UNITED NATIONS

EP

UNEP/GC.27/INF/13

Distr.: General
29 November 2012

English only

Governing Council of the United Nations Environment Programme

Twenty-seventh session of the Governing Council/
Global Ministerial Environment Forum
Nairobi, 18–22 February 2013
Item 4 (a) of the provisional agenda*
Policy issues: state of the environment

Responsible resource management for a sustainable world: findings by the International Resource Panel

Report of the Executive Director[1]

Summary

The well-being of humanity, the environment and economic prosperity all depend on the way in which society uses and cares for natural resources. With this in mind, the International Resource Panel was established in 2007 in order to provide independent, coherent and authoritative scientific assessment on the sustainable use of natural resources, delivering cutting-edge knowledge to policymakers at all levels.

The present report presents some of the Panel's initial policy-relevant findings on topics such as priority products and materials for resource efficiency; decoupling natural resource use and environmental impacts from economic growth; metal stocks in society and recycling rates; biofuels; and water accounting. It also presents the way ahead for the Panel's work in terms of building upon and expanding its initial findings, as well as its emerging work streams on additional priority themes. In doing so, it demonstrates how the Panel's work can contribute to a strengthened science-policy interface through filling knowledge gaps in key areas of resource use and management.

* UNEP/GC.27/1.
[1] Issued without formal editing.

Introduction

Progress in terms of economic and social development over the last century has been largely achieved through the extensive use of our planet's finite resources. Today, resource exploitation already exceeds the Earth's biological capacity, with consequences in terms of supply security and on the state of the environment. This, in turn, jeopardizes the fundamental economic, social and environmental systems on which our development relies. The problem is systemic and includes all natural resources such as energy carriers, metals, water, soils, and relates to the whole products and services life cycle. Resource productivity is therefore essential to future economic success, sustainability and prosperity.

Significant potential exists for improved resource productivity through technological innovation and demand changes over the whole resource life cycle, from the extraction and use of raw materials to end of life disposal. While this will require enormous political commitment and financial investment, if the situation is not addressed, actual costs to nations at a later stage are likely to be much higher. The challenges to bring the necessary changes are enormous and there is an urgent need to increase the knowledge base and to develop policies, strategies and the institutional capacity to confront these issues.

The International Resource Panel (IRP) was established to provide independent, coherent and authoritative scientific assessments on the use of natural resources and their environmental impacts over the full life cycle, as well as contribute to a better understanding of how to decouple economic growth from environmental degradation. Benefiting from the broad support of governments and scientific communities, the Panel is constituted of eminent independent experts from all parts of the world, bringing their multidisciplinary expertise to address resource management issues. The information contained in the International Resource Panel's reports is intended to be policy relevant and support policy framing, policy and programme planning, and enable evaluation and monitoring of policy effectiveness. The Secretariat is hosted by the United Nations Environment Programme (UNEP).

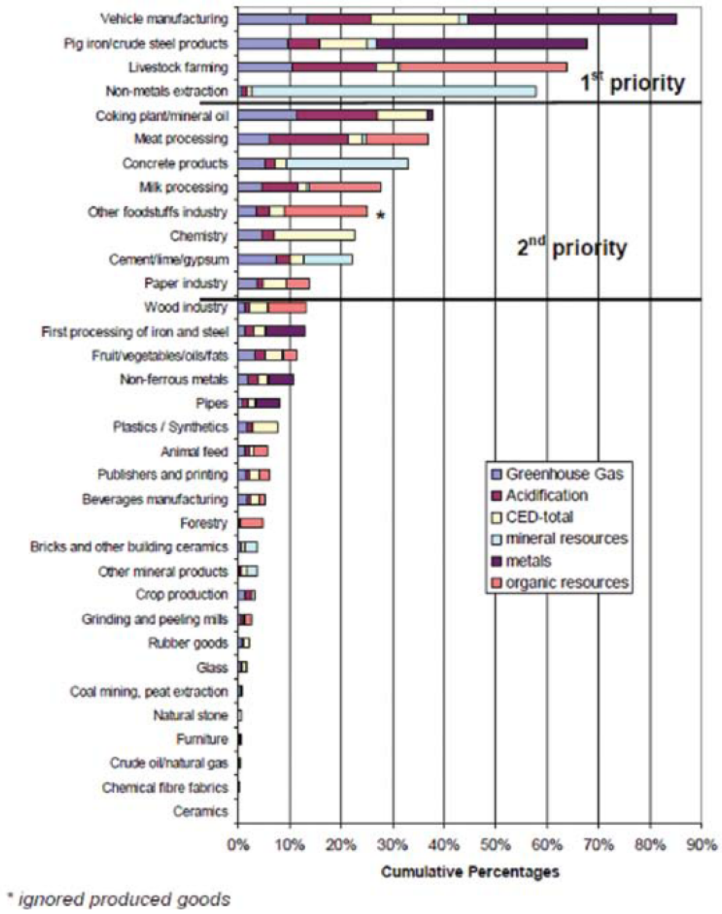
Since the International Resource Panel's launch in 2007, six reports have been published. This first series of reports covered biofuels, priority economic sectors and materials for sustainable resource management, metals stocks in society and their rates of recycling, water accounting, and finally the unsatisfactory state of untapped potential for decoupling resource use and related environmental impacts from economic growth.

