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**Analysis of
BP Statistical Review of World Energy
with respect to
CO₂ emissions**

4th Edition

Joint Working Paper

Prepared
by
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Executive Summary

This working paper analyses the BP Statistical Review of World Energy with respect to CO₂ emissions from fossil fuel consumption. The focus is put on the classification of Annex B ("industrialized countries") and non-Annex B countries ("developing countries") as defined in the Kyoto Protocol.

The method applied here is to convert the fossil fuel consumption with specific emission factors for coal, oil and gas into CO₂ emissions. The resulting figures were then analysed in various ways. Though this method might be criticized as being too simple, the trends and relative changes are reproduced with sufficient accuracy.

Main trends of 2002 emissions compared to 2001 are:

- World CO₂ emissions from fossil fuel consumption increased by about 3 percent. Since 1990 world CO₂ emissions have increased by about 13 percent.
- The emissions of Annex B countries remained almost constant. We believe that this can be attributed primarily to a weak world economy in 2002 in conjunction with high oil prices. In 2002 emissions from OECD countries increased slightly by 0.5 %.
- The emissions of non-Annex B countries increased by about 7 percent in 2002 with a total increase of 38 percent compared to 1990, giving these countries a rising share in total emissions (presently about 42 percent).
- The largest relative increases can be witnessed in Thailand (+ 128 %), Malaysia (+127%) and South Korea (+ 124 %).
- China increased its coal consumption for the second time after the strong reductions between 1998 and 2000. However, China's coal consumption in 2002 was still 3 percent below the consumption in 1998.
- China, the world's largest coal consumer in 2002, consumed approximately 20 percent more than the second largest coal consumer, the USA.
- Emission trends of most countries seem to be influenced by high oil prices. Almost all non-Annex B countries increased their absolute coal consumption as well as the share of coal in primary energy use.

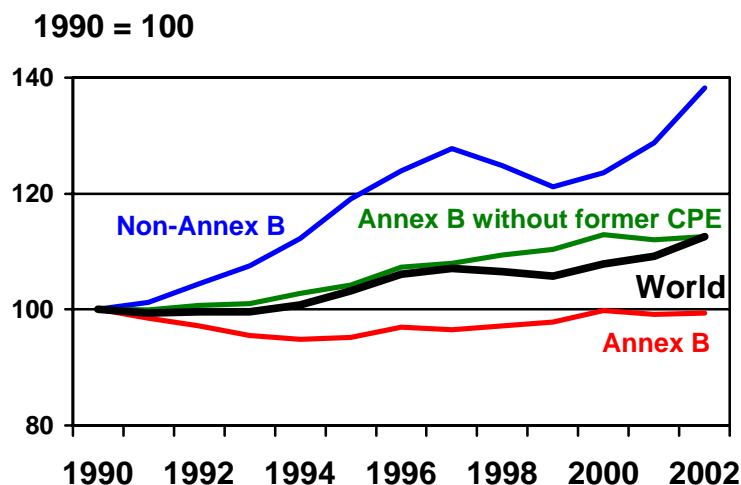


Figure: CO₂ emission trends

Analysis of BP Statistical Review of World Energy with respect to CO₂ emissions

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Analysis of BP Statistical Review of World Energy with respect to CO₂ emissions

1 Introduction

In this paper we analyse the energy consumption of nearly all countries with respect to their CO₂ emissions. Basic data are taken from the BP Statistical Review of World Energy [1] which is published annually. With simplified emission factors for coal, oil and gas the energy consumption is converted into direct CO₂ emissions due to combustion of fossil fuels. Although the derived results do not take into account country-specific differences in fuel quality and preparation, the resulting trends should provide reliable results – even if the absolute emission figures are not represented correctly.

The main emphasis is put on the difference between Annex B countries (industrialised countries) and non-Annex B countries as defined by the Kyoto protocol. Existing trends in energy consumption patterns are exhibited and shown to explain the changing patterns of CO₂ emissions.

Finally, we give explicit explanations for several countries to demonstrate the regional and country-specific choices which lead to different emission patterns. Most prominent are the United States of America and China. Both countries represent the largest emitter in each category (Annex B, resp. Non-Annex B), and surprisingly, in recent years both countries have developed differently than was projected. Whereas the coal consumption and total emissions of the United States of America continue to rise, China's economy has already started to reduce its energy consumption, most notably by reducing its coal consumption in the late 1990s. During the past two years, China's coal consumption has increased again but is still below the level of 1997.

2 LBST methodology

The applied method of one separate emission factor for coal, oil and gas consumption, neglecting country and sector specific deviations, may be criticized as oversimplifying the situation. In order to give an impression of that effect, the baseline emissions for each Annex B country are first compared to these simplified results. The deviation between both figures is about 6% in total. Most large emitters are represented accurately within a 10 % margin. However, in the case of individual countries, large deviations occur, in the worst case by as much as 35 % (The Netherlands). Therefore, some caution must be taken when working with the absolute values presented here (e.g. for comparisons with different statistics). However, relative annual changes which are mainly due to relative changes of the energy supply situation are presumably represented with sufficient accuracy. We are confident that at least the major trends are presented correctly.

The IPCC (Intergovernmental Panel on Climate Change) recommends the following specific emission factors for the combustion of fossil fuels:

Oil	20 Mg carbon per TJ	=	264 g CO ₂ /kWh
Natural Gas	15.3 Mg carbon per TJ	=	202 g CO ₂ /kWh
Lignite	28.5 Mg carbon per TJ	=	381 g CO ₂ /kWh
Bituminous	25.8 Mg carbon per TJ	=	340 g CO ₂ /kWh.

Since the basic data are given in Mtoe (Megatons of oil equivalent), we used a conversion factor of 11.6 MWh/Mtoe. Applied to all energy carriers, this factor doesn't influence the relative changes.

We chose the following emission factors:

Oil:	260 g CO ₂ /kWh,
Natural Gas:	195 g CO ₂ /kWh,
Coal:	330 g CO ₂ /kWh

Even with these (with respect to the IPCC recommendation) slightly reduced factors our results are on average 5 percent above those reported in the National Communications by Annex B countries. This difference was not investigated in further detail. A major reason for the difference might be the fact that non-energetic use of fossil fuel consumption is not separated in these statistics. Non-energetic use usually doesn't result in direct CO₂ emissions.

3 Emissions of the Negotiating Parties of the Kyoto Protocol

Our calculations give total CO₂ emissions from combustion of fossil fuels of about 21 Gt in the base year 1990. Two-thirds of these emissions can be attributed to Annex B countries (for a list of these countries see table 1). Total emissions increased by about 13 % 1990-2002. Emissions of the Annex B countries decreased slightly by 0.6 %, whereas the emissions of the non-Annex B countries increased by almost 38 %.

