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EU Natural Resources policy: Signposts on the roadmap to sustainability

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Overview

The need for robust natural resources policy is becoming increasingly evident, with worries over availability and prices of food, water, energy and specific metals that are central to the low-carbon economy approaches being developed around the world. The EU's foray into policies in natural resources is still relatively early and under-developed, and the EU's economic strategy, 'Europe 2020', focus on resource efficiency provides high-level political attention to this complex, often controversial area of policy. Having produced a resource efficiency flagship initiative document in January 2011 in the Europe 2020 context, the European Commission is to publish a resource efficiency roadmap later in 2011 which will provide more detail on medium and long-term objectives and how they will be met. Given the complexity of the issues, a natural resources policy framework requires mechanisms at the high, mid, and low-levels, with some fundamental elements necessary for the development of effective policies given continuing data gaps, building on existing policies and developing a future agenda.

KEY MESSAGES

- Despite much debate and numerous initiatives, the EU still lacks a clear sense of direction in relation to natural resource use.
- The proposal for a roadmap is welcome. However, it must contain clear objectives, linked to a timetable with concrete policy commitments and a strategic link to European economic policy.
- It is now the time to set strategic targets that reflect Europe's equitable share of the planet's carrying capacity. This is required to give policy development in Europe sufficient drive in parallel with commitments on climate.
- The roadmap needs to address both critical individual resources; and the underlying drivers of resource consumption, in particular housing, mobility and food and drink.
- The resource use dimension of EU product policy needs to be developed over the next few years as a matter of urgency.

The need for natural resources policy

The over exploitation of natural resources is not a new phenomenon. However, the pressure to develop and implement more dedicated public policy strategies on the sustainable use of these resources has been growing in the past few years, due to scarcity scares about some finite resources and increasing pressure on many others that are more renewable. Both situations have led to increased market prices with sometimes wildly unpredictable price fluctuations, having the knock-on negative effects of unstable supply and social unrest, particularly where prices for staple foods and fuel have been affected.

Forecasts predict increasing global demand for many natural resources, and consequently continued supply instability for some, including

a range of metals. Broader increases in environmental pressures (such as on land use and biodiversity) are expected, as well as continuous increases in prices. Escalating demand is driven both by economic development and the rising global population, anticipated to be 9 billion by 2050. Global resource use already exceeded the planet's biocapacity¹ by 50%² in 2007 (up from about 40% two years earlier), when the global population was just over 6.6 billion people. Consequently, more concerted efforts are needed to achieve substantial increases in resource productivity if we are to satisfy the needs of 9 billion people without intolerable further burdens on our ecological systems, or risking serious economic instability and social unrest.

This challenge has been recognised not only by environmental organisations and agencies but also by business interests aware of the opportunities as well as the hazards of a transformational change in resource use. In 2010, two well-known global, corporate groupings - the World Business Council for Sustainable Development and the World Economic Forum – produced reports providing visionary views on sustainability³. These reports underline the fundamental shifts needed – by governments, companies and citizens – to ensure that 9bn people can live well and within the limits of the planet. The World Economic Forum report on sustainable consumption states clearly: *“The global consumption trajectory remains largely unchanged. ...incremental improvements in sustainability are not enough. A more fundamental, transformational shift in the way the world produces, consumes and manages value chains is needed.”* Companies within and outside these corporate groupings are already engaged with sustainability issues, and are looking for some clear policy messages and framework conditions from governments to ensure that they can both utilise and contribute to these transformational changes without risking their market presence.

The EU has joined many national governments in promoting innovation as a strategic response to economic, environmental and social

challenges following the financial crisis. They have also promoted ‘green’ or ‘sustainable’ growth as a revised economic objective, although with as yet little detail on how this can be done beyond the current climate change and energy agendas. This vision needs to be amplified and more concrete plans developed.

Towards a Roadmap

The EU's new economic strategy, Europe 2020⁴, identifies three mutually reinforcing objectives of ‘smart, sustainable and inclusive growth’, built upon seven ‘flagship’ initiatives. A number of these flagships have potential relevance to sustainable use of natural resources, and address resources issues directly or indirectly. These focus particularly on resource efficiency (‘Resource Efficient Europe’), innovation (‘Innovation Union’) and industrial policy (‘An industrial policy for the globalisation era’). Although these have been published, there is no detail yet on how resource efficiency is to be understood, nor targets set, or how it can be achieved, for example through innovation activities. Nonetheless, the recognition of the need to manage resources better is encouraging, especially within an economic rather than a purely environmental strategy. A resource efficiency ‘roadmap’ to 2050 is expected from the European Commission in mid- 2011. This is where more detail on policy objectives and means of achieving them is expected to be elaborated. The roadmap needs to set out realistic scenarios to 2050, build on existing EU natural resources and related policies, and propose what new initiatives will be needed.

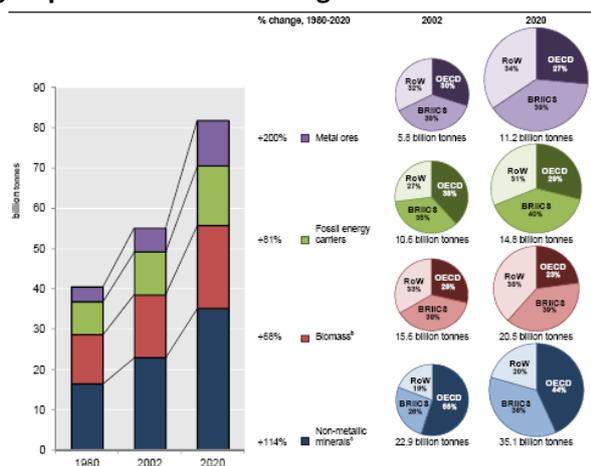
“The global consumption trajectory remains largely unchanged. Incremental improvements in sustainability are not enough. A more fundamental, transformational shift in the way the world produces, consumes and manages value chains is needed.”

World Economic Forum, 2010

The roadmap scenarios will not need to start from zero as much work has recently been done on future demand for some materials. Figures 1

and 2 provide different perspectives on anticipated growth in extraction of various key natural resources to 2020 and 2030. Figure 1 shows that global resource extraction is expected to increase from a 2002 figure of 55bn tonnes to just over 80bn tonnes by 2020, with BRICS countries (Brazil, Russia, India, China and South Africa) increasing their share, based on levels of economic development and domestic supply of natural resources. Amongst the natural resources, metal ores have the highest rates of increase in extraction rates which are expected to almost double between 2002 and 2020 levels. Biomass (extraction from agriculture, forestry, fisheries etc) increases much less than the non-renewable resources, indicating a smaller share of resources in materials production by 2020.

