

Decline in CO₂ Emissions in 1999 Should Not Be Overstated

At the conference of the parties to the convention on climate change held in Bonn in the autumn of 1999, the German government once again restated its aim of reducing CO₂ emissions in Germany by 25% compared with their 1990 level by 2005. Moreover, within the framework of the European Union, Germany has committed itself to reducing the overall emissions of six greenhouse gases – the most important of which is CO₂ by 21% between 2008 and 2012. This is to ensure that the reduction of 8% in EU emissions promised at the Kyoto climate conference in December 1997 will be achieved.

According to preliminary estimates, in 1999 Germany emitted around 834 million tonnes of CO₂ as a result of energy combustion. This was 3% down on the previous year; allowing for differences in temperatures, however, the reduction represented just 1.8%. In the course of the 1990s CO₂ emissions fell by more than 150 million t, or by 15.5%. However, the pace of the reduction has declined since 1993, when the impact of the transition-related developments in eastern Germany came to an end.

If emission trends continue on their present trajectory, the government's targets for 2005 will be missed by a wide mark. By that date CO₂ emissions would have to be cut – figures allowing for temperature changes – a further 11% or almost 100 million t. Only if policy efforts to reduce the extent of climate change are intensi-

fied immediately and substantially will Germany even come close to meeting its emission target.

Mild weather reduces CO₂ emissions in 1999

Energy-related CO₂ emissions in Germany fell from just under 860 million t in 1998 by almost 26 to 834 million t in 1999; at 3% the reduction was considerably greater than that of primary energy consumption (–1.8%).¹ This reflects the shift in energy-source structure in favour of low emission (natural gas) and zero emission (hydroelectric and wind power, and nuclear energy) sources of energy. As a result the CO₂ content of total primary energy consumption declined by 1.3%, from just under 60 t CO₂ to less than 59 t CO₂ per terajoule. If the structure of energy sources had remained unchanged on the previous year, CO₂ emissions in 1999 would have been just 15 million t lower.

As in the previous year, in 1999 all fossil energy sources with the exception of gases contributed to the cut in CO₂ emissions. The most pronounced fall in emissions was that resulting from the combustion of coal (–6.5% or around 11 million t). The ranking of CO₂ emissions by energy source has changed only marginally: at 37% the combustion of petroleum made the greatest single contribution to CO₂ emissions, followed by gases, accounting for almost 24%, lignite at just under 20%, and coal rather more than 19% (cf. table 1).

¹ The calculations of CO₂ emissions are based on the energy balances for Germany published by the *Arbeitsgemeinschaft Energiebilanzen*. Only the energy-related CO₂ emissions are considered here; those emanating from industrial processes (estimated at around 25 million t) are not included in the analysis.

