UNHDR Mitigation Country Study for Germany

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Content

1 Executive Summary

The German CO_2 emission reductions have been backed by the reorganisation of the former German Democratic Republic. Many of the reductions could be achieved within the first years after the fall of the wall. The development in secondary industry is a clear indication. Later, beginning in the later 1990's, the annual rates of decline in carbon exhaust fell significantly. If these are used for extrapolating future trends, the long term goals of reducing the CO_2 emissions by 40% between 1990 and 2020 and 80% till 2050 would clearly not be achieved. Also more precise scenarios come to the conclusion that the goals will be missed if no further measures are introduced. The most problematic subsector is the electricity production, since it is responsible for by far the biggest share of the total of carbon emissions, the production is growing relatively fast and can be expected to escalate its carbon intensity drastically if no striking measures are taken to avoid this development. On the other hand there are known possibilities to avoid the negative development in the electricity production. One way which would be favourable for the national economy is the use of renewable energies in an international cooperation with other countries in and around Europe. This cooperation would also open up new development perspectives for the poorer cooperating economies. Other strategies – which should be followed anyway – would be to take much more effective legislative measures as well as spending much more money on energy research.

2 Current Structure of Carbon Emissions and Projections

Since 1990, the base year for the reduction target setting for CO_2 emissions, the total CO_2 emissions in Germany was reduced from 1009 to 850 Mt of CO_2 in the year 2004 by nearly 15% (see Figure 1) [BMWi 2007]. One main reduction occurred as so called Wall-Fall-Profits from the de-industrialisation or reorganisation of the former German Democratic Republic, also known as East Germany, where the CO_2 emissions were cut by almost half since 1987 – similar to other former Eastern Block countries – while in the former Federal Republic of Germany a small increase in CO_2 emissions had been detected [Bundestag 1995] [Bundestag 1995a] [Bundestag 1995b]. The cut down in CO_2 emissions of 11% between 1990 and 1995 can therefore not really be considered a success in terms of climate policy. In the following nine years, the CO_2 emissions only fell by roughly 4% or 4.4‰ per year (see Figure 3). This is a remarkably low reduction rate, since it was accompanied by a relatively low real growth of gross domestic product per capita of about 1.3% annually which not least resulted from an austerity policy involving most social classes and public expenditures[1].

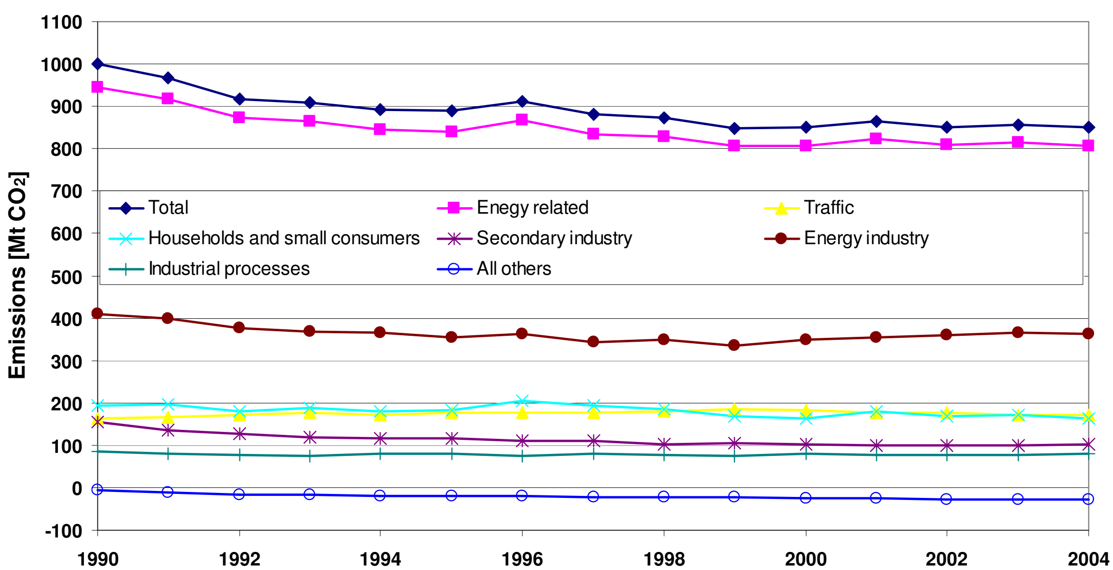

Figure 1. Total and sectoral historic CO_2 emissions in Germany 1990 – 2004, data source [BMWi 2007]

