





Introduction

Setting the stage for a green economy transition



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1 Introduction: Setting the stage for a green economy transition

1.1 From crisis to opportunity

The last two years have seen the idea of a “green economy” float out of its specialist moorings in environmental economics and into the mainstream of policy discourse. It is found increasingly in the words of heads of state and finance ministers, in the text of G20 communiqués, and discussed in the context of sustainable development and poverty eradication.

This recent traction for a green economy concept has no doubt been aided by widespread disillusionment with the prevailing economic paradigm, a sense of fatigue emanating from the many concurrent crises and market failures experienced during the very first decade of the new millennium, including especially the financial and economic crisis of 2008. But at the same time, there is increasing evidence of a way forward, a new economic paradigm – one in which material wealth is not delivered perforce at the expense of growing environmental risks, ecological scarcities and social disparities.

Mounting evidence also suggests that transitioning to a green economy has sound economic and social justification. There is a strong case emerging for a redoubling of efforts by both governments as well as the private sector to engage in such an economic transformation. For governments, this would include leveling the playing field for greener products by phasing out antiquated subsidies, reforming policies and providing new incentives, strengthening market infrastructure and market-based mechanisms, redirecting public investment, and greening public procurement. For the private sector, this would involve understanding and sizing the true opportunity represented by green economy transitions across a number of key sectors, and responding to policy reforms and price signals through higher levels of financing and investment.

An era of capital misallocation

Several concurrent crises have unfolded during the last decade: climate, biodiversity, fuel, food, water, and more recently, in the global financial system. Accelerating carbon emissions indicate a mounting threat of climate change, with potentially disastrous human consequences. The fuel price shock of 2007-2008 and the related skyrocketing food and commodity prices,

reflect both structural weaknesses and unresolved risks. Forecasts by the International Energy Agency (IEA) and others of rising fossil fuel demand and energy prices suggest an ongoing dependence as the world economy struggles to recover and grow (IEA 2010).

Currently, there is no international consensus on the problem of global food security or on possible solutions for how to nourish a population of 9 billion by 2050. See Box 1 for further information on the population challenge. Freshwater scarcity is already a global problem, and forecasts suggest a growing gap by 2030 between annual freshwater demand and renewable supply (McKinsey and Company 2009). The outlook for improved sanitation still looks bleak for over 1.1 billion people and 844 million people still lack access to clean drinking water (World Health Organization and UNICEF 2010). Collectively, these crises are severely impacting the possibility of sustaining prosperity worldwide and achieving the Millennium Development Goals (MDGs) for reducing extreme poverty. They are also compounding persistent social problems, such as job losses, socio-economic insecurity, disease and social instability.

The causes of these crises vary, but at a fundamental level they all share a common feature: the gross misallocation of capital. During the last two decades, much capital was poured into property, fossil fuels and structured financial assets with embedded derivatives. However, relatively little in comparison was invested in renewable energy, energy efficiency, public transportation, sustainable agriculture, ecosystem and biodiversity protection, and land and water conservation.

Most economic development and growth strategies encouraged rapid accumulation of physical, financial and human capital, but at the expense of excessive depletion and degradation of natural capital, which includes the endowment of natural resources and ecosystems. By depleting the world’s stock of natural wealth – often irreversibly – this pattern of development and growth has had detrimental impacts on the well-being of current generations and presents tremendous risks and challenges for the future. The recent multiple crises are symptomatic of this pattern.

Box 1: Managing the population challenge in the context of sustainable development

The link between population dynamics and sustainable development is strong and inseparable, as reflected in Principle 8 of the 1992 Rio Declaration on Environment and Development.

“To achieve sustainable development and a higher quality of life for all people, States should reduce and eliminate unsustainable patterns of production and consumption and promote appropriate demographic policies.” Rio Declaration, Principle 8 (UN 1992).

This year the world population will reach 7 billion and by mid century grow to over 9 billion. Contrary to previous projections the most recent population projections expect continued population growth thereafter (UN DESA 2009 and 2011). Population growth raises the stakes in efforts to reduce poverty. It not only increases the challenge of feeding a growing population, which crucially depends on higher agricultural output (FAO 2009 and 2010; Tokgoz and Rosegrant 2011), but also requires creation of sufficient employment opportunities, which in turn depend on favorable economic development (ILO 2011; UNFPA 2011a; Basten et al. 2011; Herrmann and Khan 2008).

A transition to a green economy can assist in overcoming the contribution that population growth makes to the depletion of scarce natural resources. The world's least developed countries (LDCs) are more strongly affected by environmental degradation than most other developing countries (UNCTAD 2010a), so therefore have much to gain from the transition to a green economy.

In addition, changing spatial distributions of populations, driven both by rural to urban migration and by urban growth, are changing environmental impacts and vulnerabilities. When planned,

urbanisation can be a powerful driver of sustainable development. Given that in 2008 the share of the urban population has for the first time exceeded the share of people living in the rural areas at the global level (UNFPA 2007), a transition to a green economy becomes increasingly important. Significantly, in the least developed countries where the majority of people are still living in the rural areas, 2000 to 2010 was the first decade that growth of the urban population outpaced the growth of the rural populations. These types of changes at a societal level can also present opportunities for a green economy to develop.

For example cities can provide essential services, including health and education, at lower costs per capita due to economies of scale benefits. Efficiencies are also realised in the development of vital infrastructure including housing, water, sanitation and transport. Urbanisation can also reduce energy consumption, particularly in transport and housing, and create interactive spaces that further cultural outreach and exchange. Realisation of these positive benefits requires proactive planning for the future demographic changes.