Table 1
Energy-related CO₂ Emissions in Germany by Energy Source, 1998 and 1999

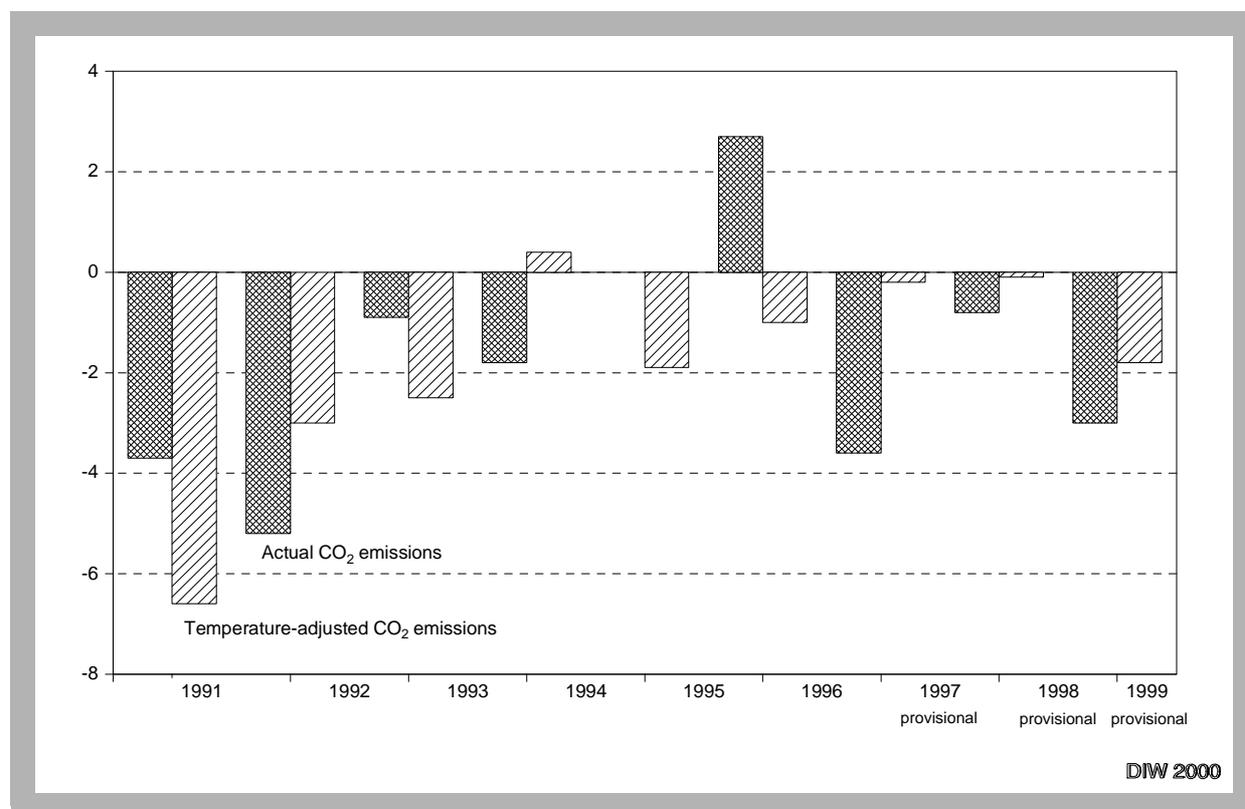
	CO ₂ emissions		Changes 1998/1999 ¹		% shares	
	1998 ¹	1999 ¹			1998 ¹	1999 ¹
	in mill. t			%		
	Actual values					
Petroleum products ²	318.4	307.9	–10.5	–3.3	37.0	36.9
Gases ³	196.3	197.2	1.0	0.5	22.8	23.6
Coal	171.8	160.6	–11.1	–6.5	20.0	19.3
Lignite	169.7	164.8	–4.9	–2.9	19.7	19.8
Other ⁴	3.7	3.5	–0.1	–3.4	0.4	0.4
Total	859.8	834.0	–25.8	–3.0	100.0	100.0
	Temperature-adjusted values					
Petroleum products ²	324.0	317.6	–6.4	–2.0	37.1	37.0
Gases ³	203.1	209.5	6.4	3.1	23.2	24.4
Coal	172.5	161.8	–10.7	–6.2	19.7	18.8
Lignite	170.3	165.7	–4.6	–2.7	19.5	19.3
Other ⁴	3.9	3.9	0.0	1.3	0.4	0.5
Total	873.9	858.5	–15.4	–1.8	100.0	100.0

¹ Estimated. — ² Excluding aviation fuel consumption for international air transport (80% of the aviation fuel consumed in Germany). — ³ Natural gases, liquid and refinery gases, and coking/town gas and top gas. — ⁴ Including statistical discrepancies.
Source: DIW calculations

Figure 1

Changes in Actual and Temperature-adjusted CO₂ Emissions in Germany, 1991 to 1999

% changes on previous year



Sources: Federal Office of the Environment; AG Energiebilanzen; calculations by the DIW.

The CO₂ emission trend is linked directly with changes in primary energy consumption, and this, in turn, is influenced by weather conditions. The influence of the weather needs to be taken into account, particularly when analysing energy consumption and CO₂ emissions over the short run, in order to avoid misinterpreting the original data. The temperature effect plays a central role in explaining the difference between 1998 and 1999. Measured in terms of 'degree days',² the weather in 1999 was significantly milder than during the previous year – by around 5%. This means that, allowing for temperature differences, primary energy consumption fell by just 0.5%. Accordingly, CO₂ emissions, allowing for the temperature effect, also fell to a far lesser extent than suggested by the unadjusted data, namely by 1.8% or around 15 million t. Thus around 40% of the overall reduction in emissions was due to the temperature effect (cf. figure 1). A further factor that

² The degree days measure the influence of the weather in terms of temperature. They are defined as the sum of the differences between a given room temperature and the daily average (outside) air temperature.

needs to be taken into account is that in 1999 consumers significantly reduced their stocks of fuel, particularly of light heating oil. Allowing for this effect, CO₂ emissions are estimated to have fallen by just 12 million t or 1.4% between 1998 and 1999. The following analysis does not consider the figures adjusted for changes in stocks further, however, due to the uncertainty surrounding the extent and evolution over time of such changes: they are not itemised directly by official statistics, but must be estimated on the basis of panel surveys.

