Information and Opinion

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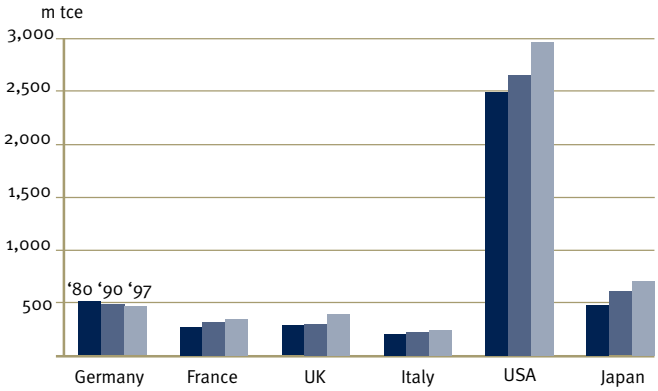
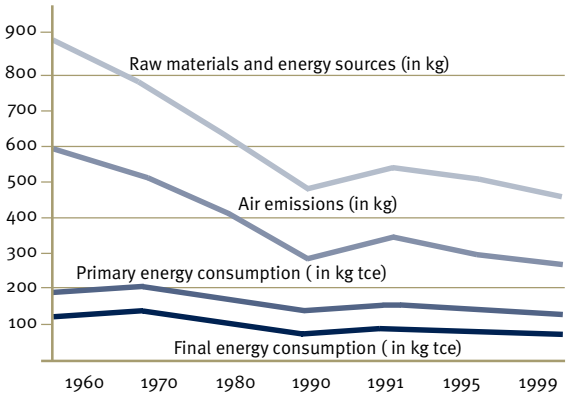
German economy successful on sustainability trail

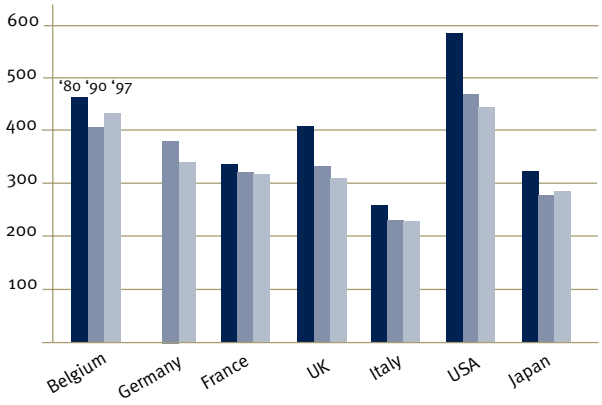
Cologne – The German economy has definitely and successfully set out on a sustainability trail, says the Cologne-based Institute for the German Economy (*IW*). Development is sustainable, according to the *IW*, when "protection of the natural bases of life is ensured, prosperity can be further developed and a balance of interests in society guaranteed." It is important, says the *IW*, that sustainable development pursues and harmonizes ecological, economic and social goals on an "equal and integrative basis". So sustainable development is defined as an ongoing process in which positions, instruments and targets are continuously reassessed. In Germany's case, a national sustainability strategy is currently being developed by a ministerial committee, a council for sustainable development with 17 experts from the worlds of science, business and politics, and a forum for the sustainable development of the German economy currently with 21 global players. One of the chief tasks is to find or develop measurable quantities or indicators of how the various targets are being achieved or met. One informative indicator of sustainable development for the *IW* is the un-coupling of economic growth from the consumption of resources. This indicator links economic and social targets with the ecological dimensions of sustainable development. An analysis of the resource intensity of German business shows that the country is on a "sustainability trail". All the relevant indicators are on the decline, according to the Institute. Inputs of raw materials and energy sources have practically halved over the last 40 years. During the 1990s, too, the trend was clear, and this is particularly true of the energy sector.



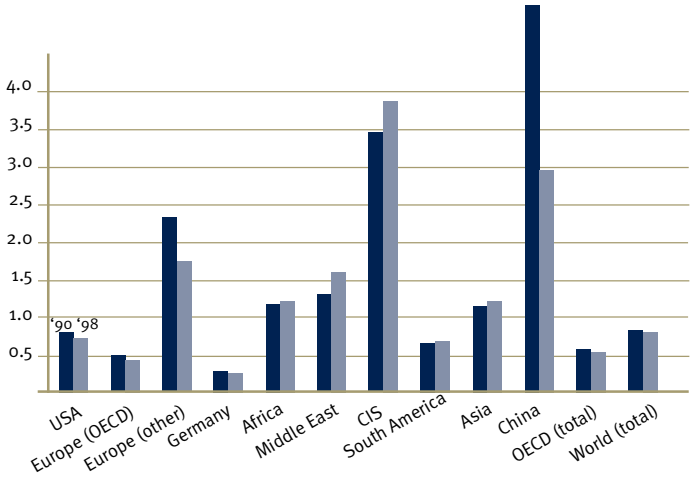
Energy consumption of selected countries in an international comparison; 1980, 1990 and 1997 (in m tce)