Forward planning by governments and local authorities can address population dynamics in a proactive way. For example, one tool available to assist countries is to make better use of available population data and conduct a systematic population situation analysis (UNFPA 2011b), aiming to highlight how current and projected population trends affect the development of countries. Such analysis provides the necessary foundation to address population dynamics and their links to sustainable development and poverty reduction strategies.

Source: UNFPA

Existing policies and market incentives have contributed to this problem of capital misallocation because they allow businesses to run up significant, largely unaccounted for, and unchecked social and environmental externalities. To reverse such misallocation requires better public policies, including pricing and regulatory measures, to change the perverse incentives that drive this capital misallocation and ignore social and environmental externalities. At the same time, appropriate regulations, policies and public investments that foster changes in the pattern of private

investment are increasingly being adopted around the world, especially in developing countries (UNEP 2010).

Why is this report needed now?

UNEP's report, *Towards a Green Economy*, aims to debunk several myths and misconceptions about greening the global economy, and provides timely and practical guidance to policy makers on what reforms they need to unlock the productive and employment potential of a green economy.

Towards a green economy

Perhaps the most prevalent myth is that there is an inescapable trade-off between environmental sustainability and economic progress. There is now substantial evidence that the greening of economies neither inhibits wealth creation nor employment opportunities. To the contrary, many green sectors provide significant opportunities for investment, growth and jobs. For this to occur, however, new enabling conditions are required to promote such investments in the transition to a green economy, which in turn calls for urgent action by policy makers.

A second myth is that a green economy is a luxury only wealthy countries can afford, or worse, a ruse to restrain development and perpetuate poverty in developing countries. Contrary to this perception, numerous examples of greening transitions can be found in the developing world, which should be replicated elsewhere. *Towards a Green Economy* brings some of these examples to light and highlights their scope for wider application.

UNEP's work on green economy raised the visibility of this concept in 2008, particularly through a call for a Global Green New Deal (GGND). The GGND recommended a package of public investments and complementary policy and pricing reforms aimed at kick-starting a transition to a green economy, while reinvigorating economies and jobs and addressing persistent poverty (Barbier 2010a). Designed as a timely and appropriate policy response to the economic crisis, the GGND proposal was an early output from the United Nations' Green Economy Initiative. This initiative, coordinated by UNEP, was one of the nine Joint Crisis Initiatives undertaken by the Secretary-General of the UN and his Chief Executives Board in response to the 2008 economic and financial crisis.

Towards a Green Economy – the main output of the Green Economy Initiative – demonstrates that the greening of economies need not be a drag on growth. On the contrary, the greening of economies has the potential to be a new engine of growth, a net generator of decent jobs and a vital strategy to eliminate persistent poverty. The report also seeks to motivate policy makers to create the enabling conditions for increased investments in a transition to a green economy in three ways.

First, the report makes an economic case for shifting both public and private investment to transform key sectors that are critical to greening the global economy. It illustrates through examples how added employment through green jobs offsets job losses in a transition to a green economy.

Second, it shows how a green economy can reduce persistent poverty across a range of important sectors

– agriculture, forestry, freshwater, fisheries and energy. Sustainable forestry and ecologically friendly farming methods help conserve soil fertility and water resources. This is especially critical for subsistence farming, upon which almost 1.3 billion people depend for their livelihoods (UNEP et al. 2008).

Third, it provides guidance on policies to achieve this shift by reducing or eliminating environmentally harmful or perverse subsidies, addressing market failures created by externalities or imperfect information, creating market-based incentives, implementing appropriate regulatory frameworks, initiating green public procurement and by stimulating investment.

1.2 What is a green economy?

UNEP defines a green economy as one that results in “improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities” (UNEP 2010). In its simplest expression, a green economy is low-carbon, resource efficient, and socially inclusive. In a green economy, growth in income and employment are driven by public and private investments that reduce carbon emissions and pollution, enhance energy and resource efficiency, and prevent the loss of biodiversity and ecosystem services.

These investments need to be catalysed and supported by targeted public expenditure, policy reforms and regulation changes. The development path should maintain, enhance and, where necessary, rebuild natural capital as a critical economic asset and as a source of public benefits. This is especially important for poor people whose livelihoods and security depend on nature.

The key aim for a transition to a green economy is to enable economic growth and investment while increasing environmental quality and social inclusiveness. Critical to attaining such an objective is to create the conditions for public and private investments to incorporate broader environmental and social criteria. In addition, the main indicators of economic performance, such as growth in Gross Domestic Product (GDP) need to be adjusted to account for pollution, resource depletion, declining ecosystem services, and the distributional consequences of natural capital loss to the poor.

A major challenge is reconciling the competing economic development aspirations of rich and poor countries in a world economy that is facing increasing climate change, energy insecurity and ecological scarcity. A green economy can meet this challenge by offering a development path that reduces carbon dependency,

promotes resource and energy efficiency and lessens environmental degradation. As economic growth and investments become less dependent on liquidating environmental assets and sacrificing environmental quality, both rich and poor countries can attain more sustainable economic development.

The concept of a green economy does not replace sustainable development; but there is a growing recognition that achieving sustainability rests almost entirely on getting the economy right. Decades of creating new wealth through a “brown economy” model based on fossil fuels have not substantially addressed social marginalisation, environmental degradation and resource depletion. In addition, the world is still far from delivering on the Millennium Development Goals by 2015. The next section looks at the important linkages between the concept of a green economy and sustainable development.