In 2004, 95% of the total CO_2 emissions in Germany were energy related the most important sector being the conversion sector, or energy industry, with 43% of the total emissions (see

Figure 2) and 45% of the energy related emissions. The emissions of the conversion sector come mainly from fossil fuel burning electricity production. Thus the electricity producing industry is the most important CO_2 emitter in Germany as indeed worldwide. The transport sector causes about 20% of the CO_2 emissions while road traffic is the dominating factor accounting for almost 94% of the sectoral emissions. Of equal importance are the emissions of households and small consumers with 19% of the emissions in 2004 dominated by households which are responsible for more than two thirds. Slightly smaller are the emissions of secondary industry (The secondary sector of industry includes those economic sectors that create a finished, usable product: manufacturing and construction.) accounting for 12% of the total CO_2 output followed by industrial processes with 9.3%.

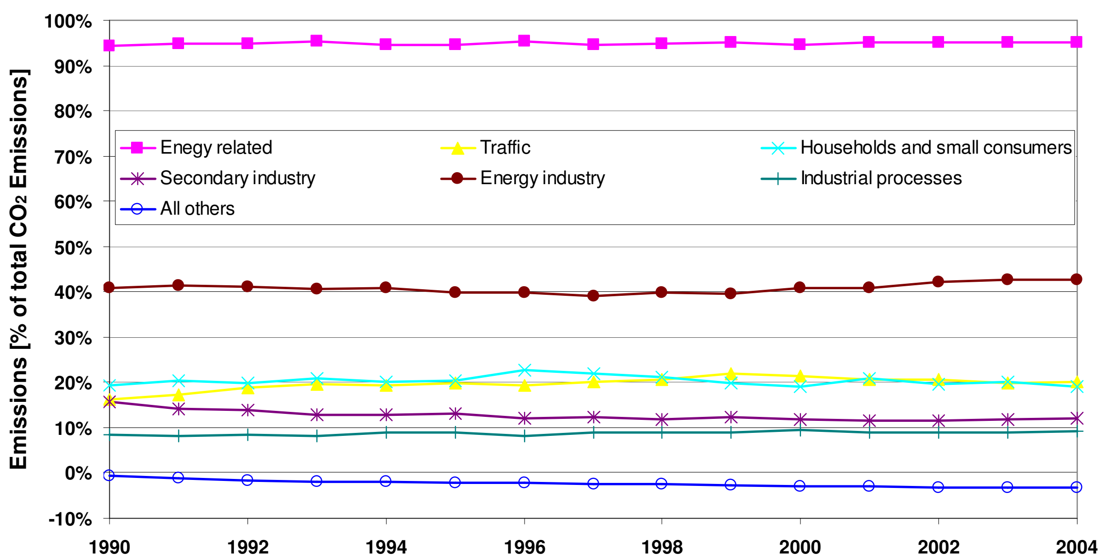

Figure 2. Sectoral share of the historic CO_2 emissions in Germany 1990 – 2004, data source [BMWi 2007]

Conversion Sector

The CO_2 emissions of the conversion sector, or energy industry, have been reduced by 12% between 1990 and 2004. Its share of the total emission reduction in Germany was 32% and its total contribution of emissions in 2004 was 362 Mt_{CO2}. As already stated above, the emissions of the conversion sector are mainly caused by electricity production. Only a relatively small fraction of roughly between 5 and 10% of its emissions are not related to electricity production [UBA 2005]. The electricity sector in Germany is a highly problematic sector since between 1995 and 2004, electricity consumption has grown at nearly the same rate as the economy [DoE 2006a]. (The domestic electricity consumption contributes about 27% to the total consumption and the industrial consumption about 47% [BMWi 2007]. Both shares have been quite stable between 1991 and 2004. The rest of the consumption consists of 14% in the trade and business sector, 8%

in public facilities, 3% in the transport sector and 2% in agriculture.) As the demand for energy from the conversion sector increased, the sector had to reduce its contribution to the carbon emissions by more efficient production. Even though this was successful to a certain extent, the share of the total CO_2 emissions grew from 41 to 43% for this sector (see Figure 2). Due to the high relevance of the electricity production for CO_2 emissions in Germany, further aspects are discussed in the box "Case study electricity" below.

