

## 9. Climate change

policy issue	indicator	assessment
achieving the Kyoto Protocol targets	total emissions of greenhouse gases	
controlling emission reduction - contributions across sectors	emissions of greenhouse gases by sector and gas	
maintaining average temperatures below provisional 'sustainable targets'	global and European mean temperature	

*Total greenhouse gas emissions in the EU have decreased (by 3.5 % between 1990 and 2000) and thus the EU is about halfway towards reaching its Kyoto target for 2008–2012 assuming only domestic measures will be used. Decreases of carbon dioxide and methane emissions from the energy supply sector and industry, nitrous oxide emissions from the chemical industry and methane emissions from landfills were achieved, but these were offset by increases of carbon dioxide emissions from road transport. However, positive progress in reducing emissions to date is misleading as 'one-off' gains have delivered much of the improvements in the energy supply sector and industry. Germany and the UK are well below their linear target Kyoto ('Burden sharing agreement') target path, but most EU Member States are significantly above this path.*

*Substantial further emission reductions from all sectors are needed to reach the EU and national targets; total EU greenhouse gas emissions are projected to be at the 1990 level by 2010, with existing policies and measures. Emissions from the transport sector are projected to rise by more than 30 % by 2010. All Member States, except UK, Germany and Sweden, project their baseline emissions (by 2010) to be above their Burden sharing target.*

*Global mean temperature has increased about 0.6° C over the past 100 years. In Europe, the mean temperature in 2000 was an absolute record for the past 100 years. There is new and stronger evidence that most of the warming observed over the past 50 years is attributable to human activities.*

Climate change, and avoiding its potential consequences, is addressed by

the United Nations Framework Convention on Climate Change (UNFCCC). Achieving 'sustainable' atmospheric greenhouse gas concentrations would require substantial (50 to 70 %) global reductions in greenhouse gas emissions, far beyond the targets set at Kyoto, which are for a 5 % reduction of developed countries' emissions from 1990 levels by 2008–2012. For the EU, the Kyoto Protocol sets a target of a reduction of 8 % for this period for the basket of six greenhouse gases. In June 1998, EU Member States agreed a system of 'burden sharing' or 'target sharing'. The European Community reaffirmed these targets for Member States in the agreement on ratification of the Kyoto Protocol (European Commission, 2001a; European Community, 2002).

In November 2001 agreement was reached within the UNFCCC on many of the rules and guidelines for the use of both the Kyoto mechanisms (joint implementation, clean development mechanism, international emissions trading) and the sinks for meeting the Kyoto targets (UNFCCC, 2002). This enables countries, as well as the EU, to ratify in 2002. By early 2002, 47 parties had ratified the Kyoto Protocol but, as yet, no major developed country. The Protocol will enter into force when it has been ratified by at least 55 parties to the Convention, including developed countries accounting for at least 55 % of carbon dioxide emissions from this group in 1990. After the Kyoto Protocol has entered into force, the European Community and the Member States

could also use the Kyoto mechanisms and sinks to meet their targets.

Greenhouse gas emissions (with their percentages of total emissions in 1999, weighted to take account of their different global warming potentials), originate from:

- carbon dioxide (81 %), the main greenhouse gas, mainly from fossil fuel combustion;
- methane (9 %) from agriculture (cattle and manure management), waste (waste disposal in landfills) and fugitive emissions from fuels (e.g. in gas distribution networks);
- nitrous oxide (8 %) from agriculture (soils and fertiliser use), industrial processes (mainly adipic and nitric acid production) and, as a by-product, passenger-car catalysts;
- industrial fluorinated gases (hydro-fluorocarbons, perfluorocarbons, sulphur hexafluoride) (2 %).

EU policy actions to reduce emissions are delivered through the European Climate Change Programme (ECCP), which was established in June 2000 to help identify the most cost-effective measures (i.e. at costs less than 20 EUR per tonne carbon dioxide equivalent). Important existing measures are:

- the agreement with the European, Japanese and Korean car industry to reduce carbon dioxide emissions from new passenger cars by 25 % between 1995 and 2008;
- the requirement of the Landfill Directive to reduce the amount of organic waste to landfills and to collect landfill gas for energy use;
- Directives on energy-efficiency requirements for appliances and agreements on minimum energy standards.

