

Major Challenges to International Climate Protection Policy

International negotiations

The United Nations Framework Convention on Climate Change (UNFCCC), which was passed in Rio de Janeiro in 1992 and came into force in 1994, represents the first international treaty seeking to combat the risks facing the global climate.¹ In particular, the countries listed in Annex I of the Framework Convention ('those parties to the convention that are industrialised countries, as well as the other parties listed in Annex I'), known collectively as the 'Annex I countries',² undertook to implement measures at national level seeking to restrict anthropogenic emissions of greenhouse gases and to protect and enhance their greenhouse gas sinks and reservoirs.³

Thus, in Rio in 1992, the Annex I countries had already agreed in principle to reduce their greenhouse gas emissions by 2000 to the level reached in 1990. However, at this stage the agreement amounted to no more than non-binding declarations of intention. The negotiations became more serious at the third Conference of the Parties to the UNFCCC in Kyoto in 1997. The ratification of the protocol passed in Kyoto would have obliged the industrialised countries listed in Annex B (the 'Annex B countries'⁴), as the main parties responsible for the additional greenhouse effect, to commit themselves for the first time under international law to binding concrete restrictions on or reductions of their emissions. Under Article 3, § 1, these countries would have been obliged to individually or jointly ensure that their total anthropogenic emissions of the six most important greenhouse gases⁵ did not exceed their allocated quotas, with the

aim of reducing their total emissions to at least 5% less than the 1990 level by the compliance period of 2008 to 2012.⁶

Now, despite the USA's withdrawal from the international negotiations, the conditions have been created for the Kyoto Protocol to come into force in the near future.⁷ This process was furthered by the recent Conferences of the Parties in Bonn and Marrakech, where the participants managed to reach agreement on significant issues regarding the implementation of the protocol – in particular, with respect to the system used to monitor its compliance, the design of the so-called flexibility mechanisms (emissions trading, joint implementation and the clean development mechanism), credits for carbon sinks, and the promotion of climate protection in the developing countries.

However, on the long slow path to ratification, numerous concessions were made to hesitant signatories in order to secure their agreement. The result was that the reduction targets stipulated in the Kyoto Protocol, which were not particularly ambitious to begin with, have since been further weakened. Nonetheless, for the first time binding agreement has been reached on the reduction of greenhouse gases by the first compliance period of 2008–2012.

The Intergovernmental Panel on Climate Change (IPCC)⁸ believes, however, that much larger emission reductions must be achieved in the long term if the risks facing the global climate are to be mitigated. This is why the future Conferences of the Parties will, on the one hand, have to agree on emission limits that both are much stricter than those stipulated for the first compliance period and at the same time extend beyond

¹ Cf. Article 2 of the UN framework agreement (Framework Convention on Climate Change).

² The Annex I countries include the OECD countries, with the exception of South Korea and Mexico, and the transition countries, with the exception of Croatia and Slovenia. Thus, the Non-Annex I countries are basically the developing and newly industrialised countries.

³ Cf. Article 4, § 2a, of the Framework Convention on Climate Change.

⁴ The Annex B countries include the OECD countries, with the exception of Turkey, South Korea and Mexico, as well as the Russian Federation, Ukraine, Bulgaria, Estonia, Croatia, Latvia, Lithuania, Romania and Slovenia.

⁵ Carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), partly halogenated hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆).

⁶ Australia, Norway and Iceland were actually granted an increase in emission levels. The European Union as a whole and its member countries undertook to reduce emissions by 8%. Under the EU burden-sharing agreement, Portugal, Spain, Greece, Sweden and Ireland were also granted increased emission levels.

⁷ Under Article 25, § 1, the Kyoto Protocol will enter into force on the ninetieth day after the date on which 'not less than 55 Parties to the Convention, incorporating Parties included in Annex I which accounted in total for at least 55 percent of the total carbon dioxide emissions for 1990 of the Parties included in Annex I, have deposited their instruments of ratification, acceptance, approval or accession.' Although the protocol had already been signed by 79 parties in mid-August 2002, the second condition was not fulfilled because only 36% of the relevant emissions had been accounted for. Following the withdrawal of the USA, arrival at the 55% quota now depends on Russia (which accounts for 17.4% of emissions) and other countries ratifying the protocol. Given that the Russian government declared itself basically in favour of ratification on 11 April 2002 and that other countries have also indicated their intention to sign, the protocol is likely to become internationally binding within the foreseeable future.

⁸ Cf. 'Climate Change 2001: The Scientific Basis.' Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge/New York 2001. (Also cf. the IPCC reports on the Internet at <http://www.ipcc.ch>).

2008–2012 and, on the other, incorporate the developing countries to a greater extent in the reduction commitments. Further efforts to encourage the USA, the largest emitter world wide, to rejoin the Kyoto process will also be necessary, however.

Overview of global emission trends

Lack of data prevents us from providing a comprehensive picture of global emissions of the six greenhouse gases listed in the Kyoto Protocol. Data of this kind are only available for the Annex B countries, and even in this case they are not always up to date.⁹ Disregarding certain inaccuracies resulting from the varying dates of the most recent reports, it can be shown on the basis of these sources that the greenhouse gas emissions in the Annex B countries were almost 7% lower in 1999/2000 than in 1990 (cf. table 1).

Thus, the joint reduction target of a collective 5.2% by the first compliance period of 2008–2012 has already been overshot. However, this result should not be seen too optimistically, for the decrease is almost exclusively due to the massive economic decline in the transition countries.¹⁰ At the end of the 1990s, greenhouse gas emissions in these countries were almost 38% below their 1990 level. Thus, the 'western' industrialised countries listed in Annex B of the Kyoto Protocol¹¹ together increased their emissions by over 6% during this period; if the EU-15 countries had not achieved a reduction, the increase would actually have amounted to over 11%.

⁹ The following are the main data sources used in this report: UNFCCC, FCCC/SBI/2001/13 corr.: 'National Communications from Parties included in Annex I to the Convention.' Report on National Greenhouse Gas Inventory Data from Annex I Parties for 1990 to 1999. Note by the Secretariat. Corrigendum, 9 May 2002; International Energy Agency (IEA): 'CO₂ Emissions from Fuel Combustion', 2001 edition, Paris 2001; European Environmental Agency (EEA): 'Annual European Community Greenhouse Gas Inventory 1990-2000 and Inventory Report 2002', Technical Report no. 75 (http://reports.eea.eu.int/technical_report_2002_75/en), April 2002; European Commission: '2001 - Annual Energy Review', Brussels, January 2002; Federal Republic of Germany 2001 report on a monitoring mechanism of Community CO₂ and other greenhouse gas emissions in accordance with Council Decision 99/296/EC, March 2002; 'BP Statistical Review of World Energy', June 2002. The data provided by most of the sources on greenhouse gas or CO₂ emissions only refer to the years up to 1999 (non-EU-15 countries) or 2000 (EU-15 countries). With the exception of the German data, the CO₂ emissions up to and including 2001 referred to in this report were extrapolated from the energy consumption data by country and energy source published in the BP statistics up to 2001. For Germany, original DIW Berlin estimates were made based on the energy balance sheets, the evaluation tables for the energy balance sheets and the estimated primary energy consumption for 2001.

