentive for adoption, given that subsequent revenue from CDM can recoup this public investment as well as the public benefits gained. At the national level, it was necessary to strengthen interagency cooperation to develop effective and realistic regulations on environmental protection and discharge standards and to undertake spatial planning for the location of future livestock development to create the conditions for better recycling of effluents. A key tool for implementing policy at the local level is a template for three different Codes of Conduct. Each of the Codes is tailored to address specific farming practices and environmental challenges that are representative of most pig production systems in the region.

Although nearly 60 percent of the project's total cost represents on-farm investments for demonstration of improved livestock waste management technologies, the main benefits are environmental, health and institutional. Consequently, the project aimed to identify the cheapest technology. A second important aspect relates to the financial attractiveness to project participants of technologies and approaches to be promoted.

By far the most important component of the existing incentive framework is that of market forces, which determine the range and cost of manure storage and handling facilities that farmers can invest in, and their options for sale or on-farm recycling of manure products. Whether separating and drying solid pig manure for use in orchards, on other crops, or in fishponds, as widely practised in southern China, the use of solid manure is fairly widespread and its economic value appreciated. Intensive pig producers already use various manure management systems, but only up to a certain point as these systems are typically constrained by physical and market limitations, so tend to be overwhelmed when farms increase their stock numbers.

In all three countries, previous regulatory action on livestock waste management had had very limited impact. Social pressure to adopt better livestock waste management was reported in the lower Pearl River Delta in Guangdong and in Nakhon Pathom Province of Thailand. There was also increased conflict between livestock and crop farmers over a range of issues, including the nuisance created by manure storage and disposal especially where pig farms are concerned. Economic analysis found that the treatment only-based systems cost on average US\$2.82 per pig-cycle or twice as much as combined treatment and recycling systems (average of US\$1.17 per pig-cycle), confirming the latter as the cheapest option (Table 7). Treatment combined with recycling also substantially removed pollutants (Table 8).

Table 7: Typical costs for improved manure management systems

Farm type/improved livestock waste management system	Piggery head	Investment US\$/head	Operating cost		Total cost US\$/head
			Of invest	US\$/head	
Systems combining treatment with recycling:					
Small/medium farm with adequate local cropland	500	10.00	10%	1.00	1.36
Small/medium farm w/fish ponds	500	10.00	15%	1.50	1.59
Medium/large rural farm w/abundant cropland for manure application	5 000	3.00	20%	0.60	0.55
Mean value for systems combining treatment with recycling		7.67			1.17
Systems relying exclusively on treatment:					
Medium/large peri-urban farm without cropland	5 000	18.00	10%	1.80	2.45
Large rural farm without sufficient cropland for manure application	10 000	20.00	15%	3.00	3.18
Mean values for systems relying exclusively on treatment		19.00			2.82

Source: Livestock Waste Management in East Asia Project, FAO/World Bank.

Table 8: Nutrient removal capacity

Systems	Quantity as % of nutrients in fresh pig manure		
	Safely removed	Residual air pollutant	Residual water pollutant
Baseline situation: little/no farm storage, little/no cropland used for manure application			
P ₂ O ₅	10	0	90
N	<5	30	>65
Biochemical oxygen demand	10	10	80
Treatment and recycling			
P ₂ O ₅	>90	0	<10
N	>65	30	<5
Biochemical oxygen demand	>95	0	<5

Source: Livestock Waste Management in East Asia Project, FAO/World Bank.

Regional collaboration on waste management and policy elements resulted in environmental awareness-raising among farmers and government staff of the pollution problem and the practical value of manure as fertilizer and a renewable source of energy. Waste management and environmental impact were improved through biodigestion and introduction of new technologies and new designs for large and medium pig farms (up to 500 000 head). Institutional development led to collaboration within government (agriculture, health and environment agencies), and among government, farmers and the private sector instead of the previously ineffective enforcement approach. Due to reduced pollution impact on wider society, there is enhanced public participation and fewer complaints against farmers, together resulting in improved long-term social, economic and environmental sustainability.

LESSONS LEARNED

Countries bordering the South China Sea can now apply common tools and guidelines for livestock waste management, resulting in better effectiveness at the regional level of their efforts to reduce pollution of the South China Sea caused by intensive livestock production. Raising awareness among local people of the impacts of livestock waste, empowering them to make management

decisions, and delivering private benefits (i.e. energy source) over and above the public benefit of pollution control, played a major part in the initiative's success.

Key lessons learned from China, Thailand and Viet Nam:

- An important supporting action is to provide appropriate technologies to recycle liquid livestock waste and biogas effluent safely into agricultural production.
- Key weaknesses in policy frameworks are the lack of industrial livestock production and waste management policy instruments, weak policy enforcement and poor coordination among concerned government agencies. This needs strong government commitment in compliance, enforcement and provision of incentives, and the full involvement of key stakeholders to ensure ownership and sustainability.
- For widespread adoption, the measures and promotion of reducing effluent must show tangible benefits for the key stakeholders – farmers and local communities. The top-down regulatory approach has not been enforceable.

Case study 4: Green value chains – solar drying mango in Myanmar and returnable crates for lettuce in southern Philippines

In many developing countries, the fresh produce industry is hampered by the lack of efficient and effective supply chains. Supply chains are generally not organized, are fragmented, long, and often involve many smallholder farmers who deliver produce to assemblers/collectors. Produce then moves through multiple layers of intermediaries consisting of traders, wholesalers and retailers. Supply chains, therefore, involve a series of intermediaries, and are characterized by poor information flows and the prevalence of spot transactions over long-term relationships between buyers and sellers. Traditional supply chains continue to handle bulk commodities for wet markets that serve the majority of urban populations in developing countries.

Growth in organized value chains can create opportunities for smallholders but also generate barriers to market access. There are concerns that the concentration of market power at specific points in the chain reduces the incomes of other actors in the chain, particularly small farmers. Considerable potential exists for improving the economic returns to farming systems while also reducing environmental and social impacts, through alternative models of agricultural technology and marketing. Although productivity increases may be achieved rapidly in high-input, large-scale, specialized systems, the greatest scope for improving livelihood, equity and energy efficiencies is through small-scale, diversified production, with short local value chains. Reducing food losses is a priority – FAO has estimated food losses as high as 50 percent. The trend towards rising food prices, driven in part by resource constraints, can make the necessary production system changes viable for farmers, so long as the market and profit incentives are passed along the value chain to farmers.

Clean, green, energy-saving technologies can reduce losses and wastage, provide a sustainable option for reducing post-harvest losses, while adding value to agricultural raw materials. Renewable energy-dependent processing options that do not produce GHG emissions are increasingly being used in food-processing applications at the enterprise level and in the food industry to respond to consumer demand for sustainably processed foods. Solar drying is one such processing option. Farmers in Myanmar have benefited from solar drying technology for mango with assistance from FAO.⁷ A group of mango producers was trained in the production of mango leather – a confectionery product – using traditional mango varieties that do not meet market quality standards for export in the fresh form. Solar drying was used as the final step in the preservation of these mangoes. The solar-dried mango product proved to be economically beneficial to small farmers, generating new market opportunities for these underutilized varieties.

⁷ Rolle, R. 2011. *Green technology for post-harvest loss reduction and value chain development*. Bangkok, FAO-RAP.

The dried mango leather product conformed to microbiological standards for dried confectionery products. It also found good consumer acceptance when evaluated by local consumers in Myanmar as well as by consumers in Thailand. Having recognized the benefit of solar drying in mango leather processing, the small processors have begun to process the product in an effort to broaden its market opportunities in local supermarkets and in the local tourism sector. They are also gearing up to link the solar-dried mango leather to the export market.

The new income and employment streams created by the use of the low cost solar-drying option has not only diversified the market opportunity for local non-exportable varieties of mangoes that would normally have gone to waste, but has also resulted in small farmers deriving tremendous benefit from the application of these sustainable technologies.

Growth of the food marketing sector offers new opportunities for farmers by broadening their choice of input suppliers and outlets for produce as well as access to credit and training. The comparative advantage of smallholders is usually their ability to supply low cost labour for labour-intensive crops, but it can also be the ability to assure quality supply to buyers in a market. Comparative advantage can be created by organizing small farmers into institutions that reduce the transaction costs associated with purchasing, and using greener value chains that reduce post-harvest losses. Contract farming, farmer groups, community organizations, cooperatives and modern communication technologies reduce transaction costs and provide mechanisms for coordination between farmers and buyers, allowing a degree of assurance in price, quality, quantity and time of delivery. Incorporating the value of natural resources and environmental services into agricultural input and output prices can be achieved by utilizing standards-based environmental and social labelling (for example certified organic, fair trade, and low carbon footprint) in value chains.

One of the green challenges is to develop more efficient and coordinated supply chains, particularly those associated with higher-value commodities and those which supply modern urban retail businesses including supermarkets and food service chains. In a case study⁸ of lettuce value chains in Bukidnon, Philippines, greener logistic systems involved using container recycling and sea-road freight compared to one-use cartons and airfreight.

The system works through a lettuce farmer renting plastic crates from a service supplier. Two different types of crates are rented, a green colour for handling from field to packing-house, and a yellow colour for loading into refrigerated vans to Cagayan de Oro City Port and marine shipping to a large city food service chain in Manila within 48 hours. The crates are stackable and nestable to save space and are equipped with ventilation holes and rust-free handles for food-safe handling. Each plastic crate is rented from the service provider at a cost of 35 pesos (US\$1.00 = 54 pesos) per 'use'. One use constitutes the movement from the farm to Manila market.

Logistical arrangements between the lettuce farm and the service provider insofar as the return of the empty plastic crates is concerned is that the service provider holds responsibility for both the cost of transport and for the risk of pilferage of the empty crates.

As regards hygienic management, the lettuce farm is totally responsible for the cleaning and sanitizing of the rented crates. On harvesting a lettuce plot, the plastic crates assigned to be used as harvesting containers and for field hauling are used exclusively for that harvest. This policy is also followed for plastic crates used for transporting lettuce from the packinghouse to the market in Manila. Cleaning and sanitizing of empty plastic crates is done by washing with water and detergent soap. The estimated cost of sanitizing crates is P2.50/crate.

⁸ **Rapusas, R. & Rolle, R.** 2009. *Management of reusable plastic crates in fresh supply chains*. RAP Publication 2009/08. Bangkok, FAO.

Table 9: Benefits from returnable plastic crates

Item in value chain	Approximate cost	Approximate benefit
Returnable crate rental cost per use	US\$0.64	
Returnable crate cleaning cost per use	US\$0.05	
Saving by not using single use carton (previous practice)		US\$5.00
Net financial benefit of returnable crate		US\$4.31
Reduction of post-harvest losses using the returnable crate system (compared to air freight carton), and sanitization protocols to prevent cross contamination of disease.		5-10% loss reduction across entire supply chain

LESSONS LEARNED

Improving value chains through solar drying and redesigning logistic systems reduces post-harvest losses and energy costs. Maintaining the quality and protecting the safety of fresh produce supplies necessitates the coordinated effort of everyone involved in supply chains from the grower to the consumer. In the area of post-harvest handling and transportation, improvement in bulk packaging of fresh produce through the adoption of reusable plastic crates has contributed significantly to maintaining quality and reducing losses. Proper physical and hygienic management of plastic crates is equally important in order to safeguard against chemical, physical and microbiological risks.

3 Fisheries

Challenges and opportunities

The marine environment provides humanity with an enormous range of services, from food security and climate regulation to nutrient cycling and storm protection. These in turn underpin livelihoods including those concerned with fishing, boat building, marine logistics, aquaculture, marine product manufacture (for example marine algae for food, medical and cosmetic products), value adding and tourism. Yet despite this importance, the last three to four decades have seen increasing unsustainable exploitation of oceans as a result of pollution from land-based sources, overfishing, and increasingly, climate change impact. At the global level, the World Bank in 2009 estimated that fisheries make an economic loss of US\$8 billion per year, when the environmental and social costs and benefits are included. The World Bank estimates that fisheries could be worth a staggering US\$50 billion more per year if managed at maximum sustainable yield. This paradigm is threatening the livelihoods of millions of people around the world who depend on these critical ecosystems for their primary source of protein and for income, both directly and indirectly.

With a growing population, set to rise from 7 billion today to over 9 billion by 2050, and 40 percent of the world's population living within 100 km of the coast, these pressures and impacts are likely to intensify unless the world becomes more intelligent about managing these essential resources. A shift to sustainability in terms of improved well-being and social equity can lead to healthier and more economically productive oceans that can simultaneously benefit coastal communities and ocean-linked industries.

During the next few decades, the situation in the APR and the policy responses will determine future sustainability. Most middle-income and developing economies are likely to continue to pursue high economic growth rates, at the price of ignoring crucial social and ecological problems. Political, corporate and institutional conditions encourage exploitation of fishery resources while strong demand exists unless catastrophic problems arise (including fish stock collapse, prolonged global recession or climate change related events).

Low growth and stagnation are also likely in many countries, restrained by weak recovery from the current economic crisis, again resulting in low prioritization of social and ecological sustainability, while increasing pressure to exploit the remaining wealth of marine resources.

The 'green economy' – known as 'blue economy' for fisheries and water resources – envisages changes to balance growth with social and ecological sustainability. This is increasingly the vision in the context of economic and climatic crises. Most middle-income and emerging economies can improve sustainability of their fisheries and aquaculture industry. Developed countries – with more advanced policies and institutional frameworks, and greater ability to invest in science and technology – can shift more rapidly to a green economy if inspired by visionary leadership and empowering policies. Sustainability is, however, unlikely to receive due attention against perceived imperatives for rapid economic growth, especially in resource-rich countries and regions with weaker policies and institutions, influenced by powerful corporations and elites seeking short-term gains.

Many countries are already moving to create a fresh future for their seas and oceans and adopting the kinds of smart public policies needed to unlock the investments and creative strategies necessary. The Rio+20 summit was an opportunity to scale up and accelerate these transitions under the theme of a green economy in the context of sustainable development, poverty eradication and an institutional framework for sustainable development.

Both the marine and the terrestrial environments are more than just an economy – they are part of humanity’s cultural and spiritual dimensions as well as habitats for all creatures on earth. However, through a better understanding of the enormous economic losses being sustained and the enormous opportunities from investing and re-investing in marine ecosystems, perhaps the balance can be moved away from degradation and destruction to sustainable management for this generation and those to come.

Fisheries and aquaculture sectors are major contributors to food security, income and livelihoods in the APR with some 90 percent of fishers/fish farmers being small scale. The APR produces 51 percent of global capture fishery production, with more than 2 million fishing vessels operating in the South China Sea and Bay of Bengal region. Most are small-scale vessels and more than 6.3 million people are employed.

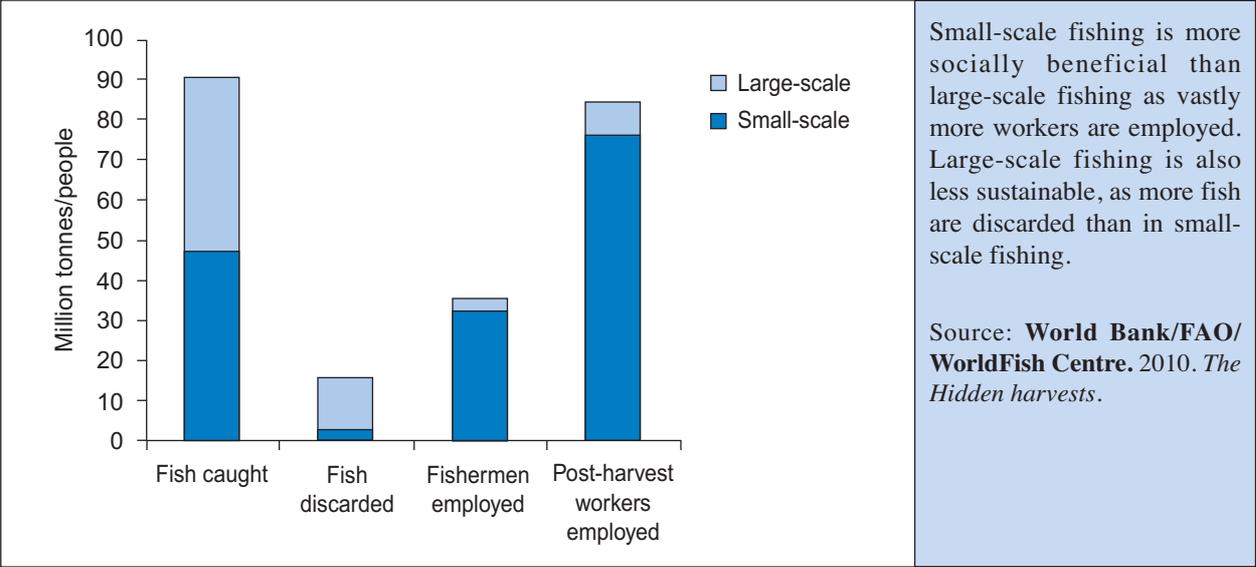


Figure 3: Comparison of small- and large-scale fishing

While a wide range of species are caught in the seas of the APR, in quantitative terms, fisheries within the exclusive economic zone are focused to a large extent on small, low-value species. Over capacity and open access regimes reflect a tendency towards employment maximization in fisheries although often at the cost of economic efficiency and product quality.

South China Sea fisheries are threatened by overfishing and habitat degradation. Lower-value species are extensively utilized in *surimi* (fish paste), canned fish, fishmeal and aquaculture feeds. Some 4.85 million tonnes of trash/low-value fish species are produced annually and total fish meal production is estimated at 574 000 tonnes, a significant proportion of this is derived from processing wastes. Including the whole of India, trash/low-value fish species annual production in the Bay of Bengal region amounts to 0.90 million tonnes. Fish meal production for the Bay of Bengal region is estimated at 152 000 tonnes.

Annual inland capture fisheries production amounts to 6.7 million tonnes. The Asia region contributes 66 percent of total global inland fisheries production, a significant contribution to food and nutritional security.

In 2008, capture fisheries and aquaculture together delivered 142 million tonnes of fish, and in the APR, 46 percent was derived from aquaculture. Per capita, this was equivalent to consumption of 17 kg fish per capita per year, the highest value recorded up to now. Fish supplied roughly 16 percent of the APR population’s intake of animal protein and 6 percent of the total protein intake. Most of the

population depends on fish protein: 1.5 billion people derive 20 percent of their animal protein intake from fish, another 3 billion 15 percent. As the global population continues to rise, a greater demand will be placed on aquaculture products, and therefore the resources from which these products come from. Aquaculture annually produces 55 million tonnes of fish products worldwide, but demand is set to rise by 60 percent, meaning more efficient and sustainable aquaculture must generate another 30 million tonnes per year. In most areas of the APR, very few unexploited resources are available for expansion of aquaculture. Therefore, it is imperative for countries to employ a sustainable intensification approach for production to keep up with demand.

Recovery of fisheries can take place in two main ways. First, a reduction in fishing effort can rapidly increase productivity, profitability and net economic benefits from a fishery. Second, rebuilding fish stocks will lead to increased sustainable yields and increased profits. Sector assessments indicate that global fish production from wild capture fisheries is approaching (or has passed) its sustainable limit – no real increase can be expected. However, the current level of fish harvest could be obtained with significantly higher economic and social benefits, especially for coastal fishing communities of developing countries whose livelihoods depend primarily on fisheries. This implies that fisheries management regimes are strengthened, fishing opportunities are allocated more equitably and low-impact fishing methods are adopted more widely.

The potential economic gain from reducing global fishing effort to an optimal level and re-establishing wild fish stocks is approximately US\$50 billion *per annum*. Approximately 32 percent of the global stocks are estimated to be overexploited, depleted or recovering from depletion and a further 50 percent to be fully exploited. Severe overfishing and the loss of yield due to overexploitation are exacerbating food security and poverty.

Future growth in fish production needs to come primarily from aquaculture. More specifically, aquaculture is today considered the most advanced option for meeting the increasing future demand for fish and seafood products; it should be noted, however, that many aquaculture species rely on feed produced using fish meal and fish oil derived from fully or already overexploited wild fish stocks. Therefore, for further growth of the sector, finding sustainable replacements for fish meal and fish oil is vital. Natural water systems – reefs, wetlands, watersheds and open seas – will need improved sustainable management.

Progress to greener (and bluer) development in the region

There are approximately 1.72 million fishing vessels operating in the South China Sea subregion (most being small-scale vessels), employing more than 5.4 million people. In the Bay of Bengal subregion there are less than 415 000 vessels (77 percent are small-scale with artisanal gear), employing more than 1.6 million people. The Asia-Pacific Fishery Commission (APFIC) acts as a regional consultative forum, providing member countries, regional organizations and fisheries professionals in the region with the opportunity to review and discuss the challenges facing the region's fisheries sector and helping them decide on the most appropriate actions to take. Maximum sustainable yield is a measure used to express the average maximum level of production that a fish stock or fishery can sustain without suffering a decline in stock abundance. This may be misleading because extended periods of excess fishing pressure can greatly modify the species composition within a fishery, reducing more valuable (and often more vulnerable) larger species while there is a proliferation of lower-value small species. Under heavy fishing pressure, even these small, usually highly productive species start to decline, such as in the South China Sea and the Bay of Bengal.

Globally, marine capture production has been stagnating for the past decade, however production in the APR is still increasing. China's capture has stabilized since 2000, but it is still the largest producer in the region representing 34 percent of total regional production. China's regional share is decreasing (40 percent in 2006) but is still more than three times greater than the share of the

second largest producer in the region, Indonesia, and three and a half times greater than that of the third largest producer, Japan. Southeast Asia's catch has been increasing very strongly in the past four decades due to increases in fleet size and technology. Capture fishery production in the South Asian subregion has grown continuously since 1980, more than doubling its capture production from 3.1 million tonnes in 1980 to 6.6 million tonnes in 2008. FAO statistics collected through the APFIC reflect a strong trend towards the capture of smaller lower-value species, and hide the effects of overfishing of juveniles of higher-value species. The heaviest fishing – depleted or fully-fished areas – is on the western side of the South China Sea in the shallower shelf, with stocks being in better condition around Sabah, Sarawak and parts of the Philippines. Catch per unit effort has declined in almost all parts of the region. The trade transshipment between fishing areas complicates analysis of data trends. With a lack of detailed information and limited critical analysis of fish stock trends it is difficult to send a clear message regarding the need for immediate action to implement management measures. This also leads to the false assumption that there remains significant potential for further expansion of fishing.

There is a general perception globally that fishery resources are declining and that the marine environment is deteriorating as a result of fishing and other human activities. Although there is evidence that this is occurring throughout the world, there are signs that fisheries are responding positively to effective management, mostly implemented in developed country fisheries, typically in the more temperate regions of the world.

Unlike other parts of Asia, Oceania's marine fish catch was increasing until 2006, but in 2006 there was a rapid drop of almost 7 percent compared to the year before and this trend has continued with a 12 percent drop between 2006 and 2008. Declining catches in the fisheries within Australia's economic exclusion zone can partly be explained by a reduction in effort and in lower catches following a structural adjustment and a ministerial direction in 2005 aimed at ending overfishing and allowing overfished stocks to rebuild. The economics of fishing may improve in the medium and long term, because fewer vessels will be operating.

Capture fisheries in marine waters in the APR are in crisis – the number of overexploited, depleted or recovering marine fish stocks reached 32 percent in 2008, the highest in history. In addition about half of the marine fish stocks were estimated to be fully exploited, this means there is no possibility to expand catches in a sustainable way. For the ten species which have the highest share in catches, most of the stocks are overexploited. Especially for small-scale fishers in developing countries, the overuse of fish resources endangers livelihoods. For inland fisheries, pollution, drainage of wetlands, construction of dams, water extraction, habitat loss and irresponsible fishery practices result in declines in captures and quality problems. Cambodia's Tonle Sap Lake, for example, lost traditional management capacity during its war years, and has suffered a proliferation of people engaging in fishing, so control in open areas is difficult.

All the countries in Table 10 have established an economic exclusion zone, and use zoning partly to apply different management measures for different areas and different fleet segments. Closed areas and closed seasons are common in the near shore zone (zone 1) of many countries in the region. Gear restriction and licensing, when applied, are used in all zones. Size limits (such as fish length) and quotas are not used by many of the countries in the region as a management measure. Across the region, basic gear restrictions have had some impact, including (i) banning of poisoning, dynamite and electro-fishing; (ii) banning spear fishing with scuba; (iii) banning small net mesh.

Closed areas come in many forms of which marine protected areas (MPAs) are the most common and well known. These countries in the region have a total of at least 726 MPAs in the South China Sea, and 636 MPAs in the Bay of Bengal. There is a degree of mixing of marine protected areas (inferring water surface or benthic ecologies such as coral or seagrass) and more general mangrove or coastal areas (which area combination of water and land). The contribution of

Table 10: Management measures used in different fisheries (by zone)

Area	Closed areas	Closed seasons	Size limit	Gear restrictions	Licensing
China	Zone 1	Zone 1		Zones 1 & 2	Zones 1 & 2
Viet Nam	Exist	None		–	–
Philippines	–	Zone 1		All zones	All zones
Thailand	Zone 1	Zone 1		All zones	
Malaysia	Zone 1	–		All zones	All zones
Indonesia	–	–		All zones	All zones
Sri Lanka	–	Zone 1	Zone 1	Zone 1	Zone 1
India	Zones 1-3	Zones 2-4	All zones	All zones	
Bangladesh	Zone 1	Zone 1	–	All zones	All zones
Myanmar	All zones	All zones	–	All zones	All zones

Source: **APFIC**. 2010. *Status and potential of fisheries in Asia and the Pacific*.

these environments to fisheries varies, but they all have unique value. There are many examples of seasonally-closed areas or zones in many of these countries. Artificial reefs have also been constructed in several countries and these could be included in future inventories.

Production of fishmeal from processing wastes is a significant way to improve resource efficiency, if sourcing is sustainable. The International Fishmeal and Fish Oil Organisation (IFFO) estimates that about 56 percent of the fishmeal produced in the East Asian region is derived from this source, whereas globally this figure is only 25 percent. IFFO together with FAO have launched a project to assist factories to achieve IFFO Global Standard for Responsible Supply (IFFO RS) certification; this can progress gradually against a series of auditable milestones on responsible sourcing and food safety.

Inland capture fisheries production in the region grew by 6.0 percent between 2006 and 2008 compared to a growth rate of only 1.3 percent between 2004 and 2006. This overall increase in inland fisheries is probably a result of more enhancement and growing effort as this increases the yield. However, part of the increase is probably because of a significant re-evaluation of the potential of inland fisheries. Enhancement and conservation of inland fisheries resources have been practised for a long time in many Asian countries for the purpose of promoting inland capture fisheries, and recently the conservation of biodiversity and environmental benefit. Enhancement and conservation activities in river systems tend to focus more on protection of aquatic biodiversity (including genetic biodiversity) and re-installation of depleted wild stock, whereas enhancement and conservation activities in lakes, reservoirs and floodplains usually focus more on enhancing catch and sometimes on environmental benefit.

Governments are still major funding sources for large-scale enhancement and conservation programmes in many countries. More recently, sources of investment are becoming more diverse. In many cases, enhancement and conservation activities are often jointly funded by different levels of government, together with other sources of funding. Entrepreneurial investment is commonly used for covering the costs of an enhancement programme when fishing rights are leased to companies/collectives/cooperatives. Contributions from beneficiaries (fishers) have become an important source of investment for enhancement and conservation programmes. The common practice is a resource enhancement fee collected from fishers when renewing fishing licences. Public donation is becoming a significant source of investment, often from public or local community organization campaigns.

Current enhancement and conservation of inland fisheries resources cover all kinds of inland water bodies and involve many varieties of fish and other aquatic animals in the region (Table 11).

Table 11: Approaches for enhancement of inland fisheries resources in Asia

	Artificial release	Artificial fish breeding substrates	Protected areas	Habitat improvement	Closed season	Restriction of harmful gear	Quota
Rivers	✓		✓		✓	✓	
Lakes	✓	✓	✓	✓	✓	✓	✓
Reservoirs	✓	✓	✓		✓	✓	✓
Floodplains	✓		✓	✓			

Source: **APFIC**. 2010. *Status and potential of fisheries in Asia and the Pacific*.

More than 100 species of fish and other aquatic animals are directly used in the enhancement or are directly/indirectly impacted by conservation activities. Thirty-three species (mostly fish, but some crustaceans) are currently used for enhancement in two or more countries in the region.

All countries of South Asia and Southeast Asia have policies to promote and expand fishing further offshore from their coasts. In some cases the policy explicitly states that the move offshore is to transfer fishing from overexploited inshore areas, but another driver is to aim for full utilization so that others cannot fish under the provisions of the UN Convention on the Law of the Sea (UNCLOS). In this respect, this law is not aligned to sustainability. Some of the offshore resources of the region, especially the highly migratory species like tuna, are being exploited by countries both from within as well as from outside the region. Governments are providing a number of incentives to facilitate this move. Illegal, unreported and unregulated fishing is already a major constraint to sustainable development in many of the coastal fisheries of the region.

Part of the solution is to strengthen internal linkages between resource management and livelihoods. Engaging the community to manage resources – rather than top-down imposed restrictions – is often more effective. Where community or fishing industry is strong, self-imposed closed seasons or closed areas protect spawning or migrations, providing fish with safe havens. Reviving and strengthening taboos and other spiritual institutions also provides fish safe havens, for example: Cambodia is reviving fishing taboos on stretches of rivers (for example in front of temples); ‘sacred ponds’ where no fishing is allowed are common in Sarawak, Malaysia, and in Indonesia, Viet Nam and some parts of South Asia.

Between the 1940s and 1990s countries in the region favoured state management policy for fisheries. For example Thailand’s state-managed coastal and fishery policy promoted tourism, leading to an influx of people to coastal areas, tourism development and displacement of fishing communities. Another politically expedient approach by governments was to step out, let nature take its course, suggesting fishers would exit when fishing was no longer economically viable. This has resulted in overfished, impoverished fisheries.

Alternative government policy is to facilitate establishment of cooperatively managed areas, such as in Fiji, under the Qoliqoli Bill of 2006. This legislation, although controversial in other aspects, recognizes the rights of local people to the resource area from their village to the outer reef. This encourages sustainable management of the reef, as it is the village’s own fishery. This can be contrasted to Tonga, where the equivalent traditional ownership was abolished in the 1960s and all coastal resource fell under state ownership: the people lost the incentive to conserve what was now not theirs, and many areas became overexploited and degraded.

Handing over some of the responsibility to communities for managing their fisheries responsibly is increasingly recognized as a means of improving equity (social development), as well as economic and environmental aims. Fisheries co-management is a tool to establish and build

a partnership accord between the interest groups involved in the fisheries sector to negotiate a trustworthy process of sharing the rights and authority for responsible stewardship of fishery resources. FAO implemented a good example of this in Aceh Province of Indonesia between 2007 and 2010 following the devastating impact on coastal communities of the tsunami, resulting in local empowerment and adoption of a Code of Conduct for Responsible Fisheries.

Aquaculture in the region continues to grow rapidly, from less than 1 million tonnes *per annum* in the 1950s to 46.6 million tonnes of aquaculture products in 2008 – 90 percent of global total by weight and 79 percent by value. Aquatic plant production by aquaculture reached 15.8 million tonnes in 2008. Aquaculture experienced rapid growth with little regulation in the 1990s, recently shifting to more sustainable practices. Globally, seven of the top ten aquaculture producing countries are in the APR: in Viet Nam, India, China, Bangladesh and Thailand. The industry is already producing significant quantities of fish protein, but still has potential to improve greatly, in terms of efficiency, quality and food safety, rather than just area expansion. Asian aquaculture has been strengthened through the Network of Aquaculture Centres in Asia-Pacific, which helps in sharing of ideas, lessons learned from mistakes made, and emerging issues within the industry. The APR is ahead of other global regions in terms of aquaculture practices because of the utilization of different species. Many fish farms use low trophic level fish species (such as filter feeders, carp, tilapia, and catfish), achieving greater efficiency compared to production of carnivorous, high trophic-level species (penaeid shrimp, jacks and sea breams). For every unit of energy captured from the sun, only 10 percent is transferred from each organism up the food chain. This means that there is less energy available to top-level predators, as opposed to primary consumers (herbivores) and detritivores.

The need for an ecosystem-based approach to fisheries (EAF) is recognized by members of the APFIC. This approach also contributes to the implementation of the FAO Code of Conduct for Responsible Fisheries. The Korean Government, for example, has traditionally managed the fishing industry through technical measures such as closed season, closed area, mesh size regulation, etc. as well as input control based on a licensing system of fishing vessels and fisheries. In addition, a vessel buyback programme has been implemented since 1994, and the output control is also utilized by adopting a total allowable catch policy since 1999. However, these single species-based management policies and measures could not prevent the decrease of fishery resources. In order to increase fishery resources, a fish stock rebuilding plan based on the ecosystems approach has been implemented since 2006. The institutional framework for the EAF is the Korean Fishery Resources Management Act 2009, which establishes a comprehensive plan for fishery resources management, based on scientific research, assessment of the resources and consideration of ecosystems. This adds to the Marine Ecosystem Conservation and Management Act 2006, which aims to protect the ecosystem, preserve marine biodiversity and use marine resources. The Ministerial Decree on Indonesian Fisheries Management Areas is a milestone in the implementation of the EAF in Indonesia. It reflects growing awareness of: the importance of interactions between fishery resources and their environment; the proven limited performance of current management approaches as witnessed by the critical state of some Indonesia's fisheries in pursuing fisheries resource sustainability; and, recognition of the cross-sector objectives and values of fishery resources and marine ecosystems within the context of national (pro-poor, pro-growth and pro-job) sustainable development. In Bangladesh, the intervention of the ecosystem approach to fisheries resource management impacts positively in enhancing production of *hilsa* fishery, a single fishery that contributes 12 to 13 percent of total fish production of Bangladesh, increasing the production by 0.59 million tonnes from 2003 to 2008.

Integration of agriculture with aquaculture has a long tradition in Southeast Asia, for example raising fish and crustaceans in rice paddies, but due to the intensification of rice cropping systems with pesticides, rice-fish cultures declined until resurgence in the 1980s as pesticide regulation strengthened, farmers began adopting IPM, and prices for fish rose. Policy in China has been particularly effective in resurging rice-fish systems.

The APFIC regional workshop on best practices to support and improve the livelihoods of small-scale fisheries and aquaculture households was convened from 13 to 15 October 2009, in Manila, Philippines, and highlighted those areas of best practice and policies that will support coastal community livelihoods and those aspects that are to be avoided or which can negatively impact coastal livelihoods.

Transboundary diseases are affecting wild and cultivated species, from uncontrolled shipment of spawn and aquaculture products, and ship ballast water. Examples include the white spot syndrome virus, which has drastically affected shrimp aquaculture in Southeast Asia, and abalone *ganglioneuritis* virus that spread along Australian coastlines in 2010 through abalone fishing boats and aquaculture. Strict biosecurity measures must be put in place to protect the fragile emerging economies from disastrous losses caused by an outbreak of a newly introduced disease. These security measures should be formed in collaboration with the other sectors. There are good indications that the development of more biosecure shrimp farming systems and better farm management practices have made it possible for shrimp farmers to limit the negative impact of viral diseases. The introduction of specific pathogen-free broodstock and postlarvae has also been important in this development. FAO support through *Fisheries and aquaculture products and industry* (TCP/CPR/3203) in 2009 made significant progress in successfully developing good aquaculture practices, improving local capacity for disease diagnosis, monitoring of culture environment and preliminary detection of drug residues.

A major issue within the aquaculture industry is the disparity of income between producers and marketers in the value chain. For example, a Vietnamese *Panassia* producer gets only about US\$0.008/kg of fish produced. This is not a sustainable situation, as the primary producers bear the most risk while obtaining the least benefit, so development of mechanisms for the secondary and tertiary parts of the value chain to support the primary levels are important. Recently certification schemes have been established addressing a diverse range of issues surrounding aquaculture production including environmental integrity, food safety and quality, social responsibility, animal health and welfare and other issues such as organic aquaculture. These allow producers to access higher value markets. For wild fish stocks, fishers can obtain certifications such as from the Marine Stewardship Council, which indicates to the consumer that the fish they are purchasing has been fished in accordance with sustainable practices, from sustainable fisheries. FAO and the Thai Department of Fisheries have conducted a joint project on *Certification for Small Scale Aquaculture in Thailand* (TCP/THA/3202). The project helped small-scale farmers implement certification through a group approach, to enhance their market access and improve their environmental, social and economic sustainability. Working in a group reduces the cost of certification for individual farmers, improves market access and assists farmers to move up in the value chain.

CASE STUDIES

We are moving into a turbulent and an uncertain era, particularly in respect of the future food and livelihood needs for an increasing global population, poverty and equity, and resource depletion. It is in this context that a small sample of case studies are presented to very briefly illustrate how a range of key green economy approaches in fisheries and aquaculture has been facilitated by policy reform or decentralization and capacity building. Sustainable development is not always measured in quantitative terms – it may reflect synergies achieved (for example in rice-fish culture); improved resource governance from social empowerment and conflict resolution (such as appreciation-influence-control and co-management approaches); and verifying good practices (like aquaculture group certification).

Case study 1: Resurgence of paddy-field fish culture

Paddy field fish, also popularly referred to as ‘rice cum fish’ culture, is a traditional integrated fish-paddy production system. The earliest practices can be traced back to more than 2000 years ago. Incorporating fish production into paddy fields remained a subsistence approach to aquaculture until the 1950s. Except for small stocking, there was almost no other input, nor any specific modification made to the paddy fields to meet any special requirements of culture of aquatic animals. Paddy harvest was the main production in the system and the fish yield was very low. Due to the insignificant difference in price between fish and paddy (fish price only doubled that of the price of paddy in the early 1980s in China), the economic importance of fish in the production system was very limited. The push to increase paddy production using high levels of fertilizer, pesticides and new cultivation techniques were often not favourable to this form of fish culture.

In the 1980s, the government actively supported paddy-field fish culture development. Standard paddy field engineering for different types of paddy-field fish culture practices under different conditions (environmental, agronomic, social) and for different fish species were developed and disseminated to vast areas. The disseminated system is typically called a ‘Ridge-Field-Trench’ system. Recent trends of application of IPM, ecofriendly agronomic practices and government policy impetus, resurrected once forgotten rice-fish culture not only in China, but also in the Philippines, Thailand, Hungary and Egypt.

In the past three decades, it has developed in a more holistic manner and adapted to significant socio-economic and environmental changes in China. To ensure environmental integrity and food safety, many new technologies were introduced to the farming systems, such as the use of formulated biofertilizer and micro-agents for water manipulation. In many areas, traditional paddy-field fish culture has gradually transformed into green/organic food production systems. Certified, labelled green and organic paddy and aquatic products not only bring the farmers more income but also contribute to holistic rural development.

There are some 1.55 million ha of paddy-field fish culture in China now, which produces approximately 1.16 million tonnes of fish products (2007), in addition to about 11 million tonnes of high quality paddy. Fish production from paddy-fish culture has increased by 13-fold during the last

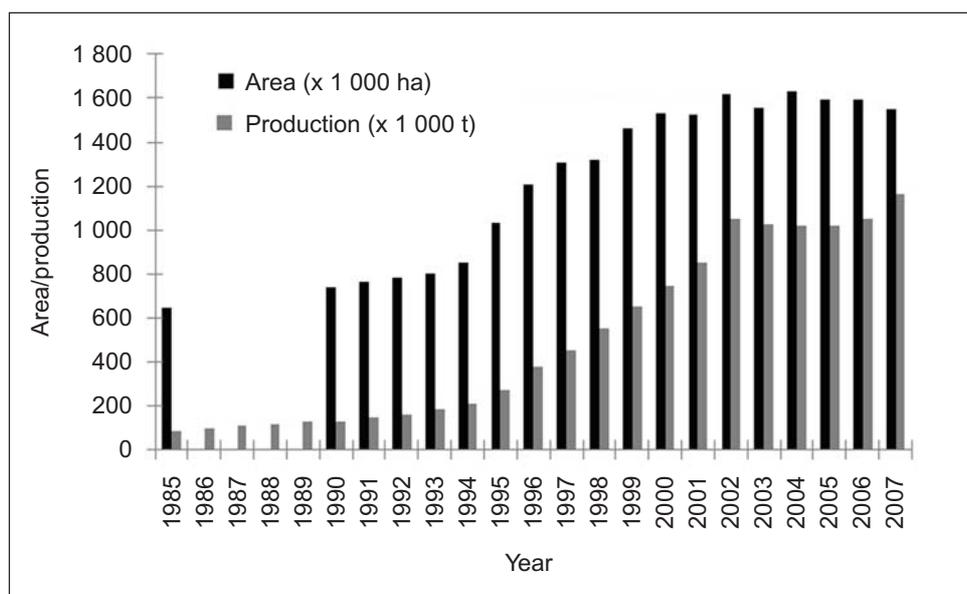


Figure 4: Area and production of fish in paddy fields in China

Source: Weimin, M. 2010. *Recent developments in paddy field fish culture in China*. Bangkok, FAO.

Table 12: Rice-fish culture increases farm income

Farm production	Yield/ha	Net Income/ha (US\$)
Grain (rice paddy, wheat, maize)	15 tonnes maximum (from 2-3 crops)	1 500
Fish from paddy culture	780 kg average	2 000-4 000
Jiangsu Province, fish from paddy	–	2 912
Yangcheng, crab from paddy	–	11 000

Source: **Weimin, M.** 2010. *Recent developments in paddy field fish culture in China*. Bangkok, FAO.

two decades in China. Paddy-field fish culture is now one of the most important aquaculture systems in China. While making significant contribution to rural livelihood and food security, development of paddy-field fish culture is an important approach for environmentally friendly holistic rural development, and epitomizes an ecosystems approach to aquaculture.

Chinese paddy farmers are characterized by small-scale family operations. A family with 1 ha of land typically makes a maximum of US\$1 500 net income from traditional grain crops annually when the harvest is good. The average unit production of 780 kg/ha fish from paddy-fish culture can bring the farmer US\$1 500-4 000/ha income, increasing farm income by two to four times compared with crop farming only.

It is estimated that the area under rice cultivation in Asia approximates 140.3 million ha, accounting for 89.4 percent of the world total. The potential for development of paddy field fish culture is very high in the region. The successful experiences and lessons of paddy field fish culture development drawn from China can be a good reference for sustainable paddy field fish culture development in the region as well as other parts of the world, and thereby contribute further to food security and poverty alleviation.

Case study 2: Fisheries co-management in Aceh, Indonesia

FAO has been active in terms of commencing co-management schemes of the fisheries in Aceh, Indonesia. The programme was structured to assist communities, fishers and the state to move towards working for fisheries co-management, where the initial effort was focused on awareness. Once awareness of the fragility of wild fish stocks had been raised, the effort moved towards action, followed by training, field action and finally, networking. The key stakeholders involved were the coastal community (in particular youth representatives), the village leaders of the traditional fisher organization and the officers of the Sea and Fisheries Department, of the province and the districts. Youth groups were trained from every settlement along the coast.

In September 2008 a meeting was convened for the officers of the Sea and Fisheries Department, with assistance from FAO. The purpose of the meeting was to discuss the issue of mini-trawling and the need for banning of the practice. The meeting was arranged in light of the Aceh Barat Parliament's order that all fishers should stop using mini-trawls by October 2008. The meeting made it clear that the traditional fisher organization had a deep split of opinions, and it was evident that those in favour of mini-trawling were those who benefited from its operations the most. The meeting helped to clarify misunderstandings about the issue. However, the problem was not entirely resolved, as some fishers owned trawling boats and were very reluctant to discontinue trawling without compensation. Following the meeting, the FAO co-management team made an assessment of the economics of mini-trawling and the extent of its practice in Aceh Barat. An article was published in the popular local newspaper, which explained the ecological reasoning behind the need for a mini-trawl ban, and gave the reasoning behind why it would be hard to achieve such a ban, because of its lucrative returns. The article advocated a stringent ban and a state funded scheme for the exchange of mini-trawls for more selective fishing gear. The Fisheries Department action

received a boost when a new (female) chief was appointed. Her enthusiasm was infectious and all the fisheries department staff members were committed to this cause. The Fisheries Department actions included joint action by navy, water police, Panglimalaot (the traditional fishers' organization) and the community motivators, each playing a distinctive role, to support the campaign against trawling. Based on the FAO programme's suggestion to institute exchange schemes for those who gave up trawling, the district parliament provided funds in this context. Most of the fishers turned in their mini-trawls in exchange for selective gear.

Table 13: Results' matrix of fisheries co-management in Aceh

Target group	Awareness creation	Capacity building training	Field action
Coastal community (focus on youth and women)	Face to face discussions in all communities; a variety of brochures, posters and audiovisual materials were used. 120 village meetings for youth for training. Over 25 000 people were reached.	Trained 164 youth community motivators. Training for 50 women on credit and saving groups. Training in livelihood activities.	Motivators held 164 activity sessions with traditional fisher groups. They established five co-management centres. Two women's credit and savings groups formed involving about 70 women.
Fishers (contact through PL)	Province-level biannual meeting of all 173 Panglimalaot (PL). Direct contact made with 33 local PL, linked with the 164 youth motivators.	Workshops along the coast discussed traditional law and co-management. Discussions to draft provincial fisheries legislation with 33 PL of the four districts of the west coast.	PL involved in making a film on traditional practices. About 25 PL engaged with the coastal community and 11 involved in the initiative to form five co-management centres involving about 2 000 fishers.
State (Department of Fisheries officers)	Workshop on fisheries management between four coastal districts and the province. Study tour to Malaysia for 14 senior officers from four districts and the province.	Training in fisheries co-management for 40 officers from four districts and the province.	Of those trained 14 have linked up with the communities where the five co-management initiatives have commenced.

Source: FAO. 2010. *Negotiating co-management in Aceh, Indonesia*.

Case study 3: Calculating the loss of not shifting to a blue economy

The World Bank *Sunken billions* (2009) study, using FAO data, calculated that the contribution of the harvest sector of the world's marine fisheries to the global economy is substantially smaller than it could be. The lost economic benefits are estimated to be on the order of US\$50 billion annually. Over the past three decades, this cumulative global loss of potential economic benefits has been on the order of US\$2 trillion. The 1974-2008 period was used because FAO produced its first 'state of the marine fisheries' report in 1974, the first of a series of 14 such reports. The losses represent the difference between the potential and actual net economic benefits from global marine fisheries.

By improving governance of marine fisheries, society could capture a substantial part of this US\$50 billion annual economic loss. Through comprehensive reform, the fisheries sector could become a basis for economic growth and the creation of alternative livelihoods in many countries. At the same time, a nation's natural capital in the form of fish stocks could be greatly increased and the negative impacts of the fisheries on the marine environment reduced.

In economic terms, some 60 percent of the world’s marine fish stocks were “underperforming assets” in 1974. By 2004, more than 75 percent of the fish stocks were underperforming, at an estimated annual loss of US\$50 billion to the global economy. The ‘sunken billions’ calculated by the World Bank in 2009, was a conservative estimate of this loss. The estimate excluded consideration of losses to recreational fisheries and to marine tourism, and losses attributable to illegal fishing were not included. The estimate also excluded consideration of the economic contribution of dependent activities such as fish processing, distribution and consumption. It omitted the value of biodiversity losses and any compromise to the ocean carbon cycle. These exclusions suggested that the losses to the global economy from unsustainable exploitation of living marine resources substantially exceeded US\$50 billion per year.

The International Sustainability Unit of The Prince’s Charities followed the World Bank study aiming to give an indication of the scale of opportunity to use maximum sustainable yield. The global fishing industry revenue of US\$79 billion per year was reduced to an operating profit of US\$6 billion after fuel, labour and other production costs. After including capital costs, the industry makes a net loss of US\$5 billion. The researchers went on to include the environmental and social costs and benefits of the global fishing industry. The only externality that could be easily quantified was carbon dioxide (cost: US\$5 billion). Social benefit was based on the total wage bill. Overall, this is a net loss to society of US\$8 billion per year.

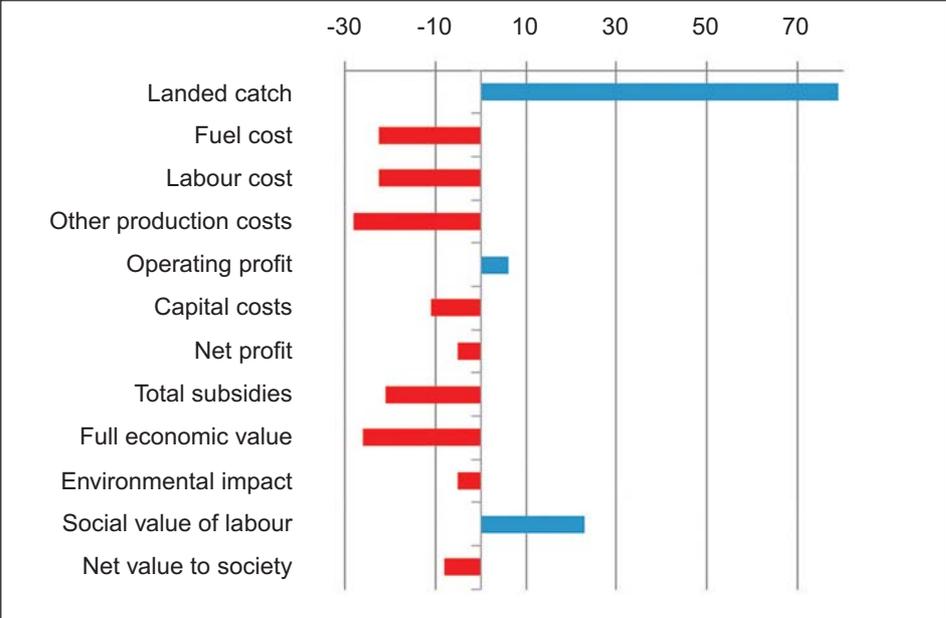


Figure 5: The value to society of global wild fisheries (US\$ billion)

Source: **The Prince’s Charities**. 2011. *Transitioning to sustainable and resilient fisheries*. London.

FAO reports that an increasing proportion of the world’s marine fish stocks is either fully exploited or overexploited. The same applies to the world’s most valuable fish stocks. The 25 percent that remains underexploited tends to consist of lower-value species or the least profitable fisheries for such stocks. When fish stocks are fully exploited in the biological sense, the associated fisheries are almost invariably performing below their economic optimum. In some cases, fisheries may be biologically sustainable but still operate at an economic loss. For example, the total catch may be effectively limited by regulations, but in a world of increasing fuel subsidies, the real cost of harvesting the catch may exceed the landed value. The depletion in fish capital resulting from overexploitation is rarely reflected in the reckoning of a nation’s overall capital and GDP growth.

These studies indicate that the current marine catch could be achieved with approximately half of the current global fishing effort. In other words, there is massive overcapacity in the global fleet. The excess fleets competing for the limited fish resources result in stagnant productivity and economic inefficiency. In response to the decline in physical productivity, the global fleet has attempted to maintain profitability by reducing labour costs, lobbying for subsidies, and increasing investment in technology. Partly as a result of the poor economic performance, real income levels of fishers remain depressed as the costs per unit of harvest have increased. Although the recent changes in food and fuel prices have altered the fishery economy, over the past decade real landed fish prices have stagnated, exacerbating the problem. The value of the marine capture seafood production at the point of harvest is some 20 percent of the US\$400 billion global food fish market. The market strength of processors and retailers and the growth of aquaculture, which now account for some 50 percent of food fish production, have contributed to downward pressure on producer prices.

LESSONS LEARNED

In striving for fisheries sustainability there has been a gradual convergence into ecosystem-based thinking. Fisheries' thinking continues to evolve, having primarily moved towards ecological considerations such as biodiversity and ecosystem health during the 1980s and 1990s, with more recent moves into participation and related social issues in the last decade or more. This can be seen as a drive towards a more sustainable, multidisciplinary thinking and a holistic, green economy approach. Identifying the global loss is a clear message for governments to cut subsidies and for corporate business to reduce capital in fishing fleets.

Aquaculture on the other hand, traditionally has been based on a strong sense of private ownership (local/national) and economic resilience, building on much older animal husbandry/farming systems linkages. Currently both fisheries and aquaculture increasingly have to come to terms with ecological sustainability closely linked to economic viability and social responsibility.

Aquaculture has now reached an important position as a globally significant contributor to food production. However, this development has had its critics, both from primary resource use as well as consumer and social responsibility viewpoints. Most criticism is directed towards aquafarming systems that produce high-valued, carnivorous species such as marine salmonids and shrimp. It raises the issue of why the world should endorse a food production system that uses nearly 25 percent of captured low-valued fish (trash fish) primarily to produce animal feeds including feeding fish, rather than as a direct food source for the millions of hungry and poor. The growth of aquaculture based on lower trophic-level species – such as in the rice-fish culture system – has proven to be a move in the right direction.

4 Forestry

The need for green economy

‘Green economy’ policy aims to enhance convergence between the three pillars of sustainable development – simultaneous economic, social and environmental benefits. During the next few decades, the situation in the APR and the policy responses will determine future sustainability. Most APR countries will likely follow one of three broad paths of development: (i) rapid economic growth; (ii) stagnation; and (iii) green economy, balancing growth and sustainability.

Most middle-income and emerging economies are likely to pursue **high economic growth** rates, overlooking critical social and ecological problems. Political, corporate and institutional conditions encourage this, taking advantage of demand for raw materials unless catastrophic problems arise (including a prolonged global recession or climate change-related events).

Low growth and stagnation are also likely in many countries restrained by weak economic performance and low priority given to social and ecological sustainability. The slow and weak recovery from the current global economic crisis may protract recession. In this economic situation, demand for forest products is dampened and investments in forestry are sluggish. Forest management stagnates and degradation accelerates, especially in poor or recession-hit areas where livelihood pressures drive people and business to greater exploitation of forests. Even with global economic recovery, low-income resource-poor countries and developed countries where economic fundamentals constrain growth remain vulnerable.

The **green economy** envisages changes to balance growth with social and ecological sustainability. This is increasingly the vision in the context of economic and climatic crises. Most middle-income and emerging economies can develop some renewable energy, to counter increasing costs of fossil fuels and concerns over energy security. Developed countries – with better-developed policies and institutional frameworks, and greater ability to invest in science and technology – can shift to a green economy. Sustainability is, however, unlikely to receive due attention against perceived imperatives for rapid economic growth, especially in resource-rich countries and regions with weaker policies and institutions, influenced by powerful corporations and elites seeking short-term gains.