Developments i n resource intensity of German business (consumption per DM 1,000 of real gross domestic product)

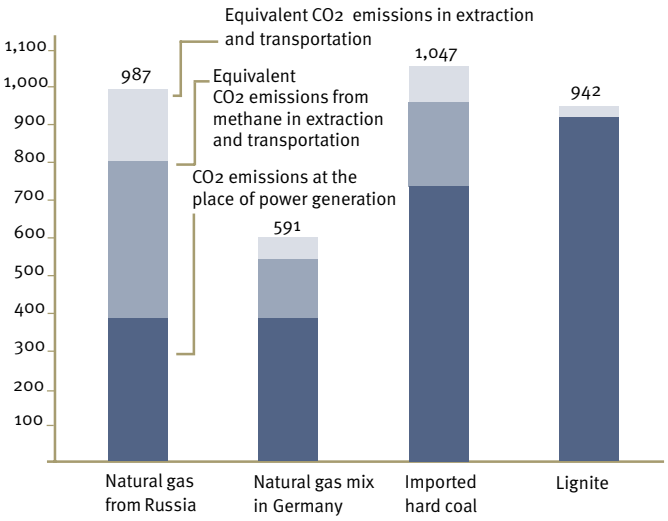


Developments in energy intensity of selected countries; 1980, 1990 and 1997 (in kg tce per US$ 1,000 of real gross domestic product)



Developments in global carbon dioxide emissions; 1990 and 1998 (in kg per US$ of gross domestic product)

Climate protection must take account of transport chain

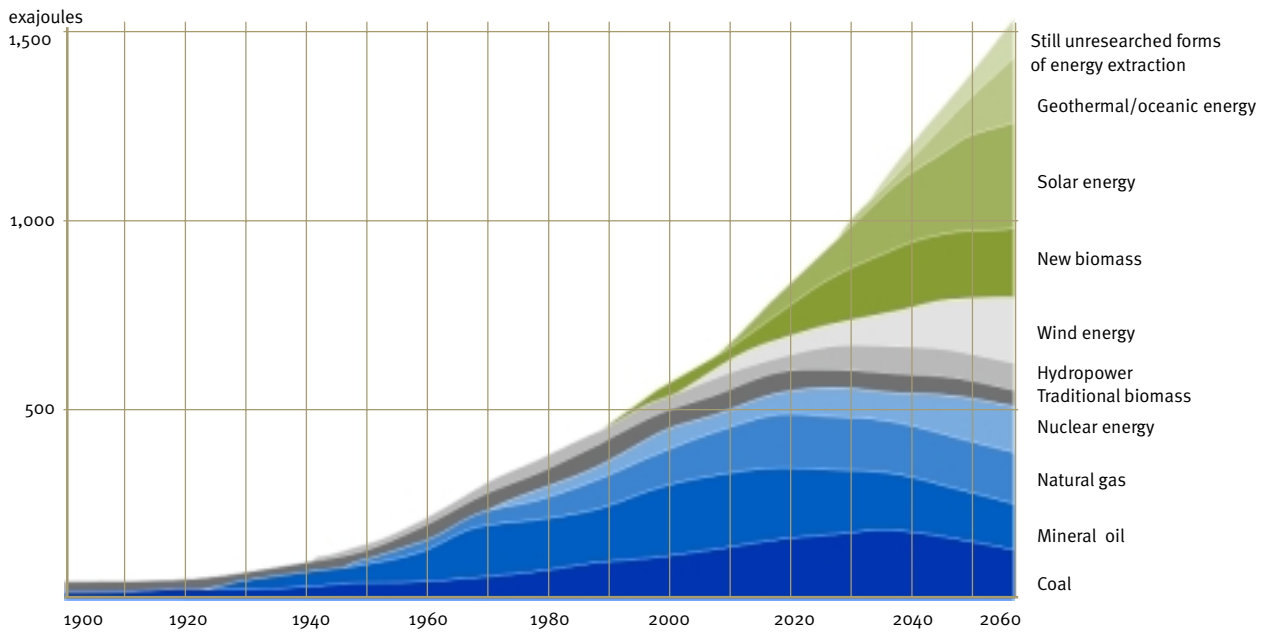


Equivalent CO2 emissions at coal- and gas-fired power plants in g per kilowatt hour (g/kWh)