¹⁰ The 'economies in transition' include Poland, the Czech Republic, Hungary, the Russian Federation, Ukraine, Bulgaria, Estonia, Croatia, Latvia, Lithuania, Romania, Slovakia, Slovenia and Belarus.

The group of industrialised countries has therefore not yet even stabilised its greenhouse gas emissions, let alone come any closer to the reduction target of a hefty 6.6% stipulated in the Kyoto Protocol. The largest absolute increase in emissions was attained in the USA, followed by Canada, Japan and Australia.

The differences in the trends for emissions between the transition countries and the industrialised countries are at the root of the debate on 'hot air' or phantom emission reductions. The transition countries were granted much more generous emission allowances in the Kyoto Protocol than they are ever likely to need by 2008–2012. If it were possible to sell such allowances, which basically only exist because of the economic collapse and not because of targeted reduction efforts (whence the name 'hot air'), to the industrialised countries under the planned regulations on international emissions trading, the overall reduction in emissions would not be any greater. The Kyoto Protocol itself sees reductions in emissions via emissions trading as having only a supplementary function to the measures undertaken in the buyer's own country.¹² Against this background, the efforts of the Europeans, in particular, to restrict the volume of trade in hot air in the first compliance period and to demand that potential buyers achieve at least half of their reduction commitments on their own territory are understandable.¹³

The estimated changes in emission levels for CO₂, the most important greenhouse gas, indicate that in recent years the emissions trend world wide has diverged even further from the targeted goals. Thus, total CO₂ emissions from fuel combustion increased world wide in the 1990s (cf. table 2); in 2001 they are likely to have been around 13% higher than in 1990 and almost 3% higher than in 1999.¹⁴ Without the sharp reductions in the transition countries, worldwide CO₂ emissions would actually have been higher by around a quarter than in 1990. The developing countries showed a particularly sharp rise, increasing their CO₂ emissions by 44% (see Non-Annex I countries in figure 1).

¹¹ With the exception of Turkey, the Annex B countries are the same as the Annex II countries in the Framework Convention. They include the OECD countries, with the exception of South Korea, Mexico, Poland, the Czech Republic, Hungary and Slovakia.

¹² Cf. Article 6, § 1d, under which any party listed in Annex I may transfer emission reduction units to any other party listed in Annex I or may acquire them from any other party listed in Annex I as long as 'the acquisition of emission reduction units [is] supplemental to domestic actions for the purposes of meeting commitments under Article 3.'

¹³ In the long term, however, i.e. in the second compliance period, agreement on a new (more recent) base year would represent a more goal-oriented policy than such restrictions on demand.

¹⁴ On worldwide emissions growth in the 1990s, also cf. Hans-Joachim Ziesing: 'CO₂ emissions: No change in the trend in sight.' In: *Economic Bulletin*, vol. 38, no. 12, December 2001.

Table 1

Greenhouse Gas Emissions in the Annex II Countries, 1990 and 1999/2000¹

	1990	1999/2000 ²	Changes 1999/2000 on 1990 ³	2008–2012 target compared to base year ⁴
	CO ₂ equivalents in million t		%	
European Union	4 207.6	4 059.3	-3.5	-8.0
Austria	77.4	79.8	3.1	-13.0
Belgium	143.1	151.9	6.2	-7.5
Denmark	69.4	68.5	-1.2	-21.0
Finland	77.1	74.0	-4.1	0.0
France	551.9	542.4	-1.7	0.0
Germany	1 222.8	991.4	-18.9	-21.0
Greece	104.8	129.7	23.8	25.0
Ireland	53.4	66.3	24.0	13.0
Italy	522.1	543.5	4.1	-6.5
Luxembourg	10.8	5.9	-45.1	-28.0
Netherlands	210.3	216.9	3.1	-6.0
Portugal	65.1	84.7	30.1	27.0
Spain	286.4	386.0	34.8	15.0
Sweden	70.6	69.4	-1.7	4.0
Great Britain	742.5	649.1	-12.6	-12.5
Australia	423.9	489.1	15.4	8.0
Iceland	2.9	3.3	12.6	10.0
Japan	1 237.5	1 307.4	5.7	-6.0
Canada	607.2	698.6	15.1	-6.0
New Zealand	73.1	76.8	5.2	0.0
Norway	52.0	56.2	8.0	1.0
Switzerland	53.0	53.5	0.8	-8.0
USA	6 038.2	6 746.1	11.7	-7.0
Total Annex II countries ⁵	12 695.4	13 490.4	6.3	-6.6
Russia*	3 040.1	1 962.4	-35.4	0.0
Ukraine*	919.2	454.9	-50.5	0.0
Bulgaria*	157.1	77.7	-50.5	-8.0
Estonia*	40.7	19.9	-51.2	-8.0
Latvia*	31.0	13.6	-56.1	-8.0
Lithuania*	51.5	23.9	-53.7	-8.0
Poland*	564.3	400.3	-29.1	-6.0
Romania*	264.9	164.0	-38.1	-8.0
Slovakia*	72.5	51.8	-28.6	-8.0
Czech Republic*	189.8	140.6	-25.9	-8.0
Hungary*	101.6	86.5	-14.8	-6.0
Total transition countries	5 432.8	3 395.6	-37.5	-1.9
Total Annex B countries	18 128.3	16 886.0	-6.9	-5.2

1 Greenhouse gas emissions excluding CO₂ emissions/removals from land-use change and forestry. Croatia, Liechtenstein and Slovenia are excluded by lack of sufficient data. — 2 1990 to 2000 for the European Union, otherwise to 1999 (Romania: 1994; Russia: 1996; Ukraine and Lithuania: 1998). — 3 Or compared to year of last report.

— 4 Reduction targets in the EU member states under EU burden-sharing agreement. The USA no longer feels bound by the commitments stipulated in the Kyoto Protocol.

— 5 Annex II countries excluding Turkey; these include all the OECD countries with the exception of South Korea, Mexico, Poland, Czech Republic, Hungary and Slovakia.

* Countries undergoing transformation into market economies (transition countries).

Sources: UNFCCC; EEA; DIW Berlin calculations.