Figure 1: Global resource extraction, by major groups of resources and regions

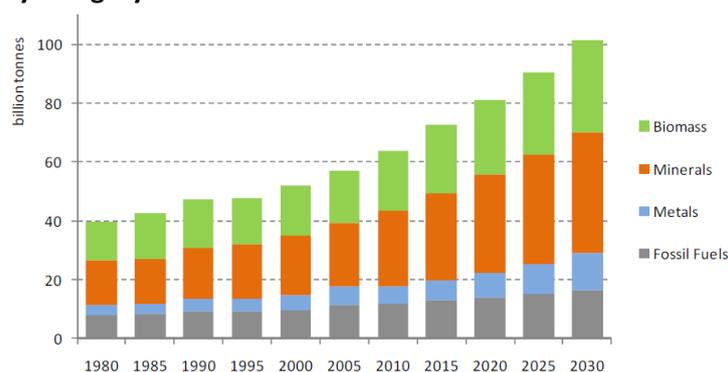


Source: OECD, 2008; *Measuring material flows and resource productivity – synthesis report*

Figure 2 provides estimates of global resource extraction at more regular intervals from 1980 to 2030, with similar increases in global extraction predicted. These forecasts are based on some basic assumptions, none of which are guaranteed to occur: that industrial country resource consumption will not reduce significantly, scarcity of resources will not get worse, and that the main factors driving the overall rise in global resource use are global population growth and increases in resource consumption per capita.

The importance of natural resources as the basis of all economic activity and as the source of goods and services for people has been recognised in the EU for some time. The European Commission's 2005 Communication on the Thematic Strategy on Sustainable Use of Natural Resources⁵ (the 'Resource Strategy') states: "European economies depend on natural resources, including raw materials such as minerals, biomass and biological resources; environmental media such as air, water and soil; flow resources such as wind, geothermal, tidal and solar energy; and space (land area). Whether the resources are used to make products or as sinks that absorb emissions (soil, air and water), they are crucial to the functioning of the economy and to our quality of life." Specifically addressing some key raw materials, the EU's 2008 Raw Materials Initiative states that "Raw materials are essential for the sustainable functioning of modern societies. Access to and affordability of mineral raw materials are crucial for the sound functioning of the EU's economy. Sectors such as construction, chemicals, automotive, aerospace, machinery and equipment sectors which provide a total value added of € 1 324 billion and employment for some 30 million people ... all depend on access to raw materials."

Figure 2: Global resource extraction 1980-2030, by category



Source: SERI et al. 2009; *www.materialflows.net* and Lutz/Giljum, 2009

The recent flagship initiative revisited this argument and sign posted a wide array of relevant EU policy. A larger step forward is now required towards more specific policies if the EU is to meet its citizens' needs within a changing

geo-political reality and within an increasingly constrained world.

EU natural resources policy – the current picture

The Roadmap will not start from the very beginning of the route. It must take account of previous progress, including a history of legislation and more aspirational policies.

An overarching EU natural resources policy is a relatively recent development. The 2002 6th Environmental Action Programme (6EAP) identified natural resources and waste as one of four key priority areas for the next decade. The 6EAP's aim on natural resources and waste was: *“Better resource efficiency and resource and waste management to bring about more sustainable production and consumption patterns, thereby decoupling the use of resources and the generation of waste from the rate for economic growth and aiming to ensure that the consumption of renewable and non-renewable resources does not exceed the carrying capacity of the environment.”* In 2005, the 6EAP Thematic Strategy on the Sustainable Use of Natural Resources was published alongside a Thematic Strategy on Waste Prevention and Recycling, to take forward these aims. These thematic strategies form the cornerstone of EU natural resources policy to date.

The Natural Resources Thematic Strategy had a less ambitious approach than that set out in the 6EAP, focusing on improving understanding and knowledge of European resource use, developing tools to monitor and report on progress, integrating lifecycle assessment into relevant areas, and raising awareness on natural resource use impacts. The Strategy was widely criticised for not including clear targets and deadlines, or even a forward process for setting these. However, future EU policy can build on these foundations, particularly in the establishment of the Eurostat data centre on products and natural resources, and on a 2010 proposal by the Commission to create a Regulation on European environmental economic accounts⁶. This Regulation would help

ensure the regular and harmonised presentation of national accounts on various natural resources, thereby plugging some existing data gaps and ensuring similar presentation of the data by all Member States.

Similar to the Resource Strategy, the Thematic Strategy on Waste Prevention and Recycling identified the need to integrate lifecycle thinking into waste policy and improving knowledge and information. This Strategy focused much more on simplification and modernisation of specific pieces of waste legislation, improved implementation of existing legislation and development of recycling and waste prevention policies. Since the publication of the Strategy, most policy attention has been spent on the revision of the Waste Framework Directive, which included the elaboration of some fundamental elements of EU waste policy, particularly by strengthening the legal basis of the existing five-step waste hierarchy and setting recycling targets for key waste streams.

The Resource Strategy was the EU's first real foray into policy directly addressing natural resources in a horizontal way. However, there are numerous more focused policies bearing on resource management in fields such as agriculture, water, waste, products and industrial processes or, more recently, on certain materials demanding more targeted attention.

Mid-level policies produced in 2008 focused on the foundations of future resource use (sustainable consumption and production) and on specific materials (raw materials). Some of the key policies with potential to contribute to a strategic approach to natural resources policies are examined briefly below.

The **Sustainable Consumption and Production and Sustainable Industrial Policy Action Plan (SCP/SIP)** aimed to create ‘a dynamic framework to **improve the energy and environmental performance of products and foster their uptake by consumers**’. The content on natural resources was extremely limited however, despite the Action Plan containing a section entitled ‘boosting resource efficiency’. This

simply reiterated the Resource Strategy intentions of creating tools to monitor, benchmark and promote resource efficiency, taking account of the life cycle perspective and including requirements of trade rules. At a later stage, it is proposed that 'detailed material-based analysis and targets' be addressed, based on environmental significance and on access to natural resources. No substantial work on this has been presented publicly to date.

The **Raw Materials Initiative**⁷ (RMI) focuses on key raw materials, particularly **construction minerals, 'high-tech' metals and secondary raw materials**. The Initiative seeks to establish an integrated raw materials strategy at EU level, based on three pillars: ensuring *access* to raw materials at international level; fostering sustainable *supply* from European sources; boosting overall *resource efficiency* and promoting *recycling* to *reduce the EU's consumption of primary raw materials*. Thus, much of the focus is on ensuring continuing supply of materials to Europe, and an attempt to reinforce waste, product and natural resources policies in support of this. The original 2008 Initiative makes mention of the Resource Strategy and the SCP/SIP Action Plan, identifying their overall strategic goals, rather than specific measures in either. It also identifies potential provisions in the Ecodesign Directive⁸ to incorporate criteria for resource-efficient products, which have yet to be taken up, as well as the more robust integration of natural resource-related impacts into preparatory studies and implementing measures. The updated Initiative published in early 2011 reiterates the three pillars, giving more urgency to the need to improve recycling performance, but still with little detail on how this is to be done. Indeed, its focus has been diluted and confused by the last-minute inclusion of elements relating to the better management of commodity markets. These are seen as having important impacts on prices of materials (of metals but also of food), but the actions make no mention of the need to reduce resource consumption and therefore do not help to make the RMI more coherent.

