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BRIEFING

Green Economy

WHAT DO WE MEAN BY GREEN ECONOMY?

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MAY 2012

UNEP

Summary

Reinvigorated by the United Nations Environment Programme (UNEP), a global discussion and national activities on green economy transitions have regained momentum since 2008. The increase in interest is, among other things, due to our growing understanding of the similarity and interlinkages between many of the recent financial, economic, environmental and social crises.

The 2008 global financial crisis focused attention not only on the financial losses, and implications for economies, jobs and housing, but also raised questions as to the fundamental imbalance in our economies. The choice of capital allocation - investment in property, fossil fuels and financial assets, rather than in measures to encourage resource efficiency - has created destructive imbalances. A further common element to all these crises is the focus of decision making on short time horizons and trust in what has often proven to be an incomplete evidence base including a lack of proper accounting, for example as regards the cost of climate change and biodiversity.

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Initiatives such as UNEP's 'Green Economy Initiative' and the OECD's 'Green Growth strategy' seek to place economic performance within environmental and social boundaries. 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. In its simplest expression, a green economy can be thought of as one which is low carbon, resource efficient and socially inclusive." The OECD Green Growth Report defines green growth as "fostering economic growth and development, while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies". Hence, both operate on the basis of development within environmental limits.

However, the pertinent political question concerns the nature of these limits and how we can live more sustainably within them. This will frame discussions at the Rio+20 Conference (the 2012 United Nations Conference on Sustainable Development, UNCSD) being held on the 20-22 June.

Rio+20 will focus on two main themes: the green economy in the context of sustainable development and poverty eradication; and the institutional framework for sustainable development. The green economy theme has attracted relatively more attention to date in preparatory discussions and supporting documentation. Preparatory discussions show that perceptions of the green economy theme are extremely diverse. Concerns have been raised on the implications of what the green economy means in practice and steps to be taken to achieve it. Although some of these concerns have been partly addressed during the preparatory stages, certain reservations remain.

Within the EU, an approach to a green economy is evolving. The objectives of the EU's economic strategy, Europe 2020, are building 'smart, sustainable and inclusive growth' where sustainable is characterised as low-carbon and resource-efficient. Several strategic initiatives have been launched since the 2010 publication of Europe 2020 (including the Roadmap for a resource-efficient Europe), which have elaborated what a low-carbon, resource-efficient economy might entail. While none address the 'green economy' as such, there is considerable focus on low carbon pathways, particularly in the power generation and transport sectors, the development of quite ambitious "milestones" for improved resource efficiency and some recognition of a range of specific objectives and tools that could contribute towards a green economy.

In the run-up to 'Rio+20', the European Commission published its contribution to preparations for the Conference: 'Rio+20: towards the green economy and better governance'. The Communication notes that responses to the continuing challenges and crisis 'will not come from slowing growth, but rather from promoting the right kind of growth'. The Commission calls for the adoption of a 'Green Economy Roadmap' at Rio+20, setting out a menu of actions, a timetable for implementation, targets and indicators.

The EU has funded many research projects which provide valuable insights, evidence and arguments that merit further consideration in the run up to Rio. They point to the value of looking at a number of interlinked building blocks, including understanding and avoiding unacceptable trade-offs, proactive risk management, investment in natural capital, resource efficiency and actions to reach absolute decoupling if we are to truly achieve ambitious results at the Rio+20 summit. The nine key principles of the green economy as agreed by the UNEP Governing Council - sustainable development, equity, prosperity and wellbeing, improving the natural world, decision-making, accountability, resilience, sustainable consumption and production; and investing for the future – are central in helping us to create 'the future we want'.

1. INTRODUCTION – WHAT IS A GREEN ECONOMY?

This briefing provides an introduction to the green economy concept as it has developed to date, key policy tools to support a green economy and potential future steps in the EU's on-going development of a green economy approach. It also sets out key findings from research projects funded through the European Commission's Research Framework Programmes with results relevant to the green economy. It has been written by Doreen Fedrigo-Fazio and Patrick ten Brink of IEEP, with support from IEEP colleagues Samuela Bassi, Leonardo Mazza, Sonia Rouabhi, Axel Volkery, Emma Watkins, and Sirini Withana. Further support was provided by Jennifer Emond and Thierry Lucas from UNEP. This briefing covers:

- What is a green economy?
- Green economy, green growth and sustainable development
- Green economy and environmental challenges
- Policy options and research insights for a green economy
- The way forward

Annex 1 of this briefing lists a number of FP6 and FP7 projects with relevance to the green economy.[1]

The global financial crisis that began in 2008 triggered questioning of the soundness of economic models and policies as they have developed over past decades. This questioning was amplified by the identification of various interrelated global crises (environmental and social) and the role of traditional views of economic growth in creating or worsening these. The rise and spread of the concept of the 'green economy' has stemmed from the identification of the need to address multiple issues in an integrated way, to overcome these existing interrelated crises and to better avoid any further ones.

Some systemic environmental problems have become more evident in recent years, with climate change topping the media and political attention, closely followed by biodiversity loss in major part due to habitat destruction. Pressure from increasing resource demand has also led to availability scares of some resources (raw materials) that have become economically important and are central to a green economy, and in other basic resources such as water and phosphorus. Speculation on food commodities was also central in driving up prices for important staple foods, causing social hardship and riots in some countries. In industrialised countries, waste generation and most importantly the illegal shipment of hazardous wastes continues to cause the double negative impacts of wasting renewable and non-renewable resources and polluting the environment.

Despite international political discussion on sustainable development dating back at least four decades, the underlying factor helping to make environmental problems systemic is the economic system not taking appropriate account of natural capital assets nor of environmental and human health impacts. When the 2008 global financial crisis highlighted further weaknesses in most of the world's economic approaches and policies, the green economy concept was promoted as a means of reforming traditional economics to better reflect natural and human/social capital. In so doing, economic development could be stimulated whilst nourishing natural and human capital and respecting planetary limits. Central to the development and promotion of the green economy as a means of overcoming a number of crises was the United Nations Environment Programme, notably its Green Economy Initiative[1] (GEI).

What is a green economy?

The above-mentioned UNEP Green Economy Initiative (GEI) defines a green economy as *"one that results in* ***improved human well-being*** *and* ***social equity****, while* ***significantly reducing environmental risks*** *and* ***ecological scarcities****"*. In its simplest expression, a green economy can be thought of as one which is **low carbon**,

[1] This main briefing is complemented by the supporting briefing: the ***Green Economy in the European Union,*** which explores what the EU is doing as regards the 10 sectors identified by UNEP as key for the transition to a green economy, and presents key EU research insights. Two supporting context briefings provide additional information for the main briefing and research insights: the ***Green Economy in the context of Rio+20***, and *the* ***Green Economy and sustainable development***.

resource efficient and **socially inclusive**."[2] Others such as OECD, World Bank and Global Green Growth Institute (GGGI) use the term 'green growth', which is similar to the concept of green economy yet slightly different in terms of its implementation approach. The OECD Green Growth Report[3] defines green growth as *"fostering economic growth and development, while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies"*. Hence, both operate on the basis of **development within planetary boundaries**. Growth is an element of both concepts, but the question remains what kind of growth and how do we come back, or remain, within planetary limits. In developing countries, roughly one billion people lack access to energy, water, sanitation, shelter, food, clothing and transport. Without significant growth of goods and services, it is impossible to lift these people out of poverty. Although growth does not always translate into poverty reduction, poverty reduction is always associated with growth whichever the measure of poverty is used. Whereas in industrialised countries, consumption and production patterns are unsustainable, using considerable amounts of natural resources and with related negative environmental and sometimes social impacts.

The green economy seeks to drive the growth of GDP and jobs through shifting investments towards clean technologies and natural capital as well as human resources and social institutions. It focuses on the shifting of public and private investment as a decisive instrument to achieve growth, environmental improvement, poverty eradication and social equity, with policy reforms supporting the shift. In a green economy, social dimensions are considered as targets for shifted investments.

The UNEP's Green Economy Report (GER) demonstrates that by investing two per cent of global GDP in greening ten key economic sectors,[2] significant economic, environmental and social gains could be achieved providing the right enabling environment. Fiscal policy reforms, proper valuation of natural capital, innovation policy for green technologies, right incentives for private investment and better engagement with business are such examples. These and other actions towards a green economy are considered in more detail in Section 3.

By using a macro-economic model, GER shows that in the longer term, a transition to a green economy could bring about higher GDP growth rate and job creation with reduced ecological footprints.

The OECD's Green Growth Strategy[4] was presented in 2011 as a response to the global financial crisis on request from its member countries, and as the OECD's contribution to the Rio+20 process (see *Supporting Context Briefing: Green Economy in the context of Rio+20* for more details).