Various Member States have adopted comprehensive national programmes to reduce greenhouse gas emissions with a wide range of policies and measures for different sectors, for example energy saving in industry through negotiated agreements and programmes to promote

renewable energy sources. Carbon dioxide taxes are in place in Denmark, Finland, Germany, Italy, The Netherlands, Norway, Sweden and the United Kingdom (see Chapter 15). The UK introduced a national emission-trading scheme in 2002.

ECCP reports (European Commission, 2001b) identified new policies and measures, resulting in proposals for Directives on:

- emission Trading (European Commission, 2001c) (industrial sector)
- bio-fuels (energy and transport sector)
- promotion of renewable energy sources (energy sector)
- energy performance of buildings (energy sector)
- energy efficient public procurement (energy sector)
- fluorinated gases (industrial sector).

Other recent Commission efforts, which are also expected to reduce greenhouse gases, include an Action Plan for Improved Energy Efficiency in the Community, a Green Paper on the Security of Energy Supply and a White Paper on a Common Transport Policy (see Chapters 4 and 5).

#### UK launches greenhouse gas emissions trading scheme

The UK Emissions Trading Scheme is the world's first economy-wide greenhouse gas trading system. Emissions trading is an approach designed to allow greenhouse gas emission reductions to be made in the most economically efficient way. Emissions trading is already being developed internationally - the European Commission has proposed that EU-wide trading at company level should begin in 2005 and the Kyoto Protocol envisages global trading in greenhouse gas emissions from 2008. The UK scheme is voluntary and started on 1 April 2002. The scheme will allow UK businesses and other organisations to gain valuable experience of emissions trading. The UK Government is making available up to EUR 343 million over 5 years for companies which voluntarily take on emission reduction targets for greenhouse gases. Companies can meet targets by reducing their emissions or by buying surplus allowances from another participating organisation. Firms have the choice of entering just carbon dioxide emissions or the basket of six greenhouse gas emissions covered by the Kyoto Protocol. Failure to meet voluntary targets can result in financial incentives being withheld or having to be repaid with interest. Additionally, the UK Government intends to publish a list of those firms failing to meet their annual targets. The scheme could significantly cut the cost to UK companies of complying with the Kyoto Protocol. A total of 34 companies are set to participate, including: British Airways; BP; Shell; and TotalFinaElf. However, it should be noted that critics have indicated that half of the planned emission reductions are either not real ('hot air') or would be achieved anyway.

Source: <http://www.defra.gov.uk/environment/climatechange/trading/index.htm>

### 9.1. Total emissions of greenhouse gases

*Environmental signals 2000 and 2001* reported a downward trend in emissions of greenhouse gases by 1998 and this has been continued with a further 2 % decrease in 1999. Recent data (EEA, 2002) show that these emissions increased 0.3% from 1999 to 2000, and thus decreased 3.5% from 1990 to 2000. The favourable situation to date is misleading, as it is largely a result of considerable cuts in emissions in Germany and the UK, which together account for around 40 % of total EU greenhouse gas emissions. About half of the reduction in Germany and the UK (18.7 % and 14.0 % respectively) was due to one-off factors.

The emissions drop was due to a combination of favourable factors, some of which will not be repeated, including introduction of technical measures to reduce nitrous oxide emissions at adipic and nitric acid production plants in

France and the UK and HFC emissions from the UK industry, a continuation of the shift from coal to gas seen during the 1990s, particularly in Germany and the UK, and relatively mild winters in Germany, UK, France and The Netherlands which reduced energy use for indoor heating.

Total EU carbon dioxide emissions decreased by 1.0 % from 1990 to 1999. Recent data (EEA, 2002) show that carbon dioxide emissions increased 0.5 % from 1999 to 2000, and thus decreased by 0.5 % from 1990 to 2000. Thus the EU target to stabilise carbon dioxide emissions at 1990 levels by 2000 was achieved. Carbon dioxide emissions increased from 1999 to 2000 by 1.2 % in the UK and stabilised in Germany.