Munich – Electricity from domestic lignite has a better climate balance than power generated on the basis of natural gas from Russia or other distant countries, provided that full account is taken of primary energy consumption for extraction and transportation and of transit and mining-related methane losses. In any extensions to domestic power generation from natural gas, the extra quantities needed would have to be obtained from remote deposits under new supply contracts. If power is generated in a modern CCGT plant, the equivalent CO2 release along the entire process and conversion chain amounts to 987 g per kilowatt hour (g/kWh), including 189 g carbon dioxide in the extraction phase, and a converted 419 g in transportation. By contrast, CO2 release in converting lignite into electricity in a modern lignite-fired power plant is 942 g/kWh. With power being generated close to the mines, practically no transit-related carbon dioxide is released.

Change in energy systems offers biggest potential for reducing CO2

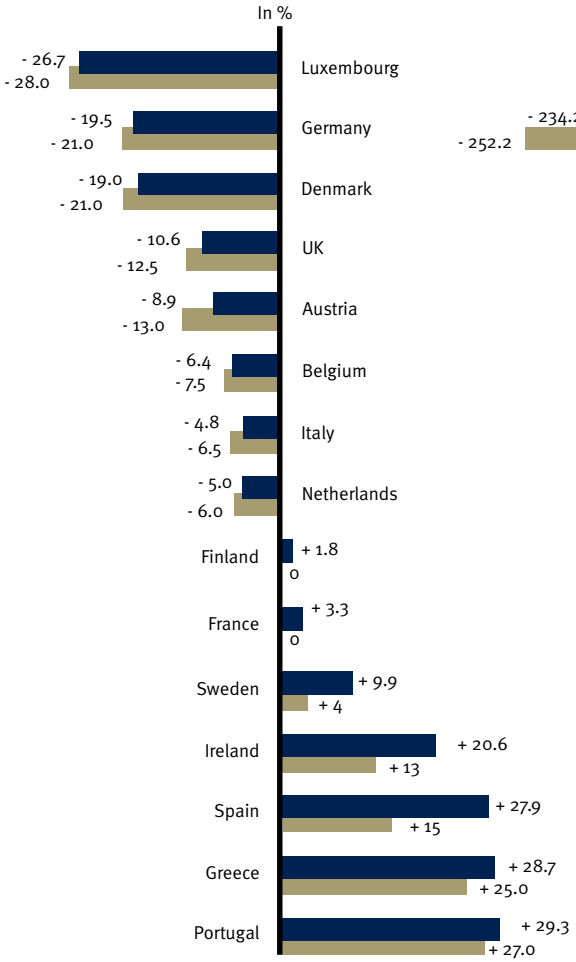
Hamburg – Worldwide energy consumption will approximately triple by the year 2060 compared with today, according to Shell, the mineral oil group. The main causes of this development are the growth in the world's population to some 10 billion, and the economic backlog in developing countries. In spite of this, the group says, a significant reduction in the release of climate-relevant trace gases can be expected as of 2020, because by that time "certain renewable energies will reach their full economic viability" and dynamically expand their share. This is true above all of solar and wind energy. On the other hand, fossil energy sources will peak in absolute terms between 2020 and 2030. Around 2050, the share of renewables in worldwide energy consumption will be as high as 50 %. From 2020 on, therefore, irrespective of any other reduction measures, we will see an absolute fall in the emissions of carbon dioxide and other climate-relevant gases simply because of the change in energy systems.



Developments in world energy consumption and energy systems between 1900 and 2060, according to Shell