According to the OECD, green growth should be conceived as a strategic complement to existing environmental and economic policy reform priorities. The Strategy provides a practical framework for governments in developed countries through which a green growth strategy would deliver opportunities for growth by:

- fostering innovation, leading to news ways of creating value and addressing environment problems;
- incentives for greater efficiency in the use of resources and natural assets;
- stimulating demand for green technologies creation of new markets;
- boosting of investor's confidence through greater predictability; and
- allowing more balanced macroeconomic conditions, in particular through its contribution to fiscal consolidation.

[2] Four (agriculture, fisheries, water and forests) are fundamentally interlinked with nature, natural resources and ecosystem services and many activities focus on investing in natural capital. The other six (energy, manufacturing, waste, buildings, transport and tourism) are sectors where green economy initiatives would tend to focus more on reducing energy and resource consumption/use. This focus on ten sectors does not suggest that the greening of other sectors is unimportant; the transition to a green economy will need to take place across all sectors to be fully achieved, but there are clearly ten priority sectors where immediate attention is merited. Cities also feature as a separate entity, as the majority of the world's population lives in these conurbations and due to their impacts.

2. THE ISSUE AT STAKE: GREEN ECONOMY AND ENVIRONMENTAL CHALLENGES

Since the Industrial Revolution, the impacts of human behaviour have had increasingly negative effects on the planet and its ability to continue providing a functioning environment for the various species making up its inhabitants, while at the same time bringing millions out of poverty, and supporting development, wellbeing and prosperity. This has been a major trade-off which is increasingly seen as not being sustainable given the impacts that risk undermining the progress made. This is particularly true given the rise of emerging economies with significant population sizes and a growing global population leading to a subsequent increased demand for resources **within a more resource constrained world**.

A short tour of key challenges starts with **climate change**. In 2007, the Intergovernmental Panel on Climate Change (IPCC) published its 4th Assessment Report[5] in which it identified that **unmitigated climate change was likely in the long term to exceed the capacities of natural, managed and human systems to adapt. Climate change mitigation activities** will need to continue to be developed in order to achieve lower stabilisation levels of atmospheric CO_2.

The crisis of **biodiversity loss** has also become increasingly evident in recent years. The Millennium Ecosystem Assessment[6] (MA) assessed the consequences of ecosystem change for human well-being. Published in 2005, the headline results were that **60% of the world's ecosystems were in a degraded state, putting in question their continuing functioning or existence**. In other words, development was far from being sustainable.

Following on from the MA, another international study on the Economics of Ecosystems and Biodiversity (TEEB) was launched in 2007. TEEB aimed "to draw attention to the global economic benefits of biodiversity, to highlight the growing costs of biodiversity loss and ecosystem degradation, and to draw together expertise from the fields of science, economics and policy to enable practical actions moving forward."[7]

In addition to climate change and biodiversity loss, human **over-exploitation of natural resources** is also resulting in the breaching of some natural thresholds. This is made evident through severe fish stock decline or total collapse, desertification, land degradation, and scarcities in key natural resources including water, phosphorus (important in agriculture) and metals and minerals used in electronics (some of which are essential to the green economy).

The solutions and opportunities provided by the green economy can help to address many of the above negative impacts while at the same time supporting (some types of) economic development. A green economy requires robust and sound **policy frameworks** that are properly implemented and enforced. These need to be supported by **market and economic reform** to avoid traditional economic models and theories which under-value nature and natural capital and invest in environmentally and socially damaging activities because these appear to be most lucrative. Instead, markets and economic strategies in a green economy need to be shaped to support the policy frameworks that set out the rules of the game, and encourage investment in good environmental performance, in natural capital and in enabling solutions to environmental and social challenges.

Green economy strategies are needed if multiple challenges are to be overcome. Investing in natural capital will better ensure that a healthy, resilient planet is supported. As we shall see in the next section, such investments can cost less than building traditional 'grey' infrastructure (e.g. wastewater treatment plants) while also bringing more positive benefits such as wider variety in the use of natural capital which leads to individual and community wellbeing, greater job creation, social equity, and community cohesion.

3. POLICY OPTIONS AND RESEARCH INSIGHT TOWARDS A GREENER ECONOMY

The 21st century demands an outlook and the use of tools that can overcome challenges of a more 'crowded' planet, characterised by increased uncertainty (political, environmental, social) and increased pressure to share limited resources more equitably.

In the EU, efforts made by individual Member States and at EU level to green economies have been made for decades, including taxes on specific pollutants, energy and transport. In its latest economic strategy, *Europe 2020*, the EU's objectives are stated as achieving economic 'transformation' to make growth 'smart,

sustainable and inclusive' and to achieve a 'low-carbon, resource-efficient economy'[8]. (See Supporting Briefing: *Green Economy in the European Union* for more details.)

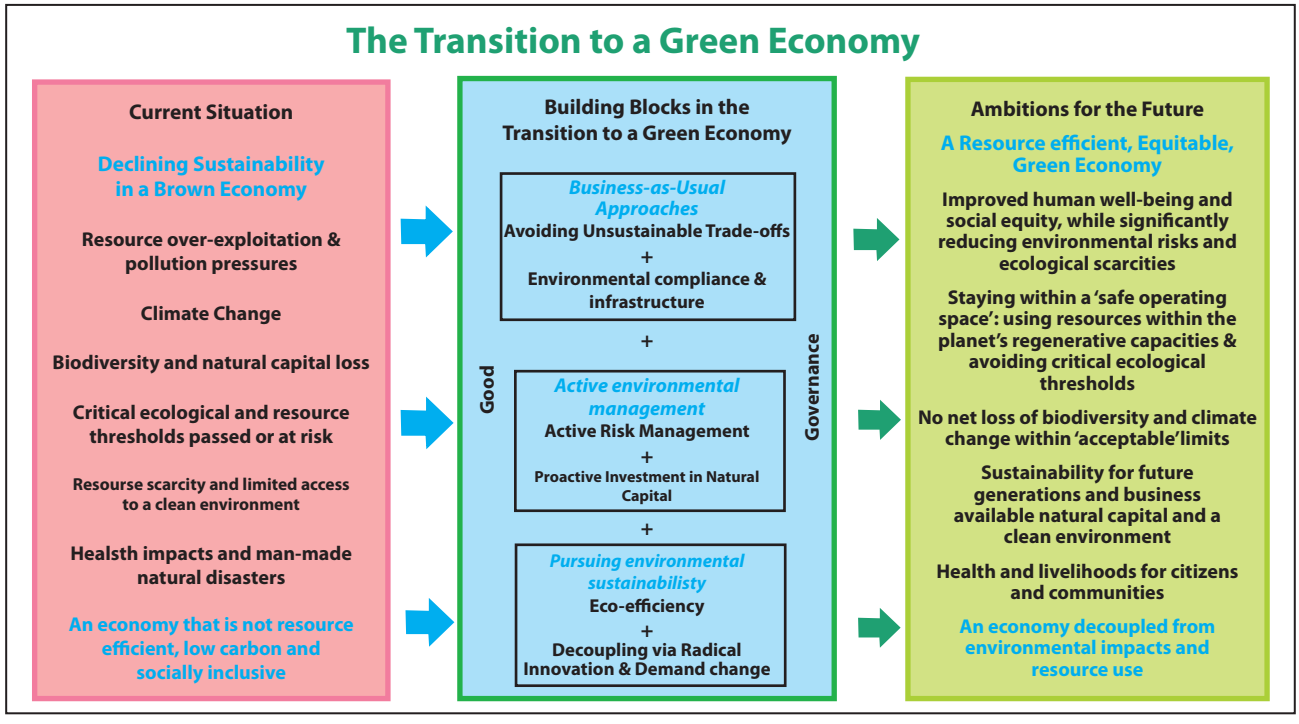
Efforts to achieve a green economy or green growth at EU level can be achieved in a range of often complementary ways: by EU (and national) policies and their objectives, strategies, plans and laws and by the use of EU funds, e.g. by integrating sustainability criteria into funding mechanisms (such as Cohesion/ Regional Policy and the EU budget). To structure ways forward for the transition to a green economy and show where different research projects contribute, we focus in this section on six "building blocks" for a transition from a 'brown' to a 'green' economy (See Box 1 below for schematic image). Broadly speaking there has been a 'traditional approach' to addressing the challenges – by understanding and avoiding unsustainable trade-offs and investing in environmental infrastructures (water supply, waste water treatment, waste management and air pollution control) to comply with environmental objectives. There has recently been a new focus on 'active environmental management' approaches, which include active risk management (e.g. spatial planning and communication for flood risk) and proactive investment in natural capital (e.g. restoration). Finally there is a growing recognition of the need for additional measures in pursuit of true sustainable development – eco/resource efficiency and use of more radical innovation (new technologies/techniques) and demand changes for achieving decoupling of our economy and development from environmental impacts