A green economy and sustainable development

In 2009, the UN General Assembly decided to hold a summit in Rio de Janeiro in 2012 (Rio+20) to celebrate the 20th anniversary of the first Rio Earth Summit in 1992. Two of the agenda items for Rio+20 are, “Green Economy in the Context of Sustainable Development and Poverty Eradication”, and “International Framework for Sustainable Development”. With the green economy now firmly established on the international policy agenda, it is useful to review and clarify the linkages between a green economy and sustainable development.

Most interpretations of sustainability take as their starting point the consensus reached by the World Commission on Environment and Development (WCED) in 1987, which defined sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED 1987).

Economists are generally comfortable with this broad interpretation of sustainability, as it is easily translatable into economic terms: an increase in well-being today should not result in reducing well-being tomorrow. That is, future generations should be entitled to at least the same level of economic opportunities – and thus at least the same level of economic welfare – as is available to current generations.

As a result, economic development today must ensure that future generations are left no worse off than current generations. Or, as some economists have succinctly expressed it, per capita welfare should not be declining over time (Pezzey 1989). According to this view, it is the total stock of capital employed by the economic system, including natural capital, which determines the full range of economic opportunities, and thus well-being,

available to both current and future generations (Pearce et al. 1989).

Society must decide how best to use its total capital stock today to increase current economic activities and welfare. Society must also decide how much it needs to save or accumulate for tomorrow, and ultimately, for the well-being of future generations.

However, it is not simply the aggregate stock of capital in the economy that may matter but also its composition, in particular whether current generations are using up one form of capital to meet today’s needs. For example, much of the interest in sustainable development is driven by concern that economic development may be leading to rapid accumulation of physical and human capital at the expense of excessive depletion and degradation of natural capital. The major concern is that by irreversibly depleting the world’s stock of natural wealth, today’s development path will have detrimental implications for the well-being of future generations.

One of the first economic studies to make the connection between this capital approach to sustainable development and a green economy was the 1989 book *Blueprint for a Green Economy* (Pearce et al. 1989). The authors argued that because today’s economies are biased towards depleting natural capital to secure growth, sustainable development is unachievable. A green economy that values environmental assets, employs pricing policies and regulatory changes to translate these values into market incentives, and adjusts the economy’s measure of GDP for environmental losses is essential to ensuring the well-being of current and future generations.

As pointed out by the *Blueprint for a Green Economy* authors, a major issue in the capital approach to sustainable development is whether substitution among different forms of capital – human capital, physical capital and natural capital – is possible. A strong conservationist perspective might maintain that the natural component of the total capital stock must be kept intact, as measured in physical terms. However, this may be questioned in practice, especially in the context of developing countries, if natural capital is relatively abundant while physical and human capital needs to be developed to meet other human demands. This type of substitution reflects the unfortunate reality that the creation of physical capital – for example roads, buildings and machinery – often requires the conversion of natural capital. While substitution between natural capital and other forms of capital is often inevitable, there is often room for efficiency gains. There is also a growing recognition of environmental thresholds that would constrain substitution beyond minimum levels needed for human welfare.

Biodiversity	Ecosystem goods and services (examples)	Economic values (examples)
Ecosystems (variety & extent/area)	<ul style="list-style-type: none"> • Recreation • Water regulation • Carbon storage 	Avoiding greenhouse gas emissions by conserving forests: US\$ 3.7 trillion (NPV)
Species (diversity & abundance)	<ul style="list-style-type: none"> • Food, fiber, fuel • Design inspiration • Pollination 	Contribution of insect pollinators to agricultural output: ~US\$ 190 billion/year
Genes (variability & population)	<ul style="list-style-type: none"> • Medicinal discoveries • Disease resistance • Adaptive capacity 	25-50% of the US\$ 640 billion pharmaceutical market is derived from genetic resources

Table 1: Natural capital: Underlying components and illustrative services and values
 Source: Eliasch (2008); Gallai et al. (2009); TEEB (2009)

Yet, there has always been concern that some forms of natural capital are essential to human welfare, particularly key ecological goods and services, unique environments and natural habitats, and irreplaceable ecosystem attributes. Uncertainty over the true value of these important assets to human welfare, in particular the value that future generations may place on them if they become increasingly scarce, further limits our ability to determine whether we can adequately compensate future generations for today’s irreversible losses in such essential natural capital. This concern is reflected in other definitions of sustainable development. For example, in 1991, the World Wide Fund for Nature, the International Union for Conservation of Nature (IUCN), and UNEP interpreted the concept of sustainable development as “improving the quality of human life within the carrying capacity of supporting ecosystems” (WWF, IUCN and UNEP 1991).

As this definition suggests, the type of natural capital that is especially at risk is ecosystems. As explained by Partha Dasgupta (2008): “Ecosystems are capital assets. Like reproducible capital assets ... ecosystems depreciate if they are misused or are overused. But they differ from reproducible capital assets in three ways: (1) depreciation of natural capital is frequently irreversible (or at best the systems take a long time to recover); (2) except in a very limited sense, it isn’t possible to replace a depleted or degraded ecosystem by a new one; and (3) ecosystems can collapse abruptly, without much prior warning.”

Rising ecological scarcity is an indication that we are irrevocably depleting ecosystems too rapidly, and the consequence is that current and future economic welfare is affected. An important indicator of the growing ecological scarcity worldwide was provided by the *Millennium Ecosystem Assessment* (MEA) in 2005, which found that over 60 per cent of the world’s major ecosystem goods and services covered in the assessment were degraded or used unsustainably.