The assessments of the IRP to date demonstrate the numerous opportunities for governments and businesses to work together to create and implement policies to encourage sustainable resource management, including through better planning, more investment, technological innovation and strategic incentives. Only with this full, complete and impartial picture can governments make the defining choices that might lead the world onto a more sustainable development pathway.

This document presents some of the Panel's initial policy-relevant findings on topics such as priority products and materials for resource efficiency; decoupling natural resource use and environmental impacts from economic growth; metal stocks in society and recycling rates; and biofuels. It also presents the way ahead for the Panel's work in terms of building upon and expanding these initial findings, as well as its emerging work streams on additional priority themes. In doing so, it demonstrates how the Panel's work can contribute to a strengthened science-policy interface through filling knowledge gaps in key areas of resource use and management.

Identifying Priorities: Priority Products and Materials

One important issue in formulating sustainable resource use policies is how to set priorities and ascertaining where to invest effort and funding. The IRP report on *Priority Products and Materials* therefore identified the economic activities causing the highest environmental impact from several entry points: production sectors, consumption categories and materials categories.



The Panel identified the priority environmental impacts that interact in turn to lead to impacts on ecosystem health, human health and natural resource depletion. These include climatic change, acidification and eutrophication of water and soils, eco-toxicity and related human health effects, in addition to overuse of natural resource reserves. It identified the economic activities most associated with the resource and emissions pressures causing these environmental problems.

It demonstrated that the production sectors with the highest environmental impacts are 1) those using processes involving fossil fuels combustion (electrical utilities, residential heating, metal production, transportation and energy intensive industries)2) Agricultural and activities using biomass which are significant contributors to climate change, eutrophication, land use, water use and toxicity. 3) Fisheries, as overexploitation leads to collapse of fish stocks and industrial fisheries are source of pollution.

In terms of global warming, the energy sector, manufacturing, agriculture (through land use change and emissions from livestock), the transport sector and residential buildings are the largest contributors. These sectors also drive acidification processes. Eutrophication and freshwater eco-toxicity are mainly caused by agricultural production, through emissions and pesticide use. Agriculture also accounts for 50% of global land use and 70% of global water use. Unsustainable forestry and finish practices have in turn been the cause of deforestation and overexploitation of fish stocks.

While abundant geological reserves of metal ores and fossil fuels still available in parts of the globe, it has become more difficult to access and more expensive to extract these resources as ore grades have declined. Surging demand and slow development of new reserves has led to supply security issues for fossil energy carriers, metal ores and industrial minerals, foreshadowing future supply problems.

The IRP also assessed the environmental impacts to consumption clusters, including household and government consumption, as well as investment into capital goods and infrastructure. In most countries, household consumption accounts for 60% or more of the life cycle impacts of final consumption.[2] The most important household consumption activities are food consumption, transport, and housing, including energy use for heating, cooling and electrical appliances. In developing countries, food and housing dominate greenhouse gas (GHG) emissions. In industrialized countries,

[2] This may be different for fast growing developing economies which show high investment in infrastructure and production capacity and where government consumption and investment contribute more to overall environmental impact than households do.

mobility and electrical appliances also contribute heavily to the environmental impacts of consumption.

The environmental impacts of government consumption are driven by energy use in public buildings, schools and hospitals. Resource use driven by government consumption can be substantial, and can create new market opportunities for products and services with less environmental impact through sustainable public procurement.

For capital investment, a comparative study of several European economies indicates that construction, transport and machinery cause the greatest environmental impacts. Some emerging economies in Asia are making large investments in building up their infrastructure and manufacturing capacity, with significant environmental impacts. In non-Asian developing economies the public sector is often a very large part of the economy and may account considerably for environmental pressures.

The environmental impact of consumption grows as per capita incomes rise, with further increases in energy use and GHG emissions from final consumption with rising wealth and changing lifestyles. This indicates that policy makers may need to consider mainstreaming sustainable consumption policies at earlier stages of their countries development trajectories.