While the substantial total increase in these countries considerably expanded their share of worldwide CO₂ emissions – from over 31% (1990) to nearly 40% (2001) – the largest share (almost half) is still accounted for by the western industrialised countries (Annex II countries). At over 11% between 1990 and 2001, the

increase in CO₂ emissions in this group was only slightly lower than the average increase world wide. Only Germany and Great Britain achieved a notable decline in emissions in absolute terms, though Luxembourg, Denmark and Belgium also achieved a reduction on 1990. All the other Annex II countries showed a

Table 2

CO₂ Emissions from Fuel Combustion in Selected Countries and Regions, 1990 to 2001¹

In million t

	1990	1995	1996	1997	1998	1999	2000	2001	% changes 1990/2001
Austria	48.7	51.0	52.9	53.3	52.7	53.2	53.3	53.2	9.3
Belgium	109.2	114.5	117.5	112.9	116.5	113.1	114.1	109.0	-0.1
Denmark	51.3	59.2	72.6	62.9	58.0	54.8	50.7	51.0	-0.6
Finland	53.9	55.9	61.2	59.8	57.4	56.8	54.9	56.6	5.0
France	363.9	363.4	378.3	372.3	393.0	381.5	376.3	370.6	1.8
Germany	987.2	876.1	899.6	867.2	859.7	839.9	840.8	854.3	-13.5
Greece	76.5	79.8	82.1	86.5	91.3	90.6	95.7	95.6	24.9
Ireland	29.6	32.4	33.6	35.7	37.7	39.6	41.2	43.7	47.6
Italy	408.7	418.4	413.5	415.8	428.6	430.8	432.5	432.9	5.9
Luxembourg	8.7	6.8	6.8	5.4	4.6	4.7	4.7	4.5	-48.2
Netherlands	157.1	170.3	177.0	166.1	171.6	168.7	170.1	174.3	10.9
Portugal	39.5	47.9	45.9	47.6	51.5	58.4	57.1	58.3	47.5
Spain	204.9	233.0	220.7	238.5	245.8	270.5	281.3	283.7	38.5
Sweden	51.4	53.4	56.8	52.1	53.3	51.7	50.9	52.3	1.7
Great Britain	556.6	525.1	543.7	521.2	524.2	514.8	521.6	529.5	-4.9
Total EU-15 countries	3 147.2	3 087.2	3 162.4	3 097.5	3 146.1	3 129.3	3 145.3	3 169.6	0.7
Iceland	1.9	2.0	2.2	2.1	2.1	2.1	2.1	2.1	10.5
Norway	28.5	32.7	33.2	35.1	36.9	38.2	37.1	38.4	34.8
Switzerland	39.9	39.8	40.7	39.3	41.0	41.1	40.0	42.7	7.1
Turkey	128.8	155.4	171.7	180.6	182.1	181.2	196.6	189.1	46.8
USA	4 829.4	5 069.4	5 258.5	5 420.6	5 462.8	5 522.4	5 660.1	5 563.4	15.2
Canada	430.2	461.2	476.8	493.1	496.6	503.6	521.9	510.0	18.6
Australia	258.9	279.2	295.3	302.2	318.0	326.6	336.2	340.5	31.5
New Zealand	21.9	25.2	27.0	29.1	28.1	29.8	29.9	30.9	40.9
Japan	1 018.7	1 099.9	1 126.9	1 120.8	1 101.4	1 127.4	1 150.3	1 147.3	12.6
Total Annex II countries	9 905.4	10 252.0	10 594.7	10 720.4	10 815.1	10 901.7	11 119.4	11 034.1	11.4
Poland	340.7	328.1	345.0	335.5	312.7	304.4	293.6	290.8	-14.7
Slovakia	55.4	40.4	40.5	39.6	39.3	40.1	38.9	41.4	-25.3
Czech Republic	153.8	125.6	123.1	118.9	114.7	110.0	114.9	119.4	-22.4
Hungary	70.5	58.6	59.5	57.3	57.4	60.5	58.0	60.2	-14.6
Mexico	292.0	312.6	318.8	331.8	352.2	348.3	361.8	355.4	21.7
Korea	229.6	364.4	394.8	419.1	364.3	400.9	426.1	437.9	90.7
Total OECD countries	11 047.4	11 481.7	11 876.4	12 022.6	12 055.7	12 165.9	12 412.8	12 339.2	11.7
PR China ²	2 291.9	3 010.2	3 171.4	3 099.4	3 117.2	2 974.4	2 977.3	3 109.1	35.7
Russia	2 097.4	1 578.3	1 554.7	1 441.7	1 424.2	1 461.8	1 483.9	1 486.9	-29.1
India	562.3	793.7	846.3	862.5	869.0	875.7	931.8	938.7	66.9
Africa	541.4	599.6	617.2	643.1	667.5	660.1	669.6	676.7	25.0
Middle East	576.1	792.1	844.7	877.7	919.1	941.5	970.6	985.7	71.1
Latin America	600.5	720.5	762.0	811.5	840.6	836.2	851.9	857.9	42.9
Asia ³	757.0	1 022.6	1 095.2	1 144.9	1 139.3	1 194.2	1 256.8	1 294.5	71.0
Others ⁴	2 261.5	1 777.1	1 761.2	1 726.6	1 720.7	1 721.8	1 741.9	1 775.8	-21.5
World ⁴	20 735.5	21 775.7	22 529.1	22 630.1	22 753.3	22 831.6	23 296.6	23 464.5	13.2
Annex I countries	13 791.4	13 041.1	13 358.1	13 308.6	13 324.2	13 431.2	13 656.2	13 579.4	-1.5
Non-Annex I countries	6 316.4	8 062.8	8 480.6	8 607.9	8 705.4	8 642.2	8 855.1	9 090.6	43.9
Transition countries	3 917.1	2 818.1	2 793.1	2 621.5	2 543.1	2 563.4	2 570.9	2 579.7	-34.1

1 CO₂ emissions from fuel combustion according to sectoral approach. Figures for EU countries from 1990 to 2000 according to national emission inventories, for selected non-EU countries from 1990 to 1999 according to International Energy Agency (IEA, 2001). Estimate for 2001 (EU) or 2000 and 2001 (non-EU): changes in CO₂ emissions calculated on the basis of the energy consumption data published in the BP Statistical Review of World Energy (BP, 2002). Figures for countries, regions and groups of countries do not include high-seas bunkers and international air traffic. — 2 Including Hong Kong. — 3 Not including PR China, Hong Kong, Japan, Korea or India. — 4 Including high-seas bunkers and international air traffic and taking account of EU figures for the EU-15 countries.

Sources: IEA; EEA; BP; DIW Berlin calculations.

greater or lesser degree of increase in their emission levels. At 730 million t of CO₂ (15.2%), the USA had by far the greatest increase in absolute terms, followed at a distance by Japan (almost 130 million t), and Canada and Australia (around 80 million t each). Thanks to the decreases in Germany and Great Britain, the CO₂ emissions in the EU-15 countries as a whole were only 0.7% higher in 2001 than in 1990.