Secondary industry

The secondary sector of industry includes those economic sectors that create a finished, usable product: manufacturing and construction. The CO_2 emissions of secondary industry were reduced by 34% between 1990 and 2004. Its share of the total emission reduction in Germany was 35%. In the industry sector only a fraction of 15% of energy consumption is used for space heating (see. e.g. [UBA 2005]). In 2004 the secondary industry emitted 103 Mt_{CO2}. There are some remarkable reductions in some subsectors. Between 1991 and 2004, the industry producing devices for electricity production, distribution and the like reduced its CO_2 emissions by 81% (see [DESTATIS 2006]). The same relative reduction could be monitored in the industry producing broadcasting, television and communications technology.

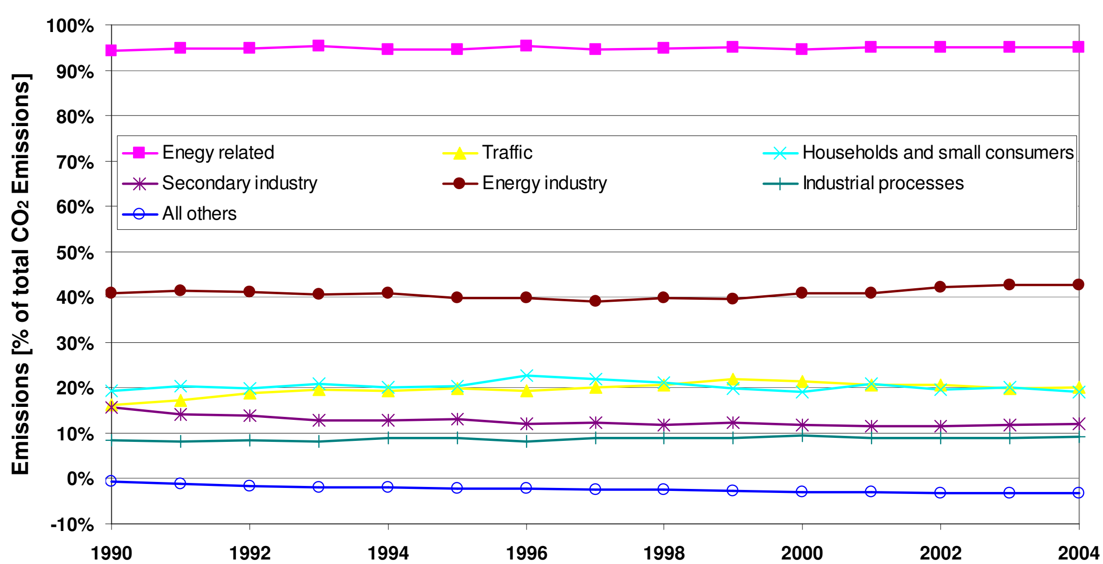

Figure 3. Development of total and sectoral historic CO_2 emissions in Germany between 1990 and 2004 in relation to the emissions in 1990, 1990 = 100%, data source [BMWi 2007]

The production of machines reduced its emissions by 65% followed by 59% by the production of wood and wooden products (excluding the production of furniture) and 55% by the production of textiles. The production of rubber and plastic goods emits 53% less and the industry producing automobiles and parts for automobiles has reduced its emissions by 41%. Altogether these seven subsectors have reduced their emissions by more than 21 Mt_{CO2}. This is a quite substantial part of the total reduction within the secondary industry. However the question is raised, not only for these subsectors, of whether this is a progress in efficiency or also the effect of a relocation of energy intensive industrial production into other countries. If this is indeed the case, it raises the question as to whether the production at the new locations is less carbon intensive than it former was in Germany. Climate change is an international task. But it also is worth mentioning that by far the biggest emission reductions in this sector coincide with the de-industrialisation of the former German Democratic Republic.

Industrial processes

The CO_2 emissions from industrial processes have been reduced by 8% between 1990 and 2004, contributing 4% of the total emission reduction in Germany. Its total contribution to the German emissions is 79 Mt_{CO2}. In 2001, the main part of the secondary energy consumption (65.8%) of industry was the direct use of fossil fuels of which 86.5% were used for process heat and 12.5% for space heating. The major remainder of secondary energy use (31.5%) was electricity consumption.

