



MOSUS Work Package 6

Policy recommendations

Stefan Giljum, Friedrich Hinterberger

Sustainable Europe Research Institute (SERI), Vienna, Austria

Andrzej Kassenberg, Ewa Świerkula

Institute for Sustainable Development (ISD), Warsaw, Poland

Vienna, 21.4.2006

EXECUTIVE SUMMARY

This report is the deliverable of Work Package 6 of the MOSUS project (www.mosus.net). It contains the **policy recommendations** which can be derived from the work undertaken on scenario building (WP 1) and scenario modelling (WP 4) and evaluation (WP 5).

The MOSUS project falls into a time of dynamic changes in and revisions of European economic, environmental, sustainable development and energy and transport policies. With its main objective to quantitatively assess the impacts of key environmental policy measures on natural resource use (materials, energy, land use) on the one hand and economic (and social) indicators on the other hand, the MOSUS project directly connects with a number of core issues of the current policy agenda, in particular the **EU Sustainable Development Strategy** (including its revision process) on the one hand and the **Lisbon Strategy** on the other hand.

The most important conclusion from the scenario simulations performed in the MOSUS project is that the implementation of a well-designed mix of (mostly) environmental policies can result in a **win-win situation for the economy and the environment**. Environmental policy measures primarily geared towards decoupling economic activity from material and energy throughput can be conducive to economic growth, contrary to the popular assumption that such policies will mainly raise costs for enterprises, decrease competitiveness and thus have an opportunity cost in terms of reduced economic performance.

In comparison to the baseline scenario (basically describing a “business-as-usual”), the policy measures implemented in the two sustainability scenarios **significantly improved the environmental performance** of the European economy in terms of energy and material productivity and emissions of CO₂, while at the same time **stimulating economic efficiency**, which resulted in higher economic growth and increased international competitiveness of European industries on international markets. Policies aiming at a radical improvement of energy and material efficiency in the European Union can therefore contribute to key objectives of both the EU Sustainable Development Strategy and the Lisbon Strategy. From this perspective, **environmental policy becomes one of the key strategies to reach the Lisbon goals**.

However, it has to be noted that several important issues remained unresolved in the MOSUS scenarios. These include maintained high levels of unemployment, rising energy demand by the transport sector and increased externalisation of environmental burden to other world regions through international trade. Results also revealed that the implemented measures show very diverse effects on the development of different economic sectors and significantly accelerated the shift from sectors of high material and energy intensities towards light manufacturing and services. Furthermore, the scenario simulations also exposed that

resource productivity increases on the micro level do not guarantee reduction of material and energy use on the macro level, as savings in material productivity are overcompensated by growth in production volumes due to rebound effects. Balanced achievement of economic and environmental targets thus demands for an additional correction of resource prices, for example through resource and energy taxes.

The realisation of objectives stated in the European Sustainable Development Strategy and other documents will require strong political commitment with regard to the implementation of adequate policy instruments. Cornerstones of a set of European sustainability policy measures, which could significantly contribute to the transformation towards more sustainable production and consumption patterns include:

- **Shift of tax burden** from labour to the use of natural resources through the introduction of an environmental fiscal reform, consisting of the reduction of employment-related taxes, along with the increase of taxes related to the use of non-renewable natural resources (energy taxes, material input taxes, levies on built-up land, etc.), with neutral effects on the budget.
- **Removal** of environmentally (and socially) **harmful subsidies** that encourage overuse of resources, in particular in the agricultural, fisheries, transport and energy sectors (considering also fair trade aspects).
- **Stimulating research and technology development** for resource efficiency in products and processes and implementation of best practice programs.
- Integration of **resource efficiency goals** into other programs like IPP, eco-labelling, green procurement, and environmental reporting.
- Stimulation of transfer of knowledge and information instead of material goods.
- Improvement in **planning processes** with regard to environmental and sustainability impact assessment.
- Fostering of **voluntary environmental agreements** between industries.
- Promoting **green consumerism** and non material and public consumption vs. material and individual one.

In the course of the MOSUS project it became clear that a number of possibilities for improving the model still exist and a number of other issues have to be tackled by future projects, in order to constantly improve the tools and indicators for designing and monitoring European sustainability policies. Most important areas for future research are (a) the further extension of the simulation model (expanding the number of represented countries, including natural resource stocks and prices and improving the labour market models), (b) the simulation of more radical sustainability scenarios and (c) the development of a model to account for indirect environmental effects related to traded products (ecological rucksacks).

Contents

- 1. INTRODUCTION5
- 2. SUSTAINABLE DEVELOPMENT POLICY IN THE EU5
- 3. DEVELOPMENT TRENDS IN CENTRAL AND EASTERN EUROPE8
- 4. RESEARCH QUESTIONS AND POLICY MEASURES.....14
- 5. SCENARIO RESULTS FROM A POLICY PERSPECTIVE16
- 6. SPECIFICATIONS OF SCENARIO MEASURES21
- 7. ADDITIONAL POLICY MEASURES TO IMPROVE RESULTS24
- 8. POLICY MIX AND POLICY INTEGRATION.....31
- 9. GLOBAL PERSPECTIVES.....35
- 10. CONCLUSIONS AND FUTURE RESEARCH NEEDS39
- REFERENCES.....43

1. Introduction

This report is the main deliverable of Work Package 6 of the MOSUS project. It contains the policy recommendations, which can be derived from the scenario building (Work Package 1) as well as the scenario modelling and evaluation (Work Packages 4 and 5).

The report starts with a short description of the policy framework of MOSUS, i.e. current sustainable development and environmental policy strategies in the European Union (section 2) and the specific developments in the new member states in Central and Eastern Europe since the beginning of the 1990s (section 3). In section 4, the policy measures of the MOSUS scenarios are illustrated. Section 5 summarises the MOSUS results for a policy maker perspective, condensing the key recommendations which can be derived from the scenario results. The following two sections 6 and 7 provide specifications of the scenario measures assumed in the two sustainability scenarios and a summary of additional policy measures not considered in the model simulations, which could help improving the results in terms of environmental performance. Section 8 calls for the implementation of a well-designed mix of policy instruments in order to steer the European Union towards a more sustainable development path. In section 9, recommendations for reforms of the international economic system, in particular the international trade regime, complete the policy analysis through an international perspective. The report closes with conclusions and outlooks to future research needs (section 10).

2. Sustainable development policy in the EU

Current European sustainable development and environment policy is characterised through a number of strategies and concepts. The most important processes are:

- The “**Lisbon Strategy**” for employment, economic reform and social cohesion, to which the environmental dimension was added at the Stockholm Spring Summit in 2001. After the mid-term review published in the “Kok Report” (High Level Group, 2004) and the suggestions for reform published by the European Commission (European Commission, 2005f), the Lisbon strategy is currently under revision.
- The **Sustainable Development Strategy** (EU SDS), which rests on the basis defined at the European Council in Gothenburg (June 2001). Also the EU SDS is currently being revised and the EU SDS II is expected to be adopted in June 2006
- The “**Cardiff Process**” describing the sectoral strategies for the integration of the environmental dimension into other policies;

- The **Sixth Environmental Action Programme** (6th EAP), which sets out guidelines for European Environmental Policy and defines the core environmental policy input of the EU SDS. Evaluation and reporting of progress in the implementation of the 6th EAP in the context of the Lisbon Strategy is carried out by the **Environmental Policy Assessment Process**. The implementation of the key policy objectives of the 6th EAP is carried out through seven **Thematic Strategies**, which are currently in the process of approval.

There exists wide consensus in the EU that the **Lisbon strategy** is no stand-alone undertaking, but has to be treated as part of the EU **sustainable development** efforts: “the European Council reaffirms that the Lisbon growth strategy itself is to be seen in the wider context of the sustainable development” (European Council, 2005). Although they have been described by the Commission as the short term and the long term contributions to sustainable development of the EU, the *existing* Lisbon and sustainability strategies do not support this claim, in particular, as the two strategies do not cover comparable territory and thus harmonisation between and integration of the two in a holistic approach is still an open issue. While there is some improvement in the revision process of the EU SDS with regard to the integration of social and economic concerns, the revised Lisbon strategy is missing equal treatment of all three dimensions. Major point of concern from a sustainable development perspective is the fact that the Lisbon procedure is structured by a hierarchy of policy fields, with a clear primacy of economic planning ensured by the Broad Economic Policy Guidelines (Spangenberg, 2005). According to the European Council (2005), these guidelines “will ensure the overall economic consistency of the three dimensions of the strategy”. Thus, in the Lisbon process, the social and environmental dimensions are added with the intention to make them comprehensive with the economic ones, rather than vice versa (EPSD, 2004). However, there exist contradictory views on the revision and future orientation of the Lisbon strategy between the Commission and the Council. The Commission establishes a causal chain, arguing that higher growth is a necessary precondition for achieving social and environmental objectives, which becomes also apparent through the focus on growth and jobs in the Commissions’ spring report to the European Council (European Commission, 2005f). However, the Council decisions included in the Presidency Conclusions of March 2005 turned the Commission logic upside down: it is not growth, which makes social cohesion and environmental protection possible, but both are a *precondition* for growth. Given this contradictory orientation of the Council and the Commission, the future development of the Lisbon strategy – including further development of the structural indicator set (see below) – cannot be clearly predicted (Spangenberg, 2005).

The “**Cardiff Integration Process**” requested nine different councils, among them key sectors from the resource use perspective, such as energy, transport and internal market, to prepare strategies for the integration of environmental concerns into their policy fields. The process has produced some positive results, such as raising the political profile of environmental integration issues and influencing some sectoral reforms, such as the recent reform of the Community’s agricultural and fishery policies (EEA, 2003). However, no generally accepted understanding of environmental integration has been developed in the process so far. Thus, individual sectoral strategies differ substantially and are in general also missing quantified goals, timetables and indicators to monitor their implementation (European Commission, 2004a). The Cardiff Process therefore is in need for revision and re-tuning, with focus on increasing coherence and linkages between the sectoral strategies and the development of a consistent set of indicators and binding time frames, along with regular monitoring and review mechanisms and enforceable deadlines (Schepelmann, 2000). Furthermore, environmental policy integration should also be promoted at the level of the member states, with a framework of a harmonised reporting system and other modes of information exchange in order to foster transnational policy learning and ensure a long-term and stable process (Kraemer et al., 2002). A core tool for policy integration could be Strategic Environment Assessment (SEA), implemented by Directive 2001/42 EC of the European Parliament and Commission. SEA would allow assessments of the effects of certain plans, programs and policies on the environment and should be used for example for the assessment of structural and cohesion funds policies in EU Member States. However, up to-day, the tool is neither sufficiently well developed nor widely applied and sometime ignored.