I. Decoupling Natural Resource Use and Environmental Impacts from Economic Growth

The last century saw significant global GDP growth, with increases in the standard of living and poverty reduction in many countries. This has been accompanied, however, by rising natural resource consumption and increased emissions and waste. Resource use per capita in developed economies remains high and continues to rise, while accelerated economic growth and urbanization in developing economies is rapidly creating another 1 to 3 billion middle class consumers. Processes of modernization, industrialization and urbanization have contributed to rising levels of resource consumption for building new infrastructure and increasing productive capacity. These trends in developed and developing economies place an increasing pressure on the demand for natural resources. Many resources are now reaching their productive limits, as indicated by rising prices and lower grades of ores being mined.

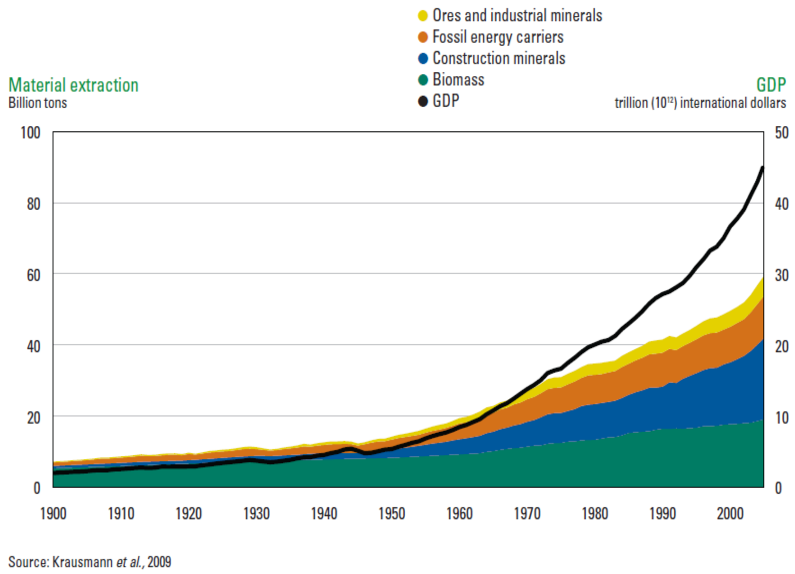


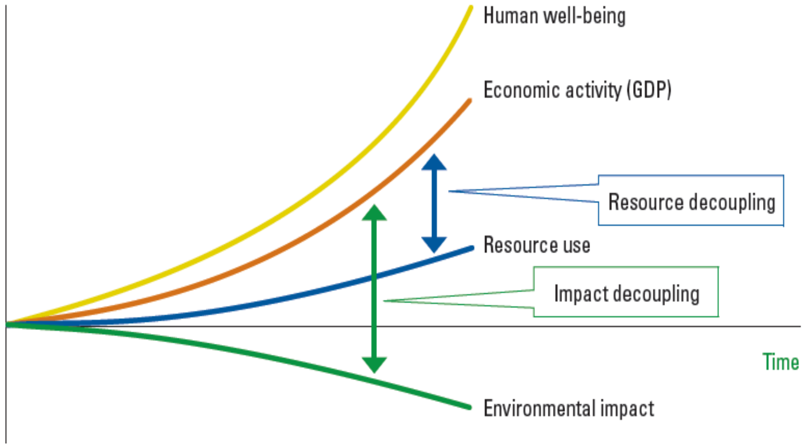
Figure 2 Global material extraction in billion tons, 1900 to 2005
During the 20th century the annual extraction of construction minerals grew by a factor of 34, ores and minerals by a factor of 27, fossil fuels by a factor of 12, biomass by a factor of 3.6, and total material extraction by a factor of about eight, while GDP rose 23-fold.

The most promising strategy for ensuring future prosperity lies in decoupling future economic growth from the rising rates of natural resource use and the environmental impacts that occur in both consumption and production patterns. Decoupling economic growth from (a) growth in resource use and (b) environmental impact, however, follow different dynamics and hence require different policy responses depending on each country's consumption and endowment levels.

The IRP report on *Decoupling* addresses four main classes of materials resources: construction minerals; ores and industrial minerals; fossil fuels; and biomass. Those resources are analyzed through a life cycle that begins with extraction, followed by production and consumption before reaching disposal or recycling. All phases of the life cycle can be subject to decoupling, with the costs and benefits differing among the phases.

The findings demonstrate that while relative decoupling of economic growth and resource use has occurred in many countries, there is little evidence of absolute decoupling, i.e. reduced overall resource use. In many instances the environmental externalities of resource use can increase, for example, as ore grades decline, or soil is depleted. There is, however, clear evidence that absolute decoupling of wealth from pollution is achievable.