Households and small consumers

The CO2 emissions of households and small consumers decreased by 11% and 27% respectively between 1990 and 2004. Because of the dominating role of household emissions, the combined reduction is only about 16%. Its share of the total emission reduction in Germany was 20%, contributing 162 Mt_{CO2} to German emissions in 2004. 30% of the entire final energy in Germany is consumed in households of which 87% is used for space heating and warm water, thus almost completely responsible for CO_2 emissions in the household sector (see [AKE 2005]). These emissions decreased by only 5‰ per year between 1990 and 2003, but due to large annual fluctuations in consumption this value is statistically not very significant (see [AKE 2005]). The group of small consumers is made up of the subsectors trade, services and remaining consumers. As in households, the main energy consumption of the small consumers is for space heating, accounting for roughly two-thirds (see. e.g. [UBA 2005]).

Traffic

The CO_2 emissions of traffic in Germany rose by 5% between 1990 and 2004. Thus traffic contributed negatively to the total emission reduction with an additional share of -6% in proportion to the overall reduction. The traffic sector is the only sector with a rise in emissions. But here the maximum emission was reached in 1999 with an increase of 24 MT_{CO2} above the value of 1990. Until 2004, the augmentation was reduced to 15 MT_{CO2} and emissions were 171

MT_{CO2}. "*The most important energy sources (fuels) currently used in the German transport system are petrol (accounting for approx. 45 per cent), diesel (accounting for close to 42 per cent) and kerosene used in air traffic (accounting for nearly 11 per cent of total fuel consumption in this sector). Two-thirds of the energy consumption in the transport sector is due to passenger transport (as of 1999), with private motor vehicles accounting for the largest share*" [Bundestag 2002].

Case study electricity

The carbon emission from electricity production in Germany is slightly below but corresponds quite well with world wide figures. Worldwide 10.5 Gt_{CO2} or almost 45% of the total CO_2 emissions from fossil fuels stem from big power plants with annual exhausts of more than 0.1 Mt $_{CO2}$ [IPCC 2005]. The biggest part of the CO_2 production in the German electricity sector in 2002 was from lignite fired power plants which account for 29% of energy content of the fuel consumption for electricity production followed by hard coal burning plants accounting for 22% whilst 9% is contributed by gas fired power plants. The total gross production of electricity was at quite a stable level between 1990 and 1999 and rose by 60 to 616 TWh_{el} by 2004.

Despite the growth, it was possible to substantially reduce the carbon intensity in the energy – conversion sector. The total emissions of this sector declined from 410 Mt_{CO2} in 1990 to 362 in 2004, reaching a minimum in 1999. Since then the emissions grew by 26 Mt_{CO2} until 2004. The main reason for the increase in emissions was the increase in electricity production from lignite which grew in the same period from 136 to 158 by 22 TWh_{el} or 16%. Another considerable rise was in electricity production from Gas and Oil which may be a result of the liberalisation of the electricity market possibly calling for more faster deliverable electricity as would be the case if least cost planning was in "one hand". The declining production from hard coal compensated for this increase. Furthermore there was a slight decrease in electricity production from nuclear energy which in 2004 still accounted for 167 TWh_{el} and holds the biggest production share in the German electricity sector. This production is mainly CO_2-free but it is regulated by law that it will be phased out within a relatively short time [BGBL 2002]. "*If the decision had been taken at the time to build coal-fired instead of nuclear power plants, using them to generate the same annual quantity of power, the CO_2 emissions in Germany would have been approx. 160 million tonnes higher per year.*" and "*If we were now to replace these nuclear plants with modern fossil-fired plants with the kind of characteristics described in Chapter 3, CO_2 emissions would still rise by 100-120 million tonnes (the higher figure applies to retaining the current mix of fossil fuels, the lower figure for doubling the natural gas component in fossil power generation from* *the current 16% to 32%).*" is stated in [AKE 2005]. It is not yet clear how to substitute the electricity in a climate-friendly manner.

Almost CO_2 neutral electricity production from renewable energies is a relatively fast growing factor in the German electricity supply. The German feed in law (the Electricity Feed Law – StrG – and its extensions in form of the "Renewable Energy Sources Act" "Erneuerbare-Energien-Gesetz" – EEG [BGBL 2004]) has enabled this great success for renewable energies. Wind energy started in 1991 with less than 0.1 TWh_{el}, produced 5.5 TWh_{el} in 1999, 25.5 TWh_{el} in 2004 and 26.5 TWh_{el} in 2005. The biggest growth of wind power capacity was in the year 2001 with 3.2 GW. The installation rate has since declined rapidly to about 1.8 GW in 2005. This is mainly due to the fact that the step into the sea to the use of offshore wind power has not yet been achieved, while the good land sites became more and more rare. In particular, problems with insurance and the resulting financing problems of offshore projects would have had to be solved by adjusted policy measures. Here policy did not cope adequately with its large responsibility of setting the right incentives.