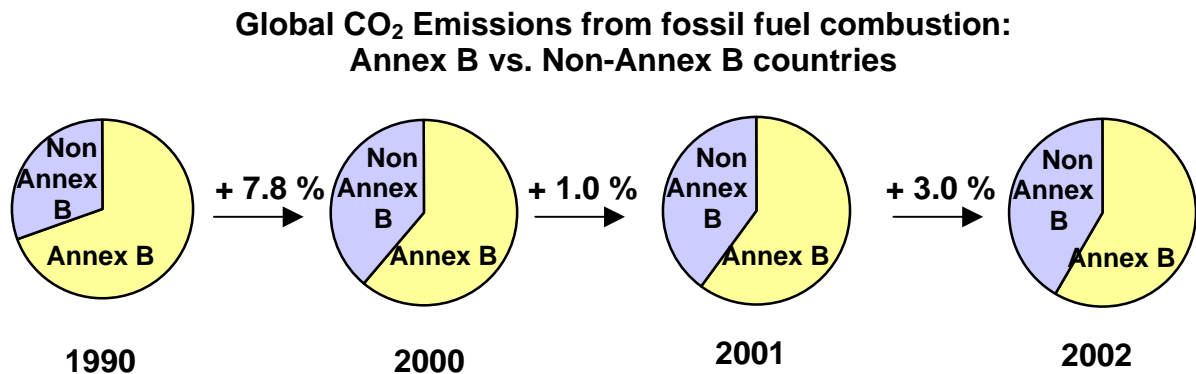


Figure 1: Shares of Annex B countries and non-Annex B countries in global carbon emissions from fossil fuel combustion.

3.1 Emissions of Annex B Countries

The following table 1 lists the Annex B countries and their CO₂ emissions from fossil fuel combustion.

The first column next to the country's name indicates the baseline 1990 emissions as reported to the UNFCCC (United Nations Framework Convention on Climate Change). The second column presents the 1990 emissions according to the LBST method (derived from BP world energy statistics from fossil fuel consumption with the emission factors for oil, gas and coal consumption explained above). To compare these two data sets, the third column shows the percentage of deviation of the LBST

figures from the reported baseline emissions. The fourth and fifth column show the 2001 and 2002 emissions which were also calculated using the LBST method and therefore should show the relative difference to the 1990 figures accurately. The last column gives the percentage of change in 2002 emissions compared to the 1990 figures.

Table 1: CO₂ Emissions from fossil fuel combustion of Annex B countries (in Gg)

	1990 Emission UNFCCC Data	1990 from BP Energy Statistics (LBST method)	Deviation BP over UNFCCC	2001 from BP Energy Statistics (LBST method)	2002 from BP Statistics (LBST)	Difference between 2002 and 1990 emissions in %
Australia	262,623	283,800	+ 8.1 %	352,000	353,000	24 %
Austria	46,620	58,100	+ 24.6 %	65,500	69,100	19 %
Belgium/Luxemb	118,052	136,100	+ 15.3 %	156,100	157,500	16 %
Bulgaria	76,484	72,600	- 5.1 %	44,600	44,600	- 39 %
Canada	412,000	453,500	+ 10.1 %	552,000	552,300	22 %
Czech Republic	160,073	164,700	+ 2.9 %	125,000	120,900	- 27 %
Denmark	50,898	54,200	+ 6.5 %	56,000	56,000	3 %
Estonia	37,184	n.a.	--			
Finland	53,900	51,000	- 5.4 %	55,300	58,500	15 %
France	364,315	402,500	+ 10.5 %	417,700	415,600	3 %
Germany	986,832	1,002,000	+ 1.5 %	891,000	875,600	- 13 %
Greece	77,256	78,200	+ 1.2 %	104,100	107,700	38 %
Hungary	68,105	69,200	+ 1.6 %	57,400	56,100	- 19 %
Iceland	1,674	2,200	+ 31.4 %	3,100	3,100	41 %
Ireland	29,038	26,000	-10.5 %	42,600	41,500	60 %
Italy	400,047	424,700	+ 6.1 %	461,900	462,400	9 %
Japan	1,052,964	1,142,300	+ 8.5 %	1,301,600	1,292,400	13 %
Latvia	24,209	n.a.	--	n.a.	n.a.	--
Liechtenstein	208	n.a.	--	n.a.	n.a.	--
Lithuania	37,332	28,700	- 23.1 %	14,200	14,400	- 50 %
Monaco	106	n.a.	--	n.a.	n.a.	--
Netherlands	157,530	212,000	+ 34.6 %	244,600	246,200	16 %
New Zealand	22,240	28,400	+ 27.7 %	36,000	36,800	30 %
Norway	26,403	34,000	+ 28.8 %	39,200	38,200	12 %
Poland	371,433	374,800	+ 1.0 %	303,500	298,200	- 20 %
Portugal	43,281	44,200	+ 2.1 %	68,000	70,200	59 %
Romania	165,382	163,800	- 1.0 %	93,200	94,600	- 42 %
Slovakia	56,585	53,500	- 6.0 %	39,400	40,500	- 24 %
Slovenia	13,294	n.a.	--	n.a.	n.a.	--
Spain	207,592	230,900	+ 11.2 %	331,000	348,000	51 %
Sweden	51,328	59,200	+ 15.4 %	54,900	55,200	- 7 %
Russian Federation	2,298,900	2,299,700	+/- 0 %	1,549,400	1,538,500	- 33 %
Switzerland	40,330	43,400	+ 7.6 %	45,500	43,400	0 %
Ukraine	672,075	736,500	+ 9.6 %	333,400	327,600	- 56 %
United Kingdom	558,091	605,200	+ 8.4 %	583,500	565,100	- 7 %
United States of America	4,928,900	5,309,100	+ 7.7 %	6,100,200	6,175,900	16 %
Total	13,873,284	14,644,500	+ 5.5 %	14,521,900	14,559,100	- 0.6 %

Over the 1990 to 2002 period the Annex B countries reduced their emissions by a total of 0.6 %. However, these reductions are almost entirely due to the restructuring of the former centrally planned economies (CPEs), the so-called "economies in transition". Without these states the total CO₂ emissions of Annex B countries were 10,681,000 Gg in 1990 compared to 12,024,000 Gg in 2002. This corresponds to an increase of 13 %. Apart from the economies in transition, the only decrease in emissions is reported for Germany (including the former GDR, -13 %), Sweden (-7 %), and the UK (-7 %).

At first glance, it seems that in the UK clear political signals initiated a strong change of energy consumption patterns, which resulted in reduced CO₂ emissions (e.g. steadily increasing CO₂ taxes on gasoline and a strong switch to natural gas in the power sector). In Germany, for the first half of the nineties, the restructuring of the former German Democratic Republic may have contributed substantially to a decrease in emissions. But at least the decreases of the last few years can be attributed to other effects.