Declining pace of CO₂ emissions reduction during the 1990s

In 1999 energy-related CO₂ emissions in Germany were down by 15.5% on 1990 (cf. table 2). Yet around 110 million t of CO₂, or almost three-quarters of the total reduction of around 153 million t achieved between 1990 and 1999, had been realised by 1994 (-11%); thus, compared with the 1994 figure, by 1999 CO₂ emissions had been

Table 2

Energy-related CO₂ Emissions in Germany by Energy Source, 1990 to 1999

	1990	1991	1992	1993	1994	1995	1996	1997 ¹	1998 ¹	1999 ¹
Actual CO ₂ emissions in million t										
Petroleum products ²	299.7	320.2	322.7	330.4	320.0	320.5	329.2	320.8	318.4	307.9
Gases ³	158.1	164.9	161.4	166.7	173.0	182.6	198.9	195.6	196.3	197.2
Coal	181.7	188.2	175.9	174.9	175.3	177.5	181.0	169.5	171.8	160.6
Lignite	343.2	274.8	239.1	218.8	205.9	192.7	187.4	177.6	169.7	164.8
Other ⁴	4.0	2.6	2.4	2.3	2.6	3.4	3.5	3.6	3.7	3.5
Total	986.6	950.6	901.4	893.1	876.8	876.7	899.9	867.1	859.8	834.0
% changes in actual total CO ₂ emissions compared with...										
1990		-3.7	-8.6	-9.5	-11.1	-11.1	-8.8	-12.1	-12.9	-15.5
Previous year		-3.7	-5.2	-0.9	-1.8	0.0	2.7	-3.6	-0.8	-3.8
% structure of actual CO ₂ emissions										
Petroleum products ²	30.4	33.7	35.8	37.0	36.5	36.6	36.6	37.0	37.0	36.9
Gases ³	16.0	17.4	17.9	18.7	19.7	20.8	22.1	22.6	22.8	23.6
Coal	18.4	19.8	19.5	19.6	20.0	20.2	20.1	19.6	20.0	19.3
Lignite	34.8	28.9	26.5	24.5	23.5	22.0	20.8	20.5	19.7	19.8
Other ⁴	0.4	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Temperature-adjusted CO ₂ emissions in million t										
Petroleum products ²	307.9	320.1	329.9	332.4	328.7	323.4	320.5	323.6	324.0	317.6
Gases ³	167.0	164.9	168.1	168.6	182.7	186.0	188.1	199.0	203.1	209.5
Coal	186.5	188.2	178.5	175.6	178.5	178.6	179.1	170.1	172.5	161.8
Lignite	351.9	274.8	242.7	219.6	209.3	193.6	185.4	178.2	170.3	165.7
Other ⁴	4.2	2.6	2.5	2.4	2.7	3.4	3.1	3.7	3.9	3.9
Total	1 017.6	950.5	921.6	898.5	901.9	885.0	876.2	874.6	873.9	858.5
% changes in temperature-adjusted total CO ₂ emissions compared with...										
1990		-6.6	-9.4	-11.7	-11.4	-13.0	-13.9	-14.1	-14.1	-15.6
Previous year		-6.6	-3.0	-2.5	0.4	-1.9	-1.0	-0.2	-0.1	-1.8
% structure of temperature-adjusted CO ₂ emissions										
Petroleum products ²	30.3	33.7	35.8	37.0	36.4	36.5	36.6	37.0	37.1	37.0
Gases ³	16.4	17.3	18.2	18.8	20.3	21.0	21.5	22.7	23.2	24.4
Coal	18.3	19.8	19.4	19.5	19.8	20.2	20.4	19.5	19.7	18.8
Lignite	34.6	28.9	26.3	24.4	23.2	21.9	21.2	20.4	19.5	19.3
Other ⁴	0.4	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

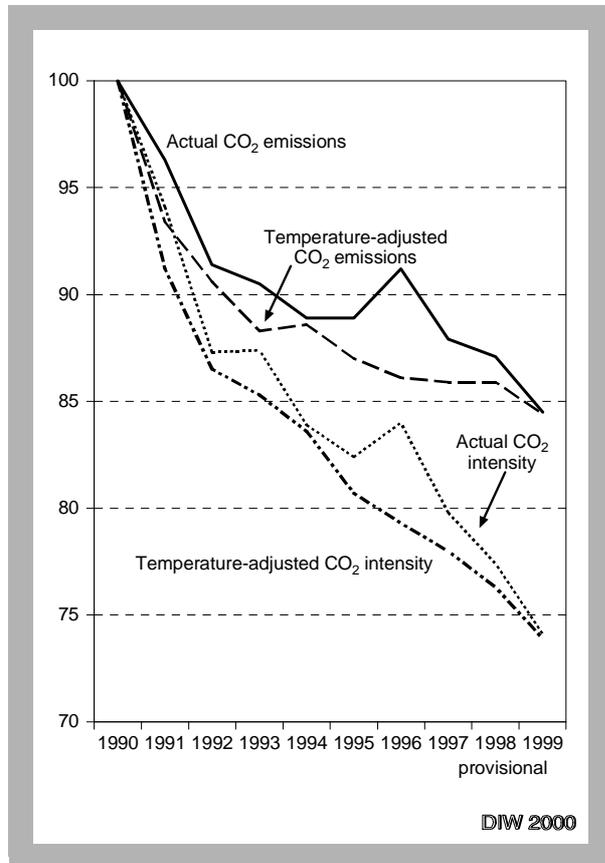
1 Estimated. — 2 Excluding aviation fuel consumption for international air transport (80% of the aviation fuel consumed in Germany). — 3 Natural gases, liquid and refinery gases, and coking/town gas and top gas. — 4 Including statistical discrepancies.