The **Sixth Community Environment Action Programme** (EAP 6) (European Commission, 2001d) names four key environmental priorities to be met by the Community: climate change, nature and biodiversity, environment and health and quality of life as well as natural resources and wastes. In an effort to initiate a new, co-ordinated approach to tackling environmental issues, the Sixth EAP includes the development of seven so called Thematic Strategies. They include the issues of Soil protection; Protection and conservation of the marine environment; Sustainable use of pesticides; Air Pollution; Urban environment; Sustainable use and management of resources; and Waste prevention and recycling. These strategies concentrate on the complexity of the relevant issues, on the diversity of actors concerned and on the need to find multiple and innovative solutions. Several strategies, such as the strategy for clean air for Europe (CAFE), the strategy on sustainable resource use, protection and conservation of the marine environment, waste prevention and recycling and the urban environment have already been adopted by the Commission. Many environmental

organisations criticise that the 6th EAP and its Thematic Strategies are in most cases lacking quantitative and well-defined qualitative targets and that more ambition would be needed in using essential instruments such as environmental taxation, abolishment of "perverse" subsidies, extended producer responsibility, promotion of eco-innovation and environmental liability. Furthermore, too little attention would be paid to the integration of the environment in other sectoral policies, as demanded by the Cardiff Process.

With regard to **material, energy and land use**, the 2004 Environmental Policy Review (European Commission, 2005a) emphasises the crucial role of higher material and energy productivity (particularly in the areas of energy and transport) as a central factor to ensure that economic growth is more environmentally sustainable. Along with benefits to the environment, the development of eco-innovation and eco-technology and a more sustainable management of natural resources should lead to the creation of new outlets and new jobs and increase European competitiveness on world markets, thus strengthening European export industries (see also European Council, 2005). The 2005 Environmental Policy Review (European Commission, 2006) points out that Environment Policy is part of the Lisbon partnership for Growth and Jobs and that the Framework Programme for Competitiveness and Innovation (2007-2013), the 7th Framework Programme for research and technological development and the new policy guidelines for cohesion 2007-2013 all support the development of eco-innovations.

3. Development trends in Central and Eastern Europe

For many years the CEE countries functioned in a system without economic freedom and a democratic system of governance. Their economies were highly inefficient, they caused excessive consumption of resources and generated substantial amounts of pollutants, contributing to the emergence of areas with a substantially degraded environment posing danger to the health of the persons which inhabited them. At the same time, CEE is characterised by high biodiversity and extensive areas with natural values.

Transition

The process of political and economic transformations started in 1989, with the aim of replacing the totalitarian political system by a system based on the principles of democracy, the rule of law, civic liberties and respect for human rights, and the centrally planned economy by a market economy based on private ownership and competition rules. The New Member States of the EU are the countries which are most advanced in the transition process. In the first phase of the reform, each of these countries experienced deep

recession, reflected by a drop in production, a breakdown in mutual trade (within the area of the former COMECON), inflation (hyperinflation in certain countries) and mass-scale unemployment. The dozen or so years of the transition set market-based mechanisms in operation (including liberalisation of prices and foreign-exchange rates, closure of unprofitable enterprises, restructuring of the banking system (the independence of the central bank). They triggered entrepreneurship (e.g. as a result of the building of the capital market, the protection of ownership rights and the introduction of the economic freedom), a substantial increase in the share of private enterprises (through privatisation and demonopolisation of a number of industrial branches) and a reorientation of trade (towards ties with Western Europe or Scandinavian countries). Civil society institutions began to be established and social activity was triggered; but, at the same time, many persons are unable to cope with the new situation. The social cost of the transition is a drop in the sense of economic and social security. The closure of enterprises and the liquidation of state-owned and co-operative farms brought mass layoffs and unemployment, which are of structural nature in most countries. The society became stratified, with income differences deepening and poverty areas growing.

A favourable effect, caused by economic recession and observed in the early 1990s, was a fall in pollutant emissions, particularly those into the air. The later reductions resulted from the restructuring of the economy, changes in the energy sector, which consisted, e.g., of the improvement in the efficiency of fuel use and/or the replacement of fuels and raw materials by less environmentally harmful substitutes as well as from the new directions of environmental policy.

Integration

On 1 May 2004, the European Union was enlarged with 10 states, including 8 countries in Central and Eastern Europe. Bulgaria and Romania signed their Treaties of Accession and will become EU members on 1 January 2007, provided that they meet the conditions set out in the Treaties. It can be said that the entire transition period is a process which prepares the states for their integration with the EU, but it does not finalise the process of necessary reform. As a result of restrictive monetary policy, inflation was kept a low level (except for Romania). Tax systems were changed, introducing indirect taxes (with VAT having the greatest significance as a source of budget revenues). The countries in transition are characterised by the highest GDP growth rate among European countries; the main contribution comes from exports (the elimination of trade barriers – in connection with the entry into the Single Market – is favourable for export growth) and domestic demand (primarily individual consumption). Economic and political stabilisation contributed to investment growth, mainly the growth of foreign investment, which plays an important role in

the economic development of countries having very little capital of their own. The effect of the economic reform carried out is a large share of the private sector in the economy. Despite the advanced process of transition, certain problems related to the functioning in different political and economic realities have not been solved yet, while as the time passed new problems emerged. The problems experienced by most CEE countries include the bad situation of public finance (a high level of budget deficit, public debt), high unemployment (particularly in Poland and Slovakia), income differentiation among regions and the growing range of poverty.

Economy

The countries of Central and Eastern Europe are characterised by the fastest GDP growth rate, but, at the same time, by low per capita GDP levels, much below the average for EU15. A measure of success for politicians from EU Member States in CEE is a fast GDP growth so that in the timeframe of 10 to 20 years they could achieve levels close to those of the poorest EU15 countries, and perhaps even come close to the Community average. Still, the questions as to how this goal is to be achieved and what are to be the social and environmental costs of its achievement are not so clear as the goal itself. To what extent will this path more or less copy the path travelled by the EU15 countries in the second half of the 20th century and to what extent will it be characterised by an innovative, novel approach? This may mean basic changes in the structure of the economy, serious changes on the labour market and social problems, and thus different pressures on the natural environment and its resources. An essential unknown factor is whether the political system will be able to accept this short-cut path.

The membership in the EU is not a guarantee of quick and sustainable external convergence; still, it is an opportunity for the development of trade, the influx of capital and assistance funds from the EU. When supported by a clearly defined long-term development strategy – a sustainable strategy – it may bring an increase in investment in the sectors of advanced technologies and high productivity. The measures and institutional arrangements supporting competition, which are, however, provided in advance and have sustained nature, are a factor which encourages entrepreneurs to improve their efficiency through better technological or organisational solutions.

Dematerialization of production and consumption becomes particularly significant; this involves the limitation of material flows in the economy. It is especially important for CEE countries, since their productivity is lower by a multiple factor compared to the EU15 countries.

Energy

The energy sector is the most important sector of the economy which conditions economic growth and efficient functioning of the state and, at the same time, poses a serious danger for the environment. For CEE countries, this is a particular challenge, in the light of the need to build a new strategy on energy supply, which must reconcile the substantial capacity to improve energy efficiency with higher demand for energy services in dynamically developing economies, with growing needs of consumer societies, while having to change the concept of security of energy supply of the countries, and with increasing requirements of environmental protection, particularly the protection of the global climate.

Transport

This sector is particularly important for sustainable development, since the dynamic growth of individual motorisation and the growing dependence of the economy and society on road transport may hamper its achievement. For CEE countries, which have preserved many solutions characteristic of sustainable development (e.g. the well-developed rail network in several countries, a significant share of public transport in passenger transit), although they dynamically lose in importance, the choice of a strategy on transport development is especially complex and difficult. The first important step is to change the approach and recognise that the purpose of transport policy is not to build infrastructure, but to manage and satisfy the demand for transport services. Without this change all the other efforts will only be of cosmetic nature. Calculations must be carried out for the efficiency of the disbursement of resources on new transport infrastructure compared with their spending in other areas (e.g. the Internet for everyone), which possibly may bring greater and better social effects with the assumption that sustainable transport needs would be satisfied. Indeed, the aim is to shape sustainable mobility rather than uncritically satisfy transport needs without affecting their rationale. Given the so-called substantial “underinvestment” in CEE transport infrastructure, EU and domestic politicians exert a strong pressure to ensure that it is built, particularly new roads, i.e. motorways and expressways, which is a catchy political message, especially with entrepreneurs. It is particularly difficult to act against these tendencies.

Cities

The concentration of the population and business in big cities, along with the frequent decline of small towns and the uncertain position of medium-sized towns, is a characteristic feature of CEE countries. This leads to urban sprawl, exerting strong pressures for the development of centres and suburban areas (chaotic economic activity, supermarkets, isolated housing estates), leading in turn to their takeover of more and more valuable natural and cultural

areas on their outskirts. At the same time, unemployment and the percentage of marginalised population grow; there are no prospects and no resources to meet the basic requirements in the scope of broadly conceived infrastructure. This also leads to their unsustainable development, although in a different way than in big cities.

Rural areas

The challenge faced by CEE countries is to develop and then to implement an integrated policy of sustainable development of rural areas, including forest areas. On the one hand, there are strong grounds for this as a result of the rich biodiversity, the reduced scale of intensive agriculture, the riches of authentic culture; on the other hand, there are more and more dangers arising from the need to cope with competition from the EU15 countries, particularly in agriculture, and the growing fragmentation of landscapes as a result of the development of transport infrastructure, particularly roads.

Society

The demographic trends for both EU15 and CEE countries show falling tendencies. The number of inhabitants falls and societies age. In consequence, reforms of the social security systems will be needed. Despite this similarity, there are differences between the CEE members of the EU and the EU15 countries. These societies are fairly young and dynamically learning, with much lower incomes and living standards. Despite the substantial progress in recent years, the quality of the natural environment and hygienic standards are unsatisfactory. To date, the influx of immigrants into these countries has not been a problem, while many CEE inhabitants leave for the EU15 countries on a temporary or permanent basis looking for jobs – well-paid jobs. The levelling out of the quality of life standards between CEE and EU15 is an essential, though long-term process contributing to the building of sustainable development in Europe.