Figure 3 Two aspects of 'decoupling'
Resource decoupling refers to when fewer resources are used per unit of economic output, while impact decoupling is when negative impacts on the environment are reduced.



The report argues the necessity of a new economic model involving reduced resource use, emissions and waste from production and consumption. Economy-wide resource decoupling can be said to occur when resource productivity improves at a rate that is faster than the economic growth rate. This means that more economic value and a greater level of well-being can be created by using the same amount of - or less - resources. Economy-wide impact decoupling refers to achieving more well-being and (if necessary) economic growth with few negative environmental impacts or, indeed, even restoration of eco-system services.

Over the past decade the world has faced a new economic context of rising prices for many natural resources caused by demand outpacing supply, and increased challenges in extracting natural resources in an affordable and timely manner. Past strategies where national policy frameworks and business plans have focused on labour productivity at the cost of increasing use of materials, energy, land and water require rethinking. Rising prices and greater price volatility for natural resources, combined with new supply risks, make resource productivity investments a new imperative. Indeed, this may become the primary driver of the next long-term industrial development cycle.

Resource efficiency at the product level and economy-wide resource productivity are important political and business objectives, especially for developing countries which are facing the dual challenge of delivering infrastructure and raising living standards while living within environmental means. However, the relationship between natural resource use and economic growth has become non-linear. While at lower income levels the correlation between income and resource use is very strong, above a certain threshold of development a further increase in natural resources and emissions does not necessarily enable greater economic development and wellbeing.

The report identified an important relationship between per capita resource use, per capita emissions and population density. Greater density, as found in cities and in many countries in Europe and Asia, enables lower per capita resource use rates and is more sustainable.[3] The IRP used these observations to engage in a new report studying the relations between urbanization and decoupling more systematically.

Investing in resource efficiency is necessary but not sufficient for sustainable natural resource use. Because of the size of the global challenge, resource efficiency needs to be complemented by systems sustainability–oriented innovation to enable the rates of decoupling that will be necessary to align development and environmental objectives.

[3] Although it must be noted that on the other hand, in some instances cities and densely populated nations have externalized resource and emission intensive production to other parts of the world. Therefore their apparent resource efficiency may be somewhat artificial.

Decoupling economic activity and wellbeing from resource use and environmental impacts will depend on governments that provide enabling frameworks for businesses and workforce training and up-skilling existing and new workers across many industries. Well-designed policies and institutional innovation, as well as new forms of governance, are identified as critical in the report.

The report noted that finance, technology and capacity building will be core elements in enabling decoupling. Investment into supply systems for food, housing and mobility needs to shift from 'brown' to 'green' sectors to allow for a fast transition from current systems of production and consumption. Innovation and technology development, in principle, could produce 80% reductions in resource and emissions intensity in some crucial activities within these sectors (such as cement production). The Panel is therefore in the process of developing a new work stream on innovation which will aim to identify and quantify the potential role of innovations in the global decoupling process.

An especially promising source of sustainability innovations could be cities, where more than half of the world's population lives. There is also a need to redesign cities and their infrastructure in ways that are less resource and emissions intensive and which create a cleaner, healthier and more efficient future for their residents. The need for systems innovation in providing essential services such as housing, mobility, food, energy and water especially applies to growing cities in developing countries, where wise investments today will pay off in decades to come. The panel has since deepened its assessment work on city-level decoupling, which will be the focus of one of its upcoming assessment reports.

The report stresses that countries and economic processes are increasingly interconnected through trade relations. Trade has direct environmental impacts in terms of transportation in addition to indirect (or embodied) impacts that occur when a country produces goods or services for consumption abroad. For example, the report shows that CO_2 emissions embodied in internationally traded products account for 27% of total energy-related CO_2 emissions. Embodied water was around 16% of total water use and materials extraction embodied in global trade has been estimated at about 20% of global extraction.

International trade has made it possible to displace resource extraction and production to countries where the bulk of manufacturing for global markets now takes place. For example, a large share of the impacts occurring in Asia (20% to 40%) can be attributed to consumption in developed economies. More information is needed as to what extent trade shifts environmental burdens to areas that are more vulnerable or resilient with respect to their local environmental thresholds. Given the importance of further understanding these dynamics, the IRP has launched work to provide more information about the embedded resource use and emissions in traded products for decision makers.