Sources: AG Energiebilanzen; Federal Office of the Environment; DIW calculations.

reduced by less than 43 million t or just under 5%. The relative figures are similar when the calculations are based on temperature-adjusted figures. The end of the one-off transition-related effects in eastern Germany has

meant that the pace of the reduction in emissions in Germany as a whole has slowed. Only in 1999 – on temperature-adjusted figures – was the most significant reduction since 1995 achieved.

Figure 2
CO₂ Emissions and Macroeconomic CO₂ Intensity¹ in Germany, 1990 to 1999
 1990 = 100



¹ CO₂ emissions per unit of GDP (at 1995 prices).
 Sources: Federal Statistical Office; Federal Office of the Environment; AG Energiebilanzen; DIW calculations.

There has been a steady decline, one maintained in recent years, in the overall 'emission intensity' of the German economy, i.e. CO₂ emissions with respect to GDP (cf. figure 2). In 1999 a quarter less CO₂ was emitted per unit of GDP (at 1995 prices) than in 1990; this amounts to an annual average fall of 3.3% over the period as a whole; between 1990 and 1994 the annual average was 4.4%, between 1994 and 1999 just 2.4%.

In order to gain a more highly differentiated impression of the influence exerted by the various determining factors, they were split up into their components, enabling the extent to which the changes in CO₂ emissions depended on the following factors to be determined (cf. table 3):

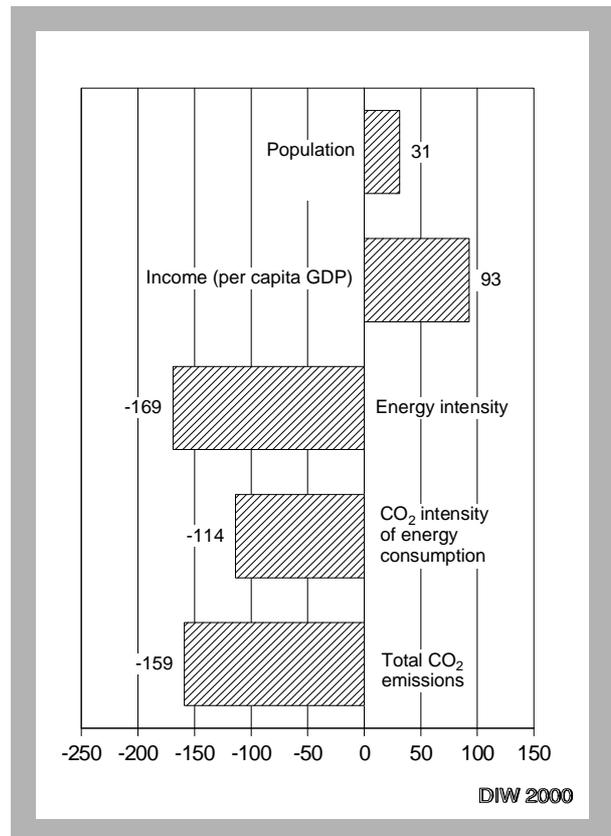
- population (demographic component);
- GDP per capita (income component);
- macroeconomic energy intensity (energy intensity component); and

- the CO₂ content of primary energy consumption (energy mix component).

The analysis of temperature-adjusted figures shows that the fall in CO₂ emissions in Germany between 1990 and 1999 by 159 million t is the outcome of the interplay of contradictory factors (cf. figure 3). The emission-increasing effects of the rise in per capita GDP (+93 million t of CO₂) and of population growth (+31 million t) were more than offset by the emission-reducing effects of the substantial decline in energy intensity (-169 million t) and the lower CO₂ content of total primary energy consumption (-114 million t).

The decline in energy intensity, which, at the risk of oversimplification, can be interpreted as an improvement in the 'energy productivity' of the German economy, played the leading role in the overall emission reduction throughout the 1990-1999 period. The decline in the average CO₂ content of total energy consumption,

Figure 3
Contribution by Various Components to the Changes in Temperature-adjusted, Energy-related CO₂ Emissions in Germany
 Change between 1990 and 1999 in million t of CO₂



Sources: AG Energiebilanzen; Federal Office of the Environment; German Meteorological Office; DIW calculations.