The emissions of the Annex B countries, excluding the former CPEs, remained almost constant. This plateau of emission trends, which has existed since 2000, is due to a weak world economy resulting in reduced energy consumption. In comparison to 2001, carbon dioxide emissions in 2002 fell in Switzerland (-4.3 %), the UK (-3.2 %), Iceland (-2.6 %), Norway (-2.6 %), Germany (-1.7 %), Japan (-0.7 %) and France (-0.5 %). Decreases in the former CPEs were reported for the Czech Republic (-3.3 %), Hungary (-2.2 %), Ukraine (-1.7 %) and the Russian Federation (-0.7 %).

Due to the crudeness of this analysis, based on the BP energy statistics, the figures should be seen as a fast survey on trends. For deeper analysis, the identified key countries should be investigated in more detail to get conclusive figures.

The following figure 2 shows the ranking of Annex B countries according to their 1990 baseline emissions, based on national communications.

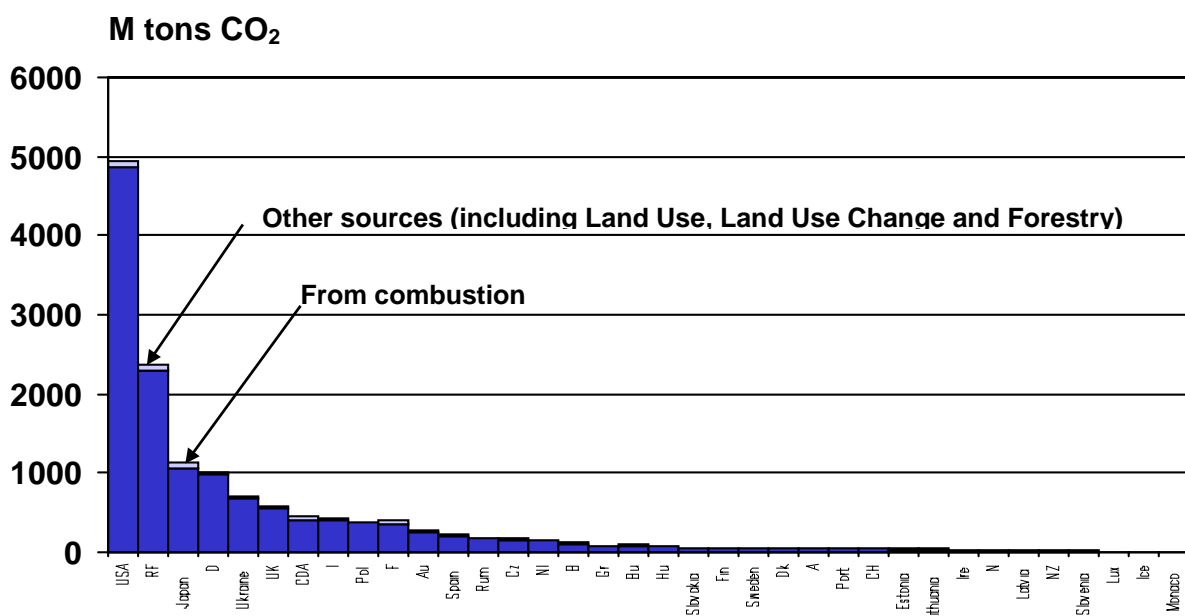


Figure 2: Ranking of Annex B countries according to their 1990 CO₂ emissions. Note that in addition to table 1 also the emissions and sinks (LULUCF) other than from combustion are included. Data are taken from UNFCCC [2].

Note that the four largest emitting countries, the USA, the Russian Federation (RF), Japan and Germany covered two-thirds of Annex B emissions in 1990. (In both calculations, with UNFCCC figures and with BP energy data). In 2002 this share amounted to 68 percent.

3.2 Emissions of Non-Annex B Countries using the LBST method:

Table 2 lists the non-Annex B countries and their CO₂ emissions from fossil fuel combustion. These figures are derived from fossil fuel combustion applying the emissions factors for oil, gas and coal as specified above.

Table 2: CO₂ emissions of non-Annex B countries (in Tg) calculated with the LBST method described above

Country	1990 Emissions	2000 Emissions	2001 Emissions	2002 Emissions	Change 2002/2001	Change 2002/1990
Algeria	62.5	71.9	82.1	85.4	4.0 %	37 %
Argentina	100.4	131.5	123.5	114.5	-7.0 %	14 %
Azerbaijan	58.1	29.8	27.0	26.9	0 %	- 54 %
Bangladesh	16.6	31.5	33.4	34.6	3.6 %	108 %
Belarus	107.4	54.1	51.7	52.3	1.2 %	- 51 %
Brazil	220.2	323.3	334.4	331.3	- 0.9 %	50 %
Chile	32.5	58.9	52.9	53.6	1.3 %	65 %
China	2405	2634	2742	3,342.4	22.0 %	39 %
China-Hongkong	40.1	48.4	59.0	64.9	10.0 %	62 %
Colombia	50.4	52.1	58.6	50.3	-1.4 %	0 %
Ecuador	12.9	17.7	18.0	18	0 %	40 %
Egypt	88.6	122.0	125.4	127.9	2.0 %	44 %
India	606.5	996.9	1,007.4	1,044.2	3.7 %	72 %
Indonesia	145.9	270.3	289.1	293.4	1.5 %	101 %
Iran	192.4	301.7	298.3	301.7	1.1 %	57 %
Kazakhstan	244.3	129.6	127.2	122.4	- 3.8 %	- 50 %
Kuwait	29.3	50.8	51.1	49.9	- 2.3 %	70 %
Malaysia	59.6	118.3	124.6	135.5	8.7 %	127 %
Mexico	273.7	355.6	357.0	356.5	-0.1 %	30 %
Pakistan	63.2	102.8	104.0	104.6	0.6 %	66 %
Peru	18.9	24.9	23.3	23.5	0.8 %	24 %
Philippines	38.5	66.5	67.2	64.1	- 4.6 %	66 %
Saudi Arabia	222.7	289.5	298.4	306.1	2.5 %	37 %
Singapore	61.2	104.2	112.3	110.7	- 1.4 %	81 %
South Africa	323.0	381.4	378.3	384.3	1.6 %	19 %
South Korea	249.5	518.6	532.9	558.0	4.7 %	124 %
Taiwan	127.5	244.7	251.3	258.8	3.0 %	103 %
Thailand	84.4	176.4	179.4	192.1	7.1 %	128 %
Turkey	158.8	209.4	202.7	194.8	- 3.9 %	23 %
Turkmenistan	34.7	32.5	33.5	34.8	3.9 %	0 %
UAE	72.7	100.8	114.7	117.5	2.4 %	62 %
Uzbekistan	128.8	119.0	127.9	130.5	2.0 %	1.3 %
Venezuela	101.0	124.6	126.2	124.7	- 1.2 %	23 %
other						
Total*	7,522	9,294	9,688	10,403	7.3 %	38 %