These build upon a range of research projects as well as projects undertaken for other EU services such as DG Regio[9] that have also built on past research. Although the early projects looked specifically at EU structural funds, the building blocks have relevance to building the green economy more widely - not only other EU programmes, sector policies and their implementation, but also for the transition to the green economy more widely, and support by other governance levels (e.g. cities, regions, countries), as many governance decisions (investment, infrastructure creation, etc.) are taken at different levels. The building blocks and the contribution of research projects in each area are discussed in turn below.

a) ***Better balancing between economic, environmental and social aspects – avoiding unsustainable trade-offs***

Unsustainable trade-offs have been created through the misallocation of capital, and economic development and growth strategies encouraging the accumulation

Box 1: Schematic diagram of the building blocks forming the transition to a green economy



of physical, financial and human capital, while also encouraging incredible degradation and depletion of natural capital. Often, the different types of capital (natural, social, manufactured and financial) are seen in opposition to each other, i.e. economic policy undervalues natural capital in order to encourage financial capital; similarly, social capital can be seen as reducing or restricting financial capital. These opposing positions are called 'trade-offs', where one gains and therefore another loses. In practice, policies and use of funds lead to a range of 'trade-offs' sometimes intentionally (i.e. choosing priorities), and sometimes unaware of the existence, scale and implications of the trade-offs. Avoiding inappropriate trade-offs is a key building block of any strategy to a green economy.

This can be done by redefining objectives, and by better identifying the benefits and negative impacts of different policy/investment decisions. Such measures include environmentally harmful subsidies (EHS) reforms, and use of tools like Strategic Environmental Assessment (SEA), Environmental Impact Assessment (EIA), and Impact Assessment (IA).

The FP6 Aquastress project aimed to deliver methodologies to help actors at different levels of involvement and at different stages of planning processes to mitigate water stress problems. The project drew on both academic and practitioner skills to generate knowledge in technological, operational management, policy, socio-economic, and environmental domains. The project undertook economic analysis in various case studies in eight aquatic catchment areas including in six EU countries (Bulgaria, Cyprus, Italy, the Netherlands, Portugal, and Poland) and in neighbouring Morocco. In using a tool to better value the ecosystem services provided by different water bodies, the project was able to propose more effective integrated management tools, including water pricing via local taxes, to help implement the EU Water Framework Directive more cost-effectively, thereby avoiding trade-offs between economy, environment and society.

The FP7 project, SOILSERVICE, **investigated the conflicting demands of land use, soil biodiversity and the sustainable delivery of ecosystem goods and services.** According to a project report, partners "*quantified the negative impacts of intensive arable cropping systems on soil fertility, due to loss of soil organic matter and soil biodiversity. Using scenarios of future land use, the project predicted how soils can be better managed to improve the long-term incomes of European farmers, to mitigate climate change and reduce nutrient and chemical inputs. This can be achieved by conserving soil biodiversity, the natural capital that generates ecosystem services. Ecosystem services link farmers' economic decision making with production, land use (food vs. biofuel), soil diversity and sustainability. This information can be useful for a broad range of decision and policymakers, in particular the on-going reform of the Common Agricultural Policy (CAP), but also environmental policy.*" The project produced easy-to-read policy briefs on issues such as soil biodiversity and intensive agriculture; agriculture and ecosystem services provided by retention of nutrients; and on agricultural production, soil fertility and farmers economy. According to a policy brief on 'Soil as Natural Capital', "*...unsustainable agriculture can accelerate water and wind erosion, drain soil organic matter and cause loss of soil fertility. For example overgrazing by cattle and use of heavy machinery can cause soil compaction, and irrigation can lead to salinisation and water logging. This all has a profound impact on soil quality and diminishes crop yields.* ***Yearly economic losses in affected agricultural areas in Europe are estimated at around €53 euros per hectare.***"

b) Environmental compliance and environmental infrastructures

The necessity for policy frameworks on key environmental issues in setting out political objectives, targets, and measures is evident if concerted action is to be required, encouraged and supported. Such policy frameworks usually set out the 'rules of the game', and provide the framework within which green economy objectives and actions can be set. Ensuring effective development of the green economy requires some supporting tools, in addition to the policy framework. These include policy coherence (between different environmental policies and between environmental and related policies, such as economic, innovation and industrial policies); implementation of public infrastructure-related legislation (e.g. on water, wastewater, waste) requiring significant economic investment; setting of environmental 'thresholds' such as through emissions, and environmental quality standards.

Instruments and measures to help encourage the transformation to a green economy include greening investment (public, private); better use of fiscal tools

(such as levies/charges) to achieve full cost recovery and to implement the polluter pays principle; better governance as a minimum ensuring respect for the rule of law, and through inspection and enforcement; and conditionality in financing.

An FP7 project focusing on waste management provides good examples of building appropriate infrastructure. Although the project focuses very much on transfer between EU countries and those in Asia, there is still much to learn in the EU from the experiences and case study results for EU Member States too.

ISSOWAMA (Integrated Sustainable Solid Waste Management in Asia) aims to raise awareness of the Integrated and Sustainable Waste Management (ISWM) approach in Asian countries, as significant economic and industrial developments in this world region over the last decade, combined with a rapid increase in urban populations have put extreme pressure on existing systems. Experience has shown that relying on technical solutions is not enough, and a more integrated approach is needed. Taking a case study approach, good practice examples are being identified amongst the participating countries from South Asia ((Bangladesh, India), the Greater Mekong Sub-region (Cambodia, Thailand, China) and South East Asia (Indonesia and Philippines). All the elements in the waste management system from generation to final disposal are addressed; as are all the aspects - social, institutional, legal, financial, economic environmental and technical; and it involves all the stakeholders at different levels; in order to ensure the effective implementation of a sustainable system. As the project is on-going, final results are not yet available.

c) Proactive risk management

For some environmental issues (such as climate change) future risks are relatively well developed scientifically. For others, e.g. in relation to availability of key natural resources, the science is less exact. However, in both cases, a precautionary approach is best applied in anticipation of an increasingly resource-constrained situation. Preventive measures that help to better understand and to manage risks are needed. **Spatial planning and risk mapping exercises,** for example in relation to sea level rise and climate change, can help to avoid future damage, or exacerbation of climate change impacts, as well as help in mitigation measures. Further development and better application of the precautionary principle and polluter pays principle also support preventive measures.

Instruments and measures include the development of indicators, for example on resource limits and ecological thresholds; climate change/risk maps (for example relating to potential floods, sea level rise, and water stress/desertification); the use of natural capital and environmental economic accounts; and linking risk and environmental management systems (such as EMAS).

A number of FP6 and FP7 projects provide interesting results which aim to encourage a proactive approach to risk management, focusing on different resources and environmental challenges.

Three projects focus specifically on water. The FP7 ACQWA project assesses the impacts of climate change and land use evolution in the Spanish Pyrenees and their implications for water resources availability and management in the Ebro basin. Box 2 provides some results from the project.

The FP6 project, **NeWater** (New Approaches to Adaptive Water Management under Uncertainty), considers the **complexity of water resource management** and the many challenges it poses. **Water managers need to solve a range of interrelated water dilemmas, such as balancing water quantity and quality, flooding, drought, maintaining biodiversity and ecological functions and services, in a context where human beliefs, actions and values play a central role.** NeWater addressed some of the present and future challenges of water management, recognising the value of highly integrated solutions and advocating integrated water resource management (IWRM) concepts. However, NeWater was based on the hypothesis that IWRM cannot be realised unless current water management regimes undergo a transition towards more adaptive water management.

On the issues of **marine and freshwater ecosystems and biodiversity**, the FP6 project, **MODELKEY** (Models for Assessing and Forecasting the Impact of Environmental Key Pollutants on Marine and Freshwater Ecosystems and Biodiversity) provided some interesting results. The EU Water Framework Directive (WFD) aims to achieve good ecological status for Europe's water bodies. One of the driving forces for poor ecological status and reduced

Box 2: ACQWA project case study on climate change and land evolution in the Pyrenees: implications for water resources availability and management in the Ebro basin

During the period 1950-2006, a marked decrease in river discharges has been observed in almost all sub-basins of the Ebro river, as well as warmer temperatures and a moderate decrease in precipitation. However, there is strong evidence that climate alone does not explain the observed magnitude of the decrease in water resources availability. Research developed through the ACQWA project has revealed that water yield in mountain areas has decreased in the last decades as a consequence of an increase in evapotranspiration rates in natural vegetation, which has expanded during the 20th century in areas where grazing and traditional agriculture have disappeared. Climate projections for the end of the 21st century suggest a reduced capacity for runoff generation because of increasing temperature and less precipitation. Thus, the maintenance of water supply under conditions of increasing demand presents a challenging issue requiring appropriate coordination amongst politicians and water managers.