Germany to assume 112 % of EU share in Kyoto Protocol

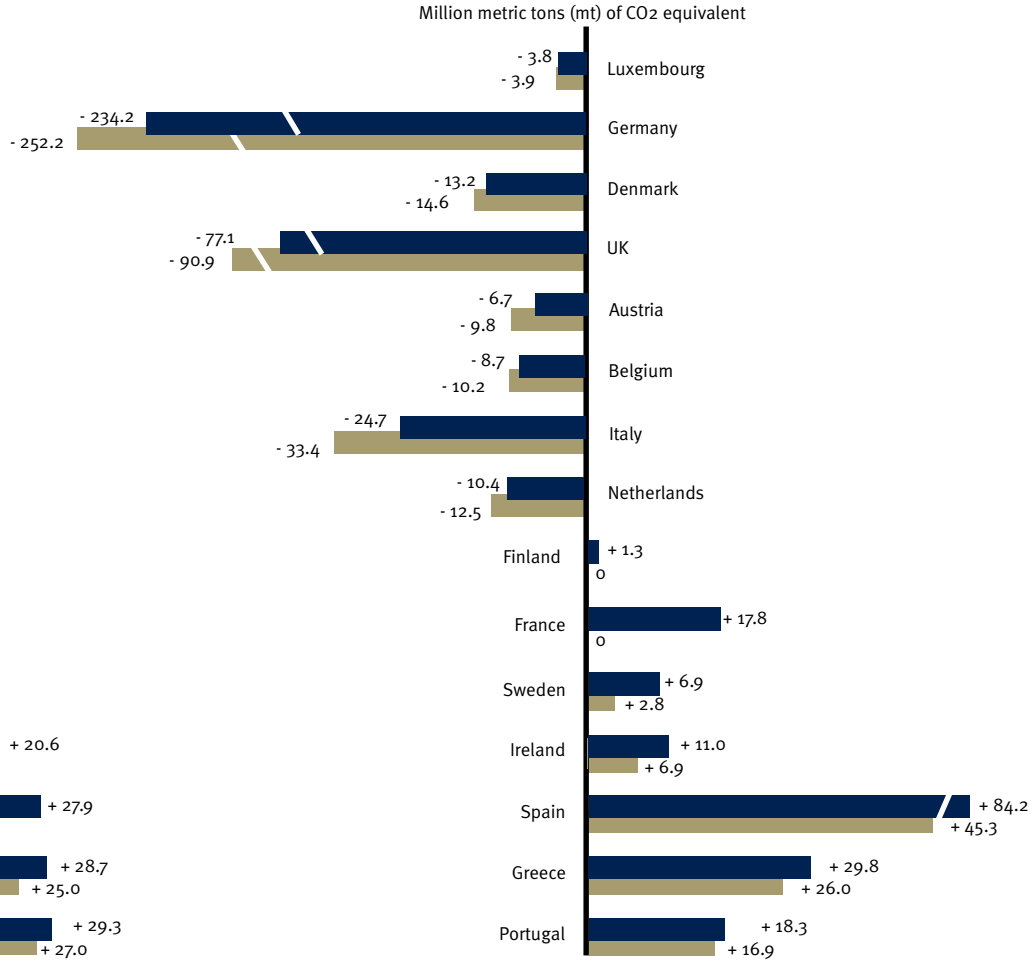
Bonn – After analysing the results of the climate summit held at Bonn in July of this year, the conservation group Greenpeace noted that Germany will now be assuming a 112 % share of the European Union's contribution to the Kyoto Protocol, up from a previous 75 %. This excessive German share is largely due to concessions granted to France and Spain, allowing them to increase their emissions over the base year 1990. This year's climate summit in Bonn re-negotiated the reduction targets for the six Kyoto gases. With a view to including further states in the treaties, natural CO_2 sinks, like forests, too, will count toward national shares. For the EU, the result is a reduction target down from 8 to 5 % compared with 1990. Instead of the previous 331 million metric tons (mt), the entire EU must now contribute a cut of 207 mt CO_2 equivalent by 2008/12. This will also benefit Germany, whose share falls from 252.2 mt to 234.2 mt, though in total this is now even 12 % above the EU's entire net reduction. While France, prior to the summit, was required to keep emissions at a constant level compared with 1990, it may now release an extra 17.8 mt, placing a burden of minus 3.3 % on the reduction target. Spain's cutting duties were eased even more: on a 1990 basis, it may increase its release of Kyoto gases by 84.2 mt; before Bonn, the figure was 45.3 mt. Greece, Portugal, Ireland, Sweden and Finland, too, may release higher amounts than previously agreed. Germany's high share, experts say, will have growth-inhibiting and competition-distorting consequences. To at least cushion this effect, Germany would have to be given freedom of choice above all in its climate-protection instruments. A successfully practised self-commitment must be given preference over compulsory measures, like the introduction of permit trading. ■



EU member states' share in cutting Kyoto gases as set forth in the EU burden-sharing scheme, in per cent of national emissions

New EU share (- 5 %)

Former EU share (- 8%)