Some important benefits to humankind fall in this category, including fresh water; capture fisheries; water

purification and waste treatment; wild foods; genetic resources; biochemicals; wood fuel; pollination; spiritual, religious and aesthetic values; the regulation of regional and local climate; erosion; pests; and natural hazards. The economic values associated with these ecosystem services, while generally not marketed, are substantial (see Table 1).

One major difficulty is that the increasing costs associated with rising ecological scarcity are not routinely reflected in markets. Almost all the degraded ecosystem goods or services identified by the *Millennium Ecosystem Assessment* are not marketed. Some goods, such as capture fisheries, fresh water, wild foods, and wood fuel, are often commercially marketed, but due to the poor management of the biological resources and ecosystems that are the source of these goods, and imperfect information, the market prices do not reflect unsustainable use and overexploitation.

Nor have adequate policies and institutions been developed to handle the costs associated with worsening ecological scarcity globally. All too often, policy distortions and failures compound these problems by encouraging wasteful use of natural resources and environmental degradation. The unique challenge posed by rising ecological scarcity and inefficient resource and energy use today is to overcome a vast array of market, policy, and institutional failures that prevents recognition of the economic significance of this environmental degradation.

Reversing this process of unsustainable development requires three important steps. First, as argued by the *Blueprint for a Green Economy* authors, improvements in environmental valuation and policy analysis are required to ensure that markets and policies incorporate the full costs and benefits of environmental impacts (Pearce et al. 1989; Pearce and Barbier 2000). Environmental valuation and accounting for natural capital depreciation must be fully integrated into economic development policy and strategy. As suggested above, the most undervalued components of natural capital are ecosystems and

the myriad goods and services they provide. Valuing ecosystem goods and services is not easy, yet it is fundamental to ensuring the sustainability of global economic development efforts.

A major international research effort supported by UNEP, the Economics of Ecosystems and Biodiversity (TEEB), is illustrating how ecological and economic research can be used to value ecosystem goods and services, as well as how such valuation is essential for policy making and investments in the environment (Sukhdev 2008; TEEB 2010).

Second, the role of policy in controlling excessive environmental degradation requires implementing effective and appropriate information, incentives, institutions, investments and infrastructure. Better information on the state of the environment, ecosystems and biodiversity is essential for both private and public decision making that determines the allocation of natural capital for economic development. The use of market-based instruments, the creation of markets, and where appropriate, regulatory measures, have a role to play in internalising this information in everyday allocation decisions in the economy. Such instruments are also important in correcting the market and policy failures that distort the economic incentives for improved environmental and ecosystems management.

However, overcoming institutional failures and encouraging more effective property rights, good governance and support for local communities, is also critical. Reducing government inefficiency, corruption and poor accountability are also important in reversing excessive environmental degradation in many countries. But there is also a positive role for government in providing an appropriate and effective infrastructure through public investment, protecting critical ecosystems and biodiversity conservation, creating new incentive mechanisms such as payment for ecosystem services, fostering the technologies and knowledge necessary for improving ecosystem restoration, and facilitating the transition to a low-carbon economy.

Third, continuing environmental degradation, land conversion and global climate change affect the functioning, diversity, and resilience of ecological systems and the goods and services they supply. The potential long-term impacts of these effects on the health and stability of ecosystems are difficult to quantify and value. Increasing collaboration between environmental scientists, ecologists and economists will be required to assess and monitor these impacts (MEA 2005; Polasky and Segerson 2009). Such interdisciplinary ecological and economic analysis is also necessary to identify and assess the welfare consequences for current and future generations from increasing ecological scarcity. Further

progress in reversing unsustainable development calls for more widespread interdisciplinary collaboration to analyse complex problems of environmental degradation, biodiversity loss and ecosystem decline.

Interdisciplinary research also needs to determine the thresholds that should govern the transformation of specific types of natural capital into other forms of capital. For example, how much forestland is allowed for conversion into farmland, industrial use or urban development in a given area? How much underground water is allowed for extraction each year? How much and what fish species can be caught in a given season? Which chemicals should be banned from production and trading? And more important, what are the criteria for setting these thresholds? Once these standards are established, incentive measures at national or international levels can be devised to ensure compliance.

The other key to balancing different forms of capital recognises that substitutability is a characteristic of current technologies. Investing in changing and substituting these technologies can lead to new complementarities. Most renewable energy sources, such as wind turbines or solar panels, considerably reduce the amount of natural capital that is sacrificed in their construction and the lifetime of their operation, compared to fossil fuel burning technologies. Both of these types of solutions – setting thresholds and altering technologies – are important for achieving a green economy.

In sum, moving towards a green economy must become a strategic economic policy agenda for achieving sustainable development. A green economy recognises that the goal of sustainable development is improving the quality of human life within the constraints of the environment, which include combating global climate change, energy insecurity, and ecological scarcity. However, a green economy cannot be focused exclusively on eliminating environmental problems and scarcity. It must also address the concerns of sustainable development with intergenerational equity and eradicating poverty.