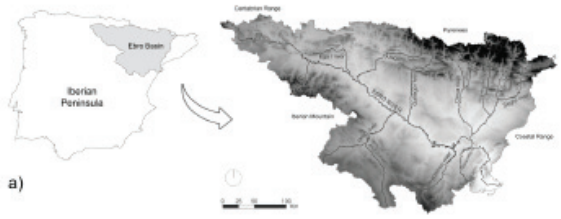


Figure 1. *Relief of the Ebro River basins and main tributaries of the Ebro River.*

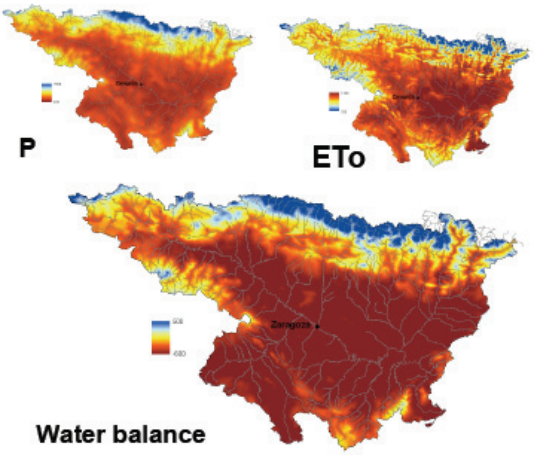


Figure 2. *Spatial distribution of annual precipitation (P), potential evapotranspiration (ETo) and climatic water balance (P-ETo).*

Conclusions highlight that adjustments to reservoir management or building new dams will not remain a solution for much longer, and instead investment is needed in improved management, in water consumption reduction and water recycling policies. Strong institutional frameworks are needed to coordinate socially, economically and environmentally sustainable water management. This is especially the case given anticipated increases in periods of water scarcity and subsequent conflicts amongst different water users, territories and administrations responsible for the control and use of available water.

biodiversity of freshwater and marine ecosystems is chemical stress due to environmental pollutants.

The WFD classifies the quality status of aquatic ecosystems based on traditional hydromorphological, physico-chemical, biological parameters and priority pollutant concentrations. This procedure allows a rough quality assessment. However, a reliable diagnosis, prediction and forecasting of toxic impacts on aquatic ecosystems and an efficient mitigation of toxic risks demand the identification of the respective stressors and reliable cause-effect relationships between chemical pollution and biodiversity decline. To date important knowledge gaps impede the evaluation and mitigation of the causes for an insufficient ecological status in many aquatic ecosystems. MODELKEY was designed to bridge these knowledge gaps. Through the MODELKEY project, a new parameter was developed to **help assess the effects of chemicals on ecological status of a water body**. The new proxy parameter, a measure for a net local toxic pressure, helped to unravel local multi-stress impacts, including the role

of mixtures and separate compounds therein. Scientific additions to existing (bio)monitoring data sets may enrich databases to such an extent that they signal and rank local stressor relevance – which is then the basis for (cost-)effective river basin management – more clearly than before. Linking the landscape-scale diagnostics techniques (based on monitoring data) to the site-specific tools results in a versatile toolbox for effective river basin management.

Two FP6 projects focused on **climate change**. **CIRCE** (Climate Change and Impact Research: the Mediterranean Environment) aimed to develop a first time assessment of the **climate change impacts in the Mediterranean area**. The project investigated how global and Mediterranean climates interact, and confirmed climate change trends in the Mediterranean area already foreseen by IPCC, implementing ad hoc models capable to provide more detailed projections from the present day to 2050. **CIRCE** models can be used in making simulations on future climate features more realistic and detailed. According to the project final results: "*CIRCE take home message is based on the idea to support "green economy", that provides solidarity, employment and sustainable development in the southern Mediterranean, instead of stimulating a 'grey economy' approach, based on competition among countries, inequality, unemployment and South to North migration. In this way, climate policy could be the occasion for a long-term social and economic improvement for all the countries in the Mediterranean region.*"

The second project, **CLAVIER** (Climate Change and Variability: Impact on Central and Eastern Europe), aimed to provide measures to cope with the triple challenges faced by Central and Eastern European countries: the on-going economic and political transition, continuing vulnerability to environmental hazards, and longer term impacts of global climate change. Three representative CEE Countries were studied in detail: Hungary, Romania, and Bulgaria. **Local and regional impact assessments and an evaluation of the economic impact of climate change and variability on agriculture, tourism, energy supply and the public sector** were conducted.

In **Bulgaria**, the **agriculture** sector would benefit positively from climate changes anticipated. The impact of climate changes on crop yields, measured as variation of gross agricultural output, is positive. It varies between 11% and 23% for different climate scenarios. The impacts of this climate-caused crop yield changes on the regional economy are expected to be positive with increases between 2% and 4% in the total output compared to the baseline scenario.

In **Romania**, winter **tourism** could be affected negatively by climate change. According to the project, the Prahova Valley – Braşov area abilities to

Box 3: CIRCE project final results

A very detailed scenario on climate change impacts on ecosystems and Mediterranean communities is needed to tackle future changes, both rendering them less dramatic and turning some of them into opportunities. The final event of this project highlighted that scientific knowledge (from climatology to meteorology, from economics to ecology) provides elements more and more relevant to estimate on-going climate change effects and to implement adaptation and mitigation policies.

Global framework and local differences

The CIRCE project shows a scenario in the Mediterranean basin that will be characterised by an increase of temperature of about 2°C (from 0,8 to 1,8°C on the sea surface), an according sea level rise of 6-12 centimetress (also due to salinity increase), precipitation reduction from 5 to 10%, and an increase of extreme events (heat waves, floods, torrential rains, cyclones) rate.

Water: Rainfall and river flow decreases, drought, desertification will feature more in the future more than to date. The whole area will be affected, although the Alps region could see an increase in rainfall. Less rainfall (-10/-20% globally), and increasing evaporation (+5-10%) will mean a depletion of surface water and groundwater, and aquifers salinisation in coastal areas. Water will become an increasingly precious resource, to be managed both for domestic and industrial uses and for irrigation.

Agriculture, Forests and Ecosystems: Reduced water availability and increased frequency and intensity of heat waves render ecosystems more vulnerable since carbon balance in deep soils is deeply modified. Soils begin to emit carbon, and no longer act as a reservoir or sink. Climate change will occur too quickly to allow ecosystems to adapt. Particularly affected are traditional crops (wheat, olives, grapes), both due to less available time for biomass accumulation, and for higher temperatures and water stress on crops.

Human Health: Excluding pollution effects, the increase in temperature results in more deaths (0.1 to 8.0% for each augmented Celsius degree). Even more dramatic are the impacts of heat waves (as per 2003 and 2007), with an increase in mortality of 14%, and cardiovascular and respiratory diseases 22% and 32%, respectively. Oceans and lands warming from South to North also implies a redistribution of infectious diseases. Urban environments will increase their vulnerability: more days of heat waves, or of summer ozone peaks, are already impacting on public health in cities like Athens, Alexandria, Valencia.

Tourism: Northern countries of the Mediterranean area could take advantage of hotter and longer summers to host tourists searching for relief. Tourism could be considered the sector more inclined to adaptation also because consumers have already changed attitudes and in the future the South could be strongly affected by a gradual loss of tourists. However, carbon emissions from flights also add to climate change. Therefore, it is important to foresee strategic plans both to support tourism resilience and development in new zones and to reduce carbon emissions related to tourism.

Economics: The climate impact on GDP could be a decrease of 1% in 2050, or even more (about 3%) in North Africa and in small Mediterranean islands (Malta, Cyprus), which are expected to be more subjected to climate change effects. CIRCE research in the economic field took into account three factors: tourism, energy consumption and rising sea levels. Concerning energy, in the future there is likely to be a higher demand for electricity (for air conditioning during the summer) and a lower demand for gas used for heating. Desertification, together with other relevant climate change effects for the economic sector will be accentuated because of global warming. Thus, a structured strategy based on green economy is urgently needed, namely investments in massive reforestation and renewable energy, smart-grid connections between the South (more devoted to solar energy) and North (more inclined to wind energy), and between the West and East.

adapt to climate change are low at present as there are no strategies reflecting climate change and adequate measures on this matter. However, some of the resorts oriented towards other segments of the tourism market have an increased adaptive capacity. Within the regional economy, depending more on the secondary sector which itself suffered during the restructuring process after 1990 and is implicitly economically vulnerable, the winter tourism industry's sensitivity and adaptability to climate change stands out again as issues of sector vulnerability at a micro-regional/local level.