* includes only those non-Annex B countries listed above

In total, emissions of all non-Annex B countries rose by 43 percent over the twelve-year period with strongest increases recorded in Thailand (128 %), Malaysia (127 %) and South Korea (124 %). Besides several "emerging countries" (Indonesia and Taiwan) Bangladesh also showed a strong emission increase of more than 100 percent. The next largest changes with emissions increases of more than 70 percent are reported from Singapore and Kuwait. Although China reduced its emissions during the late 90's, it still increased its emissions significantly by 39% compared to the 1990 level. Though over the entire period only former CPE countries showed a (strong) emission reduction, it is worth mentioning that 2002 several other countries

reduced emissions compared to 2001, namely Argentina, Brazil, Colombia, Kazakhstan, Kuwait, Mexico, the Philippines, Singapore, Turkey and Venezuela.

As a group of countries, the five Middle Eastern oil producers (Iran, Iraq, Saudi Arabia, Kuwait and the United Arab Emirates) increased their emissions by more than 50 percent between 1990 and 2002. This is the highest emissions increase among all regions of the world (as defined in the BP Statistical Review of World Energy). Hence, this region which from a global point of view is usually recognized in its role as a supplier of oil is obviously on the way to increase its own energy demand. Furthermore, Colombia might be worth mentioning as it reduced its emissions by more than 17 % since 1997.

This short analysis reveals that even among members of the non-Annex B countries, the respective emissions developed quite differently depending on varying economic conditions, but also depending on different political decisions, the largest and most prominent examples being perhaps China and India.

The following figure 3 shows a ranking of non-Annex B countries according to their calculated 1990 emissions. In addition to the 1990 figures, the development over the last four years is shown.

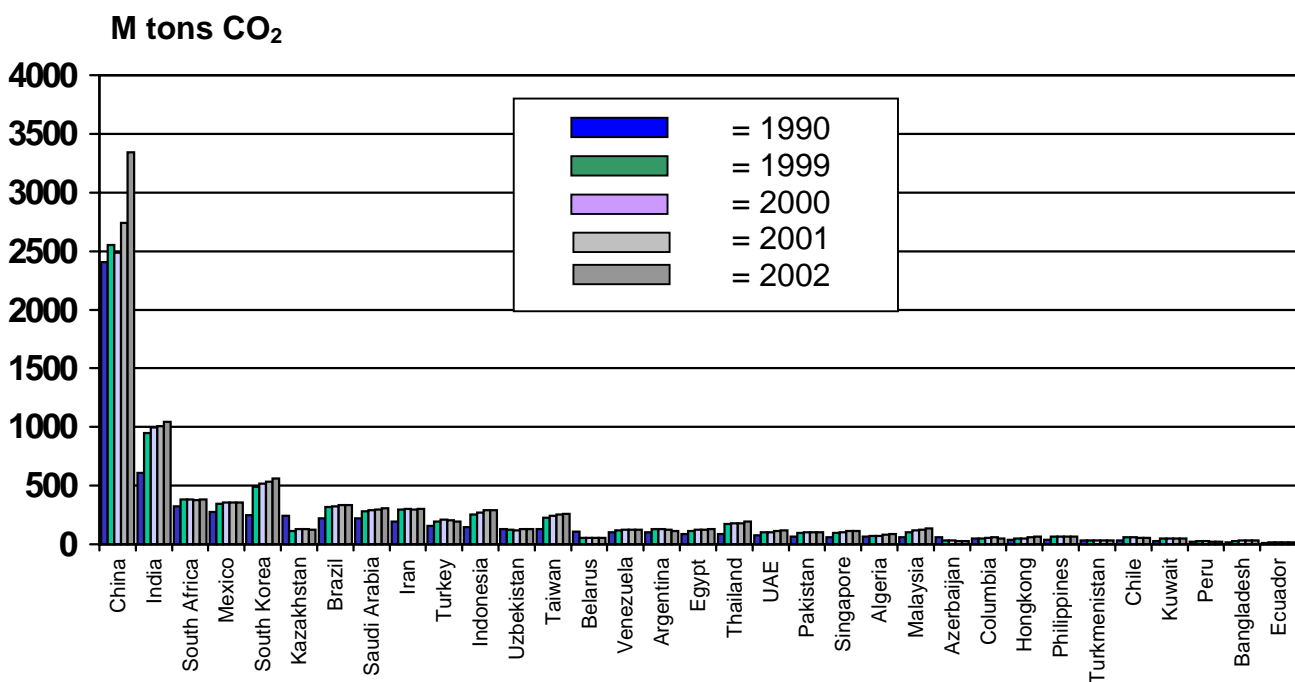


Figure 3: Ranking of non-Annex B countries according to their 1990 emissions (blue bars). The green, violet, light grey and dark grey bars show the emissions of 1999, 2000, 2001 and 2002 respectively.

South Korea, being the fifth largest emitter in 1990, has clearly become the third largest CO₂ emitting non-Annex B country. The four countries with the largest emissions, China, India, South Korea and South Africa, covered approximately 52 percent of all non-Annex B emissions in 2002, which is approximately the same share as in 1990.

3.3 Emission changes 1990 to 2002

Figure 4 lists the countries according to a ranking of their relative emission changes from 1990 to 2002. As specified above the emerging markets of Thailand, Malaysia and South Korea exhibit the strongest CO₂ emission increases by more than 120 %. Bangladesh also increased its emissions by more than 100 percent, though still remaining at a very moderate absolute level.

The Annex B countries are marked with red bars. In Europe, the strongest relative increase was recorded in Ireland (more than 60 percent), Portugal, Spain and Iceland (about 40 – 45 percent).

Emission reductions took place only in former centrally planned economies (so-called Economies in Transition) and in the UK, Sweden and Germany. Germany profits to some extent from the inclusion of the former German Democratic Republic. But, as shown below, its reduction is also due to additional factors.