The **Ecodesign Directive** is **product-focused legislation**, extended in 2009 from 'energy-using' to 'energy-related' products. It includes provisions relating to resources aspects, such as water consumption in the use phase, the quantities of a given material incorporated in the product or a requirement for minimum quantities of recycled material. To date, implementing measures for different products have been limited to highly problematic substances such as mercury, and to water efficiency and durability on a total of three products. As already stated, attempts to extend the Directive to cover natural resource-related impacts more explicitly in the 2009 revision were blocked internally within the European Commission by, amongst others, DG Enterprise.

The **Water Framework Directive**⁹ (WFD) addresses water quality, water management, and pricing. Implementation is based on the ecological 'river basin' structure, and Member States were to prepare River Basin Management Plans (RBMPs) by December 2009, addressing both water quality and water quantity status. The management plans also need to take into consideration the cost-effectiveness of improvement measures, which potentially touches upon **water charging** for users, as the Directive aims to deliver full cost recovery for water use. There is concern, however, that Member States are delaying many of the measures that they need to take to the final period of implementation deadlines, that is, 2027, so early action may be limited.

The 2010 **Industrial Emissions Directive**¹⁰ will replace the Integrated Pollution Prevention and Control Directive, which seeks to regulate the activities of key **industrial sectors'** to prevent and control pollution. There are provisions on the use of natural resources and the impact on natural resources of industrial emissions. The Directive is meant "to establish a general framework for the control of the main industrial activities, giving priority to intervention at source, ensuring prudent management of natural resources..."¹¹. The Directive works on the basis of installation-based permits provided by competent authorities. Permit conditions to date have largely focused on setting emission

levels for pollutants and their use for resource use objectives has been more limited.

At the EU level, some overarching resources-related policies are in place as well as more specific resources-related provisions in product- or process-based legislation. However, the gaps between the overarching policies and the detail needed for more precise implementing measures or process values continues to hold back on-the-ground implementation of middle level measures to drive resource efficiency or sustainable resource use provisions. Existing overarching policies will not drive this middle-level orientation alone, so the public policy framework needs to be further developed to provide an effective hierarchy of measures during a time of continuing data gaps. This would allow better coverage of the key areas having particular natural resources impacts, and further integration of natural resources aspects into 'micro' level policies.

The next steps

Taking account of the experience of EU policies related to resource use to date, a coherent and effective EU natural resources policy would need to:

- Address issues side-stepped up to now:
 - **The EU's very large overall natural resource footprint**, which is much beyond our fair share of what the planet provides. This is likely to be reduced over time through market forces, but policy is needed to make this happen faster for reasons of ethics, long-term sustainability and global leadership.
 - **Non-renewable resources** are being depleted too quickly, and our knowledge of the different uses of these resources, levels of reserves and lifecycle impacts is still too under-developed to know which specific resources are in serious threat of running out of supply. We need to address the issues with more urgency.
- Further develop more robust, coherent and integrated policies in areas where work has begun:
 - On some **'critical' raw materials**: The Raw Materials Initiative focuses primarily on 'high tech' metals, particularly those considered 'critical' because their production is highly concentrated in a non-EU country, because their continuous supply is threatened due to low political-economic stability of the main suppliers, and because of their currently low substitutability and low recycling rates. These types of geo-political issues affecting supply will only heighten in future. However, the important issues go beyond supply security to questions of appropriate consumption levels and also to wider sustainability impacts, implying further development beyond the existing RMI approach.
 - On some **highly strategic resources facing increased, often competing, demands**: An example of this is soil, where the EU policy framework is very weak but some policy elements exist that address degradation and absolute loss. Resources such as water, biomass (including bio-energy materials), energy carriers, and forest also fall into this category.
 - On **resources already addressed by EU policy, but where results in implementation have been weak**: This applies particularly to the areas of waste, aspects of water, and marine and fisheries, where implementation continues to be unsatisfactory and which are likely to need fresh impetus and greater focus on implementation. It also applies for supporting policies such as on biodiversity. New regulatory design and/or significant development of other mechanisms (including the use of economic instruments), will need attention as well.
 - On **less tangible resources**, only recently addressed by EU policy such as many ecosystem services: Natural resource management still largely focuses on

tangible goods such as timber, water or food. Underpinned by biodiversity, ecosystems also provide a range of regulating services such as water and air purification, erosion control, natural hazard protection or pollination which are of enormous value to sustainable resource management.

Policy gaps and needs – building blocks towards a resource-efficient, low-carbon economy

In order to address the shortcomings in EU policy on resource use, the following elements of a more *directed*, robust natural resources public policy framework are proposed, working towards a sustainable level of consumption of renewable and non-renewable resources that does not exceed the carrying capacity of the environment. Given the finiteness of some resources, and our unsustainable consumption of others, a stronger policy focus on the planet's carrying capacity is very important. Increasing the efficiency of resource use is part of this but an absolute reduction in use in many resources is a necessary basis for moving towards sustainability and this step change needs to be signalled well ahead. This is a crucial role for the roadmap.

High-level policy mechanisms

Overarching goal

The EU is preparing a Resource Efficient Europe Roadmap to 2050 to be published around mid-2011. The Roadmap is meant to '*define medium- and long-term objectives and means for achieving them with the main aim to decouple economic growth from resource use and its environmental impact*'.¹² In no Commission documents on Europe 2020, or subsequent elements on resource efficiency, has there yet been any mention of **overarching political objectives**. Apart from the continuing notion of decoupling economic growth from resource use and its environmental impacts, nothing has been communicated on how to ensure that resource use is actually reduced. An over-arching political

goal of absolute reduction, with supporting monitoring and evaluation mechanisms is needed if appropriate objectives are to be set and reviewed in future.

It is useful to compare the policy dynamics of developing a resource-efficient society with that of developing a low-carbon society to address the challenge of climate change. The path towards a low-carbon EU is much clearer and populated by a series of targets and measures addressing different aspects of climate change mitigation and energy use, helping to create such an economy. Admittedly, the global political agenda and government efforts are strongly driven by scientific evidence developed within the Intergovernmental Panel on Climate Change and the subsequent UN Framework Convention on Climate Change. Notwithstanding recent political difficulties in agreeing post-2012 directions and structure, these international bodies and measures have helped to focus political minds on domestic activity within the EU and elsewhere. The science-based identification of the importance of the 2 degree limit for global temperature increases also helps to put proposed policies and measures into a more contained context, thereby providing a clear rationale of *absolute* reduction rather than *relative* reduction of greenhouse gas emissions.