In **Hungary**, the limitations for further development of **wind farms** in Győr-Moson-Sopron are not determined by climate change. Wind power capacity potentials are given in Győr-Moson-Sopron – by now and in future and can be harvested if the institutional settings and the financial incentives are set in the right way. Győr-Moson-Sopron is classified as an Industrial Centre. The high adaptive capacity of industry centres is even increased by a productive service sector. The industry is dominated by SMEs, transition is completed and the regional economy is able to overcome external effects. Thus, the adaptive capacity of the case study region Győr-Moson-Sopron presumably counts among the highest of all CLAVIER regions – adaptation is affordable, in terms of tangible and intangible assets.

d) Investing in natural capital

The TEEB study highlighted various attempts at better valuing ecosystem services, existing gaps and the needs for such valuation efforts, to better ensure a reversal in serious global biodiversity loss. Such investment includes protection/management and restoration of wetlands for carbon storage; forests for aquifer recharge and water provision for cities; flood plains for flood control, etc. For such investment to be achieved and to have good effect, it will need instruments and measures such as the clarification of the **values** of natural capital (which can be in quantitative terms, such as flow of ecosystem services, and in monetary terms); **investment** in natural capital (including protected areas and wider green infrastructure); and **rewarding benefits**, for example through payments for ecosystem services or recognition of benefits through spatial planning and regulation. The level of value tends to be very location specific both due to the scale, quality, and diversity of the biodiversity on the site, its functions and links to people and the economy.

A number of FP6 and FP7 projects have provided some interesting insights and steps forward in the better understanding and application of investing in nature and natural capital.

The FP6 project, **RUBICODE** (Rationalising Biodiversity Conservation in Dynamic Ecosystems) reviewed and developed **concepts of dynamic ecosystems and the services they provide**. The components of biodiversity which provide specific services to society were defined and evaluated in order to increase understanding of their value and, consequently, of the cost of losing them. This is meant to give decision-makers a more rational base for halting biodiversity loss by shaping adequate conservation policies.

Integrating ecosystem services, ecosystems dynamics and biodiversity conservation can be achieved in doing the following:

- **Taking account of the dynamic nature of ecosystems:** Ecosystems are naturally dynamic and management needs to ensure that this dynamism is maintained, but increasingly humans are modifying or regulating the types and rates of ecosystem change. Habitat management, therefore, must take into account the effects of these environmental pressures to protect against, or mitigate, adverse effects, facilitate adaptation, or restore habitats. This is particularly the case when considering interactions between land use change and climate change.
- **A precautionary approach:** The world is made up of often unpredictable, complex, interactive and nonlinear dynamic systems, so conservation and ecosystem service provision must build in contingency plans. Such a precautionary approach means that ecosystems are maintained intact, as far as possible, to ensure continued service provision in the face of changing environmental conditions and biotic interactions, even if there is currently insufficient supporting scientific evidence. This approach also caters for many possible services that have not yet been identified.
- **Future conservation policy options and needs:** Many existing European biodiversity strategies and policies need changing and adapting to include the elements of ecosystem dynamics and service provision. Some existing legislation can be interpreted as implying ecosystem service

protection, but it is not explicit (e.g. the EU Birds Directive). Strategies and policies are needed that have "on the ground" flexibility to deal with such dynamic systems, which are closely interlinked with service provision. To incorporate an ecosystem services approach into conservation policy requires a focus on governance and institutions and increased communication and integration across the different sectors.

The FP7 project, **SCALES** (Securing the conservation of biodiversity across administrative levels and spatial, temporal and ecological scales), identified that to advance integration of conservation considerations in economic planning and decisions, **the existing impacts assessments tools** (i.e. Environmental Impact Assessments and Strategic Environmental Assessments) **could be improved so as to be able to consider scale issues when considering the impact of developments**. The issue of scale, for example, spatial and temporal, need to be able to be addressed in assessment tools, to ensure appropriate considerations are made for environmental and anthropogenic drivers affecting biodiversity. Effective conservation and policy responses need to consider the scale at which effects occur, and therefore it is crucial that administrative levels and planning scales match the relevant biological scales.

Whereas scale-insensitive drivers may be addressed by a common approach across Europe, scale-sensitive drivers need policies that account for these differences – and this should facilitate the development of a greening of the economy. Most of the indicators referring to economic sectors (with the exception of tourism) or to demographic factors show minimal changes as we move across administrative levels. In contrast, most direct drivers show high scale sensitivity with characteristic examples being deforestation, agricultural conversion, and wetland loss.

The above are but a subset of the wide range of DG Research funded projects. Other key ones include **ALARM** (Assessing Large Scale Risks for Biodiversity with tested Methods) and **ALTER-Net** (A Long-Term Biodiversity, Ecosystem and Awareness Research Network). **DAISIE** (Delivering Alien Invasive Species Inventories in Europe) which focuses on invasive alien species that can and do create biodiversity, social and economic problems. **KNOWSEAS** (Knowledge-Based Sustainable Management for Europe's Seas) aims to develop and test an ecosystem approach between natural and social science that delivers the knowledge base to support management for sustainable European regional seas.

e) Eco-efficiency

Some countries and global regions have for some time identified **eco-efficiency** as a win-win opportunity addressing economic and environmental challenges. Many activities have focused particularly on energy efficiency, to help contribute to efforts meeting Kyoto Protocol targets. Fewer have developed detail on **resource-related eco-efficiency,** and there is great potential to marry efforts to protect natural capital while developing social and economic capital. Detail is needed on political objectives and targets, sectoral contributions to these, market prices, reform of environmentally harmful subsidies, product standards and related certification systems and labelling, green public and private procurement, appropriate innovation to support objectives and targets while avoiding unwanted trade-offs, and setting incentives and requirements.

Two FP6 projects focused on **environmental tax reform**, as a means of ensuring that the right prices are paid for use of natural resources and their impacts. **COMETR** (Competitiveness Effects of Environmental Tax Reform), provided an ex-post assessment of experiences and competitiveness impacts of using carbon-energy taxes as an instrument of Environmental Tax Reform (ETR), which in this case shifts the tax burden and helps reduce the carbon emissions that cause global warming. COMETR reviewed the experience in ETR in seven EU Member States (Denmark, Finland, Germany, the Netherlands, Slovenia, Sweden and UK). In summary, **ETR can help reduce fuel use and hence improve fuel security, contribute to reducing GHG emissions, help mitigate climate change, and can increase GDP**. Results are highlighted in Box 4 below.

INDI-LINK (Indicator-based evaluation of interlinkages between different sustainable development objectives) further improved EU Sustainable Development indicators, assessed the interlinkages between the different priorities of the renewed EU Sustainable Development Strategy and derived policy conclusions for its implementation. It concluded that **the best policy instruments identified in meeting different sustainable development objectives**

are "environmental taxes and auctioned tradable permits in the framework of an Environmental Tax Reform (ETR), in combination with environmental regulation and subsidies for environmental industries, with voluntary agreements and eco-labels playing a subsidiary role. **Environmentally-harmful subsidies should be phased out and investment made in a Green New Deal** to promote the growth of green technology and industries for the future of economic development." Further, a reduction of the total environmental burden associated with production and consumption needs new policy instruments beyond the usual suspects of taxes and trading relating to energy and greenhouse gas emissions. **Economic instruments on a range of resources will need to be introduced, for example on non-renewable materials, biomass products and built-up land**. Finally, the project's results suggest that Europe needs to more proactively address potential conflicts between its economic goals (such as ensuring access to resources globally) and development goals (such as raising the material standard of living in developing countries).

Looking specifically at **agriculture in relation to climate change**, the FP6 project **MEACAP** considered the extent to which existing EU agricultural and related policy instruments reflected the EU's commitments under the Kyoto Protocol and the Convention on Biodiversity, and what adaptations to these would be needed.

A cluster of four projects addressed eco-innovation directly, but from different angles. The FP6 project, **TESTNET** (Towards a European verification system for environmentally sound Technology) aimed to develop a structure of organisations and a system for verification (ETV) of ready-to-market innovative environmentally sound technologies. Its particular focus was on technologies in the field of water, clean production, and environmental monitoring (air emissions and water treatment). **Water technologies** with significant potential were in the control and treatment of water processes leading to efficiency improvements in the management of resources, and the quality of outputs and better environmental quality. The improved understanding of chemical processes supports the development of new water quality monitoring and treatment technologies which enable better modelling and simulation and will ultimately lead to improvements in the planning, development and management of water resources. On **cleaner production** (CP), a verification

Box 4: Some COMETR project results

By 2007, seven EU member states have implemented tax reforms which to some extent shift the tax burden from taxation of labour to taxation of carbon-energy: Sweden (1990), Denmark 1993), the Netherlands (1996), Finland (1997), Slovenia (1997), Germany (1999), and the UK (2001). The reforms include tax shifts toward energy and transport taxes, as well as in some cases a restructuring of energy taxes to reflect better their carbon emissions. While the scale of the tax shifts differs between Member States, altogether these tax reforms are assessed to have shifted tax revenues by more than €25billion annually in Europe. It is mainly labour which has experienced the lighter tax burden.

