Environmental issue report | No 36

Greenhouse gas emission trends and projections in Europe 2003

Tracking progress by the EU and acceding and candidate countries towards achieving their Kyoto Protocol targets

European Environment Agency

Cover design: EEA
Layout: EEA

Prepared by: Bernd Gugele, Bernd Strobel, Peter Taylor — European Topic Centre on Air and Climate Change
Project manager: André Jol, EEA

Cataloguing data can be found at the end of this publication.

Luxembourg: Office for Official Publications of the European Communities, 2004

ISBN 92-9167-632-2

Environmental production
This publication is printed according to the highest environmental standards.

Printed by Scanprint a/s
— Environment Certificate: ISO 14001
— Quality Certificate: ISO 9001: 2000
— EMAS registered — licence no. DK- S-000015
— Approved for printing with the Nordic Swan environmental label, licence no. 541 055

Paper
— 100 % recycled and chlorine-free bleached paper
— The Nordic Swan label

Printed in Denmark

European Environment Agency
Kongens Nytorv 6
DK-1050 Copenhagen K
Denmark
Tel. (45) 33 36 71 00
Fax (45) 33 36 71 99
Enquiries: http://www.eea.eu.int/enquiries
Website: http://www.eea.eu.int

Contents

Key messages

In 2001, greenhouse gas emissions in the EU had fallen by 2.3 % relative to the base year (1990), little more than a quarter of the way towards meeting the EU greenhouse gas emissions target for 2010. Five Member States (France, Germany, Luxembourg, Sweden and the United Kingdom) were on track towards reaching their burden-sharing targets with domestic policies and measures, while the other 10 Member States were not on track.

Between 1990 and 2001, carbon dioxide (CO_2) emissions from energy industries (28 % of total emissions) declined by 2 %, while final electricity consumption increased by 23 %, showing a decoupling in all Member States. EU carbon dioxide emissions from domestic transport (28 % of total emissions), mainly by road, increased by 20 %. Carbon dioxide emissions from international aviation and navigation, not covered by the Kyoto Protocol (6 % of total emissions in 2001), increased by 44 % from 1990 levels.

Between 1990 and 2001, EU carbon dioxide emissions from fossil fuel use in manufacturing industries and nitrous oxide emissions from chemical industries decreased by 9 % and 54 %, respectively (industry accounts for 20 % of total emissions). Over the same period EU nitrous oxide emissions from agricultural soils declined by 8 % and EU methane emissions from enteric fermentation (by cattle) declined by 9 % (agriculture accounts for 10 % of total emissions). EU methane emissions from landfills (accounting for 2 % of total emissions) declined by 28 %. Between 1995 (the base year for fluorinated gases) and 2001, EU hydrofluorocarbon emissions, accounting for 0.8 % of total EU greenhouse gas emissions, increased by a factor of four. Carbon dioxide emissions from households increased by 7 % from 1990 to 2001 after a decline below 1990 levels in 2000 (households, small commercial businesses and services account for 17 % of total emissions).

With existing domestic policies and measures, projections for the EU show total greenhouse gas emissions decreasing only slightly by 0.5 % between 1990 and 2010. This leaves a shortfall of 7.5 % in reaching the EU target of an 8 % reduction. Sweden and the United Kingdom project that existing domestic policies and measures will be sufficient to meet their burden-sharing targets and they may even over-deliver on their targets. If these two countries did no more than meet their agreed targets, the EU reduction would be just 0.2 %. Austria, Belgium, Denmark, Finland, France, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain are all projected to fall short of their burden-sharing targets by 2010 with existing domestic policies and measures. Germany projects it will almost reach its target with existing domestic measures.

Savings from additional domestic measures being planned by Member States would result in emission reductions of about 7.2 %, almost sufficient to cover the shortfall and thus meet the target. However, this relies on over-delivery by some Member States (Finland, France, Greece, Ireland, Sweden and the United Kingdom) compared with their burden-sharing targets. However if no over-delivery by these Member States is considered, the EU as a whole will achieve a 5.1 % reduction with additional policies and measures. This leads to a shortfall of 2.9 % from the EU's Kyoto target in 2010.

EU-wide projections of energy-related CO_2 emissions show an increase of 4 % between 1990 and 2010, which is in line with the aggregated Member State projections. However, there are significant differences for individual Member States.

The EU has adopted some and the European Commission has proposed additional common and coordinated policies and measures that would result in additional emission reductions, potentially covering the gap between the projection based on existing domestic measures and the EU target. Policies and measures include the EU greenhouse

gas emission trading scheme, promotion of electricity from renewable energy, promotion of combined heat and power (CHP), improvements in the energy performance of buildings and energy efficiency in large industrial installations, and promotion of the use of energy-efficient appliances.

Emissions from energy supply and use (excluding transport) are projected to increase by 2 % by 2010 in the 'with existing domestic measures' projections, but decrease by 6 % below 1990 levels by 2010 in the 'with additional domestic measures' projections. Renewable energy targets for the EU (of 22 % of gross electricity consumption) and Member States for 2010 are unlikely to be met under current trends. The current rate of increase in combined heat and power (CHP) is not sufficient to achieve the EU target of 18 % for the share of CHP in total electricity production by 2010.

Emissions from transport are projected to increase by 34 % from 1990 levels by 2010 in the 'with existing domestic measures' projections. Average carbon dioxide emissions of new passenger cars were reduced by about 10 % from 1995 to 2001, suggesting that the target of the EU, of 140 g carbon dioxide/km (by 2008/09 at the latest), agreed with the automobile industry, is achievable. Past and projected increases in passenger transport by road will make an absolute reduction or even a limitation in carbon dioxide emissions from passenger cars by 2010 difficult to achieve. Nitrous oxide emissions from transport currently account for only 0.6 % of total EU greenhouse gas emissions. Emissions are projected to increase due to the projected increase in transport carried out by petrol cars equipped with catalysts.

EU-wide greenhouse gas emissions in agriculture are projected to decrease to 11 % below the 1990 level in 2010 in the projection based on existing domestic measures. EU greenhouse gas (fluorinated gases and nitrous oxide) emissions from industrial processes are projected to decrease by 2010 by 2 % from 1990 with existing domestic measures and by 22 % with additional domestic measures. EU-wide greenhouse gas emissions in the waste sector are projected to decrease by about 50 % from 1990 by 2010.

The projected use of Kyoto mechanisms for achieving the EU Kyoto target is so far limited to about 21 million tonnes (Mt) CO_2-equivalent per year of the commitment period (by the Netherlands and Portugal), and only a few countries have allocated financial resources (Austria, Finland, Sweden and the Netherlands). The Netherlands expects to achieve its target by a combination of domestic policies and measures and the use of Kyoto mechanisms. The projected use of carbon sinks for achieving the EU Kyoto target is so far limited, with an estimated removal by forestry and agricultural activities of 10 and 3 Mt CO_2 per year respectively.

In the 10 acceding and candidate countries total greenhouse gas emissions declined by 36 % in 2001 relative to the base year. All acceding and candidate countries except Slovenia were on track in 2001 to meet their Kyoto targets. Transport carbon dioxide emissions decreased by 19 % between 1990 and 1995, but increased afterwards and were above 1990 levels in 2001 for the first time (4 %).

Seven acceding and candidate countries (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Poland and Slovakia) project that existing domestic policies and measures will be sufficient to meet their Kyoto targets by 2010. Slovenia, however, projects increasing emissions by 2010 and therefore a shortfall from its Kyoto target.

Under the EU monitoring mechanism all Member States provided greenhouse gas inventory data for 1990 to 2001 for all gases. Two Member States have gaps in their data on fluorinated gases (Greece, Luxembourg). Several acceding and candidate countries did not provide greenhouse gas inventory data for 1990 to 2001 for all gases (Bulgaria, Czech Republic, Estonia, Hungary, Lithuania, Slovenia).

The quality of reporting of emission projections and policies and measures has improved for most Member States. Further improvements in reporting of inventories, projections and policies and measures are still needed, and proposals are being developed as part of the process of revising the monitoring mechanism during 2003 and 2004.

1 Introduction

Scope of the report

This report is an indicator-based assessment of European Community and acceding and candidate countries' (1) greenhouse gas emission trends, emission projections and existing and proposed policies and measures to reduce greenhouse gas emissions by 2010.

The report presents an assessment of the actual (1990 to 2001) and projected progress (by 2010) of the European Union (EU) and its Member States and of acceding and candidate countries towards achieving their emission targets under the UN Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol.

Main changes from the 2002 report

This year (2003) the report is published for a second time. The information in the report published at the end of 2002 on trends and projections (EEA, 2002a) has been updated with the most recent emission inventories submitted by all Member States (by April 2003). New emission projections and national programmes have also been taken into account, as available by May 2003.

For the first time a preliminary assessment of the use of Kyoto (flexible) mechanisms and 'carbon sinks' for meeting Member States' commitments is included, as reported by some Member States by May 2003.

Purpose of the report

The assessment is designed to provide policy-makers with the information necessary to identify the countries that are on track towards the targets, using domestic policies and measures as well as Kyoto mechanisms (based on limited available information). The report also identifies the socio-economic sectors that are contributing most, the effectiveness of existing domestic policies and measures — both national and Community-wide — in reducing or limiting emissions, and the extent to which additional domestic policies and measures or the use of Kyoto mechanisms might be required to achieve the targets. The report focuses on trends and domestic policies and measures in the main sectors (energy supply and use, transport, industry, agriculture, waste management).

The report, prepared by EEA and its European Topic Centre on Air and Climate Change (ETC/ACC), serves to support and complement the annual evaluation report of the European Commission to the Council and European Parliament, which is required under Council Decision 1999/296/EC for a monitoring mechanism of Community carbon dioxide (CO_2) and other greenhouse gas emissions (2) (European Commission, 2003a), which is being revised in 2003. The EEA report provides additional analyses to the Commission's annual report, and it follows the same model as other recent EEA indicator-based reports, in particular Energy and environment in the EU (EEA, 2002b, 2003b) and the Transport and environment reporting mechanism (EEA, 2002c, 2003c).

The monitoring mechanism is an instrument to assess accurately and regularly the extent of progress being made towards the Community's commitments under the UNFCCC and the Kyoto Protocol. Progress is evaluated by the European Commission,

(1) This report covers the ten central and eastern European acceding and candidate countries (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia), which are in this report referred to as 'acceding countries'. The report does not cover the other three acceding and candidate countries: Cyprus, Malta and Turkey.

(2) OJ L 117, 5.5.1999, p. 35.

in consultation with the Member States, and is based on national programmes supplied by the Member States and on other relevant information. The national programmes should include (a) information on actual progress and (b) information on projected progress, including domestic policies and measures, in line with the guidelines under the Decision.

Member States are required by 31 December each year to submit inventory data for the two previous years and any updates of previous years (including the base year 1990) and their most recent projected emissions for the years 2005, 2010, 2015 and 2020. Any updates to the national programmes, e.g. new domestic policy measures, should also be reported to the Commission by 31 December each year.

Reporting under the monitoring mechanism is voluntary for acceding and candidate countries, but will be mandatory after joining the EU. The central and eastern European acceding and candidate countries are, however, already required to report greenhouse gas emissions and national programmes to the UNFCCC and this report uses this information.

Assessment approach

The evaluation of progress towards the targets has two main components:

1. evaluation of actual progress in 2001 relative to the base year, based on an analysis of contributions of domestic policies and measures by sectors and countries to greenhouse gas emission trends (EEA, 2003a);

2. evaluation of projected progress up to 2010, based on an analysis of adopted and future (planned, or currently under discussion) domestic policies and measures at both national and Community levels: this evaluation is based on emission projections provided by Member States in their national programmes and on additional Community-wide projections (EEA, 2003a).

A third element is a limited comparison, for energy-related carbon dioxide emissions, between projections (in 2010) from the Member States and recent EU-wide assessments (for 2010).

An additional analysis of the extent to which Member States are preparing to use the flexible mechanism of the Kyoto Protocol to fulfil their commitments is included in this report for the first time. The assessment is based on information provided by eight Member States. A first analysis of the extent to which Member States intend to make use of land-use change and forestry (carbon sinks) to fulfil their commitments is also included in this report, although methods for estimation of emissions from and removals by carbon sinks are not yet internationally agreed.

These analyses are incorporated in two separate chapters in the last part of the report (see below). All emission and emission projections information in the first parts of the report focus on domestic policies and measures, excluding Kyoto mechanisms and emissions and removals from land-use change and forestry.

The report uses a number of indicators to address the following key questions (which are related to chapters in the report):

1. Which targets have to be achieved?

2. What is the actual progress of countries in limiting greenhouse gas emissions?

3. Is the projected progress of countries in limiting greenhouse gas emissions, based on existing and additional domestic policies and measures, sufficient to achieve targets by 2010?

4. What are the effects of existing and additional domestic policies and measures taken in the EU to limit greenhouse gas emissions by 2010?

5. To what extent do countries expect to use the Kyoto mechanisms and carbon sinks by 2010 in addition to domestic policies and measures?

6. Is the reporting scheme of the EU sufficient for assessing the progress of greenhouse gas emissions reduction?

The 'smiley' faces for each indicator or group of indicators aim, in this report, to provide the following assessment:


positive trend, moving towards the Kyoto or 'burden-sharing' target;


some positive development, but either insufficient to reach the Kyoto or burden-sharing target or a mixed trend within the indicator;


unfavourable trend, moving away from the Kyoto or burden-sharing

This approach can be applied in a transparent way for the overall assessment of trends in total greenhouse gas emissions. However, for the assessment of trends in emissions from sectors this is not as straightforward due to the lack of clear sectoral targets at the EU level, although some countries have set national sectoral emission targets.

Therefore, for sectors, the 'smiley' faces are used to assess the relative contribution of the specific sector to the trend. In some cases it is impossible to evaluate the trend because of data gaps. In those situations this is explained in the evaluation.

