Wuppertal Institute
for Climate, Environment
and Energy

A Green New Deal for Europe

Towards green modernization in the face of crisis

Authors:

Dr. Philipp Schepelmann
Marten Stock
Thorsten Koska
Dr. Ralf Schüle
Prof. Dr. Oscar Reutter
Wuppertal Institute for
Climate, Environment and Energy

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Report

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Wuppertal, September 2009

Foreword

We are confronted with the convergence of multiple crises - economic, environment and social, which call for a global response. In the 1930s, President Roosevelt launched his ambitious "New Deal" to get America out of the Great Depression, crashing markets and soaring unemployment. Today, the crisis is not only economic and can only be fought with an integrated policy approach: A GREEN NEW DEAL. This has been acknowledged as global challenge by the Secretary General of the United Nations, Ban Ki Moon, the UN Environmental Programme (UNEP).

Trying to overcome the economic crisis by putting more pressure on the environment is not an option, because global warming and resource depletion already threaten our very existence. Overcoming the environmental crisis by putting a halt to economic activity of citizens, risking unemployment and poverty to soar to unprecedented heights, is not an option either. Our strategic task is to decouple economic activity, the use of resources and environmental impact while creating sustainable and decent jobs for people.

In the past years, billions of Euros were spent in Europe, the US and other industrialised countries for so-called recovery packages to overcome the economic crisis. From the beginning, our Group urged the use of these unprecedented massive amounts of public money to green the economy and start the ecological transformation of product and service markets towards more sustainable patterns.

This is not an easy task and needs "enlightened" political strategies - reason for which we approached the Wuppertal Institute to help us take stock of the current situation and identify the most suitable areas, effective instruments and best practices for promoting our Green New Deal.

The report reveals that in terms of recovery packages, the EU is lagging behind the US and Asia - and it presents evidence of the economic and employment potential of a Green New Deal. The report takes a pragmatic approach in the sense that it focuses primarily on how to "green" immediate recovery activities in specific economic areas and how to support framework conditions, which initiate a dynamic in the direction of an ecological modernisation and structural change. It identifies key elements towards the implementation of a Green New Deal.

The report shows that the European Union and its Member States have many ingredients to deliver an effective Green New Deal. However, what is lacking is political determination and leadership. No scientific study can help overcome this situation. Only a political strategy working for new majorities and putting pressure on the institutions and political actors to

change direction can do so. We can learn from the case studies presented here that the development of eco-industries in some Member States depended on a societal consensus regarding key aspects of sustainability as well as a determined government which is able to set and enforce high environmental standards.

Today, the European Union must take a leading role in orchestrating a Green New Deal, the ecological conversion and the creation of Green jobs. We know that the EU has a number of targeted programmes at hand, which have the potential to develop into central elements of such a strategy - one of our main tasks as a political group in the European Parliament will be to find ways to mainstream EU policies by putting strong environmental and resource-use conditionality on activities financed by the EU-Structural Funds, research programmes, recovery spending, etc.

We thank the research team from the Wuppertal Institute for the precious work they did and for keeping all the time-lines - we take a lot of political inspiration from this cooperation.

Rebecca Harms
Co-president of the Greens/EFA Group
in the European Parliament

Claude Turmes
Vice-president of the Greens/EFA Group
in the European Parliament

Brussels, September 2009

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Executive Summary

After the financial and economic crisis of 2008 a number of governments around the world have made a powerful contribution to active economic policy-making by launching recovery packages. Most packages have green elements, sometimes of a considerable size. European recovery programmes are small in relative and absolute terms especially compared to Asian programmes, nevertheless we can expect globally a strong state-driven demand pushing green markets.

The real impacts of the green stimulus of recovery packages remain to be seen. Discussions about actual sizes, measures and even additional packages are often still ongoing. Comparing green shares of recovery programmes is often difficult, not the least because there is no general consensus about which measures are supposedly green. This is one of the main reasons why Europe needs a clear vision of what a Green New Deal is all about.

Many studies and comments on the green share of recovery programmes focus on climate and energy issues, but a Green New Deal comprises – and should comprise – more than an answer to climate change. It needs to promote eco-industries with a clear vision of a green modernisation of the economy.

Based on the Eurostat/OECD definition of eco-industries we define a Green New Deal as a targeted state investment in activities which produce goods and services to measure, prevent, limit, minimise or correct environmental damage to water, air and soil, as well as problems related to waste, noise and eco-systems. This includes innovation in cleaner technologies, products and services that reduce environmental risk and minimise pollution and resource use.

In the EU, eco-industries already generate a considerable turnover and employment. Different studies confirm excellent potentials for further growth. They also show an uneven distribution in the EU. Therefore, successful innovation and industry policies of the market frontrunners could be a model for active diffusion of eco-innovation in all EU Member States.

Support for eco-industries is not enough, because even green economic growth can be harmful, if it merely contributes to increase an already unsustainable high level of natural resource consumption. Thus, a Green New Deal needs to be more than a technology platform for eco-industries. It has to be guided by a vision of how a green modernization of industry should look like in the long run. A Green New Deal requires structural change on all policy levels fulfilling three functions; it should:

1. Break-up unsustainable structures
2. Build-up sustainable structures
3. Give the right mid- to long-term orientation

A Green New Deal should meet these functions on a strategic level, on the level of individual EU policies and on programming level.

Strategies

On a strategic level there is a lack of a long-term guiding vision of sustainable production and consumption patterns beyond low carbon. The green parts of the Lisbon Strategy in combination with the Sustainable Development Strategy contain elements which could be used as central building blocks of such a vision. In particular, the huge gap in energy and material productivity between Member States in the EU (up to a factor of 8!) should become the central challenge for guiding (eco-innovation) policies. This requires support for efficiency front-runners and a technological leapfrogging in regions with low resource productivity. This would enable the EU to harvest a double-dividend of decreased pressure on the environment (including CO_2 emissions) and increased competitiveness due to the reduction of production costs. Thus the EU would set course on a development path, which would eventually lead towards consumption and production patterns respecting ecological boundaries in Europe and beyond.

Policies

Major EU policies could boost resource efficiency of EU industries and infrastructure by combining EU and national funds. In particular, with the Cohesion Policy the European Union has a funding system dedicated to structural change which is already operating in the same order of magnitude as the green stimulus of European recovery programmes. By combining national recovery programmes with EU Regional Funds the EU Member States could create the necessary financial leverage to change production and consumption patterns especially in regions which are lagging behind. For this purpose the European Parliament could initiate special fast-track financing mechanisms. Such a mechanism would grant "green light" for green structural interventions to increase resource productivity of industry and infrastructure monitored by EU Structural Indicators on energy and materials productivity.

Programmes

Short-term Community support for a Green New Deal could be followed-up by more consolidated medium-term action of integrating the necessary components of an appropriate policy mix. This could be achieved by improvements on the programming level. The EU has a number of sophisticated innovation programmes, which are already contributing to a greening of the EU economy (e.g. ETAP, CIP). Different EU programmes affecting eco-innovation would have to converge and should be strengthened with Cohesion Funds for improving overall resource productivity (energy and materials). Integrated schemes for using RTD, innovation and regional development programmes could be the financial foundation for developing on a European and regional level a "triple-helix" consisting of stakeholders from enterprises, the public sector, research and teaching who could drive and create a self-sustaining market for improving resource efficiency in the European Union.

Priority areas for the development of regional transformation could be sustainable mobility, as well as energy and material efficiency.

Sustainable Mobility

The improvement of sustainability of transportation is not only a key challenge in fighting climate change and other environmental problems. As an important sector in modern economies, more efficient and sustainable transport systems contribute to economic growth. Thus, integration of sustainable transport investments in European recovery plans can provide important stimuli for economic growth and employment.

Regarding political strategies and social and economic conditions, freight and passenger transport are quite different, as well as earthbound and plane or ship transport. Thus, this paper exemplarily concentrates on describing problems and solutions in the field of earthbound passenger transport.

A sustainable policy for passenger transport should focus on three basic strategies:

1. Avoiding of transport,
2. Modal shift to more sustainable modes of transport and
3. Increase of efficiency of vehicles and the traffic flow.

With respect to the sustainability of measures, a hierarchy of these three strategies can be introduced.

Avoidance of transport is a top priority, as it allows maintaining mobility while reducing the kilometres travelled. This notion of mobility is defined by the possibility to achieve different human activities such as business, work, purchase, leisure and other social and cultural activities. Therefore, an integrated policy of transport and spacial development is necessary which require a long-term development. Thus, they are not in the focus of a recovery package that concentrates on quick effects.

A second strategic aspect of sustainable mobility is about the way in which the remaining transport needs are satisfied. The different **modes of earthbound transport** – walking, cycling, busses, trains and cars – have different environmental advantages and disadvantages. It is reasonable to support zero-emission mobility on short distances and train and public transport by bus or tram on medium range or longer distances. This includes the provision of infrastructure and its interconnection to promote intermodality, the purchase of vehicles as well as mobility management, measures of information, education and service. They act as pull-factors for a modal shift. On the other hand, push factors should be introduced: speed limits, low-emission-zones or congestion charges, eco-taxes on fuel and higher motor vehicle taxes for gas guzzlers are examples for measures that help levelling the uneven conditions for more sustainable modes of transport.

The third strategic pillar is the improvement of **transport efficiency**. This includes measures concerning vehicle technology as well as intelligent traffic management systems and eco-driving. Policy instruments on this field are e.g. emission limits, fiscal measures to integrate external costs of transport as well as R&D programmes; the latter two are possible parts of a Green New Deal.

In summary, the following possible elements of a Green New Deal can be identified:

- investments in new transport vehicles – busses, trams and regional trains
- investments in short-term realizable infrastructure for bicycle and pedestrians

- investments in infrastructure improvements for public transport
- investments in services to improve user-friendliness of public transport
- incentives for retrofitting of cars and vehicles of public transport
- fiscal measures to subsidise high efficiency vehicles
- research for energy efficiency technology
- marketing for more sustainable modes of transport
- education for eco-driving

Sustainable Energy Policy

As a premise, an EU Green New Deal has a greater long-term impact in emission reductions and employment if it is embedded in a coherent policy mix at EU, Member State and regional level.

Four main strategic fields can be identified:

1. *Energy performance of buildings (residential, tertiary, and industry buildings; existing buildings, new buildings, heating and cooling, incl. use of renewable energies, smart metering)*

In the building sector, an additional consultancy scheme should issue service vouchers for house-owners and SMEs. Additional direct grants for retrofitting exsisting building should promote renewable energies and high energy efficiency standards. Additional pilot projects for passive or zero emission houses need to be launched to improve performance standards of the existing stock of buildings. Intelligent combinations of high energy performance standards of the building envelope and renewable energies are required to significantly reduce energy consumption and emissions from the building sector. A Green New Deal should support cities and regions to develop zero-emission quarters or zero emission cities. For new buildings, energy-plus-houses provide an example for new buildings standards in general. The integration of low emission strategies in new buildings with resource efficiency requires further external financial support (e.g. BREEAM, CASBEE, Effinergie, DGNB and LEED). Supporting the reduction the energy consumption of heating and air-conditioning systems is another contribution to significantly reduce emissions. Old and inefficient heating sytems need to be replaced or technically modernised. Energy efficient motor technology, for example, can significantly reduce electricity consumption for circulation pumps and fans up to 80%. In order to accelerate the modernisation and optimisation of heating and air-conditioning systems.

2. *Energy use of electrical appliances*

The market penetration of efficient appliances is still at a very low level. Also the reduction of stand-by and on-mode consumption of office, communication, and entertainment appliances shall be subject of further supportive measures. The following measures are recommended:

- Supporting programmes for the most energy efficient white appliances

- Supporting programmes for office, communication, and entertainment appliances without stand-by and with low on-mode consumption

3. Emissions in industrial processes

An EU Green New Deal should support the combination of voluntary agrements with financial incentives (e.g. tax deductions). A combination of free or subsidised energy audits (consultancy and audit vouchers), regional and/or sectoral networks and sectoral energy concepts (as, e.g., in North Rhine-Westphalia), energy services, and targeted financial support programmes to promote end-use, e.g., in the sectoral networks or concepts appears to be the most successful policy-mix for stimulating energy efficiency.

4. *Electricity Grids and Smart Metering in the EU*

Recent EU regulation, especially the Directive on energy end-use efficiency and energy services (ESD) has clearly emphasised the role of smart metering systems. A European Green New Deal should supporting the development and implementation of smart metering systems in order to

- create awareness of consumers for energy consumption, energy costs and greenhouse gases emissions
- motivate consumers to monitor energy consumption and to take additional action
- decrease the running costs of metering and billing
- create the technical basis for managing peak demand and integration of renewable energy sources.

Diffusion of smart-metering systems also requires a flexible European electricity grid. The structure of the European grid needs to be adapted to general developments in the energy supply market, the integration of decentralised renewable large supply systems, the integration of large-scale offshore wind and concentrated solar power plants. Only innovative and smart grid technologies will be able to manage these strategic challenges and address further energy conservation potentials. Additional funding should focus on EU-wide distribution and transmission infrastructure.

Sustainable Resource Management

Europe highly depends on a broad variety of other resources from domestic sources as well from other parts of the world. Rising global demand from emerging economies will raise resource prices and increase the risk of limited access to resources. Therefore, a strong economic argument for resource efficiency is a high cost reduction potential with two major effects: Improved competitiveness and job creation. Resource productivity could therefore be a core element of a Green New Deal which could not only lead to short term effects but an overall stronger economy.

Official Eurostat reporting reveals a large development gap among EU Member States concerning resource efficiency. The EU could realize considerable environmental and competitive advantages, if it systematically addresses the internal resource productivity gap. This would entail the promotion of existing resource policies of the frontrunners and leapfrogging strategies for regions which are lagging behind.

In a long-term perspective resource efficiency has to be embedded in a more comprehensive vision of a sustainable metabolism of the EU. A sustainable metabolism may be characterised by four paradigmatic and complementary perspectives:

1. a resource-efficient and recycling-based industry,
2. the steady stocks society,
3. a solarised technosphere and
4. a balanced bio-economy which develops even further towards a bioniconomy.

On a pragmatic and short-term basis there are five core objectives for the first paradigm of a resource-efficient and recycling-based industry:

1. Sustainable markets of the future
2. Strong institutions
3. Resource efficient products and services
4. The Government as consumer – role model and market power
5. Change in peoples' heads

For a short term impact on economic development and job creation the combined introduction of a European Resource Efficiency Agency (EREA) and the establishment of national Resource Efficiency Funds (REF) could be an adequate strategy of the Green New Deal

The EREA would initiate international cooperation and communication to raise awareness in Member States and industry in order to stimulate demand for consultancy services. Awareness of cost-reduction potentials among decision-makers in industry would lead to an increased demand for specific resource efficiency technologies, products and services. The desired long-term effect would be a self-sustaining competition for meeting cost-advantages of resource efficiency in the EU's manufacturing industry.

The national Resource Efficiency Funds would finance resource efficiency especially in SMEs, which often lack sufficient capital and expertise for resource efficiency measures. The national REFs could co-finance EU Regional Funds.

Resource efficient public procurement could be an additional instrument to support directly resource efficiency. Public institutions should start to improve procurement procedures and assets by investing in resource efficient products and services.

1 Introduction

The world is at crisis. An unprecedented breakdown of the financing sector has hit the world in 2008. Whole economies are shaken by unemployment and financial instability threatens the social and economic stability of the European Union.

At the same time the natural environment of the EU economy is changing on a global scale. Climate change, receding biological diversity and dwindling natural resources are an increasing threat to the development of societies.

How can EU policy-makers and other actors rescue our economies and their natural environment? Can we only safe our economic wealth on the expense of nature? Is there an alternative of striking a Green New Deal which would at the same time boost economic development, create jobs and decrease pressure on the environment? Could Europe emerge even stronger and more sustainable than is has been at the beginning of the current economic crisis?

This study presents research results on economic recovery packages and their potential for contributing to a Green New Deal. It proposes a greening of the economy and presents evidence on its economic and employment potential. Against this background it offers an outlook on short to mid-term political strategies and instruments in the European Union and gives recommendations for a Green New Deal in the European Union.

The study focuses primarily on immediate recovery activities and supporting frame conditions, which are currently launched throughout the world. Therefore it selects only some elements of a new "green" policy mix, but it does not attempt to outline comprehensive green reforms of the economy. Long-term fiscal reforms, or fundamental shifts to a steady-state economy and other more profound changes will have to occur eventually to allow a sustainable development of the European Union, but they are not subject of this study. A Green New Deal has to take a pragmatic approach to immediate recovery plans it should nevertheless initiate first steps in the direction of an ecological modernization and structural change. A Green New Deal will therefore not be a complete strategy for an ecological modernization, but it could help Europe to emerge stronger and more sustainable than it had been before the current crisis.

2 Comparison of recovery packages

Soon after the beginning of the economic crisis governments around the world understood that the state would have to compensate rapidly dwindling private investments with large recovery packages. The world has turned away from previous laisser faire approaches towards more proactive role of the state. Recent studies tried to compare different packages. Research has often been based on preliminary governmental information about the different recovery packages that were often still in the making. Often unclear references and varying methodologies have resulted in a range of different assessments. Based on various studies the following section contains basic information about the total sizes of recovery packages, their composition and potentials.

2.1 The overall size of the recovery packages

According to a first overview by HBSC (2009) the absolute volumes of recovery packages, which have been launched recently, vary considerably (figure 1).

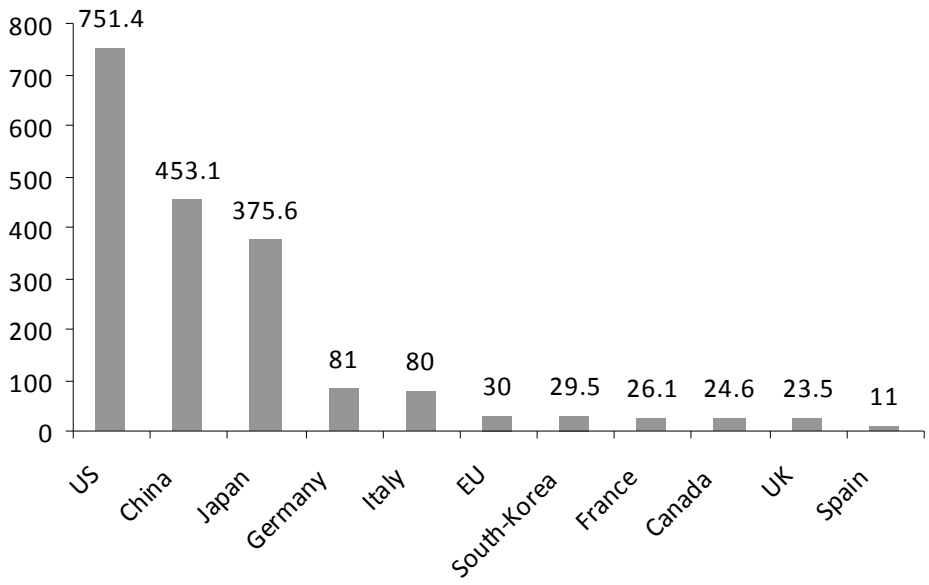

Figure 1 Absolute volumes of selected recovery packages in bn€ (based on HSBC 2009)

Most recovery packages are still in the process of development and ratification. Thus the actual size and the exact financial details are still changing. More recent studies from OECD (2009) are presenting different absolute sizes of the packages. For instance the packages of Spain and Canada are significantly higher with 56.8 and 61.6bn€.

A relative comparison taking into account the different sizes of the countries' economies might be more meaningful. Comparisons of figures are problematic, because the different packages often have different time spans. A comparison which takes into account the size of the economies as well as the time frame can be found in Saha and Weizsäcker (2009). They estimated the amount of the 2009 stimulus spending in the EU, the US and in China in relation to GDP:

	bn€	%GDP
EU	112.5	0.9%
USA	199.6	1.8%
China	233.1	7.1%

Table 1 Comparison of 2009 spending and GDP (Saha &Weizsäcker 2009, p.5)

In relation to its GDP the US spends in 2009 exactly twice as much than the EU, while China's recovery package is almost eight times larger.

A comparison of total stimulus spending of the different world regions in relation to the global GDP underlines the relatively small size of the European packages. As shown in figure 2 Europe makes the third largest contribution in bringing the global economy out of crisis. It is twice as large as the Near/East and Africa, one third of the US spending and less than one third of Asian/Oceanian effort.

The Nobel Prize laureate Paul Krugmann concluded at a press conference in Brussels on 17th March, that the European stimulus packages are by far not sufficient to fight the crisis (Strobl 2009).

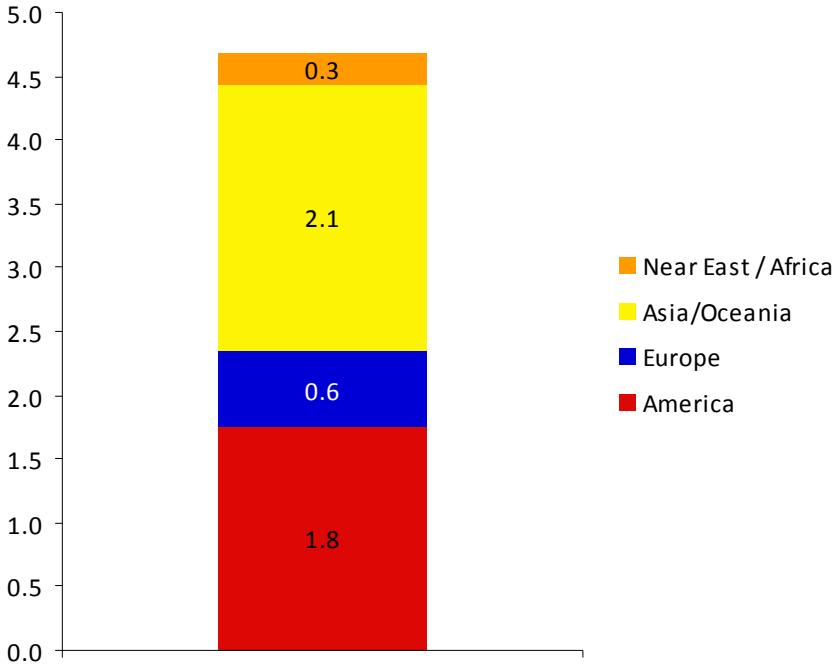

Figure 2 Stimulus as percentage of the World GDP by Region (Deka Bank 2009, p.4)

2.2 Comparing the green share

In addition to their overall size, the green share of the recovery plans also vary considerably ranging from 1.3% in Italy to 80.5% in South-Korea as displayed below:

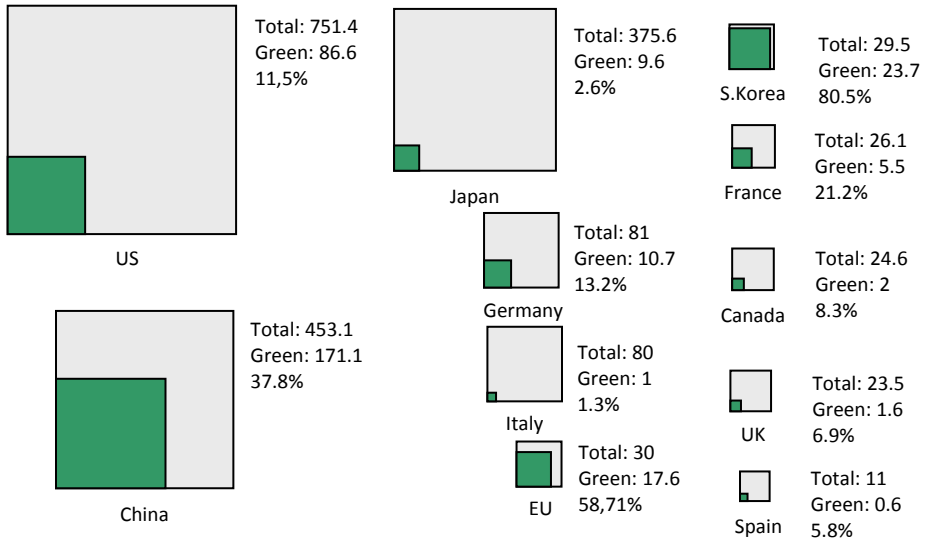

Figure 3 Ratio of green stimulus of national recovery packages, absolute volumes in bn€ (based on Bernard et al. 2009)

HSBC (2009) defines green stimuli as spending according to the 18 themes identified by the HSBC Climate Change Index. Within their study the areas of Low Carbon Power, Energy efficiency and Water/ Waste and Pollution Control are covered. "Green" refers to "*a sizeable slice of fiscal stimulus plans allocated to launching a low-carbon recovery*" (HSBC 2009, p.1). Bowen et al. (2009) have proposed a green share in the average order of 20% of a total stimulus. This would result in a rough figure of some 300 bn€ public spending annually. This is in line with McKinsey & Company (2009) who estimated that 320 bn€ annually by 2015 are necessary to get the global economy on a low-carbon trajectory.