The project modelled the likely effects of fiscal reform on GHG emissions and GDP.

- The western European countries that have implemented an ETR show a reduction in fuel demand from the ETR
- The scenario results show that there are reductions in GHGs in six of the seven countries (Finland, Sweden, Germany, Netherlands, UK, Denmark; the largest reductions occurring in regions with the highest tax rates. The largest reduction in emissions occurs in Finland and Sweden
- As a general rule, the effects of the ETR will be positive on economic activity, depending on how the revenues from the environmental taxes are recycled.
- However, it is likely that there will be transition costs, so the gains may not be immediate.
- Five of the seven ETR countries have an increase in GDP as a result of the ETR: Finland, Sweden, Germany, Netherlands, Denmark

protocol was urgently needed in the following areas, since CP is a very broad and complex concept: 1) New business models in manufacturing industry; 2) Process intensification in chemical processing technologies; 3) ICT based control systems in CP and in achieving CP; 4) Purification and formulation engineering in chemical processing technologies; 5) Biorefinery solutions; 6) Nanotechnological applications; and 7) Life cycle material design.

The FP6 project, **ECODRIVE**, explored **how best to measure eco-innovation**. Eco-innovation **indicators** are proposed to measure progress, both of economic performance, in terms of cost reduction and enhanced functionality, and environmental performance, from reduced emissions and resource depletion and other environmental improvements. The project distinguishes five types of derived eco-innovation indicators. The first involves changes in economic activities at a macro level like the share of R&D expenditure in national income. Second, there are socio-economic indicators at a meso level like sectors, showing the development path. Third are the economic developments at a micro level, especially in a company. Fourth are the cultural developments in science, invention, innovation and development, and values as related to entrepreneurship and to long term views on sustainability. Fifth are the institutions which shape the behaviour of firms and consumers.

The FP6 project, **LENSE** (Methodology development towards a Label for Environmental, Social and Economic Buildings), looked specifically at producing a label for **buildings**. The results of the project include that governments can use the methodology for the implementation of subsidiary schemes in order to promote sustainability; architects could use it to communicate about sustainability issues with their clients; and project developers could use the instrument to determine the sales values of buildings in the context of sustainability. The methodology could also be translated into a sustainability certification for buildings. Clients can get reliable information about the sustainability performance of the planned building before purchase or construction.

f) Absolute decoupling

In most country cases, where decoupling of resource use and GDP has occurred, the result has been **relative decoupling**. On an increasingly 'crowded' planet, a policy approach explicitly aiming to achieve **absolute decoupling** is needed. Such an approach will require considerably more effort in **setting and meeting ambitious resource efficiency objectives and targets**. Support mechanisms will also need to be created or refocused to support a transition to a green economy, for example in renewable energies, energy efficiency, public transport and modal shifts, buildings (from design and build to refurbishment and demolition/recycling, and spatial development), ecodesign, design for sustainability, resource efficiency, waste prevention and recycling/reuse. Instruments and measures to achieve the transformation include **investment** and **incentives**, **product standards**, **training** and training related activities (**skills assessment** and **reskilling**, **capacity-building**), social capital elements (including **behavioural change**, **social norms change**, **information**).

Two FP7 projects addressed sustainable consumption. The first, **EU-POPP** (Policies to Promote Sustainable Consumption Patterns), addressed sustainable consumption strategies and individual policy instruments specifically in the areas of housing and food. In the analysis, all European regions are covered, with special emphasis on Spain, Finland, Germany, and the Baltic area. The international dimension of the effects of sustainable consumption was covered as well. Box 5 below provides some detailed results.

The second project, **CORPUS** (Enhancing the Connectivity Between Research and Policy-Making in Sustainable Consumption), aims to experiment with and develop new integrative modalities of knowledge brokerage at the policy-science interface. It also aims to foster evidence-based policy-making in sustainable consumption and production policies at EU and national levels. Focusing on the three consumption areas with largest environmental impact – food, mobility and housing – it aims to strengthen the policy orientation of relevant research communities through the development of online and offline mechanisms.

g) Good Governance

Good governance is both a final building block for the transition to a green economy as well as an integral part of the six above blocks. To avoid repeating governances aspects already noted above, this section focuses on "measurement to manage" governance issues,

presenting insights from **EXIOPOL** regarding on accounting, **IN-STREAM** and **OPEN:EU** on indicators, and **THRESHOLDS** and **SRDTools** on integrated thresholds into governance.

The FP6 project, **EXIOPOL**, aimed to set up a new environmental accounting framework using externality data and input-output tools for policy analysis. The project was a key contributor in expanding and synthesising a database on the costs of environmental burdens within the EU, measured in monetary terms. It evaluated, analysed, and assessed damages from the emissions of pollutants into air and water. The project therefore updated and detailed external costs by type of emission, industry sector, and country, as well as for a range of themes, namely: health, agriculture, biodiversity, forestry and wastes. Each theme corresponds to a different Policy Brief, which detail externalities by sector. The project focus and insights are useful also for the on-going developments with natural capital accounts and move towards integrated environmental and economic accounts (SEEA) and the commitments to taking accounting of the values of nature made at the CBD COP 10 in Nagoya.

IN-STREAM (The Integration of Mainstream Economic Indicators with Sustainable Development Objectives) aimed to propose types of indicators that provide a useful assessment of progress toward the simultaneous aims of economic success, human well-being, environmental protection and long-term sustainability, in place of economic measures such as

Box 5: Some EU-POPP project results

First results from an EU-wide impact evaluation project
While sustainable consumption policies in housing are relatively mature, food – despite its significant potential for reducing adverse sustainability impacts – is still deficient when it comes to instruments tackling consumer behaviour. Interventions in this field for reasons other than ensuring food safety and security are not yet widely accepted and envisioned. Existing initiatives are mostly local or regional except for a number labelling and voluntary schemes.

Specifically targeting the demand side of sustainable consumption and production through policy measures is a necessary, yet sensitive prerequisite for achieving a green and balanced economy in Europe. It has become increasingly clear that supply side measures can be very effective but are not sufficient in the long run, particularly in the two focal areas of this policy brief: food and housing.

Beyond awareness: Capacity-building
Awareness building and consumer information have long been at the forefront of sustainable consumption. At the same time, the awareness-action gap has been repeatedly shown to be a social reality. Consumers want to make sustainable consumption choices, but frequently do not follow through. For policy makers, this opens two avenues of action: prescribing what consumption choices can be taken (e.g. through choice editing) and through long term capacity-building measures.

Enhancing consistency among policies and measures
The effectiveness of sustainable consumption policies is frequently hampered by counter-productive supply side policies. At the same time, our findings show that complementary, mutually supportive policy mixes are essential for policy effectiveness.

Promoting sustainable food consumption
An integrated policy bundle for more sustainable food consumption is suggested, comprising four complementary elements, namely promoting sustainable meals in public catering, building food literacy through promoting local initiatives and social learning, reducing food waste, and revisiting taxation on food with a view to promoting healthy and sustainable diets.

GDP. Results include that:

- Such indicators should be used to support the **integration of sustainability considerations across a wide range of policy areas**. For instance, biodiversity and climate change related indicators can be useful for informing a wide range of policies, from budget allocations (e. g. EU Cohesion Funds) to environmental policies.
- Analyses of the **regional employment impacts of climate change actions can show whether and how investments in renewable energy are displacing other investments**. Additionally, they can estimate whether potential job losses can be compensated for by fostering an export industry that creates additional jobs.
- Policy makers setting ambitious **biofuel targets to reduce GHG emissions** can use models to determine whether the **induced additional land conversion may offset much of the GHG emission reductions**. The models also allow policy makers to take into account the potential impacts of those targets on food availability, risk of hunger and deforestation.
- Environmental indicators are very often only available as **pressure indicators**. Complementing those indicators with **impact indicators**, like health effects or biodiversity gains of emission reductions, supports policy makers in making the relevant trade-offs within sustainability categories.

OPEN:EU focused on developing a 'Footprint Family' of indicators: ecological, carbon and water footprints to track the multiple and often hidden demands that human consumption makes on the planet's resources and to measure their impacts on the planet. Four policy scenarios were developed which highlighted that, given Europe's economy is now nearly three times larger than what is required for a sustainable world, the current policy framework needs to undergo further transformation for a sustainable Europe to be achieved by 2050.

Turning to natural systems, **resilience theory** is partly based on the concept of **ecological thresholds**. Such thresholds can be seen as tipping points that change the behaviour of a system once the threshold is passed. The FP6 **THRESHOLDS** (Thresholds of environmental sustainability) project aimed to establish and test an innovative policy formulation mechanism based on the integration of three complex elements. The first was a target-setting process driven by the novel scientific knowledge on environmental sustainability indicator "thresholds" and "points of no return". The second was the assessment of socio-economic costs and impacts associated to such targets. The third was evaluations incorporating both external and abatement costs into an integrated assessment model system leading to the identification of the most cost-effective abatement measures.