Another difficulty is the assessment of trends in acceding and candidate countries. For these countries fewer data are available, but in addition the different economic situation needs to be recognised. After the beginning of the transition to market economies, in the early 1990s, acceding and candidate countries experienced an economic downturn, although in varying degrees. Countries that were advanced in bringing about economic reform recovered earlier than other countries. In most acceding and candidate countries economic growth was restored in the second half of the 1990s.

2 Targets

2.1 Burden-sharing within the EU to fulfil the Kyoto Protocol

☺ The EU and its Member States have ratified the Kyoto Protocol.

☹ The Protocol has not yet entered into force because neither the United States nor Russia has ratified it.

Climate change, and avoiding its potential consequences, is addressed by the United Nations Framework Convention on Climate Change (UNFCCC) and remains a high priority in the EU. Achieving 'sustainable' atmospheric greenhouse gas (GHG) concentrations would require substantial (50 to 70 %) reductions in global greenhouse gas emissions (IPCC, 2001).

To take the first steps towards stabilisation of the world's climate, or at least a moderate sustainable climate change, the third Conference of the Parties (COP3) to the UNFCCC, held in Kyoto in December 1997, adopted different binding targets of greenhouse gas emissions for industrialised (called 'Annex 1') Parties, including the European Union (EU), in the Kyoto Protocol. The Kyoto Protocol requires a 5 % reduction in developed countries' emissions from 1990 levels by 2008–12 ([3]) of six greenhouse gases (carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6)). Under the Kyoto Protocol the EU agreed to reduce its greenhouse gas emissions by 8 % from 1990 levels by 2008–12 ([4]).

The European Commission has acknowledged the need for further emission reductions beyond 2012 by proposing an EU target to reduce emissions by an average of 1 % per year up to 2020 and a global target of 20 to 40 % reduction by 2020, both from 1990 levels (European Commission, 2001a and 2001b).

According to Council Decision 2002/358/EC ([5]), the EU and its Member States agreed in 2002 on different emission limitation and/or reduction targets for each Member State according to economic circumstances, called the burden-sharing agreement. Eight Member States agreed to reduction targets by 2008–12 (Austria, Belgium, Denmark, Germany, Italy, Luxembourg, the Netherlands and the United Kingdom). Two Member States (Finland and France) agreed to stabilise greenhouse gas emissions by 2008–12, whereas five Member States (Greece, Ireland, Portugal, Spain, Sweden) agreed to limit their increases by 2008–12. The targets range from a reduction of 28 % for Luxembourg to allowed but limited increases of greenhouse gas emissions of 27 % for Portugal. The largest absolute emission reduction has to be achieved by Germany, of about 250 million tonnes CO_2-equivalent (Mt CO_2-equiv.) ([6]) (Figure 2.1).

Earlier the UNFCCC had agreed that industrialised countries to this convention, including the EU, its Member States and the acceding and candidate countries, had to adopt policies and measures with the aim of returning their anthropogenic CO_2 and other greenhouse gas emissions,

(3) As an estimate for the commitment period 2008 to 2012, projections for the year 2010 are presented later in this report.

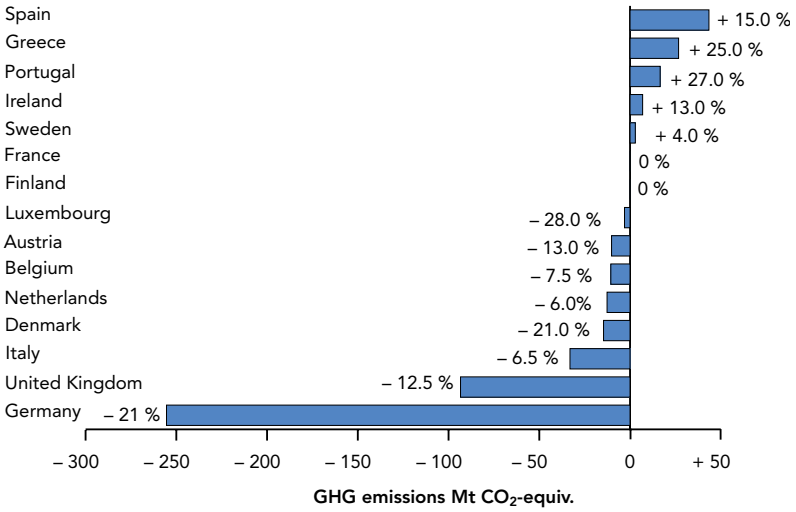
(4) For France, Finland and Greece, the base year is 1990 for emissions of all six greenhouse gases. For the other Member States the base year is a combination of 1990 emissions of CO_2, CH_4 and N_2O and 1995 emissions of HFCs, PFCs and SF_6 (the 'F-gases'). For the purpose of this analysis, total GHG emissions for the EU covering all Member States' emissions have been aggregated using 1995 as the base year for fluorinated gases for all Member States.

(5) Council Decision of 25 April 2002 concerning the approval, on behalf of the European Community, of the Kyoto Protocol to the United Nations Framework Convention on Climate Change and the joint fulfilment of commitments thereunder (2002/358/CE), OJ L 130, 15.5.2002, p. 1.

(6) All emission data provided in this report are in million tonnes CO_2-equivalent.

Figure 2.1 **Greenhouse gas emission targets of EU Member States for 2008–12 relative to base-year emissions under the EU burden-sharing decision (7)**

Source: EEA, 2003a.



individually or jointly (applying to the EU), by the year 2000 to 1990 levels.

At the seventh Conference of Parties (November 2001) of UNFCCC, agreement was reached on many of the rules and guidelines for use of the Kyoto mechanisms (joint implementation, clean development mechanism, international emissions trading) and of carbon sinks (8) for meeting the Kyoto targets.

By January 2003 the EU, all Member States (MS), all acceding countries (Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia) and two candidate countries (Bulgaria and Romania) had ratified the Kyoto Protocol. Turkey has not signed or ratified the UNFCCC and Kyoto Protocol. The Protocol will, however, only 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 CO_2 emissions from this group in 1990. By mid-2003, 109 countries had ratified the Protocol, but of those developed countries account only for about 44 % of CO_2 emissions. The Kyoto Protocol will come into force with the ratification of Russia. The other possible country, the United States, has withdrawn from the Kyoto Protocol.

2.2 The Kyoto Protocol targets of acceding and candidate countries

Acceding and candidate countries belong, within UNFCCC, to the group of countries undergoing the process of transition to a market economy (except Cyprus and Malta) and most of them have targets under the Kyoto Protocol (Figure 2.2) Czech Republic, Estonia, Latvia, Lithuania, Slovakia and Slovenia — and the candidate countries Bulgaria and Romania — have a target of a reduction of 8 % from the base year, while Hungary and Poland have a target of a reduction of 6 %. Cyprus and Malta have no targets.

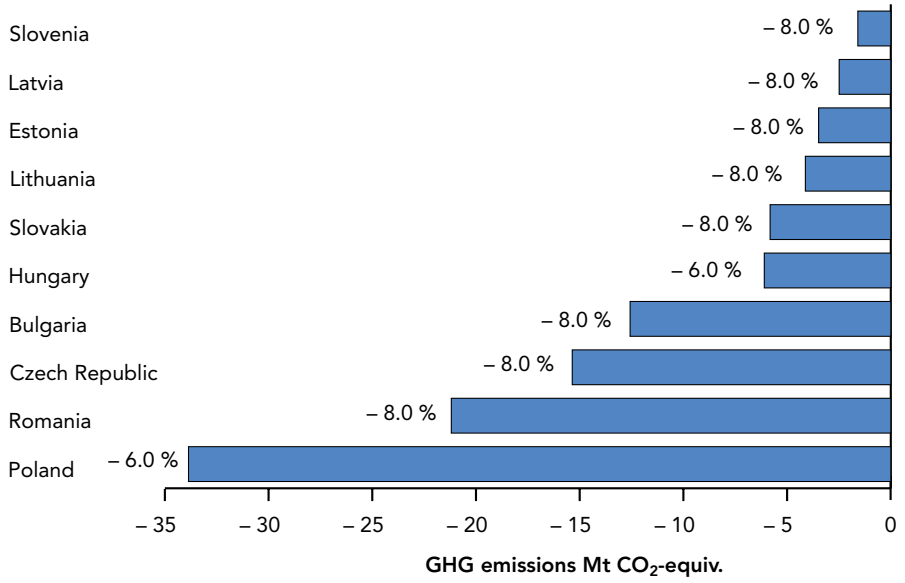
Poland has to achieve by far the largest absolute emission reduction of about 34 Mt CO_2-equiv.

(7) In the Council decision on the approval by the EU of the Kyoto Protocol (2002/358/EC) the different commitments of the Member States are expressed as percentage changes from the base year. In 2006 the respective emission levels will be expressed in terms of tonnes of CO_2-equivalent. In this connection, the Council of Environment Ministers and the Commission have in a joint statement agreed to take into account *inter alia* the assumptions in Denmark's statement to the Council Conclusions from 16–17 June 1998 relating to base-year emissions.

(8) Carbon sinks are officially called 'emissions and removals from land use, land-use change and forestry'. In the main part of this report carbon sinks are not regarded in the assessment of progress. However, a first overview on some Member States is given separately in Section 7. Furthermore, methods for calculating carbon sinks are still under development by the Intergovernmental Panel on Climate Change, and therefore the initial analysis will be revised in the coming years when additional data become available.

Source: EEA, 2003a.

Figure 2.2 **Greenhouse gas emission targets of acceding and candidate countries for 2008–12 relative to base-year emissions under the Kyoto Protocol**



Note: Countries with base years other than 1990 are Bulgaria (1988), Hungary (average 1985–87), Poland (1988), Romania (1989) and Slovenia (1986). Cyprus and Malta have no targets and Turkey is not a Party to UNFCCC.

3 Actual progress of the EU and acceding and candidate countries in limiting greenhouse gas emissions

3.1 Actual progress of the EU in limiting emissions in 2001 relative to the base year

😐 In 2001, greenhouse gas emissions in the EU were 2.3 % below the base-year level, taking the EU little more than a quarter of the way towards its greenhouse gas emission target. After an initial decrease in the early 1990s, emissions fluctuated, but remained below the base-year level.

😐 Greenhouse gas emissions increased by 1 % between 2000 and 2001.

☹ CO_2 emissions were up 1.6 % from 1990 levels in 2001, although earlier the target of stabilising CO_2 emissions (by 2000) had been achieved.

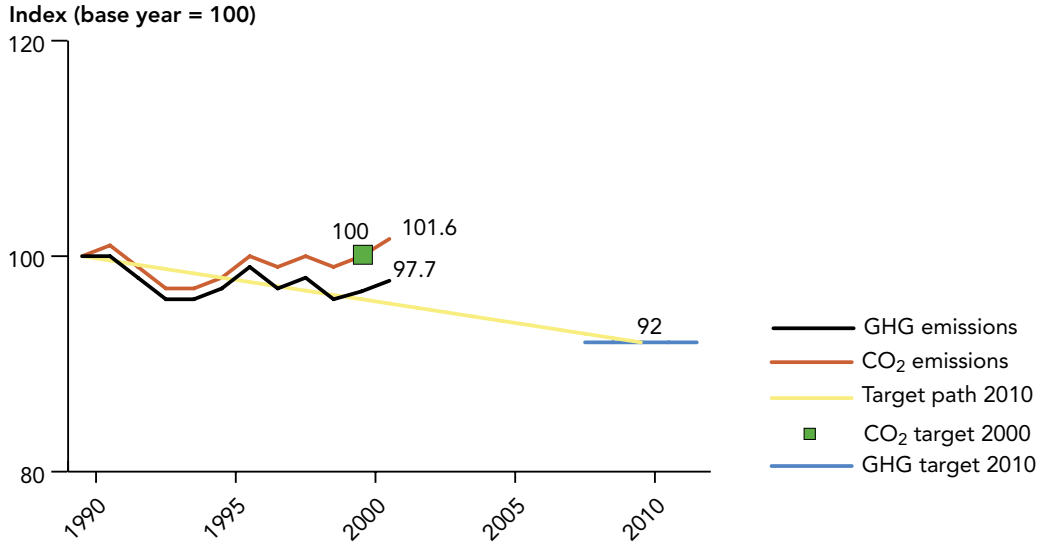
Total greenhouse gas emissions in the European Community (9) decreased by 2.3 % between 1990 and 2001. After half of the available time span this is little more than a quarter of the way towards meeting the EU greenhouse gas emission target of an 8 % reduction by the period 2008–12 (Figure 3.1).

Due to recalculations GHG emissions for 2000 are higher than reported in last year's trends and projections report (EEA, 2002a).

After an initial decrease in total greenhouse gas emissions by more than 4 % in the early 1990s, emissions fluctuated between reduction levels of 1 and 4 % compared with the base-year level in the second half of the 1990s. An increase of 1 % occurred between 2000 and 2001. A colder winter in most EU countries, and the related increase in the use of heating fuel in households, was the main reason for this rise. In

Figure 3.1 **Actual EU greenhouse gas emissions compared with targets for 2000 and 2008–12**

Source: EEA, 2003a.



Note: The target path is used to analyse how close 2001 emissions were to a linear path of emission reductions or allowed increases from the base year to the Kyoto Protocol target, assuming domestic measures are used. Data exclude emissions and removals from land-use change and forestry.

(9) Total GHG emissions for the EU are calculated by the aggregation of national GHG emissions reported by Member States (MS) and are referred to as EU-15 or EU emissions later in this report.

addition, emissions increased from growing transport demand and greater use of fossil fuels in electricity and heat production.