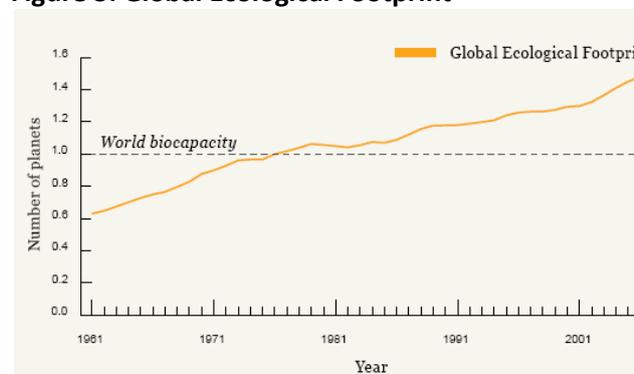
There is a strong need for a similar absolute limit orientation in the natural resources sphere, not least because of the finiteness of some key non-renewable resources and their inter-linkages with renewable resources. Non-renewable resources are in finite supply, their deposits vary in their accessibility for extraction and therefore prices can fluctuate considerably. Renewable resources may be renewable in principle but in practice this depends upon our rate of use and current estimates are that we are using some at a speed greater than nature's ability to replenish them. Furthermore, many renewable resources depend very much upon a finite resource: land. Recent political wrangling on the EU's biofuels target is an example of the inter-linkages between biotic materials and land.

An overarching goal should be for the EU to come back within the planet's carrying capacity at the latest by 2050

Therefore, prudent use and reuse are of increasing urgency on our more 'crowded' planet and will only become more so as that population continues to grow.

As stated in the introduction to this paper, global use of natural resources already exceeds global biocapacity by 50% (see Figure 3), with higher levels of resource use occurring in industrialised countries. **An overarching goal therefore should be for the EU to come back within the planet's carrying capacity for overall natural resource at the latest by 2050.** On information available today, this means reducing Europe's current ecological footprint of 2.5 planets' worth to within one, which will also address the important issue of more equitable global access to resources. This target would need to be met by a mix of measures affecting the provision of materials, products and services (design, transport, etc) and their use (consumption and production) with the ultimate objective of achieving *absolute* reductions in use.

Figure 3: Global Ecological Footprint



Source: WWF Living Planet Report 2010 (Human demand on the biosphere more than doubled between 1961 and 2007 – Global Footprint Network, 2010)

Support mechanisms

This long term goal needs to underpin a strategy designed to address individual resource issues over a sustained period of time. Greater clarity about the priorities is necessary to give substance to this strategy. Building on the 2005 Resource Strategy priority of improving knowledge and data of resources issues, the policy **support mechanisms** particularly needed

relate to establishing priorities and driving indicators that help to sharpen the challenge, and that can be used in reporting, monitoring and evaluation. The Resource Strategy identified the need to develop tools to monitor and report on progress, but with no final selection yet being made, despite some work having been done on a potential '**basket**' of indicators. Such a 'basket' is needed precisely to be able to monitor progress and to help to orient specific policy mechanisms against this progress.

Member States already provide regular data on some natural resources flows to the Commission on a 'gentleman's agreement' basis and, as stated earlier, work is underway on making this more mandatory via a Regulation on European environmental economic accounts. The proposed Regulation includes requirements on important resources such as biomass and biomass products, metal ores and non-metallic minerals, and fossil energy materials/carriers. These are very good starting points for specific resources, and could have the dual use of providing feedback on policies addressing specific resources while also feeding in to a higher-level basket of indicators.

There is a considerable amount of independent work on indicators which can be utilised. This includes a study by the Sustainable Europe Research Institute (SERI) and Friends of the Earth Europe¹³ which suggests four headline indicators as a starting point to monitor:

- Land area required (in hectares), including land used outside the EU (for example to grow crops for imported food or energy sources)
- Material consumed (in tonnes), including those used to make products that are imported into Europe (sometimes called the material rucksack of products). Data sources allow this figure to be broken down into different forms of materials, for example biological and mineral resources.
- Water consumed (in litres), including water used outside the EU to produce imported products (e.g. cotton).
- Greenhouse gas emissions created by the EU's consumption (in CO₂ equivalent), which includes both Europe's Kyoto emissions, and

the carbon footprint associated with imported products.

According to the study, extensive information to support these indicators already exists in the research literature, and they are transparent as they measure physical quantities. The indicators do not measure direct biodiversity impacts or the use of hazardous chemicals or pollution. However, for issues such as biodiversity, they can give signals on issues needing further investigation.

Mid-level policies and analysis

Prioritising policy development requires identification of critical issues. This needs to take place at two levels. One is to focus on individual resources, following the carbon model, the other is to consider the underlying drivers of resource consumption and to address these.

Key consumption areas – housing, mobility, and food and drink

Some important recent studies¹⁴ have confirmed what studies since the 1970s have shown: our largest environmental impacts arise from where we live (housing and the electronic products we use), how we move ourselves and things around (transport/mobility) and what we eat (food and drink). Taking a function approach to natural resources is a good means of addressing the issues from a **systems perspective**, building on the historical functional unit approach which has given us improved environmental performance per *unit* of consumption but has not resulted in a more sustainable system or economy or in an overall reduction in environmental impact or resource use – a phenomenon otherwise known as the **rebound effect**. Taking a systems perspective requires us to think more widely, for example to address lifestyles and infrastructure – hence the cities and towns we design, and the modes of transport we build.

The European Commission's studies on products and potential improvement measures¹⁵ date back to 2006, but their results have not yet been systematically built upon or integrated into

relevant existing policy areas. **A Roadmap for resource efficiency must address the underlying drivers of consumption and start to develop policy approaches in the key areas of housing, mobility and food and drink.** The complexity of these consumption areas will likely raise the need to cluster or package a range of measures to address different aspects, as occurred with the EU's 2008 climate and energy package containing complementary measures to help achieve the current overarching political target¹⁶. The Resource Efficiency flagship initiative rightly identifies the need to take 'coordinated action in a wide range of policy areas', and it specifically mentions climate change/energy, transport, biodiversity, agriculture, fisheries, chemicals in water, construction, and cohesion (regional) policy. Such coordinated action can be informed by a cluster approach and extended over time. Focus on clusters also helps to distinguish the different levels of action that will be required, ranging from the European to the local.