II. Metal Stocks in Society and the Critical Role of Recycling

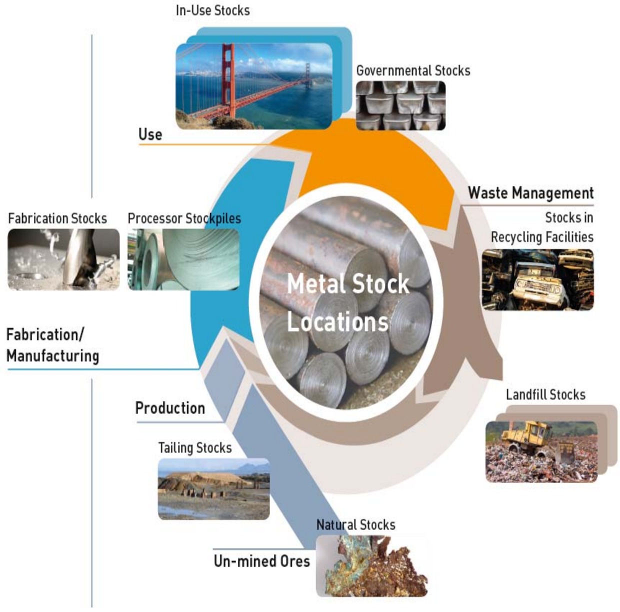
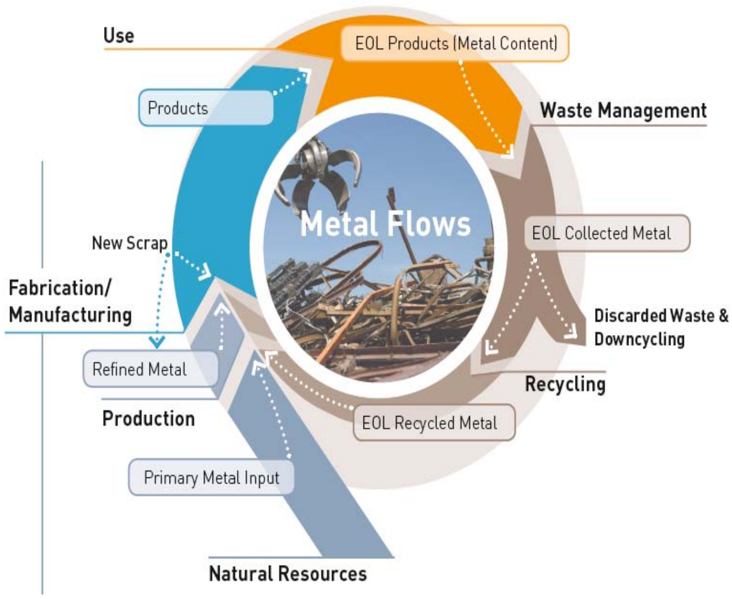


Figure 4 Metal stock locations
The lifetime of different metal products and the different metals within them varies, from weeks in the case of a beverage can, to decades or centuries, in the case on construction and infrastructure. Different kinds of stocks develop along the life cycle of metals.

Economic development is closely linked to the use of metals for construction, transport and communication systems, and for machinery and appliances. While in the past industrialized countries have dominated the use of metals, more recently developing countries have markedly increased their use of metals to build modern infrastructure, manufacturing facilities and transport systems. The fast growing demand implies a permanent pressure upon existing production systems and has contributed to issues of supply security and rising metal prices.

The continued increase in the use of metals over the twentieth century has led to a substantial increase in metal stocks in society, compared to the geological resource base. Such a shift raises social, economic, and environmental issues that require quantifying the amount of stock of "metal capital" in society. The copper stock per US citizen, for example, has quadrupled over the last 70 years and available data suggests that per capita in-use stocks in more-developed countries typically exceed those in less-developed countries by factors of five to ten. However, as technologies and lifestyles in developing economies converge with those in industrial countries the global in-use stocks of metal are expected to grow three to nine-fold. Understanding stocks in society can help decision makers know where their future secondary supplies will come from. The IRP report o*n Metal Stocks and Recycling Rates* addresses these issues.

Figure 5 Metal flows
For some metals there is a long tradition of recycling, whereas for others almost no recycling infrastructure exists.



Metal recycling is an important strategy to increase the economic benefit of extracted metals and to reduce pressure on primary metals and the environment. Despite metals having excellent properties for recycling the end-of-life recycling rates for many metals generally remain extremely low because of a lack of recycling infrastructure and technologies, especially in developing countries.

Recycling of iron and steel, aluminum and copper have a long tradition and well-established infrastructure and so recycling rates are quite high, 70% to 90% for iron and steel, and above 50% for aluminum and copper. Precious metals including gold, silver and platinum are valuable enough to have high recycling rates, except in some applications and when used in very small amounts. Platinum group metals currently have recycling rates of 60% to 70%, while gold and silver are above 50%. These rates signal a large amount of wasted metal and point to the need for strengthening institutional frameworks, and the logistics and technologies for metal recycling in many countries in the world. Consumer applications are much harder to address by recycling than industrial applications. Enhancing recycling for consumer applications needs to be a priority in developing policy, and practical solutions are required.