Forecasts suggest that an increase in emissions can be expected practically everywhere in the future. Thus, in its latest forecast the U.S. Energy Information Administration (EIA) actually comes to the conclusion that under the defined reference conditions, 'global carbon dioxide emissions are expected to grow more rapidly over the projection period than they did during the 1990s.'¹⁵ The EIA expects world carbon dioxide emissions to increase on 1990 by almost 36% by 2010 and by almost 70% by 2020. Even the Annex I countries are expected to increase their emissions substantially (by 12% and 26%, respectively). An even higher increase in emissions will be prevented by the expected trends in the transition countries where, despite the increase expected in the future, emissions will remain substantially below the 1990 level until 2020.¹⁶ The remaining Annex I countries, by contrast, will show a sharp increase which, at 54% by 2020, is likely to be largest by far in the USA. However, in the western European countries, too, which together have made a (binding) commitment to reducing greenhouse gas emissions by 8% by 2008-2012, CO₂ emissions, at least, are expected to rise sharply.

All in all, if the relevant framework conditions of climate protection policy are not fundamentally modified, the reduction targets sought at the global level are likely to be missed by a large margin. This outcome will be all the more probable if it does not prove possible both to reinsert the USA in the Kyoto process and oblige it to achieve an absolute reduction in emissions, and also to induce the developing countries to undertake specific commitments with respect to medium-term restrictions on emissions.

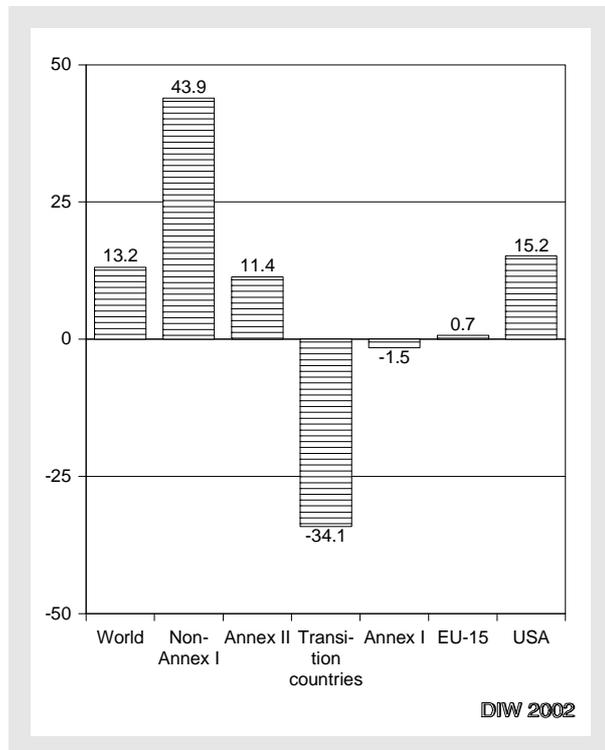
Emission trends in the EU-15 countries

According to the national inventories of the member states, the EU-15 countries' total greenhouse gas emissions in 2000 were around 148 million t (CO₂ equivalent).

¹⁵ Cf. Energy Information Administration: 'International Energy Outlook', Washington D.C., March 2002.

¹⁶ This also has implications for the 'hot air' problem mentioned above.

Figure 1
Worldwide CO₂ Emissions by Country Groups
% change 2001 on 1990

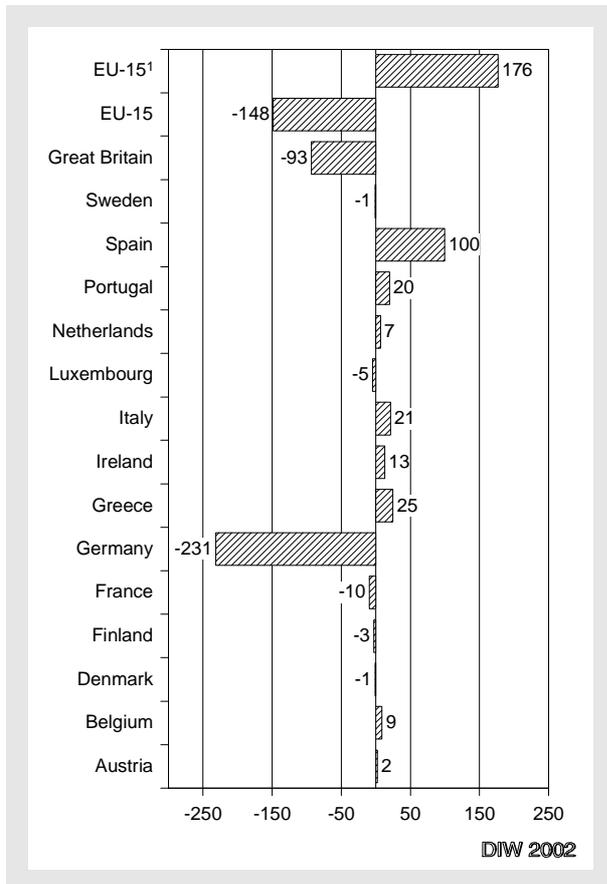


Sources: IEA; EEA; BP; DIW Berlin calculations.

lents) or 3.5% lower than in 1990 (cf. table 1). While the self-imposed goal of stabilising emissions at the 1990 level was thus actually exceeded, less than half of the distance to the binding target of an 8% reduction by 2008-2012 has been covered. Moreover, observing the trend during the 1990s it becomes evident that greenhouse gas emissions were reduced by around 3% in the first half of the decade, but only by another 0.5% in the second half. This divergence becomes even more graphic if the absolute figures are compared: of the entire reduction, 128 million t, or around 86%, was achieved between 1990 and 1995, while the fall in emissions in the second half of the 1990s only amounted to slightly over 20 million t. If the reductions continue at this pace, the target for 2008-2012 (which would require a further reduction of nearly 190 million t on the 2000 level) will be missed by a large margin.

A more detailed analysis of the national data shows that the picture drawn for the EU as a whole must be substantially modified (cf. figure 2). The only reductions that really stand out in the 1990s are those achieved in Germany (231.3 million t) and Great Britain (93.4 million t). However, in Germany, especially, the hefty reductions achieved at the beginning of the 1990s in the

Figure 2
Greenhouse Gas Emissions in the EU-15 Countries
 Changes 2000 on 1990 in million t (CO₂ equivalents)



¹ Excluding Germany and UK.
 Source: EEA.

former GDR have been followed by a substantially slower pace of reduction.¹⁷

If Germany and Great Britain are removed from the equation, greenhouse gas emissions in the EU rose by almost 8% between 1990 and 2000, increasing at an even higher rate in the second half of the 1990s than in the five previous years. The increases were particularly marked in Spain, Greece, Italy, Portugal and Ireland,

¹⁷ For an analysis of greenhouse gas emissions in Germany and Great Britain, cf.: 'Greenhouse Gas Reductions in Germany and the UK - Coincidence or Policy Induced? An Analysis for International Climate Policy.' Study on behalf of the German Federal Ministry of the Environment (BMU) and the German Federal Environmental Agency (UBA). Fraunhofer Institute for Systems and Innovation Research (ISI), Science Policy and Technology Policy Research (SPRU) and German Institute for Economic Research (DIW Berlin), June 2001. This study shows that around 60% of the reductions in emissions in Germany are a consequence of the structural transformation of the economy in the former East Germany.

with emissions in this group increasing by almost 180 million t (17%) between 1990 and 2000.