Housing is an area where multi-level action is required. At the EU level this can build upon the Directives on the Energy Performance of Buildings and on Construction Products, while putting these into a wider sustainable housing and spatial planning perspective. The Commission has also communicated its intention of proposing a Directive on water savings in buildings. A strategy for the sustainable competitiveness of the EU construction sector is anticipated for 2011. Looking at housing more systematically requires addressing the land-use aspects of the design of cities, and other settlements as well as the design of building across a number of impact areas – beyond energy and water to the materials used, including their inherent sustainability and their recycled content and recyclability (linking to waste policy). The EU has a substantial role here as some action will need to be coordinated at a European level, as is apparent from the climate debate.

Mobility is another policy area where the EU is involved, but which has not yet addressed natural resources issues (beyond energy) in a comprehensive way. There has been much

discussion about a modal shift from personal to public transport, and shifting goods transport from road to rail and waterways. Current policies focus on some aspects of this (co-modality), but with a particular focus on the least polluting and energy-efficient modes of transport, and progress has been slow. More effort is needed to develop policies beyond encouraging the purchase of more fuel-efficient cars and tentative changes in infrastructure, to the sustainable use of transport. This means curbing growth in air transport, providing public transport infrastructure and pricing of different modes that better reflect their environmental impacts, designing settlements for reduced private transport needs, and containing demand for mobility (whether for people or goods). Again the EU has a clear role in terms of leadership, regulation and influence on development models, through Europe 2020 and such as the European Regional Development Fund and cohesion funds for example.

Food and drink, particularly protein derived from animals, have been identified as having a high environmental impact. As with minerals and biofuels, the impact of the global supply chain is critical, with some of Europe's greenest land demands arising from imported proteins for livestock. The EU's involvement is not only via the CAP, which influences several aspects of supply and demand, for example for milk, vegetables and wine but also through food policy, currently focussed on quality, nutrition, food safety and labelling issues. There is considerable scope for developing a more holistic approach.

Materials

Alongside these clusters, individual resources and their associated supply chains need to be evaluated so that key issues can be identified. There is always the danger that the resource efficiency debate will be submerged. The complexity of natural resource impacts according to their source, their use and their final disposal destination has a substantial role here as some action will need to be coordinated at a European level, as is apparent from the climate debate. Policies have begun to be

developed, most notably through the Raw Materials Initiative, but initiatives need to focus on other key materials and also to address the full *demand* and *supply* cycle.

A study undertaken for the Dutch government in 2004¹⁷ identified the top 20 materials having the greatest ecological impacts according to levels of materials used and lifecycle impact assessment. The top 10 materials were: animal products, crops, plastics, oil for heating and transport, concrete, hard coal for electricity, brown coal for electricity, iron and steel, gas for heating, paper and board.

All of these figure prominently in the three function areas listed in the previous section, as well as in industrial production allowing for an approach to be constructed around both systems and individual materials. The evidence suggests an early focus on **biomass, construction minerals and metals, animal products (particularly fish, meat and dairy), and energy generation minerals**. A focus on biomass in particular is needed in the next two years due to the impacts of the EU 2020 biofuels target on greenhouse gas emissions as well as other land uses. The bio-based economy becoming an increasingly important theme in EU policy requires careful appraisal so that the full implications are explored¹⁸. A sectoral approach to these materials, utilising a cluster approach could work well here.

Both the resource efficiency flagship initiative and the latest version of the raw materials initiative to highlight **the need to achieve higher levels of recycling and overall resource efficiency, most notably in the better implementation of existing EU waste policy**. This is a valid conclusion, as EU waste policy for the past 35 years has been based partly on the notion of reducing natural resource use by encouraging more recycling and avoidance of waste generation. However, waste policy remains poorly implemented and enforced and is characterised by large discrepancies between Member States in how waste is treated. The record in individual Member States can be an indicator of their overall approach to resource efficiency; a microcosm of a wider picture. The

countries with better performance levels on waste and recycling have generally supported their waste management plans with other instruments – legislative, economic and informational – to build a coherent culture of selective waste management, changing public behaviour (in purchasing decisions and in recycling rather than throwing out recyclable or reusable materials), communicating the notion of the value of recyclable materials and the need to keep them live in our economies by recycling/composting them, or at least recovering the energy from them.

One of the failures of EU waste policy has been the stagnation of objectives and targets so that the focus has been on the *supply* of materials for recycling. There have been no mirror policies to create the market for *demand* for recycled materials. Although policies concerned with the environmental attributes of certain products have existed since 1992 (starting with the European Ecolabel, and progressing with the Ecodesign Directive and green public procurement product criteria), there has been little focus on their natural resource characteristics or encouragement to use recycled materials. More supportive domestic markets for recycled materials are needed to increase their use. Action here would complement waste policy targets though these will likely still be necessary to ensure collection of some materials for recycling.

Up to now the materials highlighted for targeted policy action have been traditional materials such as wood and wood-based products (to deter illegal logging and unsustainable forest management), more recently expanded to biofuels and to 'raw materials'. **A more proactive and directional EU natural resources policy needs to identify priority materials requiring attention because of recognised patterns of unsustainable use, or other pressing sustainability or supply concerns. Measures to address consumption need to be developed alongside steps to increase efficiency.** A recent proposal by the Japanese government to ease supply constraints on some rare earth metals includes increasing recycling, developing substitute materials and new

technologies that reduce the amount of rare earths used. Such demand-based management, and links to a more developed product policy, needs to become more prominent in EU natural resources policies.

Micro-level policies

Products

Policies concerned with individual products work at the micro level, giving signals to producers and to entities putting products on the market of the continual need to improve their environmental and sometimes social performance. Existing product-level policy mechanisms such as the **European Ecolabel**, the **Ecodesign Directive**, the **Energy Labelling Directive** and **green public procurement (GPP)** have served as market drivers for better performing products, but have been under-performing partly because they are generally voluntary measures (the Ecolabel and GPP) and have lacked direct links to wider policy areas (such as the 20-20-20 objectives for climate).

These policies can be developed in four directions to strengthen their contribution to longer term resource efficiency on the scale required:

- increase the focus on the products and groups of products of greatest concern;
- extend producer responsibility beyond end-of-life management (recycling) issues;
- extend beyond the current dominance of energy-related impacts in consumer targeted policies to full lifecycle tools on a broader list of products; and
- increase the ambition level on requirements, moving away from incremental improvements and linking strongly to innovation policy.

In the case of GPP, it will need to become a mandatory requirement for it to become most effective.

A study for the Commission¹⁹ undertaken in 2006 resulted in the identification of several product categories and specific products having the largest environmental impacts, with some

gaps and data limits acknowledged. This is a helpful foundation for developing the current list of product policies:

- **Food and drink:** particularly livestock products
- **Transport:** private cars (and other private motor vehicles) account for about four fifths of the transport related impacts of consumption

A complementary study undertaken for the German government in 2004²⁰ identified eight 'final demand' product groups with a high impact: construction; food products and beverages; motor vehicles, trailers and semi-trailers; electricity, gas, steam, and hot-water supply; basic metals; agricultural products; chemicals and chemical products; and machinery equipment.