In France, nitrous oxide emissions from transport increased significantly while large reductions were achieved in nitrous oxide emissions from the chemical industry. Transport and electricity production were the sources

Table 9.1. Progress towards Kyoto Protocol and burden sharing targets

Notes: Including all six Kyoto Protocol greenhouse gases, but excluding land-use change and forestry. Base year is 1990 for all gases except fluorinated gases (base year is assumed to be 1995). The change in greenhouse gas emissions from Denmark is — 4.6 % if Danish greenhouse gas emissions are adjusted for electricity trade in 1990 (this methodology is used by Denmark to monitor progress towards its national target).

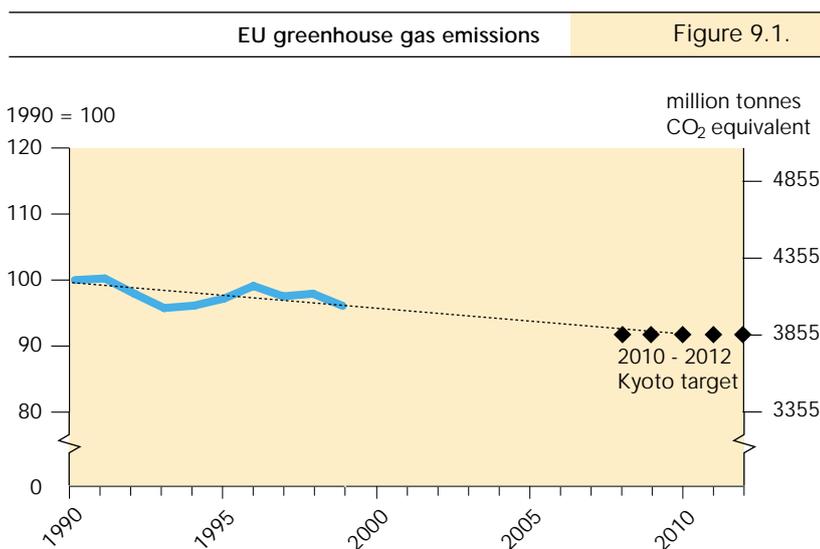
Country	Greenhouse gas emission change 1990-1999 (%)	Kyoto (Burden sharing) target for 2008-2012 (% from 1990)
Luxembourg	-46	-28
Germany	-19	-21
United Kingdom	-14	-12.5
Finland	-1	0
France	0	0
Sweden	2	4
Austria	3	-13
Denmark	4	-21
Italy	4	-6.5
Belgium	6	-7.5
Netherlands	7	-6
Greece	17	25
Ireland	22	13
Portugal	23	27
Spain	24	15
<b>EU Total</b>	<b>-4</b>	<b>-8</b>

of increases in Italy while emissions in Ireland, Portugal and Spain have increased by more than 20 % since 1990 due to large increases in energy consumption in several sectors and increased passenger road transport due to high economic growth (in particular in Ireland).