The issues and potential of forestry

Countries and their forestry sectors are becoming ever more closely linked as economic liberalization and regional integration accelerate. Forestry has the potential to lead the development of green economy. Heightened awareness of forest values and inclusion in international climate change agreements have increased the importance of understanding the issues and opportunities. The economic, social and environmental functions of forests include *wood* and wood products; *bioenergy*, on which many people in developing countries rely, as well as emerging large-scale technologies from industrial forestry that otherwise considers it ‘waste’; *non-wood forest products (NWFPs)*, a treasure trove of diversity for livelihoods that are often neglected by governments and forest industry; and *ecosystem services*, including biodiversity conservation, combating desertification, carbon sequestration, water resource functions, and amenity functions for tourism, recreation, and urban values. Forestry therefore is a major source of environmental benefits, as well social and economic benefits of poverty reduction, employment and economic growth.

Over recent decades, the APR forestry sector has undergone major changes in response to larger societal transformation within and outside the region. A better understanding of what is likely to happen in the context of such changes is essential in choosing options and developing plans and policies to transition to a green economy.

APR forests cover a total of 740 million ha, accounting for 26 percent of the region's land area and 18 percent of the global forest area. However, the large population means the APR is, per capita, the least-forested region in the world (0.2 ha of forest per person). There is enormous pressure on forests in some countries and subregions, for example South Asia has 23 percent of the world's population, but only 2 percent of the world's forests – only 0.05 ha per person.

Deforestation is a major issue faced by many countries in the region. Annual regional loss of forests was over 0.7 million ha during 1990 to 2000, to an annual increase of 0.5 million ha per year between 2005 and 2010. The increase in forest area over the last decade is primarily due to large-scale afforestation in the People's Republic of China. In addition to China, forest area has increased in Bhutan, Fiji, India, the Philippines, Sri Lanka, Thailand and Viet Nam. If gains in these countries are excluded, deforestation elsewhere remains high. Major areas of forest loss, driven by policy distortion and powerful corporate elites, are particularly evident in Indonesia and Myanmar – and in Australia, where large areas of ancient, biodiverse native forests continue to be cleared. This is an example of unsustainable development in a wealthy country – the state-owned Tasmanian forestry practices of clearing, napalm burning, elimination of browsing wildlife, application of residual herbicides and aerial pesticide spraying to establish short-rotation monoculture plantation for exported wood fibre – are accelerating loss of species, negative health impacts from pesticide residues entering waterways and loss of local livelihoods, including in apiculture, sawmilling and furniture manufacture.

It is increasingly evident that countries cannot develop forestry policies in isolation – rights and responsibilities are increasingly spilling across borders and across sectors as populations increase, demands on resources heighten and economies integrate. In 2008, the value of APR trade in primary forest products exceeded US\$90 billion. The region's forests produce up to 300 million m³ of industrial roundwood each year, with imports from other regions exceeding 30 million cubic metres. Production and consumption of sawnwood, based almost entirely on natural forest, declined from about 95 million m³ in 1980 to 91 million m³ in 2008 as resources continued to diminish. Indicating the decreasing availability of larger diameter timber, wood fibre-based panel production increased significantly, from about 19 million m³ in 1980 to over 114 million m³ in 2008. Demonstrating the interconnections, China lacks substantial production forest but imports wood fibre to produce wood-based panels enabling it to become a major exporter. Production of paper and paper board has increased rapidly during the last two decades, increasing from about 31 million tonnes in 1980 to 147 million tonnes in 2008. Until about 2000 most of this was sourced from unsustainable natural forest clearing. China, Indonesia and Malaysia are exporters of value-added wood products, relying on imports of lower value-added items (such as wood fibre). While increasing domestic demand has raised investments in processing capacity, low wages have spurred export-oriented production. Poorly defined property rights, weak governance and high demand have led to high levels of local peoples' dispossession of their land and illegal logging.

More wood has begun to be produced from plantations with the decline in natural forests. The APR accounts for about 45 percent of the world's plantations, but public sector forest plantations are particularly prone to low productivity, largely on account of inadequate management. The potential wood production from planted forests in 2005 was estimated at 542 million m³ but total industrial roundwood production (including production from natural forests) in 2005 was only half that, about 273 million m³. Relatively small investments in better silviculture, for example planting higher value species, thinning and high pruning, generates local employment and social benefits, intermediate

wood products (such as poles, fuelwood, and fibre logs), and substantially increase benefits through an increased ratio of high-value sawlogs (increasing employment rates in value adding), and slightly longer rotation (strengthening environmental services). Investment in sawlog plantation provides good potential social and economic benefit in view of the preponderance of small- and medium-sized sawmills, many of which operate in the informal sector and generate significant employment and growth from value adding.

Demand for forest products and services will only grow towards 2050, particularly for energy needs, housing, food and fodder, and industrial use. Conservation, appropriate planning and management of existing forests, especially native and high biodiversity forests, is the greatest priority, and should not be converted for short-term economic gain. Forests play an important role in a bio-based economy, which will assist in achieving poverty eradication and rural development and can be achieved if the forestry sector works closely with other sectors such as agriculture, waste and biotechnology.

Ecosystem services from forests are gaining importance, but since 2002 the extent of protected areas has not increased. Mining and infrastructure development threaten protected areas across much of the region. Allocating environmental service contracts to reward long-term afforestation and conservation programmes are fundamental in counterbalancing the pressure for deforestation. Third-party certification of sustainable systems is important – support for the Forest Stewardship Council (FSC) label is well recognized by purchasers and retailers of timber wood and NWFPs.

Natural forests are vital sources of food and income for some of the poorest and most vulnerable people in the world who traditionally live in these forests. NWFPs, such as fruits, seeds, roots of trees, mushrooms, wild animals and insects provide food for rural households. Income is gained from apiculture; products for cosmetic, herbal and medicinal industries; natural dyes; and from tourism and other amenity uses. This is threatened by the loss of 13 million ha per year over the last decade, mostly due to the conversion of forests to agricultural land. Conversion may increase the total amount of food produced (but not, for example in the case of oil-palm), but it may not be accessible to marginalized local people who have lost access to the natural resources on which they depend. Small investments in forest diversity and stability can be critical to food and livelihood security.

Progress towards green economy forestry in the APR

Over the last two decades the region has dramatically increased its demands on forests. Rapid growth in countries such as China and India is bringing about fundamental changes in production, consumption and trade of all forest products and services. The GDP of the region is expected to increase from about US\$10.7 trillion in 2006 to US\$22 trillion by 2020. Continued growth implies a surge in demand for all products, including wood and wood products. Demand for industrial roundwood will increase from 317 million m³ in 2005 to 550 million m³ in 2020. East Asia, especially China, will account for most of the surge in consumption, and both East Asia (mainly China) and South Asia (mainly India) will rely very heavily on imports. The region is also a major net importer of recycled paper. In 2008 China imported 25 million tonnes of recycled paper, 77 percent of the regional total.

Since 2000, total forest area in the region has increased by 14 million ha, largely as a result of reforestation efforts in a handful of countries, most notably China, India and Viet Nam. Wood resources outside forests are also increasing as secure tenure and assured markets are encouraging the expansion of farm-based tree planting. At the same time, loss of 16 million ha of natural forest is expected in the next decade, especially across Southeast Asia, South Asia and some of the Melanesian countries.

Forest degradation is expected to remain a major problem in more densely populated low-income countries, especially in South Asia where dependence on land and forests is high. Considering the high rates of population growth in many countries, a scenario of low economic growth could aggravate degradation. Logging in resource-rich countries to supply export markets will continue to damage forest health, wildlife and waterways. Improving forest management including forest rehabilitation and restoration is the core objective of FAO's APR forestry strategy. A wide range of activities to support forest restoration has been implemented, with a specific focus on applying assisted natural regeneration (ANR) techniques to restore forest ecosystem services.

Table 14: Forest area change in the APR

Subregion	Area (million ha)		Annual change (1 000 ha)		Share of global population in 2010 (percent)	Share of global forests in 2010 (percent)
	1990	2010	1990-2000	2005-2010		
East Asia	209	255	1 762	2 557	23	6.3
South Asia	78	80	-6.5	96	23	2.0
Southeast Asia	247	214	-2 422	-1 086	8.5	5.3
Oceania	199	191	-36	-1 072	0.5	4.7
APR	733	740	-703	494	55	18.4
World	4 168	4 033	-8 323	-5 581	100	100

Source: FAO. 2010. *Asia-Pacific forests and forestry to 2020: Asia-Pacific Forestry Sector Outlook Study II*. Bangkok, FAO.

In various locations across the region, renewed efforts are being made to restore forests in previously degraded sites. Approaches range from large-scale forest plantation, to agroforestry, to passive natural regeneration. ANR is a forest restoration approach based on the concepts of enhancing ecological succession processes, including regeneration and growth of indigenous species. Experiences with ANR demonstrate that this approach is particularly successful in engaging local communities, reducing the risk of forest fires and creating new income-generating opportunities. ANR also significantly reduces the costs of forest restoration, making it a particularly attractive alternative to costly plantation establishment.

Many technical cooperation projects have addressed an enormous diversity of forest management issues ranging across agroforestry, invasive species, integrated mangrove management, participatory tree plantation development and wildlife management. As the market reach of traditional producers expands under sustainable harvesting certification, many NWFPS are being cultivated on a commercial scale, for example aromatic oils and medicinal herbs.

Grama Mooligai Company Limited: scaling up through collective action in India

Established in 2000, the Grama Mooligai Company Limited (GMCL) successfully created a structure to bring together collectors and cultivators of medicinal plants. GMCL is a member-owned enterprise with shareholding held by 30 groups representing 1 200 members, in seven states, linked with 1 200 retail outlets and several large pharmaceutical companies. The company's turnover increased from a modest US\$60 000 in 2001-2002 to US\$170 000 in 2003-2004. The members, mostly women, have been trained in simple value-addition techniques including sorting, grading and packing produce, as well as sustainable harvesting techniques, and skills to handle most aspects of trade.

NWFP certification in Nepal

In Nepal's Himalayas, NWFPs provide important income for villagers. However, traders encourage them to harvest as much as they can, while paying them poorly for their products. The growing demand for environmentally friendly products in Europe and North America has created an opportunity through sustainable, certified harvesting, supported by the Forest Stewardship Council (FSC). In 2005, the Rainforest Alliance and SmartWood awarded FSC certification to the Federation of Community Forestry Users Nepal (FECOFUN), which has 14 500 member groups. Certification has been given to 23 products including handmade paper, essential oils, Ayurvedic medicines, herbal teas, cosmetics and raw herbs.

Source: *Rainforest Alliance Newsletter* (2009).

FAO has played a critical role in forest rehabilitation in the wake of natural disasters and in relation to mitigating future disasters – including floods, landslides, tsunamis, earthquakes and wildfires. Forest protection and forest health issues have been addressed including through the activities of the Asia-Pacific Forest Invasive Species Network. Assisting countries to implement better forest resource monitoring, assessment and reporting has also been a key technical focus.

Forest plantations in countries such as Australia, China, India, Indonesia, Malaysia, Thailand, New Zealand and Viet Nam increasingly dominate wood supplies along with farm-level plantings in China and India. Slight increases in productivity could significantly increase wood supplies, but this will depend on favourable policy, institutions and incentives.

A wide variety of FAO's APR forestry activities focus on rural development, poverty alleviation and improving access to resources while preserving native forests. Enhancing community-based forest management has been an important theme, encompassing issues such as devolution rights, responsibilities and participation in forest management. Investment in sustainable forest management including community and private holdings has been receiving attention with the United Nations Forum on Forests (UNFF) according priority to the development of National Forest Financing Strategies since 2007. The World Bank and Asian Development Bank have initiated financing mechanisms for reducing emissions from deforestation (REDD+) and adaptation under the UNFCCC, conservation of biodiversity under the Convention on Biodiversity, and arrest of desertification (under the UNCCD). FAO has supported the design of financing sustainable forestry management in Asia, in an initiative titled 'Putting principles into practice: Developing an inclusive framework for enhancing investments into Asia-Pacific forestry', which maps the interests of rural communities in sustainable forest management and provides improved pathways in the process of allocating rights and financing mechanisms to community groups to prevent their marginalization (Figure 6).

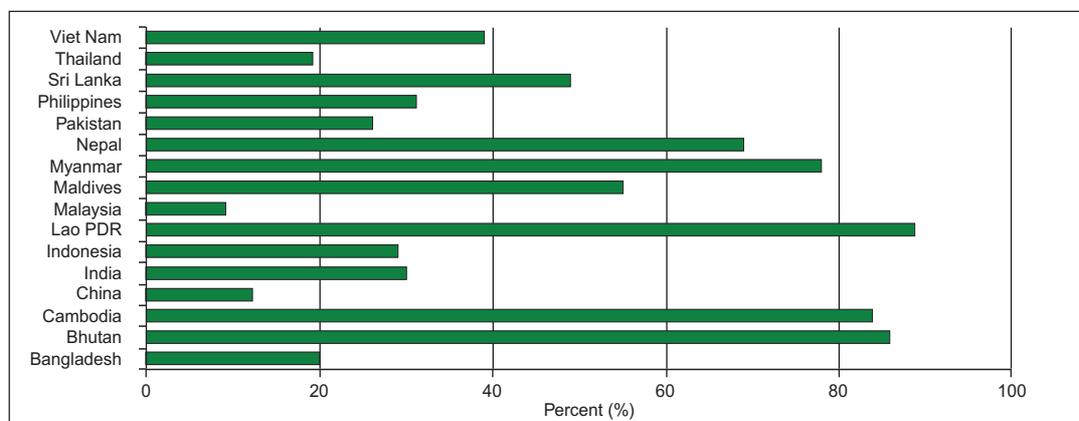


Figure 6: Wood energy in total energy consumption in selected APR countries

Source: **FAO**. 2010. *Asia-Pacific forests and forestry to 2020: Asia-Pacific Forestry Sector Outlook Study II*. Bangkok, FAO.

Two distinct wood energy subsystems exist in the APR, namely ‘traditional’ wood energy of households and small industry, especially in rural areas of developing countries, and industrial wood-sourced bioenergy that are emerging to substitute for fossil fuels. Efficiency improvement has been a key ‘green’ thrust, especially improved cook stoves.

Adoption of energy efficient cook-stoves in Asia and the Pacific

It was the energy crisis in the 1970s – including a perceived wood energy crisis – that drew widespread attention to improving the design and dissemination of simple, low-cost, energy-efficient cook-stoves. China and India have led these efforts, with millions of households now using improved versions. But despite more than 50 years of efforts, adoption of improved cook-stoves remains mixed. In many rural areas, wood is collected free of financial cost; so there is little incentive to adopt more efficient stoves, even when the costs of the devices are low.

Energy and environmental policies are causing changes in wood use as many countries attempt to reduce dependence on fossil energy sources.

Woodfuel consumption in Japan

Woodfuel consumption accounts for less than 1 percent of wood produced in Japan. However, utilization of wood biomass is being promoted as part of a government initiative to assist in meeting climate change goals. According to a 2008 report, Japan used about 8.6 million m³ of wood biomass as fuel, primarily in the form of waste wood to generate electricity and in pellet stoves. Waste materials from sawmills comprised more than half of the total, with waste material from construction sites providing the remainder.

Source: **MAFF, Japan**. 2008.

Wood pellets in Asia and the Pacific

Wood pellets are presently the world’s fastest growing demand for bioenergy. High density, convenience in transport and use and renewability are making wood pellets an attractive alternative in the context of climate change policies. This has negative implications on forest resources in the region, if wood is sourced from previously natural forests.

The Republic of Korea Forest Service signed a Memorandum of Understanding with the Indonesian Ministry of Forestry entailing a lease of 200 000 ha of forest land to produce wood pellets and to develop export-focused wood pellet plants in Indonesia as part of a ‘green economy’ policy in ROK, to reduce dependence on greenhouse gas-emitting, coal-based power generation. It is arguable whether the land was converted from natural forest. Wood pellet production is also emerging in other countries; for example, Australia, China, New Zealand, Singapore and Thailand (where some pellets are being made from bamboo).

Source: **FAO**. 2010. *Asia-Pacific Forestry Sector Outlook Study II*. Bangkok, FAO.

The provision of ecosystem services – including conservation of biological diversity, watershed protection, land degradation and desertification, and climate change mitigation – varies markedly (in terms of efficiency, quality and magnitude) across the region in view of differing resource situations and policy and institutional environments.

Local-level efforts to combat desertification in Pakistan

In Pakistan the area desertified is expanding at a rate exceeding 1 percent *per annum*. Increased extraction of woodfuels and monoculture agriculture are the main causes. A number of initiatives to combat desertification focus on improving resource management by involving local communities. In Morkhoon village in the far north of Pakistan, the Aga Khan Foundation (AKF), supports several women's organizations to better manage natural resources. The AKF has promoted forest plantations on the boundaries of fields, communal land, private land and any other areas where original vegetative cover has disappeared. This has helped to overcome fuelwood and fodder shortages. Women's committees to monitor forest use and grazing.

Source: UNCCD. 2007.

Developed economies, with higher incomes and greater willingness to pay, are able to improve the provision of ecosystem services. Through REDD, developed countries in the region are offsetting carbon emissions by supporting forest development in Indonesia, Lao PDR, Nepal, India and other countries in the region. Perhaps the most proactive developing country on climate change issues has been Papua New Guinea, which has championed the cause of REDD through the Coalition of Rainforest Nations. While the appeal of afforestation and reforestation as a climate change mitigation strategy is considerable, forest-based carbon offset projects face several challenges, including setting baselines, ensuring permanence in reductions achieved, and leakage prevention. Rigorous stipulations and complex processes have marginalized forestry participation in the CDM, which is largely dominated by less complex projects in the energy sector. Exclusion of afforestation and reforestation by most major emission trading schemes linked to the compliance market has been an important factor contributing to the low share of forestry in carbon trading. For example, the European Emission Trading Scheme, which in 2008 accounted for over 60 percent of the volume and close to two-thirds of the value of all carbon markets, does not recognize offsets generated through afforestation and reforestation. The New Zealand Emissions Trading Scheme is exceptional in that it incorporates forestry within its provisions. Thus, although there were about 2 100 registered CDM projects by March 2010, only 13 of these accounting for just 0.51 percent deal with afforestation and reforestation. Of these, six are in the APR: two projects in China, three in India and one in Viet Nam.

FAO technical cooperation projects have been implemented across the region covering issues as diverse as sustainable insect farming and linking communities to voluntary carbon markets. The exciting new Kids-to-Forests initiative has been designed to expose early and middle school children to important issues through forest visits and promises an enduring legacy in the future. The two Asia-Pacific Forestry Weeks organized by FAO in 2008 and 2011 brought together a huge number of forestry stakeholders to discuss and address a wide range of issues. Increasing awareness about the environmental roles of forests has brought forestry and other related land uses under greater scrutiny. Already a number of local, national and global environmental issues have changed the course of forestry in unprecedented ways. With climate change becoming a critical environmental issue, forests and forestry are at the centre stage of global political discussions with considerable potential for reshaping the future of the sector.

CASE STUDIES

Ongoing work in ANR in the Philippines and elsewhere in the region offers a good case illustration of green economy in practice. Community and Leasehold Forestry being vigorously developed in Nepal shows the benefit of strengthening local user rights. Nepal is an example where policies, regulations and institutional developments are being pursued to make community forestry a major initiative in the country's forestry sector. In addition, there are developments in the field to make community and leasehold forestry generate livelihood improvements, which at the same time is

creating an increase in green cover and protecting biodiversity. Corporate social responsibility (CSR) put into practice by government and the private sector has been shown to provide green economy benefits in the Philippines and India.

Case study 1: Assisted Natural Regeneration in the Philippines

Massive deforestation and land-use changes taking place over the last century in the APR have turned wide areas of formerly forested areas into low-productivity grasslands. The grass *Imperata cylindrical* alone covers over 35 million ha throughout the region on land which was once forest. In various locations across the region, renewed efforts are being made to restore forests at previously degraded sites. Approaches range from large-scale forest plantation development, to agroforestry, to passive natural regeneration. ANR is a forest restoration approach, based on concepts of enhancing ecological succession processes, including regeneration and growth of indigenous species. It is a simple, inexpensive and effective technique that relies on the natural processes of plant succession. FAO recognizes ANR as an effective forest restoration approach and has been particularly successful in the Philippines, where ANR has been piloted and practised on a limited scale for more than three decades.

Experiences with ANR demonstrate success in engaging local communities by addressing some of their basic priorities, reducing the risk of forest fires and creating new income-generating opportunities. ANR also significantly reduces the costs of forest restoration, making it a particularly attractive alternative to costly plantation establishment.

An analysis of costs shows that forest restoration via ANR is approximately 50 percent less expensive than conventional reforestation. Results of project experience show an average ANR cost of US\$579 per hectare. When conventional reforestation methods are applied, the average cost is about US\$1 048 per hectare.

Most marginal lands or grasslands are low in biodiversity and soil fertility resulting from continuous burning for pasture improvement and hillside farming. Restoring the lost forest cover not only improves biodiversity and physical conditions but also enhances the land's capacity to support local people's sources of livelihood in the uplands. Land rehabilitation will likewise contribute to mitigating climate change and environmental security.

Table 15: Average forest restoration cost per hectare (item)

	Unit	Unit cost US\$	Quantity <i>conventional</i>	Quantity <i>ANR</i>	Cost <i>conventional</i>	Cost <i>ANR</i>
Fire lines	Person day	3	32	32	96	96
Marking regenerants	Person day	3	–	3.2	–	10
Pressing (lodging)	Person day	3	–	90	–	270
Staking	Person day	3	6.25	–	19	–
Digging planting holes	Person day	3	25	–	75	–
Seedlings	Seedling	0.1	3 000	–	300	–
Hauling seedlings	Person day	3	12	–	36	–
Planting/replanting	Person day	3	30	–	90	–
Weeding regenerants	Person day	3	–	36	–	108
Weeding seedling	Person day	3	113	–	338	–
Herbicide fire lines	Litre	10	8	8	80	80
Spraying	Person day	3	5	5	15	15
Total					1 049	579

Source: Derived from FAO TCP/PHI/3010 (A) at three sites in the Philippines over three years.

Very recently, about 2.2 million ha of marginal lands in the Philippines are being eyed as potential areas for biofuel production to avoid competing with national food security. Improving the productivity of marginal lands remains daunting due to poor soil, tenure problems and regular fire events. For instance, the Philippines Government spent an estimated US\$22.4 million for the reforestation of marginal lands only for them to be destroyed by fire subsequently.

Getting people to assist with natural regeneration needs to happen ‘naturally’. The forest will come back if the land is not perceived as government-owned, but as a locally-managed resource. The activities will continue if they are viewed as part of the stakeholders’ way of life and not belonging to a project. One example of upscaling ANR is the ‘No-Fire Bonus’ Scheme in Mountain Province, the Philippines. The scheme was a provincially funded initiative from 1996 to 1998 that tapped ‘natural’ motivations and relationships. The Community Environment and Natural Resources Office (CENRO) desperately wanted to address the intense fires after the 1993-1994 *El Niño* but did not have the funds. The *barangay* (village) governments had village development plans but did not have funds for implementation. The *dap-ay* (tribal council) had a cultural system to care for forests (including fire protection) but was concerned that the system was breaking down as the sense of ancestral domain and cultural cohesion faded away. The congressman had the Countryside Development Fund that was mainly used for infrastructure projects that contributed to their political visibility. Combining all of these factors, the scheme involved the congressman awarding a PHP100 000 (US\$2 258 in September 2013) infrastructure project to each *barangay* government that had not incurred any fire. *Barangays* that obtained a *certificate of no-fire occurrence* from CENRO based on fire-monitoring reports could claim their award from the Department of Public Works and Highways. The incentive scheme successfully prevented fires in 97 percent of the 124 target *barangays*. A recent impact study found a declining trend in fire occurrence even after the scheme stopped. This scheme may be likened to payment for an ecosystem service. The most important ANR lesson emerging from the Philippines is the importance of strong collaboration with local communities and private businesses for successful long-term results.

Natural regeneration of forests, including ANR approaches, can play a significant role in mitigating climate change, increasing carbon storage by 120 tonnes per hectare or more. A clear advantage of ANR is the steady accumulation of carbon, while simultaneously generating a wide range of other forest benefits and values. Some estimates suggest that overall species extinction is now occurring at 1 000 times the historical rates indicated by fossils records. ANR offers considerable potential for restoring biodiversity. From a biodiversity perspective, ANR offers strong biodiversity benefits relative to conventional single-species plantation forestry. ANR offers great potential for restoring watershed functions because it places heavy emphasis on restoration of natural processes and steady improvement of soil productivity and water quality.

Local communities are at the core of successful ANR application. Initial experience with ANR in the Philippines demonstrated a wide variety of ways for effectively involving and empowering local people. The role of forests for income and the well-being of local people has gained global prominence as the current economic crisis vividly demonstrates the interconnected nature of today’s society. The crisis has greatly reduced demand for wood products. The reduced ability and willingness of buyers to pay has negatively affected the demand for ecosystem services. Markets for carbon and ecosystem services have witnessed a plunge in prices and demand similar to other commodities. Forestry jobs have been slashed and investment in the forestry sector has declined dramatically. At the same time, the crisis has opened new opportunities for ‘greener’ paths of development, with some countries (such as Japan, the United States, the Republic of Korea) including forestry-related measures in their economic stimulus programmes. Incentives and opportunities for forest communities to engage in sustainable forest management will hopefully be a lasting legacy of the ‘green development’ approaches emerging from the current economic crisis.

Table 16: Incentives and disincentives to ANR

Examples of observed incentives	Possible incentives for the future
<ul style="list-style-type: none"> ● Contributing to local pride and sense of accomplishment. ● Fire management (demonstrating zero-fire occurrence on formerly fire-prone sites and witnessing resulting regrowth of vegetation). ● Income opportunities through salaries for ANR work. ● Approval to grow cash crops and trees producing NWFPs in fire breaks. 	<ul style="list-style-type: none"> ● Strengthening the security of land and resource tenure. ● Zero-fire cash bonuses. ● Payment for ecosystem services, including carbon financing. ● Improved market access for cash crops and NWFPs

Case study 2: Community and leasehold forestry in Nepal

Community forestry has had a positive impact on the social, economic and environmental aspects of rural life. Roughly one-quarter of the world’s forests are controlled locally by rural communities, which contributes US\$75-100 billion in goods and services to the economy annually involving one-sixth of the global population.

The overall objectives of community forestry are typically:

- Economic efficiency in maximizing returns on investment;
- Provide incentive to communities to use forest resource wisely and sustainably;
- Promote good community governance, including accountability and transparency;
- Contribute to gender equity and inter- and intra-community justice; and
- Enhance biodiversity conservation without burdening smallholders with its costs.

At its core there are two purposes that community-based forestry can serve: improved livelihoods for community members and ecosystem services for the wider public.

To optimize the benefits of community forestry, awareness of technologies and access to finances is required. State policies are crucial instruments as incentives and subsidies may help a quick start, but can create dependencies and be unsustainable in the longer term. A long-term approach has been for the government to transfer forest land-use rights to local communities and facilitate connection to financial services.

In Nepal, previous government policies on forests left landless villagers with no rights to local forest resources, which were claimed by wealthy castes. This policy had resulted in deforestation, barren land and widespread poverty. In 1992, the Government of Nepal changed course with assistance from FAO and the International Fund for Agricultural Development (IFAD). The Forest Act (1993) and Forest Rules (1995) provided for leasing of areas of degraded forest land to communities for an extendable period of 40 years with exclusive right to the produce of the land. Communities were given the right to manage the forests and reap the benefits under an expanded programme of leasehold forestry. Deforested land was leased to villagers so they could grow grasses, orchards and trees. Government and FAO facilitators assisted in establishing community forestry groups and in preparing a management plan for each of the sites, which prescribed mandatory activities (for example obtaining group approval for harvesting), and contained salient points for improvement of forest patches including planting grass, orchards and trees.

The FAO-implemented Hills Leasehold Forestry and Forage Development project resulted in about 7 000 ha of degraded forests lands handed over to 1 660 leasehold forestry groups consisting of more than 11 000 socio-economically disadvantaged families who each received 40-year renewable leases of about 0.6 ha of forest land (by 2003).

In the first season, villagers harvested the grasses for livestock fodder and to make a variety of products that could be sold for income such as brooms and wicker baskets. Excess fodder was sold for income. Goats also provide communities with milk, helping to raise nutrition levels, especially among children. Families earning extra income thus could afford to take their children out of the fields and send them to school. Villagers subsequently also cultivated fruit trees, such as pineapple and banana. A few grew herbs such as cardamom, and some planted trees that are now yielding timber.

Tularam Ghimire, a community forestry group member, said: “There are two objectives of the programme. The first is improving the economic situation of poor farmers. The second is improving the environment. The twin objectives have brought drastic improvement to the forest. The previously barren land is now filled with grass and trees.”

The main selection criterion for leasehold forestry sites is the presence of a sizeable area of degraded forest land. Once the site is designated as leasehold forest and leasehold forestry groups are formed, grazing is stopped and pockets of grasses, legumes and trees are planted. Despite great variety among the different leasehold sites (altitudes, slopes, soils, vegetation, remoteness and so forth), in most places there is rapid natural regeneration of herbs and grasses, followed at varying speeds by the natural regeneration of trees. At some sites leasehold forestry groups intensively manage and expand the area of planted fodder grasses and legumes, or develop fruit orchards. Biodiversity has increased and at two sites the number of plant species has increased by 57 and 86 percent in six years. The vegetative ground cover at new sites was on average only 32 percent formerly; this has gradually expanded to almost 90 percent at seven-year-old sites.

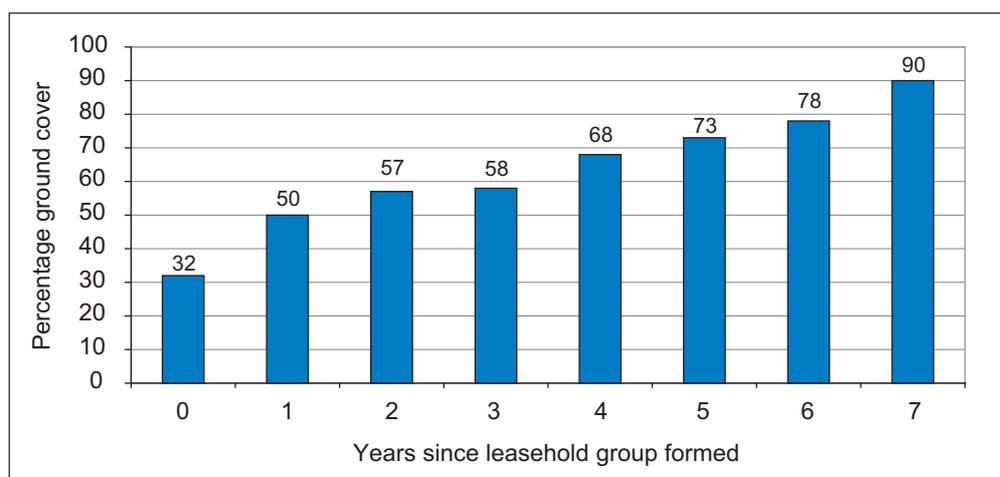


Figure 7: Increase of vegetative ground cover of leasehold forests

Source: Ohler, F. 2003. *The impact of leasehold forestry on livelihoods in Nepal*. XII World Forestry Congress, Quebec.

Villagers learned to pool their savings into microcredit groups that provide incentivized loans so the poorest members will have capital. The involvement of women in the programme has raised their status in the community, and the ability to earn a living and contribute to society has helped tear down gender and caste barriers. The number of household members earning cash income increased by 24 percent over a three-year period, while control households declined by 4 percent. Almost half the new cash earners are women.

Women are responsible for livestock management and fodder collection, which is very time-demanding and arduous. The time leasehold forestry women require to collect forest-based fodder decreased on average from 3.9 hours to 1.4 hours per day over five years, a difference of 2.5 hours

per day. The number of goats a leasehold forestry household owns increased from an average of 3.9 to 4.4 head over a three- to five-year period. Some of the poorest households did not own any livestock before they became leasehold forestry farmers, but the availability of fodder and access to credit has enabled them to keep and feed goats.

Community forestry in Nepal

Community forestry in Nepal emerged in the mid-1970s and led to the transfer of management responsibilities and rights to products for Forest User Groups (FUGs), with the objective of conserving and arresting degradation in hill forests. During the past three decades, the country's community forestry programme has evolved in terms of coverage and institutional innovation, supported by changes in policies and legislation that have empowered local communities. Substantial international support has also helped to sustain community participation. As of September 2007, a total of 1.2 million ha of forests had been handed over to approximately 14 500 FUGs. An important development has been the establishment of FECOFUN, which has become a powerful institution in helping FUGs to improve their efficacy, sustainability and equity. FECOFUN is one of the most effective community-based organizations in the APR and has been highly successful in articulating the needs of FUGs and influencing policy processes at various levels.

Source: FECOFUN (2009).

Case study 3: Corporate social responsibility and farm forestry: a smart partnership for a greener future and improved rural livelihoods

The idea that business has some social responsibility is not new, but CSR⁹ has drawn increased attention in the past decade, partially as a result of corporate scandals arising from a misalignment between industry's judgement regarding its responsibilities and the concomitant judgement of society. Another factor explaining increased attention to CSR is the advent of globalization, a phenomenon that connects global corporations with local communities across the globe, with notable social implications.

Societies conceptualize CSR differently depending on the socio-economic context. At one extreme are societies – usually with a high level of economic development and strong democratic traditions – that expect business to be a vehicle for sustainable development. At the other extreme are societies – usually less economically developed – that expect business to be a purely economic activity that provides jobs and fulfills other economic functions.

The legal requirements that business must meet can also differ a great deal from one society to another. Such differences in legal requirements may lead multinational companies to move their operations to locations with less stringent environmental and social regulations – a phenomenon known as “industrial flight” or “race to the bottom”. The World Business Council for Sustainable Development (2000) integrated aspects of the concept of sustainable development in its definition, “the continuing commitment by business to behave ethically and contribute to economic development while improving the quality of life of the workforce and their families as well as of the local community and society at large”. Since the post-Rio world has increasingly been converging around a sustainable development mandate, this definition has gained increasing recognition. Associating CSR with sustainable development has become so common that CSR reporting is often called ‘sustainability reporting’.

⁹ Panwar, R. & Hansen, E. 2008. Corporate social responsibility in forestry. *Unasylva*, 230 (59). Rome, FAO.

Of the 100 largest forest products companies in the world, 61 are reported by Pricewaterhouse Coopers (2007) to have produced sustainability reports, and the proportion is increasing. However, most of the social (health and safety) and environmental (air emissions) indicators that these companies use in their sustainability reports are already part of legislative requirements. As such, these reports do not show the companies to be making any extra legal commitments to help society and the environment.

In developing countries much attention has focused on the social and environmental aspects of forestry practices, but less information is readily available regarding the social and environmental performance of forest product manufacturers.

The wood product sector operates under more intense public scrutiny than other extraction-based industries because wood comes from forests and forests are commonly seen by the public as natural places that should be left relatively untouched by humans. Forest certification and ecolabelling are two important concepts to ensure that wood is sourced from sustainably managed forests. But CSR can go further. CSR practices should address sustainability issues important to community of *place* – issues that are best identified locally (see box on local governments in the Philippines) – and the concerns of the community of *interest* – issues of people interested or affected

Social benefit from investment in farm forestry in India

India is one of the world’s fastest-growing paper markets, and pulp and paper companies are engaging in partnerships with small farmers to grow fibre trees on unproductive and marginal land. The International Finance Corporation (IFC) has approved more than US\$120 million investment for India’s four leading pulp and paper companies; combined, these firms account for 60 percent of the nation’s farm forestry programmes and they adopt CSR to provide triple bottom line benefits including employment, improving the environmental capacity of the pulp and paper manufacturing industry, reducing wood shortages and enhancing economic sustainability.

Triple bottom line	Range of benefits from CSR
Social	<ul style="list-style-type: none"> • Over 150 000 part-time employees • Training farmers in forest technology • Corporate sponsorship of local health services and education • Infrastructure improvement
Environmental	<ul style="list-style-type: none"> • 100% increase in area reforested • Localized wood supply to reduce transport energy consumption and carbon emissions • Reduced impact on local biomass for fuel
Economic	<ul style="list-style-type: none"> • 25-50% increase in farmer income • Corporation can access international finance from banks that have signed on to the equator principles • Certification to standards provides a competitive advantage in markets • Improved supply, lower costs, lower risks and better community relations.

Source: Casey, L. & Chandler, M. 2008. *IFC forestry sector in India: farm forestry*. Washington DC, IFC.

by forestry but not necessarily located in the same geographic region¹⁰, such as carbon sequestration and other ecosystem services.

Voluntary and market-driven institutions also play roles in CSR in forestry. The FSC is a global certifier of sustainable social and environmental aspects for forest organizations, and holds a high profile as representing the most stringent standards for CSR. The Malaysian Timber Certification Council (MTCC), for example, developed the Malaysian Timber Certification Scheme based initially on International Tropical Timber Organization criteria and indicators. The scheme began in 2001 and aims to provide independent assessments of forest management practices and meet demand for certified timber products. Currently, the MTCC is collaborating with the European Union in combating illegal logging through the Forest Law Enforcement Governance and Trade Voluntary Partnership Agreement. In Indonesia, the Indonesian Ecolabelling Institute has developed criteria and indicators for sustainable forestry management to assess the performance of commercial as well as community-based forest management.

Increased green roles of local governments in the Philippines

Local government units and other stakeholders are increasingly warming to their roles and responsibilities in the shared management of forest lands as evidenced by modest investments in management of forest lands and recognition of the economic and sociocultural values of forests, and the ecosystem services they provide. Civil society and private organizations have become directly involved in forest management through agreements with the central government and local government units. They manage specific areas within forest lands as part of their corporate social responsibility or offer assistance towards reforestation, livelihood development and capacity building. Recognition of the multiple functions of forests such as climate change mitigation and biodiversity conservation attract private, non-government and international organizations to invest in protection and development of natural forests. Government-owned or controlled corporations are investing in ecosystem services in forest lands.

Source: **Panwar, R. & Hansen, E.** 2008. Corporate social responsibility in forestry. *Unasylva*, 230 (59). Rome, FAO.

Rigorous CSR requirements for mutual recognition among forest certification schemes

In Malaysia, uncontrolled logging became a concern in the early 1990s. In response the National Forestry Act was amended in 1993 to make licence holders and contractors jointly liable for illegal logging. Penalties were increased and police and armed forces were empowered to undertake surveillance of forestry activities. Illegal logging incidents in Peninsular Malaysia subsequently dropped dramatically. Logging in forest areas claimed by indigenous peoples continues to create conflicts, however, particularly in Sarawak. These claims are being addressed through the legal system but remain one of the obstacles to mutual recognition between the MTCC and FSC certification schemes. Three factors hinder further advances:

- The government is resistant to international calls for change, due to low levels of foreign debt and international aid;
- Extra-government influence within Malaysia is weak; and
- The government considers that it has 'got it right' on ethnic redistribution.

Source: **Yasmi, Y., Broadhead, J., Enters, T. & Genge, C.** 2010. *Forestry policies, legislation and institutions in Asia and the Pacific. Trends and emerging needs for 2020*. RAP Publication 2010/10. Bangkok, FAO.

¹⁰ **Dare, M., Schirmer, J. & Vanclay, F.** 2008. *A brief guide to community engagement in the Australian plantation sector*. Technical Report 181. Hobart, Cooperative Research Centre for Forestry,

LESSONS LEARNED

Experiences with ANR demonstrate success in engaging local communities by addressing some of their basic priorities, reducing the risk of forest fires and creating new income-generating opportunities. ANR also significantly reduces the costs of forest restoration, making it a particularly attractive alternative to costly plantation establishment.

Community forestry is a proven tool to increase livelihoods for community members, and to provide ecosystem services for the wider public. The most successful long-term approach has been for governments to transfer land-use rights to local communities.

Leasehold forestry clearly demonstrates its potential as a means for both poverty reduction and the rehabilitation of degraded forest land. Contrary to the community forestry instrument, leasehold forestry can be fine-tuned to specifically target the most resource-poor households within rural communities. It can be used to increase their resource base and thereby contribute to more sustainable livelihoods. Leasehold forestry could play a significant role in the green economy, particularly in mountainous parts of South and Southeast Asia, where poor households cause forest degradation. Long-term secure tenure leads to sustainable flow of forest products and services, directly benefiting the poorest households and the environment.

Societies interact with forests in different ways, thus it is important that CSR practices be based on input from local stakeholders rather than importing regulations from outside. To develop CSR programmes suited for local contexts, government and forest companies need to engage experts locally and sometimes from elsewhere to provide independent technical advice in forestry, business and social issues. CSR, in combination with sustainable forest management, has potential to enable companies to foster a better state of the world's forests and societies. Limited-scope concepts and weak standards can turn into public and private sector image-dressing rhetoric, undermining the promise that CSR holds for securing sustainability. A locally focused approach can help CSR become a legitimate tool for helping business define its role in society.

5 Energy

The energy sector in a green economy

Access to affordable and reliable forms of modern energy (electricity, gas, petroleum products and clean cooking facilities) is a necessary condition for economic development and a high standard of living.¹¹ Modern energy improves productivity by replacing manual labour with the use of boilers and motors; at the household level, it saves time devoted to collecting fuelwood and cooking, reduces health risks related to indoor air pollution and improves access to drinking water, sanitation and health care.¹² In the absence of modern energy, biomass for cooking and heating is often collected in an unsustainable manner and burned in inefficient cook-stoves, contributing to land degradation and emitting black carbon.¹³ Given these economic, social and environmental impacts, there is a strong argument that the energy sector within a green economy must first and foremost be concerned with achieving universal access to modern energy.

Energy access can be pursued using different types of natural resources and technologies. For example, rural households can be electrified via a connection to a coal- or gas-powered electricity grid; alternatively, electricity can be generated by off-grid solar photovoltaic (SPV) panels or decentralized microhydro plants (MHPs). The choice of resources and technologies used will have impacts on the quality of environment (such as the level of air pollution), the available stocks of natural resources such as forests and water, and the type of energy service provided to users.

It is generally agreed that the use of renewable energy technologies (RETs) and energy-efficient technologies (EETs) reduces pollution and consumption of natural resources. By reducing energy intensity, EETs can also help decouple energy supply from economic growth.¹⁴ Hence it can be argued that, within a green economy, the energy sector should promote the use of RETs and EETs.

The energy sector in the APR

Current situation

In 2009, fossil fuels – coal, oil and natural gas – comprised 81 percent of primary energy supply in the APR.¹⁵ Coal is the main source of energy in the electricity sector, and is popular due to its abundant availability and price competitiveness.¹⁶ Petroleum products are fuelling the transport sector and are often subsidized by governments to ensure supply for low-income consumers,¹⁷ despite the fact that this is an extremely inefficient means of assisting the poor.¹⁸

¹¹ ‘Clean cooking facilities’ are biogas systems, liquefied petroleum gas stoves and advanced (i.e. energy-efficient) biomass cook-stoves (IEA, 2011a, p. 12).

¹² Around 1.5 million people die every year from indoor air pollution produced by inefficient biomass stoves, most of whom are women and children (IEA, 2011a, p. 28; WHO, 2005).

¹³ Deforestation, forest degradation, floods, landslides, topsoil erosion and lowland productivity are the most visible manifestations of unsustainable biomass harvesting. Fuelwood collection accounts for 6 percent of annual global deforestation (UNFCCC, 2007).

¹⁴ ‘Energy intensity’ is a measure of the energy efficiency of an economy. It is calculated as units of energy per unit of GDP.

¹⁵ IEA, 2012b. Primary energy supply equates to energy production, minus exports, plus imports.

¹⁶ ADB, 2009, p.18.

¹⁷ ADB, 2009, p. xiv.

¹⁸ In 2010, only 6 percent of global subsidies on gasoline and diesel went to the poorest 20 percent of the population (IEA 2011b).

This reliance on fossil fuels has significant environmental consequences, with 10 030 million tonnes of carbon dioxide (CO₂) emissions released in 2009 from fuel combustion.¹⁹ It also results in lack of energy security for many countries due to dependence on oil imports. Between 2001 and 2011, the cost of imported crude oil in the region grew from US\$15 to US\$115 per barrel;²⁰ as a result, the combined oil import bill of India and oil-importing least-developed countries grew from US\$22 billion in 2000 to US\$100 billion in 2011.

In the context of energy access, certain countries in the APR have achieved remarkable improvement in recent years.²¹ Nonetheless, in 2009, almost 2 billion people in the region were dependent on the traditional use of biomass and almost 800 million had no access to electricity.²²

New and renewable energy (NRE) sources accounted for 15.7 percent of the region's energy supply in 2009.²³ However, 93 percent of this was biomass, primarily used in rural areas without access to modern energy. To date, market penetration of modern RETs has been slow due to their lack of cost-competitiveness and availability; furthermore, in rural areas and islands, dispersed habitations and fragmented markets often result in high transaction costs and low sales. Consequently, in 2009 RETs accounted for only 1.2 percent of electricity produced in the region. Introduction of EETs has also been restricted in most countries by government subsidies for electricity and fossil fuels and the lack of awareness of EETs among the industry and consumers.

Outlook to 2030

Over the next 20 years, the supply of energy and electricity in the APR is expected to grow by 2.3 percent and 4.2 percent *per annum* respectively. This supply will be driven by the region's strong economic growth, and will outpace the rest of the world (Table 17).

Table 17: Primary energy supply outlook for the APR, 2005 and 2030

Energy source	Share of primary energy supply, 2005 (%)	Share of primary energy supply, 2030 (%)	Forecasted growth <i>per annum</i> , 2005-2030 (%)
Coal	41.0	38.3	2.1
Oil	28.4	27.0	2.2
Natural gas	10.6	14.5	3.6
Nuclear power	3.7	7.1	5.1
Hydropower	1.7	2.0	3.0
NRE	14.7	11.2	1.3

Source: ADB. 2009. *Energy outlook for Asia and the Pacific*. Manila, ADB.

Coal and oil are expected to remain the dominant sources of energy, driven by the growth of power and transport sectors in China and India.²⁴ The consumption of natural gas will grow significantly because it is considered an environmentally friendly fuel and reduces oil import dependency; however, its uptake will be restricted by relatively high supply costs. Due to the ongoing dominance of coal and oil, CO₂ emissions in the region are expected to grow at 2.3 percent

¹⁹ IEA. 2012b.

²⁰ IEA. 2012a.

²¹ Over the last 35 years, Viet Nam's electrification rate has increased from below 5 percent to 98 percent. In India, rural electrification rates grew from 56 percent in 2006 to 67 percent in 2009 (IEA 2011a, p. 10).

²² UNDP. 2011c, p. 15.

²³ For statistical purposes, in this report NRE sources include biofuels, waste, solar energy, geothermal energy, wind power and ocean energy (but not hydropower).

²⁴ ADB. 2009, p. ix, 9, 22.

per year. Oil imports in the region are expected to double, driven by transport demand in China and India and slow growth in domestic oil production. Combined with the expected rise in the price of oil and a decrease in financing of oil and gas exploration since 2007, oil import dependency is likely to increasingly affect many economies in the region.

While global investment in energy access will increase over the next 20 years, it is expected that 376 million people in Asia will still be without electricity access in 2030. The number of people in the region without access to clean cooking facilities will drop only slightly from 1.9 billion to 1.7 billion.²⁵

NRE supply will experience more modest growth than other sources of energy (1.3 percent *per annum*). The growth of biomass use will slow down due to increased availability of commercial energy, while supply of wind, solar and geothermal energy will increase.²⁶ However, biomass will still account for over 80 percent of NRE consumed, and NRE's share in electricity generation is expected to remain small (an increase from 1.1 to 4.1 percent).

Most countries in the region will continue to improve their energy efficiency, although results will vary by country (Figure 8). As a result, the average energy intensity in the region is projected to decrease from 0.4 in 2005 to 0.3 in 2030.

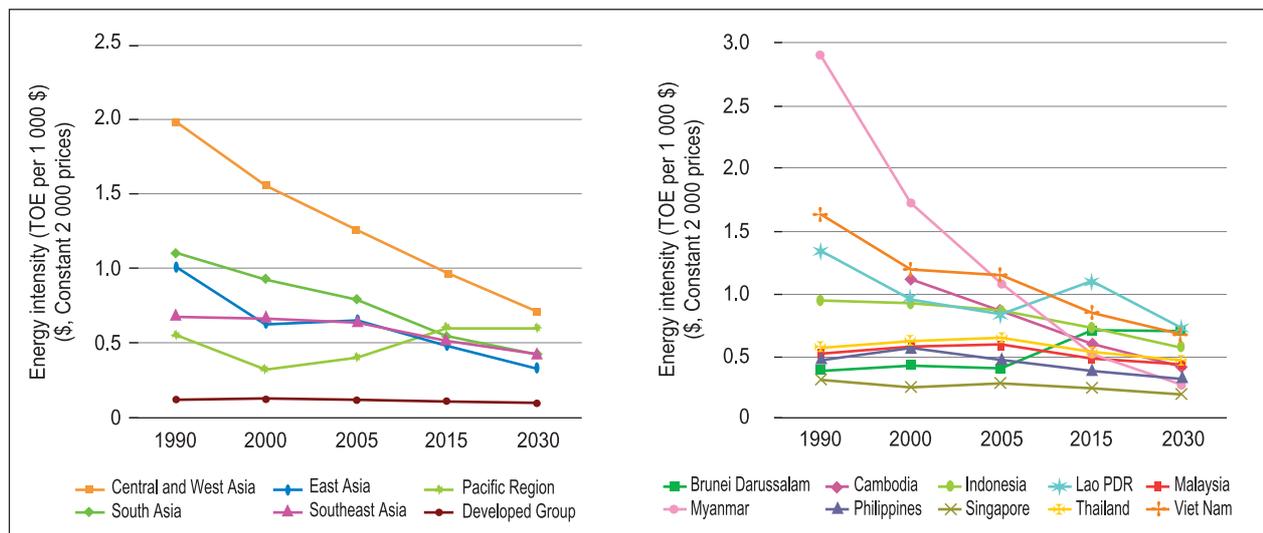


Figure 8: Regional and national energy intensity trends, 1990-2030

Source: ADB. 2009. *Energy outlook for Asia and the Pacific*. Manila, ADB.

Addressing key challenges within the green economy model

From the above analysis, it is clear that there are three major challenges for the energy sector in the APR:

- Achieving universal access to modern energy;
- Reducing CO₂ emissions and environmental degradation caused by consumption of fossil fuels and traditional biomass; and
- Improving national energy security by reducing dependence on oil imports.

²⁵ IEA. 2011a, p. 19-20.

²⁶ ADB. 2009, p. 9.

As shown below, pursuing the green economy objectives (improving energy access to modern energy and increased uptake of RETs and EETs) can provide solutions to these challenges.

Solutions to achieving universal energy access depend on national geographical features and available energy resources. To maintain and expand national electricity grids, most governments need to improve financing of national utilities.²⁷ Furthermore, the cost of extending the national grid to remote, sparsely populated or mountainous regions can be very high. In such cases, mini-grids and off-grid RETs (solar home systems, biogas plants, mini-hydro or wind power) can provide less-costly solutions:²⁸ if universal electricity access is to be achieved in Asia by 2030, it is envisaged that 63 percent of total generation will have to be delivered via such technologies.²⁹ Assistance from development partners can help with dissemination of these RETs given their generally high capital cost.³⁰

Overall, investment of over US\$300 billion above the forecasted level will be required to achieve universal energy access in Asia by 2030.³¹

Increased uptake of RETs and natural gas can decrease oil import dependency and thus improve national energy security. It can also improve the quality of the environment by reducing CO₂ emissions. As shown in the case studies below, donor-led projects can promote RET awareness, availability and cost-competitiveness. Construction of gas infrastructure, on the other hand, generally requires involvement of large private sector firms due to the vast amounts of investment and levels of technology required.³² National governments can encourage investment by providing a stable and coherent policy environment and necessary infrastructure such as roads.

Improving energy efficiency reduces energy consumption, and is thus another key option for enhancing energy security and reducing the environmental impact of the sector. For example, developing mass transit in suburban areas can reduce demand for passenger vehicles and curtail oil consumption.³³ Other government actions to encourage EET uptake include setting national and industry targets for reducing energy consumption, and providing financial incentives (grants, tax breaks and partial risk guarantee funds) for industries and consumers. Strong government commitment is important: for example, national policy initiatives in China have resulted in energy intensity being reduced by 19.1 percent between 2005 and 2010.³⁴ As shown in the case studies, energy projects can also reduce the high costs of EETs and lack of awareness through pilot applications, knowledge transfer and advocacy activities.

Currently, widespread domestic subsidies for electricity and fossil fuels reduce the incentives to invest in RETs and EETs. However, the rapid growth of international fossil fuel prices is prompting government reform in domestic energy pricing.³⁵ Removing such subsidies often requires strong political commitment, and the impact on the energy-poor needs to be taken into account. For example, the Indonesian Government has recently removed a number of fuel subsidies for power

²⁷ National utilities in the region generally lack financial resources to expand and upgrade infrastructure due to low tariff levels and tariff non-payments (ADB 2009, p. 49-50).

²⁸ Mini-grids operate at a village or district level, with loads of up to 500 kW (IEA 2011a, p. 16).

²⁹ GET FiT Plus. 2011, p. 62.

³⁰ ADB. 2009, p. 51.

³¹ IEA. 2011a, p. 21-24.

³² ADB. 2009, p. 53.

³³ ADB. 2009, p. xiv.

³⁴ China.org.cn, 2011.

³⁵ For example, in November 2011 the Asia-Pacific Economic Cooperation (APEC) countries committed to “rationalize and phase out inefficient fossil-fuel subsidies that encourage wasteful consumption, while recognizing the importance of providing those in need with essential energy services, and set up a voluntary reporting mechanism on progress”.

generation and gasoline, while retaining subsidies for diesel used in freight transport, household kerosene, and certain classes of electricity.³⁶

CASE STUDIES

This section documents four recent energy projects in Asia which sought to improve energy access by promoting the use of RETs and EETs (hence fitting the objectives of green economy). Identified good practices and lessons learned are used to draw recommendations for promoting green growth in the sector.

*Case study 1: Capacity building for the rapid commercialization of renewable energy*³⁷

China is one of the largest GHG emitters in the world, with coal accounting for over 80 percent of energy consumed. In response to climate change and a sustainable development agenda, the Government of China has recently adopted a series of policies to promote renewable energy (RE) and improve energy efficiency, including the Energy Conservation Law (2008) and the Recycling Economy Promotion Law (2008). However, widespread RE adoption is still hindered by the lack of technical capacity in the private and public sectors, lack of standards and testing facilities for RE equipment, and high initial and operational costs for small-scale RE systems in remote areas.