Table 3

Key Data on Primary Energy Consumption and CO₂ Emissions in Germany, 1990 to 1999

	Unit	1990	1991	1992	1993	1994	1995	1996	1997 ¹	1998 ¹	1999 ¹
Inhabitants	million	79.4	80.0	80.6	81.2	81.4	81.7	81.9	82.1	82.0	82.0
GDP at 1995 prices	DM billions	3 268	3 346	3 421	3 384	3 463	3 523	3 550	3 601	3 679	3 728
Per capita GDP	DM 1 000	41.2	41.8	42.4	41.7	42.5	43.1	43.3	43.9	44.8	45.5
Actual figures and coefficients											
Primary energy consumption (PEC)	petajoule	14 903	14 609	14 316	14 305	14 183	14 269	14 749	14 572	14 454	14 200
Fossil sources of primary energy	petajoule	13 132	12 902	12 496	12 518	12 392	12 355	12 795	12 489	12 445	12 091
Zero emission sources as a % of PEC	%	11.9	11.7	12.7	12.5	12.6	13.4	13.2	14.3	13.9	14.9
CO ₂ emissions	million t	986.6	950.6	901.4	893.1	876.8	876.7	899.9	867.1	859.8	834.0
Per capita PEC	gigajoule	188	183	178	176	174	175	180	178	176	173
Per capita CO ₂ emissions	tonnes	12.4	11.9	11.2	11.0	10.8	10.7	11.0	10.6	10.5	10.2
CO ₂ content of primary energy consumption	tonne/terajoule	66.2	65.1	63.0	62.4	61.8	61.4	61.0	59.5	59.5	58.7
Macroeconomic energy intensity	Terajoule/DM billion of GDP	4 561	4 366	4 185	4 228	4 095	4 050	4 155	4 047	3 929	3 809
Macroeconomic CO ₂ intensity	tonne CO ₂ /DM million of GDP	302	284	263	264	253	249	254	241	234	224
Temperature-adjusted figures and coefficients											
Primary energy consumption (PEC)	petajoule	15 343	14 608	14 627	14 389	14 575	14 400	14 360	14 695	14 692	14 616
Fossil sources of primary energy	petajoule	13 554	12 901	12 790	12 598	12 769	12 481	12 425	12 606	12 673	12 488
Zero emission sources as a % of PEC	%	11.7	11.7	12.6	12.4	12.4	13.3	13.5	14.2	13.7	14.6
CO ₂ emissions	million t	1 017.6	950.5	921.6	898.5	901.9	885.0	876.2	874.6	873.9	858.5
Per capita PEC	gigajoule	193	183	181	177	179	176	175	179	179	178
Per capita CO ₂ emissions	tonnes	12.8	11.9	11.4	11.1	11.1	10.8	10.7	10.7	10.7	10.5
CO ₂ content of primary energy consumption	tonne/terajoule	66.3	65.1	63.0	62.4	61.9	61.5	61.0	59.5	59.5	58.7
Macroeconomic energy intensity	Terajoule/DM billion of GDP	4 696	4 366	4 276	4 252	4 209	4 087	4 045	4 081	3 994	3 920
Macroeconomic CO ₂ intensity	tonne CO ₂ /DM million of GDP	311	284	269	266	260	251	247	243	238	230

¹ In some cases figures are provisional.

Sources: AG Energiebilanzen; Federal Office of the Environment; German Meteorological Service; Federal Statistics Office; DIW calculations.

which also made a significant contribution to reducing overall CO₂ emissions, reflects the changes in the structure of energy sources that occurred during the 1990s.³

The most striking aspect of this structural shift in emission terms was, on the one hand, the rapid decline in the combustion of lignite during the 1990s: in 1990

lignite had accounted for more than one-fifth of Germany's primary energy requirements; by 1999 its contribution had been halved, primarily reflecting trends in eastern Germany. As a result lignite was responsible for around one fifth of CO₂ emissions by the end of the period, compared with 35% at the start. There was also a decline in the combustion of coal and of the resultant emissions (-12%).

On the other hand there was a substantial growth in the use of natural gas, the fossil fuel with the lowest emissions: between 1990 and 1999 total emissions from

³ This reflects the fact that the various fossil energy sources produce very different specific CO₂ emissions. The figure for lignite is almost twice as high as for natural gas; the figures for coal and heating oil are around two-thirds and one-third higher than for gas respectively.

gases rose by around one-quarter. The CO₂ emissions resulting from oil combustion, on the other hand, increased only slightly – by around 3% – between 1990 and 1999.

The contributions of the various factors to the changes in temperature-adjusted CO₂ emissions fluctuated very considerably over the period under consideration. In virtually all years it was energy intensity that made the most important contribution to the reduction in CO₂ emissions; only in 1993 and 1994 was its contribution modest compared with other factors, while in 1997 it actually served to raise emissions. In all the years considered the declining CO₂ content of primary energy consumption led to a more (–30.2 million t in 1992) or less (–0.6 million t in 1998) pronounced fall in emissions. The influence of the demographic component, which had been significant in the early 1990s, is now of scarcely any importance, as population figures have recently more or less stagnated. It is thus rise per capita income that remains as a significant emission-raising factor: in 1999, considered by itself, it would have increased emissions by almost 12 million t. The fact that temperature-adjusted emissions in fact fell by more than 15 million t was thanks to both the fall in the energy intensity of the German economy (–16 million t) and the lower CO₂ content of energy consumption (–11 million t).