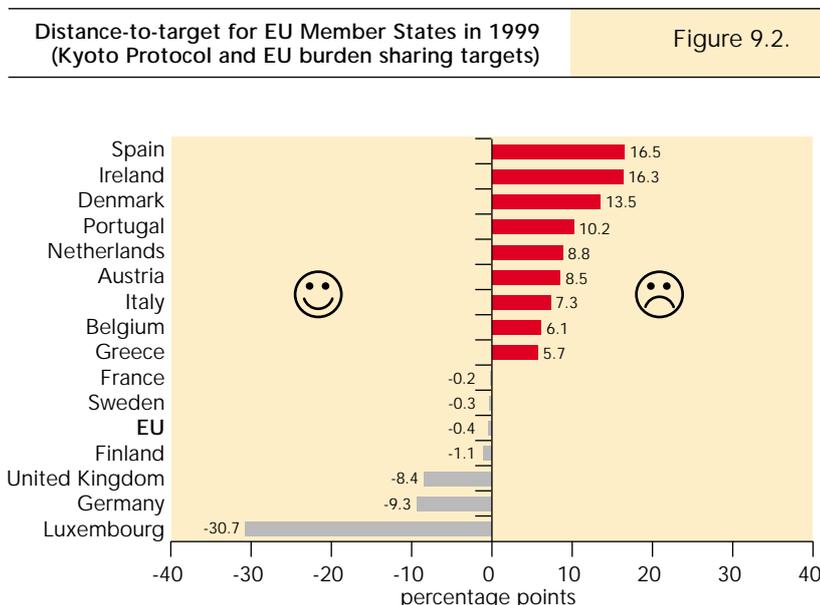
Based on both Community-wide (European Commission, 2001d; EEA, 2001) and Member State projections, EU greenhouse gas emissions are currently projected to stabilise at around 1990 levels by 2010, with existing policies and measures, including for example the agreement with the car industry to reduce carbon dioxide emissions from new passenger cars. Only the UK, Germany and Sweden project their emissions to achieve their Kyoto Burden sharing target. Achieving the Kyoto Protocol targets for the EU and the Member States are therefore expected to require large additional efforts.

Emission trends in the transport sector are of particular concern. Projections of greenhouse gas emissions from the transport sector indicate a rise of more than 30 % by 2010 (excluding emissions from international transport which were estimated to be 6 % of total EU greenhouse gas emissions in 1999).

Member States have identified additional national policies and measures that could help achieve a 5 % reduction from 1990 emissions (about 210 million tonne CO<sub>2</sub> equivalent). This still leaves a gap of 3 % (about 110 million tonne CO<sub>2</sub> equivalent). Additional savings have been identified by several Member States, and the European Climate Change Programme (ECCP) (about 240 million tonne CO<sub>2</sub> equivalent, partly overlapping with reduction potentials identified by Member States). The technical potential to meet the target through domestic policies and measures therefore exists, but success is dependent on political acceptability and the timing of the delivery of these policy measures.



Source: EEA, based on Member States data reported to UNFCCC and European Commission



Note: The distance-to-target indicator is a measure of how close the current emissions (1999) are to a linear path of emissions reductions (or allowed increases) from 1990 to the Kyoto target for 2008-2012 (for total greenhouse gas emissions), assuming that only domestic measures will be used. The targets are the EU Kyoto Protocol target and for each Member State the EU burden sharing agreement targets. All six Kyoto gases are included, but land-use change and forestry are excluded. The unit is percentage points with 1990 emissions being 100 %. For example, if a country's target is 10 % reduction (by 2008-2012) from 1990 levels, the theoretical 'target' in 1999 would be a reduction of 4.5 %. If the actual emission in 1999 is an increase by 3 % the 'distance to target' index is 3+4.5 or 7.5 percent points. The Danish distance-to-target is 4.9 index points, if Danish greenhouse gas emissions are adjusted for electricity trade in 1990 (this methodology is used by Denmark to monitor progress towards its national target).

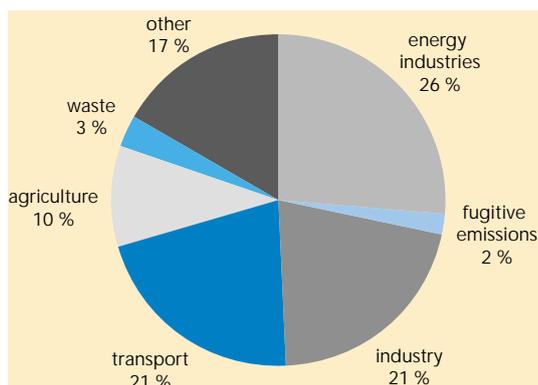
Source: EEA, based on Member States data reported to UNFCCC and European Commission

☹️ EU total greenhouse gas emissions have decreased by 3.5 % from 1990 to 2000 and are projected to stabilise at 1990 levels by 2010. However, without further policy measures nine Member States are likely to significantly exceed their agreed share of the EU total allowed emissions under the Kyoto Protocol which requires an 8 % reduction from 1990 levels.