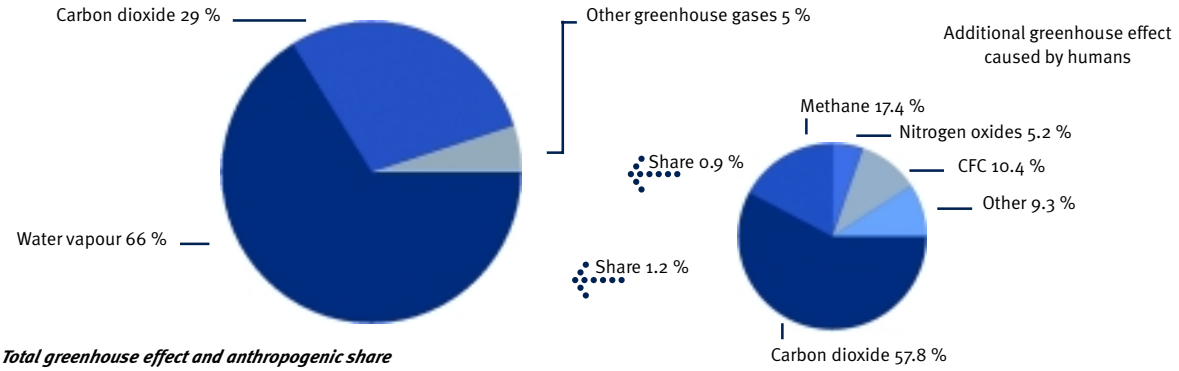
EU member states' share in cutting Kyoto gases as set forth in the EU burden-sharing scheme, in million metric tons of CO_2 equivalent of national emissions

New EU share(- 207 mt)

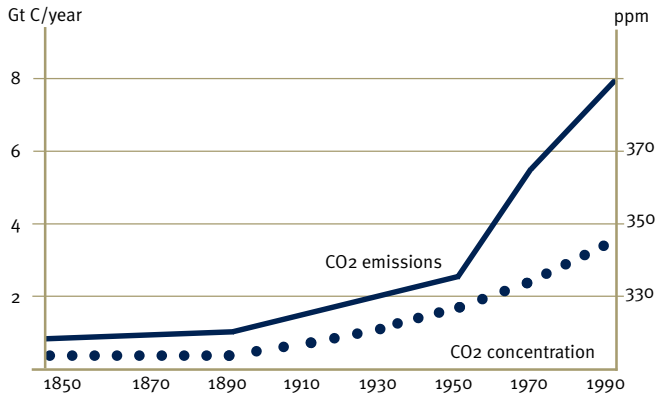
Former EU share (- 331 mt)

Water vapour's significance as greenhouse gas underestimated

Jülich – In the opinion of scientists at the Jülich research centre, water vapour is the most important greenhouse gas in the atmosphere, followed by carbon dioxide, methane and nitrogen oxides. Of the total greenhouse gases amounting to approx. 120 W/square metre (W/sqm), some two thirds are accounted for by water vapour, just under 30 % by carbon dioxide and 5 % by other greenhouse gases. The 2.1 W/sqm share in the greenhouse system caused by humans amounts to roughly 2.1 %, incl. 1.56 W/sqm or 1.2 % carbon dioxide, and 1.14 W/sqm or 0.9 % other greenhouse gases, like methane, CFC or nitrogen oxides.



Total greenhouse effect and anthropogenic share



Developments in CO2 emissions and concentrations between 1850 and 1990

Carbon dioxide: Emissions rising faster than concentrations

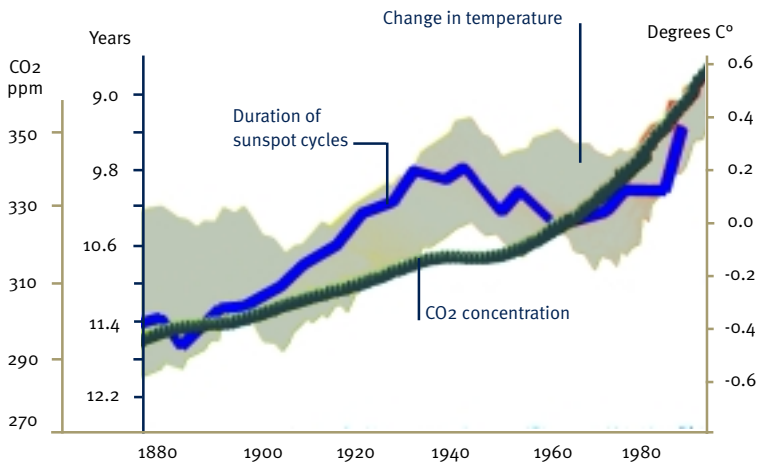
Hanover – In the past 50 years, carbon dioxide emissions have risen much faster than the concentration of this gas in the atmosphere. This development is due to "carbon dioxide sinks", like oceans and the forests of the northern hemisphere, which absorb and store a large amount of the released CO_2. Current calculations show that 50 % of the man-made CO_2 is absorbed in such sinks, so that forecasts on the course of the green-house effect and any temperature rise based solely on CO_2 emission developments are less reliable.