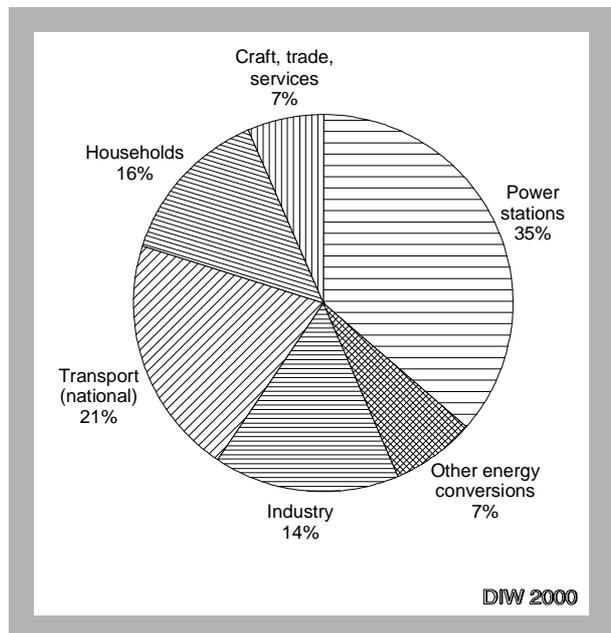
Expressed in terms of the size of the population, energy-related, temperature-adjusted CO₂ emissions, from a starting point of 12.8 t per capita in 1990, initially fell rapidly to 11.1 t in 1993; between then and 1999, however, the decline proceeded significantly more slowly, per capita emissions falling to 10.5 t of CO₂. This is more than 2.5 times the global average for per capita CO₂ emissions.

Sectoral emission trends

The data currently available for 1999 do not yet permit an analysis of energy-related CO₂ emission trends by emitting sector. Such an analysis is possible, however, for the period 1990 to 1998. Restricting the analysis to those emissions (non-temperature-adjusted) that can be allocated directly to a particular sector,⁴ the energy sec-

⁴ This means that the final energy sectors are not considered 'responsible' for the emissions from the (zero-emission) use of electricity and district heat that occur when these secondary energy sources are generated. Rather, the emissions that result from the generation of electricity and district heat are counted as direct emissions by the energy sector (power stations, heating plants etc.) Otherwise the sectoral classification of emissions is that used by the energy balances. For this reason, the figures may deviate from those from other sources.

Figure 4
Sectoral Structure of CO₂ Emissions in Germany, 1998



Sources: AG Energiebilanzen; Federal Statistics Office Federal Office of the Environment; DIW calculations.

tor clearly emerges as the major source of emissions: in 1998 it accounted for more than two-fifths of total energy-related emissions of CO₂. It is followed by transport,⁵ at 20%, private households with more than 15%, industry with over 13% and the craft, trade and services sector (CTS) with 7% (cf. figure 4).

Emission trends varied very significantly between different sectors during the observation period. Whereas in 1998 emissions were down by almost one-third in industry and the CTS sectors, and by 16% in the energy sector, compared with 1990, there was a rise of 11% in the transport sector and of 6% in private households over the same period (cf. table 4). In terms of the absolute changes in CO₂ emissions during the period 1990–1998, the most striking trend was the decline in emissions by the energy sector (–71 million t). It was followed by industry (–53 million t) and CTS (–28 million t). The transport sector, on the other hand, emitted almost 18 million t of CO₂ more in 1998, and the figure for private households was only just below 8 million t.

⁵ In accordance with the approach agreed at international level, the figures for the CO₂ emitted by the transport sector do not include those resulting from international air transport. It is assumed that such transport accounts for 80% of the aviation fuel consumed in Germany.

