I.1. Historical Trends

According to IEA data, world carbon emissions excluding FSU/CEE (where reliable data are not available for the whole period) grew by 2.1 per cent per annum from 1971 to 1992. Over the same period, energy use grew by 2.5 per cent per annum on average, implying an average annual improvement in carbon intensity per unit of energy of about 0.4 per cent.

Table 2.1: **Average Annual Increase in Energy Demand and Energy-Related CO_2 Emissions**
(% p.a.)

	1971 to 1992		1992 to 2010			
			CC		*ES*	
	Energy	CO_2	Energy	CO_2	Energy	CO_2
OECD	1.5	0.8	1.2	1.1	0.8	0.5
ROW	5.5	5.3	4.2	4.1	3.9	3.8
World (ex FSU/CEE)	2.5	2.1	2.4	2.4	2.0	2.0
FSU/CEE	1.9	0.6	0.6	0.5	-0.1	-0.3
World	2.4	1.7	2.1	2.1	1.7	1.6

The significant difference between the growth rates of CO_2 emissions and energy consumption in the OECD over the period 1971 to 1992 arose due to the substantial growth of nuclear power. The share of nuclear power in total primary energy rose from less than 1 per cent in 1971 to over 10 per cent in 1992 or, in terms of its contribution to the electricity output mix, from 2.8 per cent to 23.5 per cent. Over the outlook period, nuclear power is expected to increase by only 0.8 per cent per annum and to lose share in the primary energy fuel mix. Consequently, *ceteris paribus*, the evolution of CO_2 emissions will follow energy demand much more closely than in the past. If an alternative measure of primary energy demand were chosen, one that does not weight nuclear power so heavily,[1] primary energy consumption grew by only 2.1 per cent per annum from 1971 to 1992, much closer to growth in carbon emissions.

In the OECD, energy intensity improved by 1.3 per cent over this period implying a reduction in carbon per unit of GDP of approximately 2 per cent per annum. In ROW, over the same period, energy intensity rose by an average of 1.1 per cent per annum implying an increase in carbon intensity per unit GDP of about 0.9 per cent.[2] By 1992, OECD carbon emissions per unit GDP measured at purchasing power parities were about 5 per cent less than those of the ROW countries.

If population is taken into account, however, there is a marked difference between the two regions. The OECD emits nearly seven times as much carbon per capita as the ROW countries. This ratio is projected to fall to between four and five over the outlook period.

1. See Appendix 2 for a brief description of primary energy accounting and tables of primary energy compiled on such a basis.

I.2. The Outlook for Energy-Related CO_2 Emissions

As shown in Table 2.2, global energy-related CO_2 emissions in 2010 are projected to grow by over 40 per cent over their 1990 level under the *Capacity Constraints* (*CC*) case and by about 30 per cent in the *Energy Savings* (*ES*) case. Most of the increase in emissions is expected to occur in ROW, where CO_2 emissions are projected to more than double under each case. In the OECD countries, CO_2 emissions in 2010 will exceed their 1990 level by almost 24 per cent in the *CC* case and by over 11 per cent in the *ES* case.

In both cases, growth in CO_2 emissions in the OECD is highest in the Pacific region. Japan accounts for 80 per cent of the region's primary energy demand and for three quarters of its CO_2 emissions. Developments in Japanese energy demand and changes in its fuel mix are, therefore, of greatest significance for the region's emission levels. The relatively large increase in emissions can be explained by the growing share of solid fuels in total primary energy in Japan. In fact, the increase in emissions would be even greater without the expected large increase in nuclear power. European emissions rise almost in line with total energy demand. The increase in the share of natural gas, which should reduce the growth in emissions in OECD Europe, is offset by the assumed reduction in the share of nuclear power. In North America, like Europe, increased gas penetration compensates for the falling share of nuclear power and emissions grow roughly in line with energy demand.

The highest increase in CO_2 emissions is expected to occur in ROW, where emissions will increase from 6 billion tonnes of CO_2 in 1990 to around 13 billion tonnes in 2010. By the end of the projection period, therefore, ROW countries will become slightly larger emitters of CO_2 than the OECD and will account for nearly 45 per cent of the world total. The major reason for the increase in ROW share is the much faster energy demand growth in these countries, more than three times the growth rate in the OECD.

2. One factor influencing these trends is the relocation of the iron and steel industry, an issue discussed in detail in Section V of this chapter.