Only Belgium, Denmark, the Netherlands and Sweden, where emissions had increased to a greater or lesser extent in the first half of the 1990s, showed reductions in the second half of the decade. However, the emissions in Belgium and the Netherlands were still much higher in 2000 than in 1990. France achieved a relatively constant - if only weak - reduction in emissions.

Factors behind the changes in greenhouse gas emission levels in the EU

The changing levels of greenhouse gas emissions in the EU-15 countries are believed to have been determined by the following main factors:

- population trends (demographic component),
- per capita GDP trends (income component),
- macroeconomic energy intensity trends (energy intensity component),
- trends in the greenhouse gas content of primary energy consumption (energy mix component).

The relative influence of the individual factors on the changes in greenhouse gas emissions between 1990 and 2000 was estimated using the component decomposition method¹⁸ (cf. table 3).

The reduction in emissions in the EU-15 countries as a whole can be primarily explained on the basis of changes in the energy source structure in favour of low-emission or emission-free energy sources (570 million t) and - to a much smaller extent - falling energy intensity (400 million t). Together, these two effects substantially outweigh the emission-increasing effects of rising per capita GDP (682 million t) and a growing population (140 million t). However, this picture is reversed when the changes in Germany and Great Britain are left out of the equation. Then, the emission-reducing effects of a 'better' energy mix and more efficient energy use are entirely nullified by the increase in emissions determined by the demographic and economic factors, and the result is a total increase in emissions of around 176 million t (cf. figure 3).

The figures for the individual countries reveal the following insights:

- The population effect alone led to some degree of increase in greenhouse gas emissions in all of the

¹⁸ On the component decomposition method used here cf. Jochen Diekmann, Wolfgang Eichhammer, Anja Neubert, Heilwig Rieke, Barbara Schlomann and Hans-Joachim Ziesing: 'Energie-Effizienz-Indikatoren. Statistische Grundlagen, theoretische Fundierung und Orientierungsbasis für die politische Praxis', Heidelberg 1999.

Table 3

Effect of Various Components on the Absolute and Relative Changes in 2000 on 1990 in Greenhouse Gas Emissions in the EU-15 Countries

Changes in greenhouse gas emissions	Demographic component		Income component		Energy intensity component		Energy mix component		Total greenhouse gas emissions	
	absolute ¹	relative ²	absolute ¹	relative ²	absolute ¹	relative ²	absolute ¹	relative ²	absolute ¹	relative ²
Austria	3.8	4.9	13.9	17.9	-10.0	-12.9	-5.3	-6.8	2.4	3.1
Belgium	4.2	2.9	27.0	18.8	1.2	0.8	-23.5	-16.4	8.8	6.2
Denmark	2.6	3.8	13.3	19.1	-11.7	-16.9	-5.1	-7.3	-0.9	-1.2
Finland	2.9	3.8	13.3	17.3	-5.0	-6.5	-14.3	-18.6	-3.1	-4.1
France	20.5	3.7	77.7	14.1	-28.3	-5.1	-79.4	-14.4	-9.5	-1.7
Germany	39.1	3.2	146.2	12.0	-225.8	-18.5	-190.9	-15.6	-231.3	-18.9
Greece	4.3	4.1	22.0	21.0	1.4	1.3	-2.9	-2.7	24.9	23.8
Ireland	4.8	9.0	37.5	70.2	-20.2	-37.8	-9.3	-17.3	12.8	24.0
Italy	9.7	1.9	73.7	14.1	-9.2	-1.8	-52.9	-10.1	21.3	4.1
Luxembourg	1.2	11.3	3.7	34.6	-4.8	-43.8	-5.1	-47.2	-4.9	-45.1
Netherlands	13.6	6.5	45.8	21.8	-28.1	-13.4	-24.7	-11.7	6.6	3.1
Portugal	0.8	1.3	18.6	28.5	6.1	9.3	-5.9	-9.1	19.6	30.1
Spain	9.2	3.2	74.7	26.1	25.7	9.0	-10.0	-3.5	99.6	34.8
Sweden	2.5	3.6	9.5	13.4	-11.3	-16.0	-1.9	-2.7	-1.2	-1.7
Great Britain	26.2	3.5	126.6	17.1	-95.0	-12.8	-151.3	-20.4	-93.4	-12.6
EU-15 countries	139.9	3.3	682.3	16.2	-399.7	-9.5	-570.8	-13.6	-148.3	-3.5
EU-15 countries excl. Germany and UK	75.3	3.4	411.3	18.3	-98.9	-4.4	-211.3	-9.4	176.4	7.9

1 Changes in million t (CO₂ equivalents). — 2 Relative changes on 1990 as %.
Sources: EU-Kommission; EEA; DIW Berlin calculations.

EU-15 countries. Measured as a relative share, this effect is particularly noticeable in Luxembourg, Ireland and the Netherlands. Across the EU, an increase of over 3% in greenhouse gas emissions can be ascribed to the higher population in 2000 than in 1990.

- The income effect, in other words the increase in per capita GDP, made a substantial contribution to higher emissions in all the EU countries, and this effect was particularly noticeable in Ireland, Luxembourg, Portugal and Spain. The effect in Germany, Sweden, France and Italy was relatively weak in comparison. Across the EU, the increase in per capita GDP between 1990 and 2000 led to an increase of around 16% in greenhouse gas emissions.
- The energy intensity effect varied substantially across the EU countries. It led to reduced emissions in most countries, in particular Luxembourg, Ireland, Germany, Denmark and Sweden, where substantial improvements in macroeconomic energy productivity were achieved over the observation period. However, energy productivity actually worsened perceptibly in Portugal and Spain, while the same applies to a less substantial extent to Greece and Belgium. Only minor progress with respect to energy produc-

tivity was achieved in Italy, France and Finland. Across the EU, this effect led to a reduction in greenhouse gas emissions of almost 10%.

- The changes in the energy source structure were accompanied by lower greenhouse gas emissions in most cases. Thus, the energy mix shifted in favour of low-emission or emission-free energy sources (especially natural gas). This factor had a substantial effect in Luxembourg, followed at some distance by Great Britain, Finland, Ireland, Belgium, Germany and France. The effect was much less marked in Greece, Sweden and Spain. Across the EU, greenhouse gas emissions were reduced by almost 14% as a result of changes in the energy mix.