A mid-term overview report identified that *"A reliable estimation of thresholds may help in justifying standards and limit values in policies. If, however, research shows that the exact level of a threshold is subject to considerable uncertainty and context-dependent variation, fixing limit values by giving them normative legal status may cause significant unintended economic and social consequences. In this case the policy should be developed to include adaptive elements, that encourage learning processes. They should thus always be coupled with processes of appropriate monitoring, ex-post evaluation and revision mechanisms."*

The **SRDTools** project also looked at the issue of **critical environmental thresholds and the use of** indicators for both critical thresholds and trends for use in regional development planning and valuation.[10] Indicators of critical trends are important practical tools as it is not always possible to define critical thresholds and insights into critical trends can give indications of need for action before critical thresholds are close to being passed.

4. CONCLUSIONS: THE WAY AHEAD

The EU's position on the green economy is made rather explicit in its Communication *Rio+20: towards the green economy and better governance*[11]. The EU considers that Rio+20 can mark "the start of an accelerated and profound, world-wide transition towards a green economy – an economy that generates growth, creates jobs and eradicates poverty by investing in and preserving the natural capital offers upon which the long-term survival of our planet depends. It can also launch the needed reform of international sustainable development governance". To guarantee commitment beyond Rio+20, the Communication calls for the development of a **'Green Economy Roadmap'** to help countries accelerate progress towards the green economy (see more information on this in the Supporting Context Briefing*: Green Economy in the context of Rio+20*).

Yet, the EU's domestic developments in relation to the green economy are less clear. In recent key strategic documents with significant impacts on the economy, such as the Europe 2020 strategy, the Resource Efficiency Flagship Initiative and Roadmap, the green economy as a concept does not feature. (See Supporting Briefing*: Green Economy in the European Union*)

A more coherent transformation in the EU towards a green economy could be addressed in the upcoming 7th Environmental Action Programme (7EAP), currently under development (and expected in Autumn 2012)[12]. The 7EAP could take the environment as the starting point and set out how the sustainability challenge needs to relate to a suite of policies across the sectors key to a transition to a green economy. As regards concrete measures focus could be on institutionalising targets and indicators on resource efficiency by 2013 for key resources (land, water, materials, carbon and nutrients), helping policy integration and the monitoring of related efforts. In addition, the long-term policy transition by 2050 would suppose that Europe's place in the biosphere be reappraised, drawing on the emerging scientific discussion on planetary boundaries and critical thresholds and the need to define safe economic operating spaces[13]. It would also suppose associated consumption issues and critical trends be assessed and addressed throughout the EU acquis, policies and their implementation.

Furthermore Horizon 2020, the European Commission Framework for Research and Innovation for the 2014-2020 period, has a sharp focus on green and resource efficient (including energy) economy. Horizon 2020 will provide a framework to effectively link science to policy, identify research priorities and foster green economy innovation, thereby responding to existing and emerging environmental and climate change challenges, while supporting competitiveness, market development and job creation.

The transition to a green economy will be a major multi-level governance challenge that will require the use of a wide toolkit of measures by all stakeholders with diverse approaches depending on national circumstances and context as well as stakeholder incentives and opportunities. Research projects offer insight and an expanding evidence base to contribute to the good governance of the transition to a green economy. In the case of the EU, Horizon 2020 provides the political and institutional support necessary to tackle efficient use of natural resources (raw materials), adaptation to and mitigation of climate change, pollution reduction and increased monitoring and assessments by encouraging research and innovation which promotes economic growth and sustainable development that respects environmental thresholds.

Annex I

Projects (FP6 & 7 and others) relevant to this briefing

- The ACQWA Project: Investigating the vulnerability of water resources to climatic change in mountain regions: http://www.acqwa.ch/
- AIRTV: On air emissions environmental technologies; www.airtv.eu/
- ALARM: Assessing Large Scale Risks for Biodiversity with tested Methods; http://www.alarmproject.net
- ALTER-Net: A Long-Term Biodiversity, Ecosystem and Awareness Research Network; http://www.alternet.info
- AquaStress: Mitigation of Water Stress through New Approaches to Integrating Management, Technical, Economic and Institutional Instruments: http://www.aquastress.net/
- CIRCE: Climate Change and Impact Research: the Mediterranean Environment; www.circeproject.eu/
- CLAVIER: Climate Change and Variability: Impact on Central and Eastern Europe; www.clavier-eu.org/
- COMETR: Competitiveness Effects of Environmental Tax Reform; http://www2.dmu.dk/cometr/
- CORPUS: Enhancing the Connectivity Between Research and Policy-Making in Sustainable Consumption; www.scp-knowledge.eu
- DAISIE: Delivering Alien Invasive Species Inventories in Europe; www.europe-aliens.org/
- ECODRIVE: On how best to measure eco-innovation; www.io-arnemuende.de/ecodrive.html
- ECO-INNOVERA: Supporting eco-innovation in research and development; www.eco-innovera.eu/
- EU-POPP: Policies to Promote Sustainable Consumption Patterns; www.eupopp.net/project.htm
- EXIOPOL: On a new environmental accounting framework using input-output tools for policy analysis; www.feem-project.net/exiopol/
- IN-STREAM: Integration of Mainstream Economic Indicators with Sustainable Development Objectives; www.in-stream.eu/
- INDI-LINK: Indicator-based evaluation of interlinkages between different sustainable development objectives; http://www.indi-link.net/
- ISSOWAMA: Integrated Sustainable Solid Waste Management in Asia; http://www.issowama.net/
- KNOWSEAS: Knowledge-Based Sustainable Management for Europe's Seas; http://www.knowseas.com/
- LENSE: Methodology development towards a Label for Environmental, Social and Economic Buildings; www.lensebuildings.com/
- MEACAP: http://ec.europa.eu/research/fp6/ssp/meacap_en.htm
- MODELKEY: Models for Assessing and Forecasting the Impact of Environmental Key Pollutants on Marine and Freshwater Ecosystems and Biodiversity; www.modelkey.org/
- NEWATER: New Approaches to Adaptive Water Management under Uncertainty; http://www.newater.uni-osnabrueck.de/
- OPEN:EU: One Planet Economy Network; www.oneplaneteconomynetwork.org/
- RUBICODE: Rationalising Biodiversity Conservation in Dynamic Ecosystems; www.rubicode.net/
- SCALES: Securing the conservation of biodiversity across administrative levels and spatial, temporal and ecological scales; http://www.scales-project.net/
- SOILSERVICE: investigating the conflicting demands of land use, soil biodiversity and the sustainable delivery of ecosystem goods and services; http://www.lu.se/soil-ecology-group/research/soilservice
- SRDTools: On integrating thresholds in governance; www.srdtools.info/
- TESTNET: Towards a European verification system for environmentally sound technology; www.est-testnet.net/
- THRESHOLDS: On integrated thresholds in governance; www.thresholds-eu.org/

Annex II

Other potential useful projects with implications for green economy (links provided when available):

A number of studies have been undertaken looking at different elements relevant to the green economy. Amongst these, the following are worth noting.

Economic benefits of environmental policy:

- The economic benefits of environmental policy (2010): This report describes the areas in which environmental policies deliver Europe's current economic priorities, often more successfully than other forms of economic policy intervention. It provides evidence of the role of environmental policy both in providing a short term economic stimulus and in building a sustainable, efficient and resilient economy in the long term. http://ec.europa.eu/environment/enveco/economics_policy/pdf/report_economic_benefits.pdf
- The links between the environment and competitiveness (2009): This study asks 'if' and 'to what extent' existing theories on the links between the environment and competitiveness are correct in practice. It does so by looking at water policies and the evidence on resource productivity. http://ec.europa.eu/environment/enveco/economics_policy/pdf/exec_summary_comp.pdf
- Links between the environment, economy and jobs (2007): The study shows that there are strong links between the economy and the environment. These go far beyond the narrow definition of eco-industries traditionally measured. A good quality environment supports many sectors in the economy. At its broadest, the environment is linked to around 21 million jobs and over a trillion Euros of economic activity in Europe. http://ec.europa.eu/environment/enveco/industry_employment/pdf/ghk_study_wider_links_summary.pdf
- Facts and Figures: the links between EU's economy and the environment (2007): This is an overview publication summarising key results from many of the studies in this area. Its purpose is to quickly and neutrally communicate the facts about the size of the EU eco-industry (turnover and employment), the cost to EU businesses, the issue of international competitiveness and the cost of environmental pollution and degradation to the economy. http://ec.europa.eu/environment/enveco/industry_employment/pdf/facts_and_figures.pdf
- Eco-industry, its size, employment, perspectives and barriers to growth in an enlarged EU (2006): This report analyses the driving forces behind the development of eco-industries in Europe and the measures that can support this development. It highlights the leadership played by many European companies in some environmental goods and services and emphasises the significance of the sector as one of the biggest in Europe. http://ec.europa.eu/environment/enveco/eco_industry/pdf/ecoindustry2006_summary.pdf
- Case Studies of links between Environmental Policy and Employment (2003): Features a compilation of 58 case studies. Each of them identifies a link between environmental policy and expenditure and direct local employment effects. http://ec.europa.eu/environment/enveco/innovation_technology/pdf/case_studies.pdf