Table 4

Sectoral Energy-related CO₂ Emission Trends in Germany, 1990 to 1998

	1990	1991	1992	1993	1994	1995	1996	1997 ¹	1998 ¹
Actual CO ₂ emissions in million t									
Energy generation/conversion	439.4	426.6	400.8	387.7	384.1	379.9	382.6	365.8	368.6
of which: Power stations	353.6	349.8	332.8	323.6	322.6	320.1	321.7	309.8	312.6
Heat/power and district heat stations	42.9	39.7	36.2	33.0	31.2	29.4	30.3	26.7	27.1
Other energy conversion	43.0	37.1	31.8	31.1	30.2	30.4	30.6	29.3	28.9
Industry	169.7	147.1	135.5	127.0	128.4	127.1	123.7	123.7	117.1
Transport (national) ²	158.7	162.1	168.3	172.5	168.8	172.5	172.5	173.4	176.3
Of which: road transport	150.8	154.6	160.5	164.4	160.9	165.0	165.0	165.5	168.5
Households	128.4	130.7	123.1	133.5	128.3	128.9	142.1	141.0	136.1
Craft, trade, services ³	90.4	84.1	73.7	72.5	67.1	68.3	79.0	63.3	61.6
Total energy-related emissions	986.6	950.6	901.4	893.1	876.8	876.7	899.9	867.1	859.8
Industrial processes ⁴	27.7	24.8	25.4	25.3	27.0	26.4	25.0	25.0	25.0
Total emissions	1 014.3	975.4	926.8	918.4	903.8	903.1	925.0	892.1	884.8
Structure of CO ₂ emissions in %									
Energy generation/conversion	43.3	43.7	43.2	42.2	42.5	42.1	41.4	41.0	41.7
of which: Power stations	34.9	35.9	35.9	35.2	35.7	35.4	34.8	34.7	35.3
Heat/power and district heat stations	4.2	4.1	3.9	3.6	3.5	3.3	3.3	3.0	3.1
Other energy conversion	4.2	3.8	3.4	3.4	3.3	3.4	3.3	3.3	3.3
Industry	16.7	15.1	14.6	13.8	14.2	14.1	13.4	13.9	13.2
Transport (national) ²	15.6	16.6	18.2	18.8	18.7	19.1	18.6	19.4	19.9
of which: road transport	14.9	15.9	17.3	17.9	17.8	18.3	17.8	18.6	19.0
Households	12.7	13.4	13.3	14.5	14.2	14.3	15.4	15.8	15.4
Craft, trade, services ³	8.9	8.6	8.0	7.9	7.4	7.6	8.5	7.1	7.0
Total energy-related emissions	97.3	97.5	97.3	97.2	97.0	97.1	97.3	97.2	97.2
Industrial processes ⁴	2.7	2.5	2.7	2.8	3.0	2.9	2.7	2.8	2.8
Total emissions	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Changes in CO ₂ emissions on previous year in %									
Energy generation/conversion		-2.9	-6.1	-3.3	-0.9	-1.1	0.7	-4.4	0.8
of which: Power stations		-1.1	-4.9	-2.8	-0.3	-0.8	0.5	-3.7	0.9
Heat/power and district heat stations		-7.4	-8.9	-8.8	-5.4	-5.8	3.1	-12.0	1.7
Other energy conversion		-13.7	-14.2	-2.2	-2.8	0.5	0.6	-4.2	-1.4
Industry		-13.4	-7.9	-6.3	1.2	-1.1	-2.6	0.0	-5.3
Transport (national) ²		2.2	3.8	2.5	-2.1	2.2	0.0	0.5	1.7
of which: road transport		2.5	3.8	2.5	-2.1	2.5	0.0	0.3	1.8
Households		1.8	-5.9	8.4	-3.8	0.4	10.3	-0.8	-3.5
Craft, trade, services ³		-7.0	-12.3	-1.6	-7.4	1.7	15.7	-19.9	-2.7
Total energy-related emissions		-3.7	-5.2	-0.9	-1.8	0.0	2.7	-3.6	-0.8
Industrial processes ⁴		-10.3	2.3	-0.5	6.7	-2.1	-5.1	-0.1	0.0
Total emissions		-3.8	-5.0	-0.9	-1.6	-0.1	2.4	-3.5	-0.8
Changes in CO ₂ emissions on 1990 in %									
Energy generation/conversion		-2.9	-8.8	-11.8	-12.6	-13.5	-12.9	-16.8	-16.1
of which: Power stations		-1.1	-5.9	-8.5	-8.8	-9.5	-9.0	-12.4	-11.6
Heat/power and district heat stations		-7.4	-15.6	-23.0	-27.2	-31.4	-29.3	-37.7	-36.7
Other energy conversion		-13.7	-26.0	-27.6	-29.7	-29.3	-28.8	-31.8	-32.8
Industry		-13.4	-20.2	-25.2	-24.3	-25.2	-27.1	-27.1	-31.0
Transport (national) ²		2.2	6.1	8.7	6.4	8.7	8.7	9.3	11.1
of which: road transport		2.5	6.4	9.0	6.7	9.4	9.4	9.7	11.7
Households		1.8	-4.2	3.9	-0.1	0.4	10.7	9.8	6.0
Craft, trade, services ³		-7.0	-18.4	-19.8	-25.7	-24.4	-12.6	-30.0	-31.9
Total energy-related emissions		-3.7	-8.6	-9.5	-11.1	-11.1	-8.8	-12.1	-12.9
Industrial processes ⁴		-10.3	-8.2	-8.7	-2.6	-4.6	-9.5	-9.6	-9.6
Total emissions		-3.8	-8.6	-9.5	-10.9	-11.0	-8.8	-12.0	-12.8