Extending producer responsibility is a second way of steering the market towards low impact products. There is still much work to be done to further develop the concept of **extended producer responsibility** beyond the end-of-life management aspects addressed in the 'recycling Directives'²¹. This was proposed in the 2001 Integrated Product Policy green paper and now needs to be taken forward.

The Ecodesign Directive is flexible in the range of products it can address, whilst being restricted to products having key *energy-related* environmental impacts. **The principles for moving forward were set out in the 2001 IPP green paper** 'In principle, all products and services are included in the scope of this (IPP) policy...'; IPP is 'an approach which seeks to reduce the life-cycle environmental impacts of products from the mining of raw materials to production, distribution, use, and waste management'. The Ecodesign Directive is a useful tool for pursuing this approach. In its development, some non-energy issues such as mercury levels and water consumption have been introduced, but these remain exceptions to date. **Product policy is a key leverage point for change in the production-consumption chain and framework product legislation is needed to take a central place in the policy**

framework, covering all impacts beyond energy and more explicitly addressing trade-offs between different environmental impacts which can be quite significant.

Another proposal in the IPP green paper involved **guidelines for product design**. Aspects to be addressed could include conservation of resources and reduction of waste, pollution, hazards and risks. Design concepts to pursue these goals included design for reduction/substitution (including of environmentally unfriendly materials), design for renewable materials, and design for durability and for reuse and recycling. Despite clearly stating that the European Commission 'intends to encourage the elaboration, dissemination and application of such guidelines', this has never been undertaken. **EU-level guidelines on ecodesign are needed to mainstream sustainability approaches more generally, and to help guide overall industrial and innovation policies.**

Relating Resource Efficiency to the wider economic and industrial policy agenda

Industrial policy

The resource efficiency agenda, as it has been developed within the Europe 2020 process, is presented primarily as an economic and competitiveness issue with the environmental dimension less prominent. This underlines the need to increase the profile of the environment in the overall resource efficiency agenda and in current **innovation and industrial policies**.

The Commission's 2010 Communication on industrial policy within the context of Europe 2020 - *An Integrated Industrial Policy for the Globalisation Era*²² – puts competitiveness ahead of sustainability (as though these are in competition), and does not build on the 2008 SCP/SIP Action Plan. Rather it restates existing product policy, and highlights the role of voluntary initiatives (without giving an indication of intention to work with specific sectors on these) and the wider penetration of the environmental management systems EMAS and ISO14001. There is little to provide producers and the market with clear signals on

the need to make improvements to products or their provision, despite the consistent call for industry to contribute to making Europe a low-carbon, resource-efficient economy. **DG Enterprise will need to develop a sharper and more purposeful message, with accompanying policy proposals if it is to contribute positively to achieving a low-carbon, resource-efficient economy.**

The SCP-SIP Action Plan is to be reviewed in 2012, providing an opportunity to put more determined effort into the development of sustainable industrial policy. The 2008 SCP/SIP Action Plan was weak in its treatment of industrial policy, remaining vague on delivery and development and focusing purely on energy issues. Industry policy particularly needs to be developed to provide strong links to the overarching resource objectives, and to innovation policy to stimulate progressive entrepreneurial ideas and to support sustainable business models.

Innovation policy

Similarly, innovation policy does not yet appear to reflect sufficient understanding of the links between research and development and the design or manufacture of products or their management at the end of their lives. The *Innovation Union Flagship Initiative* rightly addresses the need to tackle ‘societal challenges’ such as climate change, energy and resource scarcity, health and ageing, but its only reference to environmental innovation is within the narrow confines of an ‘eco-innovation’ action plan. As yet, there is no mention of overarching political objectives to be met beyond tackling ‘societal challenges’. There is no indication as to whether this means innovating towards CO₂ reduction of 20 per cent or 80 per cent by a certain year, or factor material efficiency gains. Therefore, innovation policy is insufficiently guided at the moment, except possibly by the general mantra of ‘reduced environmental impact’. Innovation policy will need to become clearer about targets and ambition if innovation is to be guided appropriately towards achieving *specific* outcomes. Links between the flagship initiatives

on innovation and on industrial policy need to be more explicit and resource aware. The link currently is limited to innovation helping to secure a strong industrial base and ensuring EU competitiveness.

The resource efficiency roadmap will need to make strong links to industrial, innovation and product policies, as key leverage points for intervention in the production-consumption chain. Here, most importantly, targets will be needed to help guide innovation more effectively towards acceptable solutions to societal challenges, and identify the key sectors and measures where action is required to spur the social and technical innovation by companies.

Consumption policy

Although the 2008 Sustainable Consumption and Production Action Plan notionally addresses consumption, it very much limits itself to provision of information and trying to increase the availability of more environmentally preferable products as a means of helping the public to make more informed choices and to have easier access to ‘greener’ products. **Information provision has been shown to be useful but insufficient to cause behavioural changes, which are often more heavily influenced by factors relating to cultural and social issues, habit, and even technological and infrastructure ‘lock-in’** (where alternative behaviour options are not possible within a given system). More work is needed here to further develop a robust, coherent approach to consumption policy, to make links to economic policy, and to move beyond the historical approach to consumer policy of consumer ‘protection’, ‘safety’ and choice. This is potentially controversial territory, particularly in very consumerist societies, such as can be found in the EU, which view the consumer as sovereign and give high priority to the ultimate aim of broad consumer choice.

Economic policy and instruments

The January 2011 resource efficiency flagship initiative paper and the subsequent consultation

document on the resource efficiency roadmap appear to suggest different views on the significance of resource efficiency for wider EU economic policy. Whereas the flagship initiative focuses on economic opportunities and growth through efficiency, and rehearses the familiar decoupling message, the roadmap consultation background paper includes a more candid reflection on Europe's economic system and the barriers to advancing the resource efficiency agenda, stating: *"Our economic system still does not take proper account of the damage done by inefficient resource use – particularly the long-term social and environmental costs are often neglected – even though we have succeeded in putting a price on CO2 emissions". Indeed, the aim of the roadmap is 'not only to decouple economic growth from resource use, but also to identify and create new opportunities for economic growth and strengthen EU competitiveness, while respecting carbon, resource, and fiscal constraints"*. The consultation questionnaire itself addresses related topics including inadequate market signals, market-based instruments, financial support, and tax incentives. Consequently, it is not yet clear what the Commission's view is on the role of economic policy or of economic instruments in the resource efficiency agenda, nor what potential action is being considered.