The Capacity Building for the Rapid Commercialization of Renewable Energy (CRE) Project sought to promote widespread adoption of RETs in China by removing the above barriers. Implemented between 1999 and 2008, the project focused on five promising RETs: hybrid village power systems (wind-SPV-diesel and wind-diesel); solar water heating; large-scale grid-connected wind power; industrial-scale biogas; and bagasse co-generation. Project activities focused on policy change, capacity development and implementation of pilot projects. With US\$25.8 million in funding from the Global Environment Facility (GEF) and the governments of China, Australia and the Netherlands, the project was implemented by the former State Economic and Trade Commission and the State Environment Protection Agency, with assistance from UNDP.

In terms of policy change, the project provided technical advice and advocacy to the passing of the Renewable Energy Law 2005, which supports RE development in rural areas (including off-grid renewable power generation). The project also assisted the government with preparation of the Biogas National Action Plan 2007 (which adopted a market-based approach to dissemination of biogas technology) and developed national standards for wind power concessions. The project also developed and implemented Golden Sun, a national certification programme for the solar water heater sector, and formulated standardized power-purchase agreements between biogas producers and utilities.

In terms of capacity building, 20 pilot projects provided government officials and RET suppliers with first-hand experience of market-based RET adoption, by using co-financing and cost-sharing mechanisms. CRE also established the Chinese Renewable Energy Industries Association, which now has over 200 RE-industry and 40 expert members. Training, study tours and workshops on RET awareness were also held, targeting bioengineering companies, wind energy companies and local communities (with almost 3 000 people benefiting). CRE also introduced advanced technology in wind assessment, biogas and bagasse generation, and established four national solar water heater centres.

³⁶ ADB. 2009, p. 234. More information on recent developments in energy subsidies can be obtained at IEA 2012c.

³⁷ UNDP. 2011a.

In terms of on-the-ground impacts, new government targets and activities to accelerate RE scale up were introduced following the passing of the Renewable Energy Law 2005. China is now the leading developer and supplier of solar water heaters, and one of the fastest growing markets for SPV and wind technologies. Notable national achievements since CRE commencement include:

- 2.6 GW of wind power generation capacity was developed by the end of 2006;
- 120 million m² of solar water heaters were produced by the end of 2007;
- Installed SPV capacity grew from 70 MW in 2005 to 140 MW in 2008, including 48 MW of off-grid SPV systems (mainly for rural electrification); and
- Between 2001 and 2005, 268 small hydraulic power stations and 721 SPV and wind/SPV power stations were built, benefiting 300 000 households and 1.3 million people.

LESSONS LEARNED

The project showed that a competent RE industry body (such as the Chinese Renewable Energy Industries Association) is important in market development and obtaining government support. Close consultation between regulatory authorities and the business sector also proved important in the development of RET standards and certification systems. Working with the highest-level ministries and leading private sector enterprises ensured government commitment to the project, while helping to establish continuity and commercialization of new RETs. By adapting to the re-organization of the project implementing agency (former State Economic and Trade Commission) in 2003, the project showed the importance of flexible project management and implementation arrangements.

Case study 2: Malaysian Building-Integrated Photovoltaic Project³⁸

SPV technology is one of the fastest-growing RETs on the world market. It also has the added benefit of being environmentally friendly. However, it is still a relatively high-cost source of energy, and suffers from lack of public awareness. The main barrier to increased use of SPV technologies in many countries (including Malaysia) is the subsidized price of fossil fuels.

The Malaysian Building-Integrated Photovoltaic Project (2005-2011) sought to increase awareness and reduce the cost of building-integrated photovoltaic (BIPV) technology in Malaysia, hence establishing a sustainable national BIPV market. The project's overall goal was to reduce the growth rate of GHG emissions from fossil fuel-fired power generators through widespread adoption of BIPV technology. With funding of US\$25 million from the GEF, the Government of Malaysia and the private sector, the project was jointly implemented by the Ministry of Energy, Green Technology and Water and UNDP.

The project achieved significant regulatory and policy change in promoting and reducing the cost of SPV technology. This included establishing a national feed-in-tariff scheme for SPV-generated electricity; waiving import duties and sales tax for SPV technology; incorporating targets for SPV deployment into the 10th Malaysia Plan (2011-2015); and establishing a national Sustainable Energy Development Authority (SEDA), dedicated to the development of the RE sector.

The project enhanced the technical capacity of the industry by devising a national standard for BIPV installation; training and certifying equipment manufacturers and service providers; and establishing national BIPV monitoring and testing centres. It increased the awareness of the costs and benefits of BIPV technology through a BIPV Web site, a national BIPV awareness campaign and well-publicized BIPV demonstration projects (using different types of buildings).

³⁸ This information is sourced from GoM, UNDP, GEF 2011 and UNDP, GEF 2004.

By 2011, the project's on-the-ground impacts on the BIPV industry included:

- 29 trained and certified BIPV service providers operating nationwide, implementing up to 50 BIPV projects per year;
- 2 054 kilowatt-peak of BIPV technology established (439 percent growth from the 2004 baseline), with end-users generally expressing great satisfaction with BIPV systems;
- Consequent reductions in GHG emissions of 1 400 tonnes per year;
- BIPV technology cost reduction to US\$6 374 per kilowatt-peak (39 percent), making it more affordable to end-users; and
- US\$4 billion of foreign direct investment and 5 000 jobs established in the SPV sector from 2004 to 2011.

LESSONS LEARNED

Project success was largely due to the competence, dedication and skills of the project team. The skills of the project team should be transferred to ongoing activities if possible. The project team is expected to form the nucleus of the new SEDA, ensuring a smooth transition from project level to national sustainable action.

Cooperation of the national government in receiving and accepting recommendations was important in achieving project targets. Furthermore, achieving regulatory and policy support was essential in ensuring the sustainability of project activities.

Prior to the project, local production and demand for SPV systems were slow, primarily due to the industry's lack of confidence in the local market and its future development. Increasing interest is expected with new laws, policies and incentives in place, ensuring the sustainability of the industry.

Case study 3: Rural Energy Development Programme, Nepal³⁹

In rural Nepal, only 29 percent of households have electricity, and 98 percent of consumed energy comes from the traditional use of biomass. This has negative impacts on health, the environment and time availability, particularly for women.⁴⁰ Barriers to rural electrification and adoption of RETs include widespread poverty, geographic inaccessibility and lack of technical staff to design, install and operate energy equipment. While Nepal's economically-viable hydropower resources are estimated at 42 000 MW, only 1 percent of this potential has been developed to date.

To address this situation, the Rural Energy Development Programme (REDP) promoted installation of community-managed MHPs, solar home systems, toilet-attached biogas plants and improved cook-stoves in Nepal's remote rural communities. The programme was implemented between 1996 and 2011, with funding of over US\$35 million from the World Bank, UNDP, the Government of Nepal and local communities.

REDP's key element was mobilization of Micro-Hydro Functional Groups (MHFGs), village-level organizations responsible for MHP management. A Community Energy Fund was established by each MHFG to manage REDP donor grants and government subsidies for construction of MHPs. MHFGs then selected prequalified private sector manufacturers and suppliers to provide MHP equipment, installation, repair and maintenance. District Energy and Environment Sections (DEESs,

³⁹ UNDP. 2011b.

⁴⁰ Surveys in Nepal show that women devote three to four hours each day on fuel collection. Women are also disproportionately exposed to health risks associated with biomass use, including respiratory and eye ailments from indoor air pollution and the physical impacts of carrying heavy loads.

REDP's partners at the district level) were responsible for the technical soundness of the MHP, including feasibility surveys, supervising installation and verifying power output. MHFGs were trained in operation and management of MHPs; once an MHP had been running successfully for six months, MHFG were usually registered with the local government as a micro-hydro cooperative.

Overall, REDP operated in 45 districts and delivered 307 community-managed MHPs (5.5 MW), 3 099 solar home systems, 6 811 toilet-attached biogas plants and 14 255 improved cook-stoves. A total of 550 000 people benefited from the programme, including 42 828 electrified households. The benefits of delivered energy include home lighting, power for household items (refrigerators, televisions, etc.), energy for cooking and more-efficient, less-polluting cooking facilities. Time spent on fuelwood collection and agroprocessing was reduced by an average of three hours per day. Simultaneously, participation of men in household chores such as cleaning, agroprocessing and cooking increased, reflecting changing gender relations within households.

REDP also promoted productive uses of energy by encouraging MHFGs to establish Enterprise Development Funds, by making an initial contribution of NPR10 000 per kilowatt.⁴¹ These funds provided loans for enterprise development to needy villagers on convenient terms.⁴² REDP also conducted community-level training in income-generating activities. Consequently, 264 microenterprises were established in programme areas, including 129 agroprocessing mills. Women entrepreneurs own 108 of these enterprises (41 percent).

On the policy level, REDP assisted the Alternative Energy Promotion Centre with formulation and implementation of the Rural Energy Policy 2006; the policy was developed in light of REDP good practices and lessons learned. Furthermore, in 2010 the government adopted the Enterprise Development Fund modality for non-REDP projects. REDP also facilitated the establishment of DEESs in 45 districts, which have since been endorsed by the national government as district-level entities for implementing its energy and environmental policies.

LESSONS LEARNED

REDP shows that successful piloting facilitates government commitment to rural electrification, as envisaged in the passing of the Rural Energy Policy. REDP's successful mobilization of communities in managing funds and operating MHPs also improved the sustainability of programme activities. REDP's proactive dissemination of programme information also proved important to its success.

Case study 4: Promoting energy conservation in small- and medium-scale enterprises in Viet Nam⁴³

Viet Nam's SME sector consumes a significant proportion of national energy resources. Prior to 2006, most equipment used in the sector was energy-inefficient (including traditional brick kilns), resulting in energy accounting for 35 to 50 percent of total operating cost and significant GHG emissions. The domestic cost of electricity is increasing due to rising global prices of fossil fuels, threatening the competitiveness of the sector.

Implemented from 2006 to 2011 by the Ministry of Science and Technology with assistance from UNDP, the Promoting Energy Conservation in Small- and Medium-Scale Enterprises Project sought to reduce the annual growth of GHG emissions in Viet Nam's SME sector through adoption of EETs and energy-efficient practices. With funding of US\$42.5 million (primarily from Vietnamese

⁴¹ Approximately US\$126, as of January 2011 (www.xe.com).

⁴² REDP's motto 'one household, one enterprise' promoted the goal of having every household covered by the programme earn an additional monthly income of at least NPR25, allowing it to pay its monthly electricity tariff.

⁴³ UNDP, MoST 2011.

counterparts and the GEF), the project targeted five sectors – brick-making, ceramics, food processing, textiles, and pulp and paper – and promoted EETs such as vertical shaft brick kilns, LPG kilns and efficient boilers.

Project activities covered all players in the energy sector – policy-makers, energy-efficient service providers (EESPs), SMEs, financial institutions, EET producers and the general public. Key project activities included:

- Conducting 12 demonstration projects to create awareness among SMEs on potential energy savings and emission reductions;
- Training of government policy officers on economic and environmental benefits of EETs, and on development of energy efficiency policies;
- Information dissemination and advocacy activities on benefits of EETs, aimed at SMEs and the public;
- ‘Training of trainers’ – teachers from universities trained in EET management and operation, and subsequently training SME managers;
- EESPs trained in energy audits, feasibility studies, financial analysis, contracts and operating as a profitable energy consulting businesses;
- Training local equipment manufacturers on equipment design and production; and
- Credit officers from Vietinbank and Viet Nam Environmental Protection Fund educated on the risks, benefits and evaluation of EET projects.

In terms of policy achievements, the project facilitated the approval of the national Law on Energy Efficiency and Conservation 2010, as well as related decrees and circulars. Furthermore, numerous incentive policies for supporting EET investment in SMEs (labelling, grant provision for energy conservation projects, technology transfer, etc.) were approved by the national government and incorporated into the National SME Development Programme.

To help improve industry’s capacity, the Viet Nam Energy Conservation and Energy Association was established, encompassing EESPs and 600 SME members. It serves as a focal point for EET dissemination, training and advice. In addition, a loan guarantee fund was established by the Government of Viet Nam, Vietinbank and UNDP, with US\$1.7 million used to support 50 EET projects, supplementing SME investment of US\$24 million. Due to its success, the Government of Viet Nam agreed to finance and administer the fund after project completion.

In terms of on-the-ground impacts, 543 EET investment projects were completed during the project, 121 of which were replication projects without any financial or technical assistance from the project. The majority of the projects involved introduction of EETs in brick-making and ceramics SMEs. The consequent CO₂ emission reductions were an estimated 837 kilotonnes, with cumulative energy savings of 205.8 kilotonnes of oil equivalent. An average reduction of 24 percent in energy cost per unit of production was achieved.

LESSONS LEARNED

- High-quality project design was essential to project success. Funding of over US\$300 000 was used to establish an accurate baseline, identify and engage key stakeholders, and set realistic project objectives and achievable outcomes;
- Capacity-building must cover all players in the energy sector (government, SMEs, manufacturers, banks, energy specialists, universities);

- Successful demonstration projects are essential in gaining necessary attention from relevant stakeholders. By demonstrating increased productivity and improvement of product quality, the project was able to generate interest from SMEs and subsequently exceeded its replication targets;
- Awareness-raising programmes must include simple messages strategically disseminated to target groups; and
- ‘Good projects will attract money’ – by demonstrating improved productivity and the profitability of EET investments, the project ensured funding for EETs after its completion.

Summary of findings and the way forward for energy

Given the three pillars of green economy (economic growth and poverty reduction; social equity; and environmental sustainability), the energy sector within a green economy should pursue universal access to modern energy. It should also promote the use of RETs and energy-EETs, providing that this does not compromise energy access.

This strategy is consistent with addressing key challenges of the energy sector in the APR, namely the widespread lack of energy access, reducing CO₂ emissions and environmental degradation caused by consumption of fossil fuels and traditional biomass; and reducing dependence on oil imports. It is also consistent with the objectives of the UN Secretary General’s recent Global Initiative ‘Sustainable Energy for All’:

- Universal access to modern energy services by 2030;
- Doubling the rate of improvement in energy efficiency by 2030; and
- Doubling the share of renewable energy in the global energy mix by 2030.⁴⁴

The case studies above illustrate successful approaches to improving energy access by promoting the use of RETs and EETs. However, while the development plans of governments in the APR regularly contain aspirations to universal energy access, the issue is dealt with in a piecemeal manner and remains a problem. Furthermore, programmes and projects that combine energy access with measures that generate cash incomes and hence have greater impact on poverty reduction (the ‘Energy Plus’ approach) remain few in number.⁴⁵

The global initiative ‘Sustainable Energy for All’ is an opportunity for countries in the region to address this lack of national coordination and low levels of activity. Specifically, by developing national action plans and committing to concrete targets on energy access, energy efficiency and the use of renewable energy, countries can obtain additional project funding. The initiative therefore presents an opportunity to steer the region towards the green economy model.

⁴⁴ Sustainable Energy for All, 2012.

⁴⁵ UNDP 2011c, p. 40-42.

6 Water

Key challenges and issues

The APR has the largest land area in the world and with it comes an impressive endowment of renewable freshwater resources at 21 135 billion m³. Although absolute natural endowment is high, the region's natural water resources support about 60 percent of the world's population with 38 percent of the world's water resources. With this uneven distribution between supply and demand, the APR faces uncertainties in water, an essential resource for inclusive and sustainable development.

There are many challenges to water resources in the APR. High water utilization, water pollution, water-related natural disasters and the impact of urbanization and extreme weather patterns, as well as poor household access to water and sanitation paint a complex and worrisome picture. Access to clean water for domestic use, drinking, cooking and personal hygiene as well as access to basic yet more effective sanitation is essential to maintain a healthy population and environmental sustainability. Ensuring access to safe water and sanitation catalyses many aspects of human development. This message is clearly articulated through the United Nations MDGs, which target reduction by half of the proportion of people without sustainable access to safe drinking water and basic sanitation. The United Nations General Assembly declared in July 2010 that access to safe and potable drinking water as well as sanitation is a 'human right essential to the enjoyment of life and all other human rights.' Water plays a key role in achieving all the MDGs, including hunger reduction, universal education, empowerment of women, improved health, environmental sustainability and advancing partnerships for development. However, clean water has become scarce and the poor continue to suffer first and foremost from water pollution, water shortages and the lack of adequate sanitation.

The economic, health and other costs of environmental degradation are high. The cost of air and water pollution in Jakarta probably exceeds US\$1 billion a year, while in Bangkok it is more than US\$2 billion.⁴⁶ In March 2005 officials in Beijing noted that 70 percent of China's rivers and lakes were polluted.⁴⁷ Environmental experts fear pollution from untreated agricultural and industrial waste could turn the Yangtze into a 'dead river' within five years. A 2006 desk review study, found that more than 60 percent of lakes in Malaysia suffer from eutrophication. Water pollution in Asian cities is largely caused by domestic sewage but is compounded by industrial wastes. Contamination of available water is also a major health threat. Comprehensive water resource management will be one of the most difficult issues in Asia in coming years. Such an approach must encompass all demands – industrial and agricultural as well as urban – on water resources. The health and welfare impacts of urban water pollution have to be tackled on two fronts: provision of safe water supply and reduction of effluents. Public and private sectors together with community participation are needed to solve this problem using a collaborative approach.

As Asia urbanizes, pollution problems grow even more urgent. The United Nations Department of Economic and Social Affairs estimated that more than 50 percent of the population in the APR will be concentrated in urban areas by 2025. Rapid urbanization and mushrooming slums are putting additional pressure on the capacity of cities to meet the unprecedented demand for water resources

⁴⁶ **Brandon, C. & Ramankutty, R.** 1994. As Asia urbanizes, pollution problems grow ever more urgent. *The New York Times*. <<http://www.nytimes.com/1994/01/04/opinion/04iht-edbrand.html?pagewanted=print>> Accessed on 22 August 2011.

⁴⁷ **Lim, L.** 2005. China warns of water pollution. *BBC News Asia Pacific*. <<http://news.bbc.co.uk/2/hi/asia-pacific/4374383.stm>> Accessed on 22 August 2011.

and wastewater facilities. Pollution of waterbodies becomes more pronounced with the migration of people to urban areas. This has created physical scarcity and has increased the challenge of allocating water among increasing and competing economic activities. Agriculture is by far the main consumer of water in the region, but as countries have urbanized, demand for commercial and industrial use has increased steadily.

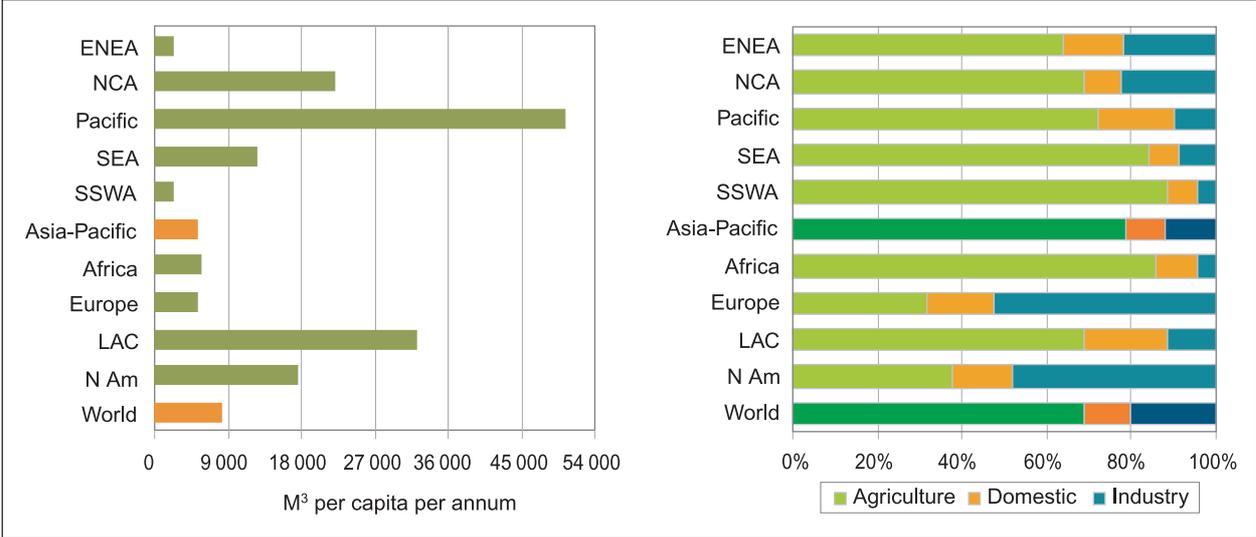


Figure 9: Availability of water resources per capita, and water use by sector

Source: ESCAP, 2010. *Statistical yearbook for Asia and the Pacific 2009*. Bangkok.

As an increasing proportion of water is allocated to the industrial and domestic sectors, and the net global amount of water remains the same, there will be a proportional net reduction in water use for agriculture. Yet the relative and absolute increase in the urban population means that more food will need to be produced by fewer people in the agriculture sector, and with less water. Besides these changes in the demand pattern for water use in the APR, the absolute demand for water is expected to soar in the next 15 years, leading to severe stress on major river and groundwater systems and rising tensions between users and countries over scarce resources. Water scarcity thus affects all social and economic sectors. Currently around 1 444 km³ of freshwater is withdrawn annually for human use in Asia, which is equivalent to about 500 m³ per person per year. This represents 20 percent of the renewable freshwater resources (as opposed to 9 percent globally). Agriculture is the major user of water with 81 percent of water withdrawal occurring in Asia. The lack of equitable access to water and related services is a salient feature of most of the regional water problems.

In overall economic terms, the scope for managing demand for agricultural water use will need to focus on seeking gains in water-use efficiency and agricultural productivity along the value chain from farm to market. This involves generating water-use efficiencies and productivity increases with farm water management, irrigation system performance, improved governance and adjustments of national water and irrigation policies. Beyond the national systemic response to water scarcity, the possible role of international trade to offset global water scarcity can also be taken into account. Demand for food and animal feed crops will have to double in the next 50 years to feed the extra 1.5 billion people who will live in the region by 2050. Over 700 million in the region still live on less than US\$1/day and half the population of the APR will still be rural in 2030. Farming will continue to provide livelihoods and food security for many people.

Poverty alleviation will remain a key objective in future developments in agricultural water management. However, future allocation to the sector will become increasingly difficult as the relative weight of the agriculture sector decreases in the overall economy.

The predictions of increasing future water withdrawals will place further pressure on water resources. Accordingly, many river basins will be under severe stress, complicated by strong competition for scarce water resources among households, industry and agriculture. The lack of adequate institutional and legal instruments for water sharing will lead to inequitable water allocation.

Water scarcity induces competition for water between users, among and between local communities, economic sectors and countries sharing a common resource – often generating conflict. But water scarcity is not the only indication for the lack of ‘water security’. Water security is an increasingly important development issue in the region, where increased populations and rapid urbanization have expanded demand and competition, driving changes in allocation of water resources. Many define water security as the “protection, sustainable use and development of global/national water resources so as to make possible socio-economic development, protect against extreme hydro-meteorological events and water-borne diseases and continuously provide water functions and services for society and the environment.” And “Water Security must be achieved without compromising the sustainability of vital ecosystems in all parts of the hydrologic cycle, and must meet the basic food, energy and other needs essential for human well-being in an equitable and reasonable manner. This concept operates at all levels from local to global and must be based upon an equitable sharing and conflict-preventive management of water resources through legal regimes that are transparent, mutually beneficial and enforceable”.

Besides the issues of supply and demand for agricultural, industrial and domestic needs, there is also the question of security from climate change impacts and/or climate variability, water pollution and water-borne diseases. Water hazards from extreme events such as cyclones, floods and droughts have been reported to have increased in intensity and occurrence in the APR due to global warming from emission of GHGs. These observed changes in climatic conditions are linked to changes in the large-scale hydrological cycle such as: increasing atmospheric water vapour content; changing precipitation patterns, intensity and extremes; reduced snow cover and widespread melting of ice; and changes in soil moisture and runoff. These changes have steadily increased hydrological extremes in the APR. Changes in weather patterns influence precipitation, temperature, and potential evapotranspiration, as well as the occurrence and severity of droughts. Extreme weather events cause changes in the water balance, changes in snow cover and melting glaciers as well as sea-level rise, impacting not only water supply for the various services but also other agricultural production factors of crops and soil. Floods and storms bring loss of life and huge economic costs. The total damage and losses from the 2011 floods in Thailand amounted to US\$46.5 billion, with losses accounting for 56 percent of the total.

An analysis of the water challenges in the APR by ESCAP, using available information from the World Bank, has identified hot spots, areas facing multiple water-related challenges in terms of access, depletion, pollution and disaster in the region (Figure 10).

Water security has been increasingly recognized as a crucial factor for sustainable development in many international fora at regional and global levels. The theme for the First Asia-Pacific Water Summit in Beppu, Japan in 2007 was ‘Water Security – Leadership and Commitment’. The Second Asia-Pacific Water Summit, held in Chiang Mai, Thailand in May 2013 also had a similar theme. The 2011 World Economic Forum in Davos launched its water initiative entitled ‘Water Security: Water-Food-Energy-Climate Nexus’ to promote more effective international cooperation on the development of a new economic fact base on water. The 2010 ADB and Partners Conference ‘Water: Crisis and Choices’ aimed to ensure momentum and continuity of water and sanitation developments in the APR up to and beyond 2015. These regional and global initiatives need to be supported by similar initiatives and a framework for action at the regional, subregional and national as well as subnational levels.

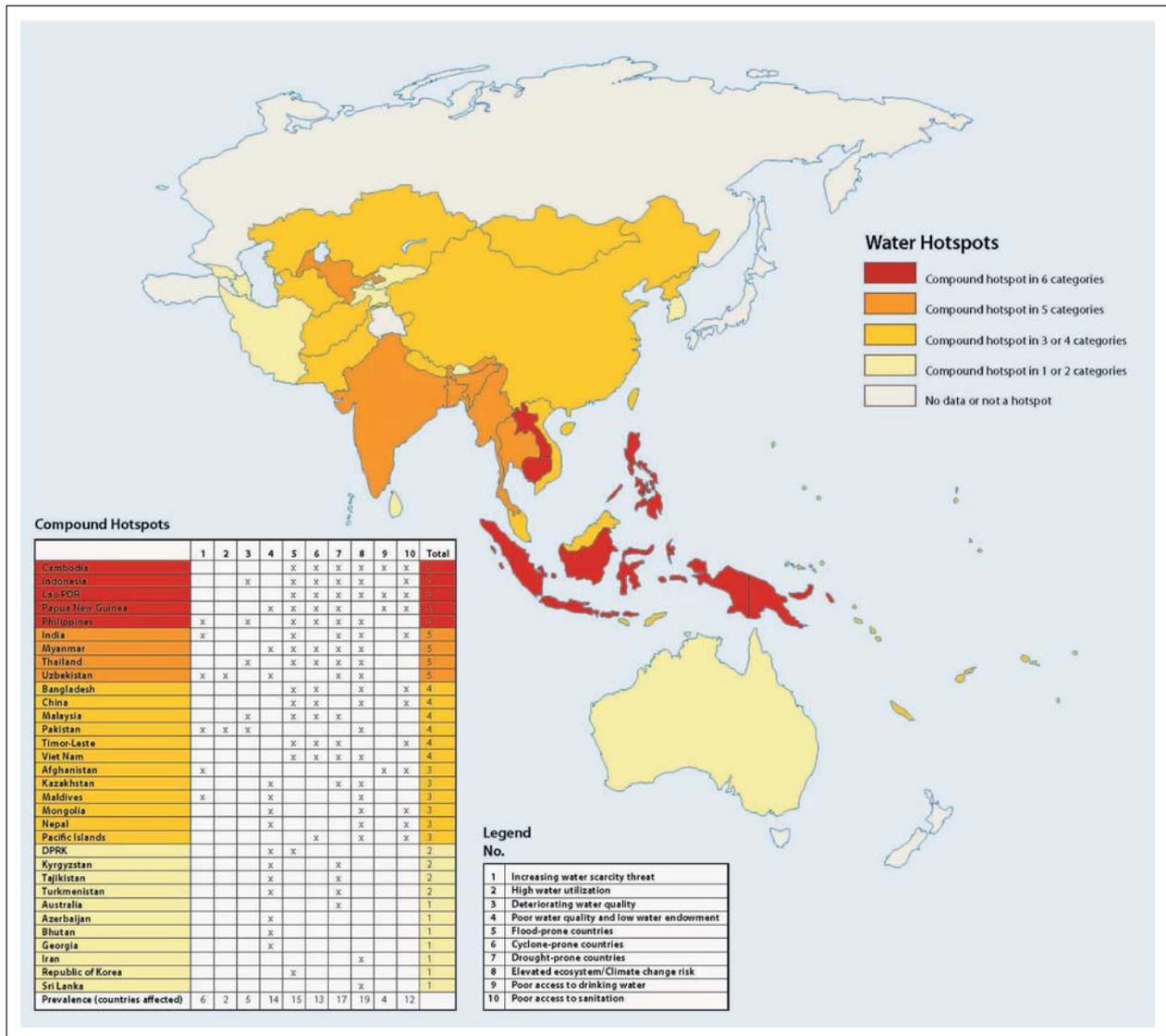


Figure 10: APR water hotspots

Source: **World Water Assessment Programme**. 2012. *The United Nations world water development report: managing water under uncertainty and risk*. Paris.

At the First Asia-Pacific Water Summit, FAO and the International Water Management Institute (IWMI) launched a regional initiative for ‘Revitalizing Irrigation and Agricultural Water Governance in Asia to Meet Millennium Development Goals’. The 2009 IWMI-FAO-ADB study on Revitalizing Asia’s Irrigation identified five key strategies which are increasingly resonating in the region:

- Modernize yesteryear’s schemes for tomorrow’s needs;
- Go with the flow by supporting farmers’ initiatives;
- Look beyond conventional approaches for transfer to participatory irrigation management;
- Boost knowledge through training; and
- Invest outside the irrigation sector.

Responding to similar challenges, ESCAP, through its Energy Security and Water Resources Section, is promoting regional cooperation to strengthen regional capacity on energy and water resource management. This aims to facilitate the move towards inclusive sustainable socio-economic development and to improve efficiency of resource management towards green growth and inclusive and sustainable development.

FAO and ESCAP have developed a strong cooperation in the region in the areas of water security and strategic planning and management of water resources. They are developing a framework for action for the role of water in green growth in support of economic, food and water security. This was presented at the 6th World Water Forum and was further discussed and developed at the 2nd Asia-Pacific Water Summit. Other UN agencies such as UN Habitat, UNEP and UNDP are also actively participating in the water sectors of the APR.

Regional progress

Agenda 21, developed at the 1992 United Nations Conferences on Environment and Development, recognized the need for establishing an integrated approach to water management to achieve sustainable development and access to water. This was reinforced in 1992, at the World Summit on Sustainable Development in Johannesburg. Since 1992, there has been significant progress across the APR in improved access to water and the development of sustainable integrated water management policies, legal frameworks, strategies and plans. This is of key importance in the region due to rapidly increasing populations and growing water scarcity.

Significant progress has been made in improving the enabling environment for Integrated Water Resource Management (IWRM) across the region. Many countries have begun developing IWRM frameworks, however continued efforts are required for translating these policies into implementation. Singapore has demonstrated extremely successful adoption of IWRM. In 2001 the government consolidated all water management activities into one agency, the Public Utilities Board, to avoid a sectoral approach to water management. The Board has implemented the 'Four National Taps' programme, which has significantly increased water security and reduced the environmental impact of the country's water needs.⁴⁸ Given the increasingly challenging water situation across the region, continued efforts towards developing and implementing IWRM should remain a high priority.

A key development for regional IWRM within the APR has been the establishment of committees and bodies to promote effective coordination and transboundary collaboration on water issues, such as the Asia-Pacific Water Forum (APWF) and the Mekong River Commission. ESCAP and FAO play key roles in the APWF, with ESCAP responsible for the overall monitoring of investment and results across the region and FAO acting as a lead organization for water for development and ecosystems. With increasingly scarce water resources and competition between users, sustainable transboundary water management is of key importance in reducing conflict in the region. Currently one of the largest challenges in the region's socio-economic development is balancing the many different water users, and managing their environmental, economic and social impact.

Across the region there have been achievements in Integrated River Basin Management (IRBM), with stakeholder groups working together to address water needs and issues. Thailand's National Water Resources Council has encouraged collaboration towards IRBM, leading to the establishment of 29 river basin committees, each focusing on a manageable section of the river basin, with stakeholders from the community as well as the private and public sectors. Increasing stakeholder engagement allows all parties a voice, working towards a fair and open dialogue on water use. IRBM is a critical issue across the region, due to the number of different users and countries dependent on rivers such as the Mekong.

The region has recently experienced a shift in focus from supply management to demand management, with the intention of increasing water efficiency and reducing consumption. Both

⁴⁸ Loh, J. 2009. *Water management: Learning from Singapore's water success*. Retrieved on 24 April 2012 from <http://workingwithwater.filtsep.com/view/934/water-management-learning-from-singapore-s-water-success/>

Bangkok and Manila, through a series of leak detection activities were able to significantly lower unaccounted for water losses, and were able to delay the construction of new water supply assets.⁴⁹ Malaysia has benefited from reducing unaccounted for water loss, utilizing an incentivized public-private partnership, to assist in detecting and fixing leaks⁵⁰ while Singapore has reduced per capita consumption from 176 litres per person in 1994, to 157 litres per person in 2007, through targeted demand management.⁵¹

Of the world's regions, the APR is the most vulnerable to natural disasters. Many countries across the region are affected by flooding and drought, with climate change predicted to increase the frequency of water-related disasters. Countries are working to increase resilience. For example in China, the Yangtze river floodplain restoration project has restored over 13 billion m³ of flood capacity, which will prove crucial in holding back floodwaters and protecting relocated communities.⁵² Improving resilience is an increasing priority for many countries, as water-related disasters can cause widespread destruction and death, with drastic social, environmental and economic consequences.

There have been some achievements across the region in improving water management for sustainable food production, with this area requiring increasing focus due to rising energy and food prices and growing populations. In Fiji, with the help of a local NGO, over 200 communities have developed and implemented a new fisheries management strategy, including establishing restricted areas and banning destructive fishing techniques leading to increased food security and sustainability.⁵³ The Lake Chilika ecosystem restoration project in India resulted in the return of several fish species including pike perch⁵⁴ and the tank restoration project in Andhra Pradesh means that water is now available to irrigate an additional 900 ha of farmland.⁵⁵ The energy-food-water nexus is becoming increasingly important and will likely be a key area for future development.

Agenda 21 recognized the need to involve all stakeholders, particularly women in the management of water. The Centre for Environmental and Geographic Information Services in Bangladesh has made significant progress in water-related disaster preparedness education, focusing on involving women and tailoring communication to suit community needs. Improved access to clean water has also been facilitated in Pakistan, through support of a women's cooperative that installed water pumps in the village, reducing time spent collecting water and improving water quality. This project has not only led to improved water access in the community, but also greater empowerment of women and an awareness of the ability of communities to work together towards sustainable development.⁵⁶

Years of rapid development across the region have led to the overuse and pollution of many waterbodies. In recent times, as awareness of the importance of sustainable water supplies has increased, there have been various ecosystem protection and rehabilitation projects. Several countries

⁴⁹ **Molle, F.D.V.** 2009. *Managing competition for water and the pressure on ecosystems*. World Water Assessment Programme, World Water Development Report 3: Water in a Changing World. Paris/London, UNESCO/Earthscan.

⁵⁰ **World Water Assessment Programme.** 2009. *Water in a changing world*. The United Nations World Water Development Report 3. Paris & London, UNESCO & Earthscan.

⁵¹ **Kiang, T.T.** No date. *Singapore's experience in water demand management*. Retrieved 24 April 2012, from http://www.iwra.org/congress/2008/resource/authors/abs461_article.pdf

⁵² **Pittock, J.X.M.** 2010. *Controlling Yangtze river floods: a new approach*. World Resources Report Case Study. Retrieved from <http://www.worldresourcesreport.org>

⁵³ **Climate Institute.** 2008. Fiji locally managed marine areas. Retrieved 24 April 2012, from http://www.climate.org/climatelab/Fiji_Locally_Managed_Marine_Areas

⁵⁴ **UNEP.** 2009. *The critical connection*. New York.

⁵⁵ **WWF.** 2008. *Water for life: lessons for climate change adaptation for better management of rivers for people and nature*.

⁵⁶ **UNDESA.** 2006. *Gender, water and sanitation case studies on best practices*. New York, UN.

including Viet Nam, Sri Lanka, Indonesia and the Philippines are considering innovative policies that involve payments for ecosystem services.⁵⁷ This should have positive effects for waterbodies such as wetlands across the region. Significant progress towards ecosystem rehabilitation has been made by the North Aral Sea Project in Kazakhstan. Years of overuse of the Aral Sea had reduced it to 10 percent of its original size with significant environmental, economic and social consequences. Through IWRM to raise the water level, the North Aral Sea is being recovered and has increased by 18 percent⁵⁸ in size, improving the quality of life for the community through an improved environment and increased livelihood opportunities and food supply.

The APR is endowed with hydro resources, which support economic development. Currently coal and gas account for 72 percent of the electric power generation mix and hydropower accounts for 13 percent of the generation in the region. Already, the region has the largest installed hydropower capacity and there is further potential in this context. Large-scale hydropower could bring about economic development while reducing GHG emissions and small-scale hydropower plants could bring more direct social, economic and environmental benefits to small scattered populations. For the region to continue shifting towards a sustainable development path, hydropower development, be it large or small scale, should be retained as one of the options. Hydropower should be regarded as one of the means, as opposed to an end, to support sustainable development with a focus on people.

Across the APR, policy-makers, civil society organizations and the media are growing more aware of the potential benefits of access to water and sanitation, not only for meeting basic needs, but also for enabling development and generating growth. Access to reliable and affordable water supply at the household level can help families raise their incomes and diversify their livelihoods, by using water in family-based businesses. Time for water collection is reduced, health is improved and food security is enhanced, as households can cultivate small gardens and easily prepare food.

The benefits of access to improved sanitation are also gaining visibility. The Economics of Sanitation Initiative of the Water and Sanitation Programme at the World Bank has shown that economies can lose up to 7 percent of their annual GDP to poor sanitation, primarily because of premature deaths attributable to poor water, sanitation and hygiene.⁵⁹ Other costs include productivity losses from poor sanitation, losses in tourism and damage to the environment, which are not easy to quantify.

The MDGs have set an important target for halving the number of people without access to water and sanitation by 2015. According to the latest data from the Joint Monitoring Programme, about 377 million people in the APR still do not have access to water, while a staggering 1.74 billion do not have access to sanitation.⁶⁰ This region represents about 50 percent of the world's population without access to clean water and 70 percent of the total number of people without access to sanitation. Indeed, if the target is achieved in the APR, it is achieved in two-thirds of the world.

Across the region, the progress towards water access has been considerable with the proportion of people who enjoy improved water sources steadily increasing from 73 percent in 1990 to 88 percent in 2008, an increase of 1.2 billion people,⁶¹ which is largely attributed to investment in

⁵⁷ **World Water Assessment Program.** 2012. *Managing water under uncertainty and risk.* The United Nations World Water Development Report: Paris.

⁵⁸ **UNEP.** 2009. *The critical connection.* New York.

⁵⁹ **Hutton, G., Rodriguez, U.E., Napitupulu, L., Thang, P. & Kov, P.** 2008. *Economic impacts of sanitation in Southeast Asia.* World Bank, Water and Sanitation Programme. 2008.

⁶⁰ ESCAP calculations based on data from the WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation, Available at: www.wssinfo.org. Last accessed on 23 April 2012.

⁶¹ **ESCAP.** 2010. *Statistical yearbook for Asia and the Pacific 2009.* Bangkok, ESCAP.

infrastructure and development in Asian subregions. Since 1990, 115 million people in Southeast Asia, 137 million in South Asia and 510 million in East Asia have gained piped water access on their premises.⁶² However, with the current pace of progress, meeting the MDG target looks like a herculean task, particularly for sanitation. A great push for sanitation came in 2008, the year the General Assembly designated as the ‘International Year of Sanitation’. Since then, 174 million additional people have gained access to sanitation in the APR. However, ten times as many (1.74 billion) still use unimproved facilities or defecate in the open.

Some innovative technology is being used within the region, such as the EcoSan latrine in China, which converts human waste into water and nutrient streams for the land. A World Bank-funded project in Indonesia that ran from 2006 to 2010 has made significant headway in strengthening government capacity and creating an enabling environment for increasing access to sanitation and hygienic waste disposal. The Indonesian Government has adopted a further four-year roadmap for improving sanitation in over 300 cities and has increased the government budget for sanitation spending by 300 percent.⁶³ A challenge for meeting the sanitation target is raising infrastructure at a rate faster than the growing population, however inclusion in the MDGs has provided a focus and many countries have incorporated sanitation into their development plans.

ESCAP has been working within the framework of the Asia-Pacific Water Forum (APWF), in collaboration with ADB and other regional water institutes to identify opportunities and policy options for providing water and sanitation to all. The target of universal access by 2025 was discussed during the regional process of the 6th World Water Forum. Vast amounts of money are needed to finance upfront investments, and even more to maintain them. Global estimates vary from a low of US\$22.6 billion per year⁶⁴ to an upper range of US\$144 billion per year.⁶⁵ The APR represents the lion’s share of this amount. An ESCAP estimate provided a range between US\$180 and 490 billion for initial capital investment only.

There is a need to draw a clearer connection between the three pillars of green economy as far as water supply and particularly sanitation investments are concerned. The initiative of the United Nation’s Secretary General’s Advisory Board on Water and Sanitation (UNSGAB) on ‘Wastewater Revolution in Asia’ is an emerging initiative that highlights the opportunities and helps connect the dots for green economy.⁶⁶ Responding to the above and the need for continued regional sustainable growth and “turning resource constraints and the climate crisis into economic growth opportunities”, the Environmental and Development Policy Section of ESCAP has collaborated on the ‘Low Carbon Green Growth Roadmap for Asia and the Pacific’, which was launched on 25 April 2012 in Seoul. The Roadmap highlights the need for the region to embrace a new growth strategy that can turn the trade-off between economic development protections into a win-win synergy in which ‘going green’ drives economic growth.⁶⁷

The Roadmap is divided into three parts: Part I provides an overview of the challenges and opportunities confronting the region in terms of low carbon green growth and elaborates on the

⁶² **UNICEF.** 2010. *Progress on sanitation and drinking water: 2010 update.* Geneva/New York, Joint Monitoring Programme for Water Supply and Sanitation.

⁶³ **Water and Sanitation Programme.** 2011. *Lessons in urban sanitation development, Indonesia Sanitation Sector Development Programme 2006-2010,* World Bank.

⁶⁴ **Stockholm International Water Institute & the World Health Organization.** 2010. *Making water part of economic development.* Stockholm.

⁶⁵ **Lloyd Owen, D.** 2009. *Tapping liquidity: financing water and wastewater to 2029,* A report for PFI market intelligence, London, Thomson Reuters,

⁶⁶ **UNSGAB.** *Wastewater Revolution in Asia – The alpha and the omega; the beginning and the end; the first and the last.*

⁶⁷ **ESCAP.** 2012. *Green growth, resources and resilience – environmental sustainability in Asia and the Pacific.* Bangkok, United Nations and Asian Development Bank.

system change required to pursue the new development path. Part II presents five tracks as core elements of the system change necessary for low carbon green growth, and elaborates on the means for implementing the policy options. Part III provides detailed information and analysis of the policy options and successful practices identified in Part II through more than 100 fact sheets and case studies.

Improved water management across the APR is expected as part of the anticipated shift in development towards green growth. Green growth should see a change across the region in ensuring water and sanitation access for all and environmentally sustainable economic growth. Many existing water management projects across the region already embody the vision of green growth. For example the North Aral Sea reclamation and the restoration of community irrigation water tanks in Andhra Pradesh India, have led to both increased food and water security, with triple bottom line improvements.⁶⁸

Since the deployment of Agenda 21 in 1992, water risks and scarcity have been exacerbated across the region due to growing populations, climate change, urbanization, industrialization and increasing food and energy pressures. This has further increased the need for sustainable water management. Whilst there is still much work to be done, countries across the APR have achieved significant progress in increasing access to water and adapting to a more integrated and collaborative method of managing water resources.

CASE STUDIES

Case study 1: Bang Pakong River Basin, Thailand – resolving conflicts through dialogue

The Bang Pakong Dialogue was an ADB-funded project in Thailand, bringing together the Bang Pakong River Basin Committee (RBC), the Department of Water Resources and the various basin water user groups. The objective of this pilot project was to strengthen the Bang Pakong RBC's capacity to reduce conflicts, introduce water allocation and promote IWRM in the basin through increasing stakeholder participation.

To facilitate better management of the country's water resources based on the concept of IWRM, Thailand's National Water Resources Council established 25 river basin hydrological units, and in 2002 formed the Department of Water Resources. The department established 29 RBCs covering the 25 river basin units, together with guidelines for operation. The RBC is a stakeholder consultation forum to ensure effective coordination and implementation of programme activities by different government agencies, so that it meets the targeted needs of the river basin community, without creating adverse impacts.

The Bang Pakong River Basin, with an area of 18 670 km², has a population of approximately 2 million. The river is critical to the livelihoods of many communities, supporting fisheries, a growing shrimp farming industry, forestry and agriculture. There are also a number of industries such as paper and tanneries that rely on the river for water supply. Due to the basin's proximity to Bangkok, the basin has experienced rapid urban and industrial development, with rapidly-increasing water demands.

There have been conflicts due to increasing and competing demands for the limited freshwater resources in the basin. The many different water users have conflicting priorities and views on how the limited water should be allocated. Often piecemeal attempts to solve the water problems of one particular user group create adverse impacts on another group. For example, the construction of a US\$60 million saltwater intrusion barrage in the Bang Pakong River, to increase the availability of

⁶⁸ UNEP. 2009. *The critical connection*. New York.

freshwater for rice farmers, resulted in serious adverse impacts on the downstream river ecosystem and on the shrimp farmers who depend on the brackish water. The resulting protests by the affected water-user groups caused the temporary decommissioning of the barrage within the first year of operation. Whilst each of the nine sub-basins in the Bang Pakong River Basin has its own individual challenges, there are many common basin-wide challenges such as the deteriorating water ecosystem that directly affects people's livelihoods, the lack of water supply for domestic use, repeated flooding and polluted waters. The Bang Pakong Dialogue initiative aimed to reduce conflicts among the water users in these contexts.

The project worked to build committee capacity through technical assistance and to engage stakeholder participation, to develop a more collaborative dialogue. Since its inception there have been over 20 workshops and consultations, where stakeholders have had the opportunity to learn about IWRM and to understand water conflicts and seek possible solutions. The committee pilot team tested a survey, which provided valuable information on the lack of understanding of IWRM, while also serving to dramatically increase stakeholder participation. At the grassroots level, the committee challenges the people to find solutions to the issues. At the regional level, the committee submits the river basin's projects for funding by the government or from external sources.

A challenge was developing a common vision for the committee and for the team-building activities. The committee is composed of local administrative body representatives, water users, local NGOs, government officials and private sector delegates. Not only do their knowledge and attitudes towards the problems and potential solutions vary, but they also sometimes distrust each other's interests and goals. In the case of the Bang Pakong RBC, the chairperson is from the private sector, the first for an RBC committee, thus creating challenges with acceptance from government. However, the chair was able to mobilize his contacts in the private sector and civil society organizations, to begin the dialogues, encouraging more widespread involvement. Representatives from the water-user groups or communities have knowledge and experience on the basin's problems and can identify possible solutions, but often have difficulty articulating their views. To reconcile the different views of its members and allow each group an equal voice, the committee requires that decisions be based on solid data generated by the various stakeholders.

There have been many challenges along the way, however the committee is making progress and has engaged a wide-ranging group of stakeholders and increased understanding of and participation in IWRM. Civil society organizations, government and communities are now collaborating and working together on policies and planning for the basin's future and are starting to address the complex issue of water allocation. The committee serves as an independent water network, that brings stakeholders together – facilitating knowledge sharing – and is a forum to address water conflicts while working together to preserve mutual interests. The experience and lessons learned from implementing the Bang Pakong RBC's Dialogue are being studied by the other RBCs to identify opportunities for replication in their own river basin settings.

Case study 2: Recent policy decisions and frameworks in the People's Republic of China

In the three decades since the initiation of reform and liberalization, China has successfully responded to a series of water-related natural disasters, built up the largest structural system in the world for river training and water resources development and distribution, and attained the MDG on water and sanitation six years ahead of time. China has kept improving efficiency and effectiveness of water use among society in general, supported a high economic growth rate of nearly 10 percent *per annum* with a low water-use growth of 1 percent *per annum* on average, increased grain output by nearly 78 percent and achieved growth in grain output for eight consecutive years since 2004. With freshwater accounting for 6 percent of the world's area and arable land accounting for 9 percent, China has guaranteed safety of grain and water and also economic development of a population accounting for 21 percent of the world.

In the agriculture sector, China has adopted a series of strategic, policy, institutional and technical innovations to facilitate nationwide Water-Saving Irrigation (WSI) development. From 1980 to 2004, while national total water diversion increased by 25 percent, irrigation water use remained at 340-360 billion m³ and the proportion of irrigation water use in total water use declined from 81 percent to 65 percent. Meanwhile, the national irrigation area increased by 5.4 million ha, food production capacity increased by 20 million tonnes and 200 million people gained food security. From 1995 to 2005, average unit irrigation water use was reduced from 7 935 to 6 450 m³/ha and nationwide irrigation water-use efficiency was improved by around 10 percent. By 2020 however, China needs to increase national food production by 200 million tonnes to maintain national food security, which requires an increase in irrigation area of 6.67 million ha.

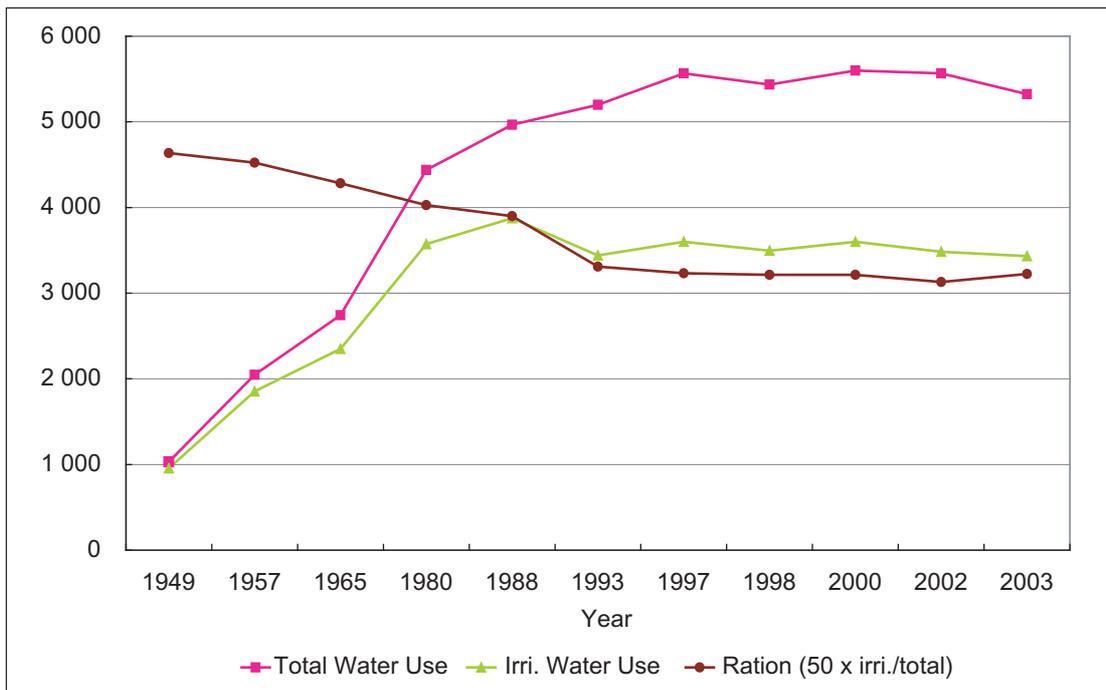


Figure 11: Irrigation water use in China

Source: Ministry of Water Resources, China.

The Ministry of Water Resources projected in 2006 that newly developed water resources in the next two decades would be mainly allocated to domestic and industrial users and that the agriculture sector would have to maintain food security for a larger population with the current amount of water allocation. The ministry developed different WSI development scenarios for the next decades to assist in planning (Table 18).

Along with further industrialization and urbanization plus the more intensive impacts of global climate change, China will face more severe situations in water resources in future with increasingly acute problems of flood, logging, drought, water shortage, water pollution and soil erosion. In 2011, the Chinese Government released its policy document on accelerating reform and development of water conservancy, convened the central conference on water conservancy and in 2012, produced its policy document on implementing the most stringent water resources management system. The document specifies the control indicators of the ‘Three Red Lines’: control of development and utilization of water resources; control of water-use efficiency; and restriction of pollutants in water function areas (Table 19). The red line control target for irrigation is based on the most ambitious and demanding scenario developed in 2006.

Table 18: Scenarios of irrigation water-use improvement in China by 2020

Indicators	Scenario 1		Scenario 2		Scenario 3	
	2010	2020	2010	2020	2010	2020
Total irrigation water allocation (100 million m ³)	3 600	3 600	3 600	3 600	3 600	3 600
Increased WSI areas (100 million <i>mu</i>)	2.0	3.0	1.5	2.5	1.0	2.0
Irrigation water use efficiency (%)	50-51	54-55	48-50	53-54	46-47	48-49
Unit irrigation water allocation (m ³ / <i>mu</i>)	400	380	410	390	418	400
Equipped WSI areas (100 million <i>mu</i>)	3.0	full	2.2	3.0	1.8	2.6
Reduction of water consumption per 10 000 yuan of agricultural production (%)	12	20	10	15	8	12
Reduction of irrigation water allocation in water-scarce areas (%)	10	15	8	12	6	10

Note: 1 ha = 15 *mu*. 100 yuan = US\$16.20 (September 2013).

Table 19: China's Three Red Lines water control indicators

Three Red Lines control targets	Control of utilization		Water-use efficiency	Restricted pollution
	Total quantity of water consumption (10 ⁸ m ³)	Water consumption per 10 000 yuan industrial value (m ³)	Coefficient of effective farmland irrigation water use	Water quality standards of the main water functional zones in rivers and lakes
2020	6 700	<65	>0.55	80%
2030	7 000	<40	>0.6	95%

The deployment of the most stringent water resources management system will focus on eight aspects:

1. Accelerate transformation of the water-use pattern under the guidance of the sustainable development concept: from water supply management to water demand management; from focusing on development and utilization to equal attention to development and protection; from extensive inefficient use to highly efficient water-saving use; from focusing on administrative approaches to integrated management.
2. Develop and utilize water resources in a scientific and rational manner centering around total quantity control: develop programmes for distribution of water flows along major rivers based on river basin strategic plans; enhance project impact assessments and implement the permit system; establish and improve a national water rights system.
3. Construct a water-saving society on all fronts with a view to improving water-use efficiency in the agricultural, industrial and urban sectors.
4. Reinforce protection and restoration of water resources with management of river basins as the vehicle: apply more stringent criteria to determine pollution; estimate absorption capacity of waterbodies; intensify efforts to control sources of industrial pollution; further protection of water ecology and adoption of a comprehensive ecosystem approach.
5. Regard local governments as the major accountable parties to strengthen performance assessment and supervision: performance assessment will be incorporated into the local integrated performance assessment system for socio-economic development; assessment results shall be used as an important basis for rewarding or disciplining relevant local government officials.