With the exception of France and the EU Commission the greening of EU Member States and the US is lower than the proposed 20% share. In contrast, China and South-Korea are far ahead with shares of 37.8% and 80.5%. Although it needs to be stressed that the green share of a stimulus does not indicate how green the overall governmental spending is.

UNEP (2009) identifies an emerging consensus among the international community for a global green new deal. During the coming years large public investment programmes should be implemented in order to achieve aims of reduced carbon dependency, job creation, environmental protection and reduction of world poverty. According to the UN Environment Programme (2009) the current amount of the green stimulus in the national recovery plans of the G20 governments are far not enough.

Most studies on the green stimulus do not consider the quality of green spending. Usually they can only estimate based on governmental information whether the measures are green or not. In addition, recent studies do not take into account ambivalence or counter-productivity of the proposed activities. The US package, for instance, includes the spending

of 21 bn€ on new roads, which will result in increased car emissions (Harvey 2009). Supposedly green measures can be ambivalent or debatable. For example, Canada has declared support to nuclear industry as "green" (HSBC 2009). Another example is the German so-called "environmental bonus". Owners of cars more than 9 years old get a financial bonus for scrapping their vehicle, if they buy a new car with a minimum emission standard of Euro 4. The risks, that the new car could consume more fuel (switch from a small car to bigger one) and/or that additional emissions and material flows are caused for the production of the new car, are often not considered. Thus, the "environmental bonus" for cars could have a negative effect in the long run in terms of emissions and material flows (T&E 2009). In comparison with environmentally targeted bonus systems the existing schemes have already created considerably lost opportunities (see box page 48).

A study by Ecofys & Germanwatch (2009) tries to introduce a qualitative dimension in the evaluation of the green stimulus. They claim that the effect of each dollar spent varies significantly depending on the measure it is invested in and the way it is spent (directly or indirectly). They define effectiveness factors for the area of investment and the policy instrument. The area effectiveness factors are defined by several qualitative criteria such as short term emission reduction potential. Counter-productive measures such as road building are indicated as negative credit. So far only a few recovery packages have been evaluated with the results illustrated in figure 4.

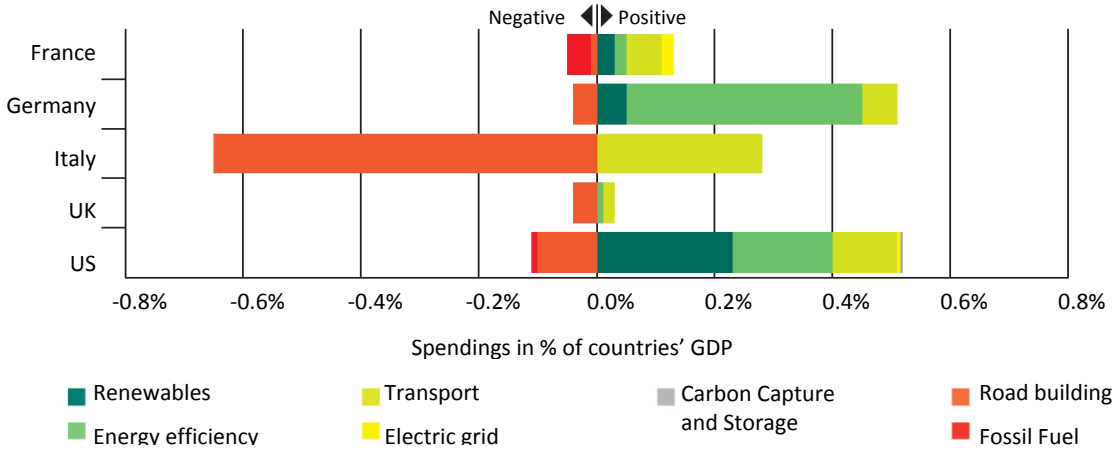

Figure 4 Evaluation of stimulus packages (Ecofys & Germanwatch 2009, p.5)

The weighted spending is expressed as a share of a country's GDP. The negative and positive calculations with coefficients have created different absolute volumes for each country. Nevertheless the study gives an impression of the different quality of green spending.

For instance, Germany and the US have positive green spending of about 0.5% of their GDP, whereby the US has a counterproductive spending of about 0.12% and Germany of 0.05%. In the case of Italy the counterproductive spending (about 0.68%) exceeds the positive green spending of 0.02%.

Ecofys and Germanwatch (2009) conclude that the share of green stimulus is not big enough. "*Stronger leadership is needed from the US and larger EU economies to set a positive example for other countries*" (ibid, p.5). According to the study current packages do not sufficiently protect the climate even as addition to regular climate policy.

In general it should be stated that the green part of the programmes is mainly focussed on climate protection and does not recognize resource protection in a broader sense and the connected economic driving forces and benefits. This is understandable because climate protection obviously should have a high priority and the economic benefits of climate mitigation technologies (e.g. end use energy efficiency , combined heat and power generation and renewables) have been demonstrated by many studies and implementing activities. It is quite clear on the one hand, that short term investment impulses can only intensify long-term climate mitigation options. On the other hand the tremendous increase of many raw material prices (not only oil) before the crisis should have been taken as a signal that ecological modernisation should include not only climate protection but resource protection as a whole. This holds true especially from an economic perspective, because the share of material costs in industry and thus the economic vulnerability through global prices shocks from non-energy raw materials (especially metals) may be as high as from energy prices. Therefore it is a lost opportunity not to foster resource productivity by green recovery packages and not to harvest the broader economic benefits connected with an integrated strategy to raise energy and material efficiency.

Looking at the carbon emission reduction potential of the recovery packages the German IFW Institute (2009) identifies that 13% of the worldwide recovery packages dedicated to climate protection result in global CO_2 emission reduction of 111 million tonnes per year. This is less than 0.5 percent of the global emissions. IFW (2009) claims that the reduction potentials of several national packages are rather limited. China, for instance, invests more than 130 bn€ in its rail and energy grid, which is more an extension of the capacity than an improvement of the efficiency, thus resulting in increased emissions. Although China has the second biggest recovery package the reduction potential is only 22.8 million tonnes of CO_2 per year. For comparison, the European recovery packages contribute to reducing annual CO_2 emission by 22.4 million tonnes with a much smaller amount of money. The US creates a reduction potential of 45.7 million tonnes per year (IFW 2009). This high potential of the US package might also be due to the high investments in low-carbon power production. (see 2.3).

2.3 Composition of the green stimulus

HSBC (2009) has allocated green funds to the sectors low-carbon power, energy efficiency and water/waste, as displayed in the following table:

				Low Carbon Power		Energy Efficiency				Water/ Waste	Total
Country	FUND €	Green €	%	Renewable	CSS/Other	Building	Low Carbon Vehicles	Rail	Grid		
EU	30.0	17.61	58.71%	0.50	9.66	2.20	1.50			3.75	17.61
Germany	81.0	10.69	13.20%			8.03	0.53	2.13			10.69
France	26.1	5.52	21.19%	0.67		0.64		1.01	3.19		5.52
Italy	80.0	1.02	1.28%					1.02			1.02
Spain	11.0	0.64	5.85%							0.64	0.64
UK	23.5	1.63	6.94%			0.22	1.07	0.32		0.02	1.63
US	143.0	14.07	9.84%	7.92	2.01	2.58	0.59	0.26	0.71		14.07
	608.4	72.70	11.95%	17.42	3.05	21.18	3.09	7.41	8.50	12.04	72.70
Canada	24.6	2.03	8.27%		0.83	0.19		0.30	0.61	0.10	2.03
China	453.1	171.07	37.76%				1.16	76.26	54.11	39.54	171.07
Japan	375.6	9.61	2.56%			9.61					9.61
South-Korea	29.5	23.72	80.55%	1.39		4.79	1.39	5.42		10.74	23.72
Total	1885.7	330.33	17.52%	27.91	15.55	49.44	9.33	94.13	67.13	66.84	330.33
				43.46		220.03				66.84	

All currencies converted to €. €1=$1.29

Table 2 Country specific allocation of the green stimulus in bn € (based on HSBC 2009)

Energy efficiency measures receive the greatest share of funds with 220.03 bn€ (67%), followed by the water treatment with 66.84 bn€ (20%) and low-carbon power with 43.46 bn€ (13%). This is in line with the global climate change policy census which identified energy efficiency measures as being the most important action item until 2020 (European Commission 2009). McKinsey (2008) supports these findings by identifying the highest reduction potential (14 Giga tonnes CO_2 equivalent per year in 2030) in the sector of energy efficiency. Among the energy-efficiency measures in the framework of recovery programmes, support for rail transport has the biggest share. This is primarily due to the high Chinese investment (76.26 bn€).

Ecofys & Germanwatch (2009) argue that measures often only focus on energy efficiency in buildings and cars. Important sectors and emerging lead markets like renewable energies, combined heat and power , smart grids, energy storage and public transportation are not sufficiently considered (Ecofys & Germanwatch 2009; Hennicke et al. 2008)

Indeed, support for renewable energy schemes is rather weak. Only France, the US and South-Korea have allocated funds to it. Germany is not mentioned mainly because this sector is already benefitting from exciting schemes like retrofitting programmes and feed-in-tariffs (HSBC 2009). In 2008 and 2009 Germany has spent about 850 mn€ on alternative heating and buildings. According to McKinsey (2008) low-carbon energy supply also has a high reduction potential (12 Giga tonnes CO_2 equivalent per year in 2030).

Within the presented data the EU, the USA and Canada are having the only packages investing in carbon capture and storage (CCS). Canada also supports nuclear power, which it considers to be a low-carbon technology (HSBC 2009).

The water and waste-related spending includes funding for general environmental improvements like the 39.54 bn€ spending of China. The US and South-Korea also contribute to a large degree. Europe has allocated only minor funds in this area.

2.4 Job Potentials

In general, the job potentials of the different stimulus packages are difficult to estimate, because they depend on various assumptions. This holds true for calculating (net) employment effects in general and for the results of existing studies. For example, sometimes only the gross effects in studies for renewables are calculated not subtracting the losses of jobs in traditional energy production. Many studies do not include indirect effects caused by macroeconomic multipliers of additional investment (or cost reductions). Other studies do only look at additional costs and do not calculate e.g. the additional tax revenues (self-financing effects) caused by state investment programmes. Especially for strategies aiming at resource productivity (energy and material efficiency) not only the additional costs of investments matter but the macroeconomic effects of cost reductions and alternative spending of saved raw material costs. As a rule of thumb it can be derived from existing studies that about 100 net jobs can be created by reducing energy consumption by one TWh. Therefore, the direction of macroeconomic impacts (net jobs, additional growth and tax revenues) of resource protection strategies is well established. Nevertheless, the induced quantity and substitution effects (e.g. direct and indirect rebound effects) of efficiency strategies are often forgotten and should be much more recognized by further research.

The short-term studies on very recent economic recovery developments did not allow in depth assessments let alone necessary econometric modelling. Nevertheless, a few attempts have been made to assess job potentials of different programmes, whereby in most cases only gross effects are described:

Germany: According to a study of the German Institute for Employment (IAB) not less than 250,000 jobs can be sustained through the German stimulus plan (FAZ 2009).

France: A job creation potential of 80,000-110,000 is estimated whereby a possible loss of 90,000 jobs can occur (HSBC 2009).

UK: 350,000 jobs can be sustained and gained in the low carbon sector (HSBC 2009).

Canada: An estimated 407,000 jobs are created (HSBC 2009).

South-Korea: A total of 960,000 jobs through mainly green spending are envisaged (HSBC 2009).

US: In total the stimulus package aims to create and save 3,500,000 jobs in the US (DB Advisors 2009).

2.5 Overview of recovery packages

	Content	Fund (bn€)	Time Aspects	Green Stimulus	Green Funds (bn€)
EU	Infrastructure projects (trans-European transport projects, high-speed Internet); employment support initiative (including for the low-skilled, apprenticeships, training, reduction of social charges, etc.); investment in R&D, innovation and education; access to financing for business; reduction of administrative burdens and promotion of entrepreneurship; increase of climate change energy security investments; improvement of the energy efficiency in buildings; and promotion of "green products" and the development of clean technologies for cars and construction.	30.00	Announced Date: 26th Nov. 2008 Timing: 2009-2010 Status: Passed	Renewable Energies; Gas and electricity interconnectors; Carbon Capture and Storage; R&D for renewable energies; Energy efficiency in public buildings; Green cars initiative; Factories of the future initiative; Infrastructure services	17.6 (58.71%)
France	Mainly investment in public enterprises (post, energy and railways), defence, investments in strategic areas (sustainable development and clean technologies, higher education and research and the digital economy); investment for regional and local authorities (in partnership investment in hospitals, childcare facilities and other social institutions); support to employment, housing, the financing of firms (in particular SMEs), health and some measures for the environment. Special measures targeted at the automobile sector.	26.10	Announced Date: 10th Dec. 2008 Timing: 2009-2010 Status: Passed	Renewable energies; Sustainable agriculture; Building efficiency; Low-carbon vehicles; Rail	5.5 (21.2%)
Germany	Infrastructure (particularly schools and universities, also measures to foster broadband); measures to help business and households retain employment and overcome the crisis (secure funding, governmental guarantees, reduction of non-wag labour costs, income tax cut and means to ease burden on households – e.g. payment for children(; training an upgrading grants (raising levels of education); fostering innovation and R&D; green technologies. Special measures targeted at the automobile sector.	81.00	Announced Date: 5th Nov. 2008 Timing: 2009-2010 Status: Passed	Building efficiency; Low-carbon vehicles; Modal-shift: Public transport	10.7 (13.2%)
Italy	Stimulating investments on infrastructures and research (including broadband); supporting low-income households (tax cuts for poorer families and pensioners); reducing the tax burden for SMEs; focus on greening the automobile sector and support to methane systems and the purchase of ecological cars.	80.00	Announced Date: 28th Nov. 2008 Timing: 2009 onwards Status: Passed	Modal-shift; Low-carbon vehicles	1.0 (1.3%)
Spain	Tax cuts; spending on public works and other stimulus measures to raise employment rates; liquidity to credit strapped companies (especially SMEs) and households (families, in particular); special help to the automobile sector and modernising of basic industries such as transportation, energy, services and telecommunications; and modernisation of the public civil service.	11.00	Announced Date: 27th Nov. 2008 Timing: 2009 Status: Passed	Low-Carbon Power; Energy efficiency	0.6 (5.8%)

UK	Cut in value-added tax rate; acceleration of capital investment projects (likely to include some research infrastructure) and for accelerated roll-out of broadband; credit line and loan guarantees (in particular for SMEs); and measures to combat unemployment (e.g. paying companies to hire and train the unemployed).	23.50	Announced Date: Nov. 2008 Timing: 2009-2012 Status: Pending	Building efficiency; Modal-shift: Rail and waterways; Low-carbon vehicles; Flood defences	1.6€ (6.9%)
US	Direct relief to working and middle-class families (tax credit, expansion of unemployment insurance, state fiscal reliefs, etc.); large infrastructure investments (roads, public transit, high speed rail, smart electricity grid and broadband); protecting health care coverage of citizens and modernising the health sector (including its computerisation and digital health records); increased funding for key scientific and engineering agencies; modernisation of classrooms; laboratories and libraries; and fostering renewable energy production and investments.	143.00 608.40	Announced Date: 3rd Oct. 2008 Timing: 10 years Status: Passed Announced Date: 15th Jan. 2009 Timing: 10 years Status: Passed	Renewable energies; Carbon Capture and Storage; Building efficiency; Low-carbon vehicles; Modernisation of the electricity grid; Environmental restoration; Flood protection; Navigation infrastructure; Water projects	14.1 (9.8%) 72.7 (12.0%)
Canada	Investments in roads, bridges and public transport, investments in clean water as well as in knowledge and health infrastructure (including post-secondary institutions, research equipment, digitisation of health records, extension of access to broadband services and green energy infrastructure); investments in the renovation and retrofit of social housing and support for home ownership and the housing sector; personal and business tax relief; access to financing, support and training to citizens affected by the crisis; and support to most affected sectors and communities (e.g. targeted funding for the auto, forestry, agriculture, and manufacturing industries).	24.60	Announced Date: 27th Jan. 2009 Timing: 2009-2013 Status: Pending	Low-Carbon Power (CCS and atomic energy); Energy efficiency; Waste and water infrastructure	2.0 (8.3%)
China	Low-income housing; rural infrastructure; water; electricity; transportation; the environment; technological innovation and rebuilding after disasters such as earthquakes. Support package to auto and steel industries.	453.10	Announced Date: 9th Nov. 2008 Timing: 2009-2010 Status: Passed	Low-carbon vehicles; Rail-Infrastructure; Electricity grid; Biological conservation; Environmental protection	171.1 (37.8%)
Japan	Support for household consumption; tax reductions on mortgages; benefits for dependent persons; cutting of healthcare costs; creation of new public-sector jobs in nursing, retirement homes and childcare, and jobs relating to the protection of the environment; raising the self-sufficiency ratio of food; funds on a priority basis to research in advanced technologies and related research; and reduction of taxes for eco-friendly cars.	375.60	Announced Date: 19th Dec. 2008 Timing: 2009 onwards Status: Passed	Tax cuts of investment in energy saving and new energy equipment	9.6 (2.6%)
South-Korea	Focus on sustaining green technology and value-added services to build new engines of growth (including sustainable energy, technologies to reduce greenhouse gas emissions, information technologies as well as healthcare and tourism).	29.50	Announced Date: 6th Jan. 2008 Timing: 2009-2012 Status: Passed	Renewable energies; Building efficiency; Low-carbon vehicles; Modal shift; River and forest restoration; Medium sized dams	23.7 (80.5%)

Table 3 Overview of selected recovery packages. All currencies converted to €. €1=$1.29 (HSBCS 2009; OECD 2009, p. 22-23)

2.6 Intermediate result

Primarily based on the presented evidence we may conclude that the overall size of EU recovery packages is low in comparison to the US and Chinese plans. European programmes contain a small green share compared to the Asian programmes, but it needs to be stressed that there is insufficient evidence on the quality of green spending. Nevertheless, the low green stimulus in the EU especially in relation to Asian programmes is remarkable and might raise the question of global leadership in the ecological modernisation of the global economy.

The presented studies have been short-term assessments reflected recent and short-term developments. Many aspects of the recovery packages could often not be considered sufficiently. The recovery packages are spent over different time spans. For instance, the US recovery packages cover a period of 10 year whereby the recovery packages of France will be spent in two years.

Many aspects of recovery packages are still not decided. Discussion about actual sizes, measures and even additional packages are still ongoing. Therefore, the references of each study should have been revealed, which has not always been the case.

Another difficulty is the identification of the green share. First, it is not always clear which measures are assigned to be green and second, the different qualities of the measures resp. the stimulus of new green lead markets are not considered.

Nevertheless, the data and references are accurate enough to conclude, that the total size and the green share of the European recovery packages are small in relative and absolute terms.

Many studies and comments on the green share of recovery programmes focus on climate and energy issues only, but a Green New Deal comprises – and should comprise – more than strategies for climate protection. For example, China, South Korea and the US dedicate substantial funds to waste and water treatment. Especially with regard to competitive EU industries in the waste and water sector these aspects should not be neglected. In emerging economies the lack of environmental infrastructure is already creating large and growing markets (ECOTEC 2002; Schepelmann 2006).

It should be recognized that on the one hand end-of-pipe technologies create new business fields, revenues and jobs in supplying industries and national economies, but raise costs for the applying sectors. On the other hand, integrated production and product policies reduce costs by application, but deficits of official statistics and comprehensive modelling makes it more difficult to calculate the probably very promising macroeconomic effects.

Combining end-of-pipe solutions with integrated process and product policies in terms of energy and material efficiency could create a special EU trade mark on this attractive market. Beyond climate change a European Green New Deal will have to address all aspects of green industries. Therefore, the following chapter outlines turnover and employment of eco-industries in Europe. It will conclude with describing economic and political drivers of eco-innovation in Europe.

3 Green New Deal and eco-industries: empirical background and expectations

New Deal policies are usually connected to stimulating demand by governmental spending. The previous chapter has demonstrated that a Green New Deals means stimulating public demand in "green" economic sectors (e.g. energy, waste and water management). Eventually, this leads to additional turnover, employment and innovation in these sectors of the economy. The following section will therefore look at the current turnover and employment situation in European eco-industries and conclude with an outlook on drivers of eco-innovation.

3.1 Definition of eco-industries

OECD and Eurostat (1999) provided a broadly accepted definition for eco-industries: Eco-industries are engaged in *"activities which produce goods and services to measure, prevent, limit, minimise or correct environmental damage to water, air and soil, as well as problems related to waste, noise and eco-systems. This includes cleaner technologies, products and services that reduce environmental risk and minimise pollution and resource use*" (ibid, p.9).

It should be emphasized that this definition focuses on ecological impacts and does no include the costs impacts of using the products of eco-industries for cost reduction which is important to calculate the macroeconomic effects of investments.

That means that the following typical statistical classification is also supply-oriented and does not differentiate the cost effects (e.g. end-of-pipe or integrated technologies) connected with application. Therefore, more research should be directed to the question what industries and technologies contribute to cost reductions through application, by avoiding unnecessary residues (e.g. waste water, heat or materials) which create only costs and no added value,

Broadly speaking industry can be sub-divided into pollution management, cleaner technologies & products and resource management. These three groups consist of the following sub-sectors (ibid, pp. 10ff.):

Pollution Management
- Air pollution Control
- Waste Water Treatment
- Waste Management
- Remediation and Clean up of Soil & Groundwater
- Noise and Vibration Control
- Environmental Monitoring & Instrumentation
- Environmental Research & Development
- Public Environmental Administration
- Private Environmental Management

Resource Management
- Water Supply
- Recycled Materials
- Nature Protection
- Indoor air pollution control
- Renewable energy plant
- Heat/energy saving and management
- Sustainable agriculture and fisheries
- Sustainable forestry
- Natural risk management
- Eco-tourism

Cleaner Technologies and Products

Cleaner/resource-efficient technologies and processes
Cleaner/resource-efficient products

Two major studies commissioned by DG Environment have been carried out to examine the European eco-industry: One has been published by ECOTEC (2002) for the base year 1999 and the other by Ernst & Young (2006) for the base year 2004 whereby the latter is considered to be a five year update of the 1999 study.

Both studies use the definition provided by OECD and Eurostat with slight variations.

Within the ECOTEC study (2002) the sector "cleaner technologies and products" is included in the sector "pollution management". In the sector "resource management" only the subsectors" water supply, recycled materials and nature protection" have been included.

In contrast to ECOTEC (2002) and Ernst & Young (2006) and the underlying classification of OECD and Eurostat (1999) Jänicke & Zieschank (2008) are proposing to include "cleaner technologies" as well as "solid waste management & recycling" in the resource management section. Thus all applications and integrated environmental technologies would be included in resource management. According to this classification resource management and cleaner technologies have a larger market share than the pollution control and end-of-pipe technologies (Jänicke & Zischank 2009).

Jänicke & Zieschank (2008) argue that a relevant contribution of eco-industry is difficult to assess if it is becoming a major trend in the entire industry. This would be the case, if e.g. the realization of cost-saving potential of improved resource efficiency would become a general trend in industry. Such a development would finally lead to a situation where the definition and delineation of distinct eco-industries would be superseded.

The definition by OECD and Eurostat is not explicitly used for describing the German eco-industry by Berger (2008), but the defined lead markets are similar to the OECD/Eurostat classification of the sectors. Differing from the classification Berger (2008) identifies "sustainable mobility" as an additional sector of the eco-industry, whereby "sustainable mobility" consists of improved energy efficiency of vehicles, decreased amount of traffic and improved vehicle utilisation and modal split (Berger 2008).

Also the employment potential of eco-industries depends on the underlying definition. UNEP (2008) defines green jobs *"…as work in agricultural, manufacturing, research and development (R&D), administrative, and service activities that contribute substantially to preserving or restoring environmental quality. Specifically, but not exclusively, this includes jobs that help to protect ecosystems and biodiversity; reduce energy, materials, and water consumption through high efficiency strategies; de-carbonize the economy; and minimize or altogether avoid generation of all forms of waste and pollution*" (ibid, p.35f.).

Eco-Innovation is defined by Reid & Miedzinski (2008) as *"the creation of novel and competitively priced goods, processes, systems, services, and procedures designed to satisfy human needs and provide a better quality of life for everyone with a whole-life-cycle minimal use of natural resources (materials including energy and surface area) per unit output, and a minimal release of toxic substances"* (ibid, p.3; see also Bleischwitz et al. 2009).

3.2 Turnover and employment of the eco-industries in Europe

The presented evidence about the size of the eco-industry can only give a rough orientation. As described in the previous chapter the data about eco-industries has to be interpreted with care since there is no clear delineation of this partly cross-sectoral industry.