The production from hydropower rose from 19.7 TWh_{el} in 1990 to 27.8 TWh_{el} in 2004. Also the use of biomass for electricity production rose rapidly from 0.7 TWhel in 1995 to 11.4 TWh_{el} in 2005. During the same period, photovoltaic electricity production rose from 11 MWh_{el} to 1 TWh_{el} and since 2004 even geothermal electricity production has started. The total CO_2 savings due to the use of renewable energies in the electricity sector in Germany was estimated to be 37 Mt of CO_2 in 2003 [UBA 2005].

Considering the huge proportion of the total electricity production from nuclear energy which is to be phased out by law and furthermore considering the decelerated growth of the use of wind energy as well as the high carbon intensity of fossil electricity production and the relatively fast growth of electricity consumption it must be said that a switch to climate friendly electricity production is a key task. However, the problems do not have to be as big as they seem at first sight. A current study shows that a totally renewable electricity supply is possible for Europe with current technology and at the same time at costs that need not at all be a problem for our national economies [Czisch 2005] (see also [GCJS 2004]). The study shows the most economic path was based on international cooperation and international electricity transport. The latter is used to balance the weather-dependent electricity production from renewable sources in order to make the best production sites accessible for common use and to enable the use of hydropower as well as decentralized biomass with its inherent storage capability for common duties within the supply area. This can be interpreted as a recommendation for action for political decision-makers, who should thus deliberately pursue international co-operation in the field of renewable energy use and include in particular the issue of international electricity transmission. The responsibility for future action now lies in the field of policy. A substantial task for policy-makers would be to organize the necessary international co-operation and to develop legal and economic instruments to transform our electricity supply.

This would mean not only that a reasonable path to a CO_2-neutral electricity supply would be taken, but furthermore, it could open excellent perspectives for the development of poorer neighbour states of the European Union and Europe.

As soon as electricity is produced on a mainly CO_2 neutral basis, other sectors could be electrified. In particular very energy consuming space heating could be replaced by much more use of heat pumps, which might be even more effective if the insulation and heat recovery techniques are widely applied in buildings.

Projections to 2020 and beyond

If no further measures are taken which are more effective than the current ones, the long-term German goals for 2020 and 2050 (40% and 80% emission reduction) will not be attained. This is the outcome of various reference scenarios (see [UBA 2005]) and other analyses which e.g. extrapolate current trends and incorporate foreseeable changes in influencing conditions (see e.g. [AKE 2005]). Following the reference scenarios, not only the total CO_2 emission will exceed the long term goals but this is also likely to happen in each of the sectors considered above. In the reference scenarios for the conversion sector, dominated by electricity production, a relatively steep increase in emissions is expected to start roughly in 2010 which corresponds with the phasing out of the nuclear reactors. The aims only can be reached under conditions which are explicitly designed for climate protection. Therefore the focus should lie on going for rapid and economic solutions.

3 Carbon Target settings and the role of government and industry

The German national target of reducing CO_2 emissions to 25% below the level of 1990 by 2005 by has clearly not been achieved (see also [DIW 2006]). Only about 17% or about two- thirds have been reached, including the Wall-Fall-Profits. According to the assumptions of a “reference scenario”[2] that extrapolates the past policy as well as the behaviour of the consumers, the national goals for 2020 and 2050 (40% and 80% emission reduction) specified by the “Enquete commission”[3] will not be achieved either. Germany’s obligation within the European "burden sharing" context of lowering the greenhouse gas emissions in 2008/2010 by around 21% may, according to the reference scenario also not be achieved, but the gap might become relatively small. However, national plans tend to fall somewhat short of this aim. After examining the German NAP II[4] more strictly, the European Community Commission reduced the German allocation plans substantially, allocating a quantity of only 453.1 Mt_{CO2} per year and allowed the German NAP II under these conditions [EU 2006]. The German NAP II proposed a cap of 482 Mt_{CO2} per year which has since been reduced by almost 31 Mt_{CO2} per year by the Commission. This cutback was immediately referred to as “not very comprehensible” (original German expression: “wenig nachvollziehbar”) by the Federal Minister of Environment Sigmar Gabriel [BMU 2006].