6. Build up capacity for allocation, regulation and control of water resources via river and lake water system connection: speed up the construction of intercatchment inter-regional water transfer projects; construction of key headwater projects will be accelerated and river and lake water system connection will also be expedited.
7. Improve water resource management based on better monitoring systems: enhance capacity building for monitoring; reinforce construction of measurement and monitoring facilities; accelerate the construction of a national water resource management system and capacity building for dynamic emergency monitoring.
8. Use reform and innovation as the driving force for improvement of water resource management systems and mechanisms: further improve the water resource management system; further enhance input from public finance; refine the policy and legal framework and proactively facilitate water pricing reform. These measures will be supported by input of US\$600 billion over the next ten years.

Case study 3: Participatory groundwater management in Andhra Pradesh⁶⁹

Groundwater in the state of Andhra Pradesh, India, is tapped through 2.2 million mostly private wells. The state is largely underlain by hard rocks, where well yields are low and determined by the thickness of the weathered and fractured zones of the rock. Pumping for rice cultivation has resulted in groundwater depletion. Of the state's 1 125 blocks, 175 are classified as semi-critical, 77 as critical and 219 as overexploited. State-sponsored legislations regulating groundwater use has proved to be very difficult to enforce because the sheer number of wells overwhelms the enforcing agencies.

The Farmer Managed Groundwater Systems (FAMGS) approach addressed the problem of groundwater depletion, in some of these blocks, from the perspective of information dissemination and capacity building of the users to rationalize the need for matching the groundwater availability with the use. Hydrological data (rainfall, static water level in wells, well discharge, stream discharge, and cropping patterns) were generated by trained volunteers, nominated by groundwater monitoring committees (GMCs) organized at the habitation level. In each hydrological unit (a natural drainage basin, which represents the aquifer unit in hard rock areas), GMCs were organized into hydrological unit networks (HUNs) and registered as societies. Scientific information and hydrological data are displayed at the village centres. HUNs also share the data with local government departments, students, study teams and research institutes.

The strategy was to help communities collect all relevant data required for estimation of the annual local groundwater balance and to facilitate adoption of cropping that matched groundwater availability, during the Rabi season (winter cropping season). As a one-time input, the HUNs are provided with the basic scientific information including: a base map of the HUN (showing road networks, administrative boundaries, and other non-technical information); five thematic maps (contours, settlements, drainage, geology, monitoring stations); geological cross-sections; groundwater recharge rates (recommended by the Groundwater Estimation Committee 1999); crop water requirement (recommended by the Agriculture University); a crop water budgeting worksheet (Excel); and several non-formal education tools. The FAMGS approach was implemented in 62 hydrological units (638 habitations) in seven drought-prone districts (Mahabubnagar, Nalgonda, Prakasam, Kurnool, Kadapa, Anantapur and Chittoor) of Andhra Pradesh, India. The intervention covered an area of 507 775 ha and a population of 596 535.

⁶⁹ Sources:

<http://www.indiawaterportal.org/node/13136>

<http://www.fao.org/nr/water/apfarms/psc.htm>

<http://www.economist.com/node/21522750/sources-and-acknowledgements>

<http://www.solutionsforwater.org/solutions/farmer-managed-groundwater-systems-fmgs>

Table 20: Participatory groundwater management in Andhra Pradesh

Institutional results	Triple bottom line results
<ul style="list-style-type: none"> ● 628 habitation level GMCs involved in data generation and updating the village population with vital technical information. ● 58 HUNs conduct the annual crop water budgeting exercise and provide the needed technical and managerial support to GMCs. ● The Hydrological Monitoring Network operated and maintained by the communities: 2 026 observation wells (1/km²); 190 rain-gauge stations (1/5 km²) and 58 stream gauge stations. ● Farmers collected daily rainfall, fortnightly water levels, fortnightly bore-well discharge and daily stream-flow data, documented in the hydrological monitoring record, This provides information needed for estimation of annual groundwater balance in a hydrological unit (HU) and influences crop choices and water management practices. ● Farmers use data for lobbying with government departments. ● The only successful project of community groundwater management at the global level. 	<ul style="list-style-type: none"> ● Static water levels in 80% of the observation wells did not show further decline. ● Annual groundwater draft decreased in 47 HUs; and increased in 16 HUs. ● The annual groundwater balance changed from negative (draft more than recharge) to positive (draft less than recharge) in 10 HUs; 35 HUs showed reduction in the negative balance; and 2 HUs remained positive. ● Farmer Water Schools (FWS) created a pool of 20 000 graduates (12 315 men and 7 462 women), who provide leadership to the communities in managing their groundwater systems and learn techniques to improve water productivity and increase their income. ● The area under rice cultivation was reduced in 14 HUs. ● Crop diversity: the number of crops grown by farmers increased from 14 to 39. ● The results have combined environmental sustainability and poverty reduction.

The idea originated during the implementation of the Indo-Dutch bilateral project APWELL. APWELL benefited about 14 000 small and marginal farm families; bringing around 35 000 acres of land under 3 500 bore-well irrigation schemes in the same districts. The HU approach was introduced to create a sense of responsibility among the beneficiaries for ensuring post-APWELL sustainability of the groundwater resource. The Royal Netherlands Embassy in India recognized the importance of the idea, provided initial financial support for the first four years of the project to deploy this approach then asked FAO to implement this project. FAO contributed expertise in Farmer Field Schools (FFS), and World Education adapted that approach to Farmer Water Schools focusing on groundwater management as well as practices to improve water productivity. A network of Partner Non Government Organizations (PNGOs) rooted strongly in the project area provided the contact between professional staff, community-based organization (CBO) and GMCs. HUNs are presently carrying forward the practice of participatory hydrological monitoring and conduct of the annual crop water budgeting workshop which is the basis for crop planning.

FAMGS have successfully tested a Plan B response strategy on how to sustain the groundwater sources in drought-prone areas in a highly informal water economy where hydrocratic approaches are not likely to succeed, based on sound water accounting and participatory stakeholder mobilization. FAMGS provide an example of an effective institutional mechanism under the leadership of motivated and informed groundwater farmers, at an aquifer or hydrological unit level, and a farmer-friendly technology for groundwater balance estimation. The platform FAMGS provides is useful for the users and other stakeholders such as local government, scientific and academic institutions. Though FMGS superficially appear community centered, they are built on a sound technical base and aim at changing the behaviour of individual users out of self-interest.

Case study 4: Singapore – total water cycle management – the Four National Taps policy

Singapore's 'Four National Taps' policy is focused on holistic and integrated water resources management, encompassing the whole island. The outputs of this policy are:

- Dramatically increased water security and reduced reliance on Malaysia.
- Reduced per capita consumption by 10 percent since 1995, to 154 litres per day in 2010.
- Improved water management has contributed to Singapore's rapid development, with Gross National Income (GNI) per capita increasing 35 times since independence in 1965, to S\$57 603 in 2010.⁷⁰
- Beautification of waterways has led to significant social benefits by providing space and opportunities for sports, recreation, cultural activities, art, commerce and education; 214 lifestyle events were held at waterways and reservoirs between 2007 and 2010.
- By 2015 the water industry is expected to contribute S\$1.7 billion to GDP *per annum*. From 2006 to 2010 water investment contributed S\$590 million and 2 300 jobs to the economy.⁷¹
- By 2007 S\$200 million was saved through reductions in unaccounted for water loss (UFW). The UFW programme and maintenance continues to operate at a cost of S\$20 million per year, while generating S\$24 million of savings annually.⁷²
- Flood-prone areas reduced from 3 200 ha in 1970 to 56 ha in 2010.⁷³

Singapore is a small island city state located off the southern tip of the Malay Peninsula, 137 km north of the equator. It is a water-scarce country and ranks 170 among 190 countries in terms of freshwater availability. Singapore partly depends on the water catchments of its neighbour, Malaysia. They have a supply agreement until 2061 only. In order to increase its national resiliency to water scarcity, Singapore implemented the Four National Taps policy. The Four National Taps refers to water from four different water sources: water from Singapore's catchment areas, imported water from Malaysia, recycled sewerage water and desalinated water. The objective of this continuous, multidecade, national water programme is to address the strategic threat of water scarcity by increasing the country's resiliency to water shortage and maximizing the benefits that can be gained from its limited water resources.

Before 2001 the responsibilities for managing the various issues related to water resources and water services were assigned to different government agencies, creating a sectoral, issues-based approach to water management. In 2001 they decided to consolidate all water management functions into a single agency, the Public Utilities Board (PUB), with the responsibility of managing the entire water cycle in Singapore, effectively 'closing the water loop'. The PUB developed the Four National Taps policy, to develop a secure and sustainable water supply.

In order to 'catch every drop of water' Singapore embarked on a systematic plan to increase the size of its water catchment areas by harvesting storm water runoff through an extensive network of canals, drains and reservoirs. Today about two-thirds of Singapore's land area is part of its water supply network. In 2003, Singapore embarked on an ambitious plan to reclaim some of the treated wastewater to produce NEWater. The NEWater is produced using state-of-the-art membrane technologies involving microfiltration, reverse osmosis and ultraviolet disinfection, which results in

⁷⁰ **Government of Singapore.** 2012. *Growing our economy*. Singapore.

⁷¹ **Government of Singapore.** 2012. *Water industry to add S\$1.7B to Singapore's GDP by 2015*. Singapore.

⁷² **Tan Yong Soon.** 2009. *Clean, green and blue: Singapore's journey towards environmental and water sustainability*, Singapore, Institute of Southeast Asian Studies.

⁷³ **Ministry of the Environment and Water Resources.** 2012. *Key environment statistics – water resource management*, Singapore.

an ultra-clean product that exceeds WHO standards for drinking water. The NEWater is supplied primarily for non-domestic use in semi-conductor wafer fabrication parks, industrial estates and commercial buildings, where it is used for industrial and air-cooling purposes, while a small percentage is mixed with raw reservoir water before treatment for drinking water. At present there are four NEWater plants that can meet 15 percent of Singapore's water needs, and there are plans to boost the capacity to 30 percent with a fifth plant.⁷⁴

The PUB has developed a robust and water-tight supply network which ensures there is no contamination or unnecessary loss of water during delivery. This has helped the PUB to reduce anomalies to 5 percent (compared to an Asian urban average of 40-60 percent), significantly reducing demand on the source water supply. The PUB has also been implementing an active programme of managing water demand through the use of economic instruments whereby the water tariff has been raised to encourage customers to conserve water. Water is priced to recover the full costs production and supply and includes a water conservation tax. The result of this programme can be seen in the reduction of the per capita water consumption from 172 litres per day in 1995 to 154 litres per day in 2010.⁷⁵

To raise awareness and enhance the capability of water users to improve their water efficiency, the PUB conducts extensive community outreach efforts in water conservation as well as to public/private sectors. Through IWRM, Singapore has also dramatically decreased risk to flooding, with flood prone areas declining from 3 200 ha in 1970, to 56 ha in 2010. In 2006 it launched the Active, Beautiful, Clean (ABC) programme encouraging the public to better appreciate and protect water resources. This generated transformation of drains, canals and reservoirs into vibrant streams, rivers and lakes, creating attractive new spaces for the community's enjoyment. Singapore has moved beyond basic infrastructure provision by adding value to its canals and reservoirs to increase appreciation of water and enhance the living environment and lifestyle in the city.⁷⁶

The implementation of IWRM in Singapore, through initiatives such as the Four National Taps and ABC programme, provides an example of a green growth economy whereby the three pillars of sustainable development are enhanced. Through good governance and competent water management the Singapore Government has managed to save money, helping to increase the wealth of the country. By minimizing loss in the water supply network and reducing the per capita water demand, through the use of full cost recovery tariff and economic instruments the PUB has reduced the need for an increase in water supply capacity. This reduction in demand not only helps tax payers but also protects the environment from damage through the unnecessary construction of water supply dams, water treatment and pumping works and water reticulation networks. The prevention of the potential environmental impacts caused by the building of unnecessary water supply infrastructures is an example of the triple win for the environment, again reducing public taxes and reserving saved funds for other productive economic activities.

Singapore is an excellent example of where a government has developed and implemented an institutional framework for IWRM. Good governance and competent technical management have made the Four National Taps and other IWRM programmes successful in increasing Singapore's water security. Singapore, being a small city-state has been able to create a single national water agency and entrust it with the responsibility for all water management functions. For a larger country a different institutional framework, such as a coordinating body, supported by strong political will and legal mandates may be necessary.

⁷⁴ **Loh, J.** 2007. *Water management: learning from Singapore's water success*. Retrieved 1 May 2012 from <http://workingwithwater.filtsep.com/view/934/water-management-learning-from-singapore-s-water-success/>.

⁷⁵ **Ministry of the Environment and Water Resources.** 2012. *Key environment statistics – water resource management*. Singapore.

⁷⁶ **Lai Choo, M.K.H.C.** 2009. *Evaluation of the "Active, Beautiful and Clean Waters Programme" of Singapore*, Report for UNESCAP.

7 Industries

The role of industry in sustainable development

Sustainable development cannot be achieved without sustainable industrial development. No country has achieved developed status without the development of its industrial sector. Industry matters for development. It is the vehicle for widespread structural change, job creation and income generation, and therefore the means to improve the quality of life of ordinary people and combat poverty.

About one-fifth of global income is generated directly by the manufacturing industry, and nearly half of household consumption relies on goods from industrial processes. People's needs for food, transportation, communication, housing, health and entertainment are met largely by manufacturing. Since the Industrial Revolution, waves of industrial innovation have shaped how people work and live.

During the nineteenth and twentieth centuries developed countries relied on manufacturing to reduce poverty and improve the quality of life of their growing populations. Today, developing countries are counting on industrialization to do the same for them. In the APR, more than half the population of the region was poor in the early 1970s, with average life expectancy of 48 years, and only 40 percent of the adult population was literate. Today, strong economic growth driven by rapid industrialization over the past decades has brought down the percentage of poor people to nearly one-third of the population, life expectancy has increased to 65 years and 70 percent of the adults are literate. Despite an increase in total population from 1.8 billion to 3 billion, the number of poor people has fallen slightly from over 1 billion to under 900 million.

At the same time, a critical side-effect of rapid industrialization is the unrestrained increase in consumption of resources, which raises serious concerns about the sustainability of the current development patterns. Industry accounts for more than 30 percent of global electricity use, 20 percent of direct GHG emissions, over a quarter of primary resource extraction and 22 percent of water consumption (ranging from 10 percent for low- and middle-income countries to 60 percent for high-income countries, due to rapid industrial development).

This resource consumption has also led to significantly increased generation of pollution and wastes, which have been taking a heavy toll on the environment of the region and affecting the quality of life negatively. It is therefore increasingly acknowledged that sustained growth is only possible when economic and industrial development is decoupled from increased resource use and environmental impacts. Sustainable development urgently requires a widespread greening of industrialization.

The greening of industries has become a core determinant of economic competitiveness and sustainable growth. As resource inputs represent an important cost of production for industries, efficiency improvements can be a significant lever for competitive advantage. The greening of industries also plays a role in poverty reduction, through promoting energy security, health conditions, jobs and reduced costs through increased productivity.

Obsolete and inefficient technologies and operating practices currently in use in many industries in developing countries need to be addressed. In today's developing world, industries are using more material and energy than is required by their production processes. In addition, producers and consumers have adopted patterns of production and consumption that do not take into account the planet's available resources and its assimilative capacity for emissions coupled with a growing population. These issues are alarming for sustainable development; therefore appropriate concepts need to be adopted and appropriate measures taken. Decoupling the use of natural resources from economic growth will be a key challenge for society in general.

In the past, progress in decoupling emissions from economic growth has been slow. Most countries have experienced a relative drop in emissions relative to GDP but absolute emissions are still rising. International trends show also that the declines in energy or material intensities have not been sufficient to offset growing demand; absolute levels of energy and materials consumption have not declined. The global challenge of the future is to decouple the consumption of natural resources from economic growth in absolute terms. It will be the prerequisite for any sustainable industrial development and the long-needed growth of industrial production in developing countries.

In short, measures aimed to support the transition to a green economy need to promote the ability of industries to 'produce more with less'. The importance of promoting green industrial practices is not only to decouple industrial consumption of natural resources and release of emissions from industrial growth, but also to increase industry's productivity, encourage the creation of new industries, allow greater access to global markets and create jobs that support environmental improvements and resource efficiency.

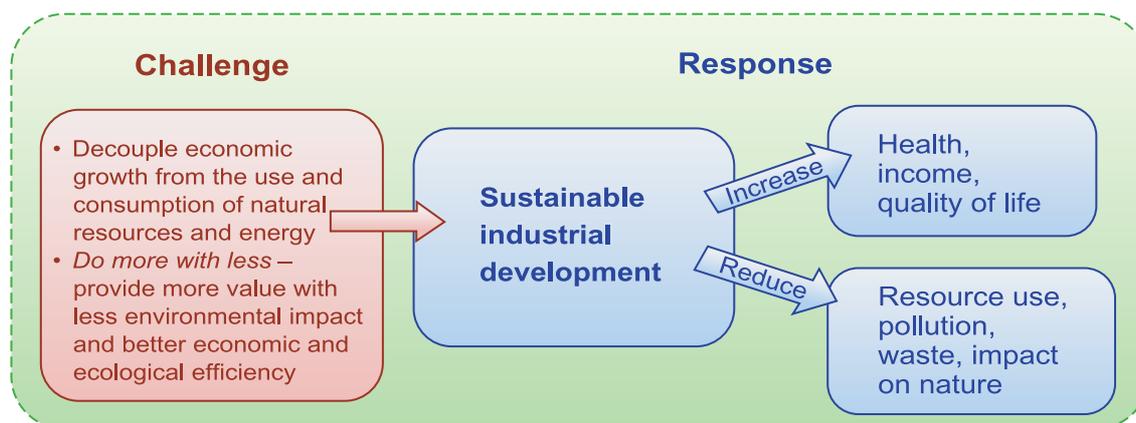


Figure 12: Decoupling economic growth from consumption of natural resources

Development of green industry in the APR

Resurgence of industrial policy for green economy

The global outlook for competitiveness is changing and there is an increasing recognition that those who are moving fastest in the transition to a green economy are likely to gain a significant competitive advantage. There is also a growing understanding that the shift towards a green economy cannot be left to market forces alone, and will require governments to introduce appropriate incentives, disincentives and regulations that govern specific forms of production. The global economic debate has seen a renaissance of industrial policy as a necessary element of economic development policy, especially in this era of globalization, growing global environmental challenges and multiple global crises – financial, food, climate change and energy. None of these problems can be solved in isolation.

The new industrial policy is seen as a coherent framework for green growth, facilitating a shift from conventional patterns to low-carbon growth paths. It is closely linked with technology transfer, innovation policy, competitiveness and with facilitating the structural change needed to upgrade to greener industrial production and green industries. Industrial policy can help to drive such green global industrial structural change, and hence contribute to the transition to a green economy. It can play a significant role as an information and technology facilitator, both at national and international levels.

UNIDO's Green Industry Initiative

As the specialized United Nations agency for the promotion of industrial development, UNIDO contributes to the green economy by focusing on the positive role of industry towards green economy and sustainable development. In 2009 the organization launched its Green Industry Initiative acknowledging the need to mainstream best practices through policy change and to create awareness about industry's role in the transition towards a low-carbon future. The Initiative is underpinned by a two-pronged strategy. Green industry calls for:

Greening of industry: Ensuring that all industries, regardless of sector, size and location, continuously improve their environmental performance and resource productivity. This includes a commitment to, and actions for reducing the adverse environmental impacts of industrial processes and products by using resources more efficiently; transforming industrial energy systems towards greater sustainability by expanding renewable energy sources; phasing out toxic substances; and improving occupational health and safety at the industrial level.

Creating green industries: Stimulating the development and creation of industries that deliver ecosystem goods and services. Green industry is a rapidly expanding and diverse sector that covers all types of services and technologies that (directly or indirectly) help to reduce negative environmental impacts and resource consumption. This includes material recovery, recycling, waste treatment and management, as well as the provision of ecosystem and energy consulting services, such as energy service companies and companies that provide monitoring, measuring and analysis services.

The potential contribution of green industries to poverty eradication and social objectives is significant. In UNIDO's experience these initiatives reinforce several economic and social objectives including improvement of the lives of the urban poor (UNIDO 2010). There are four ways in which green industries contribute to this objective:

1. Greening of industries results in constant improvements in resource use (materials, water and energy) and hence operational costs, whereby businesses become more competitive and are able to expand their operations, secure jobs and incomes, and contribute to poverty reduction.
2. Creation of new businesses that provide ecosystem goods and services also creates new job opportunities for the urban poor and/or youth, for example through the establishment of modern waste management services, including collection and recycling.
3. Greening of industries leads to a reduction of exposure of factory workers, surrounding communities and consumers to potentially harmful substances. Healthier work places and communities consequently result in mitigating diseases and poor health conditions, supporting thereby their development.
4. Implementation of green industry initiatives goes hand-in-hand with capacity building in all levels of organization. Although capacity building is related to environmental aspects of business and improving entrepreneurial skills, the improved capacities have spin-off effects, like empowerment of workers, including female employees, enhanced employability of workers and spin-off business developments.

These policies will allow sectors and countries to plan for their future resource and energy demands, and pay closer attention to the environmental implications of upcoming structural changes. For example, there is immense potential for reductions in energy intensity in high energy-consuming manufacturing sectors such as iron and steel, non-ferrous metals, pulp and paper, chemicals, petrochemicals and non-metallic mineral products.

Moreover, industrial policy can set the basis for anticipating and managing worldwide restructuring and diversification trends, not only towards higher productivity- and technologically-advanced sectors, but also towards more environmentally friendly ones. Increasing investment in these sectors (such as RE sources) helps to address the environmental effects of fossil-fuel use and is one of the industrial policy mechanisms most widely used by governments to deal with climate change concerns.

Finally, an industrial policy for green growth is needed to increase the competitiveness of the industrial base of developing countries in the markets for green goods and services, and take advantage of the opportunities for trade and new jobs. The UNIDO Green Industry Initiative addresses these issues in the context of poverty reduction and sustainable development.

Policy initiatives for greening industries in the APR

Governments that recognize the importance of facilitating the greening of businesses and industries have a range of policy tools at their disposal. These include measures such as ecotax, education, ecolabelling, green investment and green procurement.⁷⁷ Through the implementation of economic instruments (EI), or market-based instruments (MBI), such as pollution taxes and so forth, governments can shift the market's demand and supply equilibrium to be more favourable to green businesses.

Several countries in the APR have already begun to create policies to promote the greening of industries and embark on a sustainable development path. Some countries have chosen to focus on R&D and innovation such as Japan and Thailand, and others have committed to assist the industrial sector to improve its production processes. Some of the recent industry-related policy initiatives that have been introduced by some selected countries in the APR are described next.

Japan – eco-innovation, the 'Fukuda Vision' and the New Growth Strategy

In 2007, Japan declared its ambition to become a leading environmental nation in the 'Strategy for the 21st Century – Japan's Strategy for a Sustainable Society'. In order to achieve this aim, emphasis has been placed on the development of eco-innovation – a new kind of 'techno-social' innovation that takes into account environmental challenges and resource constraints creating a link between economy and environment. The Japanese Ministry of Economy, Trade and Industry (METI) is the key promoter of eco-innovation (and innovation in general) in Japan, as it believes that innovation is central to the country's international competitiveness and future economic growth.

The scope of techno-social innovation can be classified under three categories: industry, infrastructure, consumers and lifestyles. For eco-innovation to be carried out in the industrial sector, Japan seeks to build a sustainable manufacturing service that is based on recycling resources and on reducing resource consumption. Additionally, the country aims to build a zero-emission social infrastructure plus distribution and diversification of energy sources through the use of IT technology.

⁷⁷ Ibid.

The importance of innovation was reiterated in 2008 by the Japanese Prime Minister, Yasuo Fukuda, in a set of proposals commonly known as the 'Fukuda Vision', setting out to reduce Japan's carbon emissions by 60 to 80 percent by 2050. To reach this target, Japan relies on the continuous development of innovative green technologies, giving industries a crucial role to play in the process of transition.

Two institutions, METI and its affiliate body, the New Energy and Industry Development Organization (NEDO), are the coordinating institutions in charge of linking the public and the private sectors, and for promoting green R&D. NEDO furthermore is responsible for the improvement of industrial competitiveness and aims at commercializing and disseminating information about the latest green technologies. Cooperation with industries is a key point in Japan's policies to support innovation within clean technologies.

The Republic of Korea – low carbon green growth vision and strategy

In the last few decades the Republic of Korea (ROK) has undergone a rapid industrialization process resulting in a large increase in the country's CO₂ emissions. To reverse this development, the country has committed itself to a low-carbon development path aspiring to merge environmental protection with economic growth. The concept of low-carbon green growth consists of three pillars: (1) to maximize the synergy between the economy and environment in order to support the development of clean technologies and green industries, thus creating jobs while protecting the environment; (2) improvement in quality of life through the promotion of green lifestyles establishing thereby a consumer base for green industry; (3) establishing an international stance that fits international society's expectations.

In order to realize the vision of becoming a global green leader, the ROK has three key strategies: (1) adapt to climate change and increase the energy independence level to 85 percent by 2030; (2) promote and develop green technologies and industries as future growth engines; (3) improve the quality of life within and strengthen the position of the country as a global leader in the field.

In 2009, the government submitted to the National Assembly the Basic Law on Green Growth and announced its green-growth five-year implementation plans. The latter includes ten policy directions of which the most notable refer to green technologies and industries. The focus in the plans lies predominantly on four components of green technology and industries: developing green technology; greening industry; improving industrial structure; and the establishment of a green economy.

Many of the sections from the five-year implementation plan overlap with the 17 new engines of growth also announced in January 2009; they were chosen as the new leading forces that will push forward the nation's economic development in the coming ten years. These new engines of growth involve three industrial sectors: green technology businesses (6); high industrial convergence (6); and value-added-services (5).

The low-carbon green growth vision is expected to create many new green jobs and increase the national GDP, both contributing to improving living standards and environmental conditions of the country.

China – the Circular Economy Promotion Law

As home to one-fifth of the world's population, China is experiencing a series of challenges related to increasing urbanization and rapid industrial development. The rising demand for energy and raw materials is exacerbating environmental strain and the country's already significant CO₂

emissions. In 2007, China surpassed the United States in being the largest emitter of CO₂, being responsible for releasing 7.5 gigatonnes of GHGs into the atmosphere. In order to deal with these concerns, China has developed and amended a wide set of policies, laws and regulations, including the Energy Conservation Law, Renewable Energy Law, Laws on Promoting Circular Economy and Laws on Promoting Clean Production.

The Circular Economy Promotion Law was adopted in 2008 as a new model for industrial and economic development. The Law that came into effect on 1 January 2009 intends to support the development of a circular economy, improve recycling efficiency, protect the environment and support sustainable development. As defined in the Law, the circular economy is a general term for the activities of reducing, re-using and recycling of resources in the processes of production, circulation and consumption. Reduction refers to the reduction of resource consumption and waste generation.

Overall, the Circular Economy Law provides a general policy that can promote industrial ecology and cleaner production methods. Since the adoption of the Law, each industrial sector, mainly buildings and appliances, power generation, agriculture and forestry, water and emissions-intensive industries, are now subject to specific policies and regulation.

The central and local governments in China have already introduced important measures to promote the circular economy, including planning and guidance, pilot projects, economic incentives and regulatory restrictions. The 12th Five Year Plan, 2011-2015, sets a target of 72 percent utilization for industrial waste by 2015, and an increase of 15 percent in the yield rate of resources. Some of the key circular economy projects in the Plan are:

1. Comprehensive utilization of resources: utilizing large bulk solid wastes such as fly ash, coal refuse, industrial by-product gypsum, smelting wastes, chemical waste residue, tailings, construction wastes, as well as straw and waste wood. Several such bases will be established during the 12th Five Year Plan.
2. Recycling system for waste products: demonstration areas in up to 80 cities will feature advanced waste-product recycling systems to achieve high rates of recycling of key products.
3. Demonstration bases of ‘mineral industry in city’: the circular economy in the mineral industry will be pursued in demonstration zones in 50 cities, deploying advanced technology and management and enhanced regulation of environmental standards. The demonstration areas will have a broad scope, including recycling of waste metals, waste electrical and electronic products, waste paper and plastics.
4. Industrialization of remanufacturing: several national remanufacturing zones will be established, focusing on developing the size and quality of remanufactured output from sectors such as automotive parts, construction machines, mining machines, machine tools and office supplies.
5. Reclamation of kitchenware waste: several kitchenware waste reclamation facilities will be constructed in 100 cities, to improve the utilization and harmless disposal of kitchenware waste.
6. Recycling transformation in industrial parks: key industrial parks and industry cluster areas will make a major push on recycling.
7. Promotion of resource-recycling technology: demonstration projects and service platforms consistent with the circular economy.

Cambodia – government green growth policy and strategy

Over the last two decades, the Kingdom of Cambodia has experienced rapid economic growth lifting many of its people out of poverty. This fast development has, however, resulted in degradation of the environment and put strain on the country's natural resources. While it is clear that Cambodia will continue its economic growth in order to continue fighting poverty and achieve social progress, it is crucial that this happens with sustainability in mind.

In February 2010, Cambodia adopted the National Green Growth Road Map, aimed at ensuring environmental sustainability for socio-economic development, reducing poverty and adaptation to climate change. As most of the economic growth over the past decade has taken place in urban areas around the vulnerable garment export industry, tourism and construction, the Roadmap has focused on identifying and describing interventions that can improve people's quality of life, by increasing access to basic goods and services.⁷⁸

The Roadmap combines the overall objectives of pre-existing development strategies with the establishment and maintenance of green growth, defined as environmentally sustainable economic progress that fosters low-carbon, socially inclusive development. In Cambodia, green growth aims to unify development and environment objectives by means of implementing policies tailored to address the needs of all, including the most disadvantaged, to create jobs, to increase the resilience of the environment and of the population to adverse impacts, thus sustaining economic growth and human and environmental well-being in the long term. This roadmap is also intended to promote women's status for the realization of a gender-equal society.

The National Green Growth Roadmap will focus on addressing seven 'A's:

- Access to clean water and sanitation;
- Access to renewable energy;
- Access to information and knowledge;
- Access to means for better mobility;
- Access to finance and investments;
- Access to food security (agriculture) and non-chemical products; and
- Access to sustainable land-use.

These seven dimensions of access will be facilitated through green economic growth projects and programmes, low-carbon solutions, including eco-efficient, resource-efficient innovations, which can create new 'green jobs' for the population.

In order to achieve the seven accesses, there are three main objectives: short-, medium- and long-term interventions. The Roadmap will in the short term (two to five years) contribute to stimulating the economy, saving and creating jobs, protecting vulnerable groups and ensuring environmental sustainability. In the medium term (five to ten years), it will further promote sustainable and inclusive growth and the achievement of the MDGs for economic development and social and environmental stability. Finally, in the long term (ten to 20 years), the Roadmap will contribute to the reduction of Cambodia's carbon dependency and ecosystem degradation – all beneficial for sustained economic growth and poverty reduction.⁷⁹

⁷⁸ **Delegation of the European Union to Cambodia.** 2011. *EU projects promote a greener future for Cambodia.* Phnom Penh.

⁷⁹ **Kingdom of Cambodia.** 2011. *The National Green Growth Plan.* Phnom Penh.

Thailand – the National Innovation Agency

The Thai National Innovation Agency (NIA) was established in 2003 by the Ministry of Science and Technology and functions as a central platform for coordinating, networking and partnering different organizations from various fields such as academia, technology, finance or investment but focuses mainly on knowledge management to achieve innovation coherence. Over the past few years, the NIA has endeavoured to build a fully-efficient system to promote national innovation systems by providing both technical and financial support to generate business opportunities for the private sector.

The NIA is currently focusing on three strategic areas for supporting innovation development: Bio-Business, Eco-Industry and Design & Solutions. The aim is to “integrate innovation into the strategic industry” with the short-term goal of generating a shift in the structure of manufacturing meant to influence the economy and society. In the long term the aim is to turn Thailand into a knowledge-based economy and society.

One of the green sectors in the Bio-Business category that the NIA is focused on, is the bioplastic industry in Thailand. In 2007 the NIA developed the five-year ‘National Bioplastics Roadmap’ (2007-2011), aimed at developing and promoting the national bioplastic industry through coordination of the efforts of the concerned agencies. The strategic innovation programme within this sector seeks to make use of the country’s abundant raw materials to strengthen the bioplastics industry and become regional leader in the sector. The programme supports relevant industries in acquisition and development of technology in order to add value to agricultural products by more than ten times and to position Thailand in the global market for bioplastics.⁸⁰

As a part of the NIA’s ‘Industrial Innovation Programme’, the agency is furthermore committed to supporting the development of clean industry in order to deal with Thailand’s great energy demand and the environmental problems caused, particularly by industrial and domestic waste. The agency intends to apply technological and management innovations, promote waste management and re-use of waste for the generation of alternative energy to be used by industry.

CASE STUDIES

Case study 1: Promoting waste heat recovery from the Chinese coal-gangue brick sector⁸¹

As China’s economy continues to rapidly develop, the demand for building materials is also expanding a fast pace. Consequently the Chinese brick-making sector has become a major industrial sector and, by the end of 2008, it had annual production of approximately 1.0 trillion bricks of different types. The sector has become a significant consumer of national resources both in terms of clay, which is used to make clay-based bricks and energy resources, such as brick-firing fuels (predominately coal) and electricity, which are needed to operate the different brick-making processes.

With a view to promoting the comprehensive utilization of industrial wastes in industrial production as one of the objectives of its circular economy initiative, as well as enhancing future food security by protecting existing agricultural land resources, the Government of China is increasingly promoting non-clay-based brick production, with coal-gangue as one of the main options being promoted as a replacement for clay.

⁸⁰ National Innovation Agency, 2011. Bangkok.

⁸¹ Source: UNIDO.

Coal-gangue is a solid waste product left over from the coal-mining process. It presents a number of environmental and health hazards. The large quantity of abandoned coal-gangue piles not only occupies land and destroys the geological and morphological landscape, but also emits poisonous gas from the spontaneous combustion of coal, such as nitrogen oxides, sulphur dioxide, hydrogen sulphide and carbon monoxide which results in the pollution of the atmosphere, land and water, and threatens people's health. The mounds of coal-gangue could also collapse when they become saturated with rain water posing safety hazards to coal miners.

The use of coal-gangue waste as a replacement for clay in brick-making presents a number of environmental, social and agricultural benefits. Firstly, it reduces the amount of coal-gangue that is presently being piled up as a result of coal mining and reduces the associated health and environmental hazards of coal-gangue storage/piling. Secondly, substituting clay for coal-gangue helps to reduce the pressure on agricultural land by reducing the demand for clay, thereby contributing to greater long-term national food supply security.

According to China's National Coal Association, some 250-330 million tonnes of coal-gangue are produced annually in China, and it is estimated that by the end of 2007, China had piled up an estimated 5.0 billion tonnes of coal-gangue. The coal-gangue brick subsector presently represents 2.0 percent of the total output of the entire Chinese brick sector, with an annual production of approximately 20 billion bricks. However this figure is increasing rapidly due partly to government efforts to promote non-clay-based brick production.

The coal-gangue brick-making process has a number of distinguishing factors from that of clay-based brick-making, but the most obvious difference is that the coal-gangue brick-firing process does not require additional fuel to be burned to fire the bricks as the coal-gangue bricks themselves contain enough coal particles to drive the firing process – presenting coal-gangue enterprises with a significant fuel cost saving. However, coal-gangue brick factories use considerable amounts of electrical power in the brick production process, which costs the larger brick-making enterprises millions of yuan per year in electricity bills.

As part of the 'China Climate Change Partnership Framework' programme, which is funded under the UNDP-Spain Millennium Development Goals Achievement Fund (MDG-F), UNIDO in partnership with the Chinese Ministry of Agriculture is implementing the project 'Promoting Waste Heat Recovery for Power Generation within the Chinese Coal-Gangue-Brick Sector'. This project aims to promote the application and deployment of waste heat recovery power generation (WHRPG) throughout the Chinese coal-gangue brick sector, firstly as a way to reduce the sector's GHGs and hence reduce its impact in terms of climate change, while at the same time helping coal-gangue brick enterprises to reduce operational costs by reducing their energy bills, and hence increase their profits.

The project centres around a number of pillars of intervention. Firstly promoting and disseminating well-researched and developed technical support and self-assessment packages for use by brick factory operators/owners to determine the feasibility and benefits that WHRPG can yield in terms of their own operations. Secondly, the construction of two working WHRPG plants with two separate commercially-operating tunnel kilns using coal-gangue bricks. Thirdly, the development of a set of policies and regulations designed to promote replication and sustainability of the WHRPG application throughout the Chinese coal-gangue brick (and general brick) sector.

The project has determined that WHRPG investments in the 1.0 to 1.5 MW range generally have attractive payback periods of four to five years and posttax internal rates of return of 20 to 25 percent. Depending on the size of the brick enterprise, a WHRPG system can meet anywhere up to 100 percent of the factory's electricity needs.

In terms of environmental performance, these systems provide a meaningful way for coal-gangue brick enterprises to reduce their environmental and climate change impact. Based on the displaced national grid electricity, which is generated using coal, the two project pilots will be generating annual CO₂ emission reductions in the order of 6 328 and 5 796 tonnes respectively.

Case study 2: Siam Cement Group, Thailand

The Siam Cement Group (SCG) is a leading business conglomerate in Thailand with over 223 companies in 24 countries worldwide and more than 30 000 employees. Its five core businesses are SCG Chemicals, SCG Paper, SCG Cement, SCG Building Materials and SCG Distribution.

Both SCG's vision and business philosophy are central elements that lead the company to achieve sustainability. SCG's vision is to become a well-recognized innovative workplace; a role model in corporate governance; and a sustainable development regional market leader which contributes to the sustainable progress of business ethics with responsibility to all stakeholders by 2015.⁸² In 1995 the company established its Sustainable Development Committee in charge of enacting sustainability targets and developing implementation guidelines for every business unit. In 2008, the committee created the Sustainable Development Implementation Guideline in order to provide a framework for effective implementation and facilitate coordination between different business units.⁸³

SCG has become a 'green' business through the adoption of two main strategies: Green Process and Green Products.

Green Processes involve the research, development and improvement of production processes. Through the use of environmentally friendly technologies and the application of the three R's (Reduce, Re-use, Recycle) the company is able to maximize energy and resource efficiency and reduce the generation of pollution and waste. SCG has set the target for reducing the emission of GHGs by 10 percent compared to 2007 levels by 2020. This target led to a 1 percent reduction in energy use and a 16 percent use of alternative fuels in 2009. Moreover, the Waste Heat Power Generator System that uses waste energy from the manufacturing process to generate electricity has resulted in the reduction of 300 000 tonnes of GHG emissions in SCG Cement.

In addition to this, SCG is the first company in Thailand to adopt the Green Procurement initiative to improve its sustainable business practices, through the application of an environmental management system that covers its entire supply chain.

The strategic target for Green Products involves the research and development of high value products and services for consumers under the SCG ecolabel (in accordance with ISO 14021), i.e. the creation of products with lower environmental impacts.

In addition to the many green initiatives, SCG has shown its commitment to corporate social responsibility (CSR) through the creation of environmental and social policies and programmes, for example youth capability enhancement, the zero-waste to landfill policy and environmentally friendly maintenance programmes. Improvements in the production processes and workplace environment, contribute to the overall well-being of the surrounding communities in terms of health, education and quality of life.

⁸² ESCAP. Pitchayanin Sukholthaman, EDD, EPS. RL; NOT SURE ABOUT THIS

⁸³ SCG. Available at http://www.scg.co.th/en/05sustainability_development/INDEX-1.html

Case study 3: Eco-industrial development as a strategy for sustainable industrialization in India

Eco-industrial development is a promising strategy for promoting sustainable industrial development, while tackling environmental, economic and social problems in a balanced manner. An eco-industrial *parkor* estate is a community of manufacturing and service businesses located together on a common property. Member businesses seek enhanced environmental, economic and social performance through collaboration in managing environmental and resource issues. By working together, the community of businesses seeks a collective benefit that is greater than the sum of individual benefits each company would realize by only optimizing its individual performance.

In the APR, China, India, Japan, Republic of Korea, Thailand and other countries have established programmes to transform existing industrial parks or estates into eco-industrial parks. In a few instances, these programmes aim at developing new parks, but most have started by implementing industrial symbiosis, seeking exchange of by-products among companies.

In India, Andhra Pradesh is one of the leading industrialized states; the Andhra Pradesh Industrial Infrastructure Corporation Ltd. owns more than 300 industrial parks. The state has, in cooperation with the German Agency for International Cooperation (GIZ), initiated an eco-industrial park project since 2008. The project aims to upgrade existing industrial parks, which are more than 30 years old and home to hundreds of small- and medium-sized firms across sectors such as chemicals, food processing and engineering. The retrofit includes adding modern sewage systems, solar lighting, green landscaping and storm water drains.

The project uses a comprehensive approach to introduce ecologically sound practices in India's industrial production. It addresses the prevailing problems in existing industrial parks and also contributes to the planning of new parks; it provides supportive capacity development where necessary.

The project shares and replicates lessons learned, and develops policy recommendations on the basis of these lessons. It also facilitates a stakeholder dialogue involving participants from the public and private sectors in order to promote sustainable industrial development in India. The environmental infrastructure of the industrial parks is strengthened with the building of expanded drainage and sewerage systems, common effluent treatment plants, storage and disposal facilities for hazardous waste, solar street lamps and other measures.

In terms of new industrial parks, there are plans to build a special economic zone in Andhra Pradesh, for which an eco-industrial assessment has already been successfully carried out. The relocation of polluting industries is also an important aspect of the project. To this end, the Eco-Electroplaters Park at Karaisalkulam near Madurai in Tamil Nadu is being established, to which some 45 companies are likely to move from their current locations in congested residential areas.

A number of individual industries have successfully boosted their resource efficiency by using the 'EcoProfit' tool to help bring savings in their consumption of materials and energy. The 14 industries supported by the project in the Hyderabad region that use electricity, coal, furnace oil and water have made aggregated financial savings worth more than INR20 million (US\$313 687 +).

Seven Indian state governments have now asked for similar facilities to be established to serve their own industries.

Case study 4: ISA Tan Tec-Resource Efficiency⁸⁴ – Ho Chi Minh City, Viet Nam and Guangzhou, China

ISA Tan Tec is a German/Chinese manufacturer of high-quality leather that was founded in 1993 by Thomas Schneider.⁸⁵ Its two plants, located in Ho Chi Minh City and Guangzhou, produce ‘Low Impact to Environment’ leather, which is based on calculating the CO₂ emissions per square feet of leather produced.⁸⁶ The manufacturing process uses 30 percent less energy and 50 percent less water, and emits 35 percent less CO₂ than industry standards derived from the British Leather Technology Centre. In addition to this, energy and water consumption is continuously monitored and analysed for possible reductions. The company’s green efforts have been very successful to date; in a period of 18 months, the ISA Tan Tec plant in Guangzhou, China, managed to reduce electricity consumption by 76 percent and heavy oil use by 28 percent.⁸⁷ Moreover, the solar plants at the tannery generate 30 000 litres of hot water per day.⁸⁸

ISA Tan Tec’s newest ecological tannery in Ho Chi Minh City, Viet Nam, is part of a subsidiary called Saigon Tan Tec Leather Limited, which officially opened for operation in January 2010. The tannery has a similar approach to sustainability as the Guangzhou plant. Solar panels are used to heat water for the tanning process and during the drying process, water condensed from the leather is re-used as processed water. The tannery is also equipped with wind turbines, which drive the pumps for the water supply. In addition, green roofs provide insulation against high temperatures and humidity.⁸⁹

According to its founder, Thomas Schneider, there is an increasing demand for environmentally friendly leather production. Schneider stated that ‘green’ valued companies are better equipped to get through the global financial crisis, “in this way, we want to make it clear that companies with ‘green’ values, such as managing resources efficiently and sustainably, will make it through the global crisis in significantly better shape.” The tannery is projected to produce 2 million m² of leather for brands like *Timberland, Rockport, Merrell, New Balance, Keen, Simple* and *Hush Puppies*.⁹⁰

Case study 5: Sunlabob rural electrification project in Vientiane, Lao PDR⁹¹

The microenterprise Sunlabob is a private sector renewable energy provider that operates in remote regions where there is little or no access to on-grid serviced electricity. Its core philosophy is that profit-making organizations are the best catalyst for sustainable economic development through the provision of managerial, technical, and financial resources needed to meet social and environmental challenges. Their business model is an excellent example of a green business, which helps to reduce poverty and reduce GHGs while still making a profit. Since 2001, Sunlabob has installed over 5 600 renewable energy systems in 450 villages across Lao PDR, and based on this success, opened new branches in Bhutan, Cambodia, Indonesia, Timor-Leste and Uganda.

⁸⁴ ESCAP. 2010. *Green Growth Capacity Development Programme*,

⁸⁵ CSR Wire. 2009. *ISA Tan Tec manufacturer of Lite(TM) leather announces “Topping Out” party in Saigon*, Available from http://www.csrwire.com/press/press_release/27354-ISA-Tan-Tec-Manufacturer-of-Lite-TM-Leather-Announces-Topping-Out-Party-in-Saigon, (Accessed 22 February 2010.)

⁸⁶ ISA Tan Tec. 2009. *About*, Available from <http://www.liteleather.com/about.html>, (Accessed 22 February 2010.)

⁸⁷ Shan. 2009. *Leather manufacturer ISA Tan Tec To spend \$8.7 M on new Vietnam-based tannery*. Available from <http://blog.sustainablog.org/leather-manufacturer-isa-tan-tec-to-spend-87m-on-new-vietnam-based-tannery/>, (Accessed 22 February 2010.)

⁸⁸ Ibid.

⁸⁹ Ibid.

⁹⁰ Hung. 2010. *First eco-tannery comes online in Binh Duong*, Available at <http://english.thesaigontimes.vn/Home/business/environment/8517/>, (Accessed 22 February 2010.)

⁹¹ ESCAP. 2010. *Green Growth Capacity Development Programme*.

Only 58 percent of the population in Lao PDR has access to grid electricity, most of which is concentrated in urban areas. Therefore, most rural people rely heavily on fuelwood or kerosene lamps to meet their energy needs. Dependence on such sources, however, can exacerbate the rate of deforestation, incidence and severity of forest fires and chronic respiratory illness, as well as increase carbon emissions. In light of these dangers, there is a clear and present need for inexpensive, reliable, easily maintained and low-impact alternative energy sources.

In response, Sunlabob provides solar lantern charging services through a selected and well-trained network of franchises. Village households pay a recharging fee and rent the portable and rechargeable solar lanterns from a solar recharging station instead of buying kerosene lamps every time. A solar lantern lasts for ten hours and once finished is returned to the charging station. The recharging station is located in the centre of the village for easy access for households and is operated by village entrepreneurs under the franchise agreement with Sunlabob. The charging stations can recharge 24 to 144 lanterns depending on the size of the solar array and battery station. By taking advantage of economies of scale, charging stations offer affordable recharging prices for village households, which are similar or cheaper than the price of kerosene lamps. Sunlabob provides managerial assistance and technical training for village technicians to perform the installation and day-to-day maintenance of photovoltaic (PV) solar equipment.

Solar lantern recharging systems have brought co-benefits to various stakeholders. Village households can enjoy longer night hours and use this time for studying or extra income-generation activities. Moreover, they can enjoy a healthier and better quality of life because solar lanterns do not emit smoke or gas. Village entrepreneurs make profits by collecting a recharging fee and even though it is not a major income stream it is still a reliable and stable income source. Village technicians can learn a marketable skill and improve their knowledge and technical skills through Sunlabob's training. Furthermore, by using renewable energy and reducing their reliance on fuelwood and kerosene the villagers can reduce GHGs.

By providing PV solar cells as an alternative to fuelwood and kerosene, Sunlabob has improved the access to energy, increased green jobs and skills, mitigated carbon emissions, reduced poverty and enhanced the rural poor's resilience to climate change.⁹²

Case study 6: GERES New Lao Cook Stove (NLC) Project in Cambodia

The GERES group is an independent, non-profit microenterprise that since its establishment in 1976 in France, has been promoting sustainable development worldwide by leading innovative development projects. Since 1994 GERES Cambodia has worked to increase the sustainability of ongoing renewable energy services with the aim of preserving the environment and improving the lives of the Cambodian people.

As biomass is the main source of energy for household cooking and industrial needs in Cambodia, the GERES projects in Cambodia focus on how to improve current energy practices in order to make them more efficient and less polluting. According to GERES Cambodia, the projects ensure a renewable supply of local energy resources and can promote economic development locally, creating new job opportunities and products that are in line with local needs and resources.⁹³

Since 2008, GERES Cambodia has conducted a major biomass-based energy programme aimed at establishing a model for sustainable energy development in the country. The programme is based on a market approach (via small, rural entrepreneurs) and aims at "demonstrating and validating economically and environmentally sustainable energy end-use and supply models".⁹⁴

⁹² This section was prepared by ESCAP, Green Growth Capacity Development Programme, 2010.

⁹³ GERES Cambodia: http://geres-cambodia.org/about_us.php

⁹⁴ Ibid.

GERES is also engaged in activities further up in the value chain, including collaboration with stakeholders to guarantee the sustainability of biomass fuel and efficient biomass cooking devices with the ultimate goal of demonstrating a sustainable local development model which is based on local community energy self-sufficiency.

GERES has assisted in the production, marketing and distribution of cook-stoves for domestic use since 2003. These cook-stoves are more energy-efficient than the traditional ones found in local markets (the average NLC cook-stove uses 22 percent less fuel), reducing the need for fuelwood, which contributes to the deforestation problem in Cambodia. Besides its significant environmental benefits, the NLC project also has important health benefits that include reduction of mortality of women and children caused by excessive pollution during cooking.

Over 1.3 million NLC stoves have been sold in Cambodia since 2003. GERES Cambodia reports that the significant sum of US\$9 million has been saved by users and more than 769 000 tonnes of CO₂ emissions have been avoided since that year.⁹⁵ Moreover, there have been drastic reductions of air pollution in homes and kitchens through reduced smoke emissions.

In February 2011, GERES received the Partnership for Clean Indoor Air Global Leadership award in the context of its fight against indoor pollution through the production and promotion of improved cook-stoves in Cambodia.

⁹⁵ GERES: New international recognition for GERES New Lao Stove Project in Cambodia. Press release 24.02.2011 (<http://geres-cambodia.org/pdf/prpcia.pdf>)

8 Commercial services

Services sector

The services sector is the largest sector in the world, accounting for more than 70 percent of global output. The APR accounted for almost 26 percent (US\$6.2 trillion in 1997) of the global service sector output of US\$23.9 trillion in 1997.⁹⁶ The services sector makes an important contribution to GDP in most countries, providing jobs, inputs and public services for the economy. In most APR countries, the sector accounts for about 62 percent of GDP on average; in 2010, the contribution of the services sector to GDP was 43 percent in China, 55.2 percent in India, 73.8 percent in Japan and 58.2 percent in Republic of Korea.⁹⁷ These exceed the contribution from other important sectors including agriculture and industries.

The services sector, with its direct and significant contribution to GDP, job creation and poverty reduction, provides crucial inputs to the rest of the economy, and has a significant effect on the overall investment climate, which is an essential driver for any kind of growth including green growth.⁹⁸ Furthermore services sectors such as health, education, water and sanitation are also crucial in achieving social development objectives.

While services tend to be less material and energy-intensive per dollar of output than manufactured growth, the ‘services transition’ does not automatically reduce the use of material and energy. The services sector is fundamentally dependent on industrial economy, and the growth in services sectors demands more of the resources from the environment, for example telecommunications and information services require electronic hardware (and power), while trade, transport, and logistics services require vehicles, fuel and significant investments in physical infrastructure. However, past experiences clearly indicate that economic growth in the absence of environmental safeguards puts environmental quality at risk.⁹⁹

Services are important determinants of the environmental performance of the ‘product sectors’ because it is the combination of products and services that creates value. “Greening’ the trajectory of service-sector development—and using services to green the “product economy”—is critical to the long-term sustainability of economic development in Asia-Pacific’s emerging economies. This means that green, service-led business models must provide more eco-efficient alternatives by reducing the energy intake and increasing the resource efficiency”.¹⁰⁰ Moving

⁹⁶ Ghani, E. & Kharas, H. 2010. *The service revolution, economic premise*, May 2010, Number 14, The World Bank

⁹⁷ International Monetary Fund. 2011. *World economic outlook database*, April 2011: nominal GDP list of countries. Data for 2010.

⁹⁸ Cali, M. et al. 2008. *The contribution of services to development: The role of regulation and trade liberalization*, Project Briefing, No. 17, ODI.

⁹⁹ Stoughton, M. & Venkatachalam, A. 2010. *Green services and emergence and recovery from the global economic slowdown in developing Asian economies*. ADBI Working Paper 209. Tokyo, Asian Development Bank Institute. Available at <http://www.adbi.org/working-paper/2010/03/31/3648.green.services.emergence.recovery.gfc.asia/>

¹⁰⁰ Ibid.

away from the business-as-usual paradigm, they must also consider inclusive growth and help in reducing poverty. The following sections will discuss how APR countries have tried to manage the development of various service sectors and provides case studies of greening services sectors.

Commercial services

The commercial services sector plays a particularly important role in terms of its impacts on employment and GDP. Many commercial services are key inputs to all or most other businesses, for example infrastructure services such as housing, energy, telecommunications and transportation; financial services which facilitate transactions and provide access to finance for investment; legal and accountancy services which are part of the institutional framework required to underpin a healthy market economy. These services sectors provide direct inputs to employment, can have a much wider impact on overall business performance and the level of investment, and hence growth and productivity in the economy.¹⁰¹ Therefore, greening these sectors can make a huge impact on the economy, jobs, environmental quality and poverty reduction.