Although these do not necessarily come under the direction of natural resources policy, **economic instruments** will need to be developed to support any overarching political objectives. The importance of creating appropriate market signals has already been highlighted by the EU Environment Commissioner, Janez Potočnik, and this applies beyond ensuring that the impact of natural resources use is seriously reduced. The deployment of economic instruments attuned to natural resource goals together with accompanying policies, such as supporting front runners, needs to become a major strand of the Europe 2020 strategy and the wider development of a "green economy". Setting out a pathway and timetable for this endeavour is a central challenge for the Commission's roadmap.

Biological resources

The transformation of natural resource use should not be confined to minerals, metals and manufactured products, although these often take centre stage. Some of the most challenging issues arise from the exploitation of biological resources, such as fisheries and farmland; the EU is a major force in these domains. It needs to be clearly signalled in the roadmap, although most of the policy response will be in sectoral policies such as the CAP and CFP.

Agriculture and Fisheries

Agriculture occupies the largest share of European land, has a major impact on soil, water and biodiversity and may account for about 30 per cent of EU greenhouse gas emissions by 2050 according to the recent climate roadmap. It is at the centre of a number of natural resource concerns which need to advance in parallel with progress on minerals and raw materials. Soil protection for example has received a low priority in EU and most national policies for decades and there is increasing concern about falling organic content as well as erosion, compaction and contamination in some areas. This long term neglect of a key resource must be viewed alongside the shrinkage of the agricultural land resource caused mainly by urbanisation. It will become increasingly difficult to accommodate the growing demands for food, bioenergy and other biomaterials from a diminishing base.

This implies a more strategic view of the land resource within environmental, agricultural and bioenergy policy with a more incisive analysis of the best use of land on a European and global scale. To take one example, biofuel policy has hitherto severely underestimated environmental constraints, particularly indirect land use change and reversing this is an immediate priority. Clearly this is only part of a wider resource use agenda for agriculture and food policy which also needs to address urgent water management and climate issues and start to grasp consumption issues in a new way. One of the first steps required in attaining food security is to husband the resources required to

meet future production needs, including soil, water and skills. The CAP reform debate now underway is a good opportunity to take forward this agenda, building on the new recognition that securing environmental public goods is a key objective for the CAP.

Few EU policies are more closely concerned with the management of natural resources than the Common Fisheries Policy (CFP). Detailed mechanisms to govern the exploitation of both individual species and particular areas of the sea are embodied in the CFP. While there has been an increased emphasis on resource conservation and an ecosystems approach in the language and instruments of policy, the results are less than impressive. According to ILES, between 25 and 62 per cent of commercial fish stocks in the North East Atlantic were outside safe biological limits in 2008 (EEA 2010). Rebalancing the policy and its governance are amongst the declared aims of the current round of CFP reform, due to be concluded in 2012, although the EU continues to fight shy of any effort to influence consumer behaviour. While it is unrepresentative of the mainstream resource efficiency debate, in some respects the CFP remains an important test of Europe's resolve in this arena and this needs to be acknowledged and the lessons of past failures learned.

Biodiversity and ecosystem services

Since the publication of the Millennium Ecosystem Assessment in 2005, there has been increased political recognition of the seriousness of the loss of biodiversity, not least as the natural capital on which our societies and economies depend. The crucial role of the diversity of species, ecosystems and genes in underpinning the supply of ecosystem goods and services essential for human well-being has increasingly been acknowledged. This relates *inter alia* to the provision of biomass and biological resources (e.g. diversity of pollinators for food provision) to the capacity of environmental media such as water, air and soil to function as emission absorbers (e.g. atmospheric cleansing capacity of forests) or the value of protected areas for recreation and ecotourism. Conserving or restoring ecosystem

services can also positively affect the productivity of natural resources or open new sources (e.g. genetic resources). Interesting developments in integrating the socio-economic value of these services into decision-making have taken place, not least due to emerging insights from initiatives such as 'The Economics of Ecosystems and Biodiversity' (TEEB)²³. Further steps are to be expected from the implementation of the Intergovernmental Platform on Biodiversity and Ecosystem Services²⁴.

However, despite the increasing acknowledgement of the importance of biodiversity and ecosystem services as our natural capital, the European Union failed to meet the target of halting biodiversity loss by 2010. In its Communication on options for an EU vision and target for biodiversity beyond 2010²⁵, the European Commission identified a number of reasons for the EU not having met its 2010 biodiversity target. Amongst others over-exploitation of some of the services underpinned by biodiversity (e.g. overfishing) and unsustainable practices, remain a major pressure on biodiversity, affecting the stability and resilience of ecosystems to further guarantee the supply of important services to human well-being. This has been affected by the slow implementation of some important policy instruments (e.g. on water and marine issues), implementation gaps of existing policy instruments (e.g. marine Natura 2000 sites, nitrates and urban wastewater), information gaps (e.g. biodiversity and ecosystem services monitoring), and still insufficient integration of biodiversity concerns into other policy areas.

Recently the EU released its new biodiversity strategy to 2020²⁶, defining new targets and actions to counter the challenges described above. It emphasises the role of biodiversity as our natural capital, underpinning our economy, and asks for action to promote the integration of its economic value into decision-making.

More work is still needed to help policy-makers better understand the links between biodiversity loss and the use of natural resources, with ecosystem services operating as

a partial link between the two. The importance of biodiversity in ensuring the long-term supply of benefits provided by ecosystems (e.g. maintaining food security) and diversification of the portfolio of these ecosystem goods and services should form a central part of the discussions on a holistic and systematic approach to resource management.

Climate change/energy

At present both the European resource efficiency agenda in a broad sense and the Europe 2020 strategy refer to the climate change challenge. For the moment the ambition remains low with a 20 per cent cut in emissions proposed for 2020; and clearly an advance to 30 per cent, supported by many actors, including numerous Member States, would represent a more determined step towards a greener economy. Beyond this there is scope for improving the understanding of and reinforcing the relationships between these two areas, rather than running them as parallel processes. Energy generation minerals are clearly identified as priority products to be addressed under the products policy, as noted earlier and the aim would be to move beyond energy efficiency or greenhouse gas emissions to address broader sustainability aspects such as land-use, habitat destruction, and energy intensity in production.

In relation to manufactured products, there is much to learn about the energy used along the lifecycle of materials and products, as some of these have greater energy intensity in the production phase than in use. The Ecodesign Directive focuses on energy in the use phase only, and this could be extended to the production phase at least. A materials policy also could explore energy intensity along the lifecycle of a range of materials identified as particularly important in achieving both a reduction of resource and energy use.

As climate policy develops and the focus on low carbon products intensifies, it is important that a carbon logic, crucial though it is, does not distort a more complete view of environmental impacts. The lowest carbon solution will not always be best if all the pertinent resource

impacts are taken into account. At a research and technical level this underlines the need for well designed studies and appropriate life cycle assessments. But more strategically it is clear that climate and other natural resources should be synchronised rather than advance episodically, with the risks of conflict occurring, as illustrated by the case of biofuels.