Carbon cycle: Brisk exchange between atmosphere and oceans

The major carbon-containing and, hence, climate-relevant gases in the atmosphere are carbon dioxide, methane and carbon monoxide. At present, the atmosphere stores a total of 753 billion metric tons (bn t) of carbon. The oceans, by contrast, store 38,900 bn t or nearly 50 times this amount. The biosphere accounts for another 560 bn t. Annually, some 80 bn t of carbon dioxide is exchanged between the seas and the atmosphere, while the biosphere absorbs an annual 120 bn t of carbon dioxide or twice as much from the atmosphere than it emits into the atmosphere. A further 60 bn t p.a. goes into the earth's crust from the biosphere and is stored there in the long term. The combustion of fossil fuels accounts for a mere 4 % share in the global carbon cycle.

Historical climate research fighting for recognition

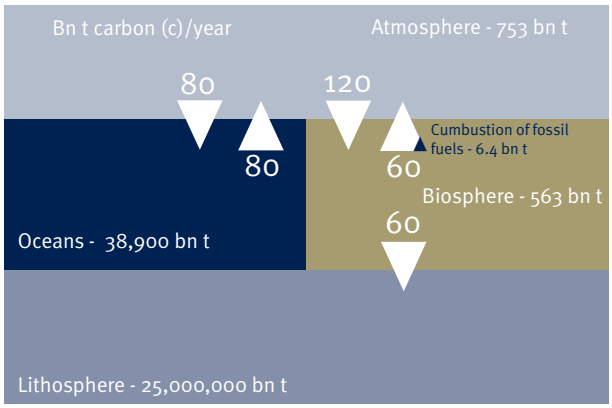
Hanover – According to calculations by scientists at the Federal Institute for Geo-Sciences, Hanover, the near future of the climate will be determined by differences in the duration of sunspot cycles. The rise in temperature and the associated climate change can be squared much better with differences in the length of such cycles than with the increase in atmospheric CO_2 concentrations. Of particular interest are the Schwabe cycle (11 years), the Hale cycle (22 years), the Gleissberg cycle (80 to 90 years) and the Seuss cycle (180 to 208 years). However, the researchers say, it is still not known "how this solar control functions". Historical climate research, on the other hand, provides incontestable evidence that temperature and carbon dioxide were by no means always linked in the course of climate history. Even today, there are still large know-ledge gaps about the sequence of the carbon cycle on earth, so that future trends cannot be forecast with certainty.



Correlation between temperature change, sunspot cycle and CO_2 concentration in the atmosphere

Federal government: Paleoclimate research indispensable

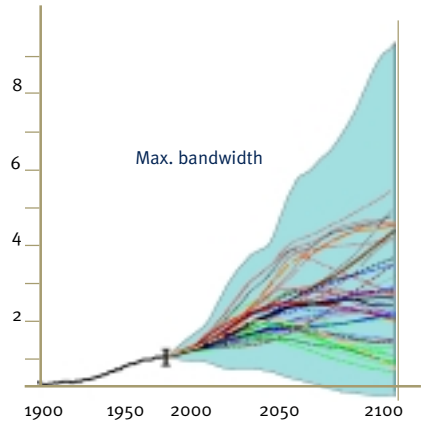
Berlin – In the federal government's view, the integration of findings from paleoclimate research into current climate models is essential and, hence, "an important component in support measures for climate protection." The government has funded this activity with DM 22.4 m in all over the last three years. In the same period, neo-climatology received DM 99.8 m and simulation and modelling studies DM 22.6 m. The government also points out that global measurements of carbon dioxide emissions are not possible at present and can only be derived from other measured values. Anthropogenic carbon dioxide release is calculated from the worldwide combustion of fossil fuels and from cement production. According to these figures, global carbon dioxide release has risen by some 1.2 bn t to 23.34 bn t since 1990. Man-made CO_2 emissions in Germany have fallen from 1,014 mt to 861 mt in the same period. Of the global estimated release, approx. 12 bn t remain in the atmosphere, 8.5 bn t are absorbed by the world's oceans and a further 2.6 bn t by terrestrial eco-systems, as current findings establish, leaving an arithmetic sink of some 8 bn t. It is assumed, the federal government writes, that most of this quantity is bound by forests. What is still contentious, however, is the extent and significance of the various climatic zones in this natural CO_2 sink. Any reliable assessment of anthropogenic CO_2 emissions, as the government sees it, is associated "with great difficulty and imprecision", because future demographic, technological and econo-mic developments cannot be accurately projected. In the public and political climate debate "it is repeatedly overlooked that we have no soundly based knowledge of future climatic trends." This being so, the Intergovernmental Panel on Climate Change (IPCC), with approx. 1,000 scientists worldwide, is studying develop-ments until the year 2100 "within the scope of model scenarios, giving possible bandwidths."