Energy and resource-efficient technologies are needed throughout the commercial sector in order to meet the estimated 80 percent reduction in consumption required to achieve sustainable development in the APR.¹⁰² The APR has enormous potential to dramatically boost resource efficiency by generating new kinds of clean technology industries that can jumpstart economic growth while guarding against environmental degradation.¹⁰³ In order to do so, governments must be active in fostering a green services sector by investing public funds directly in sustainable commercial services and providing financial incentives to ensure that green options are economically viable for businesses and consumers. Publicly-funded initiatives can also introduce new technologies that can set the bar for higher environmental standards.¹⁰⁴

The economic crisis and the past experiences of economic growth without sound environmental safeguards provide an opportunity for broad policy reform in APR nations. This will ensure that the tax burden is shifted away from economic “goods” such as jobs, income, fuel-efficient vehicles and other activities providing environmental and social benefits, to economic ‘bads’ such as carbon emissions, pollution and dirty and inefficient commercial practices.¹⁰⁵ The potential for engaging the private sector as an active partner of governments, and for improving environmental performance, is growing. An increased environmental performance in commercial sectors may remove trade barriers and attract international funding for training and capacity building to facilitate the access to, and diffusion of clean energy technologies in developing countries.

Several APR governments have an important body of experience with market-based instruments. An incentive system of subsidies, taxes and regulations that encourage environmentally responsible behaviour in the private sector needs to be more widely promoted throughout the APR. Microcredit schemes and time-bound tax incentives for the commercial services sector can also be more fully developed to prevent the reversal of the sector’s rapid growth in recent years.

¹⁰¹ Cali, M. *et al.* 2008. *The contribution of services to development: The role of regulation and trade liberalization*, Project Briefing, No. 17, ODI.

¹⁰² *Resource efficiency: economics and outlook for Asia and the Pacific*, 2011. Available at: http://www.unep.org/dewa/Portals/67/pdf/Resource_Efficiency_EOAP_web.pdf

¹⁰³ *Ibid.*

¹⁰⁴ UNEP. 2011, *Towards a green economy: pathways to sustainable development and poverty eradication – a synthesis for policy makers*, Available at www.unep.org/greeneconomy

¹⁰⁵ *Preview: Green growth, resources and resilience: environmental sustainability in Asia and the Pacific*, 2010. Available at [http://www.unescap.org/esd/environment/flagpubs/GGRAP/documents/Green%20Growth-16Sept%20\(Final\).pdf](http://www.unescap.org/esd/environment/flagpubs/GGRAP/documents/Green%20Growth-16Sept%20(Final).pdf)

Ecocertification and ecolabelling have also emerged as a response to the growing market demand for environmentally sound goods and services, with some consumers willing to pay a premium for certified products. Competitive forces are driving improvements in environmental performance of key sectors, such as commercial buildings, tourism, automobiles and communication technologies. In a worldwide survey, 38 percent of the respondents said that environmentally friendly tourism was a consideration when travelling and 34 percent were willing to pay more to stay in environmentally friendly hotels.¹⁰⁶ Such opportunities will expand in the region as the challenges of operating in a resource-constrained world become more apparent and consumers become increasingly aware and demand more socially and environmentally responsible action by corporations.¹⁰⁷

Greening the commercial sector provides an opportunity to couple much-needed environmental benefits with massive socio-economic impact through long-term economic benefits and economic incentives for the private sector, as well as creating well-paying jobs for the general public. For example tourism represents 5 percent of global GDP and contributes to 8 percent of total employment. It also ranks fourth in the global export agenda and accounts for 30 percent of the world's export of commercial services with an industrial value of US\$1 trillion a year. Greening the tourism sector will not only reduce carbon emissions from the sector, which accounts for 5 percent of global carbon emissions, but will also help in income generation and poverty reduction through sustainable means.¹⁰⁸

Greener commercial services in APR countries

The transition to a green commercial services sector is occurring to a varying degree in the developed and developing countries of the APR. With the exception of energy services companies,¹⁰⁹ green economy is still an emerging area for other commercial services sectors. Countries are acknowledging the need to address the commercial sector by working to enable producers to afford cleaner mechanisms, as well as to educate consumers about the environmental impacts of their purchasing. The tourism policies of almost all countries in Asia touch upon the concept of sustainable tourism with developing countries like Viet Nam, Cambodia and Nepal emphasizing ecotourism. Many commercial hotels and resorts in the region have opted to “green” their businesses to an extent by conserving water and electricity and in some cases helping to conserve natural ecosystems. Some enterprises have found a niche market in environmentally friendly tourism businesses. ‘Sixth Sense’ hotels and spas in Asia with its chain of hotels in five countries is one such example; numerous hotels in Asia now offer greener options to limit water usage and there are upcoming hotels like URBN hotels in China, which are retrofitting buildings and aiming to be carbon neutral.¹¹⁰ Apart from such hotels there are many sustainable and ecotourism initiatives in countries like Nepal and Bhutan.

Green buildings are mushrooming in most Asian countries, with countries like Malaysia, Singapore, China, Hong Kong S.A.R. and India already committed to green buildings. The Government of China has a national standard for green buildings and has many good examples such as Vantone Eco-City Legacy Homes, a flagship green residential project¹¹¹ that passed the country's highest green building standard and was awarded three stars. The Government of Hong Kong S.A.R.

¹⁰⁶ UNEP. 2011. *Towards a green economy: pathways to a sustainable development and poverty eradication*.

¹⁰⁷ *Preview: green growth, resources and resilience: environmental sustainability in Asia and the Pacific*, 2010. Available at: [http://www.unescap.org/esd/environment/flagpubs/GGRAP/documents/Green%20Growth-16Sept%20\(Final\).pdf](http://www.unescap.org/esd/environment/flagpubs/GGRAP/documents/Green%20Growth-16Sept%20(Final).pdf)

¹⁰⁸ <http://www.unep.org/climateneutral/Topics/TourismandHospitality/tabid/151/Default.aspx>

¹⁰⁹ ADBI green services.

¹¹⁰ UNEP GRID ARENDAL.

¹¹¹ Market news: a round up of green building news from across the region, *Sustainability Asia*, Issue 3.

gazetted the “Buildings Energy Efficiency Code”, the implementation of which is expected save around 2.8 billion kWh resulting in reduction of 1.96 million tonnes of carbon emissions. In 2009, the Malaysian Government launched the Green Building Index, a certification standard modeled on international green building rating systems including LEED and BREAMS.¹¹² The World Bank believes that by 2015 nearly half of the world’s new construction will take place in China and green commercial buildings may be the norm in that market within the next decade. Considering that commercial and non-commercial buildings are also one of the major sources of energy consumption in the urban Asia, the movement towards green building is remarkable.

Ecolabelling and ecotourism initiatives are among the green commercial actions taken by many countries in the region. Ecolabelling projects focusing on organic aquaculture are present in Viet Nam, Indonesia and Thailand. Cambodia launched a ‘Wildlife-friendly Products’ project that links community agricultural cooperatives to biodiversity conservation. Under this partnership, both environmental conservation and poverty alleviation have been achieved. The Republic of Korea has also established green consumption initiatives to better inform and educate the public about the environmental impacts of purchased products.

Viet Nam is a good example to showcase how APR countries are moving to green development within the commercial services sector. Small and medium enterprises are a critical part of the rapidly growing Vietnamese economy. However, their inefficient use of energy not only narrows profit margins, but also contributes to Viet Nam’s swift increase in CO₂ emissions. To help green these businesses, with funding from the GEF and technical support from UNDP, the Government of Viet Nam is taking the initiative to promote energy conservation in five key sectors: brick, ceramics, textiles, paper production and food processing.¹¹³ These commercial enterprises are becoming the driving force of the economy and contribute greatly to job creation within the country. In the past four years the initiative has supported more than 400 businesses, resulting in cumulative energy savings of 156 kilotons oil-equivalent in the five priority sectors.

CASE STUDIES

Case study 1: Singapore – green building policies and practices in the commercial sector¹¹⁴

Singapore is a leader in the APR for establishing green buildings and has witnessed a tremendous increase in the number of green buildings such as green offices, schools, industrial parks and even green shopping malls. Behind this surge in green buildings and sustainable construction are efforts by the Building and Construction Authority (BCA), a national agency with an ambitious plan to ensure that Singapore meets its target of greening 80 percent of its building stock by 2030. The BCA launched its Green Mark Scheme in 2005 and has since then attracted many public, private and commercial buildings to go green.

The BCA Green Mark is a green building rating system to evaluate a building for its environmental impact and performance. The assessment criteria cover the following key areas: energy efficiency, water efficiency, environmental protection, indoor environmental quality and other green features and innovation. Depending on the overall assessment and point scoring, the buildings can get a BCA Green Mark Platinum, GoldPlus, Gold or Certified rating. The BCA has revised the criteria four times since 2005 to keep the green measures innovative and cutting edge. In an effort to ensure that the target of 80 percent green building by 2030 is met, the government mandated that all new constructions since 2008 should at least meet the minimum criteria set by the Green Mark.

¹¹² Ibid.

¹¹³ Available at: http://www.undp.org/asia/SuccessStories/ESD/VNM_Jun2010.html

¹¹⁴ See <http://www.bca.gov.sg/GreenMark/others/gbmp2.pdf>

To encourage the private sector to create green buildings, the BCA introduced a S\$20 million Green Mark Incentive scheme. The scheme provides direct monetary incentives to the developers who achieve a green building rating above the basic certified level. Under the second Green Building Master Plan the BCA has set up a fund of S\$100 million (US\$79 000) as “The Green Mark Incentive scheme for Existing Building” to jumpstart greening the existing buildings in the private sector. The effort has paid off and by the end of 2011 more than 840 buildings were certified by Green Mark, including many commercial buildings. City Square Mall is one example of a Green Commercial Building.

City Square Mall is the first mall in Singapore to get the Green Mark Platinum Award by the Building and Construction Authority (BCA). The BCA Green Mark Platinum is awarded to green projects that effectively demonstrate 30 percent energy and water savings, as well as environmentally sustainable building practices and innovative green features. The Mall has over 700 000 square feet of gross retail space and about 200 stores that cater to the lifestyle of middle-income families. It is also Singapore’s first ecomall to be integrated with a 49 000 square feet (4 600 m²) urban park named City Green. City Green is designed to provide a learning experience about ecology and the natural environment.

Some of the green measures taken by the shopping centre include:

- Real-time display of indoor environmental performance;
- Eco-restrooms with waterless urinals which save about 3 000 m³ of water annually;
- Designated parking lots for electric and hybrid cars;
- A twin chute pneumatic waste disposal system that separates dry and wet refuse for recycling purposes;
- Driveway motion sensors to control lighting level at B4 car-park that save about 51 300 kWh a year;
- Lifts, escalators and travellers designed with autolighting, ventilation fans and slow-down features;
- High-efficiency air-conditioners that use less electricity, preventing the emission of more than 4 000 tonnes of CO₂ annually;
- Condensate water from the air-conditioning system that is recycled, saving enough water to fill two Olympic-sized pools yearly;
- Sensors to ensure that the landscaped greenery is not watered on rainy days;
- Variable air volume technology in the air-conditioners to moderate the mall’s temperature;
- Use of more cooling coils in the air-conditioning system to treat air for better control of indoor humidity.

The green measures have helped the shopping centre to reduce carbon emission of over 5 000 tonnes per year. They have resulted in very tangible economic benefits for the shopping centre that include annual electricity saving of 11 million kWh per year and annual water saving of over 20 000 m³.

The socio-economic impacts of green buildings apart, from saving of resources, are numerous. The shopping centre alone has provided jobs for green developers and construction workers, and continues to provide an environmentally healthy space for over 200 tenants and thousands of patrons. BCA’s training academy has trained about 3 200 workers to date in sustainable design and construction and has plans to train 18 000 people in sustainable design creating a “green collar” workforce.

In the service economy, productivity gains for healthier indoor spaces are worth anywhere from 1 to 5 percent of employee costs. By focusing on measures to improve indoor environmental quality such as increased ventilation, day lighting, outdoor views and low-toxicity finishes and furniture, people in green buildings show a remarkable reduction in sick building syndrome.¹¹⁵

Case study 2: Phasing out incandescent lamps through lighting market transformation in Viet Nam

Traditional incandescent lamps (ILs) are not energy efficient and it is estimated that if every nation switched from incandescent lamps to energy-efficient alternatives like compact fluorescent lamps (CFL) that last ten times longer, this would cut the world's electricity demand for lighting by over 2 percent, saving around 800 million tonnes of carbon emissions.

In Viet Nam, 30 to 35 percent of national electricity consumption used for lighting is in residential households. Over a four-year period beginning in August of 2010, this project aims to phase out the production and use of ILs. Led by UNEP and supported by the GEF, the project is co-financed by the Vietnamese Government (US\$8.64 million in cash and kind) and by lighting manufacturing companies in Viet Nam (US\$13.47 million in cash and kind). The project seeks to transform current production and sales from being dominated by ILs to adopting high-quality CFL products that will reduce electricity demand and GHG emissions. It will also forge a path for promoting light-emitting diode (LED) technology across numerous other sectors of the economy.

The core partners in this project are the Institute of Strategy and Policy on Natural Resources and Environment under the Ministry of Natural Resources and Environment in collaboration with the Ministry of Industry and Trade, the Ministry of Science and Technology, and Viet Nam-based IL and energy-saving lamp (ESL) producers. The project has four separate components:

Component 1: *The Local Lighting Business Capacity Enhancement Programme* sets the national market on a path to integration with the global market. Some of its activities include:

- Market research of the lighting industry in Viet Nam;
- Development of technical aids and guidebooks on new technology applications;
- Completion of training courses on ESL production and technologies and their quality assurance/quality control;
- Business transformation plans agreed for several ESL products;
- Technical support for proactive local manufacturers.

Component 2: *The Improved Quality Assurance and Quality Control Framework* helps consumers to differentiate between low-quality and high-quality lighting products. The goal is to strengthen and harmonize quality- and performance based standards and procedures in Viet Nam, including compliance in nationally- and internationally-traded lighting products. The expected total outcome in Viet Nam is for all sold lighting products to meet defined standards of environmental and energy performance, which are in line with the GEF project guidelines. Seminars and workshops are jointly organized by the United States Agency for International Development (USAID).

Specific outcomes:

- Energy, environmental, and quality standards for ESLs are strengthened and harmonized in line with regional or international best practices;
- A national quality inspection system for ESLs is established;

¹¹⁵ An average reduction in symptoms of 41.5 percent on an annual basis, according to 17 academic studies reviewed by researchers at Carnegie Mellon University (Center for Building Performance and Diagnostics, CMU).

- Capacity of two testing labs is strengthened;
- A ‘green customs’ programme to reduce import/export of ILs and low-quality CFLs is implemented; and
- Capacity of civic authorities to handle and safely dispose of mercury in ESLs and to engage in recycling is enhanced.

Component 3: *Market development and consumer education and awareness* throughout the country were tailored to the cultural and economic setting of Viet Nam. Several current initiatives include the adoption of a national mascot and design label that represent and signify the importance and goals of this project. Also, specialized educational curricula in schools as well as a nationwide awareness-raising campaign, including support from various celebrities may be utilized to shape consumer actions. Other activities include smaller pilot projects in non-public sectors for the most efficient and effective IL replacement products.

Component 4: *Institutional support and ESL policy* – for the development of an ESL policy that is in line with current Vietnamese Government policies.

The objectives of these components are to gain a clear vision and strategy to phase out the production and consumption of ILs and to establish a working legal framework for ESL businesses. By the project’s end, the goal is for 75 percent of the 95 million locally-produced and purchased ILs to be phased out and replaced by CFLs. Expected completion of the project is 2014.

It is estimated that by the end of the project 60 million ILs have been replaced with good quality CFLs and 25 million poor quality CFLs has been replaced with good quality CFLs; as a result GHG emissions will have been reduced by 2.302 million tonnes of CO₂ equivalent while the mercury content in CFLs has been brought down to the range of 3 to 5 milligrams per CFL.

The socio-economic impact of the project includes cost-saving for households and green businesses and for small and medium enterprises involved in lighting.

Case study 3: Thailand – sustainable tourism through the Green Fins Programme

Sustainable tourism through public-private partnerships has emerged as a leading green commercial service throughout the APR. Tourism is traditionally human- and natural resource-intensive, but as the Green Fins Programme demonstrates, when designed responsibly, tourism can drive the green services sector.¹¹⁶ The Green Fins Programme, initiated by the East Asian Seas Regional Coordinating Unit and supported by UNEP, established a public-private partnership among NGOs, local governments and private businesses in order to start a network of dive operators and divers who practise environmentally-friendly diving and snorkeling for the conservation of coral reefs. In 2007, this successful programme, which was initiated in the Philippines and Thailand in 2004, has now also expanded to Indonesia and Malaysia. The Green Fins Association of Thailand, an NGO, has taken the lead to introduce and implement Green Fins in Thailand through a number of marine conservation awareness-raising activities in local communities and schools.¹¹⁷ The programme runs in collaboration with the Phuket Marine Biological Centre (PMBC) and the Department of Marine and Coastal Resources. The contribution of the Green Fins Programme is tangible in Thailand. Since 2007, the country has networked with over 75 (mostly foreign) private diving companies and dive operators, as well as over 200 individuals from six different provinces

¹¹⁶ UNEP. 2011. *Towards a green economy: pathways to sustainable development and poverty eradication – a synthesis for policy makers*. Available at: www.unep.org/greeneconomy

¹¹⁷ Available at: <http://www.unep.org/roap/NewsandEvents/SuccessStories/GuardingtheSeas/tabid/6678/Default.aspx>

who all participate in the programme. Each has agreed to abide by the Green Fins Code of Conduct¹¹⁸ which includes:

- Increased awareness of good diving practices;
- Increased protective actions against coral reef destruction;
- Organized clean-up/collection and disposal of garbage at reef sites;
- Data collection and information dissemination; and
- Improved overall health of coral reefs.

To ensure that the data collected by Green Fins members become useful information for synthesis, the establishment of a Green Fins Online Database was also initiated. This was further supported by the establishment of a Green Fins Web page and Online Assessment System that will provide access to the network and provide online updating of information and also enable the dissemination of the results of the assessment through the Web site.¹¹⁹ The Green Fins Programme makes an important contribution to the amounts of scientific data about the coral reefs of Thailand. Aside from social and scientific monitoring of coral reef health and tourist and dive operator behaviour, the programme's standards are often assimilated into the environmental values of visitors staying on tourist-crowded Koh Samui in Thailand, where some diving schools endorse and educate their students on Green Fins recommendations and Code of Conduct before taking them out to dive the coral reefs.¹²⁰ The strengths of the project include heavy involvement and support by the diving industry, strong scientific support through PMBC and Reef Check and well-structured project design, planning, management and execution.

LESSONS LEARNED

The commercial services sector links green governmental policies with income-generating activities; without greening of the commercial services sector, the ability to create new green growth jobs is severely diminished. However there are some identifiable challenges in greening the commercial sector. First, environmental performance standards need to be set taking individual contexts into account and accepted in the targeted markets, such as Green Mark in Singapore. Some of the countries need to build capacity for targeted research and context-specific development of the standards that are environmentally sustainable and economically viable. Second, the new green product or service offered must be of high quality, as poor quality products undermine consumer confidence. Third, the initiative must be profitable in the long term and the investments made in green measures must be recovered in a relatively short time period. Fourth, the information regarding economic savings and the time period for payback should be effectively communicated by the experts, both to the government and the private sector. A lack of information on economic savings for projects such as that in Viet Nam tends to stagnate and reduce political will to adopt new green initiatives in the sectors. For the lighting industry, included in this analysis, this pertains to the lack of global policy consensus to back up, support and promote efficient lighting ventures on both the supply and demand sides of the sector.

One encouraging trend observed in the green development of commercial services is the independent steps from the private sector to set their environmental targets, such as the standards set by the Sixth Sense resorts and spa. This can also make the green development of commercial services entirely dependent on individual businesses, and result in ad hoc efforts at greening if not backed by a strong policy or regulation from the government. Although Asian countries are making progress on public-private partnerships, there is no systemic mechanism among governments to engage with the private sector and reliable modalities of public-private partnerships, especially in the developing countries of the APR.

¹¹⁸ Available at: <http://www.greenfins-thailand.org>

¹¹⁹ Available at: <http://www.greenfins-thailand.org>

¹²⁰ Available at: <http://www.unep.org/roap/NewsandEvents/SuccessStories/GuardingtheSeas/tabid/6678/Default.aspx>

Most of the initiatives for greening the commercial sectors have originated in developed countries. Lack of financial support, technology transfer and capacities is preventing developing countries from adapting green measures in commercial sectors despite the willingness shown by most governments for green economy. Creating partnerships with developed countries, the private sector, research organizations and technical experts would facilitate greening of commercial sectors in developing countries. As in the case of Viet Nam, support from international organizations and donors can also jumpstart green growth in commercial sectors. All the case studies discussed here have a huge possibility for replication in developing countries, if there can be meaningful partnerships to reduce the financial and capacity barriers.

The greening of the commercial services sector has just started in the APR and there is potential that commercial services such as the financial sector can tap into this. For instance, the markets in the United States and Europe provide ample opportunities for green investments and green bonds to the public. The markets in Asia are still falling behind in such initiatives.

9 Information and telecommunication

No other sector in the APR has perhaps seen faster growth than the information and telecommunication sector (IT). IT services exports, for example, increased from 29.5 percent in 2000 to 49.9 percent in 2009 in South Asia, based on World Bank data. The revenues from telecommunications alone contributed to about 2 percent of GDP in the APR in 2009. While its economic importance cannot be undermined, its growth and influence in the way people work and live is even more enormous. The number of people who will be using computers, mobile phones and the Internet in Asia will only increase in the future, greatly increasing the market for IT. Greening IT services has the power to shape the future of Asia towards greener economy and greener society.

The IT sector is unique from the perspective of green services as it helps to curb GHG emissions by making business operations much more resource-efficient. It has dramatically reduced the need for paper and for travel and has increased the energy efficiency of transport, fleet services and logistics. Conversely, ITs can have a significant impact on carbon footprints in terms of the effects from electricity use for computers, telephones and hardware. Globally the IT sector is responsible for 2 percent of total carbon emission.¹²¹ Energy use is the single largest contributor to the carbon footprint of the IT sector, which relies on the increasing use of electricity for manufacturing, distributing and running of equipment, applications and services. According to the World Summit on the Information Society, electricity demand by the IT sector for industrialized countries is between 5 and 10 percent of total electricity demand. Hence, the environmental performance of the IT sector as a whole should take into account its net contribution to CO₂ emission.

This dual nature of IT presents a good opportunity for ‘greening’ IT services by increasing IT application to reduce carbon emissions from other sectors and application of ‘greening’ measures within the IT industry and its services. In the transition to a green economy, IT will have to invest in greening the data clouds and applying green measures to its equipment, distribution, end products and services. Aside from reducing emissions, IT service sectors have huge potential to tap into socio-economic development and poverty reduction, as the health, education and agricultural information they supply in developing countries is invaluable. Green IT offers a way forward in this regard because of its potential to increase efficiency, while enabling social benefits, and offering economic competitiveness. In addition, Green IT initiatives can also influence users, including the younger generation, to be more environmentally responsible.

The APR has excellent technological capabilities and is currently playing a significant role in the information and communication technology revolution. The IT industry has realized the potential and the need for green action, which is also a business opportunity for many. It has responded by developing more efficient and therefore more environmentally friendly products, known as ‘Green Computing’ or ‘Green IT’.¹²² Japan and the Republic of Korea have already become global leaders in several areas of IT, including Green IT development and applications, and both China and India have the potential to integrate themselves into this technological advance. China has emerged as a manufacturing industry giant, producing high-end technology equipment, and India as a leading

¹²¹ Available at: <http://www.unep.org/climateneutral/Topics/Informationandcommunicationtechnologies/tabid/147/Default.aspx>

¹²² Available at: <http://www.unep.org/climateneutral/Topics/Informationandcommunicationtechnologies/tabid/147/Default.aspx>

software-producing country. Both are setting the stage for other countries in the region to benefit from the growth of the manufacturing and service industries, in which Green IT can play a vital role.¹²³

Throughout the APR, the more advanced industrialized countries are looking for opportunities to invest in the less-developed economic regions, creating strong economic ties involving technology transfer. IT is being relied upon for the regional management of enterprises and the support of collaborative research and development: all the major firms involved in the IT sector in the region have opened research centres in China and India and the governments show a strong political will to bridge the digital divide. The current situation of IT in the APR has a unique regional strength that can be used to promote green practices within the IT sector and influence other manufacturing and services sectors that IT has helped to regionalize.

E-waste from the IT sector is also one of the major factors to take into consideration while designing greener technologies. As consumers around the globe become more reliant on an ever-increasing array of electrical and electronic equipment, the amount of this equipment reaching end-of-life (e-waste) in the APR, poses a growing problem. Individuals, businesses, organizations and governments frequently upgrade their computers, mobile phones, televisions, audio equipment, electrical gadgets, photocopiers and printers, and discard the old equipment, much of which contains toxic chemicals or materials that are difficult to re-use. Massive amounts of e-waste also get exported to countries such as China, Indonesia, Cambodia and India from developed countries. The lack of effective environmental safeguards and controls in these countries make unsafe recycling commonplace.¹²⁴ Open burning and acid baths to recover metals are commonplace, and the residual toxic waste from such operations is simply discarded, allowing pollutants to seep into the ground and water. Recent studies have highlighted the dangers of working and living near these recycling facilities, particularly for children.¹²⁵

A core principle of sustainable development is the production of goods and services in ways that mimic natural processes, where energy is derived from renewable sources and ‘waste’ is simply raw material for another product or service. As electronic manufacturers and suppliers strive towards this goal, the evolving concept of ‘cradle-to-cradle’ production means that anything at the end of its useful life is remade into the same thing, or something similar.¹²⁶ Due to rapid technical innovation, this concept is difficult to apply to information and communication technologies. However, many products can be re-used or refurbished, and where this is not practically possible, products can be recycled for basic components, particularly ferrous metals, copper and aluminium or precious metals with positive benefits on raw material extraction and energy demand. Private companies like RICOH and others in Japan have created opportunities for resource efficiency and cutting edge research by making recycling a conscious objective.

Recycling facilities urgently need to be improved and countries can explore public-private partnerships with IT companies to recycle and re-use e-waste. E-waste, such as mobile phones, not only contains toxic substances like lead, cadmium and bromide, but also materials worth recovering like plastic and valuable metals. For companies manufacturing IT goods, there is considerable potential to recycle and re-use the materials within the industry and increase resource efficiency. Experiences for mobile waste recovery in China and the Extended Producer Responsibility System in Republic of Korea have proven that opportunities have emerged out of these problems in terms of increased CSR and creation of new jobs.

¹²³ http://www.unescap.org/EDC/English/Committees/CMG/CMG4-II/CMG4-II_4E.pdf

¹²⁴ <http://www.gao.gov/new.items/d081166t.pdf>

¹²⁵ For example, a study conducted by a Chinese medical school and published in 2007 in the journal *Environmental Health Perspectives* found that children in Guiyu had lead levels in their blood that were more than 50 percent higher than the limit for lead exposure set by the Centers for Disease Control and Prevention in the United States.

¹²⁶ Available at: <http://www.unep.fr/scp/waste/ewm/>

Together with enhancing resource and energy efficiency, Green IT measures have the ability to encourage inclusive growth and promote access to information. There is increasing evidence that IT is being used for development and poverty reduction in developing countries like India, Bangladesh, Sri Lanka and Nepal. In addition to creating direct employment in hardware, software manufacturing and different IT services for poor people, it can also bring the rural people closer to the market. ICT technologies can be used to increase efficiency, competitiveness and market access for developing country firms and entrepreneurs.

Greening the IT sector in the APR

The discourse on ‘greening’ the IT sector is fairly new though the development of the IT sector and its massive growth came at a time when there was already a growing awareness for sustainable development. The growing importance and influence of the IT sector regarding energy demand extends to all parts of the world, including the APR and the growth in demand for essential communication and computing technologies is greatest in developing countries. It is therefore important that both developed and developing countries develop their ICT infrastructure sustainably.

At the global level, the International Telecommunication Union, the technological arm of the UN, has an agreement with countries for a global standard to measure the effect of IT systems on global emissions, including estimates on how IT products can reduce emissions. Other UN organizations are also helping countries in their transition to green economy and at the regional level an e-learning facility on green growth has been recently established by UNESCAP, to build capacity for APR policy-makers. Despite some earlier policy dialogues there are no policies at the regional level to support Green IT but some countries in the APR have taken significant steps as in many cases, replacing old technologies with modern, sustainable alternatives can save money, improve health, generate green jobs and benefit the environment all at the same time.¹²⁷

Republic of Korea (ROK) is a possible leader in Asia for green economy with its commitment of KRW107 trillion (US\$87.7 billion) for green growth.¹²⁸ The ‘Green New Deal’ has included a total of KRW12 trillion (US\$9.5 billion) to investment in developing green technology over the next four years. Of these funds, KRW4.2 trillion will go to investing in areas such as Green IT products, building faster broadband networks, and investing in energy-efficient transportation systems. The remaining funds will be invested in R&D in 27 different green technologies, such as high-efficiency solar batteries, hybrid vehicles, high efficiency LEDs and smart grid technology. To make the IT industry more energy-efficient, ROK has adopted initiatives to spur private sector development of green hardware and IT services. For example, the ROK Government is instituting stronger certification requirements for manufacturers that want to use a green label on their IT devices, similar to Energy Star in the United States. The Korea Eco-Products Institute in the Ministry of Environment is also creating a carbon-labelling programme to show consumers the total amount of GHGs expected to be produced throughout the product life cycle.

Countries in the APR are also realizing the need for governments to work with the private sector and other experts and are in the process of identifying adequate solutions. Japan, another leader in greening services, established the Green IT Promotion Council in 2008, with IT-related industry groups, research institutes, universities, government bodies and others to work together to promote Green IT. The council has identified specific roles for the government and non-government institutions and has signed MOUs with United States’ groups and the EU for jointly working for Green IT. In an effort to encourage high environmental performance among Japanese companies, the council has also established awards for companies that are ‘green by IT’ and for those that are ‘green for IT’.

¹²⁷ UNEP. 2010. *Annual report 2009*, Available at: http://www.unep.org/PDF/UNEP_AR_2009_FINAL.pdf

¹²⁸ The Presidential committee developed a five-year plan to spend that money for green growth in July 2009.

In response to the growing problem of e-waste, countries like Republic of Korea, Japan and China have taken some definitive steps to promote recycling. A recycling campaign to collect old mobile phones in Japan was launched in November 2009 and involved 1 886 stores and supermarkets. The initiative collected 569 464 mobile phones containing precious metals amounting to 22 kg of gold, 140 mg of silver, 10 g of copper and 4 mg of palladium in only four months.¹²⁹ Some initiatives such as the ‘Waste Electronic and Electric Equipment/E-waste Management for Phnom Penh City’ are promising steps towards greener measures. The project aims to build national and local capacity in Cambodia on the inventory and environmentally sound management of e-waste by undertaking various activities, for example *E-waste manual on E-waste inventory* (Volume 1) and *E-waste management* (Volume 2). One of the major goals of the project is to disseminate lessons learned and provide training materials and guidance to other developing countries that have a similar situation to Cambodia.¹³⁰

Several governments across the APR have adopted E-government initiatives, which include IT options for citizens. For example, in Thailand tax returns are filed online and taxes can be paid electronically, eliminating much paper and travel. A number of governments in developing countries have started introducing online transactions to facilitate and streamline government service provisions within the IT sector.

In developing countries of South Asia, countries have attempted to use IT to uplift rural livelihood directly and indirectly. Leading this movement is the Grameen Bank which started to give small loans back in 1997 to Grameen Bank borrowers, mostly rural women to invest in a mobile phone. As the ‘telephone ladies’ of their villages, they purchased airtime at wholesale prices from Grameen Telecom and sold the telephone service to their neighbours at the market rate making a profit of nearly US\$1 000 a year, much more than the per capita income of US\$250.¹³¹ Telemedicine, i.e. providing medical consultations in rural areas, are still a relatively new concept but are slowly catching on in countries like Nepal, where the government has formally launched a rural telemedicine programme in 25 districts. These cases show the enormous reach and potential that Green IT has in poverty reduction and providing crucial services to the poor.

CASE STUDIES

Case study 1: Republic of Korea – Extended Producer Responsibility System to address e-waste

The ROK Government’s Extended Producer Responsibility (EPR) System requires manufacturers and importers to recycle a certain amount of their electric and electronic products. The system imposes certain quota for the recycling of wastes from the IT sector such as printers, copiers, mobile phones, batteries, fluorescent bulbs, TVs and computers. A total of 13 electronic products and seven types of batteries are included in the 24 items of the EPR policy. These electronic products have also become subject to the Act on the Recycling of Electrical and Electronic Equipment and Vehicles since 2008. As a result of the Act, preventative management efforts by the ROK Government have tightened restrictions on the use of hazardous materials.

The financial benefits of recycling 6.067 million tonnes of waste (both electronic and packaging materials) in the five years since the implementation of EPR in 2003, is estimated to be over US\$1.6 billion. In 2008, a total of 69 213 tonnes of plastic products were recycled, yielding an economic benefit of approximately US\$69 million. Furthermore, in a period of four years (2003-2006) the EPR system created 3 200 new jobs.

¹²⁹ Mohanty 2010 cited in **UNEP**. 2011, *Towards a green economy: pathways to sustainable development and poverty eradication*.

¹³⁰ **UNEP-DTIE-IETC**. 2009. *Pilot activities on WEEE/E-waste management in Phnom Penh city*, Report.

¹³¹ Available at: www.grameen-info.org

The environmental benefits of EPR are equally remarkable. By recycling the items subject to the EPR policy instead of landfilling or incinerating, CO₂ emissions have been reduced annually by an average of 412 000 tonnes. Moreover, it is estimated that as a result of these efforts, approximately 23 532 tonnes of GHGs (CO₂) from plastic landfill or incineration were prevented. Although the country's waste volume has gradually risen since 2000, the percentage of total waste volume recycled has also significantly increased. For example, in 1995, 72.3 percent of municipal solid wastes were land filled and 23.7 percent was recycled, whereas in 2007, 57.8 percent was recycled and 23.6 percent was landfilled.¹³² Furthermore, in 2007, 81.1 percent of the total waste was recycled.¹³³

This reduction in wasteland filling has opened the door for new businesses. ROK's Landfill Gas Recovery Project is a major CDM project, with a capacity of 50 MWh and production of 363 259 MWh in 2009.¹³⁴ This Metropolitan Landfill Power Plant had already reduced CO₂ emissions by 0.4 million tonnes between April and November 2007.¹³⁵ It is expected to further reduce a total of 7 million tonnes of CO₂ between April 2007 and April 2017. During the same ten-year period, the plant is also expected to save ROK US\$126 million. The plant also allowed ROK to reduce its oil imports by 530 000 barrels in 2009.¹³⁶

Case study 2: An IT company in Japan raises the bar for environmental performance for all IT industries

RICOH is one of the rare IT service industries in Asia that has won accolades for its environmental and social performance and has received much national and international recognition since 1998 as described hereunder:

- Ranked first four times in the Corporate Environmental Management Level Survey organized by Nikkei Inc;
- Ranked highest in the analysis of 205 IT companies conducted by the sustainable rating agency Oekom Research, Germany in 2011. Given the highest ranking for CSR by Oekom in its environmental ranking six times between 1998 and 2011;
- Won the 2003 World Environment Center Gold Medal 2003 became the first Asian company to receive the prize);
- Given the highest evaluation in environmental ranking organized by the Deloitte Tohmatsu Evaluation and Certification Organization, 2005-2008; and
- Chosen as one of the Global 100 Most Sustainable Corporations, 2005-2011.

Founded in 1936 in Japan, the RICOH Group engages in activities on a global scale that include the development, production, marketing, after-sales services and recycling of office equipment including copiers and printers in five regions around the world (Japan, the Americas, Europe, China, and the APR). It has offices all around the world with 227 subsidiaries and seven affiliates.

¹³² Available at: <http://www.unep.org/greeneconomy/SuccessStories/WasteManagementinSouthKorea/tabid/29892/Default.aspx>

¹³³ **Ministry of Environment, Republic of Korea.** *Extended producer responsibility.* Available at: http://eng.me.go.kr/content.do?method=moveContent&menuCode=pol_rec_pol_rec_sys_responsibility

¹³⁴ Available at: <http://www.unep.org/greeneconomy/SuccessStories/WasteManagementinSouthKorea/tabid/29892/Default.aspx>

¹³⁵ Available at: <http://www.unep.org/greeneconomy/SuccessStories/WasteManagementinSouthKorea/tabid/29892/Default.aspx>

¹³⁶ **Ministry of Environment, Republic of Korea.** *Extended producer responsibility,* Available at: http://eng.me.go.kr/content.do?method=moveContent&menuCode=pol_rec_pol_rec_sys_responsibility

The RICOH Group has combined the 3 Ps in its working principle – people, planet and profit and its Environment Principles were formulated in 1992. Incorporating the concept of sustainability, which was still a fairly new concept at that time, RICOH proposed a ‘no regrets’ environmental policy and conviction to reduce emissions of CO₂.

Aside from complying with national laws and international standards, RICOH has taken voluntary initiatives and has set environmental targets in its long-term environmental vision. RICOH measures the environmental impacts of all its businesses at all the levels, analyses them and sets targets to improve them. Every single environmental impact is measured and improved upon based on long-, mid-term and bi-yearly environmental action plans.

Specific actions taken have included encouraging customers to make greater use of energy-saving and duplex-copying functions, and making internal efforts (for example technological development and improvement of production process and product designs as well as further promotion of resource circulation) in the following three priority areas:

Priority 1: Energy conservation and prevention of global warming. In fiscal year 2010, RICOH aimed for and achieved 20 percent reduction of integrated environmental impact compared to the levels of fiscal year 2000. Fourteen percent reduction in CO₂ emission was achieved from production activities alone. In addition RICOH also helped and encouraged consumers to save energy by releasing the first multifunctional colour printers with a recovery time from energy-saving mode of less than ten seconds.¹³⁷ It also introduced an econight sensor in a colour laser printer introduced in December 2010, which automatically turns off the device when the surroundings are dark.

RICOH is also committed to green procurement and green logistics, influencing the companies it works with for a more sustainable and green business.

For the future, there is a target to reduce total life-cycle CO₂ emissions by the Ricoh Group (including emissions of the ‘five gases’ converted into CO₂ by 30 percent by 2020 and by 87.5 percent by 2050 from the fiscal year 2000 level.

Priority 2: Resource conservation and recycling. RICOH promotes re-use and recycling in its internal system to limit the use of new materials, and also plans to work effectively to reduce CO₂ emissions in transportation and logistics. In 2010, RICOH had a target to use 750 tonnes of recycled plastic in Japan and actually used 1 192 tonnes. The amount of resources recalculated in the RICOH Group has reached 28 261 tonnes. In addition it also commercially introduced biomass toners in a digital copier in 2009. The waste generated per volume was reduced by 19.5 percent compared to 2007 figures.

Future targets include:

- Reducing the new input of resources by 25 percent by 2020 and by 87.5 percent by 2050 from the fiscal year 2007 level.
- Reduce the use of or prepare alternative materials for the major materials of products that are at high risk of depletion (such as crude oil, copper and chromium) by 2050.

Priority 3: Pollution prevention. RICOH’s effort to control pollution and move to environmentally safer manufacturing and business activities has concentrated on upgrading chemical substance control. In 2010, it reduced the use of environmentally sensitive chemicals by 72.9 percent and reduced the emission of environmentally sensitive substances by 87.9 percent from the 2000 figure.

¹³⁷ It was introduced in response to a survey which found that customers considered waiting for more than ten seconds for the printer to recover from energy-saving mode was too long.

Future targets include reducing the impact of chemical substances on the environment by 30 percent by 2020 and 87.5 percent by 2050 from the fiscal year 2000 level.

In addition, inside and outside Japan, the RICOH Group has a separate biodiversity policy and backstops different activities such as forest ecosystem conservation projects that support conservation and livelihoods. RICOH stands out as a sustainable business that has consistently followed the policies and practices for greening its activities without compromising on profit.

LESSONS LEARNED

The contribution of IT to green technology and green economy demands a look at the net balance of emissions from ITs as they help to curb emissions in other sectors while their own carbon footprints are increasing. The Green IT measures must aim to bridge the gap between IT, climate, environment and energy experts, policy-makers and stakeholders and extend understanding among these groups of both the direct effect of IT impact and the enabling effect of IT on other sectors in conjunction with the systemic effects to change social and cultural behaviour through ITs.¹³⁸

Past and ongoing attempts at greening the IT sectors highlight the importance of adoption of life-cycle perspectives within IT sectors and IT-enabled sectors for sustainable management of natural resources and materials in production, distribution, use and end of life phases. There is a variety of concerns at each phase of the supply chain. For example at the start of the supply chain, there are concerns regarding the state of labour and environmental performance of mineral extraction used for electronic components; at the end user level the environmental performance also depends on consumer awareness and willingness and at the end-of-life phase the political dynamics of shipping wastes to developing countries have to be considered.

The concerns at different phases of the IT life cycle can create opportunities for collaborations, partnerships and actions from global to local levels. There should be a global understanding of methodologies and indicators to monitor the impact throughout the life cycle and global, regional and national standards and regulations in place to ensure the health and safety of the thousands of poor involved in e-waste disposal and recycling facilities. Proactive measures have to be taken to improve the working conditions of all involved in the IT industries, if the Green IT measures are to contribute to inclusive growth.

Apart from inclusive growth, technological innovations are the most important keys to greening IT services. Countries like Japan, Republic of Korea and China have realized this and have earmarked a significant budget for R&D and innovative designs. As evidenced by RICOH, the technological innovations for greening IT are not a one-off event and need continuous investment for R&D and monitoring. The IT sectors in developing countries can benefit greatly from external assistance in finance and technology transfer. There is considerable scope for international and regional cooperation to ensure that positive experiences are shared and that developing countries and countries in transition have enough capacity and technical knowledge for green technologies. Regional cooperation can also encourage development of IT applications for measuring and monitoring environmental challenges, promote cooperation and knowledge exchange between IT and non-IT firms, research institutions, governments, and other stakeholders and use flagship demonstration projects to diffuse green applications.

Strengthened international governance can assist governments to promote a holistic green IT sector and green economy. Multilateral environmental agreements, which establish the legal and institutional frameworks for addressing global environmental challenges, can play a significant role

¹³⁸ **OECD**. 2010. *Recommendation of the Council on Information and Communication Technologies and the Environment*.

in promoting Green IT, particularly in the area of e-waste. The international trading system can also have a significant influence on Green IT by obstructing the flow of harmful wastes and facilitating the flow of green goods, technologies and investments.

Even if technological innovations are made and Green IT measures are applied by IT companies, environmental performance also depends on the consumers who use IT (for example the RICOH Group case). Hence both the government and the private sector must continue their efforts to increase public and consumer awareness of environmental implications of using ITs and their potential to improve environmental performance. They should promote widespread development and adoption of clear standards and ecolabels based on life-cycle approaches to production, use and disposal of IT goods and IT-enabled applications.¹³⁹

Lastly, although IT sectors do have significant potential for poverty reduction, it is up to governments to ensure that ITs are used effectively for pro-poor growth. In South Asian developing countries, IT has played an important role in helping the poor to access markets. Three factors are crucial to market access: physical infrastructure; relations between producers, traders and consumers; and information on how markets operate, including price fluctuations and consumer preferences. Access to ITs by the poor through investment in infrastructure must, therefore, be accompanied by the development of content (or services), which facilitate relations, and the exchange of market information. With regard to rural livelihoods, pro-poor growth will be enabled by the IT sector not when the poor have access to technology, but when the poor have access to useful content – market data, options and so forth. Therefore, green policies in the IT sector should include pro-poor content creation.¹⁴⁰

¹³⁹ OECD. 2010. *Recommendation of the Council on Information and Communication Technologies and the Environment*.

¹⁴⁰ OECD. 2005. *Good practice paper on ICT's for economic growth and poverty reduction*.

10 Public services and facilities

Public services strengthen the economy, provide basic care such as health and education and bolster socio-economic growth. Shifting public services towards a green path is a necessary commitment from governments to move towards a greener economy. While the bulk of green economy investment may ultimately have to come from the private sector, the effective use of public expenditure and investment incentives is necessary to trigger a transition to a green economy. For instance, public investments in infrastructure and services can be made more resource-efficient and can encourage green markets, while tax incentives targeting consumption and production of goods and services can help promote investment in a green economy and mobilize private finance. Governments can also stimulate markets by using sustainable public procurement practices that create high-volume and long-term demand for green goods and services.¹⁴¹

In many countries, governmental procurement alone represents as much as 20 to 25 percent of GDP, making it an important pillar of national economy. Green public procurement integrates environmental and social criteria such as equity and inclusiveness into public procurement processes and decisions. This can encourage producers to make longer term investments in innovations leading in turn to the wider commercialization of green goods and services, and promoting sustainable consumption. Green public procurement leads to the greening of private procurement through the supply chain and can have far reaching impacts on greening the national economy.¹⁴²

Governments can use a variety of tools to measure public expenditure mechanisms to promote investment in the green economy. These measures need not differ from the traditional tools that they are already using. Several of these measures can be considered as a subsidy and are often thought of in terms of direct financial transfers, but technically they also include indirect advantages such as exemptions from taxes or regulations, or below-market access to government-owned resources. A number of municipalities in India, for instance, have established a rebate in the property tax for users of solar water heaters. In some cases this rebate is 6-10 percent of the property tax.¹⁴³

Apart from public procurement and financing, governments have the opportunity to green public services such as buildings, water distribution, electricity, waste management and facilities (offices, schools, social housing and so forth), by improving roads and public buildings, establishing public transport networks, designing efficient systems for water management, repairing and enhancing drainage and sewerage systems or creating and managing efficient recycling services.¹⁴⁴ Such initiatives can also provide much needed impetus for socio-economic development for different communities.

Globally, every year an estimated 11.2 billion tonnes of waste are collected, and the decay of organic proportion of solid waste contributes to about 5 percent of global GHG emissions.¹⁴⁵ It also generates considerable economic and social costs, particularly in the health sector. The global waste market, from collection to recycling is estimated at US\$410 billion a year, excluding the informal

¹⁴¹ http://www.unep.org/greeneconomy/Portals/88/documents/ger/GER_14_EnablingConditions.pdf

¹⁴² UNESCAP. 2011, *Promoting sustainable consumption and production in Asia and the Pacific*. Available at http://greengrowth.org/download/sustainable_consumption_and_production_in_Asia_and_the_Pacific.pdf

¹⁴³ Ministry of New and Renewable Energy of India 2010, cited in UNEP, 2011, *Enabling conditions: supporting the transition to a green economy*.

¹⁴⁴ UNEP. 2011, *Towards a green economy: cities-investing in energy and resource efficiency*. Available at: http://www.unep.org/greeneconomy/Portals/88/documents/ger/GER_12_Cities.pdf

¹⁴⁵ UNEP. 2011, *Towards a green economy: pathways to sustainable development and poverty eradication*. Available at www.unep.org/greeneconomy.

sectors in the developing countries. The APR, by revamping its waste management and focusing on efficient recycling systems has potential to create economic value and in the process, create sustainable jobs. In most of the developing countries of Asia, there is an informal sector that collects scrap metals, glasses and plastics for recycling. Governments and private sectors could come together to institutionalize such sectors and make recycling more efficient and safer.

It is estimated that 2.6 billion people do not have access to adequate sanitation services.¹⁴⁶ When sanitation services are unavailable or inadequate, the costs of disease can be as high as 2 percent of the combined GDP of Cambodia, Indonesia, the Philippines and Viet Nam.¹⁴⁷ An effective waste management system would primarily benefit the poor in developing countries, some of whom work for waste management and disposal and who cannot endure health costs from work-related illness. Redefining unwanted waste to become a usable resource by recycling also creates value and many green job opportunities.

One of the areas where it is extremely important to incorporate efficiency measures is provision of water for drinking and sanitation. The demand for water is rapidly increasing in Asia, while the supply is diminishing, challenging policy-makers to come up with innovative solutions. Governments can look for ways to internalize the actual cost of water that includes the cost of watershed management. Privatization of water for distribution in cities like Manila, Philippines and Jakarta, Indonesia has decreased leakage and increased efficiency. However there are some dangers of privatizing the water sector in developing countries if right of access for the poor is not ensured.

Public buildings including public housing facilities also have significant potential in Asia for green development by reducing emissions and generating sustainable socio-economic benefits in the process. The current climate footprint from buildings is equivalent to 8.6 billion tonnes of CO₂ a year and is predicted to almost double to 15.6 billion tonnes by 2030. The housing sector plays a major role in the greening of APR cities and offers positive socio-economic benefits, such as new job opportunities along with decreased pollution output and higher energy efficiency. Many of the jobs created by this sector will require knowledge of new technologies or working practices, for example, in constructing, installation and maintenance of retrofit structures. Opportunities exist for governments to invest in training and support for these types of employment in the APR, specifically within local authorities and for private companies and small enterprises.

Retrofitting older buildings in lower-income neighbourhoods can improve energy efficiency and resilience, reducing the vulnerability of poorer communities when energy prices rise. Other efficiency measures in the building sector include individual components such as water heaters, appliances, office equipment, electronic appliances, heating, ventilation and air-conditioning systems, and lighting.¹⁴⁸ Upgrading these components of building infrastructure in slum areas offers both health benefits and fewer adverse impacts on the environment.

Greening development of public services and facilities in the APR

Throughout the APR, the transition to a green economy varies greatly between nations. Factors such as natural and human capital and relative level of development all play a role in determining the ease with which these nations may transition. This is especially true of public services, where governments have total responsibility. The high pace of economic growth in the last decade,

¹⁴⁶ Ibid.

¹⁴⁷ *Economic impacts of sanitation in Southeast Asia: a four-country study conducted in Cambodia, Indonesia, the Philippines and Viet Nam under the Economics of Sanitation initiative (ESI)*. World Bank-Water and Sanitation Programme (2008), p 32.

¹⁴⁸ **UNEP**. 2008. *Green jobs: towards decent work in a sustainable, low-carbon world*. Available at www.unep.org/labour_environment/features/greenjobs.asp

diminishing natural resources and overall growth in environmental awareness have influenced governments in Asia to make conscious efforts towards sustainable production and consumption in public policies and services.

In a bid to create low carbon growth some Asian countries have reviewed public financial mechanisms and made some significant changes. Thailand included green public procurement in its tenth National Economic and Social Development Plan (2007-2011); the Philippines has passed a presidential decree on green procurement; Japan enacted the green procurement law in 2000; and the Republic of Korea passed the Act on the Promotion of the Purchase of Environment-friendly Products in 2004. Other governments throughout the region can also benefit by instituting such procurement policies. This can open new doors for trade and markets and create rippling socio-economic benefits by greening the supply chain.

Asian countries, especially East Asian countries, are also taking a lead in the creation of green infrastructure. Republic of Korea launched a national Green New Deal worth US\$36 billion in 2009 and the initiative aims to create 960 000 jobs based on green infrastructure projects and public services. China has set ambitious energy targets for the building sector to reduce building energy use in all cities by 50 percent by 2010 and 65 percent by 2020, using the average energy efficiency of Chinese buildings in 1980 as the benchmark. Beijing, Shanghai, Tianjin and Chongqing – the four largest cities in China – have targets to cut building energy use by 65 percent by 2010. Singapore also has an ambitious plan for green buildings and Malaysia and the Philippines are also stepping up their efforts.

Moving on from the concept of isolated green buildings, some Asian countries are also investing in green public housing and more ambitious green cities. Hong Kong Housing Authority (HA) at Kai Tak recently adopted low carbon construction techniques that are expected to reduce carbon emissions by about 54 000 tonnes (24 percent) during construction. The environmentally friendly techniques used by the Kai Tak Site 1A housing project include: a photovoltaic system utilizing renewable energy, energy-efficient light fittings and a rainwater harvesting and plant irrigation system. Recycled materials have also been widely used, including use of marine mud excavated from the site mixed with a small amount of cement for *in-situ* backfilling and for production of pavers. The housing project is expected to be completed by 2013 and will provide more than 5 000 housing units for around 13 000 people.

Some other examples of greening public housing include Treelodge@Punggol, the Housing Development Board's pilot green housing project in Singapore that was completed in 2010 and public housing in different cities of China, where the buildings have to comply with national and local energy-saving standards. The implementation of green building initiatives by national governments in public housing is especially important in the APR, as an increasing amount of rural dwellers are migrating to large cities.¹⁴⁹ These buildings provide highly energy-efficient houses at affordable prices to all classes of people.

Asian countries are also making an effort to overcome the problem of municipal solid waste management. While most of the countries have policies in place, resources, technology and viable long-term strategy in the face of population growth and growing economic development have made solid waste management a significant problem in South and Southeast Asia. Some regional initiatives have also tried to mitigate the problem – the Kitakyushu Initiative, adopted at the 4th Ministerial Conference on Environment and Development in Asia Pacific in 2000, is one such initiative.¹⁵⁰ It concluded in 2010 and worked with 173 cities from 19 countries in Asia to improve environmental

¹⁴⁹ UNEP. 2011, *Towards a green economy: pathways to sustainable development and poverty eradication – a synthesis for policy makers*. Available at: www.unep.org/greeneconomy

¹⁵⁰ <http://kitakyushu.iges.or.jp/>

management, including management of solid waste. For example, the city of Surabaya, in Indonesia, achieved reductions of more than 20 percent in waste generation over four years by actively promoting community-based composting.¹⁵¹

CASE STUDIES

Case study 1: GHG emission reduction through improved MSW management – LGF capture, flaring and electricity generation in Indonesia

The rising volumes of waste produced in Indonesia have raised many concerns within the country which has endured conflicts over land use and landfills for many years. Health risks to the socially-marginalized population who scavenge the landfills have raised specific conflicts regarding social equity. With external support and funding, Indonesia has been able to showcase some examples of good waste management practices. One such project is Project 1582 in the city of Pontianak. The landfills in Pontianak emit methane gas, which has a very high climate change impact – 25 times the global warming potential of CO₂¹⁵². Under the project, a plan was developed with the city authority to lower the methane level.

The project, registered under the UNFCCC's CDM, serves as a good example of a public-private partnership for improving waste management, mitigating climate change and promoting community development. The project partnered with one engineering and manufacturing private company, Gikoko, specialized in construction of biomass energy power plants and air quality management. Gikoko agreed to share the proceeds from CDM for community development and upgrading water-collection systems.

This partnership approach to investment in municipal solid waste management (MSWM) is a first for Indonesia, demonstrating the potential for removing commercial barriers that have restricted private sector investment in sustainable MSWM and the associated environmental and social improvements.¹⁵³

The objectives of the project are:

- Contribute to the global abatement of greenhouse gas emissions;
- Improve MSW collection and disposal services within the city;
- Improve the living and working environment for landfill workers and surrounding communities;
- Contribute to an enhanced living environment for Pontianak.