In the Kyoto Protocol, the EU agreed to reduce its greenhouse gas emissions by 8 % from 1990 levels between 2008 and 2012. Assuming a linear target path from 1990 to 2010, total EU greenhouse gas emissions were 2.1 index points (distance-to-target indicator (DTI)) above this target path in 2001 (Figure 3.1)

Carbon dioxide is by far the most significant greenhouse gas, accounting for 82 % of total EU GHG emissions in 2001. In the second half of the 1990s, EU CO_2 emissions stabilised, with emissions in 2000 being close to 1990 levels (less than 0.1 % point above). Thus, the EU aim of stabilising CO_2 emissions at 1990 levels by 2000 had been achieved (Figure 3.1). However, in 2001 EU CO_2 emissions (excluding land-use change and forestry) were up 1.6 % from 1990 levels.

Other gases contributing to EU greenhouse gas emissions are:

- methane (CH_4, share of 8 % in total EU greenhouse gas emissions with a decrease of 21 % from 1990 to 2001) from agriculture (cattle and manure management), waste (waste disposal in landfill sites) and fugitive emissions from fuel (e.g. in gas distribution networks);
- nitrous oxide (N_2O, share of 8 % in total EU greenhouse gas emissions with a decrease of 16 % from 1990 to 2001) from agriculture (soils and fertiliser use), industrial processes (mainly adipic and nitric acid production) and as a by-product of passenger car catalysts;
- industrial fluorinated gases (hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6), share of 1 % in total EU greenhouse gas emissions), mainly from replacement of ozone-depleting substances. All fluorinated gases together decreased by 2 % between 1995 and 2001.

3.2 Progress in limiting Member States' emissions in 2001 relative to the base year

☺ In 2001, five Member States were on track towards reaching their burden-sharing targets (France, Germany, Luxembourg, Sweden and the United Kingdom), with domestic policies and measures.

☹ In 2001, ten Member States were not on track to reach their burden-sharing targets with domestic policies and measures. Ireland, Portugal and Spain were heading towards exceeding their targets by more than 20 index points.

In 2001, five Member States (France, Germany, Luxembourg, Sweden and the United Kingdom) were near or below their burden-sharing target paths, thus close to or on track towards reaching their targets (Figure 3.2) ([10]). Ten Member States were well above their burden-sharing target paths (Ireland, Portugal and Spain by more than 20 index points) and were thus heading towards failing to meet their burden-sharing targets in 2001: Austria, Belgium, Denmark, Finland, Greece, Ireland, Italy, the Netherlands, Portugal and Spain.

The favourable situation for EU emissions in 2001 was largely a result of considerable cuts in emissions in Germany and the United Kingdom, which together accounted for around 40 % of total EU greenhouse gas emissions. The main reasons for this favourable trend in Germany were increasing efficiency in power and heating plants and the economic restructuring of the five new federal states following German reunification. The reduction of greenhouse gas emissions in the United Kingdom was partly the result of the liberalisation of the energy market and subsequent changes in the choice of fuel used in electricity production from oil and coal to gas, and partly due to significant reductions in emissions of non-CO_2 greenhouse gas emissions, including implementation of N_2O abatement

(10) In some Member States activities under the flexible mechanisms have already started, but the effects of these do not appear in the MS greenhouse gas inventories.

measures in the chemical industry. In both Member States the special circumstances mentioned above account for about 50 % of emission reductions for all six greenhouse gases, whilst specific policies and measures account for the remaining 50 % (Eichhammer *et al.*, 2001).

In 2001, greenhouse gas emissions in both Germany and the United Kingdom were higher than in 2000. In Germany, emissions from households and services increased mainly due to the relatively cold winter in 2000/01. The largest increases in the UK occurred from electricity and heat production.

France and Italy are the third and fourth largest emitters with shares of 14 % and 13 %, respectively. In 2001, France's greenhouse gas emissions reversed the decreasing trend seen between 1999 and 2000 and registered a slight increase of 0.5 % in 2001 on 2000 levels, and were 0.4 % above 1990 levels. France achieved large reductions in N_2O emissions from the chemical industry, but CO_2 emissions from transport increased considerably between 1990 and 2001. Italy's greenhouse gas emissions continued to rise in 2001 — albeit with a smaller yearly change — by 0.3 % above 2000 and 7 % above 1990 levels with increases primarily in the transport sector and electricity and heat production.

As the fifth largest emitter in the EU, Spain accounts for 9 % of total EU greenhouse gas emissions. In 2001, emissions were 32 % above the base-year level but the upward emission trends were turned into a 1 % decrease compared to 2000 due to increases in hydropower production and HFC reductions from production of halocarbons.

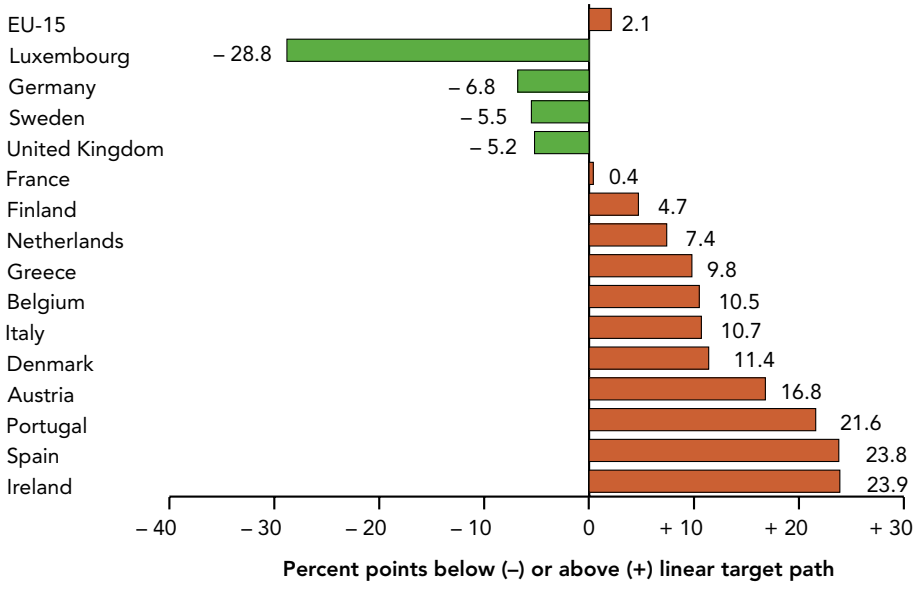
3.3 Sectors and gases responsible for EU emission trends between 1990 and 2001

3.3.1 Key emission trends

☺ Between 1990 and 2001 greenhouse gas emissions in the EU decreased in most sectors (industry, energy supply, agriculture, waste management).

Figure 3.2 **Distance-to-target (burden-sharing targets) for EU Member States in 2001 (with domestic policies and measures)**

Source: EEA, 2003a.



Note: The distance-to-target indicator (DTI) measures the deviation of actual emissions in 2001 from the (hypothetical) linear path between base-year emissions and the burden-sharing target for 2010. A positive value suggests an under-achievement and a negative value an over-achievement in 2001. The DTI gives an indication of progress towards the Kyoto and Member States' burden-sharing targets. It assumes that the Member States meet their target entirely on the basis of domestic measures. A preliminary analysis of the projected use of Kyoto mechanisms is presented separately in this report (Section 6).

☹ Emissions from transport showed an increase of 21 % in the same period.

The main contributions to total EU greenhouse gases emissions in 2001 by the following sectors were:

- energy industries (electricity sector and refineries), 28 %;
- transport (mainly CO_2 from fossil fuel combustion, but also N_2O), 21 %;
- industry (fossil fuel combustion and processes), 20 %;
- other (CO_2 from fossil fuel use by households, small commercial businesses and services), 17 %;
- agriculture (CH_4 and N_2O), 10 %.

Looking at trends in the main greenhouse gases from 1990 to 2001, methane and N_2O emissions decreased significantly by 21 % and 16 %, respectively. Emissions of fluorinated gases were 2 % below the 1990 level. However, CO_2 emissions increased by 2 % above the 1990 level.

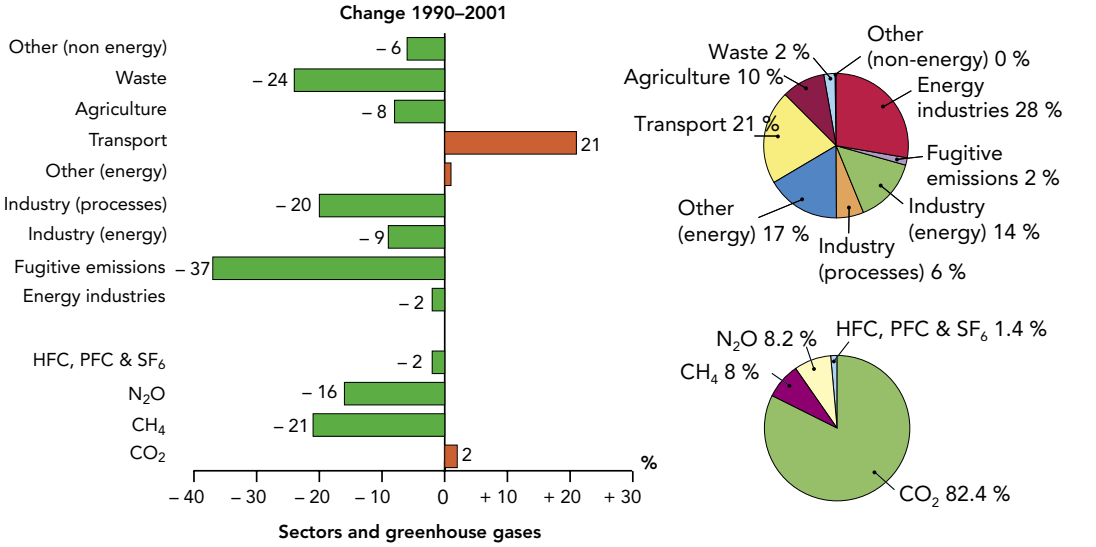
Sectors with increases in emissions (11)
Emissions from transport (Figure 3.3) excluding international transport, have risen rapidly since 1990. In 2001, CO_2 emissions had increased by 139 million tonnes or 20 % compared with 1990. This was mainly due to the growth in road transport in almost all Member States. Nitrous oxide emission increases from transport are mainly due to the increased use of catalytic converters, which reduce emissions of air pollutants but emit N_2O as a by-product. However, for newer catalytic converters N_2O emissions have been reduced dramatically.

The upward trend of total emissions of fluorinated gases was revised in 2001 into a decrease since 1990. However, industrial HFC emissions from consumption of halocarbons were still four times higher than in 1990. This was mainly due to the increased use of some HFCs as substitutes for ozone-depleting chlorofluorocarbons (CFCs), which were gradually phased out in the 1990s.

After decreasing trends in previous years, the other sectors of energy use, which include households and services, show CO_2 emissions in 2001 increased by 6 %

Source: EEA, 2003a.

Figure 3.3 **Change in EU-15 emissions of greenhouse gases by sector and gas 1990–2001 and contribution by gas in 2001**



Note: The sector 'Other (energy)' includes use of energy by households, small commercial businesses and services.

(11) Detailed analysis of trends of emissions of the six greenhouse gases by sector is provided in Annex 3 of this

over 2000, and 3 % over 1990 levels. Relatively low temperatures in the winter of 2000/01 in many Member States, with related increases in fuels needed for space heating, and the growing number of dwellings contributed to emission increases in this sector.

Sectors with reductions in emissions
The largest reductions in absolute terms were achieved in CO_2 emissions from fossil fuel combustion in the manufacturing industries mainly due to economic restructuring and efficiency improvements in the German manufacturing industry after German reunification. Emissions decreased by 57 million tonnes, or 9 %, from the 1990 level.

Nitrous oxide emissions from the chemical industry fell by 57 Mt CO_2-equiv., or 54 % from the 1990 level, mainly in France, Germany and the United Kingdom where specific measures in adipic acid production were taken.

Substantial methane reductions were achieved from solid waste disposal on land (31 Mt CO_2-equiv. or 28 % between 1990 and 2001) and fugitive emissions from solid fuels (33 Mt CO_2-equiv. or 69 % between 1990 and 2001). These reductions were mainly due to measures related to the implementation of the European landfill waste directive and the decline of coal mining after cuts in coal subsidies mainly in France, Germany and the United Kingdom.

CO_2 emissions in the energy industries sector (electricity and heat production) decreased by 25 Mt CO_2-equiv. or 2 % between 1990 and 2001. The 8 % reduction achieved in the 1990s has largely been lost due to increasing emissions in recent years.

All emission sources covering 98 % of total EU greenhouse gas emissions are given in the annex (Figure A3.1). Sectoral changes are discussed in more detail in the next sections.

3.3.2 Energy supply and use (excluding transport) (12)

☺ Between 1990 and 2001, carbon dioxide emissions from energy industries declined by 2 %, while final electricity consumption increased by 23 %, showing a decoupling in all Member States.

☺ About half the reduction was due to shifts in fuel use in power production from coal to natural gas whilst larger shares of electricity generation from renewable energy sources and nuclear power accounted for 34 %. Improved efficiency due to a switch to high-efficiency gas-turbine combined-cycle technology was responsible for the remaining 20 %.

☺ Carbon dioxide emissions from manufacturing industries decreased by 9 % between 1990 and 2001 and thus decoupled from gross value added (which increased between 1990 and 2000) in most Member States.

☹ Carbon dioxide emissions from households increased by 7 % from 1990 to 2001, while the number of dwellings increased by 12 %, showing some decoupling.