The National Climate Protection Programme 2000 lists 64 measures for the reduction of greenhouse gas emissions introduced since autumn 1998 which should altogether reduce the emission by 142-156 Mt_{CO2} by 2005 [BMU 2000]. Thirteen of the measures have been estimated to have the potential to reduce the emissions by more than 5 Mt_{CO2} each and at least by 94 Mt_{CO2} altogether (see Table 1). The real development since the beginning of the national climate protection programme did not at all fulfill the overall expectations as can easily be seen in Figure 1. CO_2 emissions have only been reduced by far less than 20 Mt_{CO2} or less than 10 Mt_{CO2} between 1998 or 2000 and 2005.

Table 1 Key measures of the national climate protection programme and anticipated effect of each measure on the reduction of CO_2 emissions by 2005 (Source of Table: [AKE 2005])

Measures for emission reduction	**MtC_{O2}**
Ecological tax reform	10
Programmes to promote energy saving in existing buildings	5 – 7
Measures relating to electricity consumption and tightening of the law on energy efficiency labelling	5
Tax concessions in mineral oil tax for low-sulphur fuels	2 – 5
Use of smooth-running oils and smooth-running tyres in newly licensed vehicles	3 – 5.5
Per-kilometre motorway toll for heavy goods vehicles	5
CO_2 reduction in new vehicles / Agreement with the automobile industry	4 – 7
Energy saving directive for industry and small consumers	up to 6
Publicity campaigns and public awareness	5
Accelerated construction of combined-cycle power plants fuelled by natural gas	5 – 10
Combined heat and power generation / Introducing a system of quotas (subsequent agreement in the order of with industry)	10
Renewable Energy Sources Act (EEG)	10
Forest management and conservation / Forestry development (carbon sink)	30

The income from eco-taxes (Ökosteuer), the instrument of the ecological tax reform, was about 18 billion € in 2005 [BdsT 2005]. This would be a remarkably high bill for an emission reduction of 10 Mt_{CO2} as estimated for this measure of the national climate protection programme, even if the anticipated reduction was reached. The calculatory costs per tonne of CO_2 are 1800 € and could be compared with prices for the EU Allowances (EUA) for CO_2 emissions which are about 100 times lower as in this sugar-coated case of 10 Mt_{CO2} emission reduction expected as a result of the Ökosteuer. In other words, the CO_2 avoidance costs per kWh of electricity causing a CO_2 emission of 600 g must be quite above 1 € to be similarly ineffective. Using this example, one could diagnose that the indirect measure of making energy more expensive is a very ineffective and expensive way of reducing climate risks. On the other hand even a few cents per kWh of renewable electricity are often disqualified as being dangerous for the economy. The effect of the Renewable Energy Sources Act (EEG) driving renewable electricity production has been greater than the estimated savings of 10 Mt_{CO2}.

In contrast to this very effective method, the free trade of emission certificates under the European Union Greenhouse Gas Emission Trading Scheme (EU ETS) introduced in 2005 seems to be a very costly instrument with no major effect on CO_2 emissions. Scientific investigations show a very high correlation between the development of the electricity tariffs and the market prices for emission certificates (see [Bundeskartellamt 2005]). Therefore the free trade of emission certificates can be seen as a national subsidy in the order of 10 billion euro annually (depending on the price per tonne of CO_2). Even if such a subsidy was not intended, it seems as though this scheme of dealing with the emission certificates prevents the intended emission reduction. If 10 billion euro were spent on extra costs of wind energy above the conventional production costs it would be enough to produce roughly one-third of German electricity even under wind conditions which are not very favourable as indeed is the case with wind conditions in Germany.

In Germany a lot of voluntary agreements on CO_2 emission reduction have been released by industry in different industrial sectors which altogether covered an annual emission of 404 MT_{CO2} or about 48% of the total CO_2 emissions in 1999. But "*the difficulty estimating the effect of the self obligation of the German economy lies in its unclear formulation and follows secondly from the predominant reference to the development of the specific emissions*" (translated from [UBA 2005]). As long as no unforeseen significant growth processes begin in the obligated industry sectors, past development suggests that the targeted reduction of 21% might be reached in the year 2012.