In June 2007, the first Pontianak TPA Batu Layang Landfill gas-collection and control system was constructed and an emission-reduction purchase agreement was signed with the World Bank. With an innovative carbon credit scheme for landfill management in Pontianak, Gikoko in cooperation with World Bank's Carbon Finance Unit became engaged in planning, development and implementation of this CDM project.

As a signatory to the Kyoto Protocol, Indonesia is committed to reducing GHG emissions. The CDM provides a means for these countries or their companies to contribute to GHG reduction measures in return for CERs. These CERs can be used by ANNEX I countries to help them meet their emission targets.

¹⁵¹ ESCAP. 2010, *Empowering Asian-Pacific cities to lead local initiatives for cleaner environment – the Kitakyushu Initiative for a Clean Environment*. Brochure available at: <http://kitakyushu.iges.or.jp/publication/>

¹⁵² Asia-Pacific Forum for Environment and Development, Second Phase: APFED II. Booklet on *Good practices and innovative activities for achieving sustainable development in Asia-Pacific 2005-2009: Award & showcase programme*. 2011.

¹⁵³ Ibid.

Gikoko develops Landfill Gas Flare (LGF) CDM projects and works closely with the municipal government in Pontianak. The goal is to reduce both environmental and social problems through public-private cooperation in the MSWM project. Installation of an LGF collection system and the construction of an Enclosed LGF flaring facility took place to destroy the methane gas that is being generated from the decay of organic waste at the city landfill. In addition to methane destruction, some of the collected LGF is used for the generation of electricity required by the flaring facility.

After implementation, the project demonstrated a methane removal rate of 55-60 percent according to the technical review team, composed of validation officials. Total reduction has been 49 098 tonnes CO₂ equivalent, *per annum*.¹⁵⁴ LGF flaring at the final disposal site in Pontianak is benefiting the surrounding community not only by reducing waste, but also through its community development projects targeted to improve income-earning opportunities through recycling activities and developing a children's programme. Several large municipal cities, including Jakarta, have built upon this model by promoting similar public-private partnership.

While methane incineration systems in Indonesia are installed and partially operated, they are not used to generate energy, electricity for instance, due to the subsidized price and exclusive grid control under the national power company.

Case study 2: Social contract formulas in rural areas by public-private partnership: water treatment plants in India¹⁵⁵

India faces great challenges in providing safe drinking water to its population of more than 1 billion and only 18 percent of rural households have access to clean water while 21 percent of communicable diseases are water-related. Rural households in the coastal districts suffer frequent outbreaks of jaundice, diarrhoea, and gastroenteritis because of unsafe water. In Andhra Pradesh, home to 80 million people, some 65 percent of the population has access to water but over 22 percent has routinely experienced bacteriological illnesses because of water contamination.

One of the projects that made a significant difference in 25 villages in Andhra Pradesh evidences a good example of public-private partnership where the local councils partnered with an NGO and an international donor. The Naandi Foundation together with Water Health India (WHI) came up with a project proposal to build a community safe water scheme that combines cost-effective water purification technology with a community-driven and performance-based approach. Global Partnership on Output-Based Aid (GPOBA) agreed to fund the project in 2006 and the project had full support from local government agencies. The project aimed to establish Community Safe Water Schemes (CSWS) in 25 coastal villages that lacked access to clean drinking water, benefiting around 12 500 poor households earning less than US\$20 per month. It was estimated that each CSWS would benefit a minimum of 500 poor households.

The project employed a community-based public-private partnership model involving the village *panchayat* (local council), Naandi and WHI. The *panchayat* was required to provide land for the plant, a treatable water source for the plants, a community financial contribution and electricity at a pre-agreed tariff for the CSWS.

A combined financing of local funds, subsidy and a loan was employed through the following nuanced mechanisms:

¹⁵⁴ UNFCCC CDM report. Data available at: <http://cdm.unfccc.int/Projects/DB/DNV-CUK1201002194.6/view>

¹⁵⁵ http://www.un.org/waterforlifedecade/green_economy_2011/pdf/watergreenconf_chap3_conference_papers.pdf

The GPOBA subsidized the cost of setting up the water treatment plants with ultraviolet (UV) purification technology for 25 villages through a US\$850 000 grant. The subsidy was paid to Naandi in installments after independent verification of three pre-agreed outputs, which Naandi prefinanced through commercial borrowing.

WHI worked as the project operator to build and install the UV filter water purification plants and the basic infrastructure needed to operate them (pumping system, storage tank and shelter) in the 25 villages; and hire and train a plant operator for each village. It provided operational performance guarantees to Naandi so it could deliver the outputs and obtain the grant subsidies.

The output-based approach also required that user fees were paid by consumers to cover the costs of operation and maintenance (O&M), user fee collection and education and communication activities that were carried out with key stakeholders and vulnerable groups such as young mothers, infants and marginalized families. A minimum user fee was levied for safe drinking water.

The total project cost was US\$1.25 million. The cost per CSWS (US\$50 000) covered investment, community awareness and running costs. Tariffs were set at an affordable rate to cover the initial investment (net of subsidy) as well as O&M costs. Sustainability of the service was thus ensured through user fees which average US\$0.03 for consumption of 20 litres.

There was flexibility in the community contribution (which was at least 20 percent of the total capital cost), which came from user fees, local government funds and donations from philanthropists and charitable organizations. The commercial loan sourced by Naandi was payable over a period of approximately seven years, i.e. by 2013. During this period the assets remain with the community and Naandi/WHI have full operational responsibility. After the loan is repaid, the *Panchayat* may choose to renew the O&M agreement with Naandi and WHI. The life of the plant system is expected to be at least 15 years.

At grant termination in 2009, the project provided access to safe water through the construction and installation of 25 UV water purification plants in 25 villages. By grant closure, all water plants were fully operational and serving a total of 16 104 poor households (or 77 878 people), 29 percent higher than the original target of 12 500 households. Household surveys conducted after grant closure found that 98 percent of the households reached by the project still continue to use water from the new plants for drinking purposes and have not reverted back to existing contaminated sources. This implies that the awareness campaigns that complemented the water plants were successful and there is high community awareness of the health risks of contaminated water.

The social benefits of this community water project included:

- Average time spent for collecting water was reduced from around 60 minutes to 22 minutes;
- Overall incidences of water-borne diseases dropped by 85 percent;
- Household savings on medical expenses alone were INR650-750 a year (approximately US\$9-11).

The project proved that if clean drinking water is made available to rural households at an affordable cost they are willing to pay for it, if they are made aware of the health, social and environmental benefits to the community.

LESSONS LEARNED

Green public services are most likely to be successful if they are aligned with national sustainable development priorities, such as provision of safe drinking water, infrastructure development or waste management in developing countries and they should take into account possible impacts across economic sectors. In order to make the transition to green public services and the facilities sector, specific enabling conditions are required. These conditions consist of national regulations, policies, subsidies and incentives, and international market, legal infrastructure, trade and aid protocols.¹⁵⁶ Government expenditure can be a powerful enabler for a transition to a green economy by providing grants, loans and other incentives.

Public expenditure, if poorly managed, can represent a significant cost to countries. For example, subsidizing non-essential goods can encourage inefficiency, waste and overuse. Subsidies and low tax in high emission sectors like fuels can actually undermine green efforts and reduce the economic viability of green investments. Once incentives and subsidies have been created, they can be difficult to remove as recipients have a vested interest in their continuation. Hence governments can make conscious efforts to design subsidies and incentive schemes for sustainable and green goods and make them time-bound.

There are some challenges associated with the implementation of public expenditure measures for green public services, and these challenges can be particularly pronounced in countries with limited institutional capacity. In some cases, governments may lack the capacity to design effective incentives and schemes, or to implement and monitor the impacts of green measures and policies.¹⁵⁷ Where governments lack the technical expertise, or where the availability of public funds is limited, different types of public-private partnerships can be explored, including private finance initiatives.

In some cases government inefficiencies have resulted in privatization of water, sanitation and other services. While this has generated mostly positive results, in some cases it has served to increase tariffs, thus excluding and further marginalizing the poor. There is always a danger in privatizing public services without adequate measures to ensure the rights of people. Privatization of water has so far invited some controversies,¹⁵⁸ especially in developing countries and the governments and private companies involved must ensure that the rights to access basic public services are protected, the tariff is not too high and private companies have social accountability.

Investing in capacity building and training of governments and other private and third party industries involved in providing public services is essential to support a transition to a green economy. The capacity to utilize green economic opportunities and implement supporting policies varies from one country to another, and national circumstances often influence the readiness of a country to go for greener measures. A shift towards a green economy could require the strengthening of government capacity to analyse challenges, identify opportunities, prioritize interventions, mobilize resources, implement policies and evaluate progress. Training, skill enhancement programmes and awareness-raising mechanisms may be needed at various levels to prepare the population for a green economy transition.¹⁵⁹

In developing countries, intergovernmental organizations, international donors, NGOs, the private sector and the international community as a whole can play a role in providing technical and

¹⁵⁶ UNEP. 2011, *Towards a green economy: pathways to sustainable development and poverty eradication – a synthesis for policy makers*. Available at: www.unep.org/greeneconomy

¹⁵⁷ http://www.unep.org/greeneconomy/Portals/88/documents/ger/GER_14_EnablingConditions.pdf

¹⁵⁸ On 6 June 2011, NGOs and the community protested in Jakarta, demanding termination of Jakarta water privatization, allegedly after the private company failed to supply water at affordable prices.

¹⁵⁹ http://www.unep.org/greeneconomy/Portals/88/documents/ger/GER_14_EnablingConditions.pdf

financial assistance to facilitate the green economy transition. In both the case studies, external funding support played a crucial role in increasing political willingness.

Additional upfront costs, market failures, information gaps and political structures are some important barriers for greening public services like green buildings in developing countries and often cannot be solved internally. Despite the opportunities, investments are held back owing to assumed cost premiums and a range of barriers – political, financial and cultural. Good communication and demonstration of costs and benefits over the years might help to shift preconceived notions.

In many developing countries, command and control policies may not work as much as flexible economic instruments and partnerships. For example, in the waste management sector, a major reason for a thriving informal sector (in waste picking, recycling etc.) is the difficulty to achieve the scale of economies needed to formalize the existing informal recycling units. Providing microfinance and access to markets may encourage informal sectors to move to a formal regime. Appropriate regulations and standards must also be implemented in the informal sector to ensure that the health and safety of people working there are not compromised. Apart from formalization, non-governmental and community-based organizations can also help in empowering workers in informal waste businesses.

Lastly, none of the green public services will achieve the desired effects if the public is not aware of their value. As in the case of India, soft services such as campaigning and awareness-raising go a long way in helping the public make the right choice. In both developed and developing countries, a continuous effort to change behaviour and perceptions is necessary to ensure that green public services start the process of transition to a green society.

11 Transport

The roles of transport in a green economy

The key aims for the transition to a green economy are to enable economic growth and investment, and to increase social inclusiveness and environmental quality.¹⁶⁰ To achieve these aims, the transport sector has a prominent role. Transport is pivotal to economic development enabling people to enjoy economic activity and escape poverty. In doing so it has in the past had an adverse impact on the environment, as it is one of the top consumers of non-renewable resources as well as a producer of harmful emissions. Although there have been significant improvements in reducing vehicle emissions and raising road safety awareness, the increasing level of motorization has resulted in an overall increase in emissions as well as traffic fatalities and accidents which have disproportionately impacted the poor.

Economic

Transport is vital for economic activities and economic development, being the enabler for movement of goods, people and for economic transactions. The sector contributes directly and indirectly to the economy and shapes the pattern of production, trade and investment.

Transport contributes directly to economic output from private consumption and government expenditures on transport infrastructure, and services. It also contributes to economic input indirectly through the “creation of resources and enhancement of productivity of these resources”¹⁶¹ by providing access to raw materials and labour that otherwise is not accessible or too costly.

It creates market opportunities for consumers and producers and shapes production, trade and investment patterns. It enables manufacturers to benefit from their comparative advantage and specializations and develop the supply chains across the globe. Off-shore sourcing of raw materials and manufacturing, and enabling responsive modern supply chains, can be made possible through quality, reliable and cost-efficient transportation systems. The availability and cost of transport have influenced both the location of trade centres and the volume of trade. Large-scale increases in production and trade and the subsequent economies of scale are possible with advances in transport.

However, inefficient transport activities and scarcity of transport infrastructure in certain modes of transport can harm the productivity of the economy. High growth of motorization in city centres can result in the growth of traffic density and, in turn, congestion. Road congestion increases travel time and cost for both passengers and goods. It also worsens the reliability of delivery services. The economic cost of congestion is high. The cost of congestion in the Republic of Korea, for instance, is calculated at 4.4 percent of GDP.¹⁶² Congestion in Dhaka and Bangkok is estimated to be at 3.3 percent and 6 percent of GDP respectively.¹⁶³ In addition, traffic congestion inefficiently exploits energy resources and generates additional pollution, which is harmful to health and the environment.

¹⁶⁰ UNEP. 2011, *Towards a green economy: pathways to sustainable development and poverty eradication*, Available at www.unep.org/greeneconomy

¹⁶¹ Baum, H. & Kurte, J. 2002, *Transport and economic development: report of the Hundred and Ninth Round Table on Transport Economics* held in Paris on 29-30 March 2001, European Conference of Ministers of Transport, 2002, pp. 5-49.

¹⁶² Deloitte. *Combating gridlock: how pricing road use can ease congestion*, Available at http://www.vta.org/expresslanes/pdf/combat_gridlock.pdf

¹⁶³ Cities on the Move – World Bank Transport Strategy Review. Available at http://siteresources.worldbank.org/INTURBANTRANSPORT/Resources/cities_on_the_move.pdf

Social

In terms of social benefits, various empirical studies connect the positive contribution of transport on reducing poverty and improving human welfare.¹⁶⁴ Transport provides physical and economic access to markets, employment, extension services, education, medical and health care, as well as to participation in social and political activities. Improved market access from rural areas contributes to the value chain of rural produce, increases the income of local producers and, in turn, helps to reduce poverty. An Indian Institution of Management study shows that 50 percent of fresh produce is wasted on the journey to the market.¹⁶⁵ With an efficient transport system and appropriate technology, such wastage can be avoided providing additional income to local producers.

In many cases where transport infrastructure and services are physically available, access to them can be easily inhibited by cost. In both rural and urban areas, the poor spend a greater proportion of their income on transport costs.¹⁶⁶ To ensure equitable access, transport has to be available at a cost affordable to all.

Rapid motorization results in more traffic accidents. Road crashes are responsible for 700 000 fatalities in the APR.¹⁶⁷ Road traffic fatalities and injuries impact disproportionately on the poor. Over 90 percent of road traffic deaths and injuries occur in low- and middle-income countries¹⁶⁸ with pedestrians and non-motorized road users accounting for most of the fatalities.¹⁶⁹ Deaths from road traffic injuries are expected to rank fifth among major causes of deaths, surpassing those of from HIV/AIDS and tuberculosis in 2030.¹⁷⁰ Although these losses are mostly immeasurable, economic losses are calculated to be more than 3 percent of the GNP.¹⁷¹

Environmental

The transport sector is heavily dependent on fossil fuel, which is non-renewable and finite. The steadily rising cost of oil and gas as indicated by historical trends is also likely to continue, as is the contribution to the impacts of climate change. In Asia, the sector is the largest consumer of petroleum products and the third largest consumer of energy as shown in Figure 13. Figure 14 shows that the road transport subsector consumes more than 78 percent of total energy consumption in the transport sector. This rapid increase in transport demand and subsequent motorization, which contribute to the region's economic growth, means this sector the fastest growing consumer of energy in the region.¹⁷²

By relying heavily on fossil fuels, the sector generates a broad range of emissions including carbon dioxide, carbon monoxide, sulphur dioxide, oxides of nitrogen, volatile organic compounds and particulate matters. In the APR, transport is the primary source or precursor of air pollution and the third largest contributor to CO₂ (Figure 15) and other GHG emissions. In 2008, CO₂ emissions from the transport sector accounted for 1 587.4 million tonnes, of which 1 275.8 million tonnes or more than 80 percent came from road transport. These emissions generate negative and costly impact on both human health and the environment.

¹⁶⁴ UNESCAP. 2006. *Towards a set of guidelines on the integrated assessment of transport policy and programmes*.

¹⁶⁵ UNCRD. 2010. Meeting summary from the Fifth Regional Environmentally Sustainable Transport Forum in Asia held in Bangkok 23-25 August 2010.

¹⁶⁶ UNESCAP. 2012. *Transport and the millennium development goals*, Ministerial Conference on Transport held in Bangkok 12-16 March 2012.

¹⁶⁷ Based on data from the World Health Organization, *Global status report on road safety: time for action* (Geneva, 2009), Tables 4 and A2.

¹⁶⁸ Available at http://www.who.int/roadsafety/decade_of_action/toolkit/key_messages/en/index.html

¹⁶⁹ World Health Organization (WHO). 2009. *Global status report on road on road safety: time for action*, p. viii. Geneva.

¹⁷⁰ World Health Statistics. 2008. Available at <http://www.who.int/whosis/whostat/2008/en/index.html>

¹⁷¹ Available at http://www.who.int/roadsafety/decade_of_action/toolkit/key_messages/en/index.html

¹⁷² The global energy use in the transport sector is expected to increase by 50 percent by 2030. (International Energy Agency, World Energy Outlook 2009.)

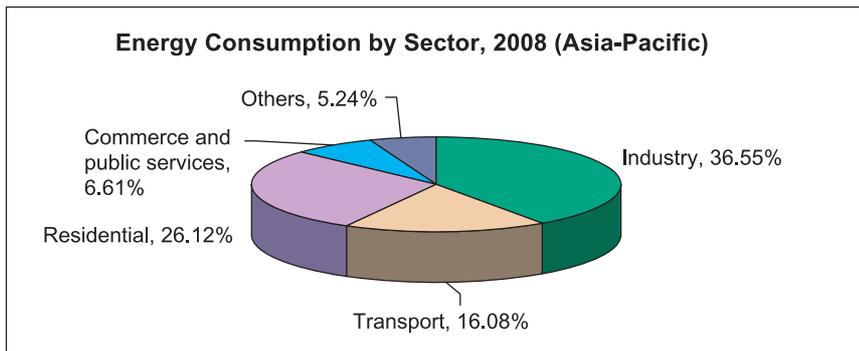


Figure 13: Energy consumption by sector, 2008 (APR)¹⁷³

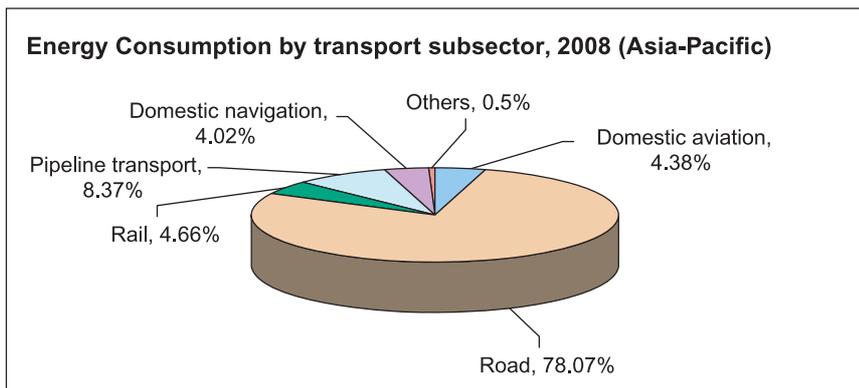


Figure 14: Energy consumption by transport subsector (APR)

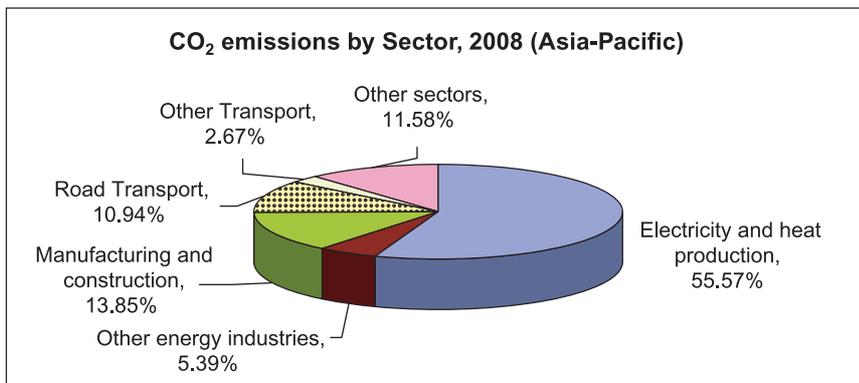


Figure 15: CO₂ emissions by sector, 2008 (APR)¹⁷⁴

¹⁷³ International Energy Agency, *World energy balances*, IEA World Energy Statistics and Balances (database). doi: 10.1787/data-00512-en (2010) (accessed 5 August 2011). Countries included in the calculation are: Afghanistan; Armenia; Australia; Azerbaijan; Bangladesh; Bhutan; Brunei Darussalam; Cambodia; China; Cook Islands; Democratic People's Republic of Korea; Timor-Leste; Fiji; French Polynesia; Georgia; India; Indonesia; Japan; Kazakhstan; Kiribati; Kyrgyzstan; Lao People's Democratic Republic; Malaysia; Maldives; Mongolia; Myanmar; Nepal; New Caledonia; New Zealand; Palau; Pakistan; Papua New Guinea; Philippines; Republic of Korea; Russian Federation; Samoa; Singapore; Solomon Islands; Sri Lanka; Tajikistan; Thailand; Tonga; Turkmenistan; Uzbekistan; Vanuatu; and Viet Nam, as well as Macau, China.

¹⁷⁴ International Energy Agency. 2010. *IEA statistics: CO₂ emissions from fuel combustion highlights*. (2010 edition). Paris, IEA. Available at www.iea.org/co2_highlights/co2highlights.pdf

While transport plays a critical role in the substantial growth of the region, there are many pressing issues that generate widespread concerns. The rise in fuel prices, energy security, air pollution, GHG emissions, the increase in the population of urban poor, land-use impacts and traffic accidents are among typical issues calling for alleviation action. To contribute toward the transition to a green economy, the transport sector needs to advance in a sustainable manner.

Addressing the challenges: green transport development in the APR

Strategic principles to ensure eco-efficient and inclusive infrastructure

Guidelines for developing eco-efficient and socially inclusive infrastructure¹⁷⁵ suggest that governments should consider the following six strategic principles to ensure eco-efficient and inclusive outcomes in the process of planning and developing infrastructure; putting sustainable infrastructure on top of the agenda; link short-term goals to long-term vision; integrate across sectors and among institutions; consider all monetary and non-monetary value of sustainable infrastructure; build business cases for eco-efficient solutions; and involve public participation.

The ASI approach

To address various growing environmental and socio-economic concerns, a combination of different green transport strategies is needed. The Avoid-Shift-Improve (ASI) approach comprises three major elements.

- **Avoid** or reduce the need to travel – this can be done through more efficient transport systems, integrated land-use planning, route optimization, improved logistics, transport demand management, localizing, telecommunication technology, etc.
- **Shift** to more efficient and environmentally friendly modes of transport – in passenger transport, non-motorized transport and public transport are among the valid choices. In freight transport, rail and water transport are most desirable.
- **Improve** existing transport options – the focus is on energy efficiency, alternative energy and vehicle technology.

The approach provides solutions that can feed into the development of green economy. Positive impacts from the ASI approach are not limited to the environmental aspect, but also impact positively on economic and social pillars of sustainable transport.

Policies initiatives in the APR

Owing to earthquakes, cyclones and tsunamis occurring in the region, the wider fluctuation in climate temperature, and unusual season cycles, there are rising concerns over the longer-term effects of climate change. At the second session of the Ministerial Conference on Transport held in Bangkok in March 2012, the transport ministers and senior transport officials from countries in the APR noted that climate change threatens the sustainability of the transport infrastructure of many countries and that low-carbon strategies needed to be implemented, with energy efficiency being an important consideration. The role of efficient, accessible and integrated urban public transport and the need to improve its service, quality and availability was also emphasized.¹⁷⁶

¹⁷⁵ **United Nations.** 2011. *Are we building competitive and liveable cities? Guidelines for developing eco-efficient and socially inclusive infrastructure*, Available at <http://www.unescap.org/esd/environment/infra/documents/Guidelines.pdf>

¹⁷⁶ **ESCAP.** 2012. *Report of the Ministerial Conference on Transport on its second session*, March 2012, Bangkok (<http://www.unescap.org/ttdw/MCT2011/MCT2011.asp>)

Various initiatives being taken by countries in this region include:

- More use of inland and coastal waterways;
- Expansion of public transport networks;
- Facilitation of non-motorized transport;
- Additions to and electrification of the rail network as an alternative to roads;
- Vehicle demand management;
- Improved engineering with intelligent transport system technology; and
- Mitigation policies including vehicle emission-reduction policies, biofuel use and fuel-efficient ships and shipping strategies.

These initiatives fit into different elements within the ASI approach. The next section shows recent national strategies and policy initiatives¹⁷⁷ of selected countries in the APR for the greening of the transport sector.

China

China accords high priority to the development of public transport infrastructure and systems, in particular mass transit, as well as the improvement of transport safety and management. In 2012, China planned to operationalize a high-speed railway network, 13 000 km in length. This high-speed railway network entails four north-south and four south-west corridors, designed to cope with the rapid increase in passenger demand for public transport. The high-speed line separates passenger traffic from freight traffic. The 2020 vision for China is to have a passenger railway network of 50 000 km across the country to provide accessibility to 90 percent of the population.

For road transport, strict emission and fuel-consumption standards are being imposed on new vehicles. Various incentives including tax benefits and subsidies have been put in place to phase out the high-pollutant vehicles from the road and replace them with cleaner and more energy-efficient vehicles. The incentives include a reduction of sales tax for energy-efficient vehicles and rebates for hybrid and electro-mobile vehicles.

There are also initiatives and projects being implemented at the city level. Many of them are being implemented with the assistance of development partners. Guangzhou city, for instance, have various transport projects which attempt to address economic, social and environmental issues. The City Transport Project, implemented in cooperation with the World Bank, aims to promote the shift to efficient use of the urban transport system. The Green Truck Project, implemented with the Clean Air Initiative (CAI), applies improved technology to enhance fuel economy and reduce emissions. Another successful project which won the 2011 Sustainable Transport Award is the Guangzhou Bus Rapid Transit Project. The project's objective is to cut down congestion and improve efficiency of the city's bus system. The project has more than exceeded its objective.

India

For urban transport, the National Urban Transport Policy (NUTP) provides an overall framework and action plans to encourage greater use of public and non-motorized transport, integration of land use and transport planning, improved accessibility and overall reduction of travel demand. The policy lays down a comprehensive roadmap of various actions in the field of urban transport.

¹⁷⁷ Collected from keynote addresses, country presentations and the meeting summary of the fifth Regional Environmentally Sustainable Transport (EST) Forum in Asia, August 2010, Bangkok (<http://www.uncred.or.jp/env/5th-regional-est-forum/index.html>), and from country statements, and the Report of the Ministerial Conference on Transport at its second session, March 2012, Bangkok (<http://www.unescap.org/ttdw/MCT2011/MCT2011.asp>).

Under the NUTP, a total of 437.7 km of Bus Rapid Transit (BRT) projects have been planned in ten cities valued at US\$1 085 million. Ahmedabad is the first city under the NUTP that has successfully launched a complete BRT system with average daily ridership of more than 55 000 passengers (this figure is for 2010). To further respond to high demand, Metro Rail Projects are planned for big cities. For the Metro Rail Projects in Delhi, Bangalore, Kolkata and Chennai, the financing comes from the Government of India (GOI) and the concerned state office. However, for Mumbai and Hyderabad, public-private partnership scheme is being implemented to finance the projects.

For rural transport, the Prime Minister's Rural Roads Programme is supporting rural roads construction/improvement of about 24 000 km of rural roads in states including Jharkhand, Himachal Pradesh, Meghalaya, Punjab, Rajasthan, Uttar Pradesh and Uttarakhand. The project will also include a technical assistance programme to build the capacity of the implementing agencies, improve their business procedures and improve overall maintenance management. The National Rural Roads Development Agency, under the Ministry of Rural Development, GOI, is the agency responsible for overall management, supervision and execution. In the rail sector, the Indian Railways network which carries 2.6 billion people a year continues to expand to connect the majority of the Indian population, bridging not only distance but also social divide by providing access for the poor, women and workers in the informal sector.

Japan

Japanese society is increasing its demand for quality transport systems that provide environmental benefits, convenience and safety. A study by the Ministry of Land, Infrastructure, Transport and Tourism shows a decline in ridership of public transport. From 1965 to 2007, ridership of trains decreased from 52 to 34 percent. Similarly for bus travel, use declined from 33 to 7 percent. Conversely, the rate of use of private vehicles has increased substantially from 7 to 56 percent.

Various initiatives have been put in place to win back public transport users and to shift private car drivers to non-motorized transport. Some of the environmentally sustainable transport initiatives are the improvement of urban transport facilities, the operation of the first full-scale light rail transit (LRT) and the implementation of a bicycle sharing system.

Despite the increase in the use of private cars, CO₂ emissions in the transport sector have been continuously declining since 2001. In 2008, Japan reached its Kyoto Protocol target of CO₂ emission levels originally scheduled for 2010. Impacts from the increase in private car use are cancelled out by impacts from other improved initiatives such as the use of environmentally friendly vehicles, the application of an intelligent transport system, the promotion of ecodriving or green-driving and, most importantly the enforcement of the exhaust emission standard.

In addition, the railway industry in Japan has introduced new technology concepts such as a fuel cell-powered train to replace diesel engine locomotives to increase the energy efficiency of the railway service. In the trucking industry, drivers are encouraged to maintain a strict record of the driving distance and fuel used to help them to review their performance and improve efficiency. This simple, inexpensive and low-technology method has exceeded expectations.

Republic of Korea

With the vision of a sustainable low-carbon green transport system, the Republic of Korea has developed key transport strategies in this context that include: (a) a modal shift to low-carbon transport and logistics; (b) transport demand management; (c) development of low-carbon transport infrastructure and technology; and (d) encouraging human-powered transport through pedestrian priority zoning, bicycle sharing and a public transport only zone.

A study from Korean Railroad Research Institute shows that a 1 percent shift to rail transport will save US\$600 million through less energy consumption and US\$280 million from reduction in congestion. As a result, considerable efforts and investment are being implemented for a modal shift from road- to rail-based transport. Expansion of the railway network would contribute to the goal of providing rail access to 83 percent of the population by 2020.

Transport demand management measures are being put in place, such as congestion charging, restrictions on total traffic volumes, reduction in parking areas and public-transport-only zones. Hybrid, biofuel, hydrogen and electric cars are among the examples of the low-carbon transport technology that the country is promoting.

The study shows that 44 percent of car journeys in Seoul are less than 5 km. Another 11 percent of travel made by car is less than 1 km. Cycling and walking can be competitive alternative options for 5-km trips and for pedestrians around 1 km. As a result, urban transport policies aim to expand the bicycle networks up to 3 114 km by 2018. A 'Road Diet' concept is being introduced to secure bicycle lanes on roads and the availability of bicycle racks in train and bus stations.

Thailand

In Thailand, 99 percent of the emissions of total CO₂ come from transport activities in the road subsector.¹⁷⁸ Road congestion is also a serious issue in Bangkok. Various strategies have been put in place to tackle the issues and move toward greener transport. For passenger transport, high-quality public transport systems such as the skytrain, subways and the BRT system are in operation in Bangkok to shift people from using private vehicles to public transport. Natural gas fuelled buses are used to provide public transport services. Moreover, the use of cleaner fuels such as compressed natural gas and biofuels is being promoted for both private and public vehicles.

Thailand is also investing in the rail transport system to increase the proportion of rail transport from 2 to 10 percent from 2012 to 2022. Its Railway Development Master Plan 2010-2025 contains three key phases of development: restructuring, improvement and enhancing the efficiency of the network. There is also a plan for the construction of a double-tracking intercity railway and the development of a high-speed train network.

For freight transport, a modal shift from road to rail is facilitated at the one of the most advanced dry ports in Asia, Lat Krabang Inland Container Terminal. Currently there are six private operators handling more than 1.7 million 20-foot equivalent units (TEUs) per year of which 400 000 TEUs or 26 percent of the total volume is carried by rail connection to Laem Chabang port. This allows a modal shift to more cost-effective and greener modes of transport, whilst removing thousands of trucks from the roads, and reduces congestion at Laem Chabang port. The cost of transport per tonne-km by rail is estimated at 0.95 baht while by truck it is between 1.29 and 1.63 baht, showing a minimum of 30 percent cost-saving. With the planned double-tracking project, it is estimated that the demand for rail connection from Lat Krabang Inland Container Terminal to Laem Chabang port will increase to nearly 900 000 TEUs per year.

¹⁷⁸ Calculated from IEA statistics.

CASE STUDIES

Case study 1: Green-eco project in Japan¹⁷⁹ – ‘low cost, low technology, high motivation’

In Japan, which is one of the most developed and technologically advanced countries in the world, a small low-cost and low technology initiative taken by the private sector can make a difference. With the right motivation, a piece of paper and a pencil results in greener transport movement towards a green economy.

From 2005, the revised Energy Conservation Law required shippers and logistics companies to submit energy-saving plans and energy-consumption reports. At that time, the trucking industry, of which 99 percent was small- and medium-scale trucking companies, did not have the capacity to implement an advanced database system to collect information on fuel efficiency. This led to the establishment of the Green-Eco project by the Tokyo Trucking Association.

The project started with the construction of a simple database for fuel efficiency. Data on fuel efficiency were collected by truck drivers on ‘driving management sheets’, which required information such as driving distance, amount of fuel consumed and a target that the driver should achieve. The sheet was designed to be filled in by hand and helped drivers to gradually develop awareness about their own fuel consumption. The data collected in the Driving Management Table, together with vehicle data, provided a basis in determining the level of fuel efficiency and CO₂ emissions. The system also became a communication tool between drivers and managers as well as among drivers themselves.

On a monthly basis, managers evaluated performance results with individual truck drivers to provide guidance and identify necessary corrective action, if improvement was needed, as well as to provide recognition of the driver when the target was met. The manager and truck driver then set the next target together.

An incentive system was key to enabling the success of the programme. In order to ensure continuous improvement, senior management of the trucking association implemented attractive promotion and recognition schemes that were directly linked to the performance of the truck drivers in order to keep them motivated. Managers also had to be closely involved in the implementation of the scheme. Seminars were offered to the managers to equip them with knowledge and techniques necessary to provide effective guidance to the truck drivers.

Another important element was training truck drivers about ‘ecodriving’.

Ecodriving is a driving method to reduce fuel consumption by refraining from sudden starts, sharp acceleration and sudden braking; avoiding vehicle overload; driving at economic speed; ensuring tyres are pumped to the correct pressure; and other approaches. It is an essential activity that forms the basis of environmental initiatives. Ecodriving is effective in the context of ‘environment’, ‘management’ and ‘safety’ in cutting atmospheric NO_x and particulate matter emissions, reducing fuel cost, promoting safety management and preventing accidents.¹⁸⁰

¹⁷⁹ **Tokyo Trucking Association.** 2010. *Environmental approaches of logistics companies in Japan: Green-eco project.* Presented at the fifth Regional Environmentally Sustainable Transport (EST) Forum in Asia, August 2010, Bangkok.

¹⁸⁰ Tokyo Trucking Association, <http://www.totokyo.or.jp/en/ecology/>, accessed on 26 April 2012.

The ten tips for ecodriving are:¹⁸¹

1. Softly depress the accelerator ‘e Start’;
2. Drive with less acceleration and deceleration;
3. Release the accelerator early;
4. Use the air-conditioner moderately;
5. Stop idling;
6. Properly perform warm-up;
7. Utilize traffic information;
8. Frequently check the air pressure of the tyres;
9. Leave unnecessary items; and
10. Do not park the car illegally.

Since the start of project in 2006, it has been successful and gradually expanded. More than 500 companies and over 10 000 trucks were participating in 2010. From 2006 to 2010, the project achieved a reduction in fuel consumption of almost 8 million litres. From this reduction in fuel consumption, the total cost-saving was approximately US\$9.5 million and CO₂ emission reduction amounted to over 20 000 tonnes. The number of traffic accidents was also reduced by 40 percent during these four years.

The project is also considered as a CSR activity which a small- or medium-size trucking company can implement with minimum cost and technology. The Tokyo Trucking Association plans to expand the project to cover the whole country. As the implementation of the project requires low cost and low technology, it can be easily implemented elsewhere. “Although Green Eco Project is a modest initiative, once undertaken by many people, it can have an enormous impact on the environment” said Mr Hiroshi Maji, the President of Japan’s ASUA corporation.

Case study 2: Urban transport in Guangzhou city: the bus rapid transit system

The continuing influx of workers from rural areas to Guangzhou city has led to the rapid growth of the city’s population. Guangzhou (GZ) is the third largest city in China, with a population of over 6 million in the city and nearly 12 million in the metropolitan area.¹⁸² The population density in one of the central districts, such as Yuexie, exceeds 34 000 inhabitants per square kilometre.¹⁸³ Private car ownership increased at the average rate of 21.6 percent per year from 2000 to 2011,¹⁸⁴ with 300 000 new cars being registered in 2010 alone. Air pollution, traffic congestion and road accident rates especially with pedestrians and cyclists have become growing concerns. The use of non-motorized transport such as walking and riding bicycles has become increasingly restricted, dangerous and unattractive.

¹⁸¹ **Ministry of the Environment and Ministry of Land, Infrastructure, Transport and Tourism.** 2010. *Environmentally sustainable transport in Japan*. Presentation made at the fifth Regional Environmentally Sustainable Transport (EST) Forum in Asia, August 2010, Bangkok.

¹⁸² **Hughes, C. & Zhu, X.** 2011. *Guangzhou, China – bus rapid transit emissions impact analysis*, Institute for Transportation and Development Policy, p. 2.; **Fjellstorm, K.** 2010, *High capacity BRT planning, implementation and operation: case study of the Guangzhou BRT*. Presentation made at the fifth Regional Environmentally Sustainable Transport (EST) Forum in Asia, August 2010, Bangkok.

¹⁸³ Wikipedia, source: “广州市2010年第六次全国人口普查主要数据公报” (in Chinese). Statistics Bureau of Guangzhou. 2011-05-16. Retrieved 2011-05-25.

¹⁸⁴ Guangzhou International (English.gz.gov.cn), Guangzhou Municipality. Accessed in April 2012 at <http://www.gz.gov.cn/publicfiles/business/htmlfiles/gzgooven/s7467/201108/847236.html>

Air pollution is considered a bigger problem and creates major concerns for Guangzhou authorities as it impacts on people's health. Reducing air pollution has become the main focus of the city administration. Partly due to the increase in the number of deaths from lung cancer which have doubled in recent decades, air pollution has replaced cigarette smoking as the first cause of death in the city. A WHO study also shows that urban outdoor air pollution is estimated to cause 1.3 million deaths worldwide per year. Those living in middle-income countries disproportionately experience this burden. Among them, the poor population is likely to have higher exposure and be more susceptible to air pollution.

Multiple efforts have been put into place toward greening the transport sector of the city in order to provide better and healthier living conditions.

The 22.5-km BRT system in Guangzhou started on Zhongshan Avenue, which is one of the busiest roads in the city, in February 2010. Before its implementation, there were over 40 bus routes in service along Zhongshan Avenue. Scenes of crowded buses struggling to stop at bus stops and blocking several lanes of traffic along Zhongshan Avenue were quite common. Buses often stopped to pick up passengers outside bus stops to avoid the jam, making them harder to access and hazardous for passengers. Such buses also blocked and slowed the traffic in the corridor. As a result, the BRT project was designed to improve the efficiency of the city's bus system and to reduce congestion along this corridor.

After several years of planning and design led by Institute of Transportation and Development Policy (ITDP) and Guangzhou Municipal Engineering Design and Research Institute (GMEDRI), the construction of the BRT corridor began. The corridor starts from the western end of Tianhe district, which has had intense development over the past two decades, to the eastern part of Tianhe and Hunangpu districts, where future growth is expected. There are more than 30 routes in operation.

All stations along the corridor are designed according to the projected passenger demand with station size ranging from 55 to 260 metres. The latter being the world's longest BRT station. This is the first BRT system in Asia that determined station size based on demand at an individual station. It is also the first BRT system in China that has multiple bus operators, having a total of seven different companies, to provide service. All buses operating within these BRT lanes use gasoline.

To attract ridership, to reduce congestion and emissions and to improve the efficiency of public transport in the city, this BRT system is the first in the world to have direct pedestrian tunnel connections to different metro-rail stations. It is also the first BRT system in China that, in its design, includes a greenway parallel to the BRT corridors, with bicycle parking and a bicycle-sharing system. It has full-length class I bikeways along both sides of the whole corridor. Bicycle-sharing schemes are being implemented with 5 000 bicycles at the 113 different stations along the corridor. The city and ITDP studies show that bicycles are used for over 20 000 trips, bicycle ridership has increased by approximately 50 percent and motorized trips have declined by at least 7 500 trips per day.

After a year of operation, this has been a very successful project. In terms of ridership, it is the most used corridor in Asia, with daily use of 805 000 trips. During the peak period, the system carries almost 27 000 people per hour per direction. The total bus ridership in the corridor has increased by 18 percent. Trip times for bus passengers and drivers have been shortened by an average of 29 percent and for mixed traffic passengers have been reduced by 18 percent, which, in total, equates to an annual saving of 52 million hours and a value of 158 million yuan (US\$24 506 188). The ITDP surveys also showed an increase in passenger satisfaction with public transport from 29 percent in 2009 to 65 percent in 2010.

In terms of the impacts on environment and health, the ITDP study estimates total reduction of CO₂ emission at 864 641 tonnes over the ten-year period from 2010 to 2019. Particulate matter emission, which causes respiratory diseases such as lung cancer, is estimated to be reduced by 4 tonnes during the same period. The calculation of the corridor's emission impacts from the BRT system are the sum of emission reductions from the induced modal shift to BRT and non-motorized transport such as bicycles; increased fuel efficiency due to higher vehicle speed (from both motorized transport and mixed traffic vehicles); reduced bus transit kilometres; and improved bus fuel efficiency (with new LPG-fuelled buses).

Guangzhou city government reports the saving over subsidy on the BRT routes of 0.3 yuan per bus-vehicle-kilometre, which yields an annual operating cost saving of over 93 million yuan (US\$15 188 507). With this estimate, the BRT's capital cost of 950 million yuan (US\$155 151 982) plus interests will be paid off by 79 percent by 2019. If the calculation accounts for public interest such as time saving and emission credits, the capital cost will be paid off within two years.

Although some of the potential longer-term impacts of the system have not yet been captured, for example, the impact on land-use patterns, private car ownership rate and health cost saving through reduction of particulate matter, the project has already shown its economic and environmental benefits as well as potential health benefit.

Case study 3: The Hebei Roads Development Project, China

China's 20-year development plan (1991-2010) for the National Trunk Highway System (NTHS) calls for improving access for less-developed communities to economic opportunity. Hebei Province is in the northern region of China and its Expressway Project is part of the 35 000-km plan and is one of the priority sections of the NTHS from Beijing to Shanghai. The expressway is financed by ADB, with poverty reduction as one of the important components of the project. It is the first ADB-financed project in China that includes a specific poverty reduction component.

The construction of the 141-km, four-lane, controlled access expressway in Hebei Province aimed to provide a strategic link in the National Trunk Highway System and tackle the accessibility of nine designated poor counties in Southern Hebei. The project, which started in 1998, was developed in a sustainable transport planning context to integrate construction of roads, traffic engineering issues, social and poverty issues, road safety, environmental impact and other relevant issues.

As one of the objectives of the project is to reduce poverty in poor counties through improved access to the main economic corridor, the project also includes design components that involve upgrading the county connector roads and linking the principal market centre to the expressway. Also included is the construction of all-weather access roads from remote low-income villages to the county connector roads and to public services and facilities to provide improved accessibility for the people in these villages.

The project's physical outputs include the construction of a dual four-lane expressway, 141 km long, that passes through six counties; the construction of five county connector roads¹⁸⁵ totalling 227.4 km in the poorer counties;¹⁸⁶ and the construction of 121 km of village access roads to class IV standard. Intelligent transport systems and road maintenance equipment are also part of project's

¹⁸⁵ Of the five contracts, ADB financed only two covering about 100.4 km, a continuous stretch from Botou to Haixing passing through Nanpi, Mengcun and Yanshan. ADB did not finance the planned 227.4 km of county connector roads as some of the construction work had already started before loan effectiveness.

¹⁸⁶ The nine counties include Botou, Dongguang, Fucheng, Haixing, Jingxian, Mengcun, Nanpi, Wuqiao and Yangshun. Of the nine, Botou and Wuqiao are not considered national poverty counties.

output. The highway was completed nine months ahead of schedule and has been in operation since December 2000. The building and service and traffic engineer facilities were completed in 2001. Land acquisition and resettlement were completed in 1999.

The upgrade and construction of the network at county and village levels has helped boost access for isolated rural areas and extended socio-economic benefits by providing more than 156 000 rural people from 168 villages with direct access to main activity centres and the overall road network. Per capita income of sample villages increased by more than 10 percent during 1999 to 2003. The overall expressway management offices employ some 1 400 permanent staff. In addition, more than 500 staff members work at petrol stations, hotels, restaurants and shops at the roadside stations; 60 percent of staff members employed in the toll and roadside stations are woman.

A strong link was shown between improvements to quality of life resulting from the development of a sustainable road transport system. Hebei Academy of Social Science assessed the project's poverty impact and found the per capita income of sample villages increased on average by more than 10 percent; the total rural population fell from 93 percent in 1998 to 86.5 percent in 2004. Per capita farmer income in the project area grew from 212 yuan in 1998 to 958 yuan in 2004 (US\$34.6/156.5).

LESSONS LEARNED

The three case studies show that sustainable transport issues impact across all angles of transport: passenger vs. freight, urban vs. rural, private vs. public or through avoid-shift or improved strategy. They also show that green initiatives in the transport sector can be initiated by anyone: individual, private company, association, local government, central government or development partner. Green initiatives can save money, provide a higher quality of life and improve health whilst enhancing mobility and freight efficiency.

From the case studies we can see the different extent to which governments are involved in the projects. We can also see the important roles of other active players. From the Eco-Project case (freight transport) the private sector was the key player which initiated and invested in the project whereas the government implemented and enforced strict policies that formed the need for a change in the behaviour of the private sector. From the Guangzhou BRT case (urban public transport), local government was the key player and investor in the project and worked in partnership with development partners who provided technical assistance. The project yields an attractive investment result, which may attract investment from the private sector in other similar projects in the future. In Hebei, the central government was the initiator of the project, seeking financial assistance from the development bank. The development bank helped to fine-tune the project by requesting the inclusion of a social equity component (poverty reduction) before agreeing to finance the project.

Therefore, sustainable transport should not be perceived as being the sole responsibility of the government or development partner. With appropriate enabling conditions, the private sector can also play a significant role in greening the transport sector. Government must take the lead in creating conditions for public and private sector initiatives and investment to incorporate environmental and social criteria.¹⁸⁷ Private participation will provide greater capacity in moving toward a greener transport sector.

There are ample opportunities to make the sector more sustainable and greener such as those listed in the three case studies. Public and private sectors in developing countries, in particular, have a greater chance to shape the future of their transport sectors through current strategic and judicious planning and investment, leveraging from the best practices and lessons learned from more advanced countries.

¹⁸⁷ UNEP, 2011, *Towards a green economy: pathways to sustainable development and poverty eradication*, Available at www.unep.org/greeneconomy p. 16.

International, regional and subregional organizations can supplement the sharing of successful initiatives by providing platforms for exchange of strategies, best practices and lessons-learned. The platform should not be only traditional government to government, but it should also facilitate exchange among private sectors in different countries and between private and public sectors.

12 Rural livelihoods

There is an urgent need for governments around the world, and in the APR in particular, to implement policies and measures that assist rural communities to adapt to the impacts of climate change and other environmental challenges while eradicating poverty. Understanding how climate change has brought about new dynamics, risks and opportunities and how best to respond, is a challenge now facing national and local governments, social partners and development partners alike. Countries at risk from the impacts of climate change will require gender-sensitive, job-centred policies to adapt to the changes, alleviate poverty and bring significant social and economic benefits at the local level. Well-developed integrated policies have the potential to initiate a cycle of positive economic development and poverty eradication while contributing to social inclusion and environmental sustainability. This can be a driver of local employment creation, including green jobs which, with decent wages, can increase workers' incomes and living standards while reducing their vulnerability to climate change impacts.

Rural livelihoods are already at risk from the impacts of climate change such as movements of agroclimatic zones leading to more droughts and changing rainfall patterns, an increase in extreme weather events, increased water scarcity and reduced groundwater levels, environmental degradation, rising sea levels and soil fertility decline. The growing frequency and scale of economic and environmental shocks in the APR over recent years has spurred the development of social policies, which have already accrued benefits to rural households. Climate change and policies aimed to adapt to it or to reduce GHG emissions have the potential to alter the pattern of development in rural areas. Activities dependent on fossil fuel energy and other energy-intensive practices may become too costly to operate in an era of resource scarcity and rising fuel prices. A green economy can help alleviate poverty and increase the capacity of rural households to adapt to climate change and promote low carbon, environmentally friendly development in a socially inclusive way. However, in order to achieve this, a just transition is required by the productive sectors of the economy including workers, the self-employed, micro-, small- and medium-size enterprises. This transition is required to maintain productive capacity; to develop new skills including skills for new green jobs and greener jobs; to develop, transfer and deploy new technologies and techniques; and to develop financial schemes better linked to climate risks. A green economy must be about reducing poverty and increasing economic resilience against the adverse effects of climate change, as well as about generating income and decent employment for workers without affecting the environment and ensuring the viability and competitiveness of rural enterprises.

The principal drivers of economic growth in rural areas are capital investment, human capital development, expanding markets through trade and economic integration and good governance. The sustainability of this growth is also inextricably linked to employment and access to productive resources, so by strengthening community-based stewardship of natural resources and ecosystems sustainable development can be realized in rural areas.

With regard to rural households, creating green jobs and adapting existing livelihoods to make them more sustainable have become critical measures required

for a green economy. The ILO/UNEP definition for green jobs is decent work in environment-related sectors, which reduces negative environmental impacts, ultimately resulting in levels that are sustainable. This includes, but is not limited to, jobs that work towards protecting ecosystems and biodiversity; reducing energy, materials and water consumption; de-carbonizing the economy; and minimizing all forms of waste and pollution. Environment-related decent work or green jobs is based on four strategic objectives: productive employment; fair income opportunities; social protection and social security for workers and their families as well as opportunities for social dialogue and tripartism. Robust policy frameworks and institutional mechanisms can support the greening of employment and socio-economic policies in rural areas and ensure their continuation and enforcement. New green jobs can be created and sustained in rural areas, as evidenced in APR countries, by focusing investment priorities on policies that develop sustainable farm-based enterprises and green rural industries, renewable energy and energy efficiency, biodiversity protection, climate adaptation, sustainable agriculture, sustainable forestry and afforestation, sustainable transport, sustainable aquaculture, water resource management, sustainable landscapes and disaster risk reduction.

The lives of people living in rural areas are directly dependent on environmental resources such as land, water and forests, making them vulnerable to weather and variability. The main sources of income for people living in rural areas can be clustered as follows: agricultural and forestry livelihoods, farm-based livelihoods (poultry, livestock, etc.) and rural industries (agroprocessing, basic manufacturing and food marketing), as well as employment related to the public sector. These activities need access to basic services to be sustainable such as potable water; access to energy; improved access to local and global agri-food markets and access to microfinance. In a green rural economy one of the first priority areas will be to enhance climate resilience by protecting livelihoods and businesses from the negative impacts of climate change. Adaptation to climate change is a critical policy that also needs to address non-climate-related and proactive poverty reduction policies, including access to renewable energy, green value chain development and accessibility and so forth. For example, in the context of food production and climate change, a green economy can help farmers to diversify livelihoods and crop varieties, have access to drought-resistant seeds and knowledge of sustainable agriculture techniques and better protect them through tailored social protection schemes designed to alleviate poverty and protect against climate variability. A green rural economy will also require a rise in the levels of investment in agriculture and rural industries to achieve higher productivity, the sustainable production of green products, a skilled labour force and higher income levels as well as better protection against systemic shocks. The cost of inaction on livelihoods in rural areas is expected to be high; indeed the Fourth Assessment Report released by the IPCC raised special concerns about the impacts that drought and temperature are expected to have on crop yields, the frequency of crop failures and diseases in livestock¹⁸⁸ and how this will affect people living in rural areas.

In the context of a green economy, a social protection floor for rural households acts as an economic and political stabilizer in times of crisis, strengthening the social pillar for more inclusive and sustainable growth. Practices that contribute to the stability of food prices and domestic markets can protect the poor from shocks while green skills training programmes can equip rural workers with the skills they need to contribute to rural economic development and environmental stewardship leading to higher value added and more productive jobs for local people. If these skills programmes are also bundled with social protection policies and livelihood diversification schemes then poverty can be reduced and rural workers can be better protected during the transition to a green economy. Creating decent gender-sensitive rural employment can be a central driver for overall rural development and thus is critical to achieving MDG 1 on halving extreme poverty and hunger, MDG 3 on gender equality and MDG 7 on environmental sustainability.¹⁸⁹

¹⁸⁸ **Intergovernmental Panel on Climate Change.** 2007. *Fourth assessment report on climate change 2007*, Available at http://www.ipcc.ch/publications_and_data/ar4/syr/en/contents.html

¹⁸⁹ **United Nations System.** Millennium Development Goals 2015, Available at <http://www.un.org/millenniumgoals/>

Rural labour markets often face substantial decent work deficits due to high levels of informal work, casual employment, self-employment and migration flows, as well as poor working conditions and limited coverage by labour regulations and social protection schemes. Representation and participation in social dialogue is also low, meaning that rural workers rarely have their rights recognized and enforced. Low labour productivity means that most jobs do not ensure adequate levels of income needed to escape poverty. This highlights the need to introduce programmes that focus on poverty eradication, raise labour productivity, improve occupational safety and health and enhance social protection, particularly in the agriculture sector where output per worker in many cases is only about 20 percent of that in industry. Pressures to reduce GHG emissions and resource use will also contribute to improvements in resource productivity in addition to labour productivity.