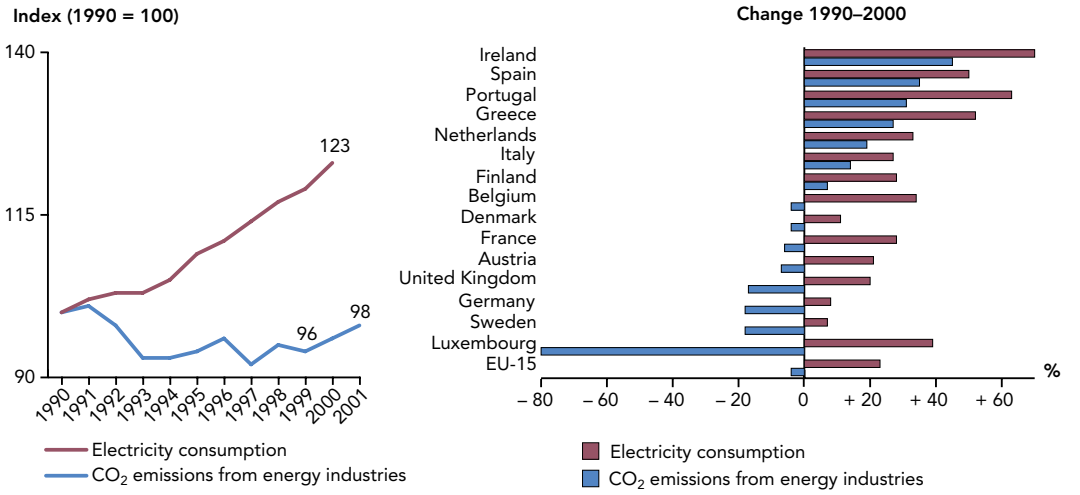
Energy industries are the most important source of CO_2 emissions, accounting for 27 % of the EU total. Energy industries include public electricity and heat production, petroleum refining and the manufacture of solid fuels.

Between 1990 and 2001, CO_2 emissions from energy industries fell by 2 % in the EU. The main driving force of CO_2 emissions from energy industries is production and consumption of electricity. In the EU final electricity consumption increased by 23 % between 1990 and 2000 (Figure 3.4). Carbon dioxide emissions from energy industries decoupled considerably from electricity consumption. This was mainly due to fuel shifts in power production from coal to natural gas, and larger shares of

(12) This sector includes energy supply and use, except energy use by transport. This corresponds to the sector '1. Energy', except '1.A.3 transport', according to UNFCCC guidelines for greenhouse gas inventories.

Source: EEA, 2003a.

Figure 3.4 **EU CO_2 emissions from energy industries compared with electricity consumption**



electricity generation from renewable energy sources and nuclear power, as well as efficiency improvements. In 2001, CO_2 emissions from energy industries grew by 2 percentage points compared with 2000, which was mainly due to increased use of fossil fuels for power production.

In several Member States CO_2 emissions from energy industries declined during the last decade whilst electricity consumption increased in all Member States (Figure 3.4). Only Germany and Sweden managed to limit growth in electricity consumption to below 10 %. A decoupling of electricity consumption and CO_2 emissions occurred in all Member States.

Carbon dioxide emissions from energy industries decreased significantly in Germany, Luxembourg, Sweden and the United Kingdom. In the energy industries this is largely explained by improved efficiency in Germany's coal-fired power plants and the fuel switch from coal to gas in power production in the United Kingdom. On the other hand, there was a considerable rise in emissions from energy industries in Greece, Ireland, Portugal and Spain. Improvements in efficient electricity use and supply will help countries to meet their targets.

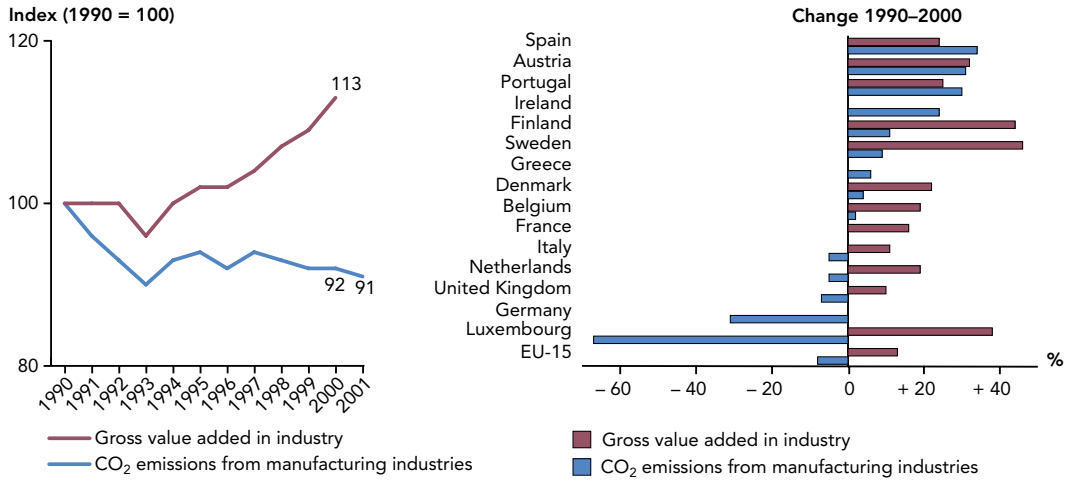
Carbon dioxide emissions from fossil fuel use in manufacturing industries accounted for 14 % of total EU greenhouse gas emissions in 2001 which is 1 percentage point less than in 2000. Between 1990 and 2001, CO_2 emissions from manufacturing industries declined by 9 %. Emission reductions were already achieved in 1993, and were mainly due to efficiency improvements and structural change in Germany after reunification and the relatively small economic growth in the EU (Figure 3.5). Between 1990 and 2000, industrial output — the main driving force for emissions from the industry sector — in terms of gross value added increased by 13 % (data for 2001 not available). Therefore, for the EU as a whole, CO_2 emissions from manufacturing industries decoupled from gross value added.

Most Member States achieved decoupling of CO_2 emissions and gross value added in industry, except Austria, Portugal and Spain. The decrease of Luxembourg's CO_2 emissions was mainly due to a sharp decline in coke consumption after the conversion of the steel industry to electric arc furnaces.

The highest degree of decoupling of CO_2 emissions from value added occurred in the chemical industry, followed by the food industry and glass, pottery and building. Less decoupling took place in the paper and printing, iron and steel, and textile industrial sectors (EEA, 2003a).

Figure 3.5 **EU CO_2 emissions from industry compared with value added**

Source: EEA, 2003a.



Carbon dioxide emissions from fossil fuel use in small commercial businesses, public institutions, small agricultural business and households ('small combustion') accounted for 16 % of total EU greenhouse gas emissions in 2001. Households account for two thirds of CO_2 emissions of this source category.

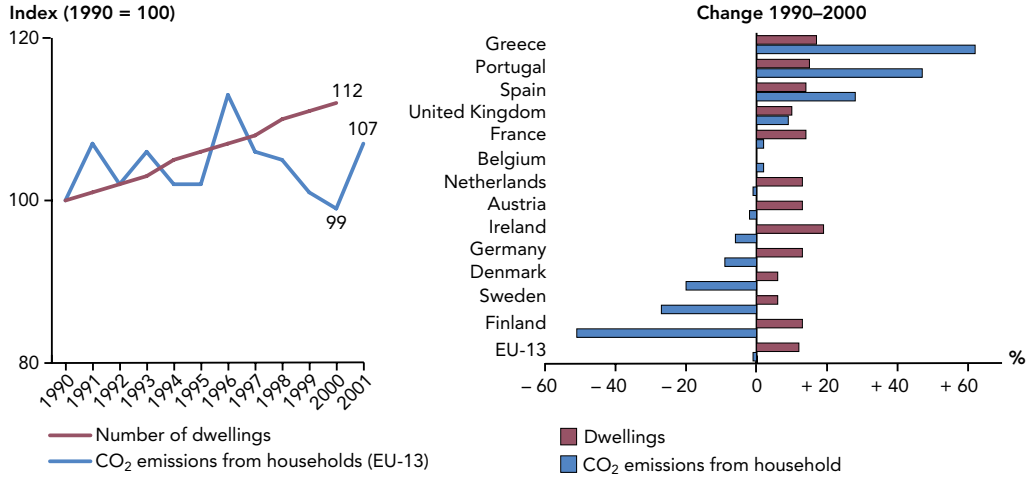
Between 1990 and 2001, CO_2 emissions from small combustion increased by 3 % in the EU, while CO_2 emissions from households increased by 7 %, mainly due to cooler winter months (the heating period) in 2001 in many countries. In 2001, emissions from small combustion increased by 6 % compared with 2000. Only Ireland and Spain stabilised their emissions. All other Member States increased their emissions from small combustion.

For households, CO_2 emissions are mainly influenced by the number and size of dwellings, building codes, the age distribution of the existing building stock, the fuel split for heating and warm water, and outdoor temperatures. The amount of living space also drives the heating demand and can be approximated by the number of dwellings. For the EU, the number of dwellings increased by 12 % between 1990 and 2000 (no data for 2001) while CO_2 emissions from households remained more or less stable, with small fluctuations linked with outdoor temperatures (Figure 3.6). This decoupling may be an indication of improvements in the energy efficiency of space heating. However, it should be noted that the high performance of some countries (e.g. the Nordic countries) could also be influenced by a shift from household heating boilers to district heating plants. That shift in heating facilities reduces CO_2 emissions from households but slightly increases emissions from energy industries.

Greece, Portugal and Spain increased their emissions by more than 30 %, which was accounted for mainly by services and small businesses rather than households. In Germany, efficiency improvements through thermal insulation of buildings, a fuel switch in eastern German households, solar thermal energy production and biomass district heating were largely responsible for CO_2 reductions in the small combustion sector.

Source: EEA, 2003a.

Figure 3.6 **EU CO_2 emissions from households, compared with the number of permanently occupied dwellings**



3.3.3 Transport (14)

☹ Between 1990 and 2001, carbon dioxide emissions from transport increased 20 % in the EU. Road transport is by far the largest emission source in the transport sector (92 %). Emissions increased due to continuous increases in road transport volume (passenger and freight).

☹ Carbon dioxide emissions from international aviation and navigation amounted to 6 % of total emissions in 2001, growing by 44 % from 1990 levels.

☹ Nitrous oxide emissions from transport currently account for only a small part of total EU greenhouse gas emissions but have more than doubled from 1990 to 2001 due to an increase in the transport volume of petrol cars equipped with catalysts. This is a negative consequence of an overall effective policy for improving air quality in Europe.

Transport is the second largest source of greenhouse gas emissions, in particular CO_2 and N_2O, in the EU. Transport causes CO_2 emissions mainly through fossil fuel combustion in road transportation, national civil aviation, railways, national navigation and other transportation (15), accounting for 20 % of total greenhouse gas emissions in 2001. Between 1990 and 2001, CO_2 emissions from transport increased by 20 % in the EU (Figure 3.7), due to continuous increases in road transport volume (both passenger and freight). Carbon dioxide emissions increased steadily in the 1990s, were stable for the first time in 2000, but increased again in 2001, by 1.3 %.

Road transport is by far the largest emission source within transport (92 % in 2001).

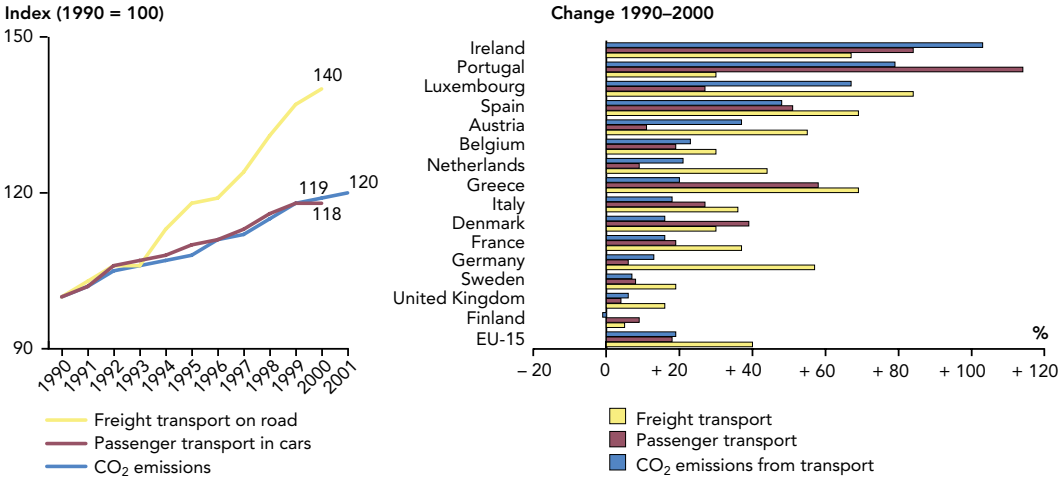
Between 1990 and 2001, CO_2 emissions from transport increased in all Member States. Finland, Sweden and the United Kingdom limited their emission increases below 10 %. Luxembourg, Portugal and Spain registered emission increases between 40 % and 80 %, while

(14) This sector includes domestic transport (or sector '1.A.3 transport') but excludes international transport, according to UNFCCC guidelines for greenhouse gas inventories.

(15) Note that, in accordance with UNFCCC guidelines, these emissions do not include CO_2 emissions from international aviation and navigation, which were 236 million tonnes in 2001 or 6 % of total EU greenhouse gas emissions. Total EU CO_2 emissions from international aviation and navigation grew by 44 % between 1990 and 2001.

Figure 3.7 **EU CO_2 emissions from transport compared with transport volumes (passenger transport in cars and freight transport by road)**

Source: EEA, 2003a.



Ireland more than doubled its CO_2 emissions from transport. The main reason for the large increase in Ireland is growth in road transport volumes. A second explanation is 'fuel tourism' — passenger car fuels bought in Ireland, where fuel prices are relatively low, but consumed outside Ireland (e.g. in Northern Ireland).

Explanations for the relatively small changes in emissions in Finland, Sweden and the UK may be high per capita CO_2 emissions from transport in 1990 and high and/or rapidly growing road fuel prices. For the cohesion countries (Greece, Ireland, Portugal and Spain), the opposite is true: low starting points in terms of per capita emissions and low road fuel prices. They have experienced strong growth in transport demand, particularly road, driven by economic growth, and have therefore also experienced large increases in CO_2 emissions.

The main driving forces of CO_2 emissions from transport are increasing transport volumes by road, both passenger and freight. For the EU, passenger transport in cars increased by 18 % between 1990 and 2000; freight transport grew by 40 % in the same period. In all counties except Denmark, Finland, Ireland and Portugal, freight transport on road grew faster than passenger transport.