However, past developments have shown that the development of eco-industries needed political leadership as it will be demonstrated with the example of the global eco-market champion Germany (chapter 3.3.). In order defend and to develop further the EU's leading role on the world marked political action is required especially in the new EU Member States.

3.2.1 Turnover of eco-industries

According to assessments of Berger (2008) the global market of eco-industries has a volume of about 1,000 bn€ which will double to about 2,200 bn€ in 2020. These are only rough estimates because eco-industries are cross-sector industries without statistically defined boundaries. Therefore, estimates of the eco-industries total volume depend highly on the definitions and the exact empirical evidence.

The differentiation of markets and potentials is often not clear but of utmost importance for conceptualizing a "New Green Deal". If the impressive figures on market potentials imply the autonomous development of self-sustained markets there is no need for policy interventions including a GND. If these figures are only calculations of potentials even greater potentials can be identified (e.g. for energy and material efficiency) and more promising economic benefits can be anticipated if existing market barriers and failures were overcome by innovative policy mixes (e.g. a New Green Deal). There is evidence that the cited figures predicting a tremendous economic growth of eco-industries are estimates of potentials, which can only be turned into markets and new business opportunities with the "helping hand" of state interventions. This is important for GNDs in two respects: On the one the hand, it emphasizes the necessity to look into policy mixes which encourage R&D and the scaling-up of eco-industries. On the other hand, the accelerated support to existing eco-industries needs additional instruments and incentive structures.

In comparison to climate mitigation policies the European Union has still no comparable studies and results for the development of resource policies[1]. Especially the specific key strategies, instruments and policy mixes have to be developed and the economic impacts have to be calculated by top down and bottom up modelling.

ECOTEC (2002) presents primarily 1999 data for the EU-15, which comprise according to Ernst & Young (2006) about 94% of the eco-industries of the EU-25 in 2004. Therefore table 4 only includes figures for the EU-15 for comparison:

[1] This is why the German government has launched the large MaRess research project, in order to identify intervention points and to conceptualize appropriate policy-mixes, http://ressourcen.wupperinst.org

	1999						2004					
Country	Total Turnover (€ million)	% of EU-15	Pollution Mgmt (€ million)	% of total turnover	Resource Mgmt (€ million)	% of total turnover	Total Turnover (€ million)	% of EU-15	Pollution Mgmt (€ million)	% of total turnover	Resource Mgmt (€ million)	% of total turnover
Germany	56,710	31.0%	41,195	72.6%	15,515	27.4%	66,114	30.9%	44,597	67.5%	21,517	32.5%
France	37,990	20.7%	22,330	58.8%	15,660	41.2%	45,851	21.5%	28,264	61.6%	17,587	38.4%
UK	24,470	13.4%	17,085	69.8%	7,385	30.2%	21,224	9.9%	12,103	57.0%	9,121	43.0%
Italy	15,980	8.7%	10,700	67.0%	5,280	33.0%	19,269	9.0%	8,946	46.4%	10,323	53.6%
Netherlands	9,610	5.2%	7,170	74.6%	2,440	25.4%	14,039	6.6%	10,953	78.0%	3,086	22.0%
Austria	8,900	4.9%	8,275	93.0%	625	7.0%	10,091	4.7%	9,092	90.1%	999	9.9%
Spain	8,030	4.4%	5,525	68.8%	2,505	31.2%	9,044	4.2%	6,047	66.9%	2,997	33.1%
Denmark	6,630	3.6%	5,405	81.5%	1,225	18.5%	8,794	4.1%	6,542	74.4%	2,252	25.6%
Belgium	4,770	2.6%	2,405	50.4%	2,385	50.0%	5,806	2.7%	2,785	48.0%	3,021	52.0%
Sweden	3,310	1.8%	2,620	79.2%	690	20.8%	3,968	1.9%	3,090	77.9%	878	22.1%
Finland	2,100	1.1%	1,790	85.2%	310	14.8%	3,543	1.7%	1,414	39.9%	2,129	60.1%
Portugal	1,750	1.0%	920	52.6%	830	47.4%	2,356	1.1%	1,069	45.4%	1,287	54.6%
Greece	1,900	1.0%	1,045	55.0%	855	45.0%	2,054	1.0%	1,266	61.6%	788	38.4%
Ireland	790	0.4%	525	66.5%	245	31.0%	1,211	0.6%	818	67.5%	393	32.5%
Luxembourg	280	0.2%	165	58.9%	115	41.1%	319	0.1%	198	62.1%	121	37.9%
EU-15 Total	183,220	100.0%	127,155	69.4%	56,065	30.6%	213,683	100.0%	137,184	64.2%	76,499	35.8%

Table 4 EU-15 eco-industry sizes from 1999 and 2004 (based on ECOTEC 2002 and Ernst & Young 2006)

ECOTEC (2002) uses demand for environmental protection goods and services in order to estimate the size of the industry of the EU-15 Member States and candidate countries. According to these estimates the eco-industries of the EU-15 supplied 185 bn€ of goods and services in 1999, whereby the pollution management and cleaner technologies sectors contributed 127 bn€ and the resource management sector 58 bn€.

Candidate countries (CC-13) supplied 10.3 bn€ of goods and services a year in pollution management, on which an average share of 1.9% GDP had been spent (ECOTEC 2002).

According to the 2004 study of Ernst & Young (2006) the total turnover of the EU-25 eco-industries amounts to 227 bn€ in 2004 whereby the EU-15 have generated a total turnover of 214 bn€ (94%). The pollution management contributed 144.9 bn€ and resource management 81.8 bn€.

Ernst & Young (2006) state that the turnover increased in total by about 7% in the EU-15 between 1999 and 2004 (measured in constant prices). Based on the data in table 4 this figure is irreproducible as information on the underlying inflation rates is missing. The country specific growth of the eco-industry is presented in figure 5:

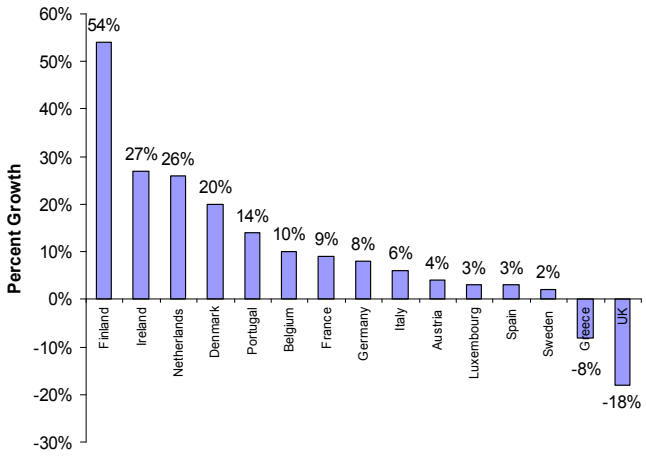

Figure 5 Country specific growth of the eco-industry between 1999 and 2004 at constant prices (based on Ernst & Young 2006)

In terms of turnover the largest sectors of the EU eco-industries are water supply, waste water treatment and solid waste management. Waste water treatment and waste manage-

ment each are accounting for about one third of the pollution management sector (Ernst & Young 2006).

In both survey periods 50% of the total EU-15 turnover had been generated by the eco-industries of Germany and France (table 4).

Based on different classifications of the eco-industry Jänicke and Zieschank (2008) claim that the resource management sector and cleaner technologies have a larger market share than the pollution control sector and end-of-pipe technologies. They underline the high growth of resource management in comparison to traditional pollution control. Jänicke & Zieschank challenge Ernst & Young (2006), because according to them, some figures have not been included and others were estimated too low. Thus, Jänicke & Zieschank (2008) estimate the total turnover of the EU-25 to be at least 270 bn€ (2.6% of the GDP).

According to the German consultancy Berger (2008) the performance of German eco-industry has been highly underestimated by ECOTEC (2002) and Ernst & Young (2006). For 2005 Berger estimated a significantly higher turnover of 150 bn€ (see chapter 3.3.1). Some factors are quantified by Jänicke & Zieschank (2008), for instance, a relatively high figure estimated at 40 bn€ for eco-construction (retrofitting) had not been considered nor industries like eco-tourism and green financing. In addition, estimates for renewable energy had been too low (12.3 bn€ in 2004 instead of 2.2 bn€). This is twice as much as the estimate for the EU-25 (6.1 bn€) (Jänicke & Zieschank 2008).

3.2.2 Employment in eco-industries

Several studies and estimations have been made for assessing the green jobs worldwide and for specific regions. For the interpretation of these studies the described statistical difficulties of capturing eco-industries have to be kept in mind. In this context it is not intended to present final quantitative data and results. Instead, the existing scattered and in part not comparable approaches are presented as robust indicators that the macroeconomic development of eco-industries is positive und promising. An overview of these studies and estimates are summarized in the following table:

Source	Estimated jobs	Region examined	Timeframe	Other consideration
University of California, 2008. "Energy Efficiency, Innovation, and Job Creation in California."	1,500,000	California	1977-2007	Resulting from energy efficiency policies
	403	California	2008-2020	Efficiency and climate-action driven jobs taking into account the potential for innovation
US Metro Economics, 2008. "Current and Potential Green Jobs in the US Economy."	750	US	2006	By increasing renewable use and implementing efficiency measures
	2,500,000	US	2008-2018	By increasing renewable use and implementing efficiency measures
	4,200,000	US	2008-2038	By increasing renewable use and implementing efficiency measures
Political Economy Research, 2008. "A Program to Create Good Jobs & Start Building a Low-Carbon Economy."	2,000,000	US	Potential	Based on spending $100 billion in public funds in a “green” recovery program
Barack Obama, 2008. Energy and Economic Policies.	5,000,000	US	2008-2018	Based on $150 billion stimulus
Gordon Brown, 2008. UK Renewable Program.	160	UK	2008-2020	Based on £100 billion stimulus
	25,000,000	Worldwide	2050	-

Table 5 Overview of studies and estimates conducted on the job creation potential of a green stimulus (DWS 2008, p. 6)

According to UNEP (2008) the perspectives of green employment are very positive. Wind and solar power are expected to create more than 8 million jobs within the following 20 years. Other major potentials can be realized in the construction of energy efficient buildings and the retrofitting of existing ones, as well as switching conventional farming to a more sustainable one. Furthermore, the introduction of modern public transport systems in regions where no system or only old inefficient ones exists could create considerable employment. Finally, the expansion of recycling and remanufacturing measures throughout entire production chains represents a large potential.

More specific studies on the employment situation of eco-industries have been made on behalf of the European Commission. Ernst & Young (2006) have identified about 3.4 million fulltime direct and indirect employees (equivalents) in Europe in 2004 whereby 2.3 million jobs belong to the pollution management sector and about 1 million to the resource management sector. Waste water treatment and solid waste management account for about 77% of the employment of the pollution management sector, which refers to about 1,77 million jobs (Ernst & Young 2006).

	Sector	EU-15 1999				
		Direct			Indirect	
		OPEX	CAPEX	Total	OPEX	Total
Pollution Mgmt	Air Pollution Control	30,300	80,700	111,000	50,400	161,400
	Waste Water Treatment	209,100	218,500	427,600	132,200	559,800
	Solid Waste Management	696,300	64,000	760,300	144,300	904,600
	Remediation & Clean Up	15,100	8,000	23,100	17,700	40,800
	Noise & Vibration	21,800	7,000	28,800	3,500	32,300
	Environmental Administration	66,500	9,100	75,600	26,100	101,700
	R&D	25,900	2,400	28,300	3,300	31,600
	Total	1,065,000	389,700	1,454,700	377,500	1,832,200
Resource Mgmt	Water Supply	208,800	88,100	296,900	135,300	432,200
	Recycled Materials	223,600	10,900	234,500	46,200	280,700
	Nature Protection	66,700	33,100	99,800	22,600	122,400
	Total	499,100	132,100	631,200	204,100	835,300
	Grand Total	1,564,100	521,800	2,085,900	581,600	**2,667,500**

	Sector	EU-25 2004				
		Direct			Indirect	
		OPEX	CAPEX	Total	OPEX	Total
Pollution Mgmt	Air Pollution Control	31,718	88,113	119,831	58,926	178,757
	Waste Water Treatment	387,547	209,245	596,792	203,355	800,147
	Solid Waste Management	774,976	68,329	843,305	165,184	1,008,489
	Remediation & Clean Up	21,176	14,763	35,939	25,026	60,965
	Noise & Vibration	20,763	9,320	30,083	3,235	33,318
	Environmental Administration	178,117	39,710	217,827	51,031	268,858
	R&D	-	-	-	-	-
	Total	1,414,297	429,480	1,843,777	506,757	2,350,534
Resource Mgmt	Water Supply	-	-	-	-	502,000
	Recycled Materials	-	-	-	-	439,000
	Nature Protection	-	-	-	-	100,000
	Total	-	-	-	-	1,041,000
	Grand Total					**3,391,534**

Table 6 EU-15 eco-industry employment from 1999 and EU-25 eco-industry employment from 2004 (based on ECOTEC 2002 and Ernst & Young 2006)

Figures are presented for direct and indirect employment. It is further differentiated between employment created by expenditures for operating (OPEX) and investment related

expenditures (CAPEX). Indirect employment is mostly generated by operating related expenses.

According to the studies of ECOTEC (2002) and Ernst & Young (2006) the estimations of employment varied considerably between 1999 and 2004. Direct employment in pollution management has increased from 1.45 million jobs in 1999 (EU-15) to 1.85 million jobs in 2004 (EU-25).The direct employment for resource management activities has increased from 0.6 million jobs in 1999 (EU-15) to 1.04 million jobs in 2004 (EU-25).

Nevertheless the results presented by these two studies should be used cautiously because ECOTEC (2002) only presents data for the EU-15 whereas Ernst & Young provide data for the EU-25. Further on differences in turnover, in wage rates of the countries or differences in other production factors can have a significant effect on the model used.

A country specific breakdown is unfortunately only supplied in the ECOTEC (2002) study as displayed in table 8:

	Direct				Indirect		Total	
	OPEX		CAPEX		OPEX			
Country	Jobs	%	Jobs	%	Jobs	%	Jobs	%
Germany	373,800	24%	128,700	25%	148,900	26%	651,500	24%
France	337,300	22%	64,700	12%	122,800	21%	524,800	20%
UK	264,100	17%	115,600	22%	85,800	15%	465,500	17%
Italy	126,500	8%	42,400	8%	46,600	8%	215,600	8%
Spain	84,200	5%	55,400	11%	34,200	6%	173,900	7%
Netherlands	90,300	6%	18,900	4%	35,600	6%	144,900	5%
Austria	72,200	5%	14,200	3%	26,100	4%	112,500	4%
Denmark	62,500	4%	18,100	3%	26,300	5%	106,900	4%
Portugal	31,500	2%	20,900	4%	11,900	2%	64,300	2%
Belgium	39,400	3%	10,000	2%	13,500	2%	63,000	2%
Greece	31,300	2%	11,100	2%	10,500	2%	52,900	2%
Sweden	24,300	2%	8,700	2%	9,000	2%	42,000	2%
Finland	16,700	1%	8,500	2%	6,300	1%	31,500	1%
Ireland	7,600	0%	3,600	1%	2,900	0%	14,100	1%
Luxembourg	2,300	0%	800	0%	800	0%	3,900	0%
EU-15 (Jobs)	**1,564,100**	**100%**	**521,600**	**100%**	**581,300**	**100%**	**2,667,300**	**100%**

Table 7 EU-15 country specific employment of eco-industries in 1999 (based on ECOTEC 2002)

The German eco-industry has the highest share of employment with almost one quarter of the total jobs in 1999. Differing from the results for Germany of ECOTEC (2002) and Ernst & Young (2004) BMU (2005) provides figures of 1.412.400 employees in 1998 and 1.459.100 in 2002 (both OPEX and CAPEX). These numbers present more than double the amount presented by ECOTEC and Ernst & Young. This may be another indication of an underestimation - at least of the German eco-industries.

It is interesting to note that the American Solar Energy Society (ASES) and Management Information Services (MISI) are estimating a gross job potential of 16 million jobs by 2030 only in the renewable industry sector. EU Member States, especially Germany, have a higher performance of the renewable energy industry. In the EU there are more jobs in the renewable energy industry and the generation of new jobs is much faster than in the US. The ASES and MISI are concerned that the US Renewable energy industry will not be able to catch up with the European market, if no further investment in US industry is done (ASES & MSI 2009). Consequently, the US has already made some major investment in renewable energies. In 2008 and early 2009 the US has made the highest new capacity investment of 24bn$ which is 20% of the global total investments. The US investment in wind energy in 2008 has already surpassed Germany, the world's former champion in wind energy capacity. In 2008 the US

and the European Union both invested more in renewable energy capacities than in the conventional energy capacities (Martinot et al. 2009).

3.3 Example: Eco-Industries in Germany

The presented evidence of the eco-industries' turnover and employment indicates an outstanding importance of the German eco-industry. Therefore, Germany will be examined in more detail in the following section. This will also shed light on the political and economic drivers of eco-innovation, which will be dealt with in chapter 3.4, which are of central importance for a Green New Deal with lasting effects on social, economic and environmental conditions.

3.3.1 Characteristics of the German eco-industries

According to recent assessments of the German Federal Ministry of Environment (BMU 2009a) the German environmental industry is booming and will continue to grow. 40% of all companies of the industry were able to realize an annual growth rate of 10% between 2004 and 2006. More than 5% of German industrial production consists of environmental goods. From 2005 to 2007 the production of the overall eco-industry grew by 27% in total. The strong development of the environmental industry in Germany also had an influence on the labour market. Companies from the environmental industry registered an average increase of 15% in labour forces between 2004 and 2006 (BMU 2009a).

In 2006 4.5% of all German employees have been working in the eco-industry which amounts to almost 1.8 million people. Between the years 2004 to 2006 the sector generated 300.000 additional jobs (BMU 2009a).

Surveys performed among companies of the eco-industry in Germany showed, that a high growth rate in turnover is expected in the coming years, especially in renewable energies and renewable resources. According to the survey it is expected that in the medium term (2030) the environmental industry will overturn the classical German manufacturing industries like machine and vehicle construction (Berger 2008).

Already Germany has a share of 16% of the global trade of environmental goods and is gaining importance in global markets (BMU 2009a).

Based on Berger (2008) the following six lead markets have been identified:

- Sustainable energy production
  The overall global market potential is estimated to double by 2020. Gas- and steam technologies will remain with a constant growth rate. The global market for solar thermal and photovoltaics will have a yearly growth rate of about 20%. In 2020 the market for fuel cells will have ten times the size of today with 75,000 mn€. The most dynamic development will be for renewable energies. The main focus of the industry until 2020 will be Central and Eastern Europe.
- Energy efficiency
  The global market for energy efficiency has a volume of 450,000 mn€, and will be double by 2020. It is the lead market with the biggest volume. German companies

will have a market share of 20%. The biggest international markets will be in North America and industrialized European markets.

- Resource- and material efficiency
  The lead market resource- and material efficiency has got the biggest share of investment in R&D. In Germany overall resource use for production is estimated to have a reduction potential of 20% until 2016 which is equivalent to cost reduction potential of 27,000 mn€ per annum.

- Circular economy
  The global market for technologies of the waste- and recycling economy is estimated to have a volume of 30,000 mn€. This market will grow to about 46,000 mn€ in 2020. The market share of German companies is expected to beat 25%.

- Sustainable water management
  The lead market sustainable water management has an estimated market volume of 0.48 bn€ until 2020. The market for waste water management has an estimated volume of 12,000 mn€ and a high potential for further growth. Germany is the market leader with a 40% share in the segment of decentralised water management.

- Sustainable mobility
  The lead market sustainable mobility has a market volume of 0.18 bn€ and can be doubled by 2020. The expected growth of the market for fuel efficient engines is moderate but the market for bio fuels and exhaust gas filter is predicted to have an annual growth rate of 20% until 2020. Also mature markets like traffic detection systems are estimated to have and annual growth of 7% until 2020.

According to Berger (2008) the emerging Asian and East European markets will become more important. German companies are estimating that the sales markets in Central and Eastern Europe will gain the same importance as West European markets. Markets in India, China and Russia will be by far larger than those in North America and Japan. Until 2020 also African sales markets will become important for the lead market energy efficiency.

3.3.2 The co-evolution of environmental policy and eco-industries in Germany

Germany is the world's leading supplier of environmental technology and services. This position in the world market has been a consequence of an environmental policy which has been shaped during several generations of policy-makers from the late 1960ies until now. It needs to be remembered that some of the most densely populated and polluted region in the world had been in Germany. The coal mining and steel-producing industries along the river Ruhr caused serious environmental pollution. Especially in the most polluted areas of Europe a systematic cleaning-up of the environment resulted in a still ongoing co-evolution of environmental policy and a highly competitive eco-industry in Germany (von Weizsäcker 1994, Jänicke 2003; Bleischwitz 2007).

The development of eco-industries tends to depend on a strong modern state which is able to set and enforce high environmental standards. Therefore, this industry depends on political will, commonly shared perspectives, and continuous credible political efforts. In Germany a broad environmental movement contributed to a societal consensus, which was also re-

flected in the different political parties. Over four decades this broad political consensus helped to establish the necessary networks of state, industry, science and society which are needed for eco-innovation. Jänicke & Zieschank (2008) mention several examples of successful sector specific programmes for environmental technology in Germany:

- Low-Energy Buildings
  In 1998 the federal red-green coalition of the Social Democrats and the Greens set up a policy to improve the energy efficiency of buildings as part of their climate programme. The approach was a combination of specific regulations and market instruments. Binding energy efficiency standards (insulation, heating systems) have been introduced. Old existing and new buildings have to fulfil these efficiency standards. Additionally, an eco tax and market incentive programmes have been introduced. Fossil fuels became more expensive and financial support was granted for low energy houses from the state-owned bank "Kreditanstalt für Wiederaufbau" (Jänicke & Zieschank 2008.). As a result of this policy mix and an overall increase of energy prices there has been a fast growing market for low energy houses in Germany. Heating energy use in Germany has been reduced by about 20% between 1996 and 2005 (SRU 2005). Altogether, 40 bn€ have been invested in energy-efficient buildings in 2005 in Germany (Jänicke & Zieschank 2008).

- Fuel-Efficient Diesel Cars
  In 1997, a differentiation in the car tax has been introduced, which supported fuel efficient cars with a tax bonus. Diesel engines with direct fuel injection have been the only ones meeting these stricter targets. The eco-tax on fuel introduced in 1999 worked well together with this tax bonus. In 1999 diesel cars with consumption of 3 or 5l/100km had been introduced to the market. This led to not only to the successful establishment of fuel-efficient diesel cars but also a decrease of fuel consumption since 1999. As a result Germany is the lead market for fuel efficient diesel cars (Jänicke & Zieschank 2008).

- Recycling
  The increased market prices for resources have been a financial incentive to reduce the use of primary resources as well as reuse and recycling. Also trade with secondary resources has become more profitable. Additionally, Germany introduced a recycling policy in 1994 (it was also strengthened in 2001) including the objective to prohibit land filling without pre-treatment until 2005.
  As a result of the policy recycling rates increased and the amount of final disposal to landfill decreased from 63.5 million tonnes in 1998 to 45.7 million tonnes in 2005 (Statistisches Bundesamt 2007). Since 2000 there was a significant decoupling of GNP-growth and waste generation (Berger 2008).
  In addition, emissions of green house gases have been avoided (40 million tonnes CO_2 equivalent compared to 1990) mainly by decommissioning land fill sites (BMU 2006).An economic effect of the policy was a significant growth of the waste and recycling sector. The waste industry has currently a turnover of 50 bn€ and 250.000 jobs. Between 2004 and 2006 the recycling sector had an annual 13% and 9%-growth in employment (Berger 2008).

- Renewable Energies
  The rising oil price and the eco-tax on fossil fuels supported the development of re-

newable energies. A major instrument was obligatory feed-in-tariffs for renewable electricity. They existed already in the 1990s (Electricity Feed In Act 1990) but have been strengthened through the Renewable Energy Resources Act in 1998. 4.19 bn€ of revenues caused by fees were realized in 2005, which resulted in the 3% increase of electricity costs for households (Berger 2008, BMU 2006).

On top of the feed-in-tariffs another financial incentive has been introduced. The "Market Incentive Programme" 2000-2004 supported the investment in renewable energies with an amount of 665.4 mn€. The state-owned bank "Kreditanstalt für Wiederaufbauf" (KfW) financed alternative heating in buildings with an amount of 350 mn€ in 2008 and an expected amount of 500 mn€ in 2009 (Jänicke & Zieschank 2008).

The effect of this policy was remarkable. A doubling of the renewable power production from 19 to 37 TWh/a took place from 1991 to 2001. Another doubling of the production to 73 TWh/a in 2006 was achieved in half the time. The growth rate still increases with an production to 86,7 TWh/a in 2007 (Jänicke & Zieschank 2008).As an environmental effect 58 million tonnes of CO_2 emissions have been cut in 2007 (BEE 2008) which makes this instrument mix the most effective one in terms of climate protection (Berger 2008).