Despite these challenges, embracing a shift to a more inclusive green economy can bring great benefits to rural workers and the economy.¹⁹⁰ Climate-smart policies and investments have demonstrated positive employment creation effects. However, a green economy is not simply a result of green investments but also dependent on facilitating the emergence of many more green jobs to improve environmental performance and sustainability amongst traditional industries and occupations. In fact, green jobs will play a key role over the coming years in greening both carbon-intensive industries, SMEs and the wider economy as a whole. While agriculture has been the predominate source of income in rural areas, sustainable off-farm jobs are also increasing and need to be promoted in order to diversify income sources and absorb workers leaving agriculture. Diversifying into non-farm incomes can be an important survival mechanism for rural households, especially landless households that otherwise would have to rely on casual agricultural wage employment.¹⁹¹ Increases in non-farm employment opportunities such as clothing production, food processing, retailing and education imply a potential reduction in the supply of agricultural workers, thereby increasing wages. Studies suggest that the development of rural SMEs is pro-poor because they tend to be more labour-intensive in nature, thus reducing unemployment and helping to smooth income seasonally and raising local wages.¹⁹² Rural SMEs also tend to generate more employment per unit of capital than big firms and typically produce goods and services that are more affordable to the poor, thereby increasing their access to goods and services which otherwise might not be available to them.¹⁹³ Retailing and manufacturing usually comprise the largest share of off-farm income-generating activities. Therefore, if these enterprises can be encouraged to start producing and selling green products and services using sustainable production techniques then more green jobs can be created in this sector.

Social dialogue mechanisms are also required to discuss the shift to a green economy and how the changes may impact different groups in society such as employers, workers, cooperatives, small business associations, representative member-based groups in the informal economy (waste workers, street vendors, etc.), etc. Social dialogue can be used as a tool to promote consensus-building and the democratic involvement of rural workers to ensure a just transition. Successful social dialogue structures and processes can encourage good governance. They have the potential to resolve any important economic and social issues arising from climate change and improve labour-management cooperation. Existing social dialogue institutions may also be adapted and used for climate change-related decision-making.

¹⁹⁰ This section is largely based on FAO's *Guidance on how to address rural employment and decent work concerns in FAO country activities*, Available at: <http://www.fao.org/docrep/013/i1937e/i1937e.pdf>

¹⁹¹ **World Bank: World Development Report**, 2008. *Agriculture for development – overview*, Washington, DC, 2007.

¹⁹² **ILO. Promotion of rural employment for poverty reduction**, Report IV, International Labour Conference, 97th session, 2008.

¹⁹³ **Lanjouw, J. & Lanjouw, P.** 2001. The rural non-farm sector: Issues and evidence from developing countries, *Agricultural Economics*, 26(1).

Encouraging socially-inclusive green growth is essential for eradicating poverty, improving the most vulnerable people's adaptive capacity and resilience against climate variability and protecting against food and water scarcities as well as weather-related disasters, all while ensuring continued economic growth. Employment-intensive work programmes and infrastructure development, human capital development, access to energy and basic services, social protection schemes and access to microfinance can all play a role in helping to ensure sustainable livelihoods while making rural economies more environmentally friendly and climate resilient.

Addressing the challenges: green development of rural livelihoods

Many countries in the APR have already begun to implement policies and programmes that promote the sustainability of rural communities and livelihoods within the context of a green economy. These initiatives have taken a co-benefits approach towards policy development, which seeks to integrate climate mitigation and adaptation activities with the economic, social and environmental pillars of sustainable development. The co-benefits approach aspires to achieve tangible economic and social benefits such as poverty alleviation, employment creation and economic growth while simultaneously improving environmental sustainability and climate resilience. The following examples have been taken from real-world experiences in APR countries and have demonstrated the feasibility of integrating economic, social and environmental considerations into sustainable development policy.

Employment-intensive programmes

Public Employment Programmes (PEPs) have been used in the region to mitigate the temporary effects of natural disasters or economic downturns and to stimulate employment and inclusive growth in rural areas. PEPs have generated significant numbers of green jobs in rural areas while helping to reduce poverty, adapt to climate change and improve environmental sustainability. In some developing countries the prevalence of unemployment and underemployment in rural areas has been a major contributing factor to poverty; therefore measures are needed to create opportunities for those who can and want to work. In many areas the private sector is unable to generate the employment levels required, leaving government as the only body that can establish a foundation level of employment. In these cases the government can establish a PEP as an additional policy instrument to promote rural development and poverty alleviation. This can directly contribute to national programmes and initiatives relating to employment, climate change and the environment as set out in paragraph 21(3) of the Global Jobs Pact adopted at the International Labour Conference in June 2009.¹⁹⁴

PEPs are designed to provide wages that meet the daily subsistence needs of casual workers. When properly targeted, and integrated with social protection policies these programmes can help to reduce poverty and the vulnerability of the poor to systemic shocks. Activities that work towards building productive assets, such as land improvement and irrigation works in the farm economy, have demonstrated how investments in climate resilience and natural capital can employ many people and have the potential, if designed correctly, to simultaneously accrue economic, social and environmental benefits to local communities by facilitating income distribution and targeting vulnerable groups, including women and disabled persons.

Green PEPs can also help monitor investments in rural development in a more systematic manner, quantifying the contributions such programmes would have in maintaining and enhancing natural capital. This would require the development and institutionalization of effective monitoring

¹⁹⁴ ILO. 2009. Global Jobs Pact, International Labour Conference, Available at http://www.ilo.org/wcmsp5/groups/public/@dgreports/@dcomm/documents/genericdocument/wcms_124350.pdf

and evaluation mechanisms to track resource allocation and the numbers of green jobs created. The Innovations in Public Employment Programmes¹⁹⁵ modular training framework for example, developed by the ILO International Training Centre in Turin, works to equip policy-makers with the skills needed to design effective PEPs. It features diagnostic and operational tools to help participants devise viable public employment schemes within their own country context. Public employment programmes integrated with a social protection scheme are presently operating or being considered in the region in Cambodia, Indonesia, Nepal and Pakistan. The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), part of a public employment scheme in India, for example, provided green jobs and a social protection floor to over 54 million rural households in 2011. There is certainly a need for PEPs to be better linked to environmental considerations and for employment policies in general and to be better integrated with national climate mitigation and adaptation plans.

Labour-intensive sustainable infrastructure programmes can also promote rural economic development and reduce unemployment, particularly in times of crisis, while ensuring greater environmental sustainability. Large-scale government spending and green public procurement can be used to stimulate an economy during an economic downturn, providing much needed employment and social support. These programmes can mobilize many people, both in rural and urban areas, to participate in large-scale construction projects that contribute to a transition to a low carbon green economy. These programmes have also demonstrated a large multiplier effect on vulnerable communities by combining multiple objectives and can be an effective instrument to increase domestic labour demand and create new employment opportunities for workers and enterprises through private sector contracting. Demand for green skills and green jobs can be generated by investing in sustainable infrastructure projects in green sectors such as renewable energy (i.e. wind farms, solar PV farms, biomass, biogas, solar thermal, etc.) climate adaptation, organic production systems, sustainable transport, water resource management and waste management.

The ROK, for example, used a green stimulus package (4 percent of GDP) associated with job creation targets during a regional financial crisis. The Four Major Rivers Restoration project was a major labour-intensive infrastructure scheme initiated in January 2009 as part of this stimulus package. The project was a component of the ROK Government's wider Low Carbon Green Growth agenda, which seeks to harmonize economic growth with greater environmental sustainability while pursuing proactive responses to climate change. The goal was to ensure water security, improve flood control measures and regenerate ecosystem vitality while creating opportunities for rural economic development along the restored river routes. Completed in October 2011, total funding for the project was estimated at KRW22.2 trillion (US\$17.3 billion).¹⁹⁶ The government had previously identified water security as one of the primary issues resulting from climate change and committed to investing in a strategy to secure and develop new water resources (1.7 billion m³ by 2016) to safeguard against droughts, floods, water contamination and increases in demand.

The restoration project took an integrated approach to sustainable development policy implementation and had a number of complementary economic, social and environmental goals. Primarily the project was designed to kick-start the economy after the 2008 financial crisis using government spending as a driver to create thousands of new green jobs. According to an analysis conducted by the Ministry of Labour, employment effects were equivalent to KRW7.37 trillion (US\$6.6 billion) for two years, creating job opportunities for 88 400 workers.¹⁹⁷ In addition, analysts

¹⁹⁵ **ILO.** *Mitigating a jobs crisis: innovations in public employment programmes*, Turin, Italy, 2010, Available at <http://sdti.itcilo.org/investment/ipep-course-report>

¹⁹⁶ **Yoon Jung Cha, Myung-Pil Shim & Seung Kyum Kim.** 2011. *The Four Major Rivers Restoration Project*. Office of National River Restoration, Government of Republic of Korea.

¹⁹⁷ *Master Plan of the Four Major Rivers Restoration*, Office of National River Restoration, the Republic of Korea, 2009.

have estimated that new jobs will also be created in leisure, tourism and cultural industries, generating about KRW40 trillion of additional economic activity. Ecological parks were built in rural areas along rivers to restore indigenous and endangered aquatic species; they also created green employment in ecotourism. Other improvements resulting from the project included ecotours and agri-tourism; the gradual adjustment of riverside farmlands; the development of remote sensors to enable real-time monitoring of water pollution; development and maintenance of unmanned underwater robots for environmental management; improved access to waterfronts; construction of bicycle lanes (1 728 km); and investments related to climate adaptation such as strengthening old levées, dredging sediment, expanding carbon sinks and flood monitoring technologies, all contributing to the creation of new green jobs. Photovoltaic solar farms and small hydropower power plants were built along the four major rivers and tributaries to provide renewable energy to local communities.

Such employment intensive programmes have demonstrated the potential to generate thousands of green jobs in rural areas by providing decent work, social protection schemes and facilitating contributions to environmental outcomes in line with local and national development policy objectives.

Policies for developing human capital and employability

Successful diversification of rural livelihoods requires investments in human capital. This includes developing skills and encouraging entrepreneurship, especially among women and young people, and building the capacity of individual enterprises. In rural areas there is a need to create green jobs and green enterprises as a means to achieving higher levels of sustainability. Activities which contribute to nurturing social capital are also important such as association building, organization of workers' groups and development of civil society organizations; this can also improve social dialogue with the authorities in rural communities.

As governments introduce policies and programmes to mitigate and adapt to the impacts of climate change, new employment opportunities arise demanding workers with green skills and demand for the production of green products and services. In the APR green jobs development programmes and upskilling programmes are in great demand in countries with large populations in rural areas such as India, Bangladesh and China. Such measures may include adapting existing training programmes and qualifications to address environment-related priority areas such as climate adaptation, renewable energy, sustainable agriculture and forestry. The shortage of a skilled labour force, particularly in rural areas, is a major hurdle while shifting to a green rural economy. For example, while the production of organic food is booming in Africa and Latin America although starting from a very small niche market, with some important employment creation and transformation effects, the APR is lagging very much behind despite an increasingly important regional demand.¹⁹⁸ The potential for sustainable tourism in the region is considered to be enormous, with a high potential for new destinations and green services in particular in rural and remote areas of many countries in the region. The employment effects from sustainable tourism could be better optimized through integrated policies for sustainable enterprises, competency-based training for workers and microfinance services.

Special training programmes can also be developed that target specific disadvantaged groups living in rural areas such as the disabled, indigenous peoples, scheduled castes or the long-term unemployed, as is the case in India, to help them to learn new skills and improve employability. Training programmes can equip farmers with new skills and ways of thinking about organic agriculture such as: improved tilling techniques; sustainable agroforestry; intercropping drought-

¹⁹⁸ *The state of sustainability initiatives review 2010: sustainability and transparency*. A joint initiative of IISD, IIED, Aidenvironment, UNCTAD and ENTWINED.

resistant varieties; permaculture techniques and cultivating food forests. This better capacity for skills needs forecasting to be integrated into rural economic planning strategies to anticipate developments in the labour market and implications for new and green skills training programmes.

Technical and financial support can be also granted to help entrepreneurs explore green business opportunities, create their own start-up companies and expand opportunities to learn about new technologies and create jobs that produce green goods and services throughout the supply chain. In particular in the APR, the youth movement has called for more green jobs initiatives, green entrepreneurship programmes and access to green skills as critical areas that need to be developed to promote a shift towards a green economy.¹⁹⁹ At the 100th International Labour Conference in 2011, the President of Indonesia also called for a global coalition for youth employment and stated the government's intention to advance a national green skills development strategy, a decentralized youth apprenticeship programme for green jobs and measures to foster entrepreneurship and self-employment in the green sector.²⁰⁰

The Training for Rural Economic Empowerment (TREE) programme is another good example; it was designed to assist people working in largely informal economies to build the skills and abilities needed for sustainable employment. The programme is a set of community-based training methodologies and tools developed for income generation and employment creation. Local development approaches and gender considerations were mainstreamed into the TREE programme and contributed to both women and men's empowerment. The programme was designed to increase self-reliance and improve the livelihood sustainability of communities and emphasizes the role of skills and knowledge in creating new employment and income diversification opportunities for the poor, the unemployed and informal economy workers in sustainable economic activities. Over 40 000 project beneficiaries in Bangladesh, Cambodia, Indonesia, Nepal, Pakistan, Pacific islands, the Philippines, Sri Lanka, Timor-Leste and Viet Nam have all benefited from TREE training; now they have utilized their skills, become employed and generated additional incomes.²⁰¹

TREE processes start with institutional organization and planning among local partner institutions, followed systematically by the identification of economic opportunities and training needs assessments to identify employment and income-generating opportunities at the community level. This results in the design and delivery of appropriate training programmes and provides necessary post-training support such as group organization, linking to appropriate microfinance programmes, skills upgrading and business management training. In particular, the TREE methodology was integrated into programmes or projects with specific concerns such as environmental protection, green skills upgrading and low carbon economic development, thus contributing to sustainable development. Rural workers have been taught alternative skills: *inter alia* horticulture, fish farming, beekeeping and rattan making. In the Philippines for example, the TREE programme has helped to increase wage-employment opportunities, self-employment opportunities and income levels (average monthly income increased by more than 90 percent) for rural workers.²⁰² While in Indonesia, the TREE programme aimed at improving the employability and capacity for entrepreneurship among young women and men through improved access to educational and training opportunities. By the end of the project, 1 563 youths had completed the training programmes and 48.3 percent were women. Approximately 10 percent of the 1 563 youths sought wage-employment and the remainder chose self-employment.

¹⁹⁹ Bandung Declaration at the TUNZA Conference, 1 October 2011.

²⁰⁰ ILO. Press release. *Indonesian president calls for global coalition for youth employment*, 2011, Available at http://www.ilo.org/ilc/ILCSessions/100thSession/media-centre/press-releases/WCMS_157666/lang-en/index.htm

²⁰¹ ILO. 2010. *Training for rural economic empowerment*. Report on the regional technical meeting on implementing TREE. Retrieved from http://skills-ap.ilo.gov.th/resources/training-for-rural-economic-empowerment-tree-1/at_download/file1

²⁰² ILO. 2005. *Evaluation: training for rural economic empowerment (TREE) Project*, 2005. Retrieved from http://www.ilo.org/wcmsp5/groups/public/-ed_mas/-eval/documents/publication/wcms_083445.pdf

Australia's National Green Job Corps²⁰³ is an a A\$79.6 million youth apprenticeship scheme run by the Department of Education, Employment and Workplace Relations to provide green skills and accredited training to 10 000 young people (aged 17 to 24 years) a year to prepare them for employment in emerging green sectors. Work programmes are environment-focused and integrated with a variety of social protection policies to create jobs in the conservation, protection and rejuvenation of Australia's natural environment and cultural heritage. Works include restoring degraded beaches, dunes, riverbanks, foreshores; land surveys and audits; building and repairing board walks; regeneration and replanting of degraded lands; wildlife and fish habitat protection; refurbishing public parks; building or repairing bikeways; landscaping gardens using native plants and work in recycling and waste management. The programme also provides skills training and work experience on activities designed to combat climate change such as improving energy efficiency in buildings or installing renewable energy technologies. Projects are developed in conjunction with local government, local communities, representatives of environment groups and relevant training providers, and provide young Australians with the green skills required for green jobs in both urban and rural areas.

Access to energy

Providing access to clean energy in rural areas will be a critical policy tool for poverty alleviation and has the potential to create new opportunities for economic development in rural areas while reducing GHGs. For many rural households in the APR a disproportionate amount of their income is spent on kerosene (up to 50 percent in Bangladesh) for cooking, lighting and heating while the overuse of local biomass has led to deforestation and environmental degradation in many parts of the region.

As environmental standards and targets are introduced to limit GHG emissions, many developing countries in the region are starting to direct investments towards renewable energy (RE) production. The dissemination of decentralized RE technologies may be the only cost-effective alternative for millions of people in rural areas without access to a conventional energy supply. There is a range of clean energy devices now available such as improved cooking stoves, solar lanterns, biogas, and small solar home systems that can contribute to improvements in the standard of living, health and well-being of rural households. Solar home systems (SHS) for example, if used for lighting, enable longer working hours, higher labour productivity and higher incomes as well as allowing children to study in the evenings at home. Using RE devices can also reduce indoor air pollution and related health problems, increase energy security and provide additional income generating opportunities. Stand-alone generators can be built that feed into microgrids to power clusters of homes and business in remote areas without access to centralized energy systems. Furthermore, decentralized RE systems are much more labour intensive per KW generated than from centralized fossil-fuel (carbon, diesel, etc.) power plants and thus can contribute to greater job creation.

This provides an opportunity to create green employment in rural areas by training RE (i.e. solar, biogas, wind, biomass, microhydro, geothermal, etc.) technicians and facilitating low-carbon development through the promotion of RE systems in off-grid areas. In Bangladesh, around 60 percent of the population is still not connected to the national power grid. In this context, the wide-scale adoption of RE technologies to mitigate GHG emissions was outlined in the Bangladesh Sixth 5-Year Plan and National Climate Change Strategy as a means to achieving a low-carbon development path. Under its Renewable Energy Policy of 2008, the government outlined plans to develop RE resources to meet 10 percent of the national demand for power by 2020.

²⁰³ National Green Jobs Corp, Department of Education, Employment and Workplace Relations, Government of Australia, 2012, Available at <http://www.deewr.gov.au/Employment/JobsandTraining/Pages/newgreenjobs.aspx>

The private sector and NGOs are also actively involved in the expansion of the RE sector in rural areas. Greater private sector involvement in the RE market can be encouraged by policies that create a stable investment environment and by establishing regulatory frameworks conducive to green business development. Some of the existing barriers to the greater uptake of RE by rural households can include the unavailability of credit; slow growth in domestic RE manufacturing; incoherence between various fiscal incentives and government policies; subsidy policies favouring fuel-based energy; and a lack of awareness among rural households about the benefits of RE.²⁰⁴ The Infrastructure Development Company Limited of Bangladesh uses an innovative framework to promote RE through the financing of about 28 service providers. Para-public actors such as IDCOL are promoting an approach that integrates both public and private actors to coordinate the supply of RE to remote areas and have recognized the importance of allocating public investments to microfinancial institutions that are promoting successful RE business models, in particular by alleviating the green equipment capital costs for the poor. Through enhanced collaboration with the National Employment Bureau of Bangladesh it became possible to support on a much wider scale the growth of domestic RE technology manufacturing, use and maintenance while integrating fully green competencies into the national technical and vocational qualification frameworks.

Policies can work to enhance competition and market efficiencies to widen access to a range of RE products and services for rural households while having a positive impact on further RE investments, local manufacturing and green job creation. Gasifiers, microhydropower and wind have more pronounced indirect job creation effects while RE devices more relevant to households such as SHS, solar lanterns and biogas have a direct impact on the well-being of households. Reducing or eliminating distorting subsidies on fossil fuels, providing subsidies and investment tax credits and reducing import tariffs on green technologies can help to level the playing field for RE manufacturers and suppliers in the private sector as well as enable microfinance institutions to better compete in rural markets. To tackle the constraints associated with high upfront costs, some RE companies will pay the upfront costs for SHS installation and have adopted a trial system to enable the purchases of energy credits via a mobile phone on a pay-as-you-go model.

The National Solar Mission of India for example, is a major initiative to promote environmentally sustainable growth, mitigate GHG emissions and address energy security challenges. The Mission's objective is to disseminate solar energy technologies across the country as quickly as possible by creating an enabling policy framework for solar energy penetration both at the national and local level. The Indian Government has estimated that potentially there are 30 GW of diesel generators nationwide that can be replaced by solar power over the coming years. The plan aims to create favourable conditions for the development of solar manufacturing facilities, to promote programmes for off-grid applications and to achieve the installation of 20 million m² of solar thermal collectors by 2022. It is envisioned that by the end of the mission at least 100 000 new green jobs with relevant skills will have been created across the skill-chain including research scientists, engineers and local technicians. This green skills training for RE will be achieved by a human resource development programme overseen by the Directorate General of Education and Training under the Ministry of Labour. A Special Incentive Package policy has also been introduced featuring zero import duties on capital equipment and raw materials and low interest rate loans to promote the development of domestic PV manufacturing plants, solar thermal manufacturing plants, component suppliers and related silicon processing facilities.

A partnership between the ILO, Grameen Shakti (a non-profit company) and the Bureau of Manpower, Employment and Training (BMET) under the Ministry of Labour and Employment of Bangladesh identified the need for more training programmes for solar technicians and opportunities

²⁰⁴ **Balkenhol, B. & Tadeo, B.** 2012. *Empowering the poor through increasing access to energy*, ADB/ILO E4ALL Partnership, Bangkok, 2012.

for gender-sensitive green employment. The partnership developed competency standards according to the newly approved National Technical and Vocational Qualifications Framework (NTVQF) and also designed NTVQF level 2 courses. The courses were offered by the public training institutes under the BMET as part of its efforts to mainstream into regular course offerings and thus satisfy the demand for more than 20 000 green jobs by 2015. Since completing the training the female solar technicians help to repair and maintain solar home systems for people in their villages as well as doing assembly work for solar accessories at home and on average earn BDT10 500 (US\$150) additional income a month. The course also helps link graduates with RE service providers for job placement as solar technicians in rural areas.

Biogas generated from animal and human waste can be a cost-effective way to provide gas for cooking and heating while reducing the spread of communicable diseases from unhygienic waste and sewage disposal. Farmers whose livelihoods depend on livestock can be taught better environmental management techniques and how to utilize more efficient use of manure to reduce methane GHG emissions and to create organic fertilizer (waste-to-feed) as well as RE from anaerobic biogas plants (waste-to-energy) creating opportunities for significant green job creation in energy and fertilizer production.

India is the largest milk producer in Asia as well as being the largest cow dung producer in the world, enabling opportunities for significant green job creation in RE and organic fertilizer production. India's National Biogas and Manure Management Programme and the Biogas-based Power Generation Programme, for example, provide policy support and capacity building for small-scale rural farmers on how to adopt biogas practices. A recent economic study of a dairy cluster in Jabalpur, Madhya Pradesh found that two jobs in the milk sector entail one job in the cow dung economy.²⁰⁵ Thus the removal and productive use of cow dung in India currently supports an estimated 900 000 jobs nationally, however at present these cannot be classified as decent or green jobs. The study estimated that 12 million biogas digesters could be built across rural India, potentially employing 1.2 million full-time jobs in construction (not counting for the already 2 million functional plants). Even more jobs could be created by systematically collecting dung, and building and operating community-level biogas plants. The potential for generating electricity from biogas from commercial dung was estimated at 5 000 MW, potentially creating 950 000 jobs in the RE sector. An integrated 'Dung Energy-Diary' policy, aligning dung management strategies with the national policy on milk production would be required to harness the full potential of biogas in rural areas. For example, the establishment of milk-processing and chilling factories could simultaneously include adjacent construction of biogas power plants while the collection of milk could be organized jointly with the collection of dung etc. Such a policy could also support skills training to create new green jobs and support the transition of the rural workforce to a greener economy while increasing the performance of the dairy sector as a whole. Reduced energy expenditures and increased farmers' income could lead to increased investment and higher milk production while biogas-based sterilization systems could improve overall quality.

Social protection in climate-vulnerable rural communities

Integrating social protection policies and economic diversification strategies can act as a buffer and stabilizer against systemic shocks and natural disasters by providing a basic floor for livelihood security and targeted social assistance for the most vulnerable rural households. Promoting greater access to social protection systems in rural areas, particularly in disaster-prone areas, can work towards strengthening the social pillar while reducing poverty and improving the resilience of climate-vulnerable communities.

²⁰⁵ Harsdorff, M. 2012. *The economics of cow dung: creating green jobs in the dairy sector in India*, Geneva, ILO.

In recent years pilot weather index-based insurance (WIBI) schemes have emerged as an effective way to protect the livelihoods of rural farmers from the negative impacts of climate change. The schemes allow individual smallholder farmers to hedge against risks to agricultural production from climate change impacts and have proven successful in many parts of India, Mongolia and Thailand. An important aspect of WIBI is that it is based on agreed weather indices and not on the actual damage inflicted to crops. This type of micro-insurance format is particularly beneficial for farmers living in remote rural areas as there is no need for a field assessment of damage, which reduces transaction costs. Payouts can be released to a beneficiary once a certain ‘index’ has been reached rather than waiting for a claim to be assessed.

WIBI schemes also allow for faster response rates to people in need by paying if there is below average rainfall (drought) or excessive rainfall (floods). Indices are developed based on historical weather data for the area along with future climate scenarios (2020, 2050, etc.) and climate projections for the current year, as well as from interviews and focus group discussions with the rural farmers themselves. The scheme can be delivered to recipients through partner financial services providers (banks and cooperatives) and local government units. If bundled with related education and training activities for alternative livelihood development then these types of social protection programmes can work towards reducing poverty, empowering rural farmers and improving their climate resilience.

The Innovative Financing Scheme for Farm Crop Production and Economic Diversification in the Philippines is a similar assistance package targeted at climate-vulnerable farming populations. It is an integrated financial package of credit-cum-savings, social protection mechanisms (loan repayment services and crop insurance) and training programmes (courses on financial literacy and agricultural technologies) designed to alleviate poverty and increase the climate resilience of rural households. As well as helping to protect rural incomes from climate-related disasters, the scheme is designed to improve socio-economic conditions for beneficiaries particularly through diversified livelihood schemes and training workshops on organic farming techniques.²⁰⁶

CASE STUDIES

Case study 1: Mahatma Gandhi National Rural Guarantee Act of India

The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) in India follows a rights-based approach to rural livelihoods and illustrates how economic, social and environmental benefits can be generated by a well-designed employment-intensive growth policy that focuses on natural resource management as an instrument of employment. The MGNREGA was enacted as a law by the Parliament of India in September of 2005 and is implemented by the Ministry of Rural Development. It aims at strengthening rural livelihoods by guaranteeing up to 100 days of employment a year to rural households that volunteer to do unskilled manual labour. The key component of the scheme is a worker’s right to self-select into the programme, to request work and to receive a job within 15 days of application, or else an unemployment allowance. Other critical design elements include local employment, flexibility, notified wage rates and wage payment through workers’ accounts, no use of contractors or machinery, a labour-intensive ratio of wage costs to material costs of 60:40, transparency and accountability and the development of productive green jobs.²⁰⁷ The Act targets the causes of chronic poverty such as drought, deforestation and soil erosion

²⁰⁶ ILO. 2011. *Climate resilient farming communities in Agusan del Norte through innovative risk transfer mechanisms*. Bangkok.

²⁰⁷ Sharma. A. The Mahatma Gandhi National Rural Employment Guarantee Act. In *Sharing innovative experiences: successful social protection floor experiences*. UNDP. Available at <http://www.ilo.org/gimi/gess/RessShowRessource.do?ressourceId=20840>

and seeks to strengthen the natural resource base and climate resilience of rural livelihoods. The government recognized that one of the most effective ways to increase and sustain crop and livestock production and water availability (for irrigation and drinking) in rural areas is through conserving local natural resources and enhancing their capacity to provide higher levels of ecosystem services.²⁰⁸ Therefore, most works are related to water, soil and land conservation activities such as recharging groundwater, reducing soil erosion, conserving biodiversity, reclaiming degraded lands and carbon sequestration – key determinants underpinning sustainable agriculture and livestock production.

By generating work related to natural resource management, the MGNREGA exemplifies a Public Employment Programme that links policies for poverty alleviation and income security with climate change adaptation and investments in natural capital. The MGNREGA thus enables state governments to use fiscal and legal instruments to tackle poverty and unemployment concurrently by formulating labour-intensive public work-based projects creating productive assets in rural areas.

The programme cost in 2009-2010 was US\$8.1 billion and in 2011, the MGNREGA provided income security and a social protection floor to approximately 54 million rural households across India. Guaranteed-wage employment has helped lift market wage rates, especially for agricultural workers, by 17 to 30 percent since 2006.²⁰⁹ Figure 16 illustrates the rise in average wage per person-days for rural workers before the current policy of linking the consumer price index with agricultural labour rates.

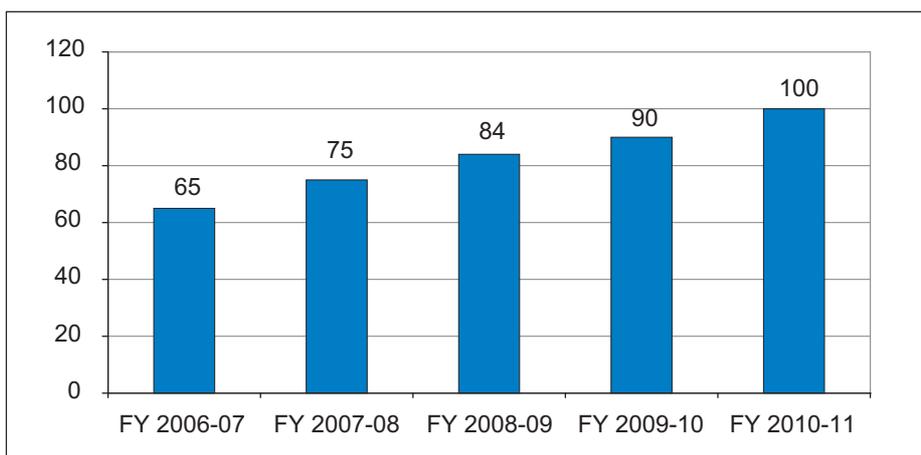


Figure 16: Average wage per person-day (under the MGNREGA)

The Act has also had a positive effect on gender equality as women constituted 50.9 percent of all persons working in the scheme from 2010-2011, which dramatically exceeded the legally mandated 30 percent. As the MGNREGA was designed to provide equal access to work and wage payment, women and other disadvantaged groups have been successfully targeted, leading to wage parity for women as well as increased governance transparency and accountability through social audits. The leading States for women participation in the MGNREGA were Tamil Nadu at 82 percent and Kerala at 71 percent.

Work is organized using a participatory approach to socio-economic decision-making so workers and others stakeholders are consulted to ensure activities are appropriate to the environmental conditions and relevant to local communities. Some state governments have also

²⁰⁸ ILO. 2010. *MGNREGA: a review of decent work and green jobs in Kaimur District in Bihar, India*,

²⁰⁹ Ministry of Rural Development. 2010. *Mahatma Gandhi National Rural Employment Guarantee Scheme*, Government of India, Available at <http://nrega.nic.in/netnrega/home>

initiated convergence of MGNREGA opportunities with other development and social protection programmes such as life and health insurance, skills development and literacy programmes. Workers have used earnings for spending on key needs such as food and health security, education, repayment of debts and construction of housing. In total, the programme has generated a total of 8.8 billion person-days of work, of which 52 percent of the beneficiaries come from scheduled castes and tribes. In addition, the scheme has expanded rural connectivity and improved access to markets through the construction of rural roads, improved financial inclusion (with 90 million accounts opened in banks and post offices for registered MGNREGA workers) and extended information and communication technology infrastructure to rural areas to monitor and administer the scheme.²¹⁰ The MGNREGA is now one of the largest rights-based social protection initiatives in the world.

Green employment opportunities created by the scheme include the regeneration of the natural resource base of local communities, water conservation and harvesting, afforestation and tree plantation, irrigation, rejuvenation of traditional waterbodies, flood prevention and the rehabilitation and maintenance of rural infrastructure. A recent ILO analysis of decent work and green jobs in Kaimur District in Bihar State²¹¹ highlighted the potential that exists for green jobs and decent work as well as the need to adhere to labour standards. It noted that 70 percent of the work projects had reduced the vulnerability of agricultural production, water resources and livelihoods to uncertain rainfall patterns, water scarcity and poor soil fertility. Incomes from crop cultivation had also increased from zero to up to Rs100 000/acre/year thus enhancing livelihood security.

Environmental outcomes have also been positive because most MGNREGA work contributes to the development and regeneration of natural capital and waterbodies. Water conservation, for example, accounts for about half of all projects supported under MGNREGA, with 850 000 water conservation works funded and completed from 2006 to 2008. The construction of percolation tanks and check dams has increased water availability and improved access to irrigation, resulting in crop diversification and dual cropping as well as enhanced ecosystem services through the recharging of aquifers and reduced drinking water scarcity. For example, in the District of Jalaun (Uttar Pradesh), the MGNREGA provided training and employment for villagers to develop solutions to their heavily silted water harvesting infrastructure, alleviating their water shortage. In 2007/2008, more than 3 000 new soak pits, together with hand pumps were constructed which helped conserve an estimated 5 million litres of water.²¹² A related study on the impacts of the scheme in Chitradurga District, Karnataka, examined the impacts of MGNREGA activities on four target villages (see Figure 17). A significant reduction in overall livelihood vulnerability was observed in all four villages due to the additional employment created by MGNREGA activities and the subsequent additional incomes provided. Two of the villages (Khandikere and Koverahatti) demonstrated a significant reduction in water vulnerability which resulted from the construction of check dams and the desilting of village tanks. Two of the villages (Khandikere and Koverahatti) demonstrated a significant reduction in agriculture vulnerability and another (Dharmapura) a marginal reduction, which was reflected in improved water resources, an increase in area irrigated and nutrient addition to cropland.

While there are still some implementation issues,²¹³ the MGNREGA experience shows that a policy designed primarily as a social safety net can also support environmentally sustainable economic development in rural areas by providing work that helps the poor earn wages and create

²¹⁰ **Sharma, A.** The Mahatma Gandhi National Rural Employment Guarantee Act. In *Sharing innovative Experiences: successful social protection floor experiences*. United Nations Development Programme, Available at <http://www.ilo.org/gimi/gess/RessShowRessource.do?ressourceId=20840>

²¹¹ **ILO & MGNREGA.** 2010. *A review of decent work and green jobs in Kaimur District in Bihar, India*.

²¹² **UNEP.** 2009. *Green economy success stories: rural ecological infrastructure in India*. Available at <http://www.unep.org/greeneconomy/SuccessStories/RuralEcologicalInfrastructureinIndia/tabid/29868/Default.aspx>

²¹³ **Bhavan, K.** *Ministry of Rural Development presentation: implementing NREGA*. Available at: nrega.nic.in/presentations/Implement_NREGA.ppt

durable productive assets that contribute to development. Indeed, there is a risk that at times these two features may be in conflict, as the operation of an effective safety net requiring a guarantee of work within 15 days of demand could lead to work that is neither sustainable nor productive.²¹⁴ However, on balance the MGNREGA has the potential to support rural households in the shift towards a green economy and produce significant economic, social and environmental benefits for rural communities in India.

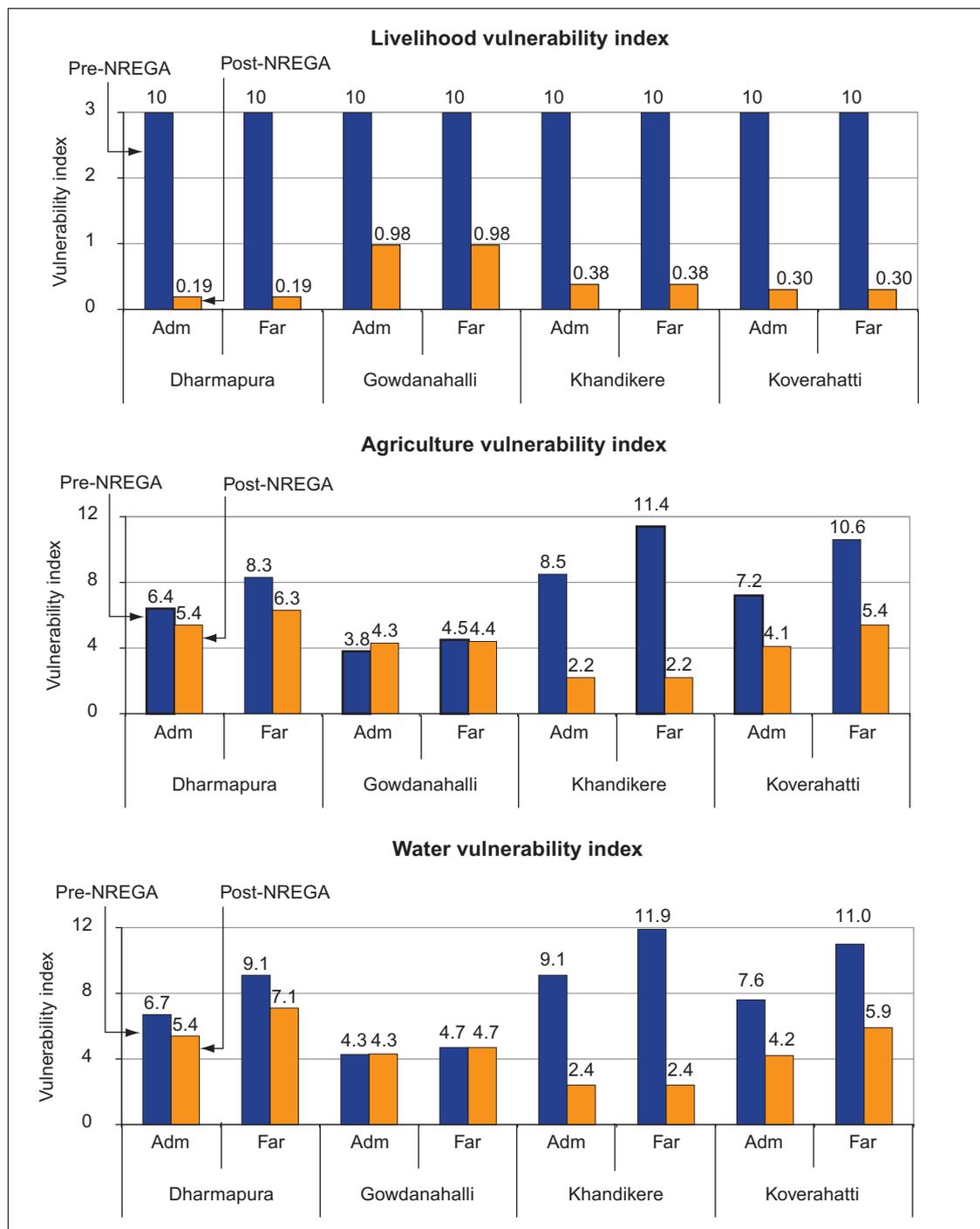


Figure 17: Livelihood, water and agriculture vulnerability indices for selected villages (Weighted for farmers' and district administrators' perspectives)

²¹⁴ Sharma, A. 2010. *Rights-based legal guarantee as development policy: The Mahatma Gandhi National Rural Employment Guarantee Act*, United Nations Development Programme. Available at: http://www.undp.org.in/sites/default/files/reports_publication/MG-NREGA_DiscussionPaper.pdf

Case study 2: Microfinance and social protection schemes in the Philippines

The promotion of climate-resilient farming communities in Agusan del Norte, Philippines uses innovative risk transfer mechanisms to alleviate poverty and strengthen the country's institutional capacity to adapt to climate change. Agusan del Norte is home to approximately 31 913 (55.6 percent) households who live below the poverty line, which is more than double the Philippines' national average (24.4 percent). The initiative was designed to strengthen the adaptive capacity of vulnerable groups through increased access to financial resources and economic diversification opportunities and was supported by the International Labour Organization (ILO), Department of Labour and Employment and the Department of Trade and Industry. It aims to develop and test a variety of financial safety nets for vulnerable populations, especially women, and to develop their capacities to participate in economic diversification within a democratized governance system.

The initiative was developed and implemented on the premise that the economic conditions of populations at risk and access to and availability of financial as well as productive resources are key determinants of adaptive capacity to climate change impacts. The strategy is to bundle financial services (i.e. credit, social protection mechanisms, insurance and savings) with non-financial services, (i.e. agricultural technology support, seminars on financial literacy, climate change and environmental protection) to help rural farmers improve climate resilience while diversifying their incomes.

Based on the results of a needs assessment, three integrated financial package models (the Rural Bank model, Cooperative model and LGU Loan Facility model) as well as a weather index-based insurance scheme were developed.²¹⁵ The main targets of the loan packages were climate-vulnerable rice and maize farmers whose wives were already registered at the bank under a similar scheme and who had a good credit history. The packages were designed to be production cycle-responsive and non-collateralized, with less documentary requirements, which allowed for more efficient processing, and lower interest rates. The three models offered variations of credit schemes, savings components, formal and informal insurance packages as well as training support that included a 16-week Farmers' Field School (complementing the Philippine Government's existing technical training package for farmers provided by the Department of Agriculture) and entrepreneurship and financial literacy seminars. The amount loaned to farmers was based on a preliminary farm plan and budget and was contingent on whether production was in the first cycle or as a repeat borrower. Amounts ranged from PhP3 000-15 000 per hectare (US\$1.00 = PhP43.1), up to a maximum of 5 ha, the interest rate was set at 2.3 percent a month and the processing fee was 4 percent. Provisions for social protection were among one of the conditions for the loan. The borrowers were required to deposit PhP450 to be eligible for mutual death benefits under the bank's Mutual Benefit Association (MBA) and I-CARE programme as well as the associated Weather Index-Based Insurance scheme. By October 2011 the Rural Bank had granted loans to 212 farming households totaling PhP6 808 000 with a repayment rate of 100 percent.

The three models included savings components, which were seen as crucial in helping farmers to deal with natural disasters and be less loan-dependent for their production needs. Both employed the clustering approach where farmers are grouped into manageable numbers of seven to 15 and provided continuous education and technology support as well as payment facilitation. The LGU Loan Facility model was implemented in two other municipalities, Buenavista and Jabonga providing access to finance to 265 farmers (111 men and 145 women) for crop production loans and 53 farmers (21 men and 32 women) for loans related to alternative livelihoods. Loan repayment was

²¹⁶ ILO. 2011. *Climate resilient farming communities in Agusan del Norte through innovative risk transfer mechanisms*, Available at: http://www.ilo.org/wcmsp5/groups/public/-asia/-ro-bangkok/-ilo_manila/documents/publication/wcms_124794.pdf

maintained at 100 percent in the Rural Bank model and almost 90 percent in Buenavista. These integrated financial packages also included a weather index-based insurance package, which covered climate risks such as low rainfall and excess rainfall for both rice and maize. The ILO Micro-insurance Innovation Facility in partnership with the Philippine Crop Insurance Corporation was able to develop a WIBI package for the two municipalities where the synoptic weather station had 30 years of historical weather data. This along with historical ten- to 15-year crop yield data and in consideration of the climate projections and climate change scenarios became the basis for the WIBI package. WIBI has the potential for fast payments as it does not require the actual inspection of damage but rather readings from automatic weather stations and pre-agreed pay out schemes. During the pilot test of the package, 56 farmers in Buenavista (52 from the LGU Loan Facility and four from the Cooperative model) who suffered from low rainfall-induced drought received pay outs and more than 90 farmers with still standing crops received pay outs when the excess rainfall index was breached.

The LGU Loan Facility model also provided production loans to farmers to produce their own organic fertilizers and included a bundle of support services to incentivize greater uptake in the scheme. This included relevant training from national agencies at the Farmer’s Field School on rice farming, organic agricultural practices, farming technologies, vermiculture (worm husbandry), vermicomposting and financial literacy for debt management. They also provided assistance in taking out crop insurance and additional loans to farmers to diversify livelihoods – initially focusing on swine production or organic vegetable farming. The farmers were also encouraged (but not required) to join the ‘Neighbourhood Dayong’, a kind of mutual assistance system like personal insurance, to help each other during medical emergencies and deaths (family gets PhP30 000 if the principal member dies), helping to build further social capital among the communities. Table 21 displays the amounts paid out to farmers under the WIBI scheme in 2011.

Table 21: WIBI rice cycle 1 – pay outs for 2011

Lender/mediator/ aggregator	No. of farmers enrolled	No. of farmers w/pay outs	Amount (PhP)
Baug CARP Multi Purpose Cooperative (Cooperative model)	4	4	55 023
LGU Buenavista (LGU Loan Facility)	52	39	189 264
LGU R.T. Romualdez (LGU Loan Facility)	98	59	998 016
Total	154	102	1 242 303

Source: ILO.

It is interesting to note that while access to loans and relevant non-financial services increased farmers’ opportunities to diversify their livelihoods and maximize farm outputs, a good and responsive insurance package needs to be bundled in to ensure protection and to give farmers greater confidence to take on agricultural risks. In the municipality of Remedios T. Romualdez a flood-prone farming town in Agusan del Norte Province, the LGU Loan Facility had assisted 178 farmers to plant 326 ha of organic crops by the end of 2011 and 51 of these had also taken out loans for alternative livelihoods such as swine production. In addition, 90 farmers had enrolled in the WIBI scheme for excess rainfall while 127 farmers had taken out traditional insurance cover.²¹⁶

²¹⁶ MDG Achievement Fund. 2011. *Climate resilient farming communities in Agusan del Norte through innovative risk transfer mechanisms*.

By December 2011, while there was not yet a marked increase in the overall production and gross income of farmers, farmers had reported an increase in their net income, primarily due to the lower interest payments and lower cost of inputs (use of organic fertilizers etc.). Interest rates were previously high, starting at 6 percent per month from traders, while the rural bank model set rates at 2.3 percent and 1 percent for the Cooperative model and even lower at 0.83 percent for the LGU Loan Facility model. Moreover, families who accessed both the crop production and alternative livelihood loan packages gained additional income, which they could use for their daily needs (income from vegetables for example, which have shorter production periods), enabling some to rent additional farm lots in higher ground (away from areas at risk of flooding) and purchase secondhand vehicles which lowers the cost of transporting goods to markets. A significant amount of savings was reported by the Baug Cooperative by their beneficiaries of PhP458 764.20 (US\$10 427) plus members' capital build-up of PhP252 978.27 (US\$5 750).

The access to financial and productive resources needed by vulnerable farming communities was further complemented by initiatives relating to climate-induced disaster preparedness and early warning systems. The Department of Science and Technology (Caraga Regional Office and PAGASA Weather Bureau), installed weather monitoring devices, (to include manual rain gauges and automatic weather stations in all municipalities, the latter also used in WIBI), the training of local monitors and established a system to transmit warning messages. This community-based early warning system helped farmers build further confidence in their agricultural production as it provided them with ready access to weather information and allowed them to adjust and adapt their activities based on the information. The project has demonstrated that armed with real-time and more accurate forecasts of weather, with easy to access financial and productive resources needed for their livelihoods and protected by varied and more responsive social protection mechanisms, vulnerable farming communities can be made resilient against climate change risks. By bundling additional support services with microfinance loans, this also enables farmers to be better money managers, while reducing poverty, increasing climate resilience and raising incomes for rural households.

LESSONS LEARNED

Greening the employment and social pillars

More environmentally friendly employment and socio-economic agendas can strengthen social pillars and may be linked with environmental standards and targets, national adaptation plans of action, nationally appropriate mitigation actions and national sustainable development plans.

Rights-based labour-intensive work programmes can empower rural people to directly contribute to work that will benefit their local communities and reduce the vulnerability of production systems against climate variability and climate change. As demonstrated by MGNREGA in India, employment-centred sustainable development policies in rural areas have the potential to create abundant quantities of quality and decent jobs, including green jobs for rural households in the region. In order to prevent suboptimal working conditions observed in some instances, it is important that work is planned, synchronized and integrated with local economic development plans and environmental considerations to benefit communities both in the short and long term. However, such programmes are based on the reinforced presence of the state in rural areas and the prominent role played by public policy.

Developing a social protection floor for rural households will also be a key policy objective in the drive towards poverty eradication and an inclusive green economy. Adapting social protection systems to address the impacts of climate change as well as bundling skills training, financial literacy education and livelihood diversification strategies with insurance and microfinance loans can enhance the resilience of communities located in climate-vulnerable areas. These types of bundled social protection packages can then be rolled out and integrated with public work programmes,

infrastructure developments and rural development plans in line with environmental objectives. This can work to guarantee that the well-being of rural people is enshrined and protected by public policy and legislation. Consultative mechanisms and multistakeholder consultations between the authorities and community representatives in rural communities can facilitate discussions about any changes and ensure that new policies introduced are just and contribute to protecting the livelihoods of rural people as well as protecting the environment. It is also important to cooperate and hold consultations with trade unions to promote a just transition for workers in rural areas. For example, the Trade Union Congress of the Philippines, the Federation of Free Workers and the Association of Progressive Labour have all included the promotion of green jobs in their action plans for the next five years. The improved participation of civil society organizations in decision-making in rural areas will depend on strengthening the rights to access information.

Promoting sustainable enterprises in non-farm activities and specific environmentally friendly poverty reduction measures

The wide-scale deployment of RE technologies, supported by robust public policy frameworks with the active participation of private partners can work towards alleviating poverty in rural areas, mitigating GHGs and reducing environmental degradation while generating alternative livelihood opportunities and sustainable farm-based microenterprises. Historically, it has been retailing that usually comprises the largest share of off-farm income-generating activities. Diversifying into non-farm employment and encouraging rural SMEs to start producing and selling green products and services using sustainable production techniques can therefore be an important strategy to assist rural households to raise incomes.

Green skills training programmes for employment related to the environment and climate change can be specifically targeted at women or other disadvantaged groups and bundled with microinsurance or other social protection schemes thus raising and diversifying incomes and raising standards of living. Entrepreneurship training programmes such as TREE have the potential to develop human capital in rural areas and empower people to identify opportunities themselves to supplement their incomes and start up new microenterprises and green businesses. The new National Human Resource and Employment Policy of Sri Lanka for example, included policies to create green jobs and address environmental considerations. The experiences in Bangladesh and India are demonstrating the way forward regarding how to link skills gaps analysis within the context of pursuing environmental targets and development plans.

Paying higher attention to the employment and social dimensions of green policies and green measures

Mechanisms such as payments for ecosystem services should be further explored and have potential to reward rural households for reducing GHG emissions while contributing to development work. If successfully incorporated into existing climate change adaptation plans these work schemes also open up possibilities for generating carbon credits and accessing international climate- and environment-related financing schemes, magnifying resources available for further employment creation and investments in natural capital. The institutionalization of effective monitoring and evaluation mechanisms by local authorities can help track resource allocation and the numbers of green jobs created.

Greater policy coherence can be better institutionalized by mainstreaming employment targeting and employment impact assessments into economic and environment-related strategies at macro, sectoral and local levels. Examples are given in the context of the green stimulus packages launched after the recent financial crisis in various countries in the region which linked fiscal measures to job and green job creation. Another example is the Climate Change Action Plan in the Philippines, which linked employment and environment plans by including the promotion of

sustainable livelihoods and jobs created from climate-smart industries and services as one of its key strategies.

Economists and planners can utilize analytical tools such as a Green Dynamic Social Accounting Matrix and updated input-output tables incorporating green sectors, to assess and predict the potential environmental and socio-economic impacts of a range of climate mitigation and adaptation measures on employment and incomes. National labour ministries can develop programmes to undertake research on the labour market and track demands for green skills and green jobs and link them with climate change and environment-related policies. Employment and skills needs' forecasting ought to be integrated in to economic planning and integrated with environment-related agendas to anticipate new developments in the labour market and to address potential skill shortages through green skills and green jobs mapping studies. Shortages and gaps in skills for green jobs are already a major challenge for operating a shift towards a socially-inclusive green economy.

Improving policy coherence and integration

Greater policy coherence and policy integration may require a higher level of interministerial collaboration. The need for dedicated, new, national- and provincial-level task forces charged with integrating environmental, employment and socio-economic development policies may be manifested. In fact taking a whole systems approach to national development planning can achieve greater sustainability in both rural areas and across the economy as a whole. The Korean Presidential Committee on Green Growth for example, was established in 2008 to facilitate greater interministerial cooperation for the new Five-Year Plan for Green Growth and related programmes. Subcommittees on Green Growth were also established at the provincial and municipal levels under the control of the governor or mayor and were required to develop their own Five-Year Plans for Green Growth to help translate the national plans into local implementation. In Malaysia for example, the Ministry of Energy, Green Technology and Water and Ministry of Human Resources, facilitate interministerial coordination on employment issues and environmental sustainability through the joint secretariat of the Working Group on Green Jobs. In India, a Multi-stakeholder Task Force on Green Jobs has been set up under the purview of the Labour Authorities.

These examples taken from across the region demonstrate how measures to mitigate and adapt to the impacts of climate change can be successfully integrated with employment and socio-economic development policies to increase the climate resilience and sustainability of rural livelihoods. Policies such as innovative public employment schemes, employment-intensive infrastructure investments, entrepreneurship promotion, skills training, social protection schemes and the promotion of decent work in environment-related sectors can all work towards eradicating poverty and strengthen the three pillars of sustainable development that contribute to building a green economy while improving the lives of rural people.

15 Urban livelihoods

Over 40 percent of the APR’s population lives in cities and towns. Growing at an average rate of around 2 percent, most of the population is expected to live in urban areas by 2026. In general, countries with advanced economies tend to be more highly urbanized while least developed countries tend to have low levels of urbanization. While rapid urbanization in the APR has generated enormous livelihood enhancement opportunities, it has invited numerous challenges including traffic congestion, improper management of waste, contaminated and deteriorated environments, a rising number of slums and squatters, social exclusion and urban divide.

The concept of green economy as a strategy to improve resource use could reap social, economic and environmental benefits and make cities and towns more sustainable and livable. Current energy and resource use is not economical and is burdening the environment, creating unhealthy and unsustainable towns and cities. The environmental health of cities goes well beyond local environmental problems and affects issues of national or global relevance. Many of these issues and challenges can be innovatively addressed to create multiplier effects and benefits.