Emissions of N_2O from transport account for only 0.6 % of total EU greenhouse gas emissions but are closely linked to the fuel consumption of petrol cars equipped with catalysts. Nitrous oxide emissions are mostly formed during the warm-up phase. EU-wide, N_2O emissions from transport increased sharply (126 %) between 1990 and 2001. However, more modern catalytic converters are emitting much less N_2O.

3.3.4 Agriculture

☺ Between 1990 and 2001, EU nitrous oxide emissions from agricultural soils declined by 8 %, mainly due to a decrease in the use of nitrogen fertiliser. This was a consequence of the reform of the common agricultural policy (CAP) of the EU, and the implementation of the nitrate directive, aimed at reducing water pollution.

☺ Between 1990 and 2001, EU methane emissions from enteric fermentation (by cattle) declined by 9 %, mainly due to a decrease in the number of cattle (10 %), which was also due to CAP reform.

Agricultural soils are the largest source of N_2O emissions in the EU and these accounted for about 5 % of total EU

greenhouse gas emissions in 2001. Emissions of N_2O from agricultural soils occur from the application of mineral nitrogen fertilisers and from organic nitrogen from animal manure.

Between 1990 and 2001, N_2O emissions from agricultural soils declined by 8 % in the EU. In 2001, emissions decreased further by 3 % on 2000, which is the strongest observed yearly decrease. The main driving force of N_2O emissions from agricultural soils is the use of nitrogen fertiliser, which was 13 % below 1990 levels in 2001 (Figure 3.8). The decrease in 2001 is remarkable because emissions have remained more or less stable since 1992.

The decrease in fertiliser use is partly due to the effects of the 1992 reform of the common agricultural policy and the resulting shift from production-based support mechanisms to direct area payments in arable production. This has tended to lead to an optimisation and overall reduction in fertiliser use. In addition, fertiliser use has declined as a result of directives, such as the nitrate directive adopted in 1991, and extensification measures included in agro-environment programmes since 1993.

Nitrous oxide emission trends from agricultural soils vary considerably in the Member States; the largest reductions over the period 1990–2001 occurred in Denmark (– 24 %), Finland (– 22 %), Germany (– 16 %) and the United Kingdom (– 15 %), whereas Ireland, Italy, the Netherlands and Spain had increases between 1 and 8 % between 1990 and 2001. The upward trend in Dutch emissions from soils and fertiliser use is due to the phasing out of manure spreading on the land and the incorporation of manure into the soil; this is a measure to reduce ammonia emissions from manure but which has the negative side-effect of increasing N_2O emissions.

Enteric fermentation of animal feeds in the stomach of cattle is the largest source of CH_4 emissions in the EU, accounting for 3 % of total greenhouse gas emissions in 2001. Between 1990 and 2001, CH_4 emissions from enteric fermentation declined by 9 % in the EU. However, during 2001 no substantial decrease occurred. The main driving force of CH_4 emissions from enteric fermentation is the number of cattle (Figure 3.9), which fell as a result of CAP reform.

Source: EEA, 2003a.

Figure 3.8 **EU N_2O emissions from agricultural soils, compared with nitrogen fertiliser use**

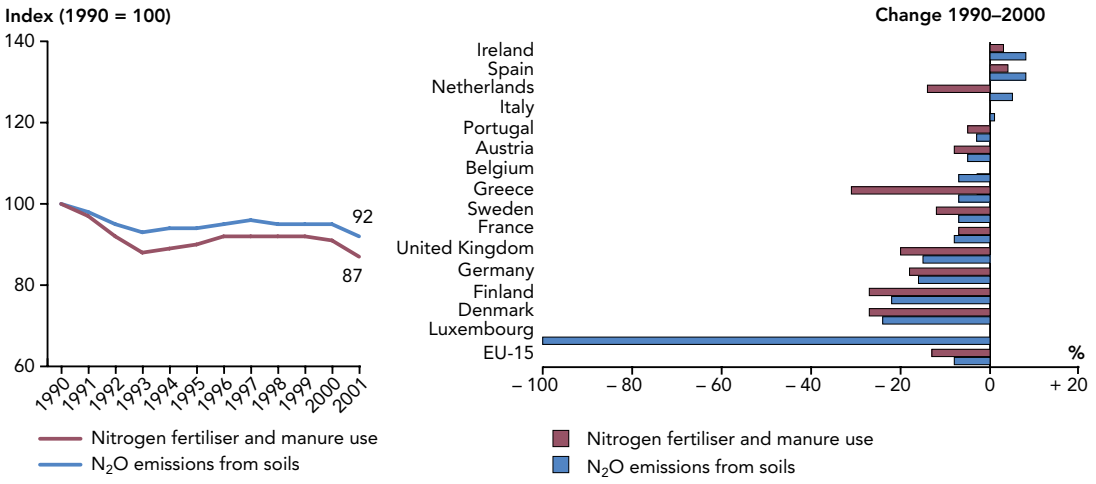
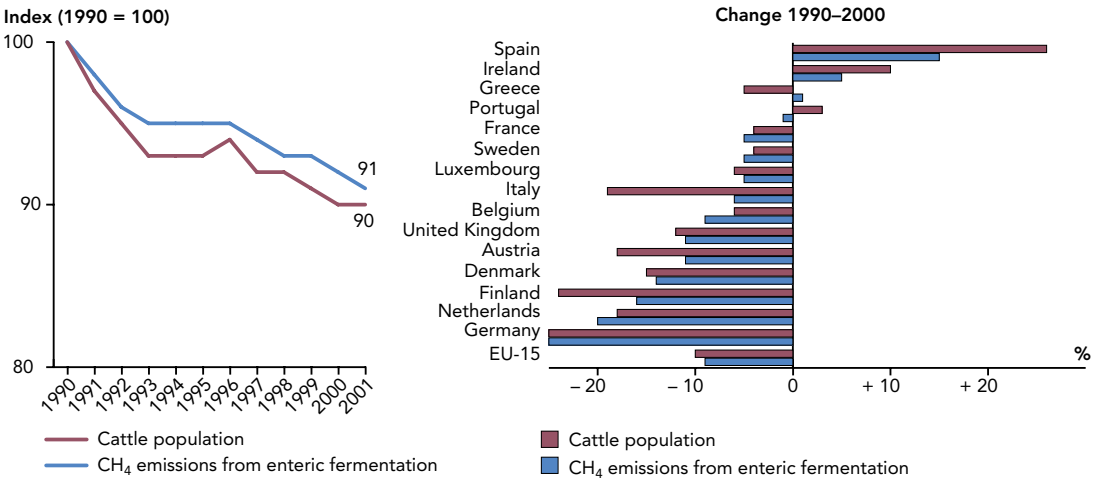


Figure 3.9 **EU CH_4 emissions from enteric fermentation, compared with the cattle population**

Source: EEA, 2003a.



All Member States except Greece, Ireland and Spain managed to reduce emissions. Emission decreases were largest for Germany (25 %) and the Netherlands (20 %).

3.3.5 Industry (non-energy related) (16)

☺ Between 1990 and 2001, EU nitrous oxide emissions from chemical industries dropped by 54 %, mainly due to emission reduction measures in adipic acid production in France, Germany and the United Kingdom.

☹ Between 1995 and 2001, EU hydrofluorocarbon emissions, accounting for 0.8 % of total EU greenhouse gas emissions, increased by a factor of four, as they replaced chlorofluorocarbons which were being phased out to protect the ozone layer. This is a side-effect of an overall effective policy to protect the ozone layer.

Industrial processes (non-fuel combustion) contributed 6 % of total greenhouse gas emissions, in particular CO_2, N_2O and HFC emissions, in the EU in 2001.

EU-wide CO_2 emissions from industrial processing of mineral products had a 3 % share of total EU greenhouse gas emissions in 2001. In 2001, CO_2 emissions from mineral products were 1 % below 1990 levels in the EU. They declined in the early 1990s but have increased in recent years.

EU-wide N_2O emissions from the chemical industry had a 1.2 % share of total EU greenhouse gas emissions in 2001. Most N_2O emissions from chemical industries occur in adipic and nitric acid production. In the EU, adipic acid is produced only in four countries (France, Germany, Italy and the United Kingdom), whereas nitric acid is produced more widely.

Between 1990 and 2001, N_2O emissions from chemical industries dropped by 54 % in the EU. In particular the United Kingdom (– 82 %), Germany (– 74 %) and France (– 53 %) achieved large reductions, both in relative and absolute terms, primarily due to emission abatement measures in adipic acid production. Belgium and Italy had increases in N_2O emissions (13 % and 22 %) from chemical industries.

HFC emissions currently account for 0.8 % of total EU greenhouse gas emissions but have grown substantially. The main reason is the phasing out of ozone-depleting CFCs. HFCs are

(16) Sector '2. Industrial processes', according to UNFCCC guidelines for greenhouse gas inventories.

replacing CFCs mainly in refrigeration and air conditioning, and as aerosol propellants and blowing agents for the production of thermal insulation foams. Between 1995 (the base year for fluorinated gases) and 2001, EU-wide HFC emissions from consumption of halocarbons and SF_6 increased by a factor of four. This was the highest increase in relative terms of all key sources of emissions in the EU.

3.3.6 Waste management

☺ Between 1990 and 2001, EU methane emissions from landfills declined by 28 %. The decrease was mainly due to the (early) implementation of the landfill waste directive and similar national legislation by reducing the amount of untreated biodegradable waste disposed of in landfills and installing landfill gas recovery at all new sites.

Methane emissions from solid waste disposal on land (landfills) account for 2 % of total EU greenhouse gas emissions. Methane emissions from landfills take place due to the breakdown of biodegradable carbon compounds by anaerobic methanogenic bacteria.

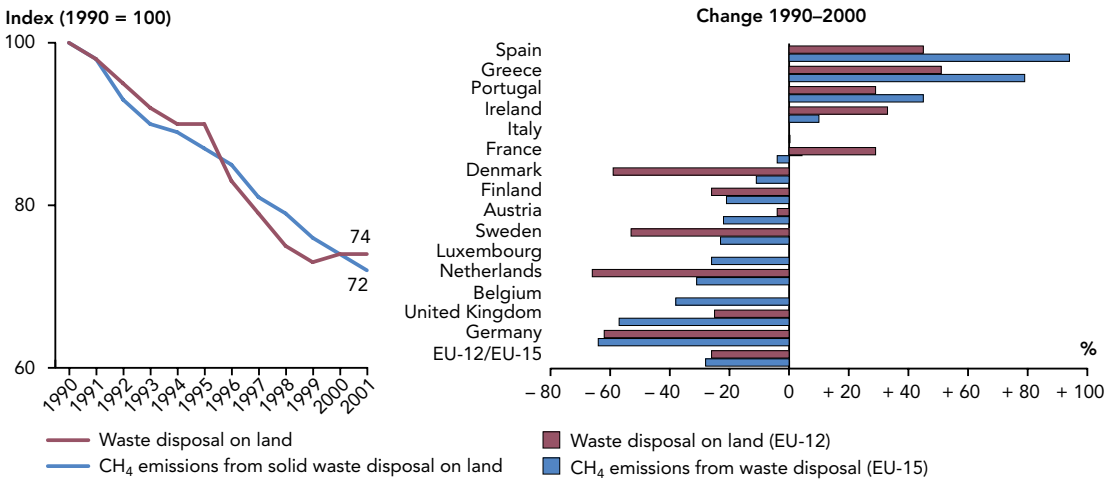
Between 1990 and 2001, EU-wide CH_4 emissions from landfills declined by 28 %. The main driving force of CH_4 emissions from solid waste disposal on land is the amount of biodegradable waste going to landfills and the amount of CH_4 recovered and utilised or flared.

Emission reductions are partly due to the (early) implementation of the landfill waste directive and similar legislation in the Member States. The landfill waste directive was adopted in 1999 and requires Member States to reduce the amount of untreated biodegradable waste disposed of at landfills and to install landfill gas recovery at all new sites.

The largest reductions occurred in Germany and the United Kingdom (about 40 %), whereas Greece, Portugal and Spain had large increases of more than 40 %.

Source: EEA, 2003a.

Figure 3.10 **EU CH_4 emissions from waste disposal on land compared with the amount of waste disposal on land**



3.4 Actual progress of acceding and candidate countries in limiting emissions in 2001 relative to the base year (17)

☺ In the 10 acceding and candidate countries total greenhouse gas emissions declined by 36 % in 2001 relative to the base year, primarily due to the economic restructuring process towards market economies.

☺ All acceding and candidate countries except Slovenia were on track in 2001 to meet their Kyoto targets.

☹ Transport CO_2 emissions decreased by 19 % between 1990 and 1995, but increased afterwards and were above 1990 levels in 2001 for the first time (4 %).

The ten central and eastern European acceding and candidate countries to the EU (18) do not have a common target for emission reductions. Each country has to reach its target individually as defined in the Kyoto Protocol. Nevertheless, an aggregate analysis is performed in this section in order to compare the overall trends in these countries with trends in the EU.

Total greenhouse gas emissions for the 10 acceding and candidate countries declined in 2001 by about 36 % below the base-year level (19) (Figure 3.11). This means the group of countries was (in 2001) well on track towards the Kyoto Protocol target, due to domestic economic developments and policies and measures.

As in the EU, CO_2 is by far the most important greenhouse gas (about 80 %); second comes methane and third is N_2O. Fluorinated gas emissions are not yet reported consistently in most of the acceding and candidate countries, but in general they do not contribute more than 1 % to national totals.

In 2001, the best performances were recorded by Latvia, Lithuania and Estonia (– 56.4, – 56.3, – 51 index points), which means that greenhouse gas emissions were cut by half compared with 1990 while the targets are only for an 8 % reduction by 2010. Only in Slovenia were emissions above the target path (+ 6 index points) (Figure 3.12).