An important issue for CEE countries is the further development of democracy through the adoption of modern procedures and democratic institutions, which will gradually transform the “ordinary” majority democracy into the so-called “enhanced democracy”, respecting to a greater extent the rights of diverse social minorities and enhancing citizens’ participation in the broadly conceived political process. This includes the functioning of central representative institutions, the institutions guaranteeing the freedom rights of particular social groups, minorities and individual (citizens), local governments, the rights and procedures of public participation in preparing and taking decisions at different levels, the right to information, the right to control authorities, the principle of subsidiarity, the consultation procedures, the procedures for co-operation between the governmental and non-

governmental sectors, the institutions for public involvement in the organs of power and finally if it necessary to justice.

One of the essential differences between the new and old UE countries is the consumption level. There is a serious danger that despite the improvement of the productivity level the pressure for CEE countries to come closer to the consumption levels of the EU15 countries will cause a substantial increase in used resources and released pollutants.

Environment

The CEE economies continue to bear the consequences of the Communist regime and centrally planned economy, focused on the heavy industry and the extraction of raw materials. The years of transition saw the reduction of pressures on the environment; however, these countries continue to be the worst polluters in Europe – primarily the Czech Republic, Poland and Hungary, which emit substantial amounts of CO₂. As indicated by the modelling results, the measures under the strong scenario, mainly the imposition of emission caps and the introduction of the carbon tax, will importantly reduce CO₂ emissions, but hard coal will still remain a significant energy carrier (mostly in the Czech Republic and Poland); although one should expect the introduction of “clean” coal technologies and the promotion of cogeneration. The measures under the strong scenario also lead to the substantial reduction of material and energy intensity of the economy – thus, the efficiency improves. The structure of energy carriers also changes – there is a departure from coal and oil and the significance of RES grows, but the share is still extremely low.

The quality of the environment improves farther, except for the adverse impacts of transport growth. The conservation of biodiversity becomes a particular challenge, particularly on Natura 2000 sites, and so does the prevention of degradation of the urban and suburban environments.

The efforts for integration with the European Union – the approximation of national legislation to EU law – were favourable for economic growth, facilitating international trading, the influx of foreign direct investment and the possibility of using assistance programmes. The process of investment into environmental infrastructure began, with the aim of making up for the substantial delays in this range. The resource management efficiency was substantially improved, the generation of many pollutants was limited and the process to improve the state of the environment was launched. The domination of thinking in terms of economic growth and materials consumption leads to the generation of new dangers to the environment and human health. The building of excessively consuming societies, mass-scale motorisation, growing amounts of waste, urban sprawl and failure to consider the needs of nature

conservation (including Natura 2000 sites) are all new challenges facing sustainable development.

Economic and social problems most often overshadow environmental problems, while the aspects of environmental protection tend to be regarded as factors impeding development. The membership in the European Union imposed the obligation of involvement in the pursuit of goals and the implementation of economic, social and environmental guidelines as set out in strategic documents, primarily in the Lisbon Strategy and the Sustainable Development Strategy. The challenges facing EU Member States include e.g. economic growth and employment, combating poverty and social exclusion, preventing climate change, reducing pressures on the environment, developing new energy- and material-efficient technologies, the competitiveness of the European economy and sustainable transport. These ambitious goals require long-term action programmes and policies, both at Community and national levels.

4. Research questions and policy measures

Given this range of processes on the Member State and EU level, the **MOSUS project** falls into a time of dynamic changes in and revisions of European economic, environmental, sustainable development and energy and transport policies. With its main objective to quantitatively assess the impacts of key environmental policy measures on natural resource use (materials, energy, land use) on the one hand and economic (and social) indicators on the other hand, the MOSUS project directly connects with a number of core issues of the current policy agenda.

In light of the revisions of both the Lisbon Strategy and the EU SDS and the need for further harmonisation of the two, most important **policy questions** to be answered by MOSUS are:

- To what extent can environmental policy measures oriented towards higher resource and energy efficiency support the Lisbon goals of growth, competitiveness and employment?
- Can win-win situation be identified, where a set of policy measures improves both the environmental and the economic situation?
- Which (mix of) policy measures are best suited to reduce environmental pressures with regard to energy and emissions, materials and land use?
- Are there trade-offs between the different environmental categories or are policy measures reducing pressures across all three categories at the same time?
- What are the impacts of the implementation of environmental policy measures for other world regions?

In Work Package 1 of the MOSUS project, trends for the baseline scenario and policy measures for the two sustainability scenarios were identified for six separate policy fields: socio-economic driving forces, technological change, resource use, land use management, consumer behaviour and unemployment/social exclusion. Based on these scenario components, story lines for the three scenarios were developed and synthesised in a matrix of policy measures for the different issues, which were regarded as highly important by the consortium members (see document on integrated scenarios for details).

From this matrix, the consortium selected **six** (groups of) **policy measures**, which could be implemented in the model simulations. All these measures aim at increasing material and energy efficiency (see Table 1).

Table 1: The six policy measures implemented in the low and high sustainability scenarios

	LOW	HIGH
(1) Technical Change	Assumptions taken from CISEP report for selected sectors	
(2) Higher Transport Costs	+5% until 2020	+10% until 2020
	Based on LSE report	
(3) (a) Higher levels of material recycling	0.1% per year	0.3% per year
(b) Higher efficiency of non-metallic minerals	0.2% per year	0.4% per year
(4) Higher material productivity in sectors 1-14 (Aachen scenario)	10%	20%
(5) (a) Higher R&D of Firms	Subsidised with 1% of public consumption between 2006 and 2010	
(b) Technical Progress	Total factor productivity (excl. labour productivity) increases by 0.15% per year	
(6) Emission trading	Target: Kyoto	Target: IPCC
(a) Change of Consumption Structures	Based on WIFO model	
(b) Higher CO ₂ prices in 2020	40 €/t	120 €/t
(c) Higher Share of Biofuels in 2020 (exog.)	8-10%	15-20%

The selection of policy measures was restricted to those variables, which could be exogenously changed in the GINFORS model. A number of key sustainability policies from the initial matrix could therefore not be considered in the model simulations. These comprise the following issues:

- *Regional and cohesion funds*: changes in the distribution of these substantial EU budgets, subject to strategic environmental assessment and plans

- *Common agricultural policy*: further shift of subsidies from production levels towards support for organic production and landscape maintenance.
- *Trade policy*: integration of social and environmental standards in trade agreements; certification schemes to foster sustainable exploitation of agricultural and forestry land and water resources in non-EU countries; special treatment for developing countries in the WTO
- *Fiscal policy & subsidies*: tax reductions for renewable energies & fuels; kerosene tax; support for recycling activities and for development of new eco-efficient technologies and materials
- *Land use management*: policy measures to support nature/landscape conservation and multi-functional landscapes and to limit urban sprawl and to promote sustainable transport; local organic agriculture supply schemes; national support schemes to preserve cultural heritage; promotion of non-economic forest use (tourism, protective function, GHG sink)

5. Scenario results from a policy perspective

A number of important guidelines for identification of SD policies can be extracted from the results of the MOSUS scenarios. Thus, in this section, the main results of the simulations shall be summarised from a policy perspective.

Triple-win situations → implement the high sustainability scenario!

The scenario simulations revealed that the implementation of the above described packages of sustainability policy measures leads to improvements of indicators in all three sustainability dimensions.

Economic performance of the EU-25 increases, with GDP per capita in 2020 being around 4% higher in the high sustainability scenario in comparison to the baseline scenario. Improved competitiveness of European industries increase goods exports in many Member States, while imports show a marked decline. Government consumption and investment declines, leading to a reduction of average share of government expenditure in GDP, while private investment grows in the sustainability scenarios.

At the same time, the environmental performance of Europe improves dramatically. CO₂ emissions decrease sharply in absolute terms and both scenarios meet the EU Kyoto targets by 2010. Growth in Total Primary Energy Supply (TPES) can be reduced by 10% in the high scenarios compared to the baseline; however, absolute levels in 2020 are higher than in 2005 in all three scenarios. The share of renewables in TPES strongly rises to 11% in 2020.

Domestic material extraction shows an absolute reduction by around 3% in the low and 7% in the high scenario.

Finally, unemployment in the old Member States slightly rises until 2010 and then decreases towards the 2005 levels in 2020, with the high scenario leading to the most positive results.

Based on these findings, it can be concluded that the implementation of policies primarily geared towards decoupling economic activity from material and energy throughput can actually be conducive to economic growth, contrary to the popular assumption that such policies will mainly raise costs for enterprises, decrease competitiveness and thus have an opportunity cost in terms of reduced economic performance. MOSUS scenario results support the view expressed in several documents by DG Environment and other institutions (for example, European Commission, 2005a) that increasing resource and energy productivity can actually improve the position of European industries on world markets and thus also lead to the creation of new jobs. From this perspective, environmental policy becomes one of the key strategies to reach the Lisbon goals. Thus, the main policy recommendation to European policy makers is to implement the policy measures indicated in the high sustainability scenario.

Considering the fact that economic growth is higher in the sustainability scenarios than in the baseline scenario, a potential remains to implement environmental policies with even more restrictive character and to reach more ambitious environmental targets (such as an absolute reduction of Total Primary Energy Supply and further reduction of domestic material extraction) without harming economic performance compared to a baseline scenario.

Policy measures largely differ in effects

The different policy measures implemented in the two sustainability scenarios largely differ in their effects on economic and environmental variables.

The positive economic effects mainly stem from the implementation of the so called “Aachen scenario”, in which Member State governments introduce an information and consulting programme to increase material efficiency in the manufacturing sector. This measure stimulates growth through productivity gains that drive prices down and increase profit margins. With the exception of positive returns to public R&D investment in some Member States, the Aachen scenario is the only component of the low and high scenarios to increase output. This growth is largely attributable to (i) increases in net exports, which are indicative of the improvement of international competitiveness of the EU manufacturing sector, and (ii) increases in household consumption. At the same time, however, this remarkable increase in

output deteriorates the environmental performance, as rebound effects overcompensate for efficiency gains (see below).

The most positive environmental effects can be observed through the implementation of the very restrictive carbon tax, which has a weak negative effect on real GDP and employment, but strongly reduces environmental pressures with regard to CO₂ emissions, energy consumption and material extraction through a sharp increase in fossil fuel prices. Decreases in material extraction result from the slowing down of economic growth and consequently the economic variables, which determine material extraction.

All other measures have significantly less effect on overall results.

Materials-energy-emissions: no environmental trade-offs

Except from the Aachen scenario, all policy measures show positive environmental effects on the cost of economic growth. Policy package 3 (higher resource efficiency of non-metallic minerals and higher recycling of metals) is the only one, which is only effective in the category of material extraction, but has no feedback to the economy and the energy system of the model.¹ All other measures reduce at the same time levels of material extraction, energy supply and CO₂ emissions, thus highlighting that there is no trade-off between increases of material and energy efficiency.