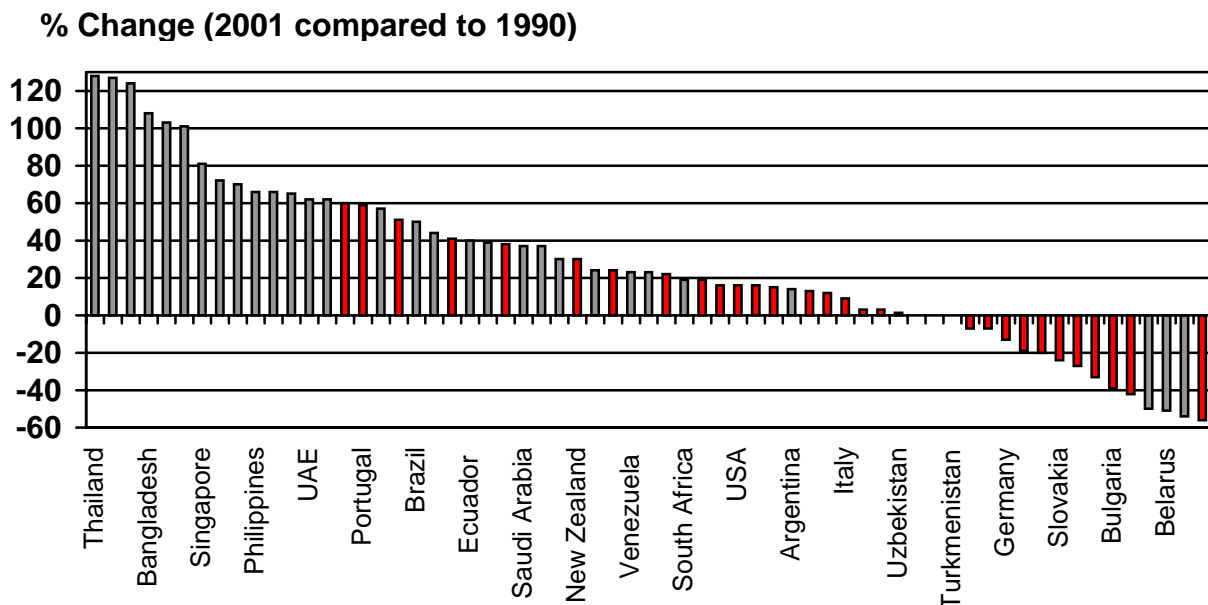


Figure 4: Relative changes of CO₂ emissions in 2002 compared with 1990. Annex B countries are marked with red bars.

Not all country names are shown in the figure. The complete sequence is as follows: Thailand, Malaysia, South Korea, Bangladesh, Taiwan, Indonesia, Singapore, India, Kuwait, Philippines, Pakistan, Chile, UAE, China-Hongkong, Ireland, Portugal, Iran, Spain, Brazil, Egypt, Iceland, Ecuador, China, Greece, Saudi Arabia, Algeria, Mexico, New Zealand, Peru, Australia, Venezuela, Turkey, Canada, South Africa, Austria, Netherlands, USA, Belgium/Luxembourg, Finland, Argentina, Japan, Norway, Italy, France, Denmark, Uzbekistan, Switzerland, Colombia, Turkmenistan, UK, Sweden, Germany, Hungary, Poland, Slovakia, Czech Republic, RF, Bulgaria, Romania, Kazakhstan, Belarus, Azerbaijan, Ukraine

As already mentioned, in 2002 several Annex B and non-Annex B countries reduced their emissions. However, this was not sufficient to keep world wide carbon dioxide emissions stable.

3.4 Development of CO₂ emissions

Figure 5 shows the development of CO₂ emissions over time. The thick black line shows the development of the world's CO₂ emissions from fossil fuel consumption according to the LBST method.

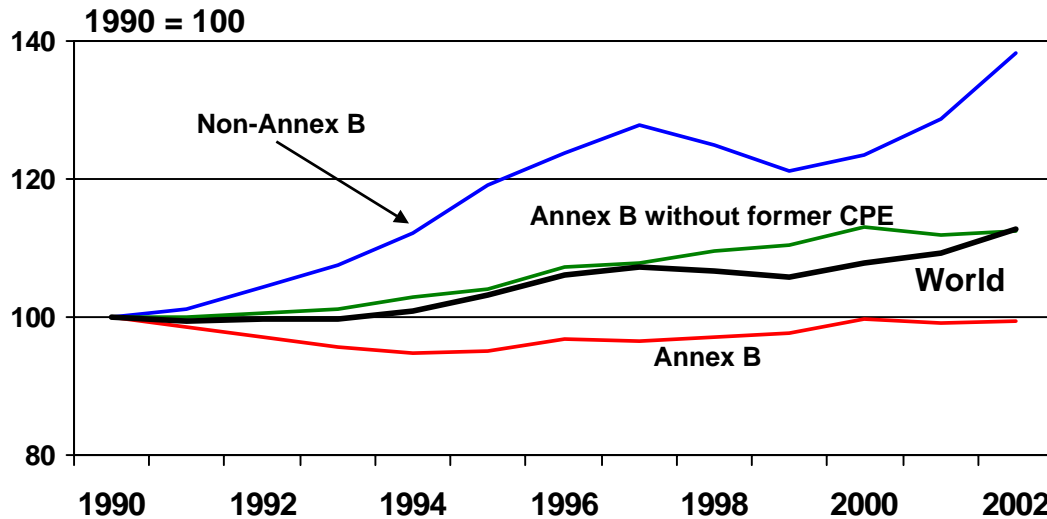


Figure 5: Development of CO₂ emissions from fossil fuel consumption. The thick black line indicates the total of global emissions. The various thin lines show the emissions from Annex B and non-Annex B countries as marked in the figure.

The 13 percent increase in global CO₂ emissions results from a very heterogeneous time history: in the first period until about 1994 the emissions were almost constant. This is composed of a strong increase of emissions from non-Annex B countries and a decrease in Annex B countries. When further splitting the emissions from Annex B countries into those from OECD countries and former CPE countries it becomes clear that the decrease of Annex B countries' emissions was almost entirely attributable to the development in the former CPEs. The OECD countries' emissions also rose over this period.

Between 1994 and 1996 global emissions rose by about 3 percent per year. This is due to an increase in emissions by both Annex B and non-Annex B countries.

Between 1996 and 1999 global CO₂ emissions were reduced slightly. Since emissions from Annex B countries still increased (slightly) over that period, this reduction is almost completely due to a reduction in emissions by non-Annex B countries. During the last three years emissions increased again in non-Annex B countries, while OECD and Annex B countries' emissions remained constant since 2000.

When further analysing this behaviour it becomes evident that the decrease in global CO₂ emissions in 1998 and 1999 was almost completely due to reduced CO₂ emissions in China. However, in 2000 the increases in India outweighed the continuing decrease of China's emissions. In 2001 and 2002 also China exhibited increasing emissions again. This is shown more clearly in figure 6.

The Economies in Transition started to increase their energy consumption and CO₂ emissions in the late 90's, but still at a lower rate than expected by most observers. Australia, Japan and the USA steadily increased their emissions throughout the

nineties, by about 15-20 percent each which is twice the world average. Thus, these nations were ignoring their aim of returning to their 1990 levels by the year 2000, as adopted in the Climate Convention.