Quality of information ☆☆☆

Figure 9.3. Greenhouse gas emissions by sector, 1999, EU

Source: EEA, based on Member States data reported to UNFCCC and the European Commission



## 9.2. Emissions of greenhouse gases by sector and gas

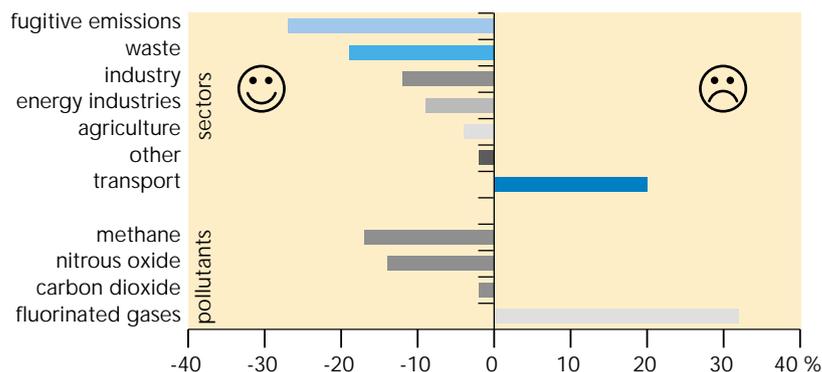
Attempts to control greenhouse gas emissions vary between sectors. Increases from transport are a particular problem, with carbon dioxide emissions from the sector (21 % of total emissions) increasing by 18 % between 1990 and 1999 due to road transport growth in almost all Member States (see Chapter 4). HFC emissions (1 % of total emissions) from industrial processes have increased by 66 % as a result of the expanding use of these chemicals as substitutes for ozone-depleting CFCs, which were gradually phased out in the 1990s.

The energy sector, electricity and heat production and petroleum refining, (see Chapter 5), the largest source of greenhouse gas emissions, with 26 % of the total, has seen carbon dioxide emissions fall by 9 % due to fuel shifts from coal to gas in the UK, efficiency improvements and increased use of combined heat and power generation in Germany and other Member States, increases in wind power generation in Germany, Denmark and Spain.

Other sectors providing reduced emissions include:

- chemical industry: reduced nitrous oxide emissions (1.2 % of total emissions), by 57 % due mainly to specific measures at adipic acid production plants in the UK, Germany and France;
- manufacturing: reduced carbon dioxide emissions (14 % of total emissions), by 9 % through efficiency improvements in several Member States and economic restructuring in Germany's manufacturing industry;
- solid waste: reduced methane emissions (2.6 % of total emissions), by 22 % in advance of the implementation of the EU landfill Directive (see Chapter 13);
- agriculture: reduced methane and nitrous oxide emissions due mainly to reduced animal numbers.

Figure 9.4. Greenhouse gas emissions changes by sector and gas, 1990–1999, EU



Source: EEA, based on Member States data reported to UNFCCC and the European Commission

☹️ The transport sector is of particular concern where projections indicate a rise in greenhouse gas emissions of more than 30 % by 2010. In some areas emissions have been reduced, but further substantial reductions from all sectors are needed.