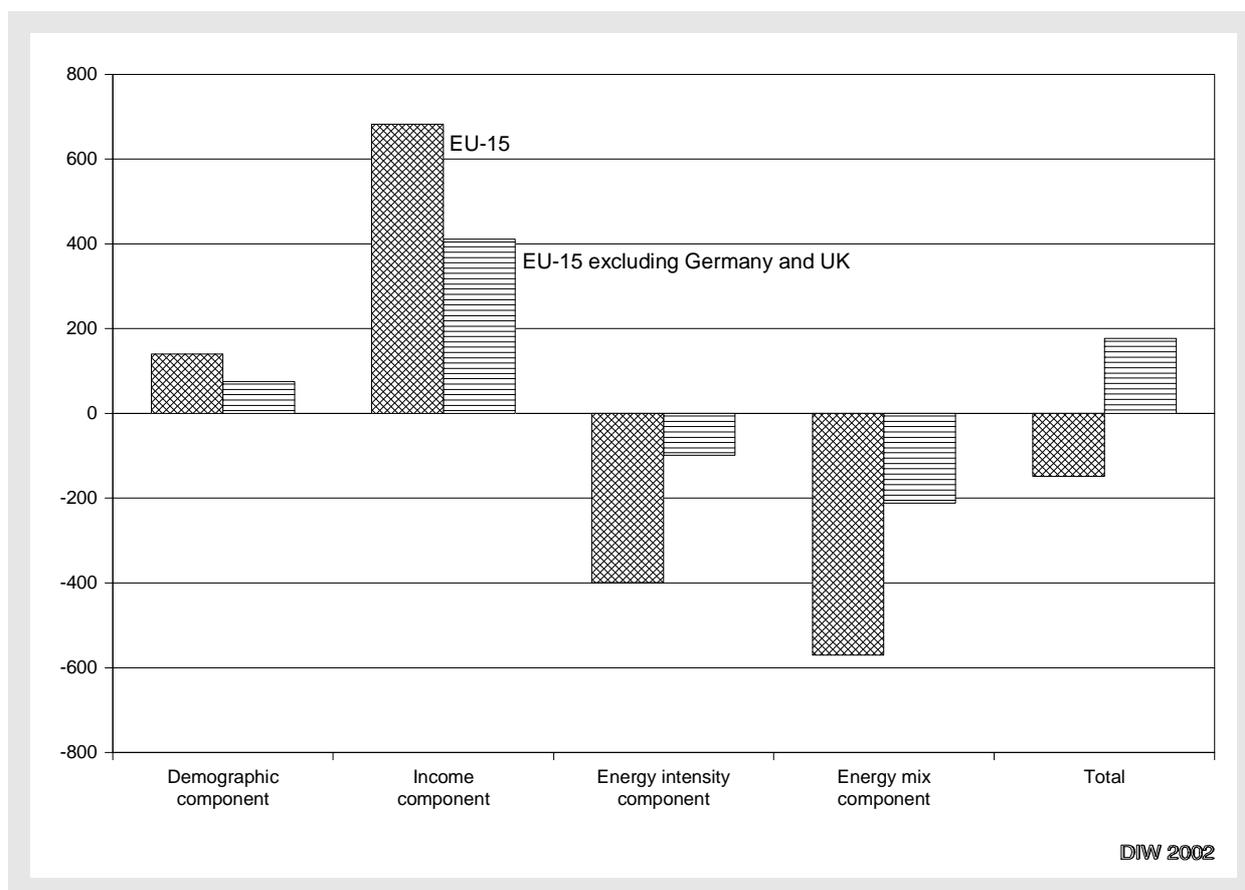
EU reduction targets at risk

Overall, then, it is not possible to present a uniform picture for the EU member states. Nonetheless, it must be concluded that both in the EU as a whole and in most of the individual member states the factors that increase emissions still have the upper hand. Despite this rather unfavourable trend to date, the EU has assumed a pio-

Figure 3

Components of Change in Greenhouse Gas Emissions in the EU-15 Countries

Changes 2000 on 1990 in million t (CO₂ equivalents)



Sources: OECD; IEA; Eurostat; EEA; DIW Berlin calculations.

neering role in the recent Conferences of the Parties as regards the implementation of the Kyoto Protocol and commitments to reductions. Unlike the USA, the EU has still not abandoned the goal of reducing greenhouse gas emissions by 2008–2012 by a total of 8% on 1990, and thus to a greater extent than the average for all the industrialised countries. Within the EU, the commitments undertaken by the individual member states vary considerably owing to the burden-sharing agreement. Thus, emissions in Germany must be reduced by 21%, which amounts to around three-quarters of the total reduction target assumed by the EU. Germany had already fulfilled around 90% of its reduction target by 2000, and its share of the decrease in emissions still to be achieved by 2008–2012 now amounts to less than 14%. Thus, the EU target can only be fulfilled if the other EU countries are willing and able to achieve much greater reductions in their greenhouse gas emissions during the remaining period than would correspond to their emission shares in 2000 (cf. table 4).

The prospects of this being achieved are clearly not very good. Thus, the European Environment Agency has complained that 'more than half of the European Union countries are still heading towards overshooting their agreed share of the EU's greenhouse gas emissions target by a wide margin. This is the case for Austria, Belgium, Denmark, Greece, Ireland, Italy, the Netherlands, Portugal and Spain.¹⁹ The (estimated) changes in CO₂ emission levels over the last two years also demonstrate that there has still been no change in trend in the EU-15 countries: As in 2000, there is likely to have been a further increase in emissions in 2001 (cf. table 2). After all, the EU commission had already concluded that according to the member states' projections, the existing policy concepts and measures would probably not suffice to further reduce the total volume of greenhouse gas

¹⁹ Cf. European Environment Agency News Release, Copenhagen, 29 April 2002 (http://org.eea.eu.int/documents/newsreleases/greenhouse_gas_emission).