The restructuring or closure of heavily polluting and energy-intensive industries led to a significant decline in total greenhouse gas emissions.

The sector showing increases in greenhouse gas emissions was transport, partly counteracting the decreases that had occurred in other sectors. Carbon dioxide emissions from transport decreased by 19 % between 1990 and 1995, but increased afterwards. In 2001, greenhouse gas emissions from transport were above 1990 levels for the first time (4 %).

The experience of the EU cohesion states (Greece, Ireland, Portugal and Spain) seems to be confirmed in acceding and candidate countries: starting from relatively low transport levels, high economic growth leads to strong growth in greenhouse gas emissions from transport.

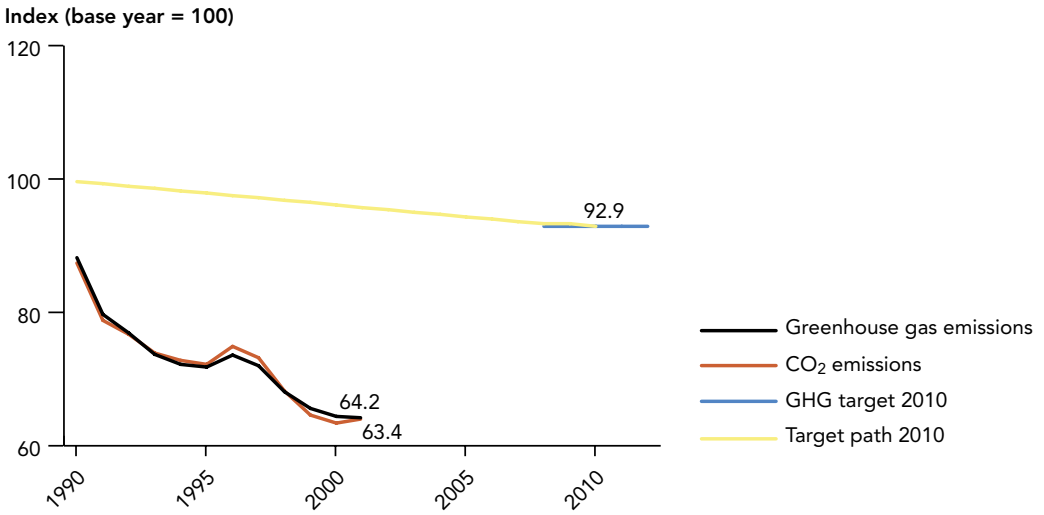
(17) This report covers the 10 central and eastern European acceding and candidate countries (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia), which are in this report further referred to as 'acceding and candidate countries'. The report does not cover the other three acceding and candidate countries: Cyprus, Malta and Turkey.

(18) For Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia third national communications under UNFCCC are available.

(19) The emissions in the base year for this group of countries were assumed to be the sum of the emissions in the base years of the individual acceding countries. Countries with base years other than 1990 are Bulgaria (1988), Hungary (average 1985–87) and Poland (1988).

Source: EEA, 2003a.

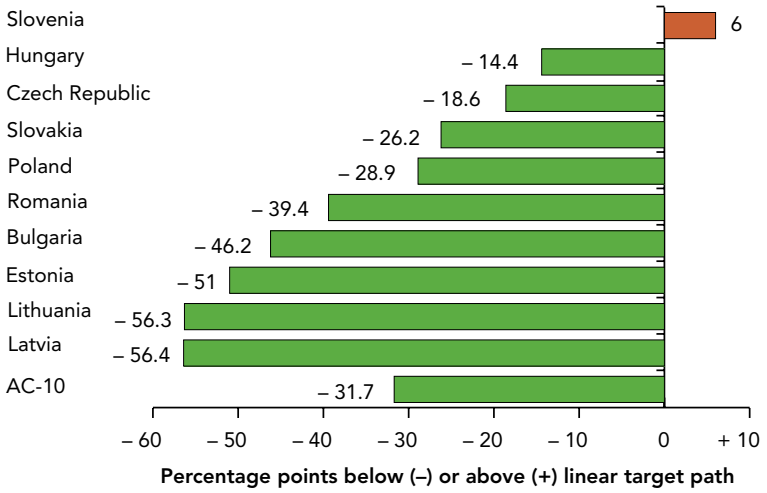
Figure 3.11 **Acceding and candidate countries' greenhouse gas emissions compared with the Kyoto target for 2008–12 (excluding fluorinated gases and land-use change and forestry)**



Note: The target path is used to analyse how close current (2001) emissions are to a linear path of emission reductions or allowed increases from the base year to the Kyoto Protocol target, assuming domestic measures will be used, excluding emissions of fluorinated gases and emissions and removals from LUCF. Bulgaria did not report the complete time series after 1999, Hungary after 2000, Lithuania after 1998, Slovenia after 1996. For missing years the values were interpolated (in the middle of series) or data from the last submitted year were used. The emissions in the base year for this group of countries were assumed to be the sum of the emissions in the base years of the individual acceding countries. Countries with base years other than 1990 are Bulgaria (1988), Hungary (average 1985–87) and Poland (1988).

Source: EEA, 2003a.

Figure 3.12 **Distance-to-target (Kyoto Protocol) for acceding and candidate countries in 2001**



Note: The distance-to-target indicator (DTI) measures the deviation of actual emissions in 2001 from a (hypothetical) linear target path between 1990 and 2010. For Bulgaria, Hungary, Lithuania and Slovenia a data gap-filling procedure was followed in order to have a complete estimate for all ten countries. A positive value suggests an under-achievement by 2001 and a negative value an over-achievement in 2001. The DTI gives an indication of progress towards the Kyoto targets. It assumes that the countries meet their targets entirely on the basis of domestic measures. The target for all ten acceding and candidate countries together was calculated for the purposes of this report alone and does not have any legally binding implication. Countries with base years other than 1990 are Bulgaria (1988), Hungary (average 1985–87), Poland (1988), Romania (1989) and Slovenia (1986).

4 Projected progress of EU and acceding and candidate countries in limiting greenhouse gas emissions

4.1 Projected progress of the EU in limiting emissions with existing domestic policies and measures

☹ Projections for the EU based on existing domestic policies and measures show total greenhouse gas emissions decreasing only slightly by 0.5 % by 2010 relative to the base year. This leaves a large shortfall of 7.5 % in reaching the EU's Kyoto target of an 8 % reduction in emissions. Compared with last year's analysis the shortfall has worsened drastically, mainly due to revisions in Germany's projections.

😐 Sweden and the United Kingdom project that existing domestic policies and measures will be sufficient to meet their burden-sharing targets and they may even over-deliver on their target. If these two countries did no more than meet their agreed targets, the EU reduction would be just 0.2 %. Emissions in most countries — Austria, Belgium, Denmark, Finland, France, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain — are projected to be significantly above their burden-sharing targets by 2010 with existing domestic measures, disregarding the possible use of flexible mechanisms under the Kyoto protocol. Germany projects it will almost reach its target with existing domestic measures.

For the EU, the aggregate projections of total greenhouse gas emissions for 2010 based on existing domestic policies and measures ([20]) show a small fall to 0.5 % below base-year levels. This means the current small emission reduction of 2.3 % achieved by 2001 on the base-year level is projected to be reversed to an increase by 2010. That development leads to a shortfall of 7.5 %, assuming only domestic policies and measures, in meeting the EU's Kyoto commitment of an 8 % reduction in emissions in 2010 from base-year levels (Figure 4.1).

A 'with existing domestic measures' projection encompasses currently implemented and adopted policies and measures ([21]).

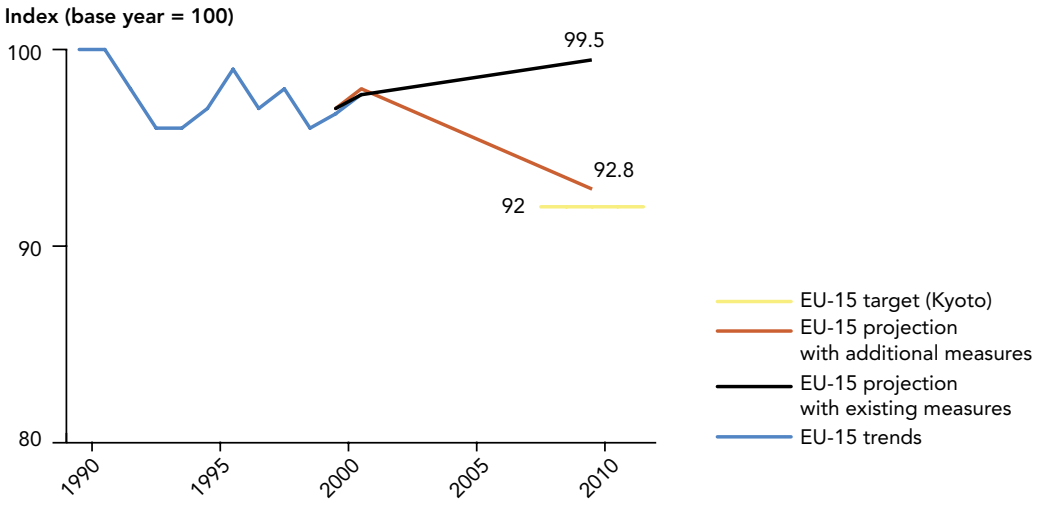
Sweden and the United Kingdom project that existing domestic policies and measures will be sufficient to meet their burden-sharing targets (Figure 4.2). Their relative gaps are about – 3 % and – 1.5 %, respectively, meaning that these countries may even over-deliver on their targets. If these two countries did no more than meet their agreed targets, the EU reduction would be just 0.2 %. This would lead to a shortfall of 7.8 %, from the EU's Kyoto target in 2010. Emissions in Austria, Belgium, Denmark, Finland, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain are all projected to be significantly above their commitments on the basis of their existing domestic measures. The relative gaps for these Member States range between more than + 30 % for Denmark and Spain to about + 10 % for France and Italy.

(20) Policies and measures in this section include only domestic national and EU common and coordinated policies and measures. Countries are also allowed to make use of the Kyoto mechanisms to achieve their UNFCCC and EU burden-sharing targets (see Section 6). Furthermore countries can make use of carbon sequestration in soils, through changes in agricultural practices, and in forests, through forestry activities, to achieve the targets (see Section 7).

(21) Existing policies and measures are those for which one or more of the following applies: (a) national legislation is in force; (b) one or more voluntary agreements have been established; (c) financial resources have been allocated; (d) human resources have been mobilised; (e) an official government decision has been made and there is a clear commitment to proceed with implementation.

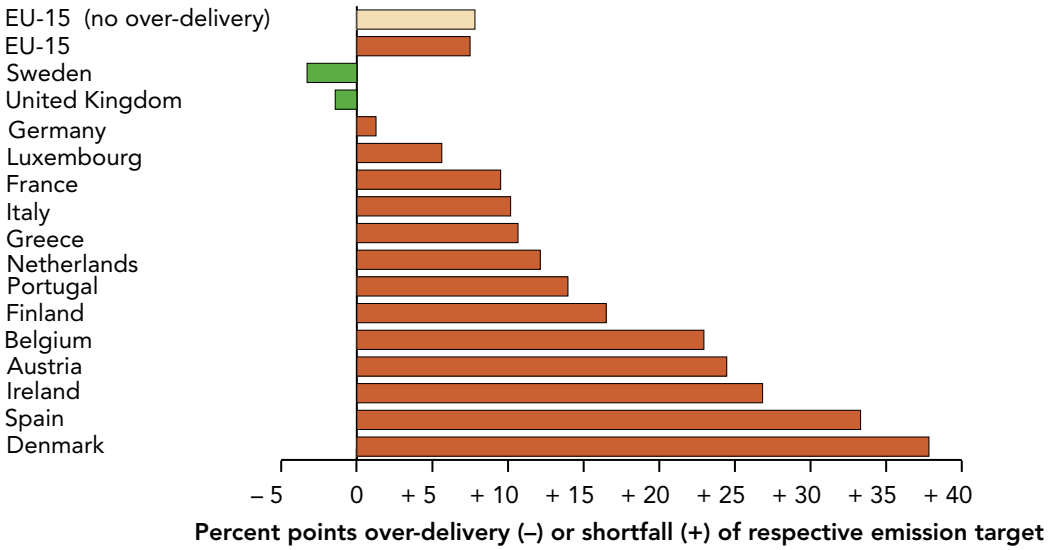
Source: EEA, 2003a.

Figure 4.1 **Greenhouse gas emission trends and projections for EU-15**



Source: EEA, 2003a.

Figure 4.2 **Relative gap (over-delivery or shortfall) between 'with existing domestic measures' projections and targets for 2010 for EU-15 and Member States**



Note: Germany's projections are preliminary results from an ongoing study provided in June 2003 (German Environmental Agency, 2003).

Compared with last year's analysis, the gap between the target and the projection based on existing domestic measures for the EU has worsened significantly. This is due, in particular, to revisions in Germany's projections (preliminary information given in June 2003). According to the most recent projections, Germany's large over-delivery on its burden-sharing target reported last year has been changed to a slight shortfall. Other countries where there are substantial differences from the projections reported last year are Denmark and Greece (increases in the shortfall) and Italy and Portugal (decreases in the shortfall).

In absolute terms the most significant gap, of about 68 Mt CO_2-equiv., is for Spain, which is nearly one quarter of the gap for the EU as a whole. Italy and France follow with absolute gaps of just over 50 Mt CO_2-equiv.

The 'with existing domestic measures' scenarios are not fully comparable between Member States for various reasons, including different cut-off dates for inclusion of existing domestic policies and measures, different underlying assumptions in the model, e.g. regarding energy price developments, and assumptions on the effectiveness of policies and measures (EEA, 2002c). It is therefore useful to compare the projections for the EU aggregated from Member States' projections with the results of Community-wide emission projections (see Section 5.3).