On **specific resources or consumption areas and related policy measures:**

- Economic Analysis of Resource Efficiency Policies (2011): This study identifies existing policies that have successfully optimised the use of resources and estimates their current net benefits to the EU. Based on a literature review and stakeholder consultations, 120 resource efficiency policies were identified in 23 countries. http://ec.europa.eu/environment/enveco/resource_efficiency/pdf/economic_analysis.pdf
- Scoping Study on completing the European Single Market for environmental goods and services (2010): The study explored what improvements EU Single Market needs to facilitate the growth of European eco-industries and to support the better trading and movement of eco-industry workers, technology and products and services. http://ec.europa.eu/environment/enveco/economics_policy/pdf/sm_egs_july2010.pdf
- Initial survey of European policy and legislation with a view to decoupling transport growth from economic growth in the EU and the accession countries: http://ec.europa.eu/environment/air/pdf/policy_legislation.pdf

On **environmental fiscal reform:**

- Environmentally Harmful Subsidies: Identification and Assessments (2010): This study developed a methodology for identification, assessment and quantification of environmentally harmful subsidies (EHS). The study tested the tools developed previously by the OECD on six case studies of subsidies in energy, transport and water sector. Based on this analysis and on results of a workshop, the study developed the "EHS Reform tool" for screening, integrated assessment and reform of environmentally harmful subsidies. http://ec.europa.eu/environment/enveco/taxation/pdf/Harmful%20Subsidies%20Report.pdf
- Beyond GDP: Developing the concept for a high level conference "Beyond GDP" and undertaking the complete preparatory and organisational work. This initiative looks at encouraging a new perception of wealth, wellbeing and progress that goes beyond the economic, and encourages a deeper understanding of the interlinkages between our societies and our natural (and other) capitals/resources such that decision making reflects the improved understanding. Follow-on activities continue. www.beyond-gdp.eu/
- The Potential Benefits of using Differential VAT for Environmental Purposes (2008): This study looked at

the potential impacts of changing current VAT rates to align them with environmental goals in some specific cases - domestic energy supply (where there are currently reduced rates in some countries), food and dairy products, insulation materials, white goods and boilers. http://ec.europa.eu/environment/enveco/taxation/pdf/vat_final.pdf

- Economic and Environmental Implications of the Use of Environmental Taxes and Charges in the European Union and its Member States (2001): This study evaluates the economic and environmental implications of the use of environmental taxes and charges by the EU Member States. It thus constitutes a follow-up to the Commission´s 1997 communication on Environmental taxes and charges in the Single Market (COM(97) 9). http://ec.europa.eu/environment/enveco/taxation/pdf/xsum_table_of_content.pdf
- Study on the relationship between environmental/energy taxation and employment creation (2000): The study provides an overview and a comparative analytical assessment of the available literature as well as existing macro-econometric models and a bottom-up engineering model on the employment effects of environmental taxation, in particular of existing CO^2/energy and energy products taxes. It also identifies the economic conditions under which a tax shift from labour taxes to eco-taxes is most likely to result in positive employment effects. http://ec.europa.eu/environment/enveco/taxation/pdf/entaxemp.pdf

On **innovation:**

- The Potential of Market Pull Instruments for Promoting Innovation in Environmental Characteristics (2009): This study examines the potential of policy instruments - for example financial incentives for products - to increase innovation, how they influence firms' decisions and how such instruments (or existing related policy instruments) should be designed to maximise the increase in innovation. The report is aimed at EU, regional and national policy instruments, with a focus on environmentally advantageous innovation. http://ec.europa.eu/environment/enveco/innovation_technology/pdf/market_pull_report.pdf
- Bridging the Valley of Death: public support for commercialisation of eco-innovation (2009): The report analyses the experience of existing innovation procurement policies. A major block to greater eco-innovation is the uncertainty over future market demand for an innovation. That uncertainty partly reflects an information failure: buyers do not indicate they will buy until the innovation is put on the market. This block can be mitigated cost-effectively if groups of market players are brought together to indicate the characteristics of an innovation that they would be likely to buy. This needs to be coupled with pre-announced use of demand-support measures, in an expansion of current EU demand-side innovation policy. The report analyses the areas of innovation where this would be successful and identifies the practical needs of the policy. http://ec.europa.eu/environment/enveco/innovation_technology/pdf/bridging_valley_report.pdf
- Mainstreaming innovative and green business models (2008): This study shows that greater adoption of different forms of business models can also bring great environmental benefits. In many situations, firms can offer a combination of products and services (rather than either alone) which achieve the buyer's objectives but incentivises resource saving in doing so, allowing both buyer and seller to achieve greater profits. The study lists successful examples and recommends greater action to spread such business models, estimating potentials for economic and environmental benefit and ways in which the models can be promoted. http://ec.europa.eu/environment/enveco/innovation_technology/pdf/nbm_report.pdf
- Effective Environment Policy: Design for innovation (2007): Designing policy in ways that stimulate or allow innovation will achieve policy goals more effectively, faster, or more cheaply. This study examined how to design environment policy to do that, and produced a clear, 1 page list of questions for policy makers to consider, backed by directly linked advice. http://ec.europa.eu/environment/enveco/innovation_technology/pdf/report_innovation_friendly.pdf
- Innovation dynamics induced by environmental policy (2006): This study analysed how different environmental policy instruments induce innovation and to what extent this can reduce the environmental impacts of products and processes. Findings include that environmental policy's role in innovation is a steering one, rather than braking or driving role as it is only one among many factors. Innovation-oriented environmental policy remains essential for sustainable technological development and, also, environmental policy will in general not be an obstacle to R&D. http://ec.europa.eu/environment/enveco/policy/pdf/2007_final_report_conclusions.pdf

Annex III

References

1 UNEP Green Economy Initiative website: http://www.unep.org/greeneconomy/Home/tabid/29770/Default.aspx

2 ibid

3 The OECD's Green Growth Strategy includes a number of supporting documents, notably its "Towards Green Growth" report; a report on OECD indicators for monitoring progress towards green growth; "Tools for Delivering Green Growth" and a summary report for policy-makers. The package can be found at: http://www.oecd.org/document/10/0,3746,en_2649_37465_44076170_1_1_1_37465,00.html

4 Ibid. footnote 3

5 IPCC, 2007: Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland, 104 pp. See: http://www.ipcc.ch/index.htm#.T1SnO7Sf8cs

6 For more information on the Millennium Ecosystem Assessment see: http://www.maweb.org/en/index.aspx.

7 The Economics of Ecosystems and Biodiversity (TEEB) study is a major international initiative to draw attention to the global economic benefits of biodiversity, to highlight the growing costs of biodiversity loss and ecosystem degradation, and to draw together expertise from the fields of science, economics and policy to enable practical actions moving forward. See http://www.teebweb.org/ for all information

8 European Commission; Europe 2020 – A strategy for smart, sustainable and inclusive growth; COM(2010) 2020 final. Smart growth means developing an economy based on knowledge and innovation. Sustainable growth means promoting a more resource efficient, greener and more competitive economy. Inclusive growth means fostering a high-employment economy delivering social and territorial cohesion.

9 Hjerp et al (2011).

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11 CEC, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Rio+20: towards the green economy and better governance, (COM(2011)363), 20/06/2011.

12 Volkery A., Withana S., Baldock D.(2011) Towards a 7th Environment Action Programme: Potential options and priorities - Policy paper for IEEP project on 'Charting Europe's environmental policy future', URL: http://www.ieep.eu/assets/864/Potential_options_and_priorities_of_a_7EAP_-_IEEP_policy_paper.pdf

13 See Rockström et al. 2009. Planetary boundaries: exploring the safe operating space for humanity. Ecology and Society 14(2): 32. [online] URL: http://www.ecologyandsociety.org/vol14/iss2/art32/; see also Garver, G. 2011. A Framework for Novel and Adaptive Governance Approaches Based on Planetary Boundaries Colorado Conference 2011 – Earth System Governance Project. Panel Sessions VII - Linking the Social and Natural Sciences: Approaches to Adaptive Governance.

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The KNOSSOS Project is funded by the EU 7th Framework Programme.

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