Economic sectors: winners and losers

The environmental policy measures implemented in the two sustainability scenarios also show very diverse effects on the development of different economic sectors. Sectors associated with the domestic extraction and supply or production of materials and energy (i.e. mining and quarrying, electricity, gas and water supply, oil refining) or material- and energy-intensive production (e.g. iron and steel making) have to 'take pain' in the low and high sustainability scenarios in terms of output and investment. On the other hand, the increase in productivity and competitiveness brought about by the Aachen Scenario lets the manufacturing sector actually increase its overall share in total gross value added in the high scenario, overcompensating the shrinking of primary sectors.

Regional disparities: old vs. new member countries

Considerable regional disparities in the effects of the low and high scenarios can be observed. In comparison to the baseline, the basket of policies introduced is more beneficial

¹ This is due to the fact that the material models are not fully integrated with the economic (and energy) system, but only receive information on economic variables, which determine the level of material extraction.

to growth in the 'old' EU-15 than in the new Member States. However, absolute growth remains higher in the new Member States, so the scenario is not significantly detrimental to the convergence of EU-25 wealth (although absolute differences remain large, with ACC-10 income being less than one fourth of average EU-15 income in 2020). The positive impacts on growth of the low and high scenarios in the new member countries is in large part a reflection of impacts in the Czech Republic and Hungary. In these two countries, the Aachen scenario could be simulated, as detailed input-output tables on the sectoral level were available. Where this part of the policy basket had to be left out, the scenarios either have a small positive or a small negative effect (e.g. in Poland). This highlights the importance of the implementation of programmes to increase resource productivity as a growth stimulating strategy.

Rebound effects

Considering this growth stimulating effect of policies targeted at increasing resource productivity, the scenario simulations also revealed that these policies must be accompanied by other measures, if ambitious environmental improvements should be achieved.² In the MOSUS scenarios, the carbon tax had the most upward pressing impact on prices. The first order effect of a significant rise in the price for fossil fuels entailed significant second order effects in the whole economic system, as higher fuel prices have an impact on production costs in many branches, in particular in material and energy intensive primary sectors. These second order effects not only reduced fossil fuel consumption, but also had a negative effect on output growth and thus indirectly also on material extraction.

In general, it can be concluded that programmes of resource productivity increases on the micro level do not guarantee reduction of material and energy use on the macro level, as savings in material productivity are overcompensated by growth in production volumes due to rebound effects. Balanced achievement of economic and environmental targets thus demand for an additional correction of resource prices, in the form of a carbon tax, a material input tax or other fiscal measures (see also chapter 6).

² However, in some countries of the model system, in general small economies such as Austria, Denmark, Finland and Greece, the Aachen scenario alone lead to both increases in growth and improvements in the environmental indicators of material extraction, energy use and CO₂ emissions.

Unresolved problem areas

Although the overall results from the two sustainability scenarios are promising in terms of positive effects for the economy as well as the environment, some important unresolved problem areas remain, which have to be tackled by additional policies:

Sustainable production and consumption patterns

Although the implementation of the basket of policy measures resulted in a significant improvement of the environmental performance of the European Union (in particular, with regard to achievement of the Kyoto targets), results remained still insufficient with regard to material and energy consumption. The transformation of the European economy towards environmentally sustainable production and consumption patterns requires absolute reductions in energy supply and consumption as well as higher absolute dematerialisation than achieved through the implemented policies. This received particular urgency in light of the ascent of the newly industrialising economies in the South (such as China, India and Brazil), which rapidly increase their per capita levels of material and energy consumption, thus putting rapidly growing additional pressures on the global ecosystems.

International externalisation of environmental burden

Faster dematerialisation of the European economy also becomes essential, as in the model only data for domestic extraction were available, but no physical data on imports to Europe from other world regions could directly be included. Considering rising resource-intensive imports in monetary terms until 2020 (see the environmental evaluation report), it can be assumed that the overall reduction in material consumption of Europe is much less pronounced. Further environmental policies thus must take into account Europe's global environmental responsibility and should be targeted at reducing negative environmental impacts along the whole life-cycle of a product (including ecological rucksacks in other world regions induced by European consumption).

Transport

The energy consumption of the transport sector increases significantly in all three scenarios, thus expanding its share in total energy consumption from around 11% in 2005 to around 19% in 2020 and contributing notably to the overall growth in Total Primary Energy Supply (TPES). Even in the high sustainability scenario, road traffic is expected to increase by 29% between 2005 and 2020, air transport by more than 170%. As the EEA (2005) points out, decoupling between GDP and transport has been marginal in the past years. With regard to passenger transport, people tend to spend a constant share of disposable income on transport, with a shift towards more frequent and faster (air) travels. Growth in freight

transport has mainly been caused by further liberalisation of the internal market, leading to relocation of production processes with additional transport demand. Therefore, additional policies are required, which are specifically targeted at reducing transport demand and supporting a shift towards more environmentally benign transport modes (see also chapter 6 below).

Unemployment

Rising unemployment is one of the core social problems in the European Union. The scenarios of the MOSUS project revealed that the mix of (mostly) environmental policy measures is not suitable to significantly reduce the level of unemployment.

The sustainability scenarios accelerate structural changes in the economy, which is likely to increase the frictions in labour markets, for example by lowering the ability to match vacant positions and unemployed people. If so, the sustainability scenarios could lead to a reduction in wages and an increase in involuntary unemployment. Reduced wages spread to the consumption levels also to the non working parts of the population, thereby enhancing the risk of social exclusion. Since the sustainability scenarios do not perform better or worse than the baseline scenario when the effect of a higher rate of structural change was not taken into account, the effect of the sustainability scenarios on social exclusion is therefore likely to be negative. However, a lower tax rate may mitigate the increase in unemployment and still contribute to an increase in governmental expenditures. The governments may then use a higher share of their income to support people at risk of social exclusion.

Thus, the lessons that can be read out of the past seem to be appropriate also for the future. The question of avoiding social exclusion is, first and foremost, a political question; additional policies are needed to attract more people into employment and modernise social protection systems, while increasing the flexibility of labour markets and invest more in human capital through better education and skills, as laid out in the Commissions Plan to stimulate the Lisbon process (European Commission, 2005f).

6. Specifications of scenario measures

Several scenario measures within the two sustainability scenario packages have been implemented without clear definition of policy instruments, which would lead to the assumed consequences (see Table 1 above). This holds in particular true for the following scenario components:

1. Higher de-coupling of extraction of construction minerals from economic growth
2. Higher recycling rates of metals
3. Higher share of biofuels

Therefore, in this section, links to ongoing policy initiatives on the EU level shall be established, which could support the achievement of these scenario components.

De-coupling of extraction of construction minerals from economic growth

Resource consumption in the construction sector is vital to society's total resource consumption. Therefore, future developments in the construction sector will have wide-ranging implications for total amounts of primary extraction of materials. Construction also generates large amounts of waste.

The EU Commission recently adopted its Urban Thematic Strategy (European Commission, 2005e), where sustainable construction methods and techniques are one of the key issues. One of the central objectives of the strategy is to integrate sustainability principles into the practice of design, construction, maintenance and management of buildings. As the interim document for the Strategy stated, the use of more sustainable construction materials could have a considerable positive impact on the environment, while having direct cost reduction implications for the end user as well as positive consequences for the health of the inhabitants. However, more sustainable construction has an extra value, which markets currently in general are not willing to pay for. Thus, policy intervention is needed in order to redirect the construction sector towards increasing resource and energy productivity. While the final version of the Strategy is missing any concrete suggestions for policy instruments, this interim report states that both top-down policy measures as well as bottom-up market initiatives are to be considered.

Suggested policy instruments include:

- Standards for sustainable construction to be fulfilled by all publicly funded construction projects
- Funds and subsidies to support new resource-extensive solutions and the development of new eco-efficient and renewable building materials (for example, within the European Framework Programmes for research and technology development)
- Public procurement to set an example in terms of more sustainable construction
- Taxes and other regulatory mechanisms at the EU, national and regional levels to help motivate actors in the construction industry to achieve these goals (see also below)
- Urban planning instruments to make sustainability standards a condition for construction permits.

Several EU Member Countries (Sweden, Denmark and the UK) have recently started to implement taxes on aggregates, such as sand and gravel. As demand for construction

minerals is rather price inelastic, at least in the short term, introduction of these taxes had a greater fiscal effect than an environmental effect so far (Söderholm, 2004). However, in the longer-term, investment activities should be negatively affected by such taxes on the rent in the sense that marginal projects become uneconomical, in particular when the tax level is continuously rising.

If the EU aims to achieve higher material and energy efficiency in the construction sector, the above described mix of standards and regulatory instruments, taxes and subsidies as well as extended planning instruments have to be implemented.

Higher recycling rates of metals

In the past few years, world metal markets saw a steep rise in prices for all metals, in particular caused to rapidly growing demand from emerging economies, in particular China. As prices are expected to remain high, although more stable (AIECE, 2005), recycled metals will increase their competitiveness in the future.

There exists also a range of policy options that could further enhance metal recycling. These include (see Joint Study Group, 2003):

- Pursuing flexible approaches to formulating recycling policy that balance regulatory measures with market based incentives appropriate to local conditions,
- Encourage the creation of collection and recycling infrastructure through the provision of financial and technical assistance,
- Facilitate the sharing of experience on aspects such as materials flow management and recycling policies,
- Facilitate trade in international recyclable materials through addressing trade distorting policies that affect the flow of recyclables.

Higher share of biofuels

One of the main energy policy targets of the EU is to double the share of the Renewable Energy Sources (RES) in gross inland consumption, from 5.4 % in 1997 up to 12.0% by 2010. These targets are in line with the assumptions of the high sustainability scenario in MOSUS. Various legislative actions have been undertaken in order to facilitate this target, the most important of which are:

- to promote the renewable electricity generation by increasing the production from 14 % in 1997 up to 21% by 2010 for EU 25 corresponded to 22.1% for EU 15 (Directive 2001/77/EC).
- to promote the biofuels for transport applications by replacing diesel and petrol up to 5.75% by 2010 (Directive 2003/30 EC) with the accompanying detaxation of biofuels (modification of the taxation of energy products and electricity directive 2003/96/EC)

The Communication on “The share of renewable energy in the EU” (European Commission, 2004b) concluded that further efforts - in particular in the biomass sector - are needed in order to achieve the above policy objectives. On the Member State level, policy measures include feed-in tariffs, green certificates, market-based mechanisms and tax exemptions. On the Community level, measures include support for energy crops within the Common Agricultural Policy, facilitate financing of green energy projects through the European Investment Bank, foster research on the European level (6th and 7th Framework Programme on Research and Technology Development) and bridging the gap between successful demonstration of innovative technologies and their effective entrance on the market to achieve mass deployment. The EU will have to strengthen the implementation on both the Member State and the EU level of the policy initiatives listed in its various proposals for renewable energy strategies, if the set targets should be achieved.