4.2 Projected progress of the EU in limiting emissions with additional domestic policies and measures

😐 Savings from additional domestic policies and measures being planned by Member States would result in emission reductions of about 7.2 %, almost sufficient to cover the shortfall and thus meet the target. However, this relies on over-delivery by some Member States (Finland, France, Greece, Ireland, Sweden and the United Kingdom) compared with their burden-sharing targets.

☹ If no over-delivery of Member States is considered, the EU as a whole will achieve a 5.1 % reduction with additional policies and measures. This leads to a shortfall, from the EU's Kyoto target, of 2.9 %, in 2010, taking into account domestic policies and measures only.

Most Member States have also reported planned (additional domestic) policies and measures that they are developing to achieve further reductions in greenhouse gas emissions. Additional (planned) policies and measures are options under discussion with a realistic chance of being adopted and implemented in future. The effects of these additional domestic policies and measures are shown (Figure 4.3) under the assumption that they will be supplementary to the effect of existing policies and measures as previously described. In this report these projections are called 'with additional domestic measures' projections.

Savings from additional policies and measures being planned by Member States would result in total emission reductions of about 7.2 % from 1990 (Figure 4.3), almost sufficient to meet the shortfall for the EU projected on existing domestic policies and measures. Assuming that all additional domestic policies and measures will actually be implemented and will have the expected effect, this would lead to only a small shortfall of 0.8 percentage points in meeting the target of – 8 %.

Finland, France, Greece, Ireland, Sweden and the United Kingdom project that with their additional domestic measures they can either meet or exceed their burden-sharing targets.

For Austria, Belgium, Denmark, Italy, the Netherlands and Spain the savings identified from planned domestic policies and measures are not sufficient to achieve their burden-sharing targets. Germany, Luxembourg and Portugal have not yet reported quantified savings from any additional domestic policies and measures that they are considering.

The largest relative effect of additional domestic policies and measures is for Ireland (gap decreases from a 27 % shortfall to a very small surplus).

Absolute reductions achieved with additional domestic policies and measures are largest for the United Kingdom, France, Spain and Italy, ranging from 64 to 37 Mt CO_2-equiv.

Under the 'with additional domestic measures' projections several other Member States are projected to exceed their targets (Finland, France, Greece and Ireland) in addition to those already exceeding the target with existing domestic policies and measures (Sweden and the United Kingdom). If all these MS are assumed to meet, but not to exceed, their targets in the 'with additional domestic measures' projection, this would mean for the EU a reduction below 1990 emissions of 5.1 % and thus a 2.9 % shortfall on the EU target (Figure 4.3).

Under the Kyoto Protocol Member States can use flexible mechanisms — emission trading, joint implementation, the clean development mechanism — to help meet their targets. A first estimate on the intention of Member States to use those instruments and a possible further closing of the gap is given in Section 6.

4.3 Projected progress of acceding and candidate countries in limiting emissions with existing and additional domestic policies and measures

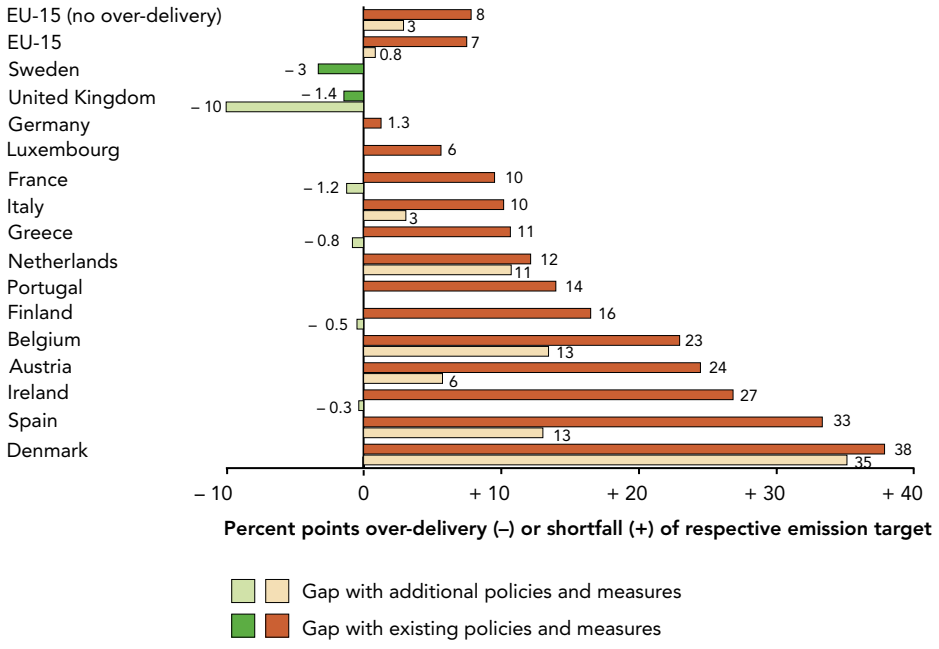
☺ Seven acceding and candidate countries (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Poland and Slovakia) project that existing domestic policies and measures will be sufficient to meet their Kyoto targets by 2010. Slovenia, however, projects increasing emissions and therefore a shortfall from its Kyoto target.

☺ Policies and measures aimed at most sectors are in place and additional domestic policies and measures have been identified.

Acceding and candidate countries do not report formally to the EU monitoring mechanism, so this section is based on third national communications to UNFCCC. Seven

Source: EEA, 2003a.

Figure 4.3 **Relative gap (over-delivery or shortfall) between projections based on existing and additional domestic policies and measures and 2010 targets for EU-15 and Member States**



Note: Germany's projections are preliminary results from an ongoing study provided in June 2003 (German Environmental Agency, 2003).

countries (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Poland and Slovakia) had submitted third national communications by June 2003. In addition, Slovenia has produced its first national communication. Figure 4.4 shows the relative gap between projections based on existing domestic policies and measures, projections based on existing and additional domestic policies and measures, and the Kyoto commitments.

The Czech Republic presents two projections, a reference scenario (labelled base in the figure above) and a scenario assuming high economic growth. All 'with existing measures' projections, except for Slovenia, result in emissions in 2010 being lower than the Kyoto commitments. For Estonia and Latvia, the emissions are projected to be significantly lower than in 1990.

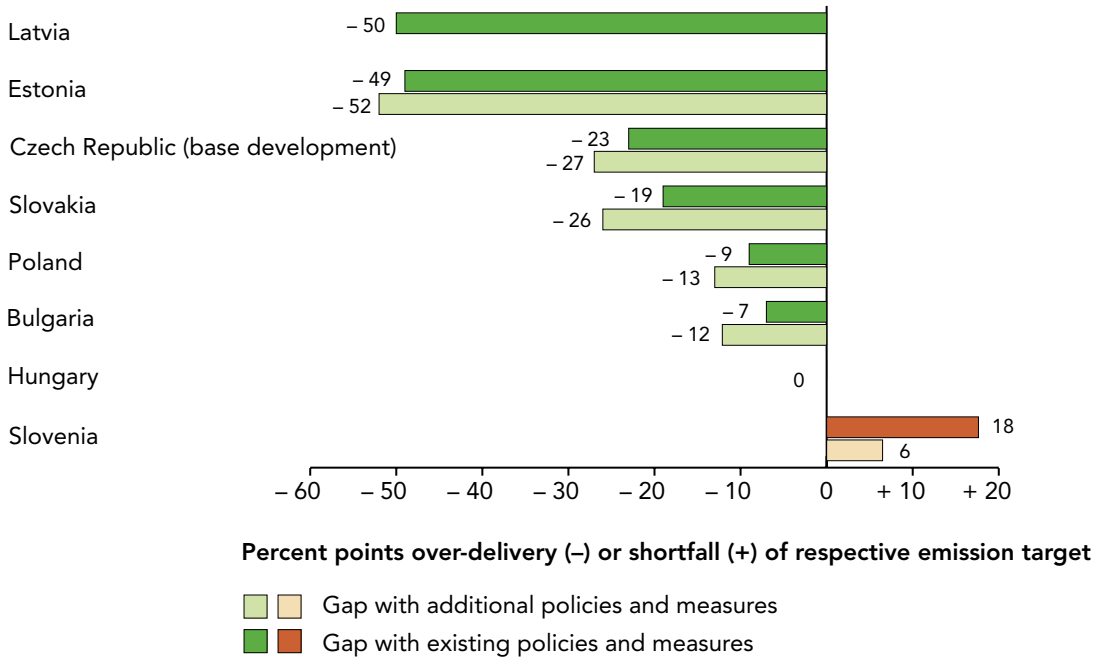
In part, the projected reductions in most acceding and candidate countries are the result of the economic restructuring that has already occurred in these countries. However, all countries have policies and measures in place to reduce greenhouse gas emissions. These are primarily aimed at energy use and waste management but there are a limited number of policies and measures in other sectors. Different types of policies and measures are used, although the use of voluntary agreements is limited. Policies and measures implemented or proposed in most countries include:

- clean air legislation to reduce air pollution — this generally has a beneficial effect on greenhouse gas emissions;
- energy market liberalisation;
- changes in building regulations to improve energy efficiency;
- harmonisation with EU environmental legislation;
- measures to reduce traffic growth;
- biodegradable waste to landfills.

Although these acceding and candidate countries project that they will meet their Kyoto commitments with existing domestic policies and measures, all but one country identified additional policies and measures. Slovenia is still not expecting to meet its Kyoto commitment even with additional measures.

Figure 4.4 **Relative gap (over-delivery or shortfall) between projections and targets for 2010 for acceding and candidate countries**

Source: EEA, 2003a.



Note: Projections for Poland include only the energy sector.

5 Effects of domestic policies and measures

5.1 Common and coordinated policies and measures of the EU

☺ The adopted and proposed additional common and coordinated policies and measures have the potential to result in emission reductions of about 300 Mt CO_2-equiv., potentially covering the gap between the 'with existing measures' projection and the EU target.

In the European Union policies and measures that address climate change are implemented at both national and Community levels. Those developed by the European Union and applying across the Community are called common and coordinated policies and measures (CCPMs). CCPMs are a central part of the EU's climate strategy and supplement national strategies.

Common policies and measures refer to actions that are adopted at EU level, usually in the form of a directive or other legal instrument, and have to be implemented by the Member States.

Coordinated policies and measures are national actions, for which added value is provided by means of coordination at EU level.

The European Commission has taken many climate-related initiatives since 1991, when it issued the first Community strategy to limit CO_2 emissions and improve energy efficiency. However, with regard to the current projections of greenhouse gas emissions (see sections 4.1 and 4.2), action by both Member States and the Community needs to be reinforced if the EU is to succeed in cutting its greenhouse gas emissions to 8 % below 1990 levels by 2008–12 under the Kyoto Protocol.

The EU-wide emissions trading scheme is well under way. Political agreement has been reached between the European Parliament and the Council, and the directive was adopted in 2003 ([22]). The scheme will apply to most of the significant emitting activities already covered by the integrated pollution prevention and control (IPPC) directive as well as some others. The only gas covered so far by the scheme is CO_2. The scheme will start in January 2005.

The European Commission has additionally proposed a directive for linking emission trading with the Kyoto Protocol's flexible mechanism in mid-2003.

The European climate change programme (ECCP), launched by the Commission in June 2000, prepared a range of most environmentally beneficial and cost-effective additional EU-level policies and measures to cut greenhouse gas emissions as well as to prepare for an EU-wide emissions trading scheme. The ECCP is an ongoing process. A second report on the progress of the ECCP was published in May 2003 (European Commission, 2003b).

The legislative measures currently adopted by the EU (Council) or proposed by the Commission represent a potential of more than 300 Mt CO_2-equiv. Key measures and their estimated greenhouse gas reduction potentials are:

- directive on the promotion of electricity from renewable energy (RES-E Directive, implemented 2001): 100–125 Mt CO_2-equiv.;
- proposal for a directive on combined heat and power to promote high efficiency cogeneration (adopted by Commission in 2002): 65 Mt CO_2-equiv.;

(22) Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC, L 275/32, 25 October 2003.

- directive on the energy performance of buildings to improve the energy performance of new buildings, as well as larger existing buildings when they undergo major renovations (adopted 2002): 35–45 Mt CO_2-equiv.;
- horizontal implementation of energy efficiency in the IPPC directive on pollution prevention and control in large industrial and agricultural installations to achieve co-benefits from air quality improvements for greenhouse gas reductions: 60–70 Mt CO_2-equiv.;
- motor challenge programme, an EC voluntary programme to improve the energy efficiency of motor-driven systems in industrial companies (launched 2003): 30 Mt CO_2-equiv.;
- agreement between the Commission and car manufacturers (ACEA, JAMA, KAMA) to reduce the average CO_2 emissions of new passenger cars to 140 g/km by 2008/09 (implemented): 75–80 Mt CO_2-equiv.;
- proposal for the promotion of biofuels in the transport sector by setting targets and enabling reductions in excise duties on biofuels (reading in the European Parliament in 2003): 35–40 Mt CO_2-equiv.;
- proposal for a regulation of the European Parliament and of the Council on certain fluorinated gases (Commission proposal of 11 August 2003 COM (2003) 492 final): 23 Mt CO_2-equiv.;
- landfill directive to recover gases from biodegradation of waste in landfills (implemented): 41 Mt CO_2-equiv.

It must be noted that the *ex ante* ECCP evaluation of the potential of a measure is uncertain for several reasons. One reason is that the potential measures have not been analysed in the same way and some have been analysed in more depth than others. Another reason is that in various cases the estimated potential is based on reaching certain (indicative) targets, which will need to be proven in practice (e.g. CHP and biofuels targets). As well, for the implemented measures, it will be important to monitor their implementation and effectiveness closely, and to review the measures if appropriate.

In addition, the ECCP has investigated carbon sequestration through the enhancement of sink activities in the agricultural and forestry sector.

Furthermore, the proposed directive on establishing a framework for the setting of eco-design requirements for energy-using products was adopted by the Commission on 1 August 2003. If daughter directives under this directive were implemented in every sector, its reduction potential of CO_2-equivalent emissions would amount up to 180 million tonnes.