The economic effect included a turnover of the renewable energy sector in 2004 of 12.3 bn€. The turnover in 2007 was already 25 bn€ with a direct and indirect gross job effect of 250.000 jobs (Jänicke & Zieschank 2008).

3.4 Economic and political drivers of eco-innovation

In a major study about the eco-industry in the EU Ernst & Young (2006) identified five key market drivers for the environmental industry:

- The compliance with EU and member states' legal requirements and policy objectives such as water quality standards or a threshold for a minimum ratio of renewable energy production.
- The development of technologies and emerging new market segments or solutions, such as monitoring of new pollutants or media or the remediation of former industrial areas in cities.
- Market incentives in order to enable the competitiveness of environmental industries compared to conventional industries, such as fair pricing based on internalization of environmental externalities.
- Availability of public funding for co-financing investments of the environmental industry.
- Consumer awareness on the special character of environmental products and technologies, their existence at all and their benefit for the consumer.

Ernst & Young conclude that "*compliance with policy objectives and legal requirements set by EU and national authorities will be the main drivers of eco-industry growth in the near future*" (Ernst & Young 2006, p. 48).

Jänicke (2008) identifies the following conditions that are supporting environmental innovations:

- Objectives that are clear, demanding and calculable.
- The combination of economic instruments like eco taxation and CO2 emissions trading in order to encourage a general tendency and regulation in order to realise specific innovations potentials ("hybrid instrumentation").
- All phases of the innovation process have to be supported by a policy mix that also covers additional instruments such as labelling and networking.

Jänicke & Zieschank (2008) identify a combination of financial instrument like the environmental tax reform and specific regulation like the Top-Runner-Programme in Japan as being a very effective approach for environmental innovations.

The significance of the price mechanism has been confirmed by the technology effects of high energy prices today and in the 1970s.

A more systematic overview of drivers and barriers of eco-innovation can be found in Bleischwitz (2007) and Bleischwitz et al. (2009). According to Bleischwitz (2009, 26) drivers of eco-innovation are "*specific and evident agents or factors leading to increased or reduced pressure on the environment. Barriers can be considered as those forms of marked imperfections that hinder markets from adopting eco-innovations. Both can be viewed either from the demand or supply side of eco-innovation*" (table 9).

Supply side	• Technological and management capabilities
	• Appropriation problem and market characteristics
	• Path dependencies (inefficient production systems, knowledge accumulation)
Demand side	• (Expected) market demand (demand pull hypothesis): state, consumers and firms
	• Social awareness of the need for clean production, environmental consciousness and preference for environmentally friendly products
Institutional and political influences	• Environmental policy (incentive based instruments or regulatory approaches).
	• Fiscal systems (pricing of eco-innovative goods and services)
	• Institutional structure: e.g. political opportunities of environmentally oriented groups, organization of information flow, existence of innovation networks
	• International agreements

Table 8 Drivers of eco-innovation (Bleischwitz 2009 based on Horbach 2005)

For steering eco-innovation Kristof und Hennicke (2009) recommend a combination of a broad range of instruments. They propose a mix of:

- economic incentives and market-based instruments,
- the reduction of counter-productive subsidies,
- legislative regulations,
- financing of innovation,
- market-introduction and diffusion as well as
- networking, information and qualification activities.

3.5 Intermediate result

The insufficient data and unclear definitions of the eco-industry result in rather fuzzy outcomes of studies about the current situation of the EU eco-industry.

Table 4 presents data from ECOTEC (2002) and Ernst & Young (2006). On the basis of this data a **total growth** of 7% between 1999 and 2004 was identified at constant prices, which is resulting in an annual growth rate of about 1.5%, which is rather low. Berger (2008) cites Ernst & Young (2006) with an **annual growth** of 7% of the industry which assumes a much higher turnover of the eco-industry in 2004 compared to the presented figures of Ernst & Young (2006).

Jänicke & Zieschank (2008) have shown that ECOTEC (2002) and Ernst & Young (2006) have both underestimated the size of eco-industry. They rather suggest a total turnover of the EU-25 to be at least 270 bn€ in 2004 (2.6% of the GDP) compared to 227 bn€ identified by Ernst & Young (2006).

The true employment potential of the EU's eco-industry is difficult to assess. Major studies like UNEP (2008) can only present some quantitative figures and provide only roughly estimated potentials. Nevertheless, findings of The Political Economy Research Institute of the University of Massachusetts Amherst (PERI 2008) suggest that investments in the eco-industry have a higher job-potential than other sectors: PERI argues, that the greatest job creation potential would be realised through "green" stimulus. According to their calculations the job potential through a 75 bn€ green Stimulus Programme in the US, would create 935,200 direct jobs, 586,000 indirect jobs and 496,000 induced jobs (PERI 2008). For comparison they calculated scenarios with the same spending in the household consumption sector an oil industry, with the results displayed in the following figure:

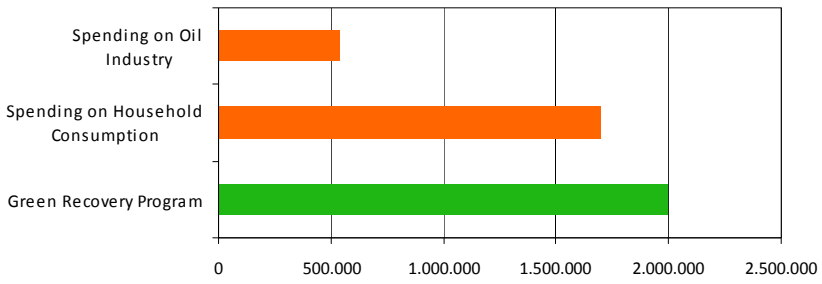

Figure 6 Total job creation through €75 ($100) billion in spending (based on PERI 2008)

Apparently, green recovery programmes have a larger job creation potential than programmes which are based on measures to increase conventional household consumption (PERI 2008).

The direct job-creation effect of green investment is outlined by UNEP (2008) through the analysis of individual cases. For example, the construction of 6,100 compressed natural gases buses in India is expected to create 18,000 jobs (DWS 2008; UNEP 2008). Based on a study of the year 2000 the UK government assumes that for every 1 mn€ invested in residential energy efficiency 11.3 to 13.5 fulltime jobs have been created. A similar case from Germany suggests that 3.8 bn€ public investment and 15.2 bn€ in private investment in energy efficiency retrofits resulted in about 145,000 jobs.

A more systematic assessment of employment effects of different GND measures would have to be based on econometric modelling. Until now no such modelling evidence has been presented.

Turnover an employment situation of eco-industries depends heavily on environmental policy. The development in Germany has shown how continuous environmental policy can influence positively the development of a competitive eco-industry.

The most important factors for the support of eco-innovations and their dissemination are:

- Ambitious policy objectives
- Binding legal requirements
- The power and the political will to enforce legislation
- Public funding for co-financing development and procurement of eco-innovation
- the reduction of counter-productive subsidies
- Market-based instruments
- The capacity to develop and apply appropriate technological solutions
- Networking, information and qualification

Political measures need to be launched synchronically in harmonized policy mix.

4 Outlines of a Green New Deal in the EU

Recovery packages should stimulate and stabilize the economy when private demand is lacking. A successful recovery package could realize multiplier effects. This means that direct governmental investments could create and stimulate self-sustaining markets which lead to structural change. This multiplier effect should be used for a targeted support of European eco-industries.

Definition

Based on the previous chapters we can attempt a simple definition of a Green New Deal: A Green New Deal comprises state investments which result in a targeted stimulus of demand for eco-industries. In combination with the definition of eco-industries this would lead to the following definition: A Green New Deal is a targeted attempt investment in activities which produce goods and services to measure, prevent, limit, minimise or correct environmental damage to water, air and soil, as well as problems related to waste, noise and eco-systems. This includes innovation in cleaner technologies, products and services that reduce environmental risk and minimise pollution and resource use.

Delineation

In contrast to the definition used in other studies and comments green stimuli are about more than creating a low carbon economy. It needs to promote eco-industries with a clear vision of a green modernisation of the economy encompassing the complete industrial metabolism of the European Union. With a focus on short-term state investments a Green New Deal can by no means comprise all instruments of a green modernization especially policies for a fundamental and long-term reshaping of society and the economy are excluded from this definition. Nevertheless, by combining a policy-mix for a short-term economic stimulus it can pave the way to a fundamental change of consumption and production patterns. A Green New Deal can therefore be nothing more, but also nothing less than a roof of political action to stimulate eco-innovation during the current election period from 2009-2014.

Functions

State investments in eco-industries are not enough for a Green New Deal, because even economic growth of eco-industries can be harmful, if they merely contribute to increasing an already unsustainable high level of natural resource consumption. Thus, a Green New Deal needs to be more than a technology platform for eco-industries. It has to be guided by a vision of how EU consumption and production patterns should look like in the long run. Therefore, a Green New Deal requires structural change on all policy levels fulfilling three functions; it should:

1. Break-up unsustainable structures
2. Build-up sustainable structures
3. Give the right mid- to long-term orientation

Orientation

Our definition of a GND implies that it is a *targeted* attempt to stimulate eco-innovation. What should be the target and long-term orientation?

A Green New Deal should not create an artificial market which collapses after subsidies recede. Therefore, it needs to realize a potential which is given by an already existing gradient within the European Union, which has the potential of a guiding indicator for an ecological modernization. Official Eurostat reporting reveals a large development gap among EU Member States concerning resource efficiency. As it will be explained in the following section the EU can realize considerable environmental and competitive advantages, if it addresses systematically the existing resource productivity gap. This would entail the promotion of existing resource policies of the frontrunners and leapfrogging strategies for regions which are lagging behind.

In addition to integrated solutions to promote overall resource efficiency in the EU traditional eco-industries should also have their place. Regional development strategies with a combination of integrated an end-of-pipe solutions should be designed within the European Union to allow implementation of the acquis communautaire in combination with an increase of overall resource efficiency. Experience with these adapted strategies could also allow improvement of international development cooperation, because in developing and emerging industrial economies traditional areas of environmental protection such as pollution control are of high importance; for example water sanitation: According to the World Health Organization (2009)[2] "*around 1.1 billion people globally do not have access to improved water supply sources whereas 2.4 billion people do not have access to any type of improved sanitation facility. About 2 million people die every year due to diarrheal diseases, most of them are children less than 5 years of age*". Especially, the French leadership in the water treatment sector could be further developed and strengthened. In more advanced economies a Green New Deal would be more directed towards integrated solutions and investments in resource efficiency. An ideal combination would be to integrate the notion of resource efficiency in the traditional end-of-pipe technologies, e.g. by offering adapted decentralized and resource efficient water sanitation technologies.

Quick start towards resource efficiency

The European Union is a complex multi-level governance system. Political compromise is often difficult to achieve especially if it is connected to substantial allocation of funds. If the EU would have to strike a fundamentally "New Deal" it is quite unlikely that it could dedicate substantial funds and implement their effective spending on the very short time-line of the current recovery plans with immediate effect. Therefore, a central strategic question is: Could a Green New Deal work with the existing strategies and instruments of the European Union? How would objectives, targets and timetables accompanied with monitoring mechanism have to look like? What arsenal of research, technological and financial instruments and programmes is required?

[2] http://www.who.int/water_sanitation_health/hygiene/en/index.html

For answering these questions we will attempt a quick scan of central strategies, programmes and policies of the European Union which would be affected by a Green New Deal. Thus, we will identify not all possible, but central entry points for a Green New Deal:

1. **Strategies** which define the broad economic guidelines of socio-economic policies of the European Union.
2. **Policies** which determine how the EU budget is spent on structural interventions in EU economies.
3. **Programmes** which have the potential to stimulate eco-innovation.

4.1 Strategies for a Green New Deal

A strategy is a plan of action designed to achieve a particular goal. This means that for deciding whether EU strategies are consistent with a Green New Deal their goals are central. Usually, objectives of political strategies are quantified by indicators. For deciding what kind of green deal could become part of broader EU strategies, it therefore needs to be decided, whether a Green New Deal's primary objective of stimulating eco-innovation could be measured with the indicators leading the strategies and if not which indicators would have to be added or adapted.

4.1.1 Lisbon Strategy

The paramount development strategy of the European Union is the Lisbon strategy. Adopted in March 2000 at the European Council in Lisbon, the strategy sets the new goal for 2010: the European Union should become the most competitive knowledge-based economy of the world with sustainable economic growth and more and better employment opportunities and greater social cohesion.

Quantitative targets and time tables complement the vision of Lisbon. So-called structural indicators for monitoring the socio-economic progress developed into a central instrument of indicator-based political controlling in the European Union to improve decision-making and assessment. In its Communication on the structural indicators of November 2000 (COM (2000) 594) the European Commission explains that the choice of the indicators was based on preceding processes. A large share of the indicators had already been presented in the framework of the so-called „*Broad Economic Policy Guidelines*". The structural indicators are used for two purposes (COM (2000) 594, p. 5):

1. monitoring progress both in achieving the identified targets and in implementing policies and for
2. assessing the effectiveness of policies.

In its communication the Commission admits that the first goal can be achieved rather easily, but the performance evaluation of measures will be a greater challenge, since it is based on an understanding of the relation between action and measured results.

There is a tension between simplification and differentiation. On the one hand, indicators have great advantages (COM (2000) 594, p. 6): "*Simple and objective quantitative policy and performance indicators can play an important role in highlighting problems, measuring progress in achieving the targets identified, guiding policy makers in their policy efforts, and focussing public attention on what is at stake*". On the other hand, the evaluation has to take

place in a coherent framework to avoid over- and misinterpretation. Some data are only comparable to a very limited degree.

In March 2001 the Stockholm European Council expanded the scope of the structural indicators from purely socio-economic objectives to sustainability. In particular the heads of state and governments wanted to know about the contribution that the environment technology sector can make to promoting growth and employment. A political motivation which is obviously compatible with a GND.

In October 2001 the Commission proposed environmental indicators, which were approved in December 2001 by the European Council in Laeken, so that the Commission could already present an integrated synthesis report with altogether 42 structural indicators in 2002.

It was already agreed in European Council in Laeken that the environmental indicators would need further refinement. For this purpose a so-called "open list" with a core set of *environmental headline indicators* was developed. The integrated environment indicators as well as the open list should be followed-up according to the political priorities of the Union. In 2003 the Italian Presidency drastically reduced the list of 42 indicators to 14. Instead of seven only three indicators should help to monitor the environmental dimension of the EU Sustainable Development Strategy (total greenhouse gas emissions, energy intensity of the economy, volume of freight transport relative to GDP). The chosen three indicators might not be able to reflect fully sustainable development of the European Union. Fortunately, the more differentiated list of structural indicators remains intact and can be downloaded from the Eurostat server[3]. It helps to assess many social, economic and environmental aspects of European integration both on a national and at EU level. This is often connected to international comparison. Getting "the big picture" might also be necessary with regard to the accession of socially, economically and ecologically very heterogeneous new Member States. Certainly, it could be used as an already agreed basis for justifying central aspects of the Green New Deal.

4.1.2 Sustainable Development Strategy

The first Sustainable Development Strategy (SDS) was agreed at the European Council in Gothenburg in 2001. The objectives and principles adopted by the European Council in June 2005 form the basis of working towards effective responses to global development risks which are described in the revised Sustainable Development Strategy (SDS). Most of the issues addressed in the SDS are persistent social, economic and environmental problems, which require a structural change in society. Therefore, the SDS can be considered to be a long-term strategy of the EU.

The renewed Strategy European Council addresses seven key challenges:

- Climate change and clean energy
- Sustainable transport
- Sustainable production and consumption
- Better Management of natural resources
- Social inclusion, demography and migration

[3] http://epp.eurostat.ec.europa.eu

- Fighting global poverty

In February 2005 the European Commission adopted a set of sustainable development indicators (SDIs) for monitoring the implementation of the sustainable development strategy (SDS).

Eurostat's sustainable development reporting has been influenced by the complex history of the sustainability paradigm in the EU. The SDI are largely based on the work of a group of national experts within a so-called SDI Task Force. "*With a view to harmonisation and rationalisation, the SDI Task Force made maximum use of existing indicator initiatives, such as those of the UN Commission on Sustainable Development and OECD, the Structural Indicators, the Laeken indicators, indicators monitoring the Cardiff integration process (agriculture, energy, transport), and the core set of indicators of the European Environment Agency*" (CEC 2005a).

For grouping the altogether about 155 SDI Eurostat has proposed a multi-layer system with 3 levels:

1. The first level contains headline indicators for initial policy analysis and monitoring progress towards headline policy objectives. It is meant for high-level policy makers and the general public (see table above).
2. The second level indicators support evaluation of core policy areas and more detailed monitoring of progress in achieving headline objectives. They are constructed for policy makers and the general public.
3. Finally, the third level is supposed to be used by a more specialized audience in further policy analysis and better understanding of the trends and complexity of issues associated with the themes or interlinkages with other themes in the SDI framework.

The Eurostat SDI and the publication "*Measuring progress towards sustainable development*" (Eurostat 2005, 2007) represent best practice in indicator-based sustainable development reporting. It is comprehensive, well-structured, intelligible and illustrated with many graphs. In the report Eurostat assessed trends against policy objectives to inform the general public and decision-makers about achievements, trade-offs and failures in attaining the objectives of the strategy. The SDI framework is supposed to provide a clear and easily communicable structure for assessing policies: "*Tight policy linkages assure strong user relevance and effective utilisation of indicators in decision-making*" (Eurostat 2005, p. 9).

GDP and Decoupling

It is not enough for us to talk about the different global challenges, as energy, climate change, health, security and the environment. We need widely accepted communication tools that show progress in these fields. And that progress can only be measured with suitable indicators. So it's time to go beyond the tools developed for the very different world of the 1930s. (…) It's time to go beyond GDP" [4]

Jose' Manuel Barroso, President of the European Commission

"Business as usual is not an option. We do not need more and more resources and energy for a good life."[5]

Angela Merkel, Chancellor Federal Republic of Germany

It is becoming increasingly clear to people that if the European institutions want to be serious about measuring sustainability, they need to move away from crude ratings of economies according to Gross Domestic Product (GDP), and move towards a re-definition of the progress putting the value of products and services in relation to resource use.

Decoupling indicators usually set social and environmental information in relation to GDP. In the OECD report on decoupling indicators 31 decoupling indicators cover a broad spectrum of environmental issues. 16 indicators relate to the decoupling of environmental pressures from total economic activity under the headings of climate change, air pollution, water quality, waste disposal, material use and natural resources, 15 indicators focus on production and use in four specific sectors: energy, transport, agriculture and manufacturing (OECD 2003, Goosens et al. 2007).

Point of departure for this research project is the existing SDI headline indicator "resource productivity" for sustainable consumption and production (SCP). SCP addresses the key SDS challenges of sustainable consumption and production as well as conservation and management of natural resources (Eurostat 2007). Resource productivity is measured by dividing GDP by Domestic Material Consumption (DMC)[6]. DMC and other material flow indicators are relevant for a number of SCP policies, most notably the Thematic Strategy for the Sustainable Use of Natural Resources (COM (2005) 670). In this strategy, the relation between economic activity and resource use is at the centre of an elaborated work programme with the three strategic components of (i) knowledge gathering, (ii) policy assessment and (iii) policy integration. In the resource strategy the European Commission expects to combine the objective of improving resource productivity by decoupling resource use

[4] Beyond GDP – opening speech. SPEECH/07/734

[5] Speech at the 7th Annual Conference of the Federal German Sustainability Council, November 2007

[6] "*Domestic material consumption (DMC) measures the total amount of materials directly used by an economy. It is defined as the annual quantity of raw materials extracted from the domestic territory of the focal economy, plus all physical imports minus all physical exports. It is important to note that the term 'consumption' as used in DMC denotes 'apparent consumption' and not 'final consumption'. DMC does not include upstream hidden flows related to imports and exports of raw materials and products*" (Eurostat 2007, p. 102).

from economic activity with aim of an absolute reduction of resource specific impacts:

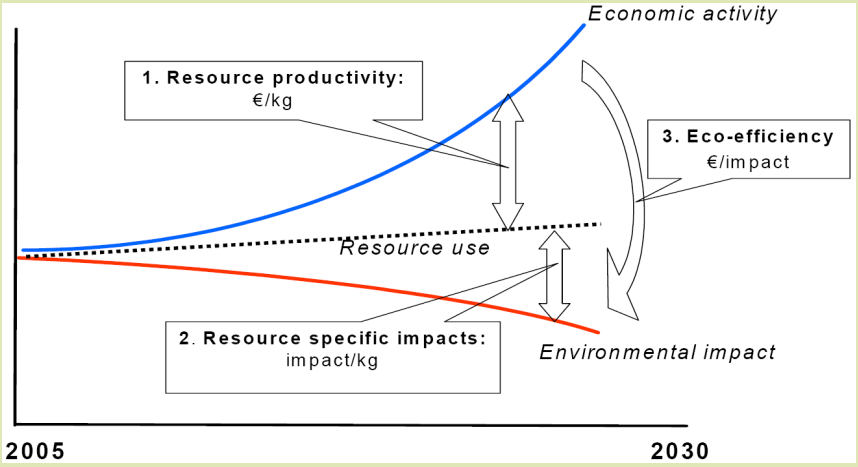

Figure 7 Decoupling economic activity, resource use and environmental impact (taken from COM (2005) 670)

Decoupling sheds empirical light on the often fuzzy concept of qualifying the growth of an economy. For example, decoupling of Domestic Material Consumption (DMC) and GDP indicates that is possible to generate economic growth by consuming less natural resources. Research by the Wuppertal Institute for Eurostat and the European Environment Agency indicates that a (relative) decoupling is already taking place in the EU, while the European Parliament and civil society demand an absolute decoupling of economic growth and resource use (Schepelmann et al. 2006).

Decoupling is also at the heart of the OECD Environmental Strategy for the First Decade of the 21rst Century, adopted by OECD Environment Ministers in 2001. In the context of SDI the draft of an OECD guide on measuring material flow and resource productivity[7] should also be mentioned.

By complementing its economic development indicators by decoupling indicators related to energy and resource consumption (figure 8 and 9), the European Union could turn towards becoming not only a competitive, but a resource-efficient economy.

4.1.3 Resource productivity as paramount indicator of a GND

The question is, whether the structural indicators in combination with the SDI can be used for guiding and monitoring a Green New Deal, e.g. by guiding innovation policies and establishing lead markets. In fact, both indicator systems are so broad that they seem to be able to reflect sufficiently different political agendas, including a Green New Deal. Actually, their political inconsistency is one of the weaknesses of both indicator systems. "*In the same way as the Sustainable Development Strategy and the Lisbon Strategy are related, albeit covering partly different priorities and with different time horizons, the SDI and the Structural Indicators sets are responding to some slightly different needs but are also in some respects overlapping*" (CEC 2005a). This overlap is symptomatic for a weakness of the Sustainable Devel-

[7] OECD (2007): Measuring material flow and resource productivity an OECD guide. Draft, ENV/EPOC/SE(2006)1/REV 2, OECD Paris.

opment Strategy (SDS) and the SDI, which indicates a lack of policy coherence. The SDS and SDI are supposed to cover economic, social and environmental dimensions of sustainable development, but so is the Lisbon strategy with the corresponding Structural Indicators. For improving the integration of environmental concerns in other policy areas the Cardiff-Strategy has been established, and for environmental policy, there is the Environmental Action Programme. A systematic order of the EU SDS in between the Lisbon-Strategy, the Cardiff Strategy and the Environmental Action Programme is not evident.

It is not clear why the European Union has developed both the Lisbon and the Sustainable Development Strategy with indicator systems for monitoring social, environmental and economic developments. For achieving the necessary policy coherence that a Green New Deal would require there are three options:

- the relation of both strategies and corresponding indicator system needs better and transparent justification, or
- one strategy and indicator system needs to be abolished, or
- both systems merge into a comprehensive overarching strategy and indicator system for (sustainable) social, economic and environmental development.

Thus, we may conclude that the indicators systems seem to reflect rather the complexity of realities in the EU rather than the simplicity of single political agendas. At the same time both indicator systems are far from being perfect and need further development and maintenance. For monitoring the implementation of a green change as a consequence of a Green New Deal they could be further harmonized, but central issues of the Green New Deal such as modes of transport, energy and material intensity are covered by the best available datasets of Eurostat and other European Agencies. Thus the European Union has the advantage of having at its disposal a central prerequisite for a Green New Deal that is a complex and highly valuable indicator systems which could be used immediately for monitoring. Nevertheless, it is unclear in which direction they should guide a Green New Deal. In line with the policy areas identified in section 6 the overall guiding objectives could be:

- Reduction of energy intensity of the EU economy
- Reduction of material intensity of the EU economy

Figure 8 and 9 reveal challenging productivity gaps within the European Union[8]. Compared to average values of the EU27 the worst performer has a material and energy productivity which is more than a factor eight (!) behind. The overall tendency is that especially economies of new EU Member States seem to use technologies which tend to require much more materials and energy. In most cases we may assume that these economies tend to waste natural resources. This decreases their competitiveness due to higher production costs. Also in the non-productive sectors (e.g. households) it has negative implications, e.g. by increasing energy bills. An overall improvement of energy and materials productivities in these economies would not only improve their economic performance, but would also put much less pressure on the environment. For example, most of the least productive economies have a primarily fossil energy supply. Thus, an increase of energy productivity by a factor four would result in a CO_2-reduction of about the same magnitude.