Quality of information ☆☆☆

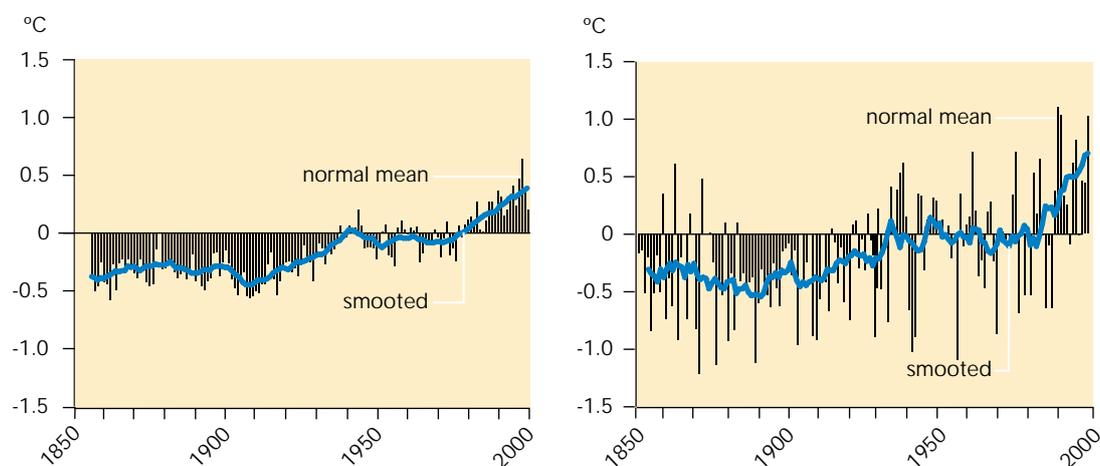
### 9.3. Global and European mean temperature

Global temperature increase is the most widely understood aspect of climate change. There is mounting evidence that emissions of greenhouse gases are causing an increase in global and European surface air temperatures. The potential consequences of further increased global temperatures include: rising sea levels, changing patterns of precipitation, floods and droughts, changes in biota and food productivity and increase of infectious diseases. These effects will have impacts on socio-economic sectors, such as agriculture, and on water resources.

Global mean temperature has increased by about  $0.6^{\circ}\text{C}$  over the past 100 years, with land areas warming more than the oceans. There is new and stronger evidence that most of the warming observed over the past 50 years is attributable to human activities (IPCC, 2001). The temperature increase in Europe during the 1990s is consistent with the global trend, although natural variations are larger. For Europe, the average temperature in 2000 showed an absolute record for the last 100 years. The annual average temperature was  $1.15^{\circ}\text{C}$  above the 1961–1990 average. The temperature extreme was caused mainly by a warm beginning and end of the year.

Observed annual average temperature deviations

Figure 9.5.



**Note:** Temperature plotted as the difference (deviation) from the 1961 to 1990 average ( $^{\circ}\text{C}$ ). The bars depict the annual average; the line gives a 10-year smoothed trend.  
**Source:** Climatic Research Unit and Met. Office Hadley Centre (UK); Jones et al, 1999, Jones, pers. comm.

☹ Globally, the 1990s was the warmest decade of the millennium. It is likely that the increase of Northern Hemisphere surface temperatures in the 20th century was greater than during any other century in the last 1000 years.

Quality of information ☆☆☆

 [http://themes.eea.eu.int/Environmental\\_issues/climate/indicators/Average\\_temperatures/index\\_html](http://themes.eea.eu.int/Environmental_issues/climate/indicators/Average_temperatures/index_html)

The objective of the United Nations Framework Convention on Climate Change (UNFCCC) is to achieve stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interferences with the climate system but would allow sustainable economic development. The basis for determining what constitutes 'dangerous anthropogenic interferences' will vary among regions, depending, for example, on the local characteristics and consequences of climate change, and the ability to adapt to climate change. Achieving 'sustainable' greenhouse gas concentrations would require substantial (50 to 70 %) global reductions in greenhouse gas emissions, far beyond those set at Kyoto.

The EU Council of Ministers has proposed that global temperatures should not exceed 2° C above pre-industrial levels, which means 1.4° C above current global mean temperature. Provisional sustainable targets consistent with the EU proposal have also been proposed: limiting temperature rise to 0.1 °C per decade and sea level rise to 2 cm per decade.

Achieving the UNFCCC and EU goals represents a major challenge as anthropogenic climate change is expected to persist for many centuries (IPCC, 2001). Current prospects are that, without further climate change mitigation efforts, human influences will continue to change atmospheric composition throughout the 21<sup>st</sup> century. Between 1990 and 2100 the global average temperature and sea level are projected to rise by 1.4 to 5.8° C and 0.1 to 0.9 m, respectively, with much larger changes in the longer term.