Simplified carbon cycle of the earth (in bn t)

IPCC scenarios with enormous bandwidths

Berlin – The Intergovernmental Panel on Climate Change (IPCC) puts the bandwidth of possible temperature rises due to greenhouse gases at between 1.4 and 5.8 C° by the year 2100. While the former value is below previous assumptions made by this organization, the extreme value of 5.8 C° presumes the combustion of virtually all fossil-fuel deposits. The 1,000 or so IPCC scientists around the world produced 40 different scenarios in all for the latest report. The scenarios can be assigned to four groups, each based on a wide range of data and assumptions. The results of the models have an extreme bandwidth that ranges from CO_2 emission cuts to the pre-1990 level, all the way to a 10-fold rise in the original value. However, as the federal government and the Federal Institute for Geo-Sciences in Hanover see it, the extreme scenario identified is highly improbable.

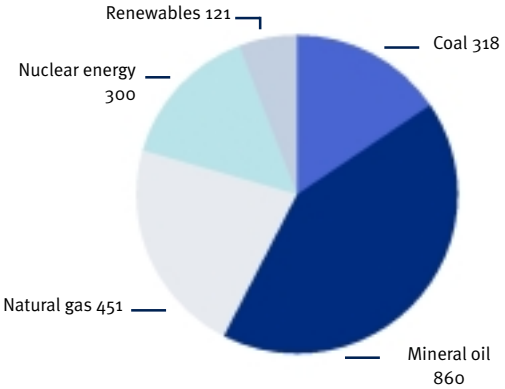


Possible developments in global CO_2 emissions until 2100 (1990 = 1), acc. to IPCC

For the period from 1990 to 2100, the extreme scenario presumes a cumulative world oil consumption of just under 30,000 EJ (10^{18} joule), which is equivalent to twice the known and assumed level of oil reserves; in the case of natural gas, the consumption forecast even exceeds resource availability more than three-fold, and for coal, it is still two-fold. This makes the scenario unrealistic, so that it cannot seriously be used as a basis for further-going climate-policy demands. Those IPCC scenarios that follow on from the more realistic trends in world energy consumption reckon with temperature rises of between 2 and 2.7 C°, i.e. within the bandwidth of previous estimates of international climate researchers. Additional climate-protection schemes cannot be based on the current IPCC reports.

EU's Kyoto pledge in conflict of goals with growth and security of supplies

Brussels – The economic, energy and climate policy goals that the European Union has set for 2010 are increasingly viewed as being incompatible. This is especially true of the exactly quantified specifications as regards energy consumption and energy efficiency. One of the EU's basic assumptions is total economic growth of 3 % p.a. in the Union. At the same time, energy efficiency is to be improved by 2.2 % annually. To this must be added a doubling of the CHP share in power generation from currently 9 to 18 %, and that of renewables from 6 to 12 %. Finally, the EU has pledged to cut the Kyoto gases by 8 % by 2008. According to these stated goals, the EU's total energy consumption must not exceed a max. level of 2,260 m tce in 2010; for CO_2 emissions, the overall level is max. 2,950 mt. To achieve the CO_2 reduction target in particular, the EU would practically have to dispense with the use of solid fuels in 2010 and considerably increase its dependence on the imported energies oil and gas.



EU energy consumption, 1998; total: 2,110 m tce

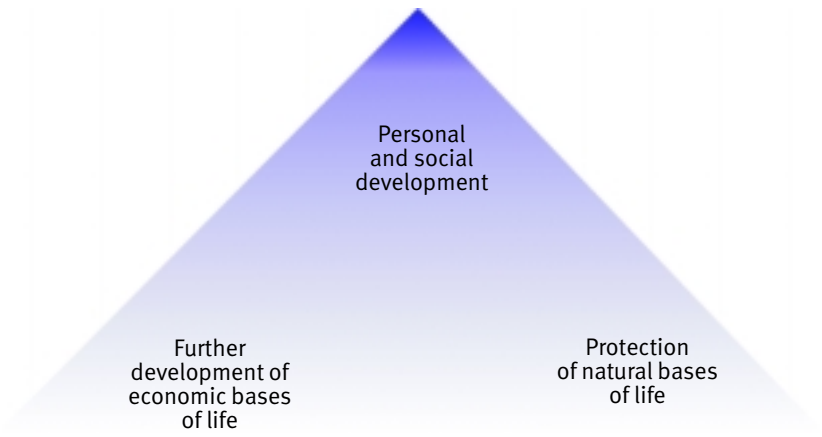
Emissions trading fails due to incompatibility with other climate protection instruments