[8] For an improved comparison the indicators should be reported consistently either in intensity or productivity values.

The large productivity gap indicates the potential for technological leapfrogging strategies in regions which are lagging behind. In this context it is important to recognize that successful technological leapfrogging depends on three factors:

1. it must be embedded in a kind a social und institutional leapfrogging concerning governance and cooperation between science, governments and business ("triple helix")
2. it should contribute to sustainable development in partnership on equal footing between efficient and inefficient regions
3. it should be closely connected to the *acquis communautaire* and conditioned financial support

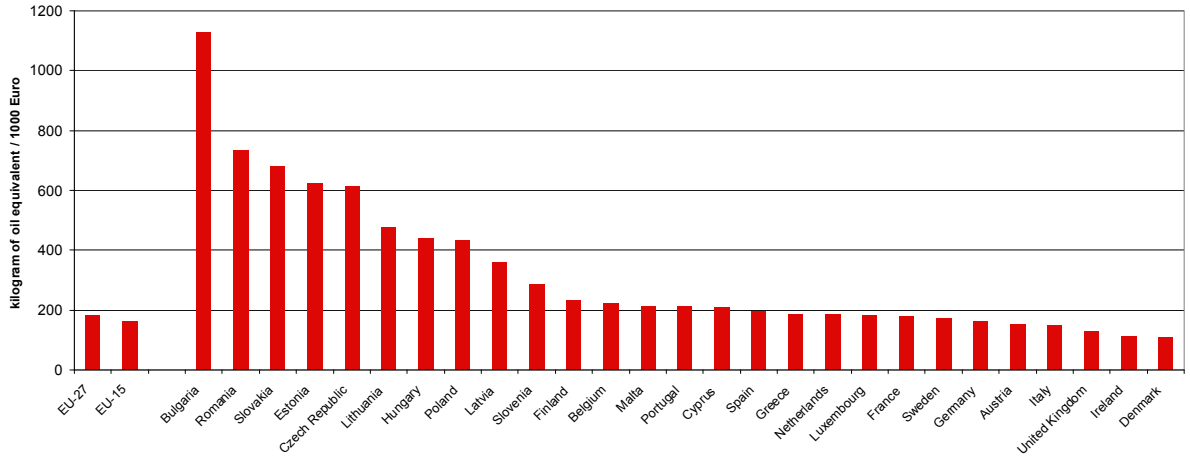

Figure 8 Energy intensity of the EU-15, EU-27, Japan and USA in 2005 (Eurostat)

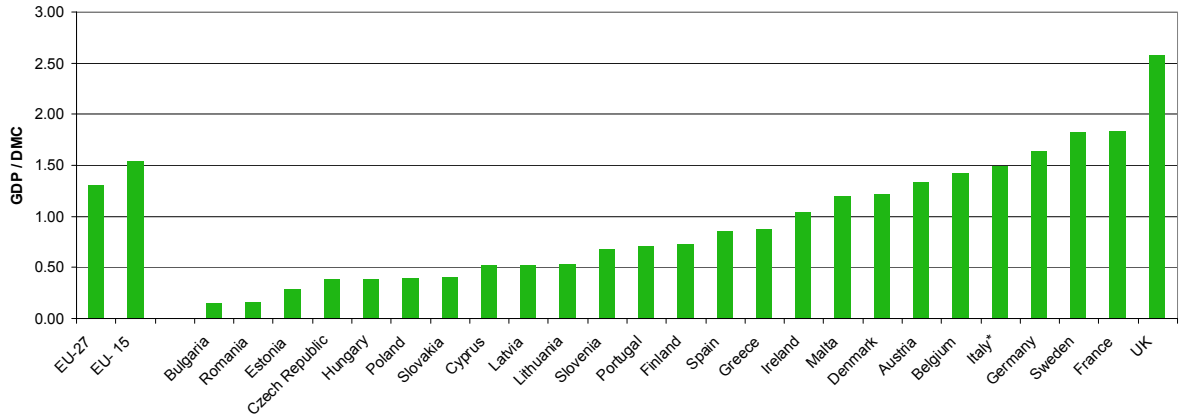

Figure 9 Resource productivity from the EU-15 and EU-27 in 2005 without Luxembourg and the Netherlands (Eurostat) *Data for Italy from 2004

4.2 Policies for a Green New Deal

New and additional policies are necessary for implementing a Green New Deal that leads to system change and eco-innovation. How a policy-mix of regulatory, economic and informational instruments could promote eco-innovation has been outlined by Bleischwitz et al. 2009, but what about the current set of EU policies? Could they be a basis for effective short-term measures in the framework of the Green New Deal?

The European Commission claims that the 2009 budget has a 10%-spending for environment[9]: "*The proposal presented today also highlights the growing trend to gear policy spending towards the energy and environment, with a massive 10% of the budget going on environment*".

An analysis of the EU budget shows that a Green New Deal in the EU will be determined by whether the EU will manage a greening of the largest spending blocs which are Regional Policy and the Common Agricultural Policy (CAP). In 2009 the spending for the CAP will remain around 60 bn€ and the programmes to support cohesion across Europe will receive a total of around 50 bn€. Thus, Regional and Agricultural Policy still cover almost 80% of the EU budget. Although the Commission presents rather traditional policies with new headings such as "sustainable growth" (Regional Policy) and "sustainable management of natural resources" (CAP), it remains to be seen whether the largest EU policies can be sufficiently steered towards a Green New Deal.

4.2.1 Common Agricultural Policy (CAP)

Over the past fifty years intensification of agriculture often supported by the Common Agricultural Policy (CAP) has increased overall pressure on landscapes and biodiversity. Agriculture has contributed to soil degradation, water pollution and loss of biodiversity (EEA 2007). Sustainable agro-environmental development and cross-compliance schemes show that farming and protection of the consumer and the environment can be harmonized. The Common Agricultural Policy can be steered towards safeguarding a diversified agriculture, taking into account the specific territorial characteristics of Europe. This would not just aim at increasing agricultural productivity, but also seek to minimize external inputs (e.g. of fertilizers or chemicals). A green CAP could guarantee quality and food safety through a productive re-organization and a high level of sustainable technological innovation. Thus, a greening of the CAP can be a potential driver of sustainable consumption and production by improving the quality of our food while protecting Europe's landscapes and biodiversity.

4.2.2 Regional Policy

From 2007 on, half of the budget for Regional Policy will be dedicated to the development of the new member states and acceding countries of Central and Eastern Europe. Huge financial injections will result in structural interventions, which shape the long-term development of these countries. Schepelmann (2005) has shown that Regional Policy could boost sustainable development in the EU. Like no other EU policy it can set a frame for research, technological development and the creation of markets by connecting public and private drivers of a Green New Deal. Regional governments cannot only use Cohesion Funds to increase overall eco-efficiency of their industry, but create regional clusters of eco-innovation (Schepelmann 2005). Nevertheless, most of the funds seem to be dedicated to traditional regional economic development schemes. For example, large conventional road transportation schemes will contribute to a long-lasting increase of the pressure on the environment. Although most of the environmental related spending of the EU happens in the framework of Regional Policy it is still dedicated to end-of-the pipe environmental protection.

[9] http://ec.europa.eu/budget/budget_detail/next_year_en.htm

4.3 Programmes for a Green New Deal

The European Union has already a number of programmes which are dedicated to central elements of a green new deal. For example, the Seventh Framework Programme for research and technological development (FP7), the Environmental Technology Action Programme or the Competitiveness and Innovation Framework Programme (CIP). The central role of these programmes in combination with other instruments has been outlined by Bleischwitz et al. (2009) in a study requested by the European Parliament's Committee on Industry, Research and Energy (ITRE). The following descriptions of selected programmes are to a large extent based on this study. They show that the EU has already a number of activities which address central socio-economic and technological aspects of the Green New Deal.

4.3.1 The Competitiveness and Innovation Framework Programme (CIP)

The general aim of the CIP programme is to boost the competitiveness and productivity of European businesses, and to promote innovation activities by financing and delivering business support services. Main target group are small and medium-sized enterprises (SMEs), the programme period runs from 2007-2013. The total budget sums up to 3.6 bn€

The CIP programme is divided into three operational programmes:

- Entrepreneurship and Innovation Programme (EIP) - 2.17 bn€
- Information Communication Technologies Policy support Programme (ICT PSP) – 730 mn€
- Intelligent Energy Europe (IEE) - 730 mn€

The ICT PSP is not relevant for a Green New Deal, but both two other sub-programmes are.

The Entrepreneurship and Innovation Programme main objectives are to support SMEs regarding start-up, cooperation and innovation. It consists of several action fields, one of which is "Eco-innovation" (in the following "Eco-innovation/EIP"), which aims at supporting the first application and further market uptake of some of the best eco-innovative products. The four priority areas of this call are materials recycling, building & construction, food & drink, greening business & 'smart' purchasing. EIP is financially by far the biggest part of the CIP, as it holds for about 60% of the total CIP programme. The funds for the Eco-innovation/EIP action are 0.43 bn€ of the 2.17 bn€ (i.e. about half the budget of IEE). Eco-innovation/EIP projects are funded with 40 to 60% of total eligible costs, in order to help bridging the gap between research & development and eco-industries. Calls are issued every year within the programme period.

The Eco-innovation/EIP programme supports the first application and further market uptake of products and services of eco-industries with high potential in Europe, and aims at helping to overcome those critical barriers that still hamper their commercial success. Thus it has the potential to be a major instrument to support eco-industries.

Intelligent Energy Europe II is the EU's tool for funding action for fostering more efficient forms of energy production and consumption and the adoption of new renewable energy sources. The IEE programme does not fund technical RTD projects. Existing measures are 'SAVE' (energy efficiency and rational use of energy), 'ALTENER' (new and renewable energy sources), 'STEER' (energy in transport) and integrated initiatives. The IEE II Programme is

implemented by grants (call for proposals or concerted action) and procurement (calls for tender).

IEE measures aim at supporting the use of renewable energy sources and the rational use of energy. It does not support the development of new technologies (see FP7), but it rather aims at changing the legal and societal framework conditions for initiating a change (optimal implementation and preparation of legalisation). The work programme stresses that projects have to build on well-tested strategies and technologies and rather aim at removing non-technological market barriers than develop new pathways. Thus it aims at transformations on the system level. 'Market transformation' and 'change of behaviour' are frequently used keywords within IEE. Awareness raising campaigns and capacity building on the public level, but also on the level of key stakeholders (industry, trade) are one means aimed at to set off behavioural changes. Moreover it is intended to lead by example (of public authorities).

4.3.2 The Seventh Framework Programme for research and technological development (FP7)

The Seventh Framework Programme for research and technological development (FP7) of the European Union is the largest research programme in the world. It bundles all research-related EU initiatives in order to develop the European research area (ERA) and to reach the goals of the European Union's Lisbon Strategy: growth, competitiveness and employment. During the programme period 2007-2013 the FP consists of four basic components:

1. cooperation (32 bn€),
2. ideas (7.5 bn€), people (4.7 bn€) and
3. capacities (4.1 bn€)

In addition, there are specific programmes for the Joint Research Centre and for the Euratom nuclear research and training activities.

Collaborative research constitutes the core of EU research funding. Within the ten distinct themes of the largest FP7 component "cooperation" (total 32 bn€) several have a strong reference to central aspects of a Green New Deal, for example:

- environment
- social science and humanities
- nanoproduction
- energy
- food agriculture, fisheries and biotechnology

The "Environment" work programme aims at advancing our knowledge on the interactions between the biosphere, ecosystems and human activities, but also on developing 'new technologies, tools and services, in order to address in an integrated way global environmental issues'.

The "Nanoproduction" work programme aims at a transformation from a resource-intensive to a knowledge-intensive economy. It supports research and technological development at the crossroads between different disciplines. Research aims at the product and process level, enforcing the generation of high added-value products and related processes and technologies.

The work programme of the "Energy" theme aims a transforming the current energy system e.g. by reducing the dependency on imported fuels, diversification of energy sources, energy efficiency, etc. The work programme focuses on technologies identified in the strategic energy plan as key challenges for the next 10 years, i.e. second generation biofuels (in particular biorefineries), carbon capture and storage, solar energy, offshore wind and smart electricity grids.

The work programme for "Food, Agriculture and Fisheries, and Biotechnology" wants to contribute to a European Knowledge Based Bio-Economy (KBBE), including a 'sustainable use and production of renewable bio-resources'. This includes alternative eco-efficient processing routes for established industrial processes using biotechnology enabled approaches. The programme requires a substantial contribution from industry and should foster innovative breakthrough biotechnology applications aimed at improving eco-efficiency.

The issue of energy efficiency is also tackled within the research for SMEs, which aims at supporting SME associations to develop technical solutions to problems common to a large number of SMEs in specific industrial sectors or segments of the value chain.

Under the 7th Framework Programme it is estimated that up to 30% of the 32 bn€ budget will address environmental technologies. This includes: hydrogen and fuel cells, clean production processes, alternative energy sources, CO2 sequestration, bio-fuels and biorefineries, energy efficiency, information technologies for sustainable growth, clean and efficient transport, water technologies, soil and waste management, and environmentally friendly materials.

The work programmes of the FP7 topics discussed above mainly aim at the development of new green technologies (product level) or new production chains (process level). The understanding of the economic and social driving forces behind unsustainable patterns of natural resources use and system level seem to be underrated with the exception of the social science and humanities work programme (SSH).

4.3.3 Environmental Technology Action Plan (ETAP)

Since 2004 the Environmental Technology Action Plan (ETAP) is supposed to stimulate the development and uptake of environmental technologies on a broad scale. It complements the DG's regulatory approaches and directly addresses the three dimensions of the Lisbon and Sustainable Development Strategies: growth, jobs and the environment.

The achievements of ETAP are reported every two years to the European Council and the European Parliament. So far, two reports are available: the first report in 2004, the second report in 2007.

ETAP consists of a sequence of 28 actions following the order announced in the Commission's Communication on ETAP published on 28 January 2004. They can be grouped in nine sections:

1. Research and Development (see also FP7)
2. Technology platforms and public private partnerships (PPP)
3. Verification of technologies: establishing networks of testing centres, drafting catalogues of existing environmental technologies

4. Definition of performance targets based on best environmental performance
5. Mobilisation of Financing: e.g. improving by introducing enhanced funding and risk sharing mechanisms, such as CIP (see section 4.3.1), LIFE, or via the European Investment Bank or the Cohesion policy
6. Market-based Instruments: reviewing Cohesion Funds, state aid guidelines, environmentally harmful subsidies, and market-based instruments
7. Procurement of environmental technologies: e.g. using life-cycle costing or technology procurement; promotion via Commission's handbook on Green Procurement or Member States action plans.
8. Business and Consumer Awareness raising and targeted training, e.g. via the ETAP website and newsletters;
9. Acting Globally: promoting environmental technologies in developing countries and countries in economic transition via global financing opportunities and responsible investment and trade.

Dissemination of experiences is supported by national roadmaps and the stakeholder's Forum on Eco-Innovation. Yet, the central role of dissemination seems to be underrated within the ETAP framework and should be further developed. Nevertheless, given the wide range of policy areas involved in the implementation of ETAP (research and technology development; public procurement; corporate social responsibility; development aid, etc.), ETAP could be one of the key policy frameworks to realize a Green New Deal in Europe and beyond.

Given the wide range of policy areas involved in the implementation of ETAP (research and technology development; public procurement; corporate social responsibility; development aid, etc.), ETAP could be one of the key policy frameworks to realize a Green New Deal in Europe.

5 Conclusions and recommendations

EU Energy Commissioner Andris Piebalgs (2009, 4) wrote in a working paper for the Robert Schuman Centre for Advanced Studies: "*If we invest wisely in research and give European companies the right incentives to become world-leaders in renewable and other low-carbon energy technologies, we can put the EU at the forefront of the third industrial revolution*". Indeed, a Green New Deal should lead towards a third industrial revolution not only in the field of energy, but in all sectors relevant for natural resource use: We need a resource efficiency revolution. The fact that a Commissioner writes about a revolution indicates that this resource efficiency revolution will not sweep away the European Union as we know it, but that a pragmatic Green New Deal can build on what is already there with powerful driving forces within the system.

Strategies

On a strategic level there is still a lack of a guiding vision for a systemic adaptation of production and consumption patterns. Sustainability objectives still lack coherence encompassing the complete metabolism of the European Union like e.g. the vision proposed by Bringezu and Bleischwitz (2009). Nevertheless, the green parts of the Lisbon Strategy in combination with the Sustainable Development Strategy contain elements which could be used as central building blocks of such a vision.

The reporting mechanisms of the Structural Indicators and the Sustainable Development Indicators should be improved and further developed, but they could be used immediately as central steering instrument for a Green New Deal. In particular they could monitor the EU-wide improvement of resource productivity.

Policies

Major EU policies could boost a GND by combining EU and national funding. With the Cohesion Policy the European Union has already a large funding system dedicated to structural change. According to the European Commission a substantial amount will be spent for a sustainable regional policy: "*Between 2007 and 2013, the total amount of Structural and Cohesion Funds allocated to environmental programs has doubled since the previous period to around 100 bn€ – 30% of the total. Half of this investment will be devoted to direct infrastructure investments related to water and waste treatment, renewal of contaminated sites, pollution reduction, and support for nature protection and risk prevention. The other half will go to indirect investments with an environmental impact on areas such as transport and energy systems, eco-innovation, environmental management for businesses, urban and rural regeneration, and eco-tourism. For example, over 7 bn€ is earmarked to support energy efficiency and renewable energies*" (CEC 2008). Thus, EU Regional Policy is already operating in the same order of magnitude as the green stimulus of European recovery programmes.

In connection with the current economic crisis changes of funding regulations have been adopted which aim at simplifying the eligibility for EU co-financing, as well as increased and accelerated payments. For example, the changes would allow pre-financing of EU funding

through the European Regional Development Fund (ERDF) and the European Social Fund in 2009 and 2010 and an additional 2% in the CEEC equivalent to 4.6 bn€.

According to Friends of the Earth Europe[10] already most of the new EU Member States have planned or adopted national recovery packages which focus largely on speeding up EU funds for infrastructure. According to the analysis of Friends of the Earth Europe and the CEE Bankwatch network the backing up of national recovery plans with additional Community funds is connected to risks and opportunities. On the one hand there is an immediate risk that this boosts conventional unsustainable planning of infrastructure as illustrated by FoEE and CEE Bankwatch (2009). This would have a long-term negative effect e.g. on transport and increase overall material and energy consumption in the affected regions. On the other hand it is an opportunity for a Green New Deal. According to FoEE and CEE Bankwatch (2009) there is evidence of positive impacts: "*In the Czech Republic, for instance, the Ministry of Environment is set to reallocate 470 mn€ towards EE/RES [energy efficiency/renewable resources] this year. In Latvia, EU funds support will increase from 20 mn€ to 73 mn€ for the improvement of heat insulation in multi-apartment residential buildings. Other countries make a step further by contemplating additional 'high-value' stimulus measures – in Poland, the government has proposed 333 mn€ for wind turbines and highly effective co-generation energy facilities. Slovakia will allocate more funds for EE/RES from the Bohunice Nuclear Power Plant International Decommissioning Support Fund and will develop soft measures such as a new program in support of EE [energy efficiency]*".

It is obvious that for any Community funding a green conditionality is necessary. It is not justifiable to the EU tax payer to spend 30% on sustainable development and to risk that 70% support a development which will set the regions of Europe on a development path which will in the conflict with the objectives of the sustainable development strategy. Especially the deregulated and intermediate support for national recovery plans needs to be connected to a Green New Deal. In the short term additional support should only be granted, if they can be connected to the green stimulus of national recovery programmes. Thus, the EU could create a fast track "green light" mechanism: Community funding will be granted on a deregulated and fast track basis, if they are co-financed with a national green stimulus. For preventing debatable green contributions Member States and regions need to show that the national stimulus programme contributes to improving a countries resource efficiency already monitored with the Sustainable Development Indicators or the green Structural Indicators. The connection of EU Cohesion funding with national green stimulus programmes and the SDI would address two persistent problems of EU Regional Policy: lack of co-funding and accountability. Using the established Cohesion Funds and reporting mechanisms would also allow the Community to implement a Green New Deal immediately.

Programmes

The short term Community support for a Green New Deal could be followed-up by more consolidated medium term action of integrating the necessary components of an appropriate policy mix. This could be achieved mainly by improvements on the (inter-) regional programming level. As demonstrated in this chapter the EU has already a number of sophisticated RTD programmes, which are already contributing to a greening of the EU economy.

[10] http://www.bankwatch.org/billions/projects-crisis.html

The different EU policies affecting a Green New Deal would have to converge and should be strengthened with Cohesion Funds. A concrete proposal for improving this kind of policy integration has been formulated by the Scientific and Technical Research Committee of the European Union (CREST). The Commission has published a report based on the CREST guidelines on using synergies between Structural Funds, the Research Framework Programme and the Competitiveness and Innovation Programme (CIP)[11]. Further integration with the Environmental Technology Action Plan could be sought. Such an advanced scheme for using of the EU budget could be the material foundation for developing a "triple-helix" consisting of stakeholders from enterprises, the public sector, research and teaching who could drive and implement a lasting Green New Deal of the European Union. As further explained in chapter 6, priority areas for the development of regional transformation could be sustainable mobility, as well as energy and material efficiency.

As demonstrated in chapter 3, the success of eco-industries depends on continuity and political leadership. Instead of a revolution a Green New Deal needs the continuous effort of all stakeholders to build a sustainable Europe. Much more than additional money a Green New Deal needs capital which is much more difficult to muster: The political determination to stop unsustainable spending practices and to implement and integrate in economic development strategies measures for improving resource productivity as outlined e.g. in the EU Sustainable Development Strategy, the Environmental Action Programme and other relevant strategies. For improving resource productivity the EU can build on the experience with a number of research and technological development programmes such as the Environmental Technology Action Plan and various successful regional development schemes.

As shown above there are no principal reasons against a European efficiency revolution. The European Union has already established European-wide consensus on elements within existing strategies, policies and programmes which could be used to start an efficiency revolution - immediately.

[11] COM (2007) 474 final

6 Analysing the main sectors and levers for a „Green Deal" in the EU27

6.1 Transport policy - problems and challenges in the European Union

Transport in the European Union contributes to several major environmental problems as it is shown e.g. by the European Environment Agency (EEA) in the Transport and Environment Reporting Mechanism (TERM) report for 2008. The transport sector accounts for 19.1% of the European greenhouse gas emissions (EU 27, 2005; Eurostat 2009).

Road transport is an especially critical sector, as it accounts for more than 70% of the CO_2-emissions from transportation (EU15, 2004; EEA 2007). Almost 85% of the passenger kilometers in the EU-15 are travelled by car, and more than 76% of the freight (tonne-km) is transported on the road (Eurostat 2007). The road transport is still growing throughout the EU-27, and its greenhouse gas emissions are rising as well.