The increased use of specialty metals is a fairly recent phenomenon and has occurred with many new applications such as the use of lithium for batteries, gallium, germanium, indium and tellurium for solar cells, and rare earth metals for catalysts, as battery constituents and as permanent magnets for power drives and wind turbines. The demand for specialty metals will grow rapidly due to innovative technologies and their increasing market potential. The recycling rates of specialty metals, however, are extraordinarily low, often below 1%, because of the lack of recycling logistics and suitable legal frameworks. The concentration of specialty metals in applications is often very low and would require suitable sorting and pre-treatment infrastructure, which is rare. As a consequence the recycling of specialty metals is in its infancy and deserves special attention from policy makers and industry in the future. As such it is a major opportunity for investment.

The IRP report advocates investment in research and development to establish a broader knowledge base on the amounts of recyclable metals in various stocks in society, as well as to develop improved recycling technologies. Efforts could focus on recycling demonstration projects, closed-loop recycling of rare earths from batteries, and tantalum recycling from electronic scraps. Current legislative systems and frameworks for metal recycling need further strengthening, especially in developing countries and at provincial and local levels, to make recycling a significant solution.

There are important social and human health issues related to using and recycling metals, which need to be addressed by policy frameworks. These include illegal waste transport and trade, and the regulation of the informal recycling sector in developing countries, which often operates with inferior technologies and creates severe risks for human health and environmental toxicity.

III. Biomass and Biofuels

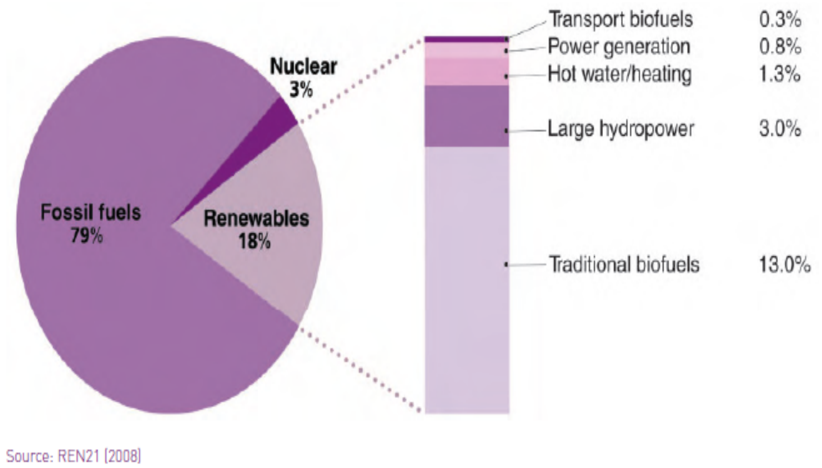


Figure 6 Renewable energy share of global final energy consumption in 2006
Biomass contributed about 1% to the total global electric power capacity of 4,300 GW in 2006. It is to a growing extent employed for combined heating and power (CHP).

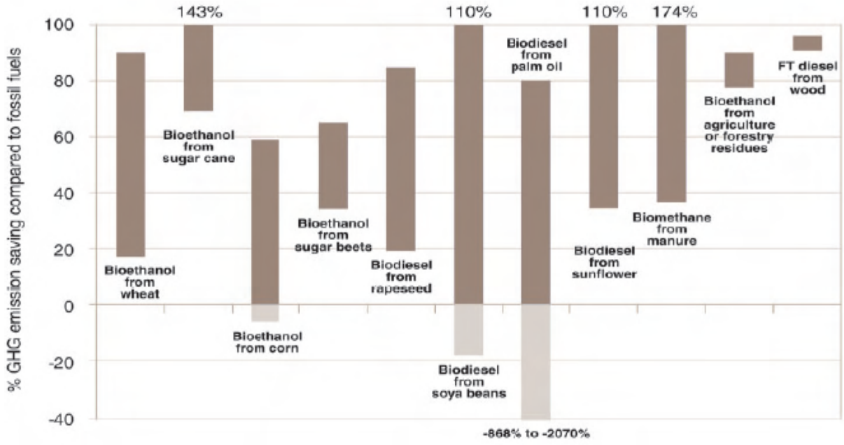
The long-term sustainability of global agricultural systems can only be secured through sound policies and planning that takes into consideration global population growth trends, agricultural land availability, the potential for improving yields, changing diets and climate change. The different uses of biomass for food, feed, as fibre or as a source of bio-energy are interdependent, and constrained by these factors.