A green economy and eradicating poverty

Most developing countries, and certainly the majority of their populations, depend directly on natural resources. The livelihoods of many of the world's rural poor are also intricately linked with exploiting fragile environments and ecosystems (Barbier 2005). Well over 600 million of the rural poor currently live on lands prone to degradation and water stress, and in upland areas, forest systems, and drylands that are vulnerable to climatic and ecological disruptions (Comprehensive Assessment of Water Management in Agriculture 2007; World Bank 2003). The tendency of rural populations to be clustered

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on marginal lands and in fragile environments is likely to be a continuing problem for the foreseeable future, given current global rural population and poverty trends. Despite rapid global urbanisation, the rural population of developing regions continues to grow, albeit at a slower rate in recent decades (Population Division of the United Nations Secretariat 2008). Furthermore, around three-quarters of the developing world's poor still live in rural areas, which means about twice as many poor people live in rural rather than in urban areas (Chen and Ravallion 2007).

The world's poor are especially vulnerable to the climate-driven risks posed by rising sea levels, coastal erosion and more frequent storms. Around 14 per cent of the population and 21 per cent of urban dwellers in developing countries live in low elevation coastal zones that are exposed to these risks (McGranahan et al. 2007). The livelihoods of billions – from poor farmers to urban slum dwellers – are threatened by a wide range of climate-induced risks that affect food security, water availability, natural disasters, ecosystem stability and human health (UNDP 2008; OECD 2008). For example, many of the 150 million urban inhabitants, who are likely to be at risk from extreme coastal flooding events and sea level rise, are likely to be the poor living in cities in developing countries (Nicholls et al. 2007).

As in the case of climate change, the link between ecological scarcity and poverty is well-established for some of the most critical environmental and energy problems. For example, for the world's poor, global water scarcity manifests itself as a water poverty problem. One-in-five people in the developing world lacks access to sufficient clean water, and about half the developing world's population, 2.6 billion people, do not have access to basic sanitation. More than 660 million of the people without sanitation live on less than US\$ 2 a day, and more than 385 million on less than US\$ 1 a day (UNDP 2006). Billions of people in developing countries have no access to modern energy services, and those consumers who do have access often pay high prices for erratic and unreliable services. Among the energy poor are 2.4 billion people who rely on traditional biomass fuels for cooking and heating, including 89 per cent of the population of Sub-Saharan Africa; and, the 1.6 billion people who do not have access to electricity (IEA 2002).

Thus, finding ways to protect global ecosystems, reduce the risks of global climate change, improve energy security, and simultaneously improve the livelihoods of the poor are important challenges in the transition to a green economy, especially for developing countries.

As this report demonstrates, a transition to a green economy can contribute to eradicating poverty. A

number of sectors with green economic potential are particularly important for the poor, such as agriculture, forestry, fishery and water management, which have public goods qualities. Investing in greening these sectors, including through scaling up microfinance, is likely to benefit the poor in terms of not only jobs, but also secure livelihoods that are predominantly based on ecosystem services. Enabling the poor to access microinsurance coverage against natural disasters and catastrophes is equally important for protecting livelihood assets from external shocks due to changing and unpredictable weather patterns.

However, it must be emphasised that moving towards a green economy will not automatically address all poverty issues. A pro-poor orientation must be superimposed on any green economy initiative. Investments in renewable energy, for example, will have to pay special attention to the issue of access to clean and affordable energy. Payments for ecosystem services, such as carbon sequestration in forests, will need to focus more on poor forest communities as the primary beneficiaries. The promotion of organic agriculture can open up opportunities, particularly for poor small-scale farmers who typically make up the majority of the agricultural labour force in most low-income countries, but will need to be complemented by policies to ensure that extension and other support services are in place.

In sum, the top priority of the UN MDGs is eradicating extreme poverty and hunger, including halving the proportion of people living on less than US\$ 1 a day by 2015. A green economy must not only be consistent with that objective, but must also ensure that policies and investments geared towards reducing environmental risks and scarcities are compatible with ameliorating global poverty and social inequity.

1.3 Pathways to a green economy

If the desirability of moving to a green economy is clear to most people, the means of doing so is still a work in progress for many. This section looks at the theory of greening, the practice and the enabling conditions required for making such a transition. However, before embarking on this analysis, the section frames the dimensions of the challenge.

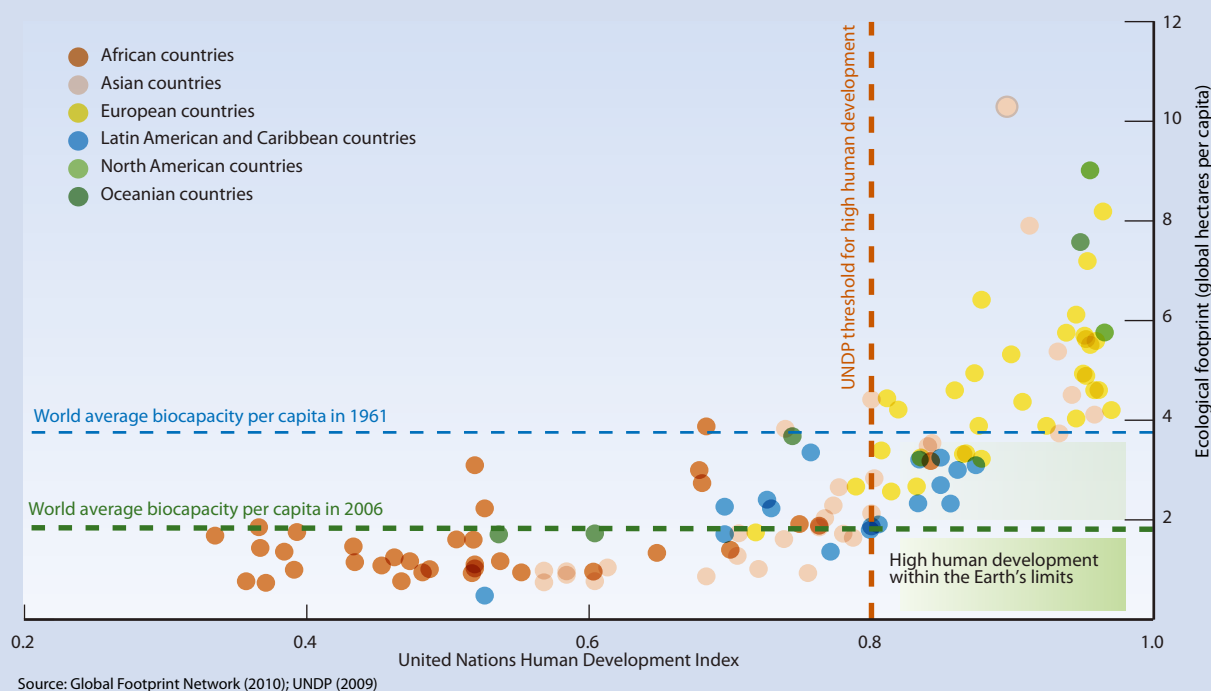
How far is the world from a green economy?