7. Additional policy measures to improve results

In the different scenario components elaborated in Work Package 1 of the MOSUS project, a large number of policy initiatives and instruments were listed as a basis for the definition of the low and the high sustainability scenario. As mentioned above, only a small number of instruments could actually be considered in the modelling exercises, mainly due to limitations in transforming qualitative information in quantitative variables for the model and in available data.

Therefore, the aim of this sub chapter is to revisit these scenario documents and summarise those policy measures, which are crucial for improving the environmental situation in the European Union as well as for supporting the broader transformation towards a more sustainable society in Europe (and beyond). Here, these policy measures will be grouped in separate (sectoral) policy fields, while the next sub chapter will emphasise the need to integrate policies for the implementation of a coherent set of measures.

Energy

High energy consumption in Europe is one main driver for environmental problems in Europe, contributing significantly to air pollution, waste generation, change of landscapes, etc. In contrary to the trends in CO₂ emissions, total primary energy supply is expected to increase in both sustainability scenarios. More efforts are therefore required to reverse this trend. As the instruments of fossil energy/CO₂ taxes as well as support for renewable energies are already included in the scenarios, other key aspects in energy policies must come to the fore. A general shift of supply side policies in favour of demand side policies, combined with the shaping of energy-saving consumption models is needed.

One key aspect are efforts to increase energy efficiency, which the EU pursues as one of its environmental top priorities. Major driving forces behind this objective are energy security, energy cost savings, increasing competitiveness, climate policy and job creation. To these ends, the EU has taken many initiatives in different areas. Some are already implemented by Member State, but most are in the status of the process of implementation and of discussion at the Council. Hence, there is not one single energy efficiency communication or initiative or directive, but it is rather an interlinked and multi-step-approach.

These policy programmes and directives include, among others:

- Green Paper on energy efficiency
- Framework programme "Intelligent Energy for Europe"
- Promotion of end-use efficiency & energy services
- Energy performance of buildings
- Efficiency in energy using products
- Eco-design for energy-using appliances

A number of key policy measures to support the increase of energy efficiency is mentioned in these documents. Achievement of targets will greatly depend on the extent to which these instruments are implemented both on the Member State and the Union level. We would recommend to focus on the following measures:

- Public sector procurement: third-party financing contracts and energy performance contracts; purchasing of low-energy products and vehicles
- Energy services: establishment of energy services as an integral part of the distribution and/or sale of energy to clients
- Financial instruments: repealment or amendment of legislative provisions and national regulations which hamper or restrict the use of financial instruments and contracts for making energy savings on the energy services market
- Energy audit schemes: development of high-quality energy auditing systems aimed at determining which measures can be taken to improve energy efficiency and which energy services it must be possible to provide, and to prepare for their implementation
- Transparency for end-users: ensuring that end-users are provided with competitively priced individual metering and informative billing that reflect their actual energy consumption

Full implementation of the Environmental Technology Action Plan (ETAP) (European Commission, 2005b) along with the development of renewable energies as described above

could also be a key factor to ensure basic energy supply in rural areas and small towns, oriented at small-scale energy supply systems, which are based on local or regional supply sources and energy raw materials.

Transport

Considering the current unsustainable development trends in the transport sector (see also above), the major transport policy objectives have to be:

1. significant decoupling of transport growth from GDP growth in order to reduce congestion and other negative side-effects of transport, in particular through reducing transport needs and
2. bringing about a shift in transport use from road to rail, to water (however, environmentally risky especially in the river valleys covered by Natura 2000) and to public passenger transport.

A number of key policy measures and instruments are mentioned in the EU White Paper on future transport policy (European Commission, 2001b). The most important instruments are:

- Introducing a framework for transport charges (“road pricing”) to ensure that prices for different modes of transport, including air, reflect their costs to society.
- Harmonisation of fuel taxation for commercial users, in particular in road transport.
- Give priority to infrastructure investment for public transport and for railways, inland waterways, short sea shipping and intermodal operations.
- Improve transport systems by addressing missing transport links, developing open markets and co-operation at EU level (e.g. railway liberalisation, air traffic systems).
- Building the trans-European network, with focus on removing bottle-necks in the railway network and in the road network in frontier regions to accession countries.

Reorientation of EU transport policy towards sustainability objectives requires the implementation of these instruments, in particular road pricing together with higher and harmonised taxation of fossil fuels. This could realise the repeatedly claimed aim of fully reflecting the costs of transportation activities to society and will significantly increase costs of both passenger and freight transport. As a consequence, this could reduce private demand for car and air transport and increase demand for alternative modes of freight transport. Together with a strong public support for investments in infrastructure for public transport and for railways and inland waterways, a shift in the overall structure of the transportation system could thereby be achieved. Furthermore, growth in the service sectors and high value added manufacturing activities in the EU economy could contribute to the overall reduction of transport activities, as these sectors are less freight intensive than the

more traditional basic manufacturing and extraction activities. It is in the core of a new policy for urban areas to foster the building of more compact cities.

Agriculture and forestry

Agriculture in the countries of the European Union is strongly determined by the principles and support schemes of the Common Agricultural Policy (CAP), on which nearly half the EU's annual budget is allocated. The main goals of future EU agricultural policy from a sustainability perspective are:

- Promotion of multifunctional landscapes, both for forestry and agriculture, with farmers and foresters increasingly viewed as countryside managers, guaranteeing preservation of landscapes for their nature conservation, aesthetic and cultural values.
- Promotion of production of energy crops to support EU efforts for reduction of fossil fuel dependency and consumption and foster rural job creation.
- Extensification of production systems, both in agriculture and breeding, in order to reduce pressures on the natural environment and to ensure the efficient functioning of life-sustaining natural systems and the preservation of biodiversity at all the four levels: genetic, species, ecosystem and landscape.
- Increased quality of food products and the expansion of the share of organic products in total production.

Achievement of these goals will require further reform of the CAP, with a focus on subsidies to be transferred from agricultural production to environmental objectives (agro-, forest-, water- environmental schemes) aiming at maintaining a diverse agricultural structure (including energy crops) and supporting a shift towards aspects of food safety and landscape maintenance.

Reductions of direct payments for bigger farms are foreseen through the mechanism of "modulation". It refers to the transfer of funds from farming subsidies to agri-environment and other development schemes and is applied to farmers with annual subsidies over 5000 EURO. However envisaged reductions are relatively small and individual big farms with large land ownerships will still receive substantial amounts of transfers. Further reductions to these individual large farms are recommended to gain acceptance of the general public for sustained levels of support for the agricultural sector.

Furthermore, stimulating organic agriculture will require active support through promotion and information campaigns, ensuring traceability and organic food authenticity, harmonisation of control procedures and accreditation and funding of research in organic farming.

For Central and Eastern European countries, the developments towards extensification of production systems and organic agriculture could imply that today's relatively energy and material-extensive production forms will be maintained, transforming the agricultural sector towards sustainability without going through the phase of highly industrial agriculture with high material and energy inputs.

In contrast to agricultural policies, which are primarily decided on the EU level, current forest policies and its institutions are mostly developed and applied on a national level. The overall objective from a sustainability point of view is towards a multifunctional management in which nature conservation plays an equally large role as wood production. A promotion of certification schemes, which certify that forest have been managed in a sustainable way, are considered to enhance marketing opportunities from producing and selling an environmentally friendly product.

The increasing relevance of international trade includes growing volumes of agricultural and forestry commodity flows. In this way Europe's land use is influenced indirectly by potential external land resource uses to satisfy domestic consumption demand. Today trade volumes in the EU25 are significant amounting to more than 40% of total agricultural and forestry production³ and have increased over the past two decades with annual increase rates of nearly 3 percent. Currently two thirds of the EU25 territory, some 260 million ha, are in use to produce agricultural and forestry products. At the same time some 105 million hectares of land are estimated to be used outside the EU25 territory to produce commodities for imports into the EU25. Traded volumes are expected to grow further in the future. This calls for a whole range of certification schemes and fair trade arrangements to avoid potential externalization of harmful environmental impacts.

Industry

Sustainable industrial production will require higher de-coupling of material and energy use as well as of the generation of waste and emissions from economic output than achieved in the two MOSUS sustainability scenarios. Energy efficiency initiatives, such as described above, along with higher taxes on fossil fuels will be one cornerstone of more sustainable industry policies and set incentives to increased substitution of bio-resources for non-renewable raw materials in production chains. Another key issue is the development of new technologies, such as micro technologies, new process technologies and new high-tech materials, which have the potential to significantly reduce the amount of raw materials needed for manufacturing purposes. In particular EU research policy is demanded to devote

³ This figure includes both trade between EU25 countries and with third countries.

sufficient resources to these areas of technological development in the upcoming 7th Framework Programme.

Another EU initiative playing a key role for industry is “Integrated Product Policy (IPP)” (European Commission, 2001c), which marks an important new stage in the development of new environmental policy approaches in the EU and is regarded as an integral part of EU’s efforts towards a more sustainable development. IPP addresses resource use and environmental impacts in an integrated way, taking into account all phases of a product’s life-cycle (from the ‘cradle to the grave’), as well as the roles of the different actors involved in it. The primary aim of IPP is to reduce the environmental impacts from products throughout their life cycle, harnessing, where possible, a market driven approach, within which competitiveness concerns are integrated. Although the potential of the IPP life-cycle approach for increasing energy and resource efficiency of products is undoubted, the EU is demanded to realise these potentials through an effective implementation of IPP-related policy measures.

Public procurement

Public procurement, accounting to over € 1,000 billion annually or about 14% of EU’s GDP (Gervais, 2002) is an often neglected instrument to reduce energy and material use. Such a large sector could play a leading role to boost innovation and development and encourage the offer/demand for environmentally friendly products and services, including eco-efficient products with low energy and material input per service unit. However, EU public procurement legislation guaranteeing fair access for suppliers sets limits on governments for attaching environmental conditions to their purchasing contracts. Furthermore, even within the limited scope to benefit the environment, any such criteria, at this stage, must provide benefits to the contracting authority rather than to the wider community.