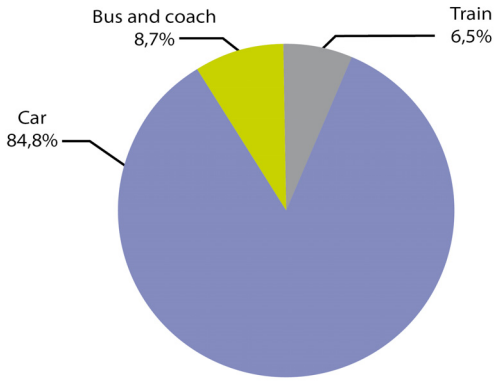

Figure 10 EU-15 modal split of inland earthbound passenger transport, 2004, % in passenger-km (Eurostat 2007, p. 79)

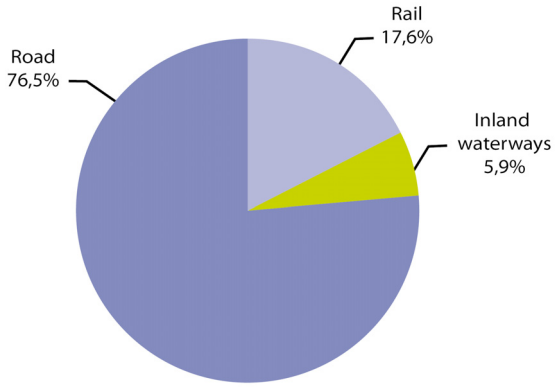

Figure 11 EU-27 modal split of inland earthbound freight transport, 2005, in tonne-km (Eurostat 2007, p. 78)

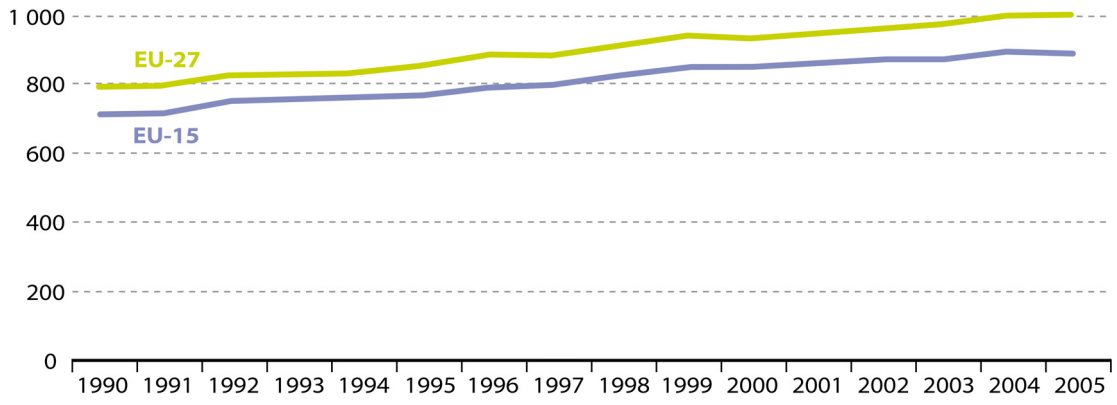

Figure 12 Greenhouse gas emissions from transport, million tonnes of CO2 equivalent (Eurostat 2007, p. 83)

In addition to its CO_2 emissions, road transport also causes other environmental and health problems such as air pollution, noise, land use and landscape fragmentation, impacts on habitats and biodiversity and severe accidents.

Noise from road and rail transport is a severe problem especially in dense populated areas. More than 210 million EU citizens are exposed to levels of road noise that put their health at risk or cause annoyance, stress and sleep disturbance (CE Delft 2007).

Air pollution by particulate matter, nitrogen oxides, sulphur dioxide and ozone caused by road transport seriously damages human health and the environment (CEC 2005b).

These problems are about to increase seriously, if there is no strategic shift in transport policies worldwide: Transport in newly industrialized countries like China or India is growing at a fast rate. Climate targets as well as the objectives of the reduction of pollution, noise and accidents will not be compliable without a fundamental transformation of the transport sector.

The improvement of sustainability of transportation is not only a key challenge in fighting climate change and other environmental problems. As an important sector in modern economies, more efficient and sustainable transport systems contribute to economic growth. Thus, integration of sustainable transport investments in European recovery plans can provide important stimuli for economic development and employment.

Especially urban mobility is a crucial in respect to achieving sustainable transport. Over 60% of the population in the European Union lives in urban areas of over 10.000 inhabitants. Urban traffic is responsible for 40% of the CO_2-emissions from road transport and 70% of emissions of other road transport pollutants (CEC 2007a).

Besides environmental problems also social aspects should be addressed: Sustainable transport has to face individual mobility problems, due to disability, age or other reasons. Also the special requirements of households with low income have to be considered.

Regarding political strategies and social and economic conditions, freight and passenger transport are quite different, as well as earthbound and plane or ship transport. Thus, this section exemplarily concentrates on describing problems and solutions in the field of earthbound passenger transport.

6.1.1 Strategies for sustainable passenger transport

To achieve a sustainable transport that meets environmental, social and economic requirements there are no simple solutions. Until now, the effects of fuel efficiency improvements have been compensated by several rebound effects: an increase in number and weight of cars, the upsizing of engines and the kilometres travelled. Hence, an integrated approach on the field of transport policy is more promising.

A sustainable policy for passenger transport should focus on three basic strategies: Avoiding of transport, modal shift to more sustainable modes of transport and advancement and increase of efficiency of vehicles and the traffic flow (WI 2008). With respect to the sustainability of measures, a hierarchy of these three strategies can be introduced.

Avoidance of transport is a top priority, as it allows maintaining mobility while reducing the kilometres travelled. This notion of mobility is defined by the possibility to achieve different

human activities such as business, work, purchase, leisure and other social and cultural activities (Petersen 2004). Therefore, an integrated policy of transport and spacial development is necessary. Dense structures of housing, working and shopping facilities and places for leisure allow people to practice their activities without long transport distances.

However, measures in spatial and infrastructural development require a long-term development – it can take decades until major effects are reached. Thus, they are not in the focus of this study, which is primarily looking at short-term effects of recovery packages.

A second strategic aspect of sustainable mobility is about the way in which the remaining transport needs are satisfied. The different modes of earthbound transport – walking, cycling, busses, trains and cars – have different environmental advantages and disadvantages.

The non-motorized modes have the lowest impact on the environment, followed by bus and train; cars have the highest impact. Therefore it is reasonable to support zero-emission mobility on short distances and train and public transport by bus or tram on medium range or longer distances. This includes the provision of infrastructure and its interconnection to promote intermodality, the purchase of vehicles as well as mobility management, measures of information, education and service. While infrastructural investments usually take a long time, the other measures can be integrated in a Green New Deal programme. They act as pull-factors for a modal shift. On the other hand, push factors should be introduced: speed limits, low-emission-zones or congestion charges, eco-taxes on fuel and higher motor vehicle taxes for gas guzzlers are examples for measures that help levelling the uneven conditions for more sustainable modes of transport.

The third strategic pillar is the improvement of transport efficiency. This includes measures concerning vehicle technology as well as intelligent traffic management systems and eco-driving. Policy instruments on this field are e.g. emission limits, fiscal measures to integrate external costs of transport as well as R&D programmes; the latter two are possible parts of a Green New Deal.

In summary, the following possible elements of a Green New Deal can be identified:

- investments in new transport vehicles – busses, trams and regional trains
- investments in short-term realizable infrastructure for bicycle and pedestrians
- investments in infrastructure improvements for public transport
- investments in services to improve user-friendliness of public transport
- incentives for retrofitting of cars and vehicles of public transport
- fiscal measures to subsidize low-carbon vehicles
- research for energy efficiency technology
- marketing for more sustainable modes of transport
- education for eco-driving

In addition to the environmental targets of sustainable transport, the social dimension (mobility needs of population share without cars) and economic dimensions (e.g. cost/benefit analysis of modal split change and higher transportation costs by internalizing external effects) of sustainable mobility should be recognized.

6.1.2 Existing recovery programmes in the European Union - instruments in the passenger transport sector

The existing recovery programmes of EU and member states already contain several measures concerning passenger transport.

The European Economic Recovery Plan, proposed by the Commission, contains a "European green cars initiative" to promote the use of renewable and non-polluting energy sources. The proposed contributions of the Member States and the EIB in research account for 5 bn€. (HSBC 2009)

Important recovery programmes of the member states contain various expenditures related to transport, e.g.: (HSBC 2009)

- Several member states invest in road and railway infrastructure. (Germany, France).
- Germany invests 2 bn€ in public transport systems over 2009 and 2010, France invests 950 mn€ in new high-speed railway lines. For rail transport, the stimulus programmes of Germany, France, Italy and the UK together contain 5.8 bn€. This is a relatively small amount compared to the expenditures for the car industry.
- France, Germany, Great Britain, Italy, Spain and Sweden have declared to start programmes supporting their car manufacturers, mostly with credits (e.g. France with 6 bn€ for Renault and Peugeot-Citroen). Credits for the car industry are also provided by the European Investment Bank – amounting to 9 bn€ in 2009.
- Germany started a programme for the development of electric mobility, containing 500 mn€, e.g. for battery development, grid adaption and integrated concepts in model regions in the years 2009 to 2011 (BMWi et al. 2009).
- Following France and Germany, the member states Austria, Cyprus, the Netherlands, Italy, Luxembourg, Portugal, Romania, Slovakia, Spain and the United Kingdom started incentive schemes for scrapping old and purchasing new cars (ACEA 2009). The effects of different programme designs are described in the box.

Scrapping Bonus as an example for different instrument design

In April 2009, the European Automobile Manufacturers Association ACEA reported a decline of the new passenger car registrations for the eleventh consecutive month, with a recent fall of 9 percent in March compared to the same month last year – after the hardest cuts in January with a minus of 27 percent (ACEA 2009b).

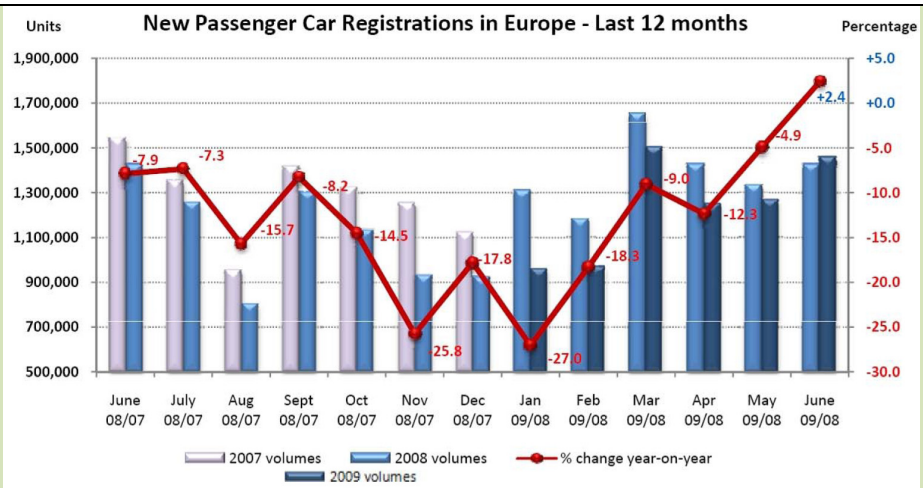

Figure 13 New Passenger Car Registrations in Europe 2008-2009 (ACEA 2009b)

The German and the French markets acted as factors for the weakening of the downward trend. In both countries governments introduced large sized incentive schemes for the purchase of new cars, followed by 10 other EU member states. Together, those schemes led to an economic recovery of the European car markets (ACEA 2009c).

In France, the scheme was started in December 2008. It subsidizes the purchase of a new car if an at least 10 years old car is scrapped. The subsidy that was raised from first 300 to now 1000 € is only paid for new cars that emit less than 160 g CO_2/km. In total, 500 mn€ will be allocated to "scrappage" and the "bonus malus" scheme in 2009 (HSBC 2009).

The requirement to emit less then 160 g sets the French scheme apart from the German so-called „environmental bonus" (*Umweltprämie*) introduced in January 2009. In Germany, 2500 € are paid for a newly licensed car and the scrapping of an at least nine years old car, the scheme totally accounts for 3 bn€. The only environmental requirement is an accordance of the new car to the Euro 4 emission standard – which applies to new car models since 2005.

Whereas the French scheme promotes the purchase of cars emitting less than the current average of the European car fleet, the German model does not affect the CO_2-emissions of the new cars. That way, the scheme allows to scrap an old but energy efficient car and possibly subsidizes a new SUV. So far the government has received 1.3 million requests for the bonus. In the first four months of 2009, the car sales increased by about 20% in Germany (VDA 2009) and the downward trend in France could be stabilized (ACEA 2009b).

An analysis of the German scrapping bonus shows an effect towards smaller and less emitting cars: The average CO_2-emissions of newly registered cars in April 2009 was 155 g/km, 10 g/km beyond the same month in 2008 (IG Metall 2009). The trend towards lower emissions can be explained by the group addressed by the bonus: Especially low-income earners own cars that are at least 9 years old, and they usually don't acquire new vehicles. Encouraged by the bonus, they tend to buy smaller and thus lower emitting new cars.

Nevertheless, it is doubtful if this relatively small decrease in the CO2 emissions of new cars contributes to less CO2-emissions overall. Regarding the total lifecycle of a car a considerable amount of the emissions emerges in the production process. Different production techniques and measurement problems make it difficult to calculate specific data, but the numbers resulting from exemplary studies range between 7 and 15 percent of the CO2-Emissions (Kim et. al. 2004; Automotiveworld 2009). The earlier a car is taken off the streets, the higher the percentage of lifecycle energy necessary for its production. Thus, the positive effect of a slightly less emitting fleet is offset by the energy of the production process due to an advanced scrappage.

Beyond this, there are other critical aspects towards the sustainability of scrapping schemes. The relatively high and short term subsidies are incentives to buy a car and not to think about choosing other modes of transport like using carsharing[12] or using public transport. On the other hand the long-term economic effectiveness of the schemes can be doubted as anticipation effects and wind-fall gains occur – many of the cars would have been bought later anyway (HWWI 2009).

It would be environmentally more effective to introduce more target-oriented instruments, like a bonus for especially fuel-saving cars. Oriented towards the CO2 emissions of new cars a low bonus for cars beyond 140g CO2/km can be spend, which rises parallel with decreasing emissions. This kind of bonus system has the effect that fleet emissions are reduced significantly and at the same time efficient technology is promoted.

[12] The term carsharing is used in the meaning of an organized short-term car-rental, in contrast to private car share.

Profiles of key instruments in the earthbound passenger transport sector

The transport sector in the European Union is of considerable economic importance: About 5.7% (2005) of the population in EU27 work for the transport services sector, of which about 900.000 (2006) are employed in the railway sector (CEC 2009d). A further 1.5% work in vehicle manufacturing. According to estimations of the International Association of Public Transport, about 1 million people in the EU are directly employed in the public transport sector, for every direct job 2 to 2.5 indirect jobs typically exist. The turnover is about 125 bn€ per year (UITP 2009a). Without an in-depth analysis of the employment structures, it is difficult to clearly distinguish the public transport and car traffic sector: The automotive industry constructs both cars and busses, supply firms work for both sectors as well.

Together, the transport sectors amount to some 8.9% of the GDP in the EU. 13.5% of the private household spending is on transport. About one third of this sum (around 310 bn€) was used for the purchase of vehicles, almost half (470 bn€) for the operation of personal transport equipment (e.g. fuel for the car) and the remainder (169 bn€) was spent for transport services like bus, train or plane tickets (EU27, 2005; CEC 2009b).

The following chapters focus on four fields of action: The support of public busses, the support of regional trains and urban trams, the promotion of walking and cycling and the support of fuel-efficient cars. The different measures in these fields can be differentiated into three categories regarding the instruments: a) direct investments, b) impulses for technology to increase competitiveness and c) soft measures like education and marketing, that help reducing emissions but have no investment effects.

Regarding the above-mentioned three strategic pillars of sustainable transport policy, the measures implement modal shift strategies with both push and pull factors, as well as strategies for a higher energy efficiency of the existing modes.

Support of public busses – fleet renewal and extension, bus technology research, eco driving, marketing

Public transport by bus has great advantages over private car transport in respect to energy use and greenhouse gas emissions – per passenger-kilometre, urban bus transport causes only about half of the CO_2-emissions compared to a car (UBA 2007). Public busses contribute to an attractive and inexpensive urban transport system. Extension and greening of the fleet as well as marketing and education measures are also suggested by the European Commission's Green Paper on Urban Transport. The following measures to strengthen public busses should be supported:

- Fleet extension: Rising passenger numbers show the acceptance of public bus transport throughout Europe. More capacity allows to increase the frequency of service or to strengthen the bus network. This raises the quality and capacity of the public transport and sets incentives for a modal shift from car to bus.
- Fleet renewal: A quick procurement of energy efficient and low emitting busses can help attaining two goals - not only avoiding greenhouse gases, but also other pollutants like diesel soot and NOx-emissions – according to the directive on air quality (1999/30/EC). Today, fewer than 5% of the Busses in EU27 comply with Euro 4 or higher (UITP 2009b). A big potential for fleet renewal can be found especially in the

new member states with large shares of Euro 1, 2 or Pre-Euro vehicles. Busses with particle filters that meet the EEV-requirements are already available; the market launch for hybrid busses, which are especially efficient in urban traffic, will probably be in 2010. The CO_2-emissions of hybrid busses are up to 30% below those of conventional busses (Mercedes-Benz 2008).

- Research: A research focus on bus efficiency technology can develop technological potential like lightweight design, hydrogen technology and electric drive.
- Education in eco-driving: An energy efficient way of driving can save 5 to 10 percent of fuel in urban traffic. Eco-driving courses for bus drivers should be supported.
- Public transport marketing: Together with an improvement of the public transport system, soft policies like social marketing can create pull factors towards public transport. The focus should be on cities and agglomerations.

Employment effects of these measures can occur in several branches: the automotive and supply industry, transport planning and consulting, driving training, marketing and advertising.

The size of the job potential is difficult to estimate as they depend on various assumptions. Rough estimations made in a recent short term study by HSBC can give a first impression about the potentials: South Korea's government estimates to create about 138,000 jobs with expenditures of about 9 bn€ in the public transport and railroad sector - against the background of a population of 49 million people (HSBC 2009).

Support of regional rail and urban trams – fleet renewal and extension

The role of rail transport on the regional level for a development towards sustainable transport is comparable to the role of busses on the urban level described in the chapter above. Rail trips on the regional and suburban level account for 90% of the total number of rail passengers and half of the passenger kilometres. Urban tram systems undergo a process of reintroduction and enlargement at the moment – as in Strasbourg, where the tram, introduced in 1994, could double the modal split of public transport within 10 years (UITP 2009c).

The CO_2-emissions by regional rail transport per passenger-kilometre are approximately 30% below the emissions of cars, the emissions of tram or metro systems are even 50% lower (UBA 2007). Rail and tram transport contributes to an attractive urban and regional transport system. The following measures should be supported to strengthen regional rail and urban tram transport:

- Fleet extension: Although the modal split of railway transport remains on the low level of 6.1 percent of the passenger-kilometres travelled in the EU, the absolute numbers are rising. At the same time, the stock of rail vehicles and coaches is decreasing (Commission 2009d). The extension of urban tram systems often fails because of tight municipal budgets.
- Fleet renewal: The infrastructure for regional rail transport in many EU member counties is close to its capacity limit. Besides an extension of the rail network, a modernization of the rail vehicle and coach fleet can expand the capacities, e.g. by procurement of double-deck coaches and energy efficient locomotives. A renewal of the tram fleet, introducing energy-efficient low-floor trams, can increase the attractiveness of public transport and help establishing a barrier-free urban transport.

Employment effects can be expected in the railway and supply industry as well as in railway and urban transport service staff.

Noise Reduction: Measures for vehicles and infrastructure

Reducing traffic noise does not only have positive effect on well-being and health, it also has substantial economic impact: the commission estimates the total costs of noise at 0.2 to 2% of the Union's GDP (CEC 1996). Measures starting at the source of the noise - at the vehicles and at the transport infrastructure – are more effective than reducing noise emissions, e.g. by noise barriers and insulated windows (KPMG 2005). As a part of a Green New Deal, following measures should be supported:

- Incentives for the purchase of low-noise tyres for cars and busses: The traffic noise reduction potential of tyres produced with today's available technology is 2-4 dB, which means halving the volume. A grant on the purchase can accelerate market penetration. This measure should be supported by a strengthening of EU tyre standards that address the reduction of noise and fuel consumption as well as emission and noise labelling.
- Fleet renewal and extension of regional rail and urban trams (see 0) should include the requirement of state-of-the-art noise reduction as low noise engines and brakes.
- Railway infrastructure should be improved for the purpose of noise reduction by periodical monitoring and grinding of rails; road renewals should be built with open-pore asphalt.

Emission Reduction: Retrofitting of cars and busses

According to EU regulation (2008/50/EC) and the Thematic Strategy on Air Pollution (CEC 2005b), pollutants like ozone, sulphur dioxide, nitrogen oxides and particulate matter have to decrease significantly. On the municipal level, clean air plans with e.g. environmental zones are an instrument to fit the emission objectives. They should be supported by incentives for retrofitting private and public road vehicles with particulate filters like the following good practice examples show:

- Cars: A retrofitting bonus of 330 € for car owners has been successfully implemented in Germany in 2007 (BMU 2009a). Since then more than 350.000 cars have been equipped so far.
- Busses: A programme for retrofitting public busses with particulate filters is in force in California with the Lower-Emission School Bus Retrofit Programme (ARB 2009) using American Recovery and Reinvestment Act funding. In France, a 1300 € subsidy is granted for the retrofit of Particulate Filter on buses (ADEME 2009).
- Commercial Vehicles: The Netherlands, the regions Lombardy in Italy Flanders in Belgium and Scotland in the UK pay bonuses for retrofitting commercial vehicles. (dieselretrofit.eu 2009)

Promotion of walking and cycling – infrastructure and campaigning

"Zero emission mobility" (walking and cycling) is sustainable in multiple ways: it does neither emit greenhouse gases nor other pollutants, nor noise and it is good for individual wellness and public health. To promote these modes of transports, a better local infrastructure and information and image campaigning can help. The Green Paper on Urban Transport highlights the meaning of education, training and awareness rising as important measures to create a new urban mobility cultures (CEC 2007a). The proposed measures are:

- Infrastructure extension: In contrast to road and rail infrastructure, the setup or upgrade of a dense urban cycle route network can be implemented quite quickly.
- Image and information campaigns: Campaigns for a modal shift from short distance car transport to walking and cycling can be carried out by the EU or the member states. The implementation of the campaigns should integrate urban politics, civil society and local business.

These measures have positive employment effects in several branches: transport planning and consulting, road construction, advertising business, bicycle (equipment) industry.

Supporting people with mobility problems

Helping to find solutions for all kind of mobility problems is a concern of the EU policy, although only the rights of flight passengers with reduced mobility have become subject of a regulation so far (Regulation (EC) No 1107/2006). Especially because of demographic change, it is important to improve the accessibility and service quality of public transport.

However, there are as well social reasons for limited mobility of people. In 2007, 78 million people in the EU – or 16% of the population – lived at risk of poverty (CEC 2007b). People living in low income households often have problems to bear the costs of mobility. As a result of higher unemployment due to the economic crisis, poverty rates are expected to rise.

The following measures should be supported to help people solving their mobility problems:

- Improvement of infrastructure, vehicles and services: Bus, tram and railway stations should be modified to better fit the needs of people with limited mobility by ramps and lifts, blind stones or talking sign systems.
- Supporting low-income households: Public transport tickets at reduced prices should be provided particular for people of low-income households. This kind of voucher stimulates demand, as low-income households tend to spend and not save their money.

Support of fuel-efficient cars according to EU CO_2-emission standards

The current crisis of the US car manufacturing industry illustrates an insight that climate change and peak oil have promoted: Vehicles with high fuel consumption have no future; the automotive industry has to shift its strategic direction towards smaller, more energy efficient cars, especially in regard of the needs of new markets in the newly industrialized countries. A downsizing has to make the cars smaller, lighter, slower and less powerful.

According to EU legislation for vehicle emission limits, the car manufacturers have to switch their production to smaller and more energy efficient cars. On the other hand, incentives for consumers can help accomplishing this "model switch".

A rearrangement of the motor vehicle tax in dependence of the CO_2-Emissions is an important incentive. The tax should take CO_2-emissions as a basis and rise progressively to encourage the purchase of energy efficient cars. It should be aligned to the EU emission standards, taking the current and the future emission limits as cornerstones for a tax bonus. The progression ensures that there is a big tax difference between an average-emitting car and a car that complies with the fleet emission standards. A dynamic design can prevent a loss of effectiveness– the tax curve is shifted annually according to the shift of emission limits.

As part of a Green New Deal, it should contain a bonus system for truly low emitting cars, exempting cars below 95 g CO_2/km completely from the tax and reducing it for the emission range of 95 - 130 g.

A new motor vehicle tax can act as a truly environmentally friendly scrapping bonus, as it sets incentives only for the purchase of low emission vehicles. It can stabilize employment in the automotive Industry in a more sustainable way than undifferentiated scrapping schemes do, as it makes the European car manufacturers fit for future.

6.2 Energy Policy: Problems and Challenges in the European Union

The energy sector plays a crucial role in EU climate policy since this sector holds a share of about 60% of all GHG emissions in the EU-15 (Eurostat 2008). Besides the environmental effects of energy production and consumption, the energy system is highly relevant for employment and economic development and for vulnerability by external price shocks or problems of security of supply of energy services. Consequently, the energy and climate package of the EU already has a special focus on further improvement of the energy system and to foster energy efficiency in all end-use sectors. This holds also true in respect to decreasing the import dependency concerning fossil fuels. With rising global energy prices the increasing costs for energy imports put pressure on the competiveness of the EU.

Energy-related indicators at the EU level show, however, that there is a need to develop and implement additional measures and supporting schemes to reduce energy consumption and GHG emissions. Since 1995, for example, the **final energy consumption** in the EU has increased slightly in both the EU-27 and the Euro area (figure 14).