The European Union kept its emissions almost constant. This was mainly due to reductions in Germany (which profited from the inclusion of the former GDR) and in the UK. Germany, which is also explicitly listed in the figure, showed a steady decrease of emissions over the 90's, indicating that the former GDR contributed only partly to that emission reduction. Other effects are also responsible for this development, such as a continuous shift from coal to less carbon intensive fuels.

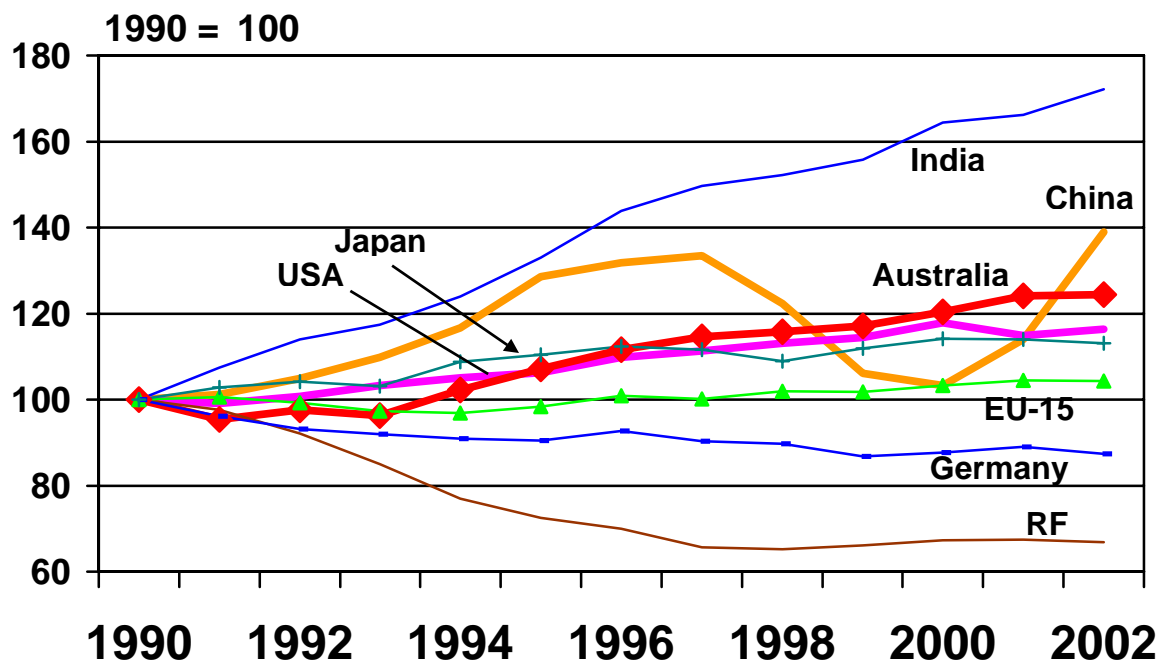


Figure 6: Trend of CO₂ emissions by leading Annex B and non-Annex B countries. Note that the figure does not display absolute emissions but the relative changes compared to 1990.

The Russian Federation (RF) experienced the strongest emission reduction with a rate of almost 35 percent. As expected the reduction was strongest within the first few years. Over the last years emissions have already been increasing again slightly.

The most remarkable change with global impact happened in China. After a steady increase until 1997, emissions decreased for three consecutive years. Only the last two years were again marked by an emission increase. In contrast, the second largest non-Annex B emitter, India, still shows a steady emission increase. Between 1990 and 2002, this increase amounts to more than 70 percent, although over the second half of the investigated period, it showed signs of leveling out. The strong fluctuations in China's emissions over the last years, however, cause some doubt over whether the statistics are correct. It seems to be more likely that the emission reduction 1998-2000 was not as steep as is indicated by the statistics.

Figure 7 shows that these changes in CO₂ emissions are not only due to a reduction of primary energy consumption, but also to a switch from carbon rich to less carbon rich energy sources.

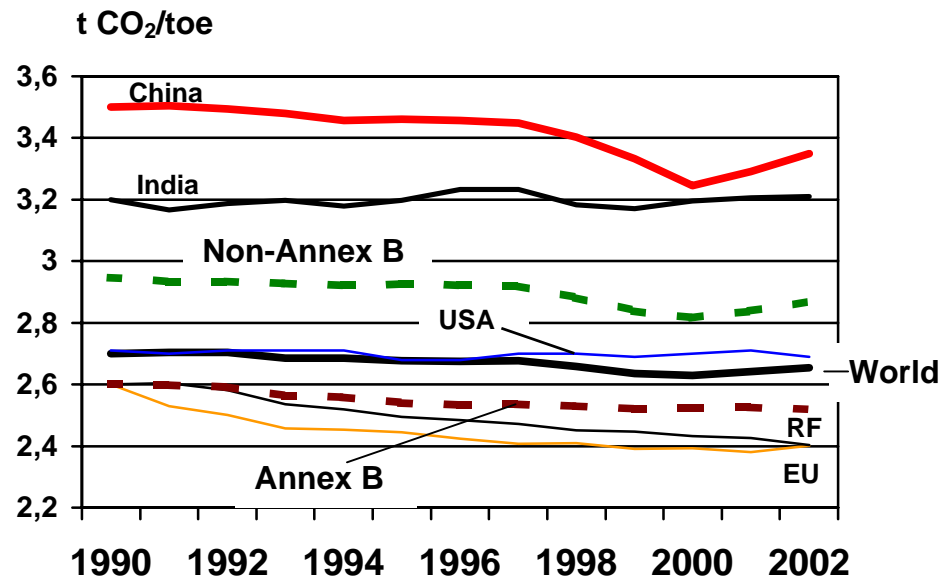


Figure 7: Average CO₂ emissions per unit of primary energy consumed for various leading countries and regions

On average, specific carbon emissions per primary energy unit were reduced by about two percent between 1990 and 2002. It should be noted that the BP Statistical Review of World Energy includes only the commercially traded energy sources of oil, gas, coal, nuclear power and hydropower. All forms of renewable energy (except hydro) are excluded from these statistics and not considered in this analysis. When comparing the figures presented here with figures from earlier editions of this report, it should be noted that BP has changed the statistical basis for the calculations. Nuclear energy and Hydroenergy have been converted into primary energy with different efficiency factors, now giving them a larger share on primary energy in total. Taking into account the changes, hydropower electricity is now converted into primary energy by the factor 2.63 (formerly 1.2), while nuclear energy is now also converted by the factor 2.63 (formerly 3).

Nevertheless, the figure shows that China still by far has the most carbon rich energy economy, emitting about 3.3 t of carbon dioxide per consumed ton of oil equivalent primary energy.