Brussels – The EU Commission's stated aim is still a phase-in of CO_2 permit trading by way of a trial in 2005. In mid-September, the Directorate General for the Environment presented a re-draft of a directive to that effect for vote by the Commission, although several member states had raised serious misgivings in the runup already. Particularly contentious is the integration of permit trading into the existing set of instruments for climate protection. Here, special mention must be made of plant-geared regulatory law, environmental taxes and levies and the instrument of self-commitment. Specifically, the co-existence of self-commitment and permit trading is being ruled out. Also, there is concern that permit trading would give rise to investment and market control via the factor CO_2 and trigger considerable exclusionary effects with an incalculable impact on production and procurement.

	Aim reached	Costs	Side effects
Regulatory law	certain	open	limitations to production possible
Taxes	uncertain	known	falling control-related tax revenue
Pricing	uncertain	individually known; open in total	
Ratios	certain	open	limitations to production
Permits Emissions trading		unlimited growing	relocation of production outside the trading area
Investment incentives	uncertain	fixed	
Self-commitment	certain	largely calculable	

Overview of chief instruments in international climate protection and their effects

Sustainability must not be subordinated to specific parameters



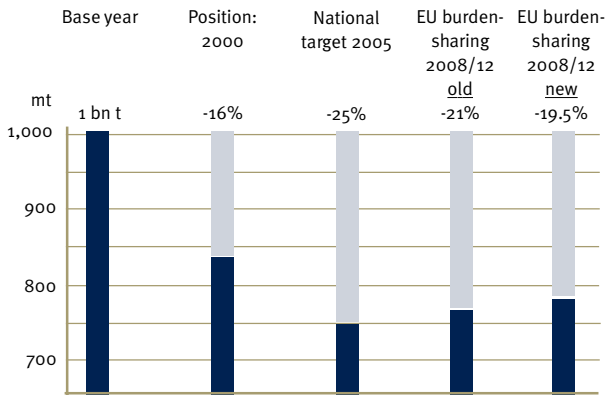
The guiding principle of sustainable development

Berlin – The mandatory introduction of new instruments for climate protection, like CO_2 permit trading, is a threat to a balanced economic policy with the triangle of goals "growth – employment – price stability". If emissions trading became established, carbon dioxide would become a new absolute parameter to which other aims, like economic and social development, would be subordinated. This would contradict a balanced and integrative approach to sustainable development which pursues and seeks to harmonize the various goals of ecological, economic and social development.

CO_2 reduction must not be taken for granted

Mannheim – According to Germany's economics minister, Werner Müller, reaching the 25 % CO_2 reduction target "has certainly turned out to be anything but a *perpetuum mobile*." Actual CO_2 cuts in Germany hitherto amount to a good 16 %, contrasting with a plus of 6 % in the rest of the EU. "Germany's outstanding result internationally" is thanks to the great efforts made to save energy and to increase efficiency in the supply of and demand for energy, especially in trade and industry. But it is also due, as Müller points out, to the upheavals in Germany's new federal states and, hence, to a "special effect" whose impact is declining and might even be reversed with the reconstruction of the East German economy. "We know that the 25 % cut can be reached, provided that further savings are achieved, especially in the traffic and buildings area." Müller recalled that there are not only "limits to growth" but also "limits to efficiency improvements". This being so, he is sceptical about a 40 % CO_2 reduction by the year 2020 over the base year 1990.

On the guiding principle of sustainability, Müller noted the general agreement that sustainable development demands that we leave nature intact, but it also calls for sound economic and social conditions. In energy-policy terms, the remit must be to solve the conflict between economic efficiency, security of supplies and environmental compatibility. For example, any over-the-top climate protection would considerably increase the dependence on the gas imports that would then become necessary, and require very costly subsidies for renewables. In this field of tension, said Müller, there are no absolute individual goals, but only compromises. Even today, more than 60 % of Germany's energy requirements must be imported. This high dependence on imports not only affects the security of supplies, but could also dampen the business cycle and growth. Of the domestic energy sources available in any larger quantities, only lignite is competitive, while hard coal and most renewables would be unable to hold their own without subsidies.



CO_2 reduction success and reduction duties of the Federal Republic of Germany

Three billion years of climate fluctuations

Krefeld – "If we take a look at the earth's CO_2 budget throughout the various geological periods, we note that carbon dioxide cannot have triggered climate fluctuations. Hence, it must be questioned whether the current temperature rise on earth is solely due to the combustion of fossil fuels and the associated higher CO_2 content in the atmosphere."

Prof. Peter Neumann-Mahlkau

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