Food security is an important issue in the policy debate around agriculture, biomass and livestock production. When bio-energy is produced from crops it can compete with food. The IRP report *Assessing Biofuels* shows that current population growth combined with changing lifestyles and dietary patterns will not be offset by agricultural innovation. Food demand is changing towards a higher share of animal and dairy based diets, particularly in developing countries. Relative yield increases have weakened since the 1960s and cereal yields are predicted to grow at a similar rate to population in coming decades. Potential for yield increases is highest in developing countries, especially those in Africa. Such improvements depend on the availability of agricultural inputs, machinery, biological quality of the soils, skills and knowledge and financing. Climate change and impacts such as flooding, drought and extreme heat and winds add to the risk of agricultural production failure compromising efforts to achieve higher output.

Biofuels for transport are a relatively new development, introduced to mitigate greenhouse gas emissions from transport. Many countries have introduced policies to increase the share of biofuels in their energy mix, both targets and blending quotas, and in 2007 liquid biofuels contributed 1.8% of the world’s total transport fuels, with ethanol and biodiesel the most widespread applications. Investment into new capacity for biofuels production exceeded $4 billion in 2007 and is expected to grow rapidly.

However, not all biofuels perform equally well in terms of their impact on climate, energy security, and on rural livelihoods and ecosystems. Life cycle assessments for biofuels show varied greenhouse gas savings when compared to fossil fuels. Negative GHG savings (increased emissions) occur when production takes place on converted natural land because of the mobilization of carbon stocks. Highest GHG savings come from biogas produced from manure and ethanol produced from agricultural and forestry residues, and from biodiesel from wood.

Figure 7
Greenhouse gas savings of biofuels compared to fossil fuels
Life cycle assessments (LCA) of biofuels show a wide range of net greenhouse gas balances compared to fossil fuels, depending on feedstock and conversion technology and other factors.



Source: own compilation based on data from Menichetti/Otto 2008 for bioethanol and biodiesel, IFEU (2007) for sugar cane ethanol, and Liska et al. (2009) for corn ethanol; RFA 2008 for biomethane, bioethanol from residues and FT diesel

Other impacts of biofuels production, such as on water and biodiversity, eutrophication and acidification, trade-offs with food security and social and livelihood impacts for rural smallholders, are barely considered by existing life cycle assessments. Many studies, however, suggest that these impacts are considerable and often worse for biofuels than for fossil fuels. The impacts of growing demand for biofuels, in particular for land use, deserve special policy attention. Regulation needs to be amended to avoid global expansion of cropland, which would occur at the expense of natural ecosystems and have significant unintended consequences.

Agricultural activity depends on the timely availability of water, and agriculture uses about 70% of freshwater globally, which has led to important groundwater bodies already being overexploited. Climate change and extreme weather events increase uncertainty around available water resources. Large scale investment into biofuels production would add to the existing pressures on freshwater availability.

The IRP report highlights options for greater resource efficiency through more efficient and sustainable production and use of biomass, whilst reducing environmental pressures and impacts. Options include optimizing agricultural production systems, restoring degraded land, more efficient biomass use including using waste and residues, cascading use of biomass, and stationary use of bio-energy.

Like biomass, solar energy systems transform solar radiation into useful energy, albeit more efficiently. Solar installations require significantly less land for the same amount of energy and often have fewer environmental impacts. Solar power is rapidly becoming an economically viable alternative to fossil fuels, especially for off-grid applications. Also, technologies such as solar cookers can substitute for traditional biomass use in developing countries. Such applications may replace biofuels and have potential to be more beneficial in regards to local livelihoods and the environment.

IV. Measuring water use in a green economy

This report underlines the importance of determining the balance between water demands and availability in order to secure the sustainability of many different ecosystem services. It provides a comprehensive examination of the various methods for quantifying water use and environmental impacts, stressing the need for common approaches to obtaining data and information at the river basin scale. The report shows how, in moving towards a green economy, water registers can provide a key to the fair distribution of access to water; water accounting can give governments a knowledge of how water, as one part of the natural capital of ecosystems, is linked to the economy and human well-being; that water footprint assessment can provide a tool for awareness raising to highlight water issues in production and consumption, especially in areas such as agriculture and food industries; that life cycle assessment and the various standards associated with it can offer benchmarking for industries; and that water stewardship can help improve quantification in corporate water monitoring. “Measuring water use in a green economy” concludes that there is an absolute need to assess water resource use and management against ecosystem resilience and the limits of sustainability when developing policy options in order to balance the competing needs of water users.