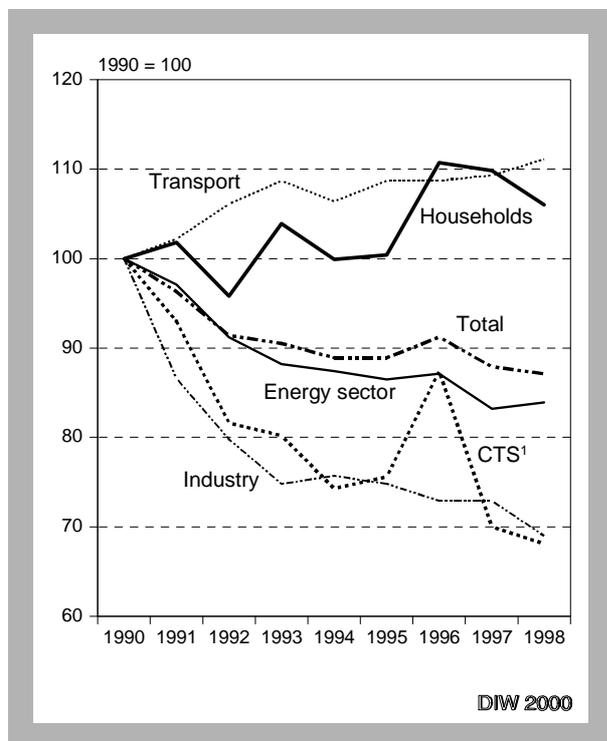
1 Provisional. — 2 Excluding aviation fuel consumption for international air transport (80% of the aviation fuel consumed in Germany). — 3 Including military facilities. — 4 Figures according to Federal Office of the Environment.

Sources: Federal Office of the Environment; DIW calculations.

Comparing emissions in 1998 with those in 1990 conceals a significant degree of heterogeneity during this period (cf. figure 5). As is the case for CO₂ emissions as a

whole, the sectorally differentiated trends also show that most of the decline in emissions was achieved during the early 1990s. In the first four-year period, 1990-1994,

Figure 5
Sectoral Energy-related CO₂ Emission Trends
in Germany, 1990 to 1998
1990 = 100



1 Craft, trade, services.
Sources: AG Energiebilanzen; Federal Office of the Environment; DIW calculations.

the energy sector, industry and CTS each achieved around 80% of their respective sectoral reduction in emissions during the entire period (1990-1998); in transport around three-fifths of the total occurred during this initial period.

It was only in the case of private households that virtually the entire increase in emissions occurred during the second sub-period (1994-1998). To some extent this may reflect the fact that this analysis was based on non-temperature-adjusted emission figures. This is also suggested by the fact that temperatures in 1990 and 1994 were broadly similar, whereas it was considerably colder in 1998 than in 1994.

Conclusion

In 1999 CO₂ emissions in Germany were around 15.5% lower than in 1990. However, this substantial reduction conceals the fact that in the course of the 1990s the pace of emission reduction has slackened. Consequently, at the present juncture it seems highly unlikely that the

goal set by the German government of reducing CO₂ emissions by 25% can be attained by the year 2005. In the few remaining years to that date, CO₂ emission would have to be reduced by almost a further 100 million t or more than 11% compared with their 1990 level. Current prognoses do not point to a reduction of such an order of magnitude.⁶

Yet irrespective of whether this goal can still be met, it is vital that the steps needed to ensure that energy is supplied in a climate-compatible way are taken as soon as possible. This can only be achieved if overall energy productivity is raised substantially and energy source structures are lastingly shifted in favour of low-emission or zero-emission sources. Some positive steps have already been taken, not least in the form of the first stage of Germany's ecological tax reform, which came into effect on 1 April 1999, and steps 2 to 5, which have already passed into law and will take effect in the years 2000 to 2003. Measures have also been taken to promote the use of renewable energy (the law on inputting electricity into the grid and the law on renewable energy that is currently undergoing parliamentary scrutiny), alongside support for energy research. Nonetheless, far greater efforts will need to be made if climate change is to be minimised.

In this context it needs to be recognised that the fall in electricity prices, which in some cases has been substantial, in the wake of the increasing liberalisation of the electricity market is serving to reduce the incentive to take steps to reduce electricity consumption, and in some cases may threaten the economic viability of combined heat-power plants, which are advantageous from an energy and environmental policy perspective. An additional factor is that the plans to phase out nuclear power plants represents an additional challenge to climate change policy, requiring substantial compensatory measures to reduce emissions in all areas of energy use and supply.

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⁶ For instance the Prognos AG and the Energiewirtschaftliche Institut of the University of Cologne conclude, in an estimate presented in the autumn of 1999 to the Federal Minister of the Economy and Technology, that in 2005 CO₂ emissions will be just 15.4% (not allowing for biomass) down on their 1990 level; compared with 1998 a further reduction of less than 3% is expected.