In the European traffic sector there has been some success concerning the distance-specific emissions of cars, which are currently responsible for 10% of the European CO_2 emissions. Since the start of the voluntary agreement between the European Automobile Manufacturers Association (ACEA) and the European Commission in 2000, ACEA has "*achieved continuous progress in reducing CO_2 emissions, although less so in 2003 and 2004 than in previous years*". [EU 2006b]. "*Despite this progress, however,*" the association has "*to make considerable further* *efforts if*" it is "*to reach the 140g CO_2/km target by 2008/9. In the remaining years, until the deadline, annual reduction rates will need to reach 3.3% for ACEA*". Therefore there is an ongoing debate about further measures of emission reduction concerning the European car industry. The final EU target is an average CO_2 emission of 120g/km for all new passenger cars by 2012. But "*with automobile manufacturers expected to miss their 2012 voluntary target to reduce CO_2 emissions, the Commission is divided on whether to introduce new binding legislation*" [EurActiv 2007]. Therefore "*Environment Commissioner Stavros Dimas wants to enshrine a 120g/km limit on average CO_2 emissions from new cars from 2012 in binding EU legislation.*"

4 Formulas for an accelerated shift to carbon neutral growth

Since the climate problem is an international problem it should be taken as such. A fast growth of the use of renewable energies could be obtained by an "international feed in law", as described in the box below, taking effect across national borders.

As a very efficient measure to increase energy efficiency, a Top Runner program should be introduced in Germany (see also [RfNE 2005]).

More binding legislation should be introduced to reduce energy intensity and thus carbon emissions. For example, a binding limit for distance-specific carbon emissions of cars, as discussed in the European Commission, would be such a measure. Other legislative measures could include the prohibition of technology which consumes much more energy as state of the art technology. This e.g. could save standby losses of about 25-30 TWh per year in the households and small consumers sector (see [AKE 2005]). Other legislative measures, for example, should be taken in the field of electrical drives as well as insulation and other technical specifications of buildings.

A very important measure is research. The real federal budget for energy research has been cut back from more than 700 million € in 1991 to less than 400 million € in 2005, which is only a fraction of 4.6% of the total federal research budget [BMWi 2007][5]. Thus the budget is far below the share of expenses for energy in society, and also neglects the fact that we will have to "win the future" of the worldwide climate in this field. Furthermore, the government should take responsibility for the development of new technologies. Therefore it should not only spend much more money on research but also on prototypes and market introduction. The focus should not only lie on technologies and strategies for national use but also take into account the international character of the climate problem, focussing also on international cooperation.

International feed in law

The German feed in law was one of the biggest success stories for new renewable energies in the world. To extend this success worldwide, an international feed in law would be very helpful and if carefully arranged, it might in all probability promote the use of renewable energies more than any other measure. One possibility for Germany would be to extend the existing EEG to become an agreement which can be ratified by other nations or bring a similar arrangement on the international agenda coming into operation as soon as two countries have signed the agreement.

The EEG commits the utilities in Germany to accept any feed in of electricity from wind power and other renewable sources into the electricity grid. It furthermore commits the utilities to provide an appropriate electricity network, sufficient to take the renewable electricity. Furthermore, the EEG commits the utilities to pay a definite minimum feed in tariff for the renewable electricity – dependent on the kind of renewable source used for its production. The total bill is distributed according to the end-users electricity consumption of the utilities customers. One of its outcomes was the rapid growth of electricity production from wind energy which made Germany become the world leading wind energy nation.

This instrument is to be used further as a component of the energy policy and should be improved in its effect. In addition, amongst other things either the EEG should be extended or a new set of rules should be created which promote the development of renewable energies in form of an international agreement, which interested states can follow by ratification. Together, these states follow the aim of developing a rapid growth of the use of renewable energies and commit themselves on a long-term basis to change to a sustainable CO_2-neutral electricity supply. The financing of the cost of electricity is to be distributed proportionately, as with today's EEG, according to the respective electricity consumption of the final customers within each country. Deviating from the German EEG, as with the Spanish feed in regulation, it seems sensible that only extra costs above a certain minimum are to be paid by the new community of responsible states. This minimum is to be agreed upon with each country signing the agreement.