On the other hand, by stipulating precise green requirements in the contract specification, authorities “could take into account the ‘environmental soundness’ of products or services, for example, the consumption of natural resources, by ‘translating’ this environmental objective into specific, product-related and economically measurable criteria by requiring a rate of energy consumption” (European Commission, 2001a). For the assessment of the most economically advantageous tender, the life-time costs of a product to be born by the contracting authority may be considered. To promote the case of higher energy and resource efficiency in public procurement, the legal framework allowing for governments to favour eco-efficient products and services should be utilised to its full potential.

Households – Sustainable Consumption

As demanded in Agenda 21 the developed countries - and thus the EU at the regional level - have to show leadership in changing unsustainable consumption and production patterns. To reach this goal is not only a question of scientific or technical improvement; it is foremost a question which values drive societal development and of political will to make the necessary changes. This means developing a wider vision of welfare, where satisfaction of needs, rather than consumption per se, is the aim.

Current government policy presumes that increasing levels of economic consumption are a pre-requisite for improving the quality of life. Research does not support this presumption. The relationship between material commodities and social well-being is much more complex than conventional policy suggests. A shift in government policy would be justified to place more emphasis on other contributors to quality of life, such as health, community engagement and meaningful work. Individual choices are constrained by a variety of social, institutional, and cultural factors. Consumers often find themselves 'locked in' to unsustainable consumption. Government plays a vital role in shaping the cultural context within which individual choice is negotiated through its influence on technology, infrastructure, market design, institutional structures, the media, and the moral framing of social goods (Jackson and Michaelis, 2003).

An effective government strategy for sustainable consumption will need to be developed on a collaborative basis with stakeholders. It will incorporate a wide range of measures, many of which have already been mentioned above. Key elements within that are:

- *Clean and eco-effective production* supported by (i) green investment; (ii) eco-innovation; (iii) eco – design; (iv) appropriate products standards and labelling programmes; (v) increasing market access for environmental goods and services; (vi) environmentally sound public procurement rules and practices.
- *Education for sustainable consumption and production* via (i) integrating knowledge of relevant consumption behaviour into curricula from pre-school to universities and in the concepts of life long learning; (ii) providing data for reliable information; (iii) report on indicators to shape consumption behaviour that can make a difference.
- *Information and public participation for sustainable consumption and production* including (i) a broader right to know; (ii) involvement of stakeholders into decision making or at least consultative structures; (iii) support and financing of participation structures; (iv) develop and provide effective transparent and verifiable consumer information tools relating to sustainable consumption and production.²

Most attention has to be given to the mobility, food, and housing sectors as they sum up to over 70% of all environmental burden caused by unsustainable production and consumption (Spangenberg and Lorek, 2002).

The requirements are similar for the European Union as well as for national policies. Thus the key elements necessary to achieve Sustainable Consumption and Production Patterns as outlined above have to be integrated into national sustainability strategies as well as national sectoral policies.

Urban and rural planning

The integration of sustainable development aspects into urban space management has to cover the whole range of economic and social processes, with the recognition that they must be underlain by the natural environment. Focal issues are

- an active national regional policy taking into account the need for ensuring equal development opportunities for small and medium-sized towns with respect to big cities;
- the adoption of sustainable development in urban management, both at the level of the vision and municipal economy, transport and construction as well as urban and architectural planning.

Despite of relatively small shares in total land area expansion of built-up land areas are significant from an environmental and sustainability point of view. Most countries today acknowledge the importance of growth in built-up areas and call for a more controlled spread of urban and infrastructure development. The European Union has included built-up area in its list of sustainable development indicators defined as the percentage of built-up land in total land area (European Commission, 2005c). However data on both current and historic built-up areas are scarce. Therefore monitoring of built-up and associated land area increases is considered to be an essential first step towards more controlled spread of built-up land. This is of particular relevance for the faster growing economies of Central and Eastern Europe.

8. Policy mix and policy integration

In order to achieve sustainable development in Europe (and beyond), a concerted action across all economic production sectors is required as well as a reorientation towards higher consideration of environmental (and social) aspects in private consumption and public procurement.

One key part of a successful sustainability strategy is the definition of (where possible, quantitative) targets. Existing policy commitments at the European level, including the recently presented Thematic Strategies within the 6th Environmental Action Programme, are

in general too vague and to a large extent missing any measurable policy targets. Missing targets and reliable indicators impede a proper evaluation of progress towards sustainability in the EU. However, the implementation of such longer-term environmental policy targets is a necessary precondition for achievement of higher decoupling of material and energy use from growth, as investments in innovative eco-efficient technologies require predictable future market framework conditions (EEAC, 2003).

An essential factor facilitating the implementation of sustainable development is the monitoring and evaluation of changes underway. Therefore, it is indispensable to continue the work on EU indicators for sustainable development (European Commission, 2005c), the application of which should be mandatory across the EU at three levels. At the nationwide level, allowing for comparisons to be made on the international stage and for communication with politicians and the public. At the regional level, with substantial specificity allowing for comparison of the degree of sustainability of the development in particular regions or on the scale of the entire EU in respect of its natural systems (e.g. the Alps or the Caucasus) or between regions within countries. At the local level with large specificity, in a division into indicators typical of the entire EU and characteristic of a given type of region (e.g. tourist regions), this would allow for comparisons within individual countries, regions in these countries, and for comparisons among different types of regions in the entire EU.

With regard to EU policy initiatives, environmental integration and environmental impact assessment process could be one core strategy to foster decoupling efforts at the European level and thus contribute to the implementation of the EU SDS, as they involve a number of key economic sectors responsible for large shares in EU natural resource and energy consumption and waste and emissions generation. However, what has been starting very promising under the term “Cardiff integration process” at the end of the 1990s, is now missing sufficient support from European institutions and environmental impact assessment is still not widely applied.

Sustainability requires the whole range of policy instruments

In terms of policy instruments, a continued application of the whole range of steering mechanisms ranging from voluntary de-centralised solutions to traditional regulations through democratically accountable nation-state institutions is required, depending on the environmental problem to be tackled (Hey et al., 2003). This pluralistic approach becomes particularly relevant in the light of the EU enlargement, as it will be essential to draw upon a diverse range of policy tools to address the widening spectrum of environmental problems associated with the enlarged EU (EEAC, 2003). Furthermore, a multi-dimensional approach is demanded acknowledging that – apart from DG Environment – a number of other DGs in

the EU Commission (such as agriculture, transport and energy) hold competences, which have close relation to environmental issues.

With regard to the overarching policy goal of reduced energy and material use and reduced production of waste and emissions, and the required shift towards sustainable production and consumption patterns, which type of instrument should be implemented for which aspect of the problem (see also Giljum et al., 2005)?

Traditional regulation is best implemented for environmental problems, which require reduction of specific substances with high potential for negative environmental impacts (quality aspect of decoupling), e.g. by posing a direct and immediate threat to human health or the natural environment (air pollution, toxic substances). In comparison to market-based instruments, however, these instruments are possibly economically inefficient and thus likely bear high costs in implementation and control. Additionally, they do not provide incentives to decrease environmental pressures beyond the agreed critical loads.

Market-based instruments provide price incentives and disincentives and allow private and public economic actors to achieve environmental objectives in a cost-effective way, including flexible adaptation according to people's behaviour and self-interest. Compared to traditional regulation, market-based instruments are drivers for technological innovation, as – within a redesigned framework of taxes, subsidies and certificates oriented towards a reduction of natural resource use and related emissions – investments in higher eco-efficiency are economically rewarding, also beyond fixed limits of e.g. emissions or waste generation. These instruments are the preferred choice for pursuing absolute decoupling of environmental pressures and economic development, in particular if charged at the input side of the economy (i.e. in energy consumption, material use and land use) (European Commission, 2003).

Voluntary instruments can contribute towards the overall decoupling goal, as enterprises are encouraged to take economic advantage of environmentally benign behaviour, e.g. through cost reduction or positive marketing implications. Also information and education instruments, such as eco-labelling, play an important role in changing consumers' attitudes towards a higher awareness of environmental issues (European Commission, 2004c). However, missing of environmental policy targets (e.g. reduction of greenhouse gas emissions or reduction of resource use) is a clear threat, if no effective monitoring processes are in place and sanction mechanisms exist in the case of non-compliance. Thus, voluntary and education instruments are recommended to complement legislation and market-based instruments rather than to substitute them.

Generally, the most effective approach in environmental protection is based on the use of a combination of the available policy options. Such a well-balanced mix should secure keeping the basic principles of good environmental governance: making decisions at the appropriate

level, providing access to information and participation, and integration of environmental aspects into all decisions (WRI, 2003). This requires diverse types of instruments to work alongside: newly introduced market-based instruments together with traditional ones, with some of them having an effect in the long run, others in the short run. It also is likely required for such a policy-mix to change over time. The suitable mix of instruments should be the result of a political process taking into account environmental, as well as economic and social objectives.

Cornerstones of EU sustainable development policies

The implementation of principles and solutions for sustainable development cannot take place without introducing new instruments and strengthening many existing ones. Many instruments on the sectoral level have already been discussed above. Most important overall policy goals and measures include:

- Economic development based on ***sustainable competitiveness***, where prices include the broadly conceived external (social and environmental) costs.
- ***Shift of tax burden*** from labour to the use of natural resources through the introduction of an environmental fiscal reform, consisting of the reduction of employment-related taxes, along with the increase of taxes related to the use of non-renewable natural resources (energy taxes, material input taxes, levies on built-up land, etc.), with neutral effects on the budget.
- ***Removal*** of environmentally (and socially) ***harmful subsidies*** that encourage overuse of resources, in particular in the agricultural, fisheries, transport and energy sectors (considering also fair trade aspects).
- ***Stimulating research and technology development*** for resource efficiency in products and processes and implementation of best practice programs.
- Integration of ***resource efficiency goals*** into other programs like IPP, eco-labelling, green procurement, and environmental reporting.
- Stimulation of transfer of knowledge and information instead of material goods.
- Improvement in ***planning processes*** with regard to environmental and sustainability impact assessment.
- Fostering of ***voluntary environmental agreements*** between industries.