Over the last quarter of a century, the world economy has quadrupled, benefiting hundreds of millions of people (IMF 2006). However, 60 per cent of the world's major ecosystem goods and services that underpin livelihoods have been degraded or used unsustainably (Millennium Ecosystem Assessment 2005). This is because the

Box 2: Towards a green economy: A twin challenge

Many countries now enjoy a high level of human development – but at the cost of a large ecological footprint. Others have a very low footprint, but face urgent needs to improve access to basic services such as

health, education, and potable water. The challenge for countries is to move towards the origin of the graph, where a high level of human development can be achieved within planetary boundaries.



economic growth of recent decades has been accomplished mainly through drawing down natural resources, without allowing stocks to regenerate, and through allowing widespread ecosystem degradation and loss.

For instance, today only 20 per cent of commercial fish stocks, primarily low priced species, are underexploited; 52 per cent are fully exploited with no further room for expansion; about 20 per cent are overexploited; and 8 per cent are depleted (FAO 2009). Water is becoming scarce and water stress is projected to increase with water supply satisfying only 60 per cent of world demand in 20 years (McKinsey and Company 2009). Agriculture saw increasing yields primarily due to the use of chemical fertilisers (Sparks 2009), yet has resulted in declining soil quality, land degradation, (Müller and Davis 2009) and deforestation – which resulted in 13 million hectares of forest lost annually over 1990-2005 (FAO 2010). Ecological scarcities are seriously affecting the entire gamut of economic sectors that are the bedrock of human food supply (fisheries, agriculture, freshwater, and forestry) and a critical source of livelihoods for the poor. At the same time, ecological

scarcity and social inequity are clear indicators of an economy that is not sustainable.

For the first time in history, more than half of the world population lives in urban areas. Cities now account for 75 per cent of energy consumption (UN Habitat 2009) and of carbon emissions (Clinton Foundation 2010).¹ Rising and related problems of congestion, pollution and poorly provisioned services affect the productivity and health of all, but fall particularly hard on the urban poor. With approximately 50 per cent of the global population now living in emerging economies (World Bank 2010) that are rapidly urbanising and developing, the need for green city planning, infrastructure and transportation is paramount.

The transition to a green economy will vary considerably among nations, as it depends on the specifics of each country's natural and human capital and on its relative level of development. As demonstrated graphically, there are many opportunities for all countries in such a transition (see Box 2). Some countries have attained high levels of

1. For a critique of these figures, see Satterthwaite, D. (2008), "Cities' contribution to global warming: notes on the allocation of greenhouse gas emissions", *Environment and Urbanization*, 20 (2): 539-549..

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human development, but often at the expense of their natural resource base, the quality of their environment, and high greenhouse gas (GHG) emissions. The challenge for these countries is to reduce their per capita ecological footprint without impairing their quality of life.

Other countries still maintain relatively low per capita ecological footprints, but need to deliver improved levels of services and material well-being to their citizens. Their challenge is to do this without drastically increasing their ecological footprint. As the diagram illustrates, one of these two challenges affects almost every nation, and globally, the economy is still very far from being green.

Enabling conditions for a green economy

To make the transition to a green economy, specific enabling conditions will be required. These enabling conditions consist of national regulations, policies, subsidies and incentives, as well as international market and legal infrastructure, trade and technical assistance. Currently, enabling conditions are heavily weighted towards, and encourage, the prevailing brown economy, which depends excessively on fossil fuels, resource depletion and environmental degradation.

For example, price and production subsidies for fossil fuels collectively exceeded US\$ 650 billion in 2008 (IEA et al. 2010). This high level of subsidisation can adversely affect the adoption of clean energy while contributing to more greenhouse gas emissions. In contrast, enabling conditions for a green economy can pave the way for the success of public and private investment in greening the world's economies (IEA 2009). At a national level, examples of such enabling conditions are: changes to fiscal policy, reform and reduction of environmentally harmful subsidies; employing new market-based instruments; targeting public investments to green key sectors; greening public procurement; and improving environmental rules and regulations, as well as their enforcement. At an international level, there are also opportunities to add to market infrastructure, improve trade and aid flows and foster greater international cooperation (United Nations General Assembly 2010).