This international feed in law should, at least in the longer run, contain three steps to create an appropriate internationally effective instrument. The first step is to pay for the electricity fed into the electricity network of each country. Therefore it might be necessary to agree in a supplementary treaty that the costs of extending the national electricity network are also included into the feed in tariff if, for example, the good resources are far away from the existing network and if the country is not able to easily afford the expenditures. The feed in tariff has to be built in such a manner that the energy specific tariff is lower at better sites but still stimulates the search for the best sites. The two next steps should incorporate the possibility of producing renewable electricity within one country and consuming it in neighbouring countries, as the second step, as well as in third countries as the third step, which means developing rules for third party access. This third step aims at progressively erecting an international renewable electricity supply system. If these steps are followed, it can be ensured that large favourable potentials of renewable energies can also be used in countries with small energy consumption or which are economically not easily able to afford the use of their renewable potentials. In this way these potentials can be placed into the service of climate protection and resource policy which are then both taken as international tasks. This form of "EEG" can thereby either be started bilaterally between Germany and other states or as a European task or most preferably as an international agreement for international ratification, whereby in particular an anchorage in the UN would appear expedient. The mechanism could eventually also developed as a new kind of CDM or as a kind of JI or make use of these instruments. The financing of renewable energy from abroad can be seen as a prelude, preparing the way for the second step of the export.

Such an international "EEG" could become a kind of development assistance for states to the south and east of the European Union and worldwide, which through the use of highly economical potentials and thus cheap renewable electricity would simultaneously be of advantage to the richer industrialised countries involved. With this, one substantial effect of an international "EEG" would be to open the use of particularly favourable locations for different renewable energies in including them into an international system, thus acquiring more economical solutions for climate protection than could be achieved with single-handed national attempts.

International co-operation in the field of electricity production and transmission opens up the possibility of a sustainable electricity supply using only renewable energies which would, even if only current technologies were used, be only slightly more expensive or even cheaper than our current electricity supply. These calculations are based on today's relatively high "renewable" technologies prices [Czisch 2004]. In the case of an approximate optimal use of the renewable resources and available techniques, costs of electricity from renewable energies could potentially lie under the current prices of comparable electricity from new fossile fired power plants. Thus a conversion to renewable energies could most likely lead to economical savings, which become continually larger as the renewable electricity generation becomes cheaper due to further techno-economic progress.

5 Conclusion

It has been shown that the German climate policy is not yet sufficient to enable national as well as international targets to be reached. Furthermore, considering the current results of climate research, it is questionable whether the emission targets are sustainable. In contrast to the growing public awareness of the climate problem and the growing frequency with which the issue is picked up in political speeches, endeavours to counteract the climate change do not always seem to be adequately committed. This may be seen as being reflected in the fact of the steadily shrinking federal budget for energy research or by the declining annual rates of emission reduction. It also may be seen as being reflected in the fact that many of the measures which have been set up are not very effective but nevertheless have not been replaced by better ones. However, there are methods, strategies and technologies available which are suitable to counteract the climate change in a manner which is easily affordable by the society. Even better ones may be found - better methods, better technology and better strategies - if enough effort was made to find them. Climate change is often seen as one of the biggest challenges mankind has ever been faced with. But the chances are that it is negligence rather than the practical infeasibility of the problem which will cause us real trouble. It is time to act.

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[1] The real GDP growth in Germany between 1995 and 2004 was the second lowest in the EU15 states only the Italian economic growth was slightly smaller [ERS 2006]. The EU15 average was 0.8% higher and in Northern America the average annual growth of the real GDP was with 3.4% about 1.9% higher than the German growth. In the same period the German energy intensity (primary Energy per real GDP) only decreased by 1.1% per year [DoE 2006]. This is only about half of the reduction in energy intensity achieved in the United Kingdom in Sweden, China, India or in the USA and about the same as reached in France and Switzerland.

[2] For details of the reference scenario see [UBA 2005].

[3] In February 2000, the German Bundestag established the Enquete Commission on “Sustainable Energy Supply Against the Background of Globalisation and Liberalisation”. The Commission was given the mandate to furnish scientific evidence to be used as a basis for the German Bundestag’s future decision-making in the field of energy policy. [Bundestag 2002]

[4] NAP II is the National Allocation Plan for the European Union Greenhouse Gas Emission Trading Scheme (EU ETS) for the trading period 2008-2012 [NAP II 2006]. The EU ETS works on a "Cap and Trade" basis and requires to set a cap on carbon dioxide emissions from the part of the sector energy and industry obligated to the emission trade, covered by the scheme. Contrary to the first allocation plan NAP it has not yet been officially agreed upon by the German federal cabinet [NAP 2004].

[5] The private sector reduced its real budget for energy research even more drastically from more than 500 million € in 1991 to less than 80 million € in 2005.