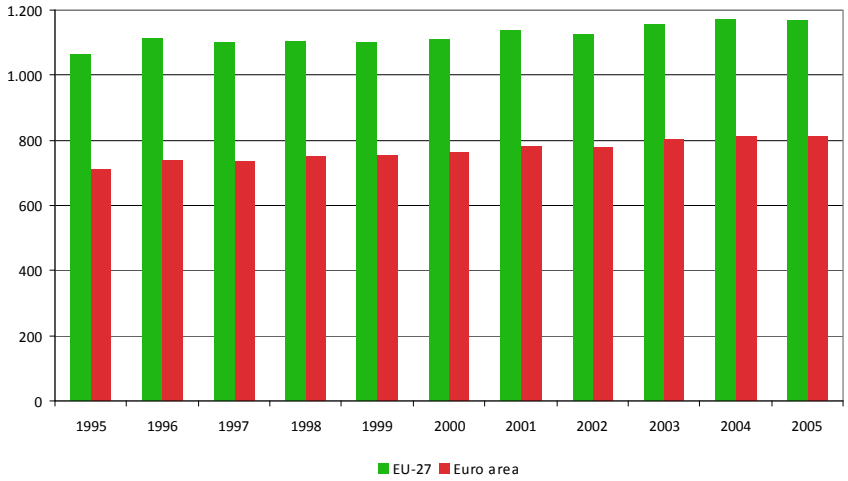

Figure 14 Final Energy Consumption in the EU (EU-27 and Euro Area; Eurostat 2008)

Despite this, most Member States in EU-27 have been able to reduce GHG emissions compared to 1990 – though not considerably (IEA 2020). Only Slovenia, Portugal, Austria, Malta, Luxemburg, Lithuania, Cyprus, Italy, Spain, Greece and Ireland still have increasing trends (figure 15). In a **sectoral perspective**, especially energy (59%) and transport (21%) represent the largest emitting sectors. Other sectors (agriculture, industrial processes, waste) are responsible for the remainder of EU-27 GHG emissions (figure 16).

It is obvious that further efforts and initiatives especially in the energy sector are required to reach the ambitious emissions reduction targets set in the EU for the year 2020.

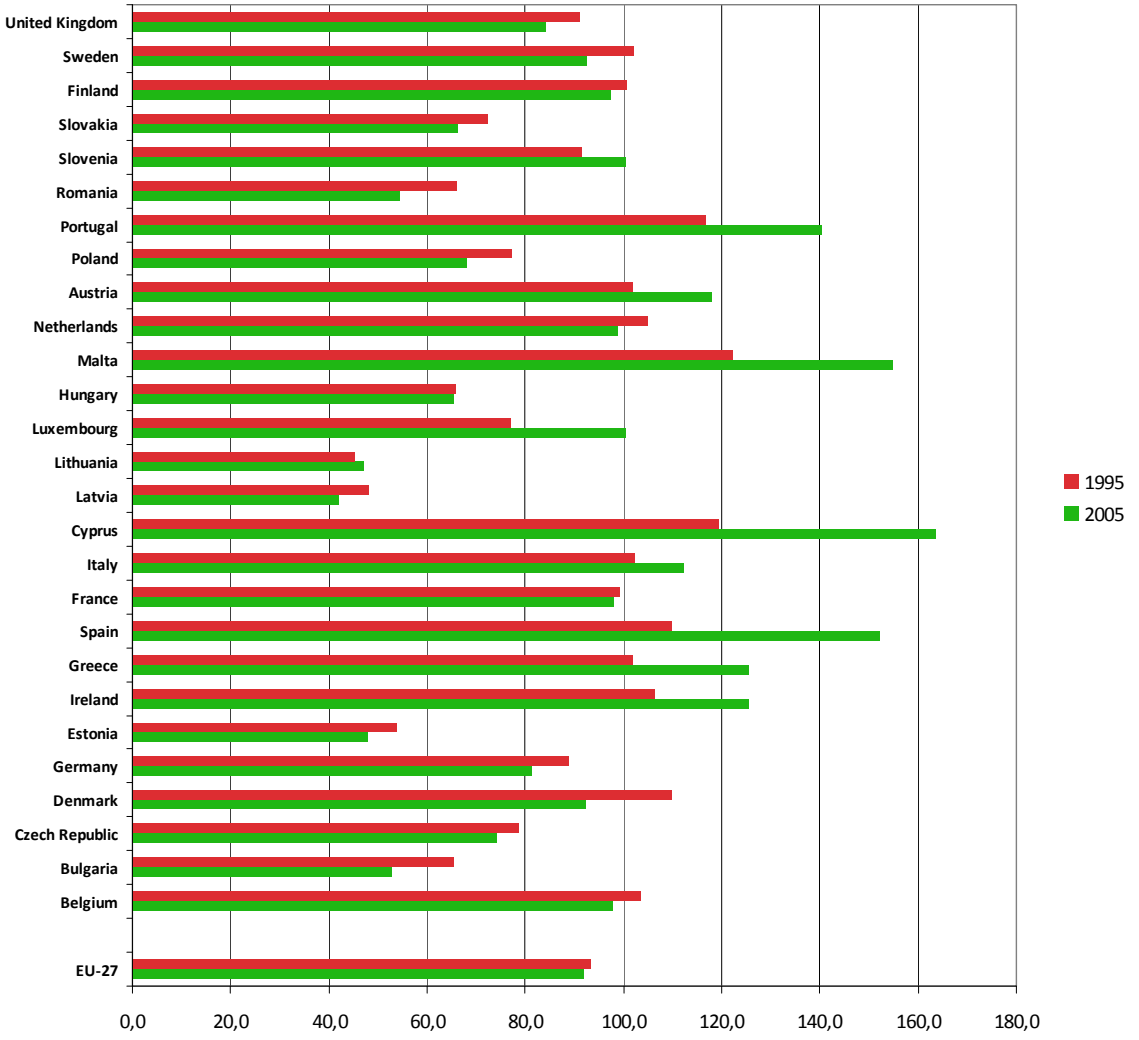

Figure 15 Greenhouse gas emissions by Member State (1995 and 2005 compared to 1990, based on data in million tonnes CO_2 equivalent; Eurostat 2008)

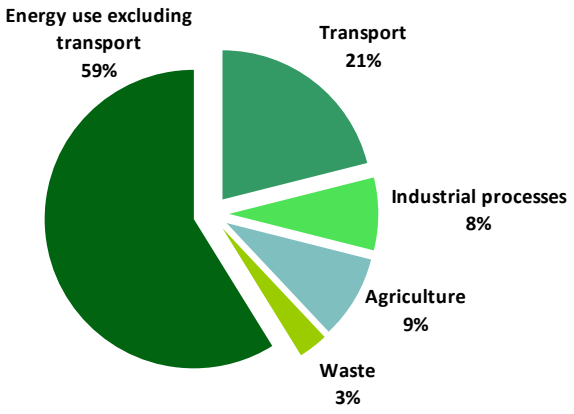

Figure 16 Greenhouse gas emissions by sector (EU-15, 2005 in percent, based on data in million tonnes CO_2 equivalent; Eurostat 2008)

6.2.1 Existing regulations and strategies

On 23rd January 2008 the EU presented its general design for an improved climate policy package to put the EU forward to further reduce energy consumption and greenhouse gas emissions until the year 2020. Most elements have now been adopted by the European Parliament and Council. The European Commission itself has presented the 20/20/20 climate package in a strategic political triangle balanced between sustainable development targets, targets of improving European economic competitiveness in the global context and security issues of energy supply (Koskimäki 2008), as shown in figure 17:

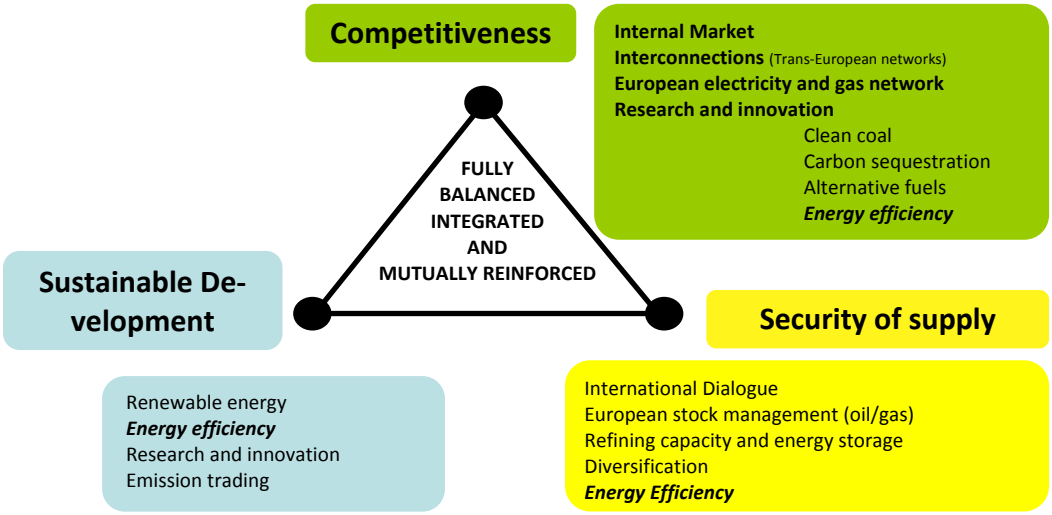

Figure 17 Integrated climate and energy policy of the EU (modified from Koskimäki 2008)

The climate package of the EU meanwhile consists of a broad spectrum of directives and regulations, including

- the Effort Sharing Decision (2009/406 EC)
- the Directive on energy performance of buildings (2002/91/EC)
- the Ecodesign Directive (2005/32/EC)
- the Directive on energy end-use efficiency and energy services (2006/32/EC)
- the Directive on the promotion of co-generation (2004/8/EC)
- the Renewables Directive (2001/77 EC)
- the Emissions Trading Directive (2008/101/EC, 2004/101/EC, 2003/87/EC)
- the Car Directive

Simultaneously, energy-related European projects and programmes have been funded within the Intelligent Energy-Europe programme (IEE) and in the context of regional development programmes (EFRE, URBAN, Cohesion Funds).

In financial terms, according to Edenhofer and Stern (2009), the EU has provided 0.6 Billion US$ (0.42 bn€) to foster the use of renewable energies and 2.8 Billion US$ (1.97 bn€) to support green investments in the building sector between 2009 and 2010.

These regulations and programmes are all set up to complement related activities and measures at Member State and regional levels. As an example, France provides 0.9 Billion US$ in fiscal measures (0.63 bn€) to foster renewable energies between 2009 and 2010 and 0.8 Billion US$ (0.56 bn€) to support refurbishments in buildings. These amounts of fiscal

resources in the building sector are exceeded by the building programmes in Germany for which 10.4 Billion US$ (7.32 bn€) are provided (ibid.).

6.2.2 Potentials and abatement costs

In 2008, the Wuppertal Institute published an update of an integrated scenario analysis on behalf of the WWF: "How to achieve a domestic 30% GHG emission reduction target in the EU by 2020" (Lechtenböhmer 2008, based on Lechtenböhmer et. al. 2008). Its objective was to assess the effects of EU initiatives and Directives to the EU's climate package by the year 2020. The study demonstrated the potential to reduce GHG emissions until 2020 by about 30% versus 1990. However, due to a lack of active policies especially in Member States in recent years it has declined compared to a similar study conducted in 2005.

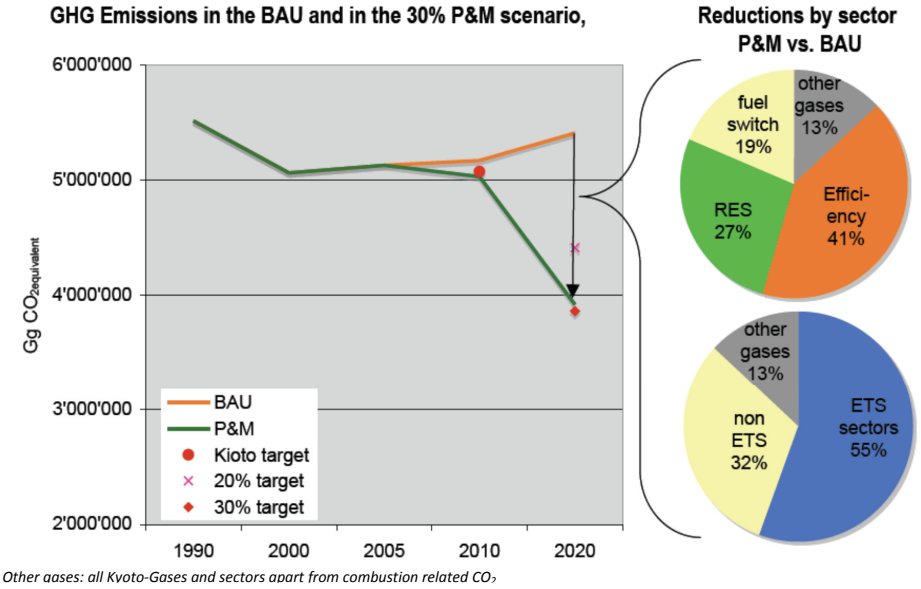

Figure 18 Overview of GHG emission reductions in the 30%-P&M scenario vs. BAU (WI 2008; DG TREN 2008)

As the predecessor of 2005, the update stressed the major role of energy efficiency as a main contributor to greenhouse gas mitigation and energy savings in all sectors and Member States. In the so called "Policies and Measures Scenario" (P&M), the final energy demand scenario decreases by 6.5% from 2005 to 2020 and almost 20% vs. the „Business-as-usual Scenario" (BAU). With nearly half of the overall savings, the main effect appears especially in the residential sector. The final energy demand in this sector is reduced by about 11.6%. Picturing the changes in final energy demand by fuel there is a sharp drop in solid fuels, decreasing by about 59% and oil, decreasing by about 20%. In contrast, the demand for district heat (48%) and the direct use of renewable energies (134%) grows significantly.

	Savings vs. BAU (2020)		Share of savings	Savings vs. 2005		Share of savings
	ktoe	%		ktoe	%	
Final Energy Demand by sector	**260,387**	**19.3%**	**100.0%**	**75,069**	**6.5%**	**100.0%**
Industry	69,838	19.0%	26.8%	21,936	6.9%	29.2%
Residential	64,482	19.2%	24.8%	35,709	11.6%	47.6%
Tertiary	40,619	19.8%	15.6%	8,913	5.1%	11.9%
Transport	85,448	19.5%	32.8%	8,511	2.4%	11.3%
by fuel *(negative savings increase demand)*						
Solids	30,974	60.9%	11.9%	28,604	5.9%	38.1%
Oil	150,304	27.9%	57.7%	95,398	19.7%	127.1%
Gas	84,394	29.1%	32.4%	65,181	24.1%	86.8%
Electricity	47,496	15.7%	18.2%	-13,098	-5.4%	-17.4%
Heat (from CHP and District Heating)	-6,952	-8.2%	-2.7%	-29,535	-47.6%	-39.3%
Other (mainly renewables)	-45,829	-58.0%	-17.6%	-71,490	-134.0%	-95.2%

Table 9 Final energy savings 30%-P&M scenario vs. BAU (WI 2008)

6.2.3 Strategic fields of action and employment effects

As a premise, the implementation of a green investment programme at the EU level will increase its long-term impact in emission reductions and employment if it is complementarily embedded in a coherent policy package at the EU, Member State and Regional level. Policy research, for example, has shown that a coherent strategy in the building sector should include co-ordinated policy instruments at European policy levels targeting at both end-users *and* multipliers. In complete policy packages for end-users, the provision of financial incentives such as soft loan schemes or direct financial subsidies represent only one element complemented by related informational measures (public information campaigns), advice and consultancy, institutional measures (e.g. energy agencies) and regulatory approaches. In addition to measures targeting at the improvement of energy efficiency at the end-user side, a coherent strategy will also address relevant multipliers, market agents and producers by educational measures, measures for ensuring quality control, market-based instruments and services, networking activities and voluntary agreements with (sub-)sectors (Schüle et al. 2009).

Regarding the employment effects of green investment programmes, there has not been any comprehensive data available by now.

- In the year 2005, the renewable energy sector employed about 1.4 million people with a gross value added of 58 bn€ in the EU, although the significance of the sector varies strongly among Member States. Biomass, wind and hydro technologies are currently the most important for employment. In the future, significantly more people are expected to be employed in the renewable energy sector, especially in the Member States that joined the EU in 2004 and 2007. A European study (ISI-Fraunhofer et al. 2009) concluded that the development of renewable energy will create about 900,000 new jobs by 2020 of which about 400,000 jobs will be created in the renewable energy sector and about 500,000 jobs in agriculture and forestry areas that supply primary fuels.
- Improved energy efficiency in general will be able to contribute at least the same amount. For Germany alone, the building sector, for example, FIEC (quoted from Ernst & Young 2006) estimates that about 26 million workers in the EU depend, directly or indirectly, on the construction sector. A range between 14 million employ-

ees in the EU-15 and 12 million people employed in EU-25 (Ernst & Young 2006) is estimated to be employed in the eco-construction sector. For Germany alone, a recent study (ifeu et al. 2009) calculated a net increase in employment of 260,000 by 2020 from energy efficiency improvement measures in the energy and transport sectors.

In developing an investment programmes at the EU level, four main strategic fields can be identified:

1. Improving energy performance of buildings (residential, tertiary, and industry buildings; existing buildings, new buildings, heating and cooling, incl. use of renewable energies, smart metering)
2. Reducing energy use of electrical appliances
3. Reducing energy use and emissions in industrial processes
4. Flexibilising European electricity grids

(1) Strategic Field 1: Improving energy performance of buildings

In order to increase the rate and quality of refurbishments in existing buildings as well as the energy performance of new buildings, the provision of information and low-interest loan schemes in combination with advisory schemes have been the predominant (and most effective) approach chosen in Member States (Schüle et al. 2009; although consumer surveys indicate that direct subsidies could be more effective than soft loans). As an example for a low-interest loan scheme, the German CO_2 Building Retrofit Programme of the German Federal Reconstruction Loan Corporation (Kreditanstalt für Wiederaufbau) focuses on both the improvement of the energy performance of building envelopes and the improvement of building installations including the use of renewable energies and CHP supply systems. Some Member States also offer incentive programmes complementary to loan schemes, like household tax deduction or direct subsidies for buildings with a high level of energy performance. Such direct subsidies for very energy-efficient buildings or retrofits have recently also been added, e.g. to the German programmes. Such direct subsidies for very energy-efficient buildings or retrofits have recently also been added, e.g., to the German programmes.

Despite large successes being achieved, however, there is still the challenge to significantly increase retrofitting rates and the energy performance in existing buildings through additional investment programmes at EU level.

Accelerating retrofitting rates and improving the energy performance of existing buildings

For existing buildings (residential, public, commercial, industrial), Member States should be required to achieve renovation of at least 3 percent of the building stock each year to low energy standards. The instruments used should be up to the Member States. Additional funding in the framework of a green investment programme should include the following elements:

1. In order to accelerate retrofitting rates and achieve higher standards in retrofitting at the same time, we recommend issuing advisory schemes in which **advisory service vouchers** for house-owners and SMEs are offered. Independent advisory

services play a crucial role in raising house owners' awareness in the residential and business sector. Such services usually comprehend a technical diagnosis of the current energetic performance of the building, recommendations on energy-saving actions and information on funding opportunities. Related research was able to show that advisory services can significantly contribute to both the implementation of *additional* energy-saving actions when refurbishments are already projected by a house owner and to the implementation of measures with a *higher* energetic performance. To avoid the implementation of an isolated additional advisory scheme, the provision of advisory service vouchers should be closely related to existing labelling schemes (energy certificates) and existing (initial and in depth) advisory schemes at Member State level.

A special focus should be set on

- multi-family houses (especially made of precast concrete slabs in CEC–Member States)
- one-family houses
- Public buildings (administration and school buildings)
- Service sector and industry buildings

2. Complementary to advisory service vouchers additional **direct grants** should directly be offered supporting the use of renewable energies and achieving high energy efficiency standards in the refurbishments of existing buildings.
3. As regards increasing energy performance standards in existing buildings, there currently is the R&D challenge to implement passive house or zero emission house standards. Intelligent combinations of high energy performance standards of the building envelope and the usage of renewable energies are required to significantly reduce energy consumption and emissions from this sector. In the short term, thus, an investment programme at EU level can address this challenge by funding **pilot projects** in which existing buildings are getting improved towards *passive house* or *zero emissions house standards* in the residential, public, service and industry sector. Apart from the financial dimension, the implementation of high energy performance standards in existing buildings requires complementing control schemes and training measures for planners, architects, craftsmen and producers of construction materials.
4. In order to extend the focus from an isolated building-perspective to a perspective of urban quarters and environments, additional green investment programmes should support cities and regions to develop concepts and pilot projects of zero-emission quarters or zero emission cities. A study of the Wuppertal Institute (2009) could show by the example of a growing urban quarter in the city of Munich that an integrated combination of ambitious efficiency measures in existing buildings, high energy performance standards of new buildings (plus-energy houses) and an extensive use of renewable energies (in the case of Munich especially solar and geothermal energy) can reduce emissions radically in the long term. The specific example shows, that existing district heating systems can be integrated in such an urban or quarter-based strategy.

Achieving Zero Emission and Passive House standards in new buildings

Minimum performance standards for new buildings and low-interest loan or subsidy schemes for energy efficient buildings have been the most common policy approach to address the new building sector. Denmark, for example, will tighten the energy requirements in its building regulations for new buildings by 25-30% as of 2006 (app. 25% by 2010). The UK has improved its energy efficiency standards so that new buildings built in 2007 are 40% more efficient than ones built in 2002. The UK is also envisaging to make all homes in England carbon neutral ("carbon zero") by 2016, according of its National Energy Efficiency Action Plan. Also the recast of the European Buildings Directive will have to play a major role in improving standards case for all kinds of buildings (residential, public, commercial and industrial) to passive house levels in the first step and net zero energy levels in the second.

In order to support this process by green investment programmes, two types of **pilot projects** are recommended to be funded at EU level:

1. The financial support of energy-plus-houses provides both an example and experimental field for new buildings in general. Energy-plus-houses produce more energy from renewable energy sources, on average over the course of a year, than they import from external sources. Especially the interlinkages between high energetic performance standards of the building envelope and the use of renewable energies or decentralised energy supply systems (e.g. CHP) for heat and electricity need to be addressed.
2. The integration of low emission strategies in buildings with resource efficiency requires further external financial support. Labelling systems like BREEAM, CASBEE, Effinergie, DGNB and LEED can help raising awareness for the materials and life-cycles used in new buildings. Additionally, buildings certified with such labels provide incentives and political support to improve energy related labelling schemes in European Member States.
3. Also in the new building sector, the perspective should be extended from the perspective of single buildings to entire urban quarters and environments (see above). In the context of a green investment programme, cities and municipalities could be financially supported in planning and implementing settlements with net-zero energy or energy-plus houses.

Optimising energy consumption in heating, and air-conditioning, and lighting systems

Reducing the energy consumption of heating, air-conditioning, and lighting systems is another adjusting screw to significantly reduce emissions originating from the building sector. Old and inefficient heating systems should be replaced or technically be modernised by direct grants also at EU level. Energy efficient motor technology, for example, can significantly reduce electricity consumption for circulation pumps and fans up to 80%. Similar energy savings are possible in tertiary and industrial lighting systems, through efficient luminary-ballast-lamp systems combined with daylight and or occupancy controls. In order to accelerate the modernisation and optimisation of heating, air-conditioning, and lighting systems, the following supporting measures are recommended:

- Replacement of old and inefficient heating systems, especially electric heating
- Further promoting of renewables in heating systems (solar thermal collectors, biomass boilers) and air conditioning sytems (solar cooling) in energetically optimised buildings
- Support of a significant market diffusion of energy-efficient circulation pumps and fans as well as implementation of quality control schemes for existing heating systems (e.g. hydraulic adjustment)
- Support of a significant market diffusion of energy-efficient lighting systems
- Reduction of net losses in distric heating systems in CEC countries (example: national energy efficiency action plan of Bulgaria)

(2) Strategic Field 2: Reducing Energy Use of Electrical Appliances

In order to reduce the energy use of electrical appliances, information and labelling schemes such as the EU labels for appliances have been the most usual measures to increase awareness and influence purchases in this subsector. In rather seldom cases, **financial incentives** in terms of fiscal measures or demand-side management programmes have been provided. A++ labelled refrigerators and freezers save around 45% of electricity compared to Class A models, which are the market standard. The market penetration of such efficient appliances, however, is still at a very low level. Also the reduction on-mode consumption of office, communication, and entertainment appliances could be a subject of further supportive measures. Such financial support will enable a faster market transformation. This will both accelerate the transition to the phase when the EuP standards come into force, and promote even more energy-efficient appliances, which will allow making the EuP standards dynamic in the future.