At the national level, any strategy to green economies should consider the impact of environmental policies within the broader context of policies to address innovation and economic performance (Porter and Van der Linde 1995).² In this view, government policy plays a critical role within economies to encourage innovation and growth. Such intervention is important as a means for fostering innovation and for choosing the direction of change (Stoneman ed. 1995; Foray ed. 2009).

2. This point has been debated since at least the time of the initial statement of the Porter Hypothesis. Porter argued then that environmental regulation might have a positive impact on growth through the dynamic effects it engendered within an economy.

For some time, economists such as Kenneth Arrow have shown that competitive firms and competitive markets do not necessarily produce the optimal amount of innovation and growth within an economy (Arrow 1962; Kamien and Schwartz 1982).³ Public intervention within an economy is therefore critically important for these purposes. This is because industries in competitive markets have few incentives to invest in technological change or even in product innovation, as any returns would be immediately competed away. This is one of the best-known examples of market failure in the context of competitive markets, and provides the rationale for various forms of interventions (Blair and Cotter 2005).

Examples of spurring growth and innovation can be seen from histories of many recently emerged economies. In the 1950s and 1960s, the Japanese and South Korean governments chose the direction of technological change through importing the technology of other countries (Adelman 1999). This changed in the 1970s when these economies shifted to aggressive policies for encouraging energy-efficient innovation. Shortly afterwards, Japan was one of the leading economies in the world in terms of research and development (R&D) investment in these industries (Mowery 1995).⁴ This pattern of directed spending and environmental policies is being repeated today across much of Asia. The cases of South Korea and China in particular are illustrative, where a large proportion of their stimulus packages was directed at a "green recovery" and has now been instituted into longer-term plans for retooling their economies around green growth (Barbier 2010b).

Thus, moving towards a green development path is almost certainly a means for attaining welfare improvements across a society, but it is also often a means for attaining future growth improvement. This is because a shift away from basic production modes of development based on extraction and consumption and towards more complex modes of development can be a good long-term strategy for growth. There are several reasons why this shift might be good for long-term competitiveness as well as for social welfare.

First, employing strong environmental policies can drive inefficiencies out of the economy by removing those firms and industries that only exist because of implicit subsidies in under-priced resources. The free use of air, water and ecosystems is not a value-less good for any actor in an economy and amounts to subsidising negative net worth activities. Introducing effective regulation and market-based mechanisms to contain

3. It has been known since at least the time of the seminal work of Kenneth Arrow (1962) and the structural work of Kamien and Schwartz (1982) that competitive firms and competitive markets need not produce the optimal amount of innovation and growth within an economy.

4. By 1987, Japan was the world leader in R&D per unit GDP (at 2.8 per cent) and the world leader in the proportion of that spent on energy-related R&D (at 23 per cent).

pollution and limit the accumulation of environmental liabilities drives the economy in a more efficient direction.

Second, resource pricing is important not just for the pricing of natural capital and services, but also for pricing of all the other inputs within an economy. An economy allocates its efforts and expenditures according to relative prices, and under-priced resources result in unbalanced economies. Policy makers should be targeting the future they wish their economies to achieve, and this will usually require higher relative prices on resources. An economy that wishes to develop around knowledge, R&D, human capital and innovation should not be providing free natural resources.

Third, employing resource pricing drives investments into R&D and innovation. It does so because avoiding costly resources can be accomplished by researching and finding new production methods. This will include investment in all of the factors (human capital and knowledge) and all of the activities (R&D and innovation) listed above. Moving towards more efficient resource pricing is about turning the economy's emphasis towards different foundations of development.

Fourth, these investments may then generate innovation rents. Policies that reflect scarcities that are prevalent in the local economy can also reflect scarcities prevalent more widely. For this reason, a solution to a problem of resource scarcity identified locally (via R&D investments) may have applicability and hence more global marketability. The first solution to a widely experienced problem can be patented, licensed and marketed widely.

Fifth, aggressive environmental regulation may anticipate future widely-experienced scarcities and provide a template for other jurisdictions to follow. Such policy leadership can be the first step in the process of innovation, investment, regulation and resource pricing described above (Network of Heads of European Environment Protection Agencies 2005).

In sum, the benefits from a strong policy framework to address market failures and ecological scarcities will flow down the environment pathway that comes from altering the direction of an economy. Policies and market-based mechanisms that enhance perceived resource prices creates incentives to shift the economy onto a completely different foundation – one based more on investments in innovation and its inputs of human capital, knowledge, and research and development.

How to measure progress towards a green economy

It is difficult, if not impossible, to manage what is not measured. Notwithstanding the complexity of an overall transition to a green economy, appropriate indicators at

both a macroeconomic level and a sectoral level will be essential to informing and guiding the transition.

To complicate matters, conventional economic indicators, such as GDP, provide a distorted lens for economic performance, particularly because such measures fail to reflect the extent to which production and consumption activities may be drawing down natural capital. By either depleting natural resources or degrading the ability of ecosystems to deliver economic benefits, in terms of provisioning, regulating or cultural services, economic activity is often based on the depreciation of natural capital.

Ideally, changes in stocks of natural capital would be evaluated in monetary terms and incorporated into national accounts. This is being pursued in the ongoing development of the System of Environmental and Economic Accounting (SEEA) by the UN Statistical Division, and the World Bank's adjusted net national savings methods (World Bank 2006). The wider use of such measures would provide a better indication of the real level and viability of growth in income and employment. Green Accounting or Inclusive Wealth Accounting are available frameworks that are expected to be adopted by a few nations⁵ initially and pave the way for measuring the transition to a green economy at the macroeconomic level.