Apart from the Russian Federation, nearly all countries increased the carbon intensity of their energy supply over the last two years. This may be a reflection of the increased oil prices, which skyrocketed in 2000 and since then remained in the upper 20 \$/barrel. It remains to be seen whether this development is already related to geological oil supply restriction.

4 Primary energy consumption

4.1 The share of fossil fuels

Figure 8 shows the change in energy mix in Annex B and non-Annex B countries. The general trend of a reduction in the share of coal in the world energy mix was reversed over the last few years, mainly triggered by the increased share of coal in non-Annex B countries' primary energy mix. At present, the share of coal in non-Annex B countries (about 33 %) ranges far above the share of coal in Annex B countries' energy mix (about 21 %).

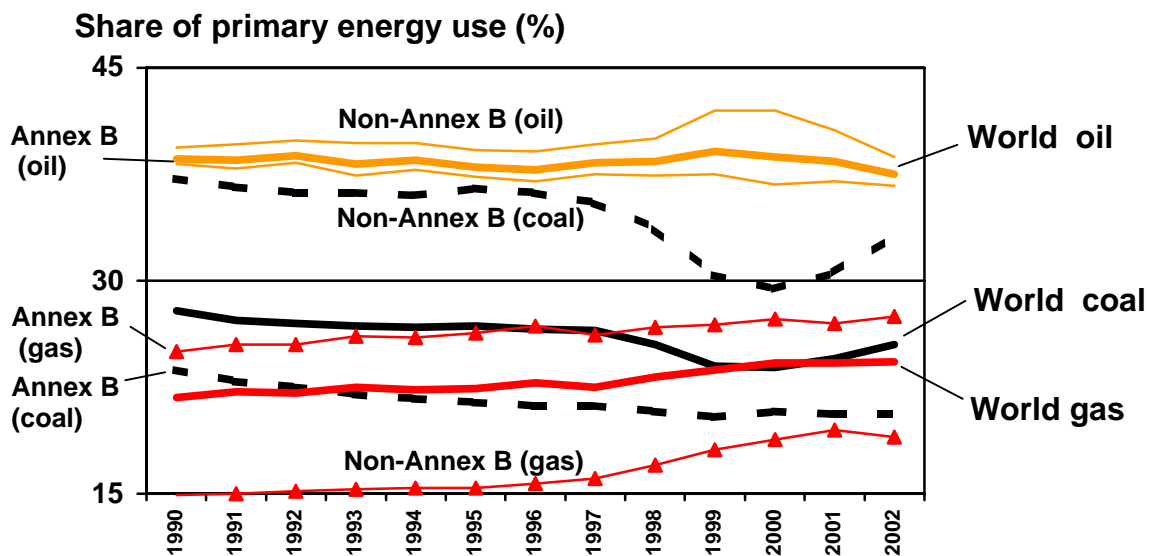


Figure 8: Development of the shares of oil, gas and coal in the primary energy mix from 1990 to 2002. For each thick line (representing world averages) a pair of lines is shown indicating the respective figures for Annex B and non-Annex B countries (broken lines: coal; thin lines: oil and gas).

In Annex B countries the share of gas rose slightly over the last ten years, from about 25 percent in 1990 to 27 percent in 2002. Although still at a much lower level, the non-Annex B countries increased the share of gas considerably over the last few years from 15 to 19 percent.

Until 1999/2000 mainly the non-Annex B countries increased their oil consumption while strongly decreasing their coal consumption. This effect reversed over the last two years. This behaviour might be connected to the strong oil price fluctuations over the last years: In 1999 oil prices hit an historical low as they fell below 10 \$, whereas the prices in 2000, 2001 and 2002 ranged above 25 \$ per barrel.

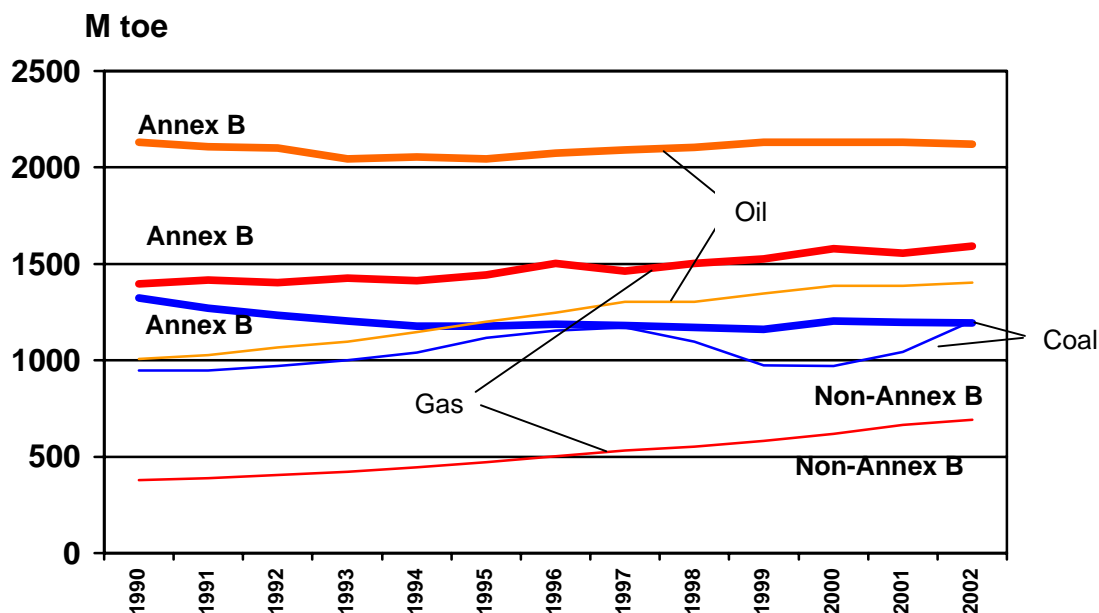


Figure 9: Consumption of oil, gas and coal in Annex B and non-Annex B countries. Thick lines represent Annex B countries, thin lines show data for non-Annex B countries

Figure 9 shows the development of fossil fuel consumption in Annex B and non-Annex B countries in absolute figures. On average, between 1990 and 2002 gas consumption in Annex B countries rose by about 10 %, while oil consumption remained constant (0 % change) and coal consumption decreased by 9 %. In non-Annex B countries, gas consumption increased by 82 %, oil consumption by 39 % and coal consumption by about 27 %.

4.2 Coal consumption

Since coal has by far the highest specific CO₂ emissions, a reduction in coal consumption shows the strongest effects in terms of reducing carbon dioxide emissions.

Figure 10 shows the coal consumption since 1990 for the world, the Annex B and non-Annex B countries and several large consumers.