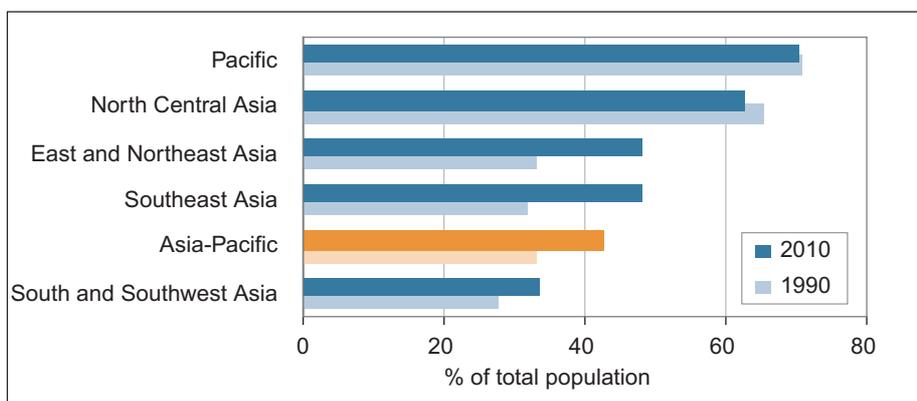


Figure 18: Urban population, APR subregions, 1990 and 2010

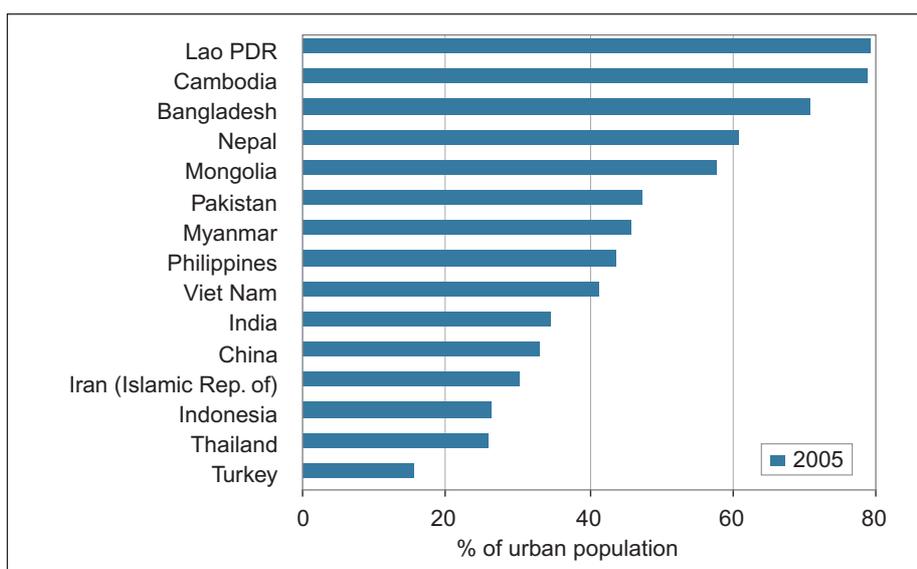


Figure 19: Urban slum population, APR countries, 2005

Asian cities are facing three broad types of environmental risks. The first category is associated with poverty, the second with industrial development and the third with prosperity and mass consumption. In most Asian cities these risks exist simultaneously.

The driving forces behind the poverty-related stage are high levels of rural-urban migration, low per-capita income, the inability of local government to manage its urban resources and insufficient investment in urban infrastructure. As a result, large sections of the urban population live in low-quality housing in densely populated slums and squatter settlements without access to adequate water supply and sanitation and other basic services, inadequate employment opportunities and no security of tenure. It is estimated that around 30 to 35 percent of the urban population in the APR lives in slums. Because of the poor environmental conditions, residents are vulnerable to infectious diseases. The impact of this type of problem is usually local, and often limited to the city.

Environmental problems associated with the early stages of industrialization and economic growth include air pollution by industries and transport, particularly by sulphur oxides and particulate matter, and water pollution by heavy metals and industrial solid waste, as well as acid rain, dust and sandstorms. The driving forces behind these problems are rapid industrialization, prioritization of economic growth over environmental management, the application of outmoded or obsolete technologies, a lack of environmental emission control and poor law enforcement. The spatial range of impacts of this category of risks is local as well as regional because pollution spreads to soil, water and air beyond the city.

Urban environmental issues associated with prosperous lifestyles, based on mass production, mass consumption and mass disposal relate to rapid and unsustainable consumption of natural resources, particularly energy, water and food, as well as large-scale pollution and waste generation. Due to the lack of an extensive mass transit system, individual ownership of automobiles increases, increasing energy consumption, which is also compounded by extensive use of air-conditioning or heating in commercial and residential buildings. Carbon footprints increase dramatically. Cities in the APR generate around 300 million tonnes of garbage and account for around 67 percent of all energy and 71 percent of all GHGs. The carbon footprint for Beijing, according to one estimate, is only slightly lower than that of London.

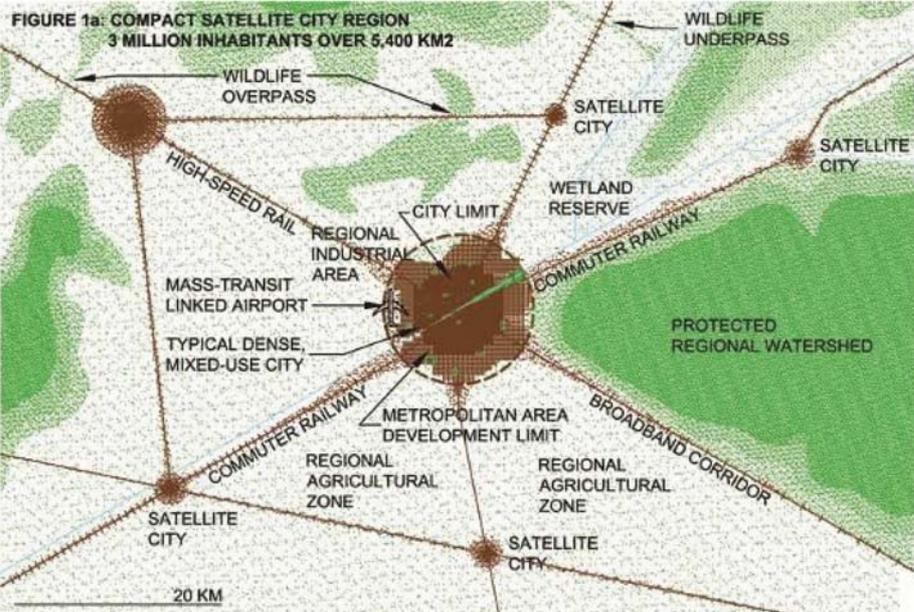


Figure 20: Compact satellite city region with 3 million inhabitants over 5 400 km²

A regional system of multiple, compact, interactive satellite cities linked by strategically-located transit lines reduces resource consumption and emissions while preserving an overall land mosaic in which ecological systems can interlink and thrive. An urbanized region composed primarily of one low-density, sprawling conurbation is poorly suited to mass transit and strategically-located facilities, increases consumption and emissions and fragments the wider landscape in a manner that is detrimental to the functioning of ecosystems.

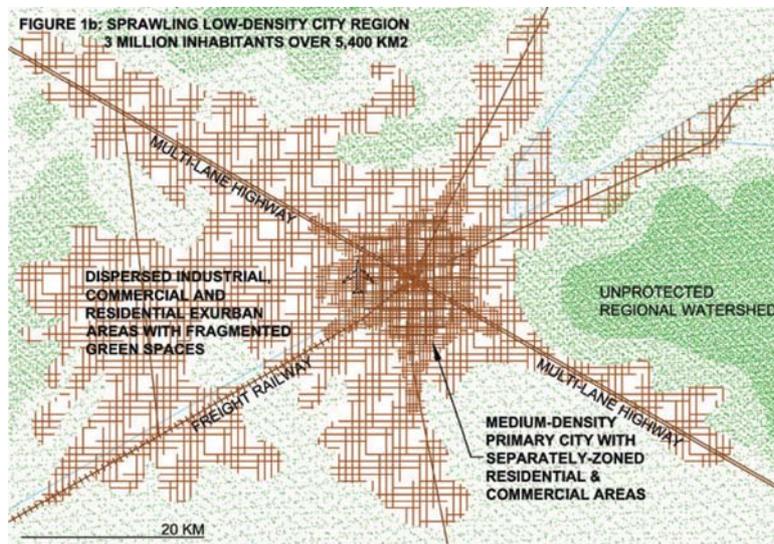


Figure 21: Sprawling low density city region with 3 million inhabitants over 5 400 km²

In addition, another emerging threat confronting urban settlements in the APR is the impact of climate change. Although climate change affects different places in different ways, urban centres are particularly vulnerable, because of the high concentration of people and economic activities. An estimated 54 percent of Asia’s urban population lives in low-lying riverine and coastal zones. Much of these areas would be inundated by a rise in sea level. In particular, slums and squatter settlements are often located in highly vulnerable areas such as riverbanks and seaboards. Anecdotal evidence suggests that around 20 to 30 percent of people who migrate to urban areas in the aftermath of natural disasters such as floods, droughts and earthquakes do not go back their rural origins. This indicates that ecorefugees and ecomigrants could become an additional driver of urbanization in the region.

Greener urban livelihoods

It is clear that business-as-usual is not an option and adopting inclusive green economy approaches is crucial in achieving sustainable urban development. There are many examples in the region that show countries moving towards ecoefficiency. Civil society activism combined with judicial activism has spurred many local governments to clean up or increase the ecoefficiency of their infrastructure. Examples of such actions include converting public transport vehicles to natural gas in New Delhi and the lawsuit filed by communities around Maptaput Industrial zone in Thailand that halted the construction of potentially polluting industries because they had not acquired environmental impact assessment.

A related action is improving urban planning by integrating green technology, energy efficiency and design innovations. It is important to include loosening zoning restrictions to allow for more mixed land use; increasing densities in high-income areas; ensuring green and public spaces; and ensuring that cities and neighbourhoods are more compact, thus reducing dependency on transportation and providing basic services with greater efficiency. Governments can adopt

approaches such as land readjustment and guided land development. The Government of Nepal has been investing in land-pooling schemes, which are basically participatory land development techniques, in which land is consolidated first, planned and distributed back to communities with better infrastructures, services, open space and living environments.

The occurrence of tsunami, floods and earthquakes over the last decade in the region has caused colossal human and economic damage and losses in urban centres. This has forced cities to integrate disaster risk management into the practices of urban planning to make cities more resilient. Mapping vulnerable zones and preparing community disaster management plans are vital for the region. Investing in slum upgrading, introducing saving and credit schemes and empowering communities to increase their resilience to climate change have to be focused.

Ecoefficiency strategies include increasing energy efficiency of buildings through improved design, increased natural lighting and air circulation, using low-energy lighting, improving insulation and the use of low-intensity fuels. An evaluation of nine building codes in the region shows that all of them have incorporated energy-efficiency requirements. Many governments have started subsidizing and promoting renewable sources of energy including waste-to-energy projects.

Increasing the ecoefficiency of urban transport systems is important. Strategies on integrated transport planning and demand management include investing in mass transit systems rather than individual transport systems; taxing private and older vehicles at a higher rate; promoting non-motorized transport modes, particularly walking and bicycling; and promoting the use of cleaner fuels. With effective and efficient mass transit systems, countries like Thailand, ROK and Japan have had considerable success in discouraging individual car ridership and have helped to reduce carbon emissions. On the other hand, Dhaka city, with its very poor transportation system and increasing number of individual car riders, is facing the daunting challenge of worsening traffic jams and environmental pollution.

One of the key reasons for the lack of ecological efficiency in Asian cities is that environmental costs have been externalized. Policies need to be introduced to charge the right costs for providing natural resources, particularly water and energy. This can be done through measures such as progressive pricing, which actively subsidize the poor and penalize overuse and wastage. For example, providing water, at a reasonable level necessary to meet basic needs, could be provided for free, while more intensive use or wastage could be charged progressively higher. Similar policies could be enacted in providing electricity. Penalizing the overuse and wastage of natural resources, particularly water and energy infrastructure, would encourage businesses and households to conserve resources and adopt ecoefficiency measures. Some governments such as Pakistan and Thailand have removed subsidies and introduced progressive tariffs, which penalize wastage of electricity. Actively making urban infrastructure, particularly water, transport and buildings, more ecoefficient would also reduce the carbon footprint of a city without unnecessarily affecting the poor. This would require short-term investments to maximize long-term gain and governments would need to take the lead.

A key action is promoting ecoefficiency of the water delivery system by minimizing unaccounted for water in the urban water supply system, promoting rainwater harvesting, water recycling and re-use (the 3Rs). Manila Water in the Philippines is a good example of how efficiency of water systems can be improved in a pro-poor manner. Many states in India now make rainwater harvesting mandatory in new buildings. Treating urban wastes more effectively by recognizing the 3R approach and 'trash is cash' approaches would go a long way towards increasing ecoefficiency. Several countries have signed up for an APR-wide 3R campaign spearheaded by UNCRD and the Government of Japan.

Even though there is a need for enormous effort among cities in the APR to move towards a green economy, there are many examples of innovative technologies, approaches and practices that

could show the way towards an inclusive and sustainable future. The challenge is to systematically identify, document, analyse, adapt and upscale such innovative solutions. This would require creation of a fiscal, regulatory and institutional environment that allows individuals, businesses, communities and civil society organizations and even government agencies to find innovative solutions. It would also require research and training institutes to identify and analyse the reasons for their success and to assist governments in upscaling such practice.

To promote sustainable and inclusive urban development, the Sustainable Urban Development Section of ESCAP together with UN-Habitat has been advocating and promoting these kinds of innovative approaches. The following innovative practices illustrate how this can be done in sustainable manner.

CASE STUDIES

Case study 1: Pro-poor sustainable solid waste management

Current solid waste management systems in Asia are strained and landfill space is fast becoming a rare commodity. Throughout the region local governments face increasing costs of disposal – while public health and the environment suffer from the damaging effects of untreated solid wastes. In most developing towns and cities as much as 20 to 30 percent of the waste generated is collected, sorted and recycled by informal collectors and junk dealers. However, the informal sector does not have the capacity to manage the organic waste. Sixty to eighty percent of municipal solid waste in Asia's developing countries is made up of organic material. This waste is currently sent to landfills and dumps, where it contributes to GHGs every year. To meet the challenge of growing amounts of waste, cities need efficient, low-cost solutions that improve waste collection, provide better working conditions for waste pickers and capitalize on the high organic content of the waste.

A few years ago ESCAP found that there was a need to identify alternative approaches for urban solid waste management in the APR that would treat waste as a resource, improve waste collection services and provide better income and working conditions for waste pickers. Through a regional assessment ESCAP identified decentralized neighbourhood-based compost plants developed by Waste Concern, an NGO in Bangladesh, as a model that could be piloted in different urban contexts in Asia. Since 2005, ESCAP and Waste Concern, together with local partners, have successfully replicated the approach in Matale, Sri Lanka and in QuyNhon, Viet Nam. The following elaboration on Matale helps us to understand the innovation and sustainability approach in solid waste management.

Matale is a medium-sized urban centre in central Sri Lanka, with a population of almost 37 000. The city is surrounded by large plantations and is famous for its spice gardens. In addition to agriculture the city's economic activities also include tourism and trade. The city generates 21 tonnes (21 000 kg) of municipal waste per day out of which 17 tonnes are deposited at an open dumpsite. Although 20 percent of the Municipal Council's budget is spent on solid waste management there is no town-wide collection and households describe the service provided by the municipality as poor. Ineffective drains, improper waste management practices and poor sanitation were the pertinent issues that communities listed as priorities among households in the city. For the Municipal Council of Matale, there is a priority to ensure a more cost-efficient solid waste management system that will also improve service to households.

At this juncture, ESCAP approached with the innovative idea of converting the waste into resources and creating healthy and livable communities in Matale. In 2006, ESCAP, SEVANATHA – an NGO – and Matale Municipal Council jointly initiated a pilot project on 'Community Based Decentralized Solid Waste Management'. The project aimed to improve the solid waste management

service in one ward, while reducing costs, generating economic outputs and minimizing the amount of waste that was sent to the landfill. The partners established an Integrated Resource Recovery Centre (IRRC) in Gongawela ward. The IRRC is a decentralized centre that include compost plants. IRRCs allow local governments to turn 80 to 90 percent of municipal waste into resources, leaving only 5 to 10 percent of total waste to be deposited at landfills. The IRRC in Matala has the capacity to treat 2 tonnes of organic waste per day and since 2007 it has been collecting and composting segregated waste from about 600 households and small businesses in the ward. The construction and operation of the IRRC has generated multiple benefits and it is moving communities towards a sustainable approach for waste disposal.

The approach puts emphasis on improving the waste separation practices from source. Thus, households have been trained to separate waste into two different bins; organic and inorganic waste. As it is not possible to reach 100 percent waste separation from households, waste is sorted one more time by the workers at the plant into organic waste, recyclables and rejects. The plants produce high quality compost using the aerated box method. The production period for compost is on average 90 days. Strict quality control is maintained and the compost complies with numerous standards for certified organic compost.

Economic benefits: The IRRC processes 2 tonnes of organic waste and produces approximately 400 kg (20 percent of waste) of compost on a daily basis. The IRRC stores, processes and sells recyclables. Because the waste is sorted at the household level, the recyclables are clean which gives them a higher value. In addition, by storing the recyclables and selling them in bulk at an appropriate time, the centre can get a higher price than if it would sell them daily. In addition to the benefits for the workers at the plant there are also benefits to other waste pickers in the city. The centre buys recyclables from other waste pickers, at a price that is transparent and in many cases better than what other junk yards in the city offer. It also generates revenue by collecting monthly fees from the households.

In addition to the direct benefits of selling the compost, there are other multiplier effects created by improved agriculture production. It produces compost from the urban waste and supplies it to rural areas for agricultural purposes. This illustrates how an urban problem (waste) can become a rural asset (compost/fertilizer) and by enhancing rural-urban linkages, there are several economic benefits. The project has also contributed towards enhancing the livelihoods of poor communities by providing regular jobs to six waste pickers.

This approach was comparatively cost effective, using less land than other methods for composting, such as wind rows, and with low construction costs. The technology is simple and non-mechanical which makes it easy to operate and maintain by the local staff while keeping operation costs low. In comparison with more advanced composting technologies, there are minimal malfunctions and repair needs.

When the bulk of waste that was previously dumped in the landfill is minimized and used for productive work, this helps to prolong the life of the existing landfill. The implication lies in saving costs to the municipality and the cost of constructing another landfill that requires a huge amount of money. The plant is located in a central ward that can be easily accessed by communities. Instead of transporting waste to the landfill site, which is situated outside the city, the waste is now treated in the community which both reduces pollution from transportation and saves transportation costs. Due to its central location, transportation costs can be kept low and some fruit and vegetable vendors operating in the areas even bring their waste directly to the plant.

The centre has been operating for three years without any support from ESCAP. While struggling to make a profit in the first years it has improved its management and is now making a profit on operational costs. The main challenge for ensuring the profitability of the centre is to

change the mindset of all stakeholders and to start treating waste as a resource from which money can be made. At present the collection fees from households and the sales of compost are almost enough to cover the plant's operational costs.

In 2009 the local government built a second plant with funds from the central government given to SEVANATHA for management. As construction costs are low it was possible for the municipality to raise funds for a second plant locally.

While the IRRC can break even on operational costs, to cover the investment costs when upscaling the approach, ESCAP will assist the Municipal Council of Matale to access additional funding through the CDM. Because the IRRCs reduce GHGs using an approved methodology, they can qualify as CDM projects under the Kyoto Protocol, allowing centres to sell their carbon credits to developed countries for a profit.

Environmental benefits: The approach mitigates climate change by reducing methane emissions. When biodegradable waste is deposited at a landfill it produces methane. Methane can either be captured or burned to produce energy from landfills or avoided through aerobic composting. Through source-segregation of waste, followed by re-using and recycling of materials and composting of organic waste, GHGs from the solid waste management sector can be reduced significantly.

This approach enormously minimizes the amount of waste that goes to the landfill, expands its life and protects the environment. As the IRRC is centrally located this also reduces air contamination due to vehicular pollution and the bulk of the waste that would have been transported to the landfill in the suburb. When the approach is upscaled to treat all city waste, the centres will also have biogas digesters that will treat meat and fish waste which is difficult to compost. The biogas produced will be used for electricity generation or as cooking gas for surrounding households.

The IRRC is constructed to ensure resource-efficient production of compost. For example due to the high moisture content of the waste, a significant amount of wastewater is generated during composting and the cleaning of the facility. Instead of discharging the wastewater into drains, it is collected in a small covered storage tank below ground level. This stored wastewater is then re-used for new compost piles to maintain the moisture balance and enhance the decomposition process by mixing it with freshwater. Using this wastewater saves groundwater resources. The plant is also equipped with a rainwater-harvesting system, which can reduce the need for groundwater and saves electricity that is otherwise needed to pump water from the ground. Unlike chemical fertilizer, the produced organic fertilizer returns organic matter to the soil, thereby replenishing it and reducing the amount of fertilizer needed, reducing costs and pollution from excess chemicals in the soil.

Social benefits: The IRRC in Matale has successfully shown the importance of community participation and has proven that it is possible to achieve a high degree of separation of waste at the household level. After training and awareness rising, people are now separating their waste in the area covered by the IRRC. SEVANATHA has worked with the community through committee meetings and door-to-door training to promote waste separation at source. The project has also showed that the community is willing to pay collection fees when it receives good service for its money.

The six waste pickers working in the compost plant are provided with uniforms, gloves and equipment. The plant provides a clean working environment and in addition to their salaries, the workers receive a bonus based on their performance in motivating households to separate waste and increased compost production and sales. In addition to the financial benefits, workers feel that by working in the IRRC they have acquired new skills and learned about new technologies. Their new skills and their better working conditions have contributed to improved social status for the workers.

The households have repeatedly expressed their satisfaction with the service provided; in particular the improvement of collection services that is now done from door-to-door, daily and at advertised times.

With the involvement of the community in the separation of waste, the project is helping communities to be more aware of the health benefits of waste management. It also helps to transfer knowledge to the young generation within communities on this issue. By overcoming haphazard disposal of waste and reducing environmental pollution through excessive vehicular movement, overall, communities can live in a healthier environment.

The promotion of this IRRC approach has been significantly supported by the Municipal Council of Matale. The willingness of the municipality to engage in a public-private partnership with an NGO is a partnership model uncommon in Sri Lanka. Furthermore, the municipality has supported the centre by providing workers, giving the centre a land concession and by collecting rejects from the plant. Its strong support for the approach also led to the construction of a second plant using the same approach, but with funds from a national solid waste management project.

Replication and continuation of practice: Under a regional ESCAP project the IRRC approach is being replicated and further improved in ten cities in the APR. As part of further improvement of the approach some of the IRRCs will have biogas digesters to treat meat and fish waste and produce biogas. Thus IRRCs are self-sustaining and profitable for local governments, entrepreneurs and investors. Through their simple, non-mechanical technology, IRRCs can be built and operated at low cost, meaning that initial investments can be quickly returned and that profits can be sustained throughout their operation. Because the IRRCs reduce GHGs using an approved methodology, they can qualify as CDM projects under the Kyoto Protocol, allowing centres to sell their carbon credits to developed countries for a profit. IRRCs directly benefit the urban poor, providing waste pickers at the centres with better, more stable incomes and safer working conditions and buying recyclables from the informal waste pickers at advertised prices.

Case study 2: Urban partnerships for poverty reduction

Bangladesh's economy is growing, driven by strong growth in the service and industrial sectors. But ensuring an adequate supply of energy remains a major challenge, with a power deficit equivalent to 30 percent of potential output. In the short term, the government is purchasing electricity from private sector diesel-run power plants, but this comes at significant cost. Determination to continue subsidizing goods will strain public finances while opportunities to increase revenue will be lost because of very weak collection of direct taxes.

Inflation is rising, driven largely by food prices. This has disproportionate impacts on the poor, especially the urban poor. Overall, around 31 percent (HIES 2010) of the population remain in poverty. Assuming ongoing economic growth, the established downward trend in the poverty level is likely to continue yet the rate of reduction will slow if inequality worsens further.

Like many countries in the global south, Bangladesh is urbanizing quickly. The urban population grew from 1.9 million in 1950 to 46.1 million in 2010, jumping from just 4.3 percent of the total population to 28.1 percent in 60 years. Rural-to-urban migration has been the main driver of urban growth as only 21.6 percent of urban residents were born in an urban area, while reclassification of administrative boundaries has had a lesser impact. More than 60 percent of the urban population continues to live in the four largest cities of Dhaka, Chittagong, Khulna and Rajshahi, while just 4 percent of the urban population lives in the 300 smallest urban centres.

In Bangladesh, unmanaged rapid urbanization is associated with myriad negative impacts, including severe environmental degradation, encroachment on productive agricultural land and

forests, increasing income inequality and increased crime and violence. For the urban poor, unmanaged rapid urbanization and its associated problems are perhaps most felt in the absence of low-cost housing and the subsequent flourishing of slum settlements.

Very little action has been taken to upgrade or improve established slum settlements or resettle slum dwellers in less vulnerable settlements, while town master plans systematically exclude the poor.

Using the Direct Calorie Intake measure, of the total 2005 urban population of about 34 million in Bangladesh, 14.8 million (43.2 percent) fell below the moderate poverty line, of which 8.3 million (24.4 percent) were further below the extreme poverty line. According to the Cost of Basic Needs method, in 2005, 9.75 million (28.4 percent) of the urban population was absolute poor whilst a further 5 million (14.6 percent) were extreme poor.

The Urban Partnerships for Poverty Reduction Programme (UPPR) is the largest urban poverty reduction initiative in Bangladesh, and one of the largest in the world. Its goal is to reduce urban poverty, and its purpose is to improve the livelihoods and living conditions of 3 million urban poor and extremely poor people, especially women and girls. The UPPR is funded by the UK's Department for International Development, managed by UNDP, technically-supported by UN-Habitat and nationally executed by the Local Government Engineering Department in the Ministry of Local Government, Rural Development and Cooperatives. With funds of about US\$120 million for the period from 2008 to 2014, the UPPR presently covers 24 and plans to cover 31 of the country's largest cities and towns.

The programme focuses on extreme poverty by giving priority to the homeless and the poorest settlements, the poorest households within settlements and the poorest members within families. It proactively supports pro-poor policy development and implementation at the national and local government levels through the sharing of international and regional experiences, sponsorship and engagement in policy dialogues, and engaging in concrete and vital local issues, like eviction threats and action, that have wider policy implications.

Improved community governance is both an objective and the means to deliver other programme benefits. Communities are supported to form a hierarchical structure comprising primary (and savings and credit) groups of about 20 households, community development committees (CDCs) of about 300 households, clusters of CDCs and town-level federations. Communities prepare and manage community-contracts, which are funded through the programme. Activities are planned and implemented by poor communities themselves, with support from programme and local government staff.

The programme includes and integrates interventions in physical infrastructure improvement (or slum upgrading); livelihood support such as apprenticeship, business start-up grants, vocational training, urban food production activities, child educational stipends, savings-and-credit operations, improvement of security of tenure and social interventions to address early marriage, dowry, domestic violence and drug abuse issues.

The programme engages local governments at the city-wide and ward levels in the approval of community action plans and contract proposals, in the oversight and disbursement of funds for these contracts, and in annual work planning. Local governments are also encouraged to provide town-level services to poor communities where possible.

Economic benefits: Economic development interventions – such as urban food production, vocational training and apprenticeships, and business start-up grants – account for 52 percent of the programme budget.

Support to urban food production has increased the number of households producing food and the quantity and quality of the food they produce. So far, more than 61 500 households, half of which are extreme poor, have benefited through improved nutrition and supplemented income.

Apprenticeships for women and men have increased their skill sets and have resulted in better jobs. Each apprentice receives a wage supplement of no more than US\$20 per month for a period averaging six months, but this varies depending on the trade.

Business start-up grants provide extreme poor women with training, a grant of up to US\$70 and a UPPR-employed mentor to provide guidance for six months. So far some 48 000 extreme poor women have benefited.

Environmental benefits: More than 400 000 people now have improved sanitation through the construction of 28 000 shared latrines and 114 community latrines. Some 600 000 people have access to an improved drinking water source, namely 3 300 new tubewells. Over a million people have better access to potable water and experience reduced flooding through 67 km of new foot-paths and 36 km of new drains. As a result, these populations have reported a reduction of water- and vector-borne diseases. In addition, some 40 000 households now have an improved cooking stove, which reduces indoor air pollution and saves fuel.

Social benefits: UPPR aligned activities to three strategic directions: (i) developing human capital; (ii) social protection; and (iii) social empowerment.

UPPR's human capital development activities support improvement in health care, education and day care. By linking its communities to existing health care service providers and training a cadre of health volunteers, more than 200 000 people have some access to improved health care services. These services cover primary health care, reproductive and child health care, eye care and family planning. In addition, UPPR advocacy activities have induced others to establish or relocate 92 satellite clinics to CDC areas to make their services more accessible to UPPR communities.

More than 16 000 students, 70 percent of whom are girls, have remained in school after receiving an education grant from the UPPR. These grants are mainly for secondary levels, but for primary levels UPPR is piloting different approaches to day care, recognizing that this can both free up mothers to work outside the home and provide a safe and supportive environment for children.

Social protection activities include targeted employment opportunities for extreme poor and support for people with disabilities. Because extreme poverty and disability cause and reinforce each other, UPPR has recently recruited a disability consultant to strengthen its interventions in this area. So far, in nine programme towns, almost 700 physically and mentally disabled have received material support, training and education. Social empowerment activities include support to the homeless, adolescents and youth; preventing violence against women; and developing a community voice.

Replication and continuation of practice: The UPPR has initiated several strategic activities to improve communications to the public and key stakeholders including a Web site, video documentaries, case studies, one-page policy briefs, brochures and posters. The UPPR Web site presents information about the programme and is updated regularly with news and events. It is linked with several windows of communication like social networks and knowledge management systems. It has produced four video documentaries on various aspects of the programme such as 'Reducing Urban Poverty in Bangladesh' and 'Urban Apprentices: Developing Skills for Life'.

The 'On-the-Ground' series of two-page case studies highlights UPPR outcomes from the viewpoints of beneficiaries. The 'One-Pagers' series presents key programme processes and tools in

one-page documents. UPPR's people-centric activities often come into the focus of national and international media. The programme is also active online through social networks like Facebook, YouTube, Flickr and Linked-In. It also participates in knowledge-sharing hubs like Issuu, Solution Exchange and other platforms.

Case study 3: Hoi An city development, Viet Nam

In Viet Nam, owing to ongoing growth and change, urban sustainability development has become a national norm and a trendy vision, as evidenced by the initial thrust 'Oriented Strategy for Sustainable Development in Viet Nam' (Decision 153/2004/QĐ – TTg), promulgated by the prime minister in 2004. The criticality and essentiality of integrated approaches to sustainable development have been addressed extensively as a fundamental basis for long-term development of livable cities and regions nationwide. As such, a few initiatives such as the City Development Strategy (CDS) and Provincial Development Strategy (PDS) have been discussed widely in Viet Nam, emphasizing incorporation of sustainability dimensions into development planning frameworks and institutionalization as an ultimate goal.

Ecocity development has been identified recently in Viet Nam as the new main task for sustainable development, being a potential strategic driver of CDS/PDS implementation. This initiative involves explicitly formulating innovative settings within local contexts: (i) convergence of 'green growth' into the whole process of urban development strategy; (ii) strengthened local leadership and ownership in strategic planning and implementation for sustainable development; and (iii) financial and human resource mobilization designed for integration of key components of urban sustainability. Ultimately ecocity models in Viet Nam are expected to bring reforms of urban areas into global climate-friendly livable cities based on doable human-oriented processes, being initiated and supported by UN-Habitat's involvement in the CDS/PDS. With efforts to strengthen the planning and management capacity of the local government in dealing with provincial and city development issues, UN-Habitat has worked to pin down the institutionalization of strategic planning for socio-economic development in cities and provinces.

Hoi An city, which has been identified as a strategically important city for sustainable development in Quang Nam Province, plays an important role, not only in the province, but also Viet Nam nationwide as a vibrant trading centre where different cultures co-exist harmoniously. In early 2008, the central government certified that Hoi An was a strategic economic, social and cultural centre; in June 2009, UNESCO recognized the Cu Lao Cham zone to be a world biosphere reserve. Urban planning and management have improved and progressed as city space has been broadened with nine urban wards and four rural communes.

Recently Hoi An's urbanization has progressed swiftly and witnessed unavoidable transformation in the city and its region. This has involved rapid change of the cultural landscape and ecological environment, conflicts between preservation and development related to economic growth planning, and rapid urban expansion leading to imbalanced resource development in the region. Ambitious government initiatives to extend Hoi An as an innovative platform for multisector investment have also created new challenges and opportunities.

Recognizing these challenges for sustainable development, the 16th Party Committee Congress of Hoi An city resolved to "continue to build Hoi An following the criteria for a secondary eco-city, as one of the cultural centres of Quang Nam Province, the province's tourist city, and one of the important tourist places of the country, with safety, friendliness and new attractions". It stated "To build eco-cities while preserving distinctive traditional villages is identified as one main task for sustainable development, in which an environment that is spacious – green – clean – beautiful and safe shall be in focus, turning Hoi An into the first eco city of the country with vision toward 2030".

This long-term ecocity initiative draws attention directly to fulfillment of the integrated approaches to sustainable development – ‘a key output’ of the ongoing Quang Nam Provincial Development Strategy developed by UN-Habitat teamed with the local government taskforce and experts. The ecocity of Hoi An is appealing for Quang Nam PDS implementation because: (i) Hoi An city as an important sociocultural and environmental centre, should initiate positive changes for development of the province; (ii) there is strong administrative commitment to change management and to realize sustainable development with UN technical assistance; (iii) there is strong awareness among locals of the integrated direction to build an ecocity – notably the importance of human-oriented urban development where people are at the centre of development, with integration of natural ecology and social ecology development.

UN-Habitat and Hoi An have worked together on the project “Building Hoi An into a ‘Living Laboratory of Best Living Quality’ in Viet Nam from Now to 2030” (Resolution No. 07-NQ/TU). The project has undergone strategic planning with local communities, government and the private sector in collaboration with UN-Habitat and international/national experts. In the past two years, collaborative efforts and resources have been mobilized for resetting goals under key ecocity performance areas, identifying key opportunities to bring sustainable solutions and prioritizing key projects for implementation. Notably, Portland State University – a leader in sustainable city development – and Oregon’s administrative officials have worked with Hoi An on the ecocity strategic planning framework. Vietnam National University has also been conducting Climate Change Vulnerability and Adaptability Assessment (CC VAA) of Hoi An, with support from UN-Habitat, and the opportunities and challenges for mitigating climate change impact are being integrated into the overall planning framework as well as the ecocity development framework.

Initial programme focus includes green building and space organization, promoting sustainable transportation, developing ecotourism and environmental preservation projects, managing urban economic growth in a sustainable and equitable manner and other ecofriendly practices. Some key projects of the 16 being implemented are land-use plan development, developing modernized infrastructure, preservation of marine protection areas, environmental management capacity building for enterprises, training for conservation of intangible heritage and establishing integrated waste treatment. Other initiatives have been developed based on identified priorities in the ecocity strategic planning framework.

The project is fully supported under the ONE UN initiative. The ecocity development framework functions as an umbrella programme for UNESCO, UNIDO, ILO and FAO activities in the region. Each UN agency has been working on sustainable development in its particular domain of expertise; UNESCO has worked on sustainable cultural heritage tourism management, UNIDO has contributed to greening industries in Hoi An, ILO has focused on strengthening inland tourism and FAO has worked on urban-rural linkage initiatives. The ecocity development project provides an overall platform where all these activities under ONE UN will be integrated as key strategic initiatives of the UN’s long-term commitment to sustainable development of Hoi An. Ultimately, this ONE UN approach has contributed to effective knowledge management practices, maximizing synergy among various sustainability development initiatives and efficient implementation with key stakeholders of Hoi An. Above all, optimizing resource mobilization will make a significant contribution to successful implementation of ecocity development.

Social benefits: Focus on sociocultural development is one of the main pillars of sustainable development that is well embedded in the Hoi An ecocity development framework. By investing in maximizing sociocultural value – the comparative advantage of the city – the project will bring highly positive social impacts on overall Hoi An development while other green economy orientation will be promoted based on local contexts and practices. This process will strengthen the sustainability of ecocity development and its implementation.

UN-Habitat also guided the workshop process to optimize participatory strategic planning, as a key to developing local ownership and leadership of sustainable city development. Representatives of local communities, local government, the private sector and UN agencies convened to refine strategic planning of the ecocity development framework. This involved defining goals, strategic solution adjustment, prioritizing key projects and key action planning for communities, the government and the private sector. The high level of buy-in will lead to maximization of positive socio-economic and environmental impacts of the ecocity development project such as social cohesion, equitable development and local place making. Establishing a monitoring framework is being planned participatorily.

Economic benefits: The CDS focuses on local socio-economic development, sustainable use of local/natural resources and urban infrastructure management. This strategy aims at finding a mechanism to achieve sustainable economic growth through human resource development and job creation, saving local resources and improving key infrastructure as the basis for local economic development.

The ecocity development initiative has a considerable focus on improving basic urban service infrastructure, especially facilities related to the quantity and quality of water supply, which have been influenced by climate change. Project results will directly improve productivity and scales of economic activities in Hoi An. Notably, these projects can increase access to basic services for the most vulnerable groups and enhance their living conditions.

Clearly, developing infrastructures for solid waste management and water treatment will bring fundamental economic benefits by reducing costs for land treatment, waste disposal and access to clean water. This will expand in the future when the capacity of these facilities meets urban needs.

Ecotourism will be developed further and well promoted in addition to current cultural heritage tourism activities. Diversifying city attractions is needed to ensure sustainable growth of key economic activities for cultural tourism. Jobs related to ecotourism will be created for communes located far from the city centre.

Environmental benefits: Most projects will directly contribute to green urban planning and reducing environmental pollution in Hoi An. Awareness-raising at schools and in the private sector will ensure that changes happen sustainably in local contexts.

Climate change vulnerability analysis and adaptability assessment have juxtaposed overall ecocity development initiatives. Being one of the key components of feasibility analysis for ecocity development, the results of sensitivity and adaptive capacity assessment are being integrated into key orientation and prioritized projects in the ecocity development framework. This process will increase adaptive capacity to respond to climate change impacts and directly accelerate local economic development, improve the quality of life of vulnerable groups, increase social equity and reduce negative impacts on environmental resources in Hoi An.

Replication and continuation of practice: The whole process has been able to provide answers to questions that might be of use for further replication and upscaling. For example:

- How to develop local ownership and leadership in developing sustainable city development?
- How to address social issues embedded in overall ecocity development?
- What are the key components for green growth-based CDS?
- How are different pillars of sustainability well connected in the process of planning and implementation?

- How can the ecocity address sustainable issues based on global standards as well as local contexts?
- What should be international organizations' roles in developing sustainable mechanisms to develop the ecocity in collaboration with local communities and local government?

LESSONS LEARNED

These case studies reveal that project success is basically guided by the approach or the concept. When the project is perceived holistically by considering the three pillars of sustainability, it can reap multiple visible and invisible benefits. But when projects are biased towards only one issue such as the environment or social or economic challenges, the balance in the development approach is often missing. Thus, perceiving social, economic and environmental dimensions through the single lens of sustainability is key to the success of any project.

The case studies further help to understand that partnership can bring success to the sustainability of a project. As urban issues are becoming more complex day by day, developing intervention plans through a top-down approach or by involving a single party are not effective. When communities, the private sector, governments and international agencies collaborate this facilitates forward movement. Roles played by each organization and the community are vitally important for the success of a project.

Bringing real transformation is challenging because this requires much effort to educate communities and build partnership for development work. Once communities are aware of the impact of intervention measures and are ready to take ownership of a project, it can be implemented easily and successfully. Involving communities in the provision of services ensures that project interventions are in line with their needs. Thus community participation is a prerequisite for project success.

Lessons from these case studies help to address current urban challenges as they highlight development through the sustainability lens and building partnership with communities and other relevant stakeholders to plan and implement development interventions. In addition they reveal that it is equally important to build the capacity of communities and empower them.

Promoting green economy strategies to overcome urban challenges definitely calls for a new paradigm shift with fundamental changes to the current development practice. Visibly, there is a need to bridge development gaps related to legal and fiscal frameworks; financing of urban development; urban planning and design; green technologies and innovations; and human resources and institutional capacity development. Increasingly cities have to adopt integrated and coordinated, adaptive and participatory approaches to urban planning, development, management and governance.

Strategies and approaches need to be incremental and built on what already exists. The lessons from these case studies demonstrate that involving communities or considering the three pillars of sustainability or small but innovative approaches can bring transform communities and help the move towards a green economy.

16 Conclusions and recommendations

Unsustainable development has increased stress on the earth's limited natural resources and on the carrying capacity of ecosystems. The crises of high food prices, energy and water scarcity, and financial collapse are directly related to unsustainable levels of consumption, global resource scarcity and environmental stress. These crises, together with the medium- to long-term problem of climate change, are expected to continue. The heads of state and governments resolved in the 2012 UN Conference on Sustainable Development (Rio+20) outcome document *The future we want* to work together for a “prosperous, secure and sustainable future for our people and our planet”. Sustainable development is built on three pillars – economic, social and environmental – and green economy policy and practices are perceived as a means for catalysing renewed national policy development and international cooperation for sustainable development.

The UNGA and the Asian and Pacific Regional Implementation Meeting (RIM) on Rio+20 outcomes is already working on aspects of the proposed high-level political framework to replace the Commission on Sustainable Development; sustainable development goals (SDGs); an effective sustainable development financing strategy; and promoting the development, transfer and dissemination of clean and environmentally sound technologies.

Throughout the APR, the transition to a green economy varies greatly among nations. Factors such as natural and human capital and relative level of development all play a role in determining the ease with which these nations may make a transition. During the next few decades, policy responses will determine future sustainability. Most APR countries will likely follow one of three broad development scenarios: (i) rapid economic growth with low priority given to social and ecological sustainability; (ii) stagnation, likely in countries that are resource-poor and those needing economic restructure; and (iii) green economy, balancing growth and sustainability, if due attention can be given to avoiding pressure from powerful corporations and the economically elite for short-term gains.

Our planet supports 7 billion people, expected to reach 9 billion by 2050. Population growth is fundamentally linked to sustainable development, poverty and gender inequality, and therefore efforts to reduce population growth are essential elements of green economy policy and action. Urbanization and population ageing will proceed rapidly in the APR over the next several decades. Urbanization and economic growth lead to an increase in consumption of resources, as well as greater waste and GHG emissions; however slower growth and an ageing population could reduce consumption and GHG emissions substantially. Policies that support lower levels of population growth through the provision of safe, acceptable, efficient and affordable contraception can help to reduce the high levels of the unmet need for contraception and should be supported. Once population growth is decelerated, then policies of lower growth can be sustained. This in turn reduces pressure on natural resources, reduces poverty and can reduce GHGs.

Natural resources and ecosystem services in many parts of the APR are under extreme pressure from demands on food, housing, water, energy and waste. As the world population rises to a projected 9.2 billion in 2050, developing countries must double their food production and to do so they must overcome declining growth in the yields of major cereals, increasing competition for land and water, declining soil fertility, rising fuel and fertilizer prices, and the impact of climate change. The present paradigm of intensive agricultural production cannot meet the challenges confronting us today. For sustained growth, agriculture must conserve and enhance natural resources, use an ecosystem approach that draws on nature and appropriate external inputs at the right time, in the right amount. This requires a major shift away from the homogeneous and technology transfer-driven model of agricultural production towards knowledge-specific farming systems using biodiversity and associated biological technologies that enhance soil fertility, reduce erosion, reduce chemical use and conserve water use, and are more resilient to natural and economic uncertainties. Agri-food value chains need to be strengthened to reduce gaps, inefficiencies, inequities and waste, and meet global food distribution needs. Primary producers are being exposed to increasingly disproportionate levels of risk, and mechanisms are needed for the secondary and tertiary parts of the value chain to share this risk and help sustain the primary levels that they rely on.

Capture fisheries in the APR are in crisis. Unsustainable exploitation of oceans is resulting from pollution, overfishing and, increasingly, climate change impact. At the global level, fisheries make an economic loss of US\$8 billion per year, when the environmental and social costs and benefits are included. If managed sustainably, this loss could change to a staggering US\$50 billion in benefits each year. The APR produces 51 percent of global capture fishery production, with some 90 percent of fishers/fish farmers being small scale. Over capacity and open access regimes reflect a tendency towards employment maximization in fisheries although often at the cost of economic efficiency. UNCLOS must be re-aligned to sustainability to avoid driving countries to overfishing. APFIC members recognize the need for an ecosystem-based approach to fisheries as well as the implementation of the FAO Code of Conduct for Responsible Fisheries. This can be seen as a drive towards a more sustainable, multidisciplinary thinking and a holistic, green economy approach. Identifying the global loss is a clear message for governments to cut subsidies and for corporate business to reduce capital in fishing fleets. Aquaculture is now a globally significant contributor to food production, but must change to sustainable feeds, lower trophic-level systems such as integration of agriculture with aquaculture and sustainable management of natural water systems.

Deforestation is a major issue faced by many countries in the region. Major areas of forest loss, driven by policy distortion and powerful corporate elites, are particularly evident in Indonesia, Malaysia and Myanmar. While China has increased the implementation of large-scale afforestation, forest area has increased in Bhutan, Fiji, India, the Philippines, Sri Lanka, Thailand and Viet Nam. It is increasingly evident that countries cannot develop forestry policies in isolation, and forest certification and CSR are increasingly seen as the way for forest industry to gain market recognition for sustainable production.

Many countries are already moving to create a fresh future for their land, forest, water and marine resources and adopting the kinds of smart public policies needed to unlock the investments and creative strategies necessary. The Rio+20 Summit was an opportunity to scale up and accelerate these transitions under the theme of a green economy.

Given the three pillars of green economy, the energy sector within a green economy needs to pursue universal access to modern energy. It also needs to promote the use of RE technologies and energy-efficient technologies, providing that this does not compromise energy access, as these technologies reduce pollution, enhance energy security and decrease consumption of natural resources. This strategy is consistent with addressing the key challenges for the energy sector in the APR, namely the widespread lack of energy access; reducing CO₂ emissions and environmental

degradation caused by consumption of fossil fuels and traditional biomass; and reducing dependence on oil imports.

The Global Initiative ‘Sustainable Energy for All’ is an opportunity for countries in the region to develop national action plans and commit to concrete targets on energy access, energy efficiency and the use of RE. The Initiative therefore presents an opportunity to steer the region towards the green economy model in terms of energy consumption.

Water plays a key role in achieving all the MDGs, however, there are many challenges to the water resources in the APR. High water utilization, water pollution, water-related natural disasters and the impact of urbanization and extreme weather patterns, as well as poor household access to water and sanitation place extreme pressure on water security. Water scarcity and security is an increasingly important development issue in the region, where population growth, rapid urbanization and industrialization have expanded demand and competition, driving changes in allocation of water resources. Accordingly, many river basins and groundwater systems are under severe stress from strong competition among households, industry and agriculture. The lack of adequate institutional and legal instruments for water sharing lead to inequitable water allocation, as well as rising tensions between users and countries over this scarce resource.

As an increasing proportion of water is allocated to the industrial and domestic sectors, there is a proportional net reduction in water availability for agriculture. Yet the increase in population means that more food will need to be produced with less water. Besides these changes in the demand pattern for water use in the APR, the absolute demand for water is expected to soar in the next 15 years.

Improved water management across the APR is expected as part of the anticipated shift in development towards green growth. Green growth should see a change across the region in ensuring water and sanitation access for all and environmentally sustainable economic growth. Whilst there is still much work to be done, countries across APR have achieved significant progress in increasing access to water and adapting to more integrated and collaborative methods of managing water resources.

Sustainable development cannot be achieved without sustainable industrial development. Industry is the vehicle for widespread structural change, job creation and income generation, and therefore the means to improve the quality of life of ordinary people and combat poverty. However, sustainable development urgently requires a widespread greening of industrialization.

The greening of industries has become a core determinant of economic competitiveness and sustainable growth. As resource inputs represent an important cost of production for industries, efficiency improvements can be a significant lever for competitive advantage. The greening of industries also plays a role in poverty reduction, through promoting energy security, better health conditions, jobs and reduced costs through increased productivity.

To be truly sustainable it is vital that all industries, regardless of sector, size and location, continuously improve their environmental performance and resource productivity. This includes a commitment to, and actions for, reducing the adverse environmental impacts of industrial processes and products by using resources more efficiently; transforming industrial energy systems towards greater sustainability by expanding RE sources; phasing out toxic substances; and improving occupational health and safety at the industrial level.

Green industry is a rapidly expanding and diverse sector that covers all types of services and technologies that (directly or indirectly) help to reduce negative environmental impacts and resource consumption. This includes material recovery, recycling, waste treatment and management, as well as the provision of environmental and energy consulting and services, such as energy service companies and companies that provide monitoring, measuring and analysis services.

The greening of the commercial services sector is emerging in the APR and there is potential that the commercial services such as the financial sector can tap into this rapidly growing global trend. The services sector, with its direct and significant contribution to GDP, job creation and poverty reduction, provides crucial inputs to the rest of the economy, and has a significant effect on the overall investment climate, which is an essential driver for any kind of growth including green growth. Furthermore service sectors such as health, education, water and sanitation are also crucial in achieving social development objectives.

Energy and resource-efficient technologies are needed throughout the commercial sector in order to meet the estimated 80 percent reduction in consumption required to achieve sustainable development in the APR. The region has enormous potential to dramatically boost resource efficiency by generating new kinds of clean technology industries that can jumpstart economic growth while guarding against environmental degradation. In order to do so, governments must be active in fostering a green services sector by investing public funds directly in sustainable commercial services and providing financial incentives to ensure that green options are economically viable for businesses and consumers. An incentive system of subsidies, taxes and regulations that encourages environmentally responsible behaviour in the private sector needs to be more widely promoted. Microcredit schemes and time-bound tax incentives for the commercial services sector can also be more fully developed to prevent the reversal of the sector's rapid growth in recent years.

Eco-certification and ecolabelling have also emerged as a response to the growing market demand for environmentally sound goods and services, with some consumers willing to pay a premium for certified products. Competitive forces are driving improvements in the environmental performance of key sectors such as commercial buildings, tourism, automobiles and communication technologies.

Greening the commercial sector provides an opportunity to couple much-needed environmental benefits with a massive socio-economic impact through long-term economic benefits and economic incentives for the private sector, as well as creating well-paying jobs for the general public.

In the APR no other sector has perhaps seen faster growth than information and telecommunications. The region has excellent technological capabilities and is currently playing a significant role in the IT revolution. The IT industry has realized the potential and the need for green action, which is also a business opportunity for many. It has responded by developing more efficient and therefore more environmentally friendly products. However, there is a need for continuous investment in R&D and monitoring of the greening of this sector, and developing countries can benefit highly from external assistance in finance and technology transfer. It is imperative that the conditions of labour and environmental performance during extraction of minerals for the IT industry are closely monitored, as well as the end phase of the IT cycle with disposal and recycling of e-waste.

While the economic importance of the IT sector cannot be underestimated, its growth and influence in the way people work and live is even more enormous. The number of people who will be using computers, mobile phones and the Internet in the region will only increase in the future, greatly increasing the market for IT. Greening IT services has the power to shape the future of Asia towards greener economy and greener society. Aside from reducing emissions, IT services sectors have a huge potential to tap into socio-economic development and poverty reduction, as the health, education and agricultural information they supply in developing countries is invaluable. Green IT offers a way forward in this regard because of its potential to increase efficiency, while enabling social benefits, and offering economic competitiveness. In addition, Green IT initiatives can also influence the users, including the younger generation, to be more environmentally responsible.

Public services strengthen the economy, provide basic care such as health and education and bolster socio-economic growth. Shifting the public services to a green path is a necessary commitment from governments to move towards a greener economy. While the bulk of green economy investment may ultimately have to come from the private sector, the effective use of public expenditure and investment incentives are necessary to trigger a transition to a green economy. Apart from public procurement and financing, governments have the opportunity to green public services such as buildings, water distribution, electricity, waste management and facilities (offices, schools, social housing, etc.), by improving roads and public buildings, establishing public transport networks, designing efficient systems for water management, repairing and enhancing drainage and sewerage systems or creating and managing efficient recycling services. Such initiatives can also provide much needed impetus for socio-economic development for different communities.

Green public services are most likely to be successful if they are aligned with national sustainable development priorities, such as provision of safe drinking water, infrastructure development or waste management in developing countries and they should take into account possible impacts across economic sectors. In order to make the transition to a green public services and facilities sector, specific enabling conditions are required. These conditions consist of national regulations, policies, subsidies and incentives, and international market, legal infrastructure, trade and aid protocols. Government expenditure can be a powerful enabler for a transition to a green economy by providing grants, loans and other incentives.

While the transport sector plays a critical role in the substantial growth of the APR, there are many pressing issues that generate widespread concerns. The rise in fuel prices, energy security, air pollution, and GHG emissions as well as the increase in the population of urban poor, land-use impacts and traffic accidents are among typical issues calling for alleviating actions. To contribute toward the transition to green economy, the transport sector needs to advance in a sustainable manner. However, sustainable transport should not be perceived as being the sole responsibility of the government or development partner. The private sector also plays a significant role in greening the transport sector. While governments must take the lead in creating conditions for green initiatives and investment in transport solutions, private participation will hasten the move toward a greener transport sector.

There are ample opportunities to make the sector more sustainable and public-private sectors in developing countries have a greater chance to shape the future of their transport sectors through current strategic and judicious planning and investment, leveraging from the best practices and lessons learned from more developed countries. International, regional and subregional organizations can supplement the sharing of successful initiatives by providing platforms for exchange of strategies, best practices and lessons-learned. The platform should not be only the traditional government to government, but it should also facilitate exchange among private sectors in different countries and between private and public sectors.

There is an urgent need for governments around the world, and in the APR in particular, to implement policies and measures that assist rural communities to adapt to the impacts of climate change and other environmental challenges while eradicating poverty. Understanding how climate change has brought about new dynamics, risks and opportunities and how best to respond, is a challenge now facing national and local governments, social partners and development partners alike. Many countries in the APR have already begun to implement policies and programmes that promote the sustainability of rural communities and livelihoods within the context of a green economy. These initiatives seek to integrate climate mitigation and adaptation activities with tangible socio-economic benefits such as poverty alleviation, employment creation and economic growth while simultaneously improving environmental sustainability and climate resilience.

Providing access to clean energy in rural areas will be a critical policy tool for poverty alleviation as it has the potential to create new opportunities for economic development in rural areas by generating alternative livelihood opportunities and sustainable farm-based microenterprises, while reducing GHGs and environmental degradation.

Over 40 percent of the APR's population currently live in urban areas and this is predicted to rise over the coming decades. The concept of green economy as a strategy to improve resource use could reap social, economic and environmental benefits and make cities and towns more sustainable and livable. The energy and resources consumed today are not economical and are adding burden to the environment, creating unhealthy and unsustainable towns and cities. It is clear that continuing current lifestyle practices is not a viable option and adopting inclusive green economy approaches is crucial in achieving sustainable urban development.

Designing and implementing green economy strategies to overcome the current challenges calls for a new paradigm shift with the fundamental changes to the current development practice. Nonetheless, it is not necessary to wait until there are substantial funds for radical change at the national policy level. Strategies and approaches towards a green economy in all sectors need to be incremental and build upon what already exists, and changes in current practices such as involving communities in decision-making, considering the three pillars of sustainability, or innovative approaches all aid in bringing transformation towards a green economy.

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