The following measures are recommended:

- Supporting programmes for the most energy efficient white appliances
- Supporting programmes for office, communication, and entertainment appliances without stand-by and with low on-mode consumption

(3) Strategic Field 3: Reducing emissions in industrial processes

Loan schemes, grants or direct subsidies for the promotion of energy efficiency actions and renewable energies in industry are offered in many Member States. Besides direct financing measures such as grants or loan schemes, some countries allow rebates in taxation for investments in energy efficiency, as documented e.g. in the Belgian and French National Energy Efficiency Action Plans. Another example is the Dutch Energy Investment Deduction (EID) that offers a tax rule allowing additional deductions on taxable profit after investments in energy efficiency. In the UK, the Enhanced Capital Allowances (ECA) scheme provides businesses in the tertiary sector a first year 100% tax allowance on designated energy efficient equipment investments. In most cases, the financial support for energy efficient appliances is complemented by incentives targeting the promotion of renewable energies or combined heat and power (CHP). The energy tax in the Netherlands is a levy on energy consumption and covers all sectors (also: Germany). Since 1999, Finland has supported energy saving investments of companies in the private sector through subsidies (new technologies:

25-35%; conventional technologies: 15-20%, valid only for companies that joined the national energy conservation agreements). Subsidies will also be part of the new energy-efficiency agreements concluded for the period between 2008 and 2016.

Following this, an EU based funding scheme should support such measures, however leaving Member States freedom on the concrete way how to do it. A combination of free or subsidised energy audits (advisory and audit vouchers), regional and/or sectoral networks and sectoral energy concepts (as, e.g., in North Rhine-Westphalia), energy services, and targeted financial support programmes to promote end-use actions identified, e.g., in the sectoral networks or concepts appears the most successful package for stimulating energy efficiency in SMEs. All of this should be organised and financed at the Member State by national, regional, and local energy agencies level, with financial support from the EU level in the framework of a green investment programme.

(4) Strategic Field 4: Improving Electricity Grids and Smart Metering in the EU

Diffusion of Smart-Metering Systems

In recent EU regulation, especially the Directive on energy end-use efficiency and energy services (ESD) has clearly emphasised the role of smart metering systems in the reduction of energy consumption and CO_2 emissions. Currently, the majority of existing electricity and gas meters are either not accessible for consumers or provide limited information only. The direct monitoring of energy consumption through smart metering systems can stimulate energy saving actions of final energy consumers and offers the possibility for additional energy-related load management services. By now, however, in most Member States only pilot projects have been designed and implemented to gather first experience with this technology, predominantly implemented in co-operation with energy suppliers and energy service companies. The design of a European investment programme of smart metering systems, thus, would pursue the target of

- promoting awareness of energy consumption, energy costs and greenhouse gases emissions at final energy consumers,
- stimulating final energy consumers to monitor energy consumption and to take additional action to save money on their energy bills, provided they receive advice on what action they could take and on its benefits,
- decreasing the running costs of metering and billing
- creating the technical basis for being able to cope with peak demand challenges and integration of renewable energy sources.

Developing Smart Grids

Diffusing smart-metering systems also requires the European electricity grid to be further improved and be made more flexible. The current structure of the European grid is also challenged by general developments in the energy supply market, such as a changing energy mix in Europe, the integration of decentralised renewable large supply systems, the integration of large-scale offshore wind and concentrated solar power plants. Only innovative and smart

grid technologies will be able to manage these strategic challenges and address further energy conservation potentials.

The European Technology Platform Smart Grids developed a comprehensive research agenda which provides important elements also for issuing a green investment programme in this sector (CEC 2007c). Five research opportunities are identified in this context:

- smart distribution infrastructure (small customers and network design)
- smart operation, energy flows and customer adaptation (small customers and networks)
- smart grid assets and asset management (transmission and distribution)
- European interoperability of smart grids (transmission and distribution)
- Smart grids cross cutting issues and catalysts

Pilot projects could be funded by a European investment programme to improve European grids towards more flexibility and stability.

6.3 Resource Efficiency Policy – Problems and Challenges in the European Union

Europe depends on a broad variety of natural resources from domestic sources as well from other parts of the world. Rising global demand from emerging economies and the natural scarcity of resources will limit access to resources (e.g. metals) and drive resource prices.

Therefore, strong economic argument and a main driver for resource efficiency is a high cost reduction potential with two major effects: Improved competitiveness and job creation. Resource productivity could therefore be a core element of a Green New Deal which could not only lead to short term effects but an overall stronger economy.

In the following the aspects of resource scarcity, resource productivity, competiveness and jobs creation will be discussed in more detail.

6.3.1 Risks and impacts of resource use

Since 1980ies the total global extraction of both abiotic (fossil fuels, minerals) and biotic (agriculture, forestry, fishing) resources has continuously increased. Between 1980 and 2005 the resource extraction grew from 40 to 58 billion tonnes. A total of about 80 billion tonnes are anticipated in scenarios for the year 2020, which is 200% of the 1980 values (Giljum et al. 2008). While the global share of extraction of the BRIICS countries (Brazil, Russia, India, Indonesia, China and South Africa) and the rest of the world (non-OECD) is increasing the global share of the OECD countries is shrinking (figure 19).

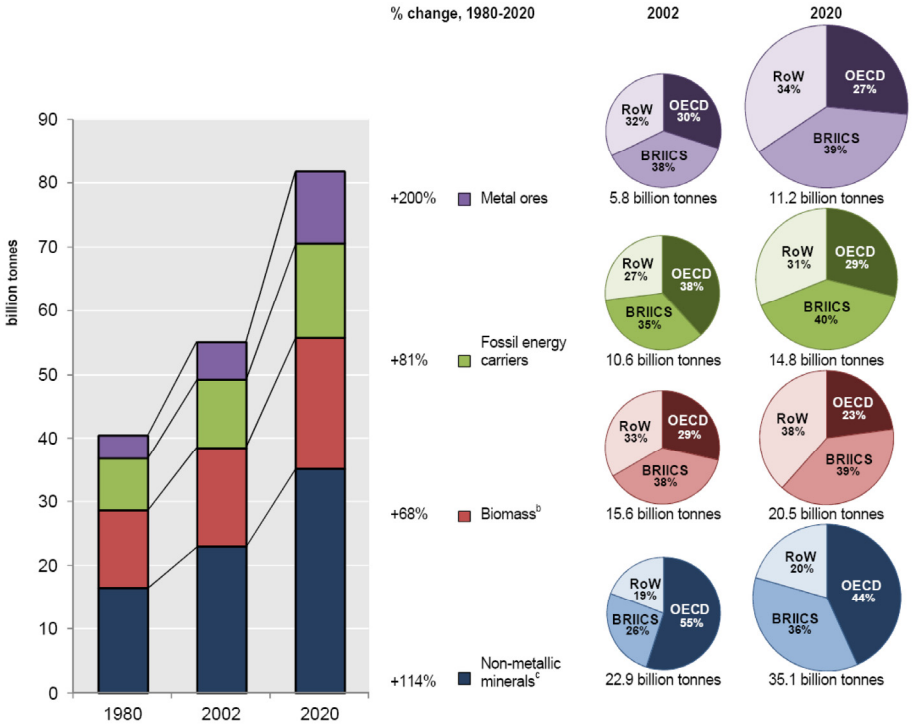

Figure 19 Development of global resource extraction (Bleischwitz et al. 2008, p.2)

Although the EU's own resource extraction decreases it is still a major resource consumer. In general, OECD and EU-25 countries require more resources than they extract (Giljum et al.

2008), whereby resource exporting countries tend to extract more than they consume. Thus there is a net transfer of natural resources to the OCED countries and the EU-25.

The EU-25 needs about 21% of resource imports for the production of goods for final demand, which underlines the EU's dependency on the extraction of natural resources in other parts of the world (Giljum et al. 2008). This dependency cannot be alleviated through the expansion of domestic extraction as the deposited of natural resources are limited in the EU (Bleischwitz et al. 2008).

Especially Europe's dependency on other countries will increase where resources are strategically important and not available on EU territory. This dependency will intensify as the relevance of the OECD countries for future global resource extraction is shrinking (see figure 19).

The increasing global demand for resources in the years before the crisis has lead to an enormous increase of raw material prices. Countries with relative resource scarcity have to face a growing competition for resources. If the global demand after the crisis increase again access to resources on the world markets would become more difficult and cost intensive (Bleischwitz et al. 2008).

In addition to economic risks, overseas resource extraction goes along with ecological risks contributing to an environmental burden shifting from Europe to other regions of the world.

Also in the area of renewable resources there are more natural resources used than the environment is able to regenerate. As a result of this overuse, natural habitats are destroyed, biological diversity is dramatically reduced, air, water and soil polluted etc. In short: Increased efficiency in using non-renewable and renewable resources decreases the overall pressure on the environment.

6.3.2 Resource productivity and competitiveness

Cost arguments support a positive correlation between resource productivity and competitiveness. Companies which spend less on resources have smaller production costs. According to the German Federal Statistical Office the share of material cost in German manufacturing industries had increased from 37.4% to 42.9% between 1995 and 2006 while labour costs had decreased from 24.7% to 18.2% (Bleischwitz et al. 2009; see figure 20).

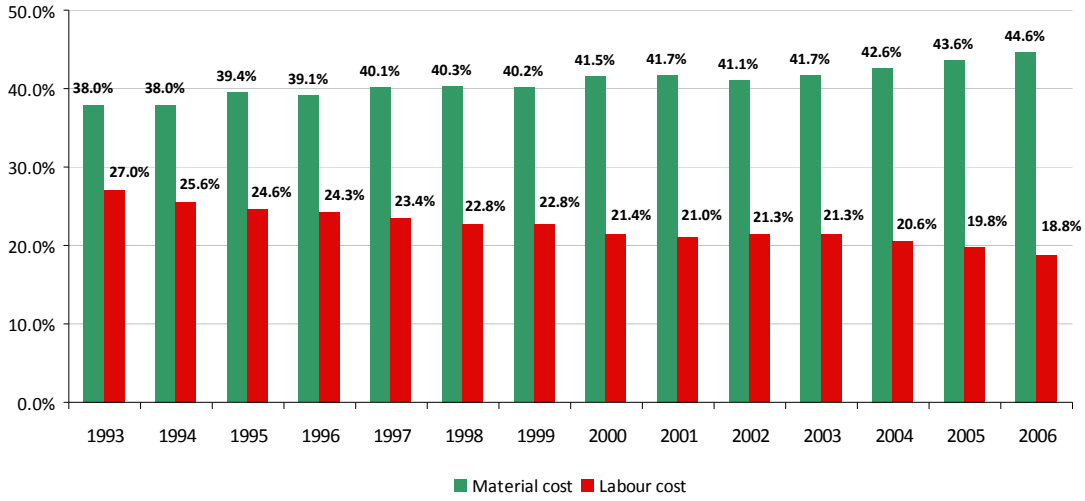

Figure 20 Development of material and labour cost in the German manufacturing industry (Statistische Bundesamt 2008)

These figures imply that for reducing costs in manufacturing industries resource costs have become more significant than labour costs. We may assume that also for improving overall competitiveness natural resource have become more relevant.

Bleischwitz et al. (2009) support this assumption with a positive correlation between resource productivity and competitiveness among countries of the EU-25. The study correlated the Growth Competitive Index of the World Economic Forum (2002) against resource productivity of EU economies (figure 21). A regression analysis identifies resource productivity to be a driver of competitiveness. A central argument of resource productivity as a competitive advantage is the high cost saving potential in material purchasing and transformation, waste handling and energy consumption. Also improved quality by radical innovation and reduced environmental impact are linked to competitive advantages through resource productivity. Finally, improved resource productivity increases planning security which is also a factor contributing to competition (Bleischwitz et al. 2009).

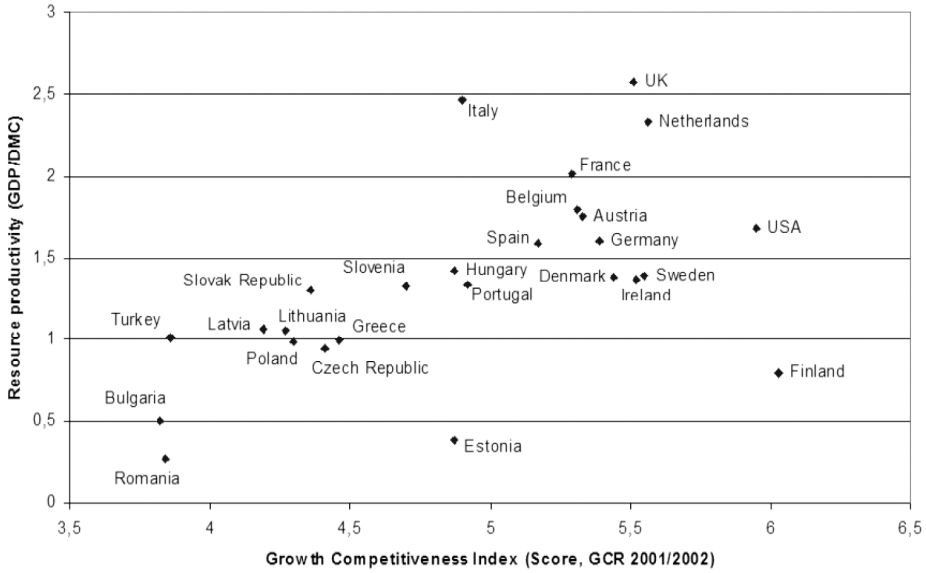

Figure 21 Resource productivity versus competitiveness (Bleischwitz et al.2009, p.36)

6.3.3 Employment effect of resource productivity

As described above material costs amount in average to about 40% of total costs in the German manufacturing industry. We may assume similar cost relations in other EU economies. Yet, cost rationalisation in companies often means reduction of labour costs and therefore increased unemployment. The cost reductions through increased resource productivity could reduce pressure on labour and save jobs.

Meyer et al. (2007) have modelled the economic effect of increased resource productivity on the German economy. The so-called Aachener Scenario is build on the assumption of 20% reduction of material and energy costs in the manufacturing sectors, construction and public administration in 11 years (linearly from 2005 to 2016). The simulation resulted in positive **net job effect** of 1 million employees by 2016 only in Germany (ibid)[13].

In summary, by implementing strategies for improving resource productivity the EU could:

- strengthen the security of supply of resource
- prepare for and avoid increasing resource prices
- taking use of the cost competitive advantage of cost reduction
- realize a considerable job creation potential
- reduce significantly overall pressure on the environment

6.3.4 Strategies of Resource Efficiency Policy

The European Sustainable Development Strategy intends to "*break the link between economic growth, the use of resources and the generation of waste*" (European Commission 2001, p.12). The 6th Environmental Action Programme aims at "*better resource efficiency and resource and waste management to bring about more sustainable production and consumption patterns, thereby decoupling the use of resources and the generation of waste from the rate of economic growth and aiming to ensure that the consumption of renewable and non-renewable resources does not exceed the carrying capacity of the environment*" (European Parliament & Council of the European Union 2002, p.3).

The European Commission uses Domestic Material Consumption (DMC) as an indicator to measure overall resource consumption. The DMC "*measures the total amount of material directly used in the economy. It is defined as all materials directly entering the national economy (used domestic extraction plus imports), minus the materials that are exported*" (European Commission & Eurostat 2005, p.119). The relation of the Gross Domestic Product (GDP) to DMC describes resource productivity (figure 9).

The monitoring of the EU SDS (Eurostat 2005) shows that the EU 15 have already broken the link between GDP growth and resource use (figure 22). Although resource productivity is steadily increasing (relative decoupling) the absolute resource use of Europe remains on a high level including it economical and environmental consequences (see 6.3.1). Policy measure should therefore focus on an absolute decoupling of resources use and economic growth.

[13] A European update of the study is expected to be published as a result of the PETRE projected funded by the Anglo-German Foundation. www.petre.org.uk

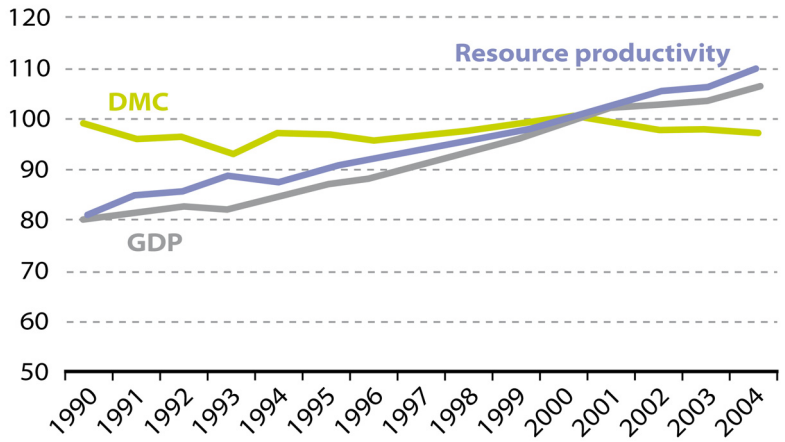

Figure 22 EU-15 DMC versus GDP at constant prices, index 1995=100 (European Commission & Eurostat 2007)

DMC as an indicator for resource use does not include hidden flows ("ecological rucksacks") that arise from the extraction or processing of resources. Especially imported goods are connected to large hidden flows. Currently, Europe is improving its resource productivity by increasing resource imports. The environmental burden connected to resource extraction is increasingly shifted to other countries (see 6.3.1). Therefore, an indicator should be chosen which includes all hidden flows of resource consumption. Thus, Schepelmann et al. (2006) have proposed to the European Parliament to use the indicator Total Material Requirement (TMR), to measure the progress of resource efficiency policy.

In accordance with the question of an adequate indicator the discussion of targets arises. Neither the 6th Environmental Action programme, nor Thematic Strategy on the Sustainable Use of Natural Resources proposes adequate targets. Additionally, the EU lacks concrete measures for achieving improved resource efficiency (Schepelmann et al. 2006).

In contrast to the EU, Germany has adopted the target of doubling raw material productivity until 2020 (excluding biomass and the ecological rucksacks; see Hennicke & Sewerin 2009) in relation to 1994 (Federal Government Germany 2002). To achieve this goal the Federal Ministry of the Environmental, Nature Protection and Nuclear Safety develops adequate actions. In this context a consortium of more than 30 institutes coordinated by the Wuppertal Institute analyse in the framework of the "MaRess" study 5 objectives, which are briefly introduced in the following chapter.

6.3.5 Core objectives for improved resource efficiency

Resource efficiency has to be embedded in a more comprehensive vision of a sustainable metabolism of industrial societies. Bringezu & Bleischwitz (2009) have outlined how a potentially sustainable resource basis for the EU should look like. A future sustainable metabolism may be characterised by four paradigmatic and complementary perspectives:

1. a resource-efficient and recycling-based industry,
2. the steady stocks society,
3. a solarised technosphere and
4. a balanced bio-economy which develops even further towards a bioniconomy.

The dynamics and features of visionary elements which Bringezu & Bleischwitz (2009) have described may provide orientation for technology and policy development.
On a pragmatic and short-term basis Kristof & Hennicke (2009) propose five core objectives for the first paradigm of a resource-efficient and recycling-based industry:

1. Sustainable markets of the future – providing a direction for innovation
2. Strong institutions – key to a successful diffusion
3. Resource efficient products and services
4. The Government as consumer – role model and market power
5. Change in peoples' heads

Sustainable markets of the future – providing a direction for innovation

Markets should promote innovations with a focus on improved resource efficiency. Political arrangement of the market framework conditions should create incentives for the development of resource efficient innovations and reduce counter productive incentives. As a result research and development would be oriented towards resource efficient solutions and the development of resource efficient products and services.

Resulting upcoming innovations need to be introduced and established on the market. Whereby the diffusion on the EU market and export to international markets needs to be supported by instruments such as support for trade fairs, market information and technology platforms. Existing RDT programmes and technology platforms need adjustment to support resource efficient solutions and their diffusion on the markets.

Strong institutions – key to a successful diffusion

Improving resource efficiency of a company is often difficult. Regularly companies have not enough expertise and resources to implement resource efficiency measures within the company. Especially SMEs have not enough expertise and often lack the time to launch resource efficiency measures.

In order to realize efficiency potentials individual and specialized consultancy services are required. These can adapt to the actual situation of a company and follow-up the whole process of the required restructuring.

This kind of service requires a large pool of consultants. Experience from Germany has shown that an intermediate agent can successfully support the cooperation of companies and adequate consultants. The networking German Material Efficiency Agency (Demea), informs public and private institutions about the necessity and benefits of improved resource efficiency, educates and collects consultants, provides access to consultants and manages networks to provide knowledge exchange and cooperation between different companies, consultants, sectors and regions.

Resource efficient products and services

There are three options for political action to support resource efficient products and service on the market:

- First, in accordance with the first core objective, cutting-edge products need to be supported especially in the phases of design and market introduction.
- Second, standards need to direct average mass market products towards improved resource efficiency. Existing standards like the eco-design directive (2005/32/EG) should be upgraded by including resource efficiency requirements.
- Third, new resource efficiency standards should also contain minimum requirements for products on the market. As a result products with old, resource consuming designs will be banned from the market.

The Government as consumer – role model and market power

Strategic consumption can force markets towards more resource efficient products and services. Governments usually have a high market power since public procurement has a high share of the total market consumption. Resource efficiency can be established as an important decision factor through specific public purchasing directives. This would also be an incentive for the design of resource efficient products, since the commercial risk is limited by a stable demand from public institutions.

Moreover, governments can have a pioneering function. If resource efficiency is established and consistently applied, long term cost advantages can be realised. The state can also set an example for socially responsible behaviour.

Change in peoples' heads

The four objectives listed above can only be realized when people (institutions, companies etc.) understand the importance and opportunities of improved resource efficiency. In order to raise awareness for resource efficiency all communication and education channels have to be used. Young people need to learn in school about resource efficient behaviour. Later on in their education and studies resource efficient technologies and services should be taught not only to create the awareness, but also to create the professional qualification. Further on the topic of resource efficiency has to be communicated through specific marketing campaigns. Visualisation of the needs and benefits of resource efficiency with best practice examples is essential to support the cognitive process in peoples' heads. The necessary communication and education process must become part of normal life.

Although improved resource efficiency has remarkable cost advantages and is of high importance for the security of resource supply it has to overcome the inertia of a society and a market adapted to high levels of resource consumption. Therefore, political action on a wide scale is needed. For all objectives described above an analysis of potentials and most relevant sectors should be performed in order to develop an efficient, harmonised and target-oriented policy mix.

6.3.6 Resource Efficiency and Green New Deal

Many of the objectives described in section 6.3.5 require legislative measures and are therefore not compatible with a short-term oriented GND, but should be treated as mid- to long-term objectives. Ideally, measures of a GND should initiate a transformation process and help to overcome short-term barriers and disadvantages for being able to meet mid- to long-term objectives.

In a first step towards improved resource efficiency the existing EU-wide expertise should be gathered, assessed and improved where necessary. This could be achieved by establishing a **European Resource Efficiency Agency (EREA)**. Its primary objective would be the development and coordination of Resource Efficiency Agencies and similar agents in the Member States. The aim would be an EU-wide network of research and technological development for improved resource efficiency. The EREA would initiate international cooperation and communication to raise awareness in Member States and industry sectors in order to stimulate demand for consultancy services. Awareness of cost-reduction potentials among decision-makers in industry would lead to an increased demand for specific resource efficiency technologies, products and services. The desired long-term effect would be a self-sustaining competition for meeting cost-advantages of resource efficiency in the EU's manufacturing industry. This would result in an increased demand for scientific and engineering skills which cannot be met by the existing market. Therefore, these measures would have to be accompanied by creating the necessary infrastructure for research, training and education. Nevertheless, in the short term less refined approaches would be sufficient to harvest the "low hanging fruits" by reducing the most obvious resource inefficiencies (see figure 9).

For harvesting these "low hanging fruits" the EU regions can build on more than 10 years of experience of existing resource efficiency agencies. For example, the regional resource efficiency agency of North Rhine-Westphalia (Effizienz-Agentur NRW – EFA) is providing effective consultancy services. It has established a number of tools to improve production, products, materials cost accounting and financing of measures. On the national level the German resource efficiency agency (DEMEA) provides two basic programmes. The NeMat programme supports the networking of companies in order to strengthen their competitive position based on cooperative improvement of material efficiency. The VerMat programme supports the individual consultancy of companies through a pool of consultants.

In combination to the EREA the national **Resource Efficiency Funds (REF)** could be established. The funds would finance resource efficiency especially in SMEs, which often lack sufficient capital and expertise for resource efficiency measures. The national REFs could co-finance EU Regional Policy.

Resource efficient public procurement could be an additional instrument to support directly resource efficiency. Public institutions should start to improve procurement procedures and assets by investing in resource efficient products and services.

The combination of the EREA, the availability of funds (national REF + EU Cohesion Funds) and improved public procurement could initiate a short-term impact on economic development and job creation. In combination with a harmonized, target-oriented policy mix it could eventually lead to a self-sustaining demand of resource efficient products and services, thus having a lasting and long-term effect with structural improvements of consumption and production patterns (ecological modernisation).

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