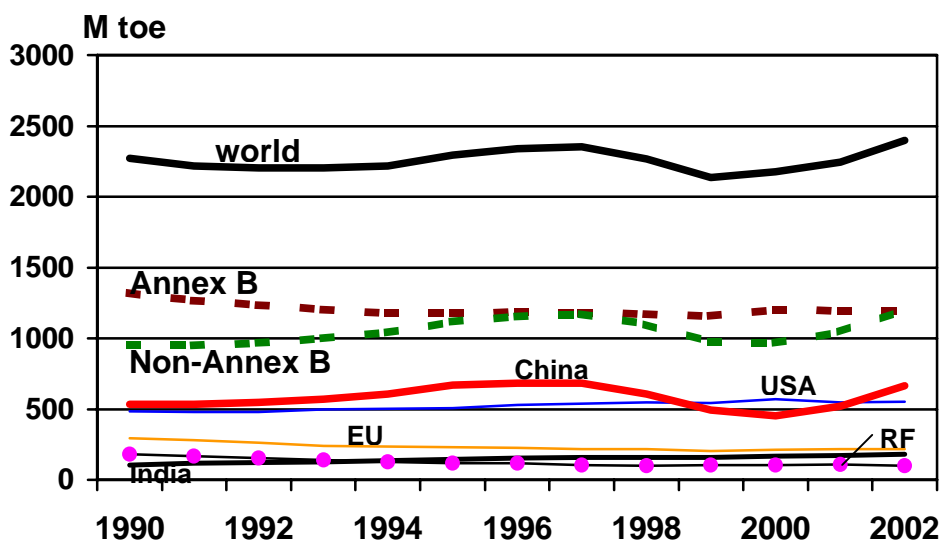


Figure 10: Coal consumption for the world, Annex B and non-Annex B countries. The development for various leading countries and regions is also shown.

World coal consumption increased by about 5.5 percent since 1990. The disaggregation in Annex B and non-Annex B countries shows that consumption decreased in the first half of the nineties in Annex B countries and was almost constant for the second half of the period. This decrease is partly due to a decrease of the total energy consumption of the Economies in Transition. But even the European Union reduced its coal consumption by about 30 percent.

The non-Annex B countries increased their coal consumption by about 24 percent until 1996. During the late 90's coal demand significantly decreased in China. However, this trend has reversed into a heavy increase in coal consumption since 2001.

Figure 11 shows the share of coal in the energy consumption of individual regions. Worldwide, the share of coal has been reduced from 28 percent in 1990 to 24 percent in 2000. This reduction is mainly due to the non-Annex B countries where even India, with its large absolute increase, reduced the share of coal consumption. It should, however, be mentioned that this trend was reversed during the last year. Due to high oil prices India (and even China) reinforced their domestic coal production and consumption while the economic crisis in the USA resulted in an overall reduction of energy consumption including coal. However, during the last years the share of coal in primary energy demand increased again, presumably due to high oil prices.

China's reduction during the late 1990's was even more pronounced, as already mentioned. Most remarkable is the reduction of the share of coal in the European Union from 22 % to 15 % in 2002. The United States of America kept the share of coal nearly constant over the last ten years. Moreover, Japan is one of the very few Annex B countries which increased the share of coal in the past years from 17 % to above 20 %.

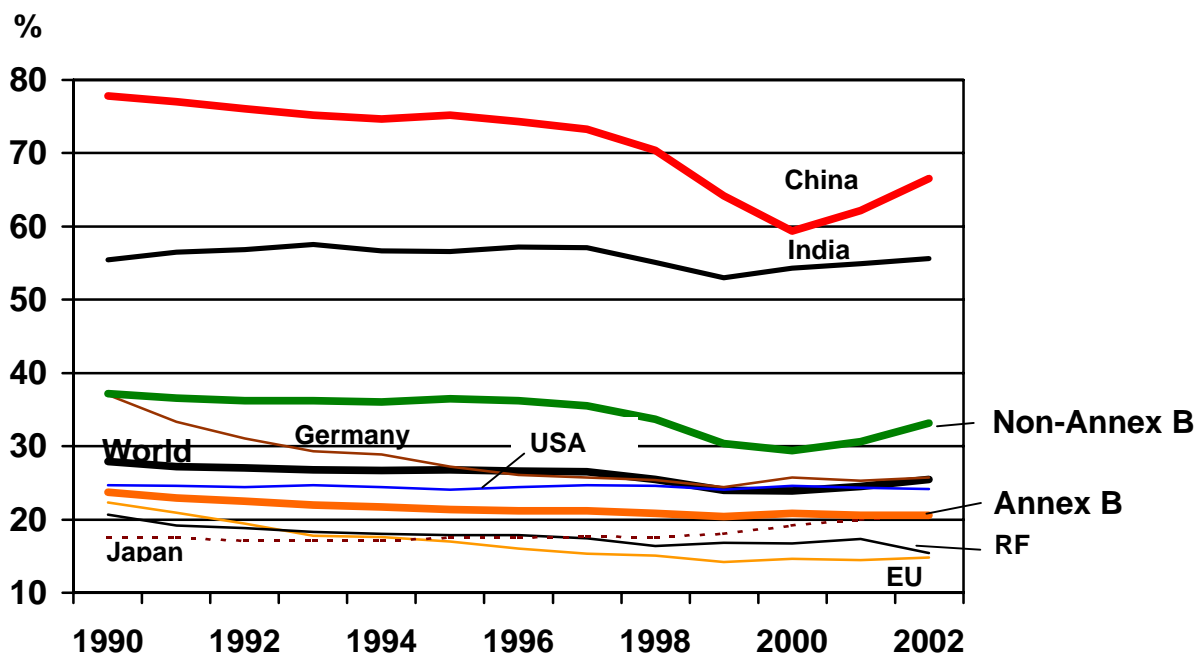


Figure 11: Share of coal consumption in primary energy use in the world, in Annex B, non-Annex B countries and several leading countries and regions.

5 References

- 1 BP Statistical Review of World Energy 2003 (see www.bp.com)
- 2 CO₂ emissions of Annex B countries in 1990 (see www.unfccc.int)
- 3 Analysis of BP Statistical Review of World Energy with respect to CO₂ emissions, 1st, 2nd and 3rd edition, Germanwatch and LBST, 2000/2001/2002 (see www.germanwatch.org)

6 Abbreviations:

CPE	Centrally planned economies (Former CPE are identical to EIT)
EIT	Economies in Transition
EU	European Union
FCCC	Framework Convention on Climate Change
GDR	Former German Democratic Republic (since 1990 part of Germany)
Gg	Gigagram (identical to kt = kiloton)
IPCC	Intergovernmental Panel on Climate Change
LULUCF	Land Use, Land Use Change and Forestry
Mtoe	Million tons of oil equivalent
RF	Russian Federation
Tg	Teragram
UAE	United Arab Emirates
UK	United Kingdom
USA	United States of America