Table 4

Greenhouse Gas Emissions in the EU-15 Countries in 1990 and 2000 and Targets for 2008–2012

	1990	2000	Changes 2000 on 1990		Emission target by 2008–2012		Required reduction of 2000 emissions by 2008–2012	
	Million t (CO ₂ equivalents)		%		Million t (CO ₂ equivalents)		%	
Austria	77.4	79.8	2.4	3.1	-13.0	67.3	-12.4	-15.6
Belgium	143.1	151.9	8.8	6.2	-7.5	132.4	-19.5	-12.9
Denmark	69.4	68.5	-0.9	-1.2	-21.0	54.8	-13.7	-20.0
Finland	77.1	74.0	-3.1	-4.1	0.0	77.1	3.1	4.2
France	551.8	542.3	-9.5	-1.7	0.0	551.8	9.5	1.8
Germany	1 222.8	991.4	-231.3	-18.9	-21.0	966.0	-25.4	-2.6
Greece	104.8	129.7	24.9	23.8	25.0	130.9	1.3	1.0
Ireland	53.4	66.3	12.8	24.0	13.0	60.4	-5.9	-8.9
Italy	522.1	543.5	21.3	4.1	-6.5	488.2	-55.3	-10.2
Luxembourg	10.8	5.9	-4.9	-45.1	-28.0	7.8	1.9	31.1
Netherlands	210.3	216.9	6.6	3.1	-6.0	197.7	-19.2	-8.8
Portugal	65.1	84.7	19.6	30.1	27.0	82.7	-2.0	-2.4
Spain	286.4	386.0	99.6	34.8	15.0	329.4	-56.6	-14.7
Sweden	70.6	69.4	-1.2	-1.7	4.0	73.4	4.0	5.8
Great Britain	742.5	649.1	-93.4	-12.6	-12.5	649.7	0.6	0.1
EU-15 countries	4 207.6	4 059.3	-148.3	-3.5	-8.0	3 871.0	-188.3	-4.6

Sources: EEA; EU-Commission; DIW Berlin calculations.

emissions at EU level. Thus, by 2010 'at best a stabilisation of emissions at 1990 level will be achieved.'²⁰

However, if the EU-15 countries and the individual member states wish to underpin their pioneering role in global climate protection by also implementing effective climate protection policy measures, then it seems that they need to significantly intensify their climate protection efforts. The EU Commission has indeed commissioned numerous studies to this end, which have proposed a sufficient range of appropriate strategies. The European Climate Change Programme (ECCP), which must now be implemented at national level, represents a step in this direction.²¹ The emissions trading mechanism

proposed by the Commission – which was already provided for in the Kyoto Protocol – also acquires particular importance in this context.²²

Developments in Germany

Of all the large industrialised countries, probably only Germany, Great Britain and France²³ are likely to fulfil the reduction target agreed for 2008–2012. This would require a further reduction on the 2000 level of 'only' around 25 million t (CO₂ equivalents) in Germany. While the pace of emissions reduction has slowed down considerably in Germany in recent years, this goal should be attainable if the climate protection policy pursued by the German government is consistently adhered to and intensified.

²⁰ Cf. Commission of the European Communities: Commission Report to the European Parliament and Council under Council Decision no. 93/389/EEC for a monitoring mechanism of Community CO₂ and other greenhouse gas emissions, as amended by Decision 99/296/EC, COM(2001) 708 final, Brussels, 30.11.2001.

²¹ Cf. Commission of the European Communities: 'EU policies and measures to reduce greenhouse gas emissions: Towards a European Climate Change Programme (ECCP)', Com(2000) 88 final, 8.3.2000, <http://europa.eu.int/comm/environment/climat/eccp.htm>; European Commission, 'European Climate Change Programme (ECCP): Long Report', June 2001; Commission of the European Communities: 'Communication from the Commission on the implementation of the first phase of the European Climate Change Programme (ECCP)', COM(2000) 580 final, Brussels, 23.10.2001.

²² Commission of the European Communities: Proposal for a Directive of the European Parliament and of the Council establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC, (COM(2001) 581 final, Brussels, 23.10.2001.

²³ Under the European burden-sharing agreement, however, France is only obliged to stabilise, but not reduce, its greenhouse gas emissions by 2008–2012 compared with 1990.

Table 5

Actual and Temperature-adjusted Energy-related CO₂ Emissions in Germany, 1990 to 2001

	1990	1995	1996	1997	1998	1999 ¹	2000 ¹	2001 ¹
Actual CO ₂ emissions in million t	987.2	876.1	899.6	867.2	859.7	839.9	840.8	854.3
Changes on ...								
1990 in million t		-111.1	-87.6	-120.0	-127.5	-147.3	-146.3	-132.8
1990 (%)		-11.3	-8.9	-12.2	-12.9	-14.9	-14.8	-13.5
previous year in million t		-0.7	23.5	-32.4	-7.5	-19.8	0.9	13.5
previous year (%)		-0.1	2.7	-3.6	-0.9	-2.3	0.1	1.6
Temperature-adjusted CO ₂ emissions in million t	1 013.5	880.6	872.6	871.2	869.9	859.9	867.3	860.9
Changes on ...								
1990 in million t		-132.9	-140.8	-142.3	-143.6	-153.6	-146.2	-152.6
1990 (%)		-13.1	-13.9	-14.0	-14.2	-15.2	-14.4	-15.1
previous year in million t		-17.3	-8.0	-1.4	-1.3	-10.0	7.4	-6.4
previous year (%)		-1.9	-0.9	-0.2	-0.2	-1.1	0.9	-0.7

Based on energy consumption data from the following sources: 1990 to 1998: energy balance sheets; calculation of preliminary data for 1999 and 2000 based on evaluation tables for the energy balance sheet; 2001 based on Wochenbericht des DIW Berlin, no. 8/2002.

¹ Preliminary estimate.

Sources: Federal Environmental Agency; Working Group on Energy Balance Sheets; German Meteorological Service; DIW Berlin calculations.

However, it is still unrealistic to believe that the federal government's goal (reaffirmed once again in its recently published Third Report on Climate Protection in Germany²⁴) of reducing German CO₂ emissions by a quarter on 1990 as early as 2005 will be achieved. CO₂ emissions adjusted for temperature were only a good 15% lower in 2001 than in 1990 (cf. table 5). Temperature-adjusted CO₂ emissions would thus have to be reduced by 2005 by around another 100 million t, or almost 12% on the 2001 level. This appears improbable given the significantly weakened rate of reduction in recent years.²⁵

The sectoral structure of energy-related CO₂ emissions changed significantly during the 1990s (cf. table 6).²⁶ While the energy sector is still by far the largest emitter, transport is now in second place, followed at a distance by industry and private households. The crafts, trade and service sectors, by contrast, are playing an increasingly insignificant role with respect to emissions.

The energy sector shows the largest absolute decline in (non-temperature-adjusted) CO₂ emissions compared

with the base year 1990 (almost 72 million t or 16%), followed by the industry sector with a decline of 50 million t (30%) and the crafts, trade and service sectors (around 30 million t or 34%); private households emitted over 14 million t (11%) less CO₂ in 2000 than in 1990. The temperature factor is extremely noticeable in households, in particular, due to the dominant importance of heating energy consumption. Thus, the sharp decline in actual CO₂ emissions after 1996 cannot yet be interpreted as the result of an extremely effective energy savings policy because at an estimated 1% the temperature-adjusted reduction between 1996 and 2000 was only insignificant.