9. Global perspectives

Limited effect of EU measures on global trends

The sustainability policy measures implemented in the two sustainability scenarios for Europe only show a very limited effect on the development of environmental pressures on the global level. World-wide resource extraction is expected to grow from 55 billion tons in 2002 to around 80 billion tons in 2020 in the baseline scenario. Through the implementation of the policy measures in the low sustainability scenario, world-wide extraction is reduced by only around 1%, in the high scenario by 2.1%. This reduction is caused by reduced import demand from other world regions, lowering economic production in economies involved in extraction and processing of natural resources. Also with regard to CO₂ emissions, the impacts of the two scenarios is small, with a 1.5% decrease in the low and a 2.75% decrease in the high scenario, again resulting from growth losses due to declining European import demand. These limited impacts reflect the fact that other world regions (in particular emerging economies such as China, India and Brazil) are catching up in their per capita levels of material and energy consumption and thus reducing the share of traditional industrialised countries in global environmental pressures. For example, EU-25 share in global CO₂ emissions will be shrinking from 14.7% in 2005 to only 10% in 2020, while China and India together will contribute already 22% to world-wide CO₂ emissions (compared to 18.5% in 2005). Therefore, if global unsustainable trends with regard to energy and natural resource use should be halted and reversed, all other OECD countries plus the big emerging economies would have to agree on concerted action for reducing environmental pressures.

Resource and energy productivity measures: world-wide action needed

Given this limited effect of European actions to reduce its global environmental impacts, initiatives to increase energy and resource productivity must be implemented also in other OECD countries, as well as in key developing countries (in particular, the so called “Anchor Countries”)⁴. Japan can be regarded as leading the way in terms of setting quantitative targets for resource productivity increases. In 2003, the government of Japan passed a strategy for establishing a material-cycle society (Government of Japan, 2003). This plan sets targets to improve resource productivity (measured as GDP/direct material inputs) by

⁴ The group of so called “Anchor Countries” includes China, India, Indonesia, Pakistan, Thailand, Egypt, Iran, Saudi-Arabia, Nigeria, South Africa, Argentina, Brasil, Mexiko, Russia and Turkey. These countries play a central role for regional economic development, are of great importance for regional political development and security, and, due their population size, have a central role to play with regard to the global protection of the environment and of natural resources (for a definition of anchor countries see Stamm, 2004).

40% from the 2000 values until 2010 and to increase recycled materials also by 40% to an absolute 14% of overall material use. Such quantitative targets are entirely missing in the recently published EU Thematic Strategy on the sustainable use of natural resources (European Commission, 2005d) and are being opposed in other non-OECD countries with significantly higher shares of material extraction and basic industry activities (mining and metal industries, forestry, etc.), notably the USA, Canada and Australia. With the passing of a Cleaner Production Promotion Law in 2003 and the goal to make progress towards the realisation of a circular (recycling) economy, especially for industrial sectors, China has set first steps towards the inclusion of environmental standards in future development. As stated in the related documents, the development towards a Circular Economy will be essential for China to reach an overall well-off society by sustaining fast-paced economic growth while mitigating negative ecological impact and creating more job opportunities.

With regard to climate policies, USA and Australia are also those OECD countries, which have not yet ratified the Kyoto Protocol on climate change. However, in 2005, the six signatories of the Asia-Pacific Partnership on Clean Development (USA, China, India, Australia, Japan and South Korea) signed a climate pact to reduce greenhouse gas emissions. The agreement is the first of its kind to include the USA and China, the world's two largest emitters of greenhouse gases responsible for man-made global warming. However, the vision statement does not list formal commitments nor does it oblige signatories to reduce greenhouse gas emissions in a legally-binding manner. Improvements should be largely achieved through technology transfers between the six signatories. European officials and NGOs are largely sceptical that a voluntary agreement of this kind will have a significant impact, which is necessary to combat climate change. Europe should therefore continue its efforts to include the USA and Australia in the Kyoto Process from 2012 onwards and to make these countries accept the necessity for establishing quantitative reduction targets for CO₂ emissions.

The OECD Development Assistant Council (DAC) recently launched an initiative to support the implementation of environmental fiscal reforms (EFR) in developing countries, which could contribute to the achievement of fiscal, environmental and social policy objectives (OECD, 2005). As the OECD states, EFR can contribute to poverty reduction directly by reducing environmental pressures (such as water contamination and air pollution) that show negative impacts on the poor. In addition, EFRs can have significant positive indirect effects by generating or freeing up resources for anti-poverty programmes in areas such as water supply and sanitation, or for pro-poor investments in the health and education sectors. Thereby, EFRs are an important measure to complement and strengthen regulatory and other approaches to fiscal and environmental management. The European Union should support further implementation of EFRs in developing countries through funding of capacity

building activities (in particular in relation to the measurement of implicit taxes and subsidies and the quantification of impacts), supporting public awareness campaigns (to overcome bureaucratic inertia or resistance from ministries or agencies against the implementation of EFRs), and to finance the transitional costs of reform (in order to protect the poor from negative impacts or to overcome politically powerful blockages) and technical co-operation to help industries adjust to change (e.g. by switching to cleaner production technologies).

Reforms of the international trade system

From an environmental perspective, the central goal for a reform of world trade towards sustainability is a reduction of international physical trade flows and partly substitute by knowledge transfer, as part of a more comprehensive strategy towards “absolute dematerialization” of all economic activities. Under this goal, especially the Northern countries are challenged to drastically reduce their share in the use of global natural resources. However, decreasing Northern demand for natural resources will show negative economic implications for extracting economies in the South, if no additional policy measures are taken to compensate these negative effects. Therefore, dematerialization should be implemented as a global strategy, combining resource use reductions in the North with structural change towards production of exports with higher value-added in the South (see next section). Along with other measures to redistribute financial resources from North to South (such as debt relief programs), this strategy could open up new development perspectives for Southern countries and enable the construction of diversified and more stable economies there.

Despite its free trade rhetoric, the North still maintains a strategy of double standards towards the South. While requirements of structural adjustment programs force Southern countries to rapidly open their economies, sectors of key interest for the North (such as textiles and agriculture) are still heavily protected by high tariff barriers (Raffer and Singer, 2001). On average, import tariffs on Southern products are four times those of exports from North to South (Oxfam, 2002). According to estimates from the World Bank, Southern countries lose incomes of more than 100 billion US \$ annually due to these protective measures (World Bank, 2002).

If the industrialized countries in fact would intend pursuing a trade-driven strategy of development and poverty alleviation, the primary measure would have to be the abolishment of discrimination of Southern export products in market access and the establishment of a fair and internationally balanced tariff system.

While the positive economic consequences of such a reform for Southern countries could hardly be questioned, the environmental (and social) implications are less clear. In the short

run, free access to Northern markets would probably set incentives for specialization in primary sectors, if no additional measures as part of a long-term development strategy (see below) are taken. This could increase export volumes especially for agricultural products and South-North resource flows. Thus, further losses of natural resources in the South and an increased inequality in terms of resource consumption could be the unintended consequence.

A removal of trade barriers in Northern agricultural sectors would likely show positive effects for the big net-exporters in the South (such as Argentina, Brazil, the Philippines, etc.), but could further strengthen an “exports first” policy in poorer developing countries. This policy stands at odds with a “food first” policy, as it favours large farmers and transnational companies producing for export demand over small scale farmers, which mainly deliver to local markets. Therefore, not unconditional market access should be the overall goal, but the institution of a whole range of fair trade arrangements including preferential treatment for small producers and sustainable products at cost-covering prices (Sachs and Agarwal, 2002).

Economic diversification of Southern economies

According to many scholars, the European Union (and the OECD countries) should through its Development Assistance Programmes support the key goal for Southern countries: the reduction of dependence on primary commodity exports and the diversification of economic structures. This could provide more production linkages to other economic sectors, could support the accumulation of technological capacities and human skills and could reduce negative environmental impacts (ECLAC, 2002). Furthermore, structural change would significantly diminish economic vulnerability resulting from specialization in a small “portfolio” of export products.

Encouraging processing of natural resources in the South (“vertical diversification”) would at the same time increase the added value of exports and reduce the negative impacts of price fluctuations on world markets for primary commodities. This would enable Southern economies to reduce extraction rates of natural resources and thus decrease pressures on the domestic environment. Simultaneously, “horizontal diversification” should be initiated, in order to build up other, less resource-intensive sectors. Active investment in education and training to foster the acquisition of skills in the labour force is one central measure to shift comparative advantages away from unprocessed to processed primary production and later on from primary production to manufacturing, which on average is more skill-intensive than activities in the primary sectors (Wood, 1999). Supporting structural change would also be a

proactive strategy to avoid economic crisis in case of falling demand for natural resources, which could emerge as a consequence of Northern dematerialization efforts.

How ever important such a development vision might be, a number of obstacles towards its realization can be identified. First of all, severe financial restraints for investing in education and skill acquisition to trigger structural change can be observed. The international debt regime, discriminative trade measures and declining prices for primary commodity exports all contribute to this situation. Another factor impeding diversification of export sectors is the fact that extraction activities very often are controlled by Northern-based multinationals operating according to interests of owners and stakeholders of industrialized countries. Transfer pricing in intra-firm trade is a common practice to repatriate profits to Northern headquarters, which further diminishes Southern incomes from extraction activities. Finally, it has to be emphasized that also efficient political institutions in the South are of crucial importance for the success of a strategy of structural change. Often politicians rather pursue their own interests through rent-seeking and luxury consumption, instead of investing in infrastructure and human capital (Murshed, 2002).

Two alternative strategies to the standard export-oriented development model as promoted by IMF, World Bank and WTO could support Southern efforts towards structural change. First, a selective and temporary dissociation from world markets along with active governmental support of young national industries through protection tariffs and the concession of tax abatements and export subsidies. This strategy was successfully implemented by the “tiger economies” in East and South East Asia, which significantly augmented the share of manufactured products in total exports (Raffer and Singer, 2001). A second alternative would be the promotion of regional trade agreements in the South. Integration of countries with small differences in productivities and economic power would likely facilitate more balanced exchange relations between the trading partners than currently in place on global commodity markets.

10. Conclusions and future research needs

The scenario simulations performed in the MOSUS project revealed that the implementation of a well-designed mix of (mostly) environmental policies can result in a win-win situation for both the economy and the environment. In comparison to the baseline scenario, the policy measures implemented in the two sustainability scenarios significantly improved the environmental performance of the European economy in terms of energy and material use and emissions of CO₂, while at the same time stimulating economic efficiency, which results in higher economic growth and increased international competitiveness of European

industries on international markets. Although a number of important issues remained unresolved in the MOSUS scenarios (such as maintained high levels of unemployment, rising energy demand by the transport sector and increasing externalisation of environmental burden to other world regions via international trade), results showed that policies aiming at a radical improvement of energy and material efficiency in the European Union can indeed contribute to key objectives of both the EU Sustainable Development Strategy and the Lisbon Strategy. The main policy message from MOSUS therefore is that the Commission as well as the Member States should strive for the implementation of policies, which lead to the development and implementation of more eco-efficient technologies and products as part of the transformation towards more sustainable production and consumption systems in the European Union.