V. Conclusions and way forward

The International Resource Panel’s first series of reports make a convincing case for sustainable natural resource management and decoupling economic growth from natural resource use and the environmental impacts that occur across the whole resource use life cycle. The assessments are based on the best available scientific information and are packaged to inform policy makers and business leaders about new opportunities and challenges they face in regard to economic development, human wellbeing, equity, resource scarcity and climate change. It also serves to inform UNEP’s own work on issues of relevance, and in particular its resource-efficiency related activities.

The work of the Panel so far clearly demonstrates that, while the well-being of humanity, the environment, and economic prosperity all depend on the way in which the society uses and cares for natural resources, the availability and accessibility of resources that are critically important to meet human needs is becoming unreliable. In particular, biomass and minerals are facing significant fluctuations. It also demonstrates that resource use is increasingly inequitable, with resource use per capita varying by a factor of 10 between nations. The shift to sustainable resource management will hence be different depending on each country’s resource endowments and development levels. Finally, the Panel demonstrates that resource efficiency is an opportunity. With today’s understanding and technologies, massive improvements in resource efficiency are possible, and could lead to improved economic productivity, improved resource security, and reduced environmental burdens. However, innovation will need stimulation for resource efficiency to reach sustainable levels.

The report on priority sectors and materials is pivotal to helping governments and businesses decide on investment priorities that will yield the greatest return upon investment in regard to saving resources, reducing pressure on ecosystem services, and avoiding emissions and pollution.

The series of reports on “Metals” highlights the scarcity of metals that are strategic for the production of goods and services and infrastructure, coupled with an extremely low rate of recycling for metals that have excellent recycling properties and increasing stocks existing within society, as opposed to geological reserves. Recycling rates need to increase substantially to reduce pressure on primary resources. Metals will also be pivotal in underpinning new sustainable technologies. Building upon these findings, the Panel is now further exploring the environmental impacts of metals in addition to metals recycling opportunities and technologies, which will be the focus of two upcoming reports.

Different uses of biomass for food, feed and fuel need to be balanced within an overall resource strategy, considering energy, climate, and water and assessing the overall costs and benefits to society, economy and the environment. This may lead to reconsideration of current biofuels mandates, targets, quotas and subsidies, to guide the contribution of biofuels to sustainable levels. Of course, other viable alternatives to fossil fuels exist, some of which have significantly smaller land requirements for the same amount of energy. An analysis of the benefits, risks and trade-offs of different low-carbon technologies is required in order to fully understand the opportunities that each provides, and when and how they can be used to their full potential. This is therefore the focus of an ongoing work stream of the Panel.

The Panel’s assessment on “Decoupling” clearly shows that “absolute decoupling” is possible. Technologies are available, as are examples of successful policies, price signals and incentives. Of course, innovation and investments are also indispensible. Areas for further research in this field have been identified, and the Panel has accordingly expanded its work on decoupling. Its upcoming report, *Decoupling in Practice*, presents the economic case for decoupling, describing successful examples of decoupling and technologies and policies that can be used to achieve it. Further, an emerging work stream on innovation will identify and quantify the potential role of innovations in the global decoupling process.

Following its establishment the Panel first devoted much of its research to issues related to the use, stocks and scarcities of individual resources, as well as to the development and application of the perspective of ‘decoupling’ economic growth from natural resource use and environmental degradation. Building upon this knowledge base, the Panel has now begun to examine systems approaches to resource use. While technological innovation and efficiency are important they are not sufficient to achieve the required decoupling between economic growth, resource use and emissions. In many cases, efficiency improvements will need to go hand in hand with systems innovation in activities that have high resource use and emissions. These include the direct and indirect (or embedded) impacts of trade on natural resource use and flows, and the city as a societal ‘node’ in which much of the current unsustainable usage of natural resources is socially and institutionally embedded. The sustainable management of land and its related resource nexus considerations, land potential and soil quality are also the foci of upcoming reports. In a similar vein it has become apparent that the resource use and requirements of the global food consumption call for a better understanding of the food system as a whole, and in particular its role as a node for resources such as water, land, and biotic resources on the one hand and the varied range of social practices that drive the consumption of food on the other. The years to come will therefore focus on and further deepen these work streams.

The outcome document of Rio +20, *The Future We Want*, recognizes the need to facilitate informed policy decision-making on sustainable development issues and, in this regard, to strengthen the science-policy interface. The outcome on strengthening and upgrading UNEP also includes the promotion of a strong science-policy interface, building on existing international instruments, assessments, panels and information networks. Further, the sustainable management of natural resources was a recurrent theme throughout the discussions, and this is reflected in the outcome document. The International Resource Panel stands ready to contribute to this process through further engaging with policy-makers in identifying key knowledge gaps, and in up-scaling and deepening its work in order to render accessible and comprehensible the scientific knowledge required by decision-makers in designing policies on sustainable resource management.