Only the transport sector showed higher emissions in 2000 than in 1990 (almost 13%). However, for the first time since 1994, emissions fell in this sector in 2000 (by around 2% on the previous year). The decline was borne

²⁴ Cf. 'Klimaschutz in Deutschland'. Dritter Bericht der Regierung der Bundesrepublik Deutschland nach dem Rahmenübereinkommen der Vereinten Nationen über Klimaänderungen, Berlin, July 2002, p. 56.

²⁵ Also cf.: Hans-Joachim Ziesing: 'CO₂-Emissionen im Jahre 2001: Vom Einsparziel 2005 noch weit entfernt'. In: *Wochenbericht des DIW Berlin*, no. 8/2002.

²⁶ Some of the figures published by the DIW in the past (cf. *Economic Bulletin*, vol. 38, no. 12, December 2001) for the years 1999 and 2000 required revision following retrospective corrections of the energy data on which they were based. It is not yet possible to provide sectoral data for 2001 because the relevant energy data are not available. These figures will be published in an additional *DIW Berlin Wochenbericht* report this autumn. Readers should note that the structure of emissions presented here is based on the system of classification of sectors used in the energy balance sheets, while the official national emission inventories adhere to the classification system stipulated in the UNFCCC guidelines. Thus, while the sectoral structures of the two reporting systems vary substantially, the differences between the respective emission totals are only insignificant.

Table 6

CO₂ Emissions in Germany by Sector as Classified in Energy Balance Sheets, 1990 to 2000

	1990	1995	1996	1997	1998	1999 ¹	2000 ¹
Actual CO ₂ emissions in million t							
Energy production/conversion	440.6	379.2	382.0	363.1	366.9	359.0	368.9
Industry	169.7	127.0	123.7	124.0	118.2	116.8	119.4
Transport (national) ²	158.0	172.5	172.6	173.1	176.4	181.9	178.3
of which: road traffic	150.2	165.0	165.0	165.9	169.4	174.8	171.2
Households	128.4	129.0	142.3	138.2	131.7	119.8	114.0
Crafts, trade, services ³	90.4	68.4	79.1	68.7	66.6	62.4	60.1
Total energy-related emissions	987.2	876.1	899.6	867.2	859.7	839.9	840.8
Industrial processes ⁴	27.7	26.6	24.8	25.5	26.2	26.5	26.5
Total emissions	1 014.8	902.7	924.4	892.6	885.8	866.4	867.3
% change in CO ₂ emissions on 1990							
Energy production/conversion	–	–13.9	–13.3	–17.6	–16.7	–18.5	–16.3
Industry	–	–25.2	–27.1	–27.0	–30.4	–31.2	–29.6
Transport (national) ²	–	9.2	9.2	9.5	11.6	15.1	12.8
of which: road traffic	–	9.9	9.9	10.5	12.8	16.4	14.0
Households	–	0.4	10.8	7.7	2.5	–6.7	–11.2
Crafts, trade, services ³	–	–24.4	–12.5	–24.0	–26.4	–30.9	–33.5
Total energy-related emissions	–	–11.3	–8.9	–12.2	–12.9	–14.9	–14.8
Industrial processes ⁴	–	–3.8	–10.2	–7.9	–5.4	–4.3	–4.3
Total emissions	–	–11.0	–8.9	–12.0	–12.7	–14.6	–14.5
Structure of energy-related CO ₂ emissions (%)							
Energy production/conversion	44.6	43.3	42.5	41.9	42.7	42.7	43.9
Industry	17.2	14.5	13.7	14.3	13.7	13.9	14.2
Transport (national) ²	16.0	19.7	19.2	20.0	20.5	21.7	21.2
of which: road traffic	15.2	18.8	18.3	19.1	19.7	20.8	20.4
Households	13.0	14.7	15.8	15.9	15.3	14.3	13.6
Crafts, trade, services ³	9.2	7.8	8.8	7.9	7.7	7.4	7.1
Total energy-related emissions	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Deviations from the figures in the Federal Environmental Agency's national emissions inventory are due to the different system of sectoral classification. With the exception of the figures for 1999 and 2000, the differences in the total emissions are insignificant.

1 Preliminary; energy data on which the figures are based as at February 2002. — 2 Excluding international air traffic (assumed to account for 80% of total aircraft fuel consumption entered in German accounts). — 3 Including military bodies. — 4 Figures according to Federal Environmental Agency.

Sources: Federal Environmental Agency; DIW Berlin calculations.

almost exclusively by road traffic emissions, while air traffic again showed a hefty increase (6%).²⁷ The decrease continued in 2001 because sales of Otto fuel (3%), diesel fuel (1.3%) and – as a consequence of 11 September – aircraft fuel (4.6%) fell perceptibly.

²⁷ The fuel consumed in international air traffic is still not taken into consideration in the national emission inventories. In the German case this amounts to an estimated 80% of the total aircraft fuel tanked in the country.

Conclusion: further action essential

The world summit in Johannesburg faced huge challenges in combating the risks to the global climate. The industrialised countries, especially, which are considered to be the main parties responsible for the climate problems, have still not managed to collectively stabilise greenhouse gas emissions, let alone reduce them. Only the fall in emissions in the transition countries – which is certainly not the result of climate protection policy – has eased the tension. If the sharp increases in emissions in

the developing countries are added to the equation, then at global level there is still no evidence of a shift in trend towards long-term emission reduction. Based on the current data, if the framework conditions for climate protection policy are not fundamentally revised, then the global reduction targets can be expected to be missed by a massive margin.

The IPCC's belief that much more substantial emissions reductions than provided for in the Kyoto Protocol are required in the long term must also be noted. Thus, the future Conferences of the Parties will also have to agree on emission limits that both are much stricter than those stipulated for the first compliance period and at the same time extend beyond 2008-2012, and also incorporate the developing countries to a greater extent in the reduction commitments. However, the efforts to persuade the USA to rejoin the Kyoto process must also be continued.

The data indicate that many EU member states are also likely to fail to fulfil their reduction commitments. If the EU wishes to remain credible in the pioneering role it has assumed at the international negotiations on climate protection, it must achieve its agreed targets by implementing the climate protection schemes at its disposal. This would include an appropriate design at European level of the emissions trading system proposed by the EU Commission.

Germany is unlikely to achieve its self-imposed goal of reducing CO₂ emissions as early as 2005 by a quarter on the 1990 level. However, if it pursues its climate protection policy consistently, it has good prospects of fulfilling the reduction target of 21% agreed within the framework of the European burden-sharing system by 2008-2012. But here, too, climate protection policy makers must bear in mind that much more substantial reductions of greenhouse gas emissions will be necessary in the long term. This means gearing energy and environmental policy even more decisively towards improved energy productivity, increased use of low-emission energy sources and much greater recourse to renewable energy sources.

Hans-Joachim Ziesing