How might a green economy perform over time?

In this report, the macroeconomic Threshold 21 (T21) model is used to explore the impacts of investments in greening the economy against investments in business as usual. The T21 model measures results in terms of traditional GDP as well as its affects on employment, resource intensity, emissions, and ecological impacts.⁶

The T21 model was developed to analyse strategies for medium to long-term development and poverty reduction, most often at the national level, complementing other tools for analysing short-term impacts of policies and programmes. The model is particularly suited to analysing the impacts of investment plans, covering both public and private commitments. The global version of T21 used for purposes of this report models the world economy as a whole to capture the key relationships between production and key natural resource stocks at an aggregate level.

The T21 model reflects the dependence of economic production on the traditional inputs of labour and physical capital, as well as stocks of natural capital in the form of

5. World Bank, together with UNEP and other partners, have recently (at Nagoya, CBD COP-10, October 2009) announced a global project on Ecosystem Valuation and Wealth Accounting which will enable a group of developing and developed nations to test this framework and evolve a set of pilot national accounts that are better able to reflect and measure sustainability concerns.

6. See the Modelling chapter for details on the T21 model.

resources, such as energy, forest land, soil, fish and water. Growth is thus driven by the accumulation of capital – whether physical, human or natural – through investment, also taking into account depreciation or depletion of capital stocks. The model is calibrated to reproduce the past 40-year period of 1970-2010; simulations are conducted over the next 40-year period, 2010-2050. Business-as-usual projections are verified against standard projections from other organisations, such as the United Nations Population Division, World Bank, OECD, the International Energy Agency, and the Food and Agriculture Organization.

The inclusion of natural resources as a factor of production distinguishes T21 from all other global macroeconomic models (Pollitt et al. 2010). Examples of the direct dependence of output (GDP) on natural resources are the availability of fish and forest stocks for the fisheries and forestry sectors, as well as the availability of fossil fuels to power the capital needed to catch fish and harvest timber, among others. Other natural resources and resource efficiency factors affecting GDP include water stress, waste recycle and reuse and energy prices⁷.

Based on existing studies, the annual financing demand to green the global economy was estimated to be in the range US\$ 1.05 to US\$ 2.59 trillion. To place this demand in perspective, it is about one-tenth of total global investment per year, as measured by global Gross Capital Formation. Taking an annual level of US\$ 1.3 trillion (2 per cent of global GDP) as a reference scenario, varying amounts of investment in the 10 sectors covered in this report were modelled to determine impact on growth, employment, resource use and ecological footprint. The results of the model, presented in more detail in the modelling chapter, suggest that over time investing in a green economy enhances long-term economic performance. Significantly, it does so while enhancing stocks of renewable resources, reducing environmental risks, and rebuilding capacity to generate future prosperity. These results are presented in a disaggregated form for each sector to illustrate the effects of this investment on income, employment and growth, and more comprehensively, in the modelling chapter.

1.4 Approach and structure – Towards a green economy

This report focuses on 10 key sectors considered to be driving the defining trends of the transition to a green economy. These trends include increasing human well-

being and social equity, and reducing environmental risks and ecological scarcities. Across many of these sectors, greening the economy can generate consistent and positive outcomes for increased wealth, growth in economic output, decent employment and reduced poverty.

In Part I, the report focuses on those sectors derived from natural capital – agriculture, fishing, forests and water. These sectors have a material impact on the economy as they form the basis for primary production, and because the livelihoods of the rural poor depend directly upon them. The analysis looks at the principal challenges and opportunities for bringing more sustainable and equitable management to these sectors, and reviews investment opportunities to restore and maintain the ecosystem services that underpin these sectors. In so doing, the chapters highlight several sector-specific investment opportunities and policy reforms that are of global importance as they appear replicable and scalable in the goal to transition to a green economy.

In Part II, the report focuses on those sectors that may be characterised as “built capital”, traditionally considered the brown sectors of the economy. In these sectors – such as transportation, energy and manufacturing – the report finds large opportunities for energy and resources savings. These savings, it is argued, can be scaled up and become drivers of economic growth and employment, as well as having important equity effects in some cases. Resource efficiency is a theme that has many dimensions as it cuts across energy efficiency in manufacture and habitation, materials efficiency in manufacture, and better waste management.

Finally, after providing an in-depth overview of the modelling conducted for this report and before examining options for financing the green economy, Part III focuses on enabling conditions for ensuring a successful transition to a green economy. These include appropriate domestic fiscal measures and policy reforms, international collaboration through trade, finance, market infrastructure, and capacity building support. Much has been said about the potential for a green economy to be used as a pretext for imposing aid conditionalities and trade protectionism. This report argues that to be green, an economy must not only be efficient, but also fair. Fairness implies recognising global and country level equity dimensions, particularly in assuring a just transition to an economy that is low-carbon, resource efficient, and socially inclusive. These enabling conditions for a fair and just transition are described and addressed at length in the final chapters of this report before conclusions, along with the steps necessary to mobilise finance at scale for a global transition to a green economy.

7. The T21 analysis purposely ignores issues such as trade and sources of investment financing (public vs private, or domestic vs foreign). As a result, the analysis of the potential impacts of a green investment scenario at a global level are not intended to represent the possibilities for any specific country or region. Instead, the simulations are meant to stimulate further consideration and more detailed analysis by governments and other stakeholders of a transition to a green economy.

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