Conclusions

The roadmap is a welcome opportunity to give the resource efficiency debate the new impetus it needs and to make it a central component of a greener EU economy. To ensure that it has clarity and political traction, it needs visionary objectives, while to achieve concrete results a timetable and concrete measures need to be set out, some of them to be delivered in the next five years. Both tracks need to be pursued if progress is to be made in this important policy area.

A robust natural resources policy will need to be elaborated at several different levels: from strategic components in innovation policy for example, through initiatives on specific products and materials to improved implementation of current legislation.

Within the spectrum it is important to include new elements so that the roadmap breaks the mould of policy in this area which has become bogged down in recent years. We have proposed:

- **Overarching political targets** addressing the need to make absolute reductions in resource use so that the EU comes back within carrying capacity at the latest by 2050
- **Enhanced investment in data provision support tools**, to back up more proposals for more rapid action and to allow for further data collection and knowledge development
- **Key cluster mechanisms addressing the major consumption areas** of housing, mobility, and food and drink, with linkages

to policy developments underway where relevant (e.g. CAP and transport policy)

- **Extending materials policy** beyond minerals and industrial raw materials, to include biomass and water
- **Measures addressing the underlying drivers of resource consumption** (e.g. natural resource prices, ecological fiscal reform, a renewed approach to sustainable consumption and production)

Such a policy framework will take time to build, with the need for data gathering and reflection particularly in the policy transformation areas of innovation, industrial and consumption policy.

The coordinated action across a range of related policy fields proposed in the Flagship Initiative is a good starting point. It now remains for the roadmap and the initiatives it spawns to mould a sense of direction and coherence in a challenging sphere of policy.

References

- ¹ European Communities, 2006; Eurostat; “*Ecological Footprint and Biocapacity*”. “The Ecological Footprint (EF) is one part of a renewable resource accounting tool that is used to address the underlying issue of sustainable consumption. It measures the extent to which humanity is using nature’s resources faster than they can regenerate. The components (variables) of sustainable consumption are aggregated using weighting factors based on the Earth’s regenerative capacities for the considered resources. EF is usually presented together with biocapacity (BC), which measures the bioproductive supply.”
- ² WWF, 2008; “*Living Planet Report 2010: Biodiversity, biocapacity and development*”; Switzerland.
- ³ World Business Council for Sustainable Development, 2010; *Vision 2050: The new agenda for business*; WBCSD, February 2010; and the World Economic Forum, 2010; *Redesigning Business Value: A Roadmap for Sustainable Consumption*; January 2010.
- ⁴ European Commission, 2010; Communication from the Commission on Europe 2020: A strategy for smart, sustainable and inclusive growth; COM(2010) 2020 final.
- ⁵ Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions on the Thematic Strategy on the sustainable use of natural resources, available at: <http://ec.europa.eu/environment/natres/>.
- ⁶ See <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0132:FIN:EN:PDF>.

- ⁷ See http://ec.europa.eu/enterprise/policies/raw-materials/index_en.htm.
- ⁸ The Ecodesign Directive (2009/125/EC) replaced Directive 2005/32/EC, extending the new directive to energy-related products. More information is available at: http://ec.europa.eu/enterprise/policies/sustainable-business/ecodesign/index_en.htm.
- ⁹ See http://ec.europa.eu/environment/water/water-framework/index_en.html.
- ¹⁰ See <http://ec.europa.eu/environment/air/pollutants/stationary/ippc/index.htm>.
- ¹¹ Taken from Recital 2 of the recently recast Industrial Emissions Directive.
- ¹² European Commission, Communication on A resource-efficient Europe – Flagship initiative under the Europe 2020 Strategy, COM(2011)21, 26 January 2011.
- ¹³ Sustainable Europe Research Institute, GLOBAL 2000 and Friends of the Earth Europe, 2009, *Overconsumption? Our use of the world’s natural resources*, http://www.foeeurope.org/publications/2009/Overconsumption_Sep09.pdf
- ¹⁴ See the Integrated Product Policy section of the DG Environment website for information on activities undertaken: <http://ec.europa.eu/environment/ipp/>. The report on the Environmental Impacts of Products (EIPRO) study undertaken within the context of Commission activities on IPP can be found here http://ec.europa.eu/environment/ipp/pdf/eipro_report.pdf
- ¹⁵ Various Improvement Potential of Products (IMPRO) studies were undertaken for the Commission within the context of IPP and can be found here: <http://ec.europa.eu/environment/ipp/identifying.htm>.
- ¹⁶ The EU’s ‘20-20-20’ target on climate and energy policies represents a 20% reduction in greenhouse gas emissions, 20% renewable energy on gross final energy consumption, and 20% energy savings. More details on the EU’s 2010 climate and energy package can be found here: http://ec.europa.eu/clima/policies/brief/eu/package_en.htm.
- ¹⁷ van der Voet, E, Laurant van Oers, and Igor Nikolic; 2004; “Dematerialisation: Not just a matter of weight: Development and application of a methodology to rank materials based on their environmental impacts”; Leiden University Centre of Environmental Science; CML report 160.
- ¹⁸ Bowyer, C. Et al; *Anticipated Indirect Land Use Change Associated with Expanded Use of Biofuels and Bioliquids in the EU – An Analysis of the National Renewable Energy Action Plans*; IEEP; 2010.
- ¹⁹ The report on the Environmental Impacts of Products (EIPRO) study undertaken within the context of Commission activities on IPP can be found here http://ec.europa.eu/environment/ipp/pdf/eipro_report.pdf.
- ²⁰ European Environment Agency; “Sustainable Use and Management of Natural Resources; Report 9/2005; Copenhagen, 2005.
- ²¹ The ‘Recycling Directives’ address batteries, end-of-life vehicles, packaging and packaging waste, waste electrical

and electronic equipment. More details on these can be found here:

<http://ec.europa.eu/environment/waste/index.htm>.

- ²² European Commission, 2010; An Integrated Industrial Policy for the Globalisation Era Putting Competitiveness and Sustainability at Centre Stage, COM(2010) 614; http://ec.europa.eu/enterprise/policies/industrial-competitiveness/industrial-policy/files/communication_on_industrial_policy_en.pdf
- ²³ The Economics of Ecosystems and Biodiversity (TEEB) <http://www.teebweb.org/>
- ²⁴ Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. More details can be found here: <http://ipbes.net/>
- ²⁵ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on Options for an EU vision and target for biodiversity beyond 2010 (COM (2010) 4/4)
- ²⁶ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on our life insurance, our natural capital: an EU biodiversity strategy to 2010 (COM (2011) 244 final)