The main objective of the MOSUS project was to build the extensive environment-economic simulation model (the extended GINFORS model) and to simulate a set of sustainability scenarios for different European development paths until 2020. Many of the key objectives of the MOSUS project have been achieved. However, in the course of the project it also became clear that a number of possibilities for improving the model still exist and a number of other issues have to be tackled by future projects, in order to constantly improve the tools and indicators for designing and monitoring European sustainability policies. Most important areas of future research needs shall be outlined in this last part of the report.

Extension of the simulation model

Although the model developed in MOSUS represents one of the most comprehensive simulation tools for European and global integrated sustainability assessments currently available (see Giljum et al., forthcoming), several areas of extension and improvements remain as future tasks.

Expanding the number of represented countries

So far, only a limited number of developing countries are specifically represented in the GINFORS model. Inclusion of a larger number of Southern countries could make GINFORS capable for analysing and the economic and environmental implications of European development assistance and trade policies in developing countries. Only thereby could be assessed, whether European sustainability policies actually do not jeopardise sustainable development efforts in other world regions, as stated in the EU's vision for creating a global partnership for sustainable development (European Commission, 2002).

Including natural resource stocks and prices

So far, the extended GINFORS model does not contain information on natural resource stocks in terms of fossil fuels, metals or construction minerals available for future extraction in different countries. Therefore, in the current scenarios, growing global demand for natural resources in the future is always met through growing extraction and no limitations of extraction can be considered. Although the European Commission stated that resource scarcities are no major problem in the short run (European Commission, 2003), this perception could rapidly change considering the continuously growing demand for raw materials of industrialising countries such as China and India. Future extensions of the model should therefore add information on available resource stocks and likely costs for their exploitation. Only thereby feedbacks to the economy stemming from rising prices for energy and raw materials could be properly included in the scenarios.

Improvement of the labour market models

In its current version, the labour market is only represented with a very limited set of data, as only data on employed people is available in an internationally reliable and comparable format. Future efforts should therefore be focused on the generation and inclusion of better data for unemployment and the separation between (the growing number of) part-time and full-time employees.

Simulation of more radical sustainability scenarios

Future work should include the definition of more radical sustainability scenarios, which are capable of drastically reducing primary material inputs and energy use. Furthermore, extended sets of policy measures will be needed in order to better mitigate negative environmental effects stemming from rebound effects (see above).

Development of a model to calculate indirect environmental effects

One of the original objectives of the MOSUS project was to assess the total amount of natural resources (in terms of energy, material and land) necessary to support the European economic system, considering indirect resource requirements embodied in internationally traded products (also called ecological rucksacks). Through including the international dimension in a comprehensive manner, we aimed at improving existing environmental indicators, such as “Total Material Consumption (TMC)”⁵ of the European Union.

⁵ TMC is the headline indicator for the area of “sustainable production and consumption” in the EU set of sustainable development indicators. However, due to limitations of data, TMC can so far not be calculated for European countries and a proxy indicator (which does not consider ecological rucksacks) has to be applied.

The objective to quantify the ecological rucksacks could not be met in MOSUS, as the GINFORS model was primarily designed as a comprehensive dynamic simulation tool, where a large number of indirect economic (and as a consequence, environmental) effects occur in other world regions due to changes in European production, trade and consumption patterns. However, a precise allocation of these environmental effects to changes in particular European countries requires a static global accounting tool, which takes into account the production structures in different countries as well as the trade relations between different sectors along international production chains. The development of such a model, which could serve statistical purposes for the calculation of comprehensive indicators, should receive high priority in future work on European sustainable development indicators.

References

- AIECE. 2005. World commodity prices 2005-2006. Association of European Conjuncture Institutes, Working Group on Commodity Prices.
- ECLAC. 2002. Globalization and development. Economic Commission for Latin America and the Caribbean, Santiago de Chile.
- EEA. 2003. Europe's environment. The third assessment. Environmental assessment report. No. 10. European Environment Agency, Copenhagen.
- EEA. 2005. The European Environment. State and Outlook 2005. European Environment Agency, Copenhagen.
- EEAC. 2003. European Governance for the Environment. European Environmental Advisory Councils, Working Group on Governance, Den Haag.
- EPSD. 2004. From here to sustainability - Is the Lisbon/Göteborg agenda delivering? European Panel on Sustainable Development, Göteborg.
- European Commission. 2001a. Communication on the Community law applicable to public procurement and the possibilities for integrating environmental considerations into public procurement. European Commission, Brussels.
- European Commission. 2001b. European Transport Policy for 2010. Time to decide. White Paper. No. European Commission. DG Transport, Brussels.
- European Commission. 2001c. Green Paper on Integrated Product Policy. COM (2001) 68 final. European Commission, Brussels.
- European Commission. 2001d. On the sixth environmental action programme of the European Community - Environment 2010 - Our future, our choice. COM (2001) 31 final. European Commission, Brussels.
- European Commission. 2002. Towards a global partnership for sustainable development. COM(2002) 82 final. European Commission, Brussels.
- European Commission. 2003. Towards a thematic strategy for the sustainable use of natural resources. COM(2003) 572 final. DG Environment, Brussels.
- European Commission. 2004a. Integrating environmental considerations into other policy areas- a stocktaking of the Cardiff process. COM(2004) 394 final. European Commission, Brussels.
- European Commission. 2004b. The share of renewable energy in the EU. COM(2004) 366 final. European Commission, Brussels.
- European Commission. 2004c. Sustainable production and consumption in the European Union. European Commission, Brussels.
- European Commission. 2005a. 2004 Environmental Policy Review. COM(2005) 17 final. European Commission, Brussels.
- European Commission. 2005b. Report on the implementation of the Environmental Technologies Action Plan in 2004. COM(2005) 16 final. European Commission, Brussels.
- European Commission. 2005c. Sustainable Development Indicators to monitor the implementation of the EU Sustainable Development Strategy. SEC(2005) 161 final. European Commission, Brussels.
- European Commission. 2005d. Thematic Strategy on the sustainable use of natural resources. COM(2005) 670 final. European Commission, Brussels.
- European Commission. 2005e. Thematic Strategy on the Urban Environment. COM(2005) 718 final. European Commission, Brussels.
- European Commission. 2005f. Working together for growth and jobs. A new start for the Lisbon strategy. Spring Report 2005. No. European Commission, Brussels.
- European Commission. 2006. 2005 Environmental Policy Review. COM(2006) 70 final. European Commission, Brussels.
- European Council. 2005. Presidency Conclusions. European Council Brussels. 22 and 23 March 2005. 7619/1/05, Brussels.
- Gervais, C. 2002. An Overview of European Waste and Resource Management Policy. Forum for the Future, London.

- Giljum, S., Hak, T., Hinterberger, F., Kovanda, J. 2005. Environmental governance in the European Union: strategies and instruments for absolute decoupling. *International Journal for Sustainable Development* 8 (1/2), 31-46.
- Giljum, S., Hinterberger, F., Lutz, C., Meyer, B. forthcoming. Accounting and modelling global resource use: material flows, land use and input-output models. In: Suh, S. (Ed.) *Handbook of input-output economics for industrial ecology*. Springer, Dordrecht, The Netherlands.
- Government of Japan. 2003. *The basic plan for establishing a recycling-based society*. Tokyo.
- Hey, C., Jänicke, M., Jörgens, H. 2003. *Environmental Governance in the European Union*. Second ECPR Conference, Marburg.
- High Level Group. 2004. *Facing the challenge. The Lisbon strategy for growth and employment*. Report from the High Level Group chaired by Wim Kok. No., Luxembourg.
- Jackson, T., Michaelis, L. 2003. *Policies for Sustainable Consumption*. UK Sustainable Development Commission.
- Joint Study Group. 2003. *Findings of Workshop on Metal Recycling*. Joint Study Groups' Workshop on metals recycling, St. Petersburg.
- Kraemer, A., Wilkinson, D., Klasing, A., von Homeyer, I. 2002. *EU Environmental Governance: A Benchmark of Policy Instruments. With a focus on Agriculture, Energy and Transport*. Study commissioned by the Belgian Federal Department of the Environment. No. ECOLOGIC, Berlin.
- Murshed, M. 2002. *On natural resource abundance and underdevelopment*. Background Paper for World Development Report 2003. No. Institute of Social Studies, The Hague.
- OECD. 2005. *Environmental Fiscal Reform for Poverty Reduction. DAC Guidelines and Reference Series*. No. OECD, Paris.
- Oxfam. 2002. *Rigged rules and double standards. Trade, globalisation and the fight against poverty*. Oxfam International, Oxford, UK.
- Raffer, K., Singer, H.W. 2001. *The economic North-South divide. Six decades of unequal development*. Edward Elgar, Cheltenham.
- Sachs, W., Agarwal, H. 2002. *The Jo'burg Memo: Fairness in a fragile world*. Heinrich-Böll-Stiftung, Berlin.
- Schepelmann, P. 2000. *Von Helsinki nach Göteborg - Evaluierung der Umweltintegration in der Europäischen Union*. Auftraggeber: Bundesministeriums für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft. No. Sustainable Europe Research Institute, Wien.
- Söderholm, P. 2004. *Extending the Environmental Tax Base. Prerequisites for Increased Taxation of Natural Resources and Chemical Compounds*. 5416. Swedish Environment Protection Agency, Stockholm.
- Spangenberg, J. 2005. *Towards systemic structures as the basis for future EU policies*. Paper presented at the Experts Meeting on Structural Indicators, Alpbach, Austria.
- Spangenberg, J., Lorek, S. 2002. *Environmentally sustainable household consumption: from aggregate environmental pressures to priority fields of action*. *Ecological Economics* 43 (2-3), 127-140.
- Stamm, A. 2004. *Schwellen- und Ankerländer als Akteure einer globalen Partnerschaft*. Discussion Paper. No. 1/2004. German Development Institute, Bonn.
- Wood, A.J.B. 1999. *Natural resources, human resources and export composition: a cross-country perspective*. In: Mayer, J., Chambers, B., Farooq, A. (Eds.) *Development policies in natural resource economies*. Edward Elgar, Cheltenham.
- World Bank. 2002. *Globalization, Growth and Poverty: Building an Inclusive World Economy*. World Bank, Washington.
- WRI. 2003. *Closing the Gap: Information, Participation and Justice in Decision-making for the Environment*. World Resources Institute, Washington.