5.2 Main savings from existing and additional domestic policies and measures of the EU Member States

😐 Policies and measures in the energy sector, targeted at moving to cleaner and more efficient energy production and use, account for the majority of the total expected savings (62 % of savings from existing domestic measures and 58 % of savings from additional domestic policies and measures).

☹ Transport policies and measures account for only a small part of the total expected savings (14 % of existing domestic measures savings and 23 % of additional domestic policies and measures savings), although transport is the most rapidly growing source of greenhouse gases.

Member States have provided information on which policies and measures (PAMs) are included in their 'with existing domestic measures' projections21 and in their 'with additional domestic measures' projections (EEA, 2003a). The type of policies and measures can be either common and coordinated policies and measures (see Section 5.1) or specific national policies and measures. In most cases this distinction is clear from the reported information by the MS.

The projected savings are shown in Figure for existing measures and planned policies and measures. Policies and measures in the energy supply and use sector, excluding transport, account for 62 % of the total savings from existing domestic measures and 58 % of the additional domestic measures savings for the EU as a whole (Figure 5.1). The high contribution of this sector is because the majority of both existing and additional domestic policies and measures are targeted at moving to cleaner and more efficient energy production or making energy use more efficient.

Transport measures are expected to deliver the second highest savings, closely followed by the effect of measures in the industrial processes and the waste sectors. However, while transport is the most rapidly growing source of greenhouse gases, the measures implemented and planned by Member States go only a small way to addressing this, providing 14 % and 23 % of the total savings from implemented and planned policies and measures, respectively.

5.3 Comparison of national 'with existing domestic measures' projections with EU-wide projections

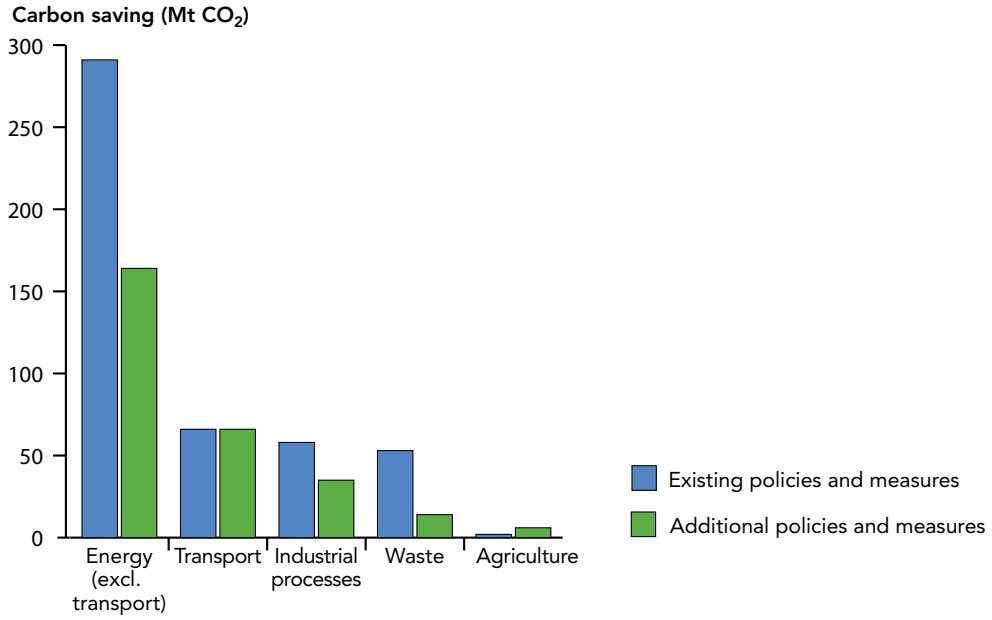
😐 EU-wide projections of CO_2 emissions from fossil fuels show an increase of 4 % between 1990 and 2010, which is in line with the aggregated Member State projections.

☹ However, there are significant differences for individual Member States, in particular for Italy, Luxembourg and Spain, where the EU-wide projections are higher than those projected by Member States, and also for Belgium, Denmark and Finland, where the Member States project a larger increase in CO_2 emissions.

Because projections are not fully comparable between Member States, due to different underlying assumptions, it is useful to compare these with information from EU-wide projections. The comparison may help to improve

Source: EEA, 2003a.

Figure 5.1 **EU-15 projected greenhouse gas emission savings by sector by 2010**



Note: Member States did not provide quantification for all reported policies and measures. This figure shows the savings only for those measures with quantified reductions of emissions. However, all policies and measures are included in the total projections of emissions presented in Section 5.4 of the report. Therefore the savings shown in this figure are lower than the projections for emissions reductions by sector presented in Section 5.4.

both national and EU-wide projections and to achieve a more consistent view on the projected effects of Member States' policies and measures. This section compares the aggregated national projections for CO_2 emissions taking into account existing domestic measures with recent Community-wide emission projections for CO_2 emissions related to fuel combustion (European Commission, 2003c). The EU-wide projections were compiled using the Primes model.

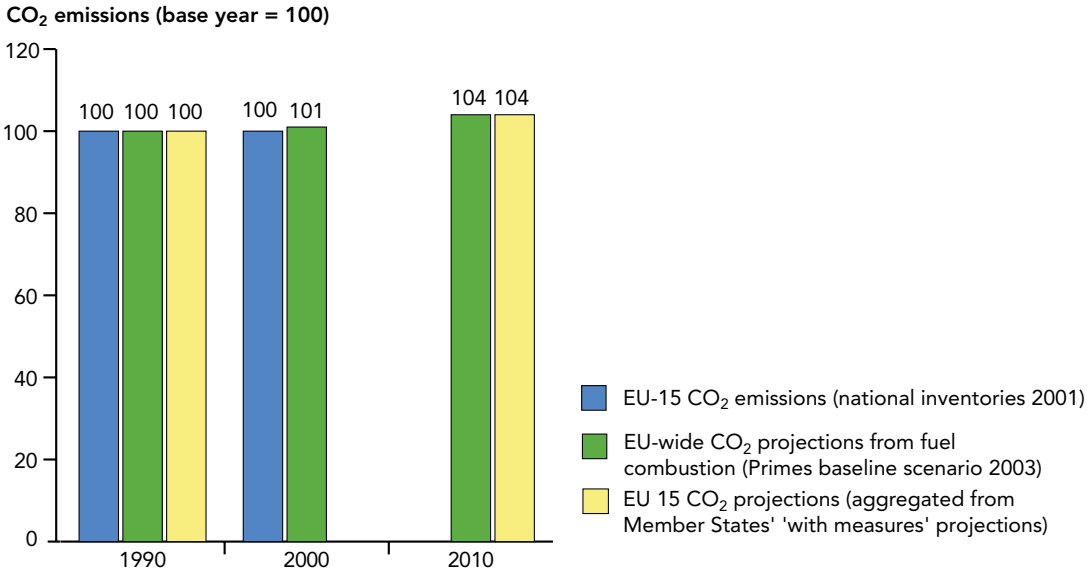
Detailed analysis of the differences is, however, hampered by a lack of consistency between the coverage and disaggregation of the EU-wide projections and those from Member States. Most Member States did not provide projections of CO_2 emissions from fuel combustion separately, which the EU-wide projections cover. Carbon dioxide emissions from industrial processes are included in Member States' CO_2 emission projections, but not in the EU-wide projection. However, their share of total CO_2 emissions is quite small (4 % in 2001). Thus total CO_2 emission projections aggregated from Member States are compared with EU-wide projections of CO_2 emissions from fossil fuel combustion. More detailed comparisons attempting to eliminate these differences show quite similar results (EEA, 2003a).

The EU-wide projections for 2010 (Primes model) show a projected increase in energy-related CO_2 emissions of 4 % between 1990 and the year 2010, which corresponds with the aggregate national projections based on existing measures (Figure 5.2).

However, at the Member State level, there are considerable differences (Figure 5.3). In some cases the EU-wide baseline projection shows a higher increase in emissions between 1990 and 2010 (Luxembourg and Spain, particularly); in other cases Member States' 'with existing measures' projections are higher than the EU-wide baseline projection (Belgium, Denmark and Finland, particularly). However, for most Member States with a large contribution to total EU emissions (France, Germany, United Kingdom,) the difference between the projections is relatively small, within 5 percentage

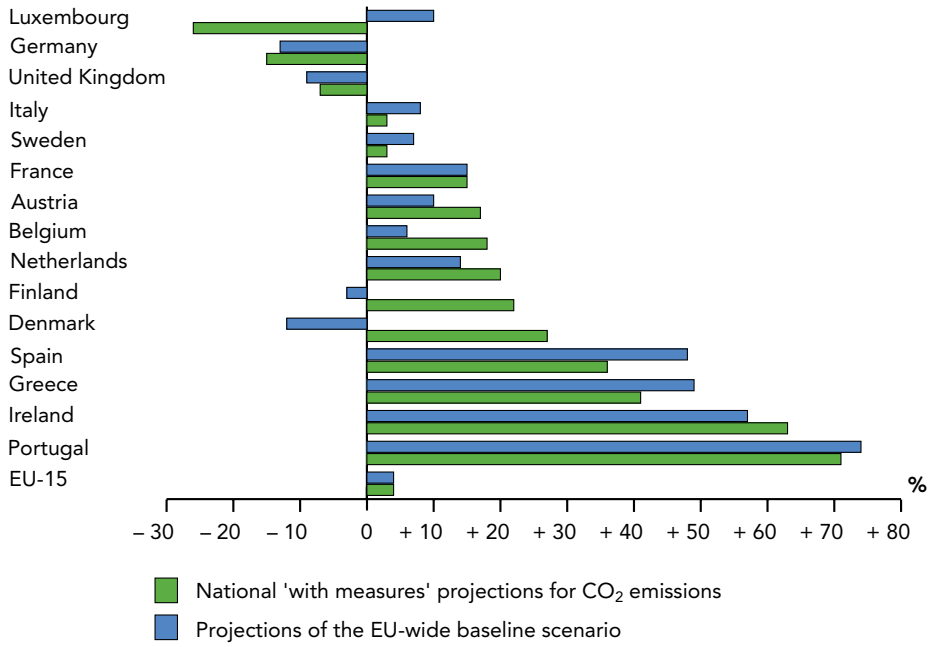
Figure 5.2 **Comparison of the aggregated national 'with existing domestic measures' projections for CO_2 emissions with EU-wide projections (Primes model)**

Source: EEA, 2003a; European Commission, 2003b.



Source: EEA, 2003a; European Commission, 2003b.

Figure 5.3 **Comparison by Member State of changes between 1990 and 2010 of national 'with existing measures' projections for CO_2 emissions with projections of the EU-wide baseline scenario (Primes model)**



points, which contributes to the relatively good agreement between the projections at EU level.

The comparison has revealed several differences between the EU-wide CO_2 baseline projection using the Primes model and the Member States projections. These differences occur for a number of reasons (see for more details EEA, 2003a).

- Differences in the database used: the Primes model is based on Eurostat energy balances for the year 2000; some of the Member States (e.g. Italy) use different databases, not fully compatible with the Eurostat data.
- Different definition of the sectors covered: an important example is the different approach for the consideration of emissions from bunker fuels used in international aviation. While Primes takes international bunker fuels into account, they are excluded from the national projections.
- Differences in emission factors: the Primes model applies emission factors for each Member State from Eurostat's default emission factor database; however, most Member States apply national emission factors, which are suited for national circumstances.
- Differences in the models applied: the Primes model is an econometric model driven by prices which simulates economic decisions by representative sectors simultaneously. Some of the Member States use quite different model approaches; Germany, for example, applies a technological optimisation model which, in general, tends to show a lower projection result than an econometric model.
- Different assumptions applied in the models including:
  - coverage of policies by the projections, and different assumptions on the effectiveness of policies;
  - growth assumptions on driving forces of the models like population, gross domestic product (GDP) and fuel prices;
  - assumptions on technological development.

5.4 Sectoral projections and policies and measures

5.4.1 Energy supply and use (excluding transport)

😐 Emissions from energy supply and use (excluding transport) are projected to increase by 2 % by 2010 from 1990 levels based on existing domestic measures, but are projected to decrease by 6 % below 1990 levels with additional domestic measures, mainly due to policies and measures in the energy industries sector.

☹ Renewable energy targets for the EU (of 22 %) and Member States for 2010 are unlikely to be met under current trends. The current growth rate will need to double to attain the EU target.

☺ Several national policies and measures, however, have been successful, including 'feed-in' arrangements that guarantee a fixed favourable price for renewable electricity producers, suggesting that growth of the renewables share can be accelerated.

☹ In the EU, the current rate of increase in combined heat and power is not sufficient to achieve the EU's target of 18 % by 2010.

☺ Continuing improvements in energy intensity (ratio of energy use to value added) in industry are expected.

☺ Energy savings by households are expected to continue due to implementation of the directive on the energy performance of buildings, the appliances labelling scheme and schemes for energy efficiency standards.

Projections of emissions from energy supply and use

For the EU, aggregated greenhouse gas emissions projections for energy (excluding transport) for 2010 cannot be given with any certainty because only 11 Member States have reported separate emissions projections for the energy sector (excluding transport) (Figure 5.4). The analysis is limited in particular because the projections of Germany, the largest emitter in the EU, are missing ([23]).

For those 11 countries that reported, aggregated total greenhouse gas emissions for the EU are projected to increase by 2 % by 2010 compared with 1990 in the 'with existing domestic measures' projections. In the 'with additional domestic measures' projections, GHG emissions decrease by 6 % below 1990 levels by 2010. The largest reductions, with existing domestic measures, are projected for Luxembourg and the United Kingdom (31 %, 15 %). Belgium, Finland, France, Ireland, the Netherlands and Spain project increasing emissions, some of them even with additional domestic measures.

Policies and measures applied to the energy industries sectors — i.e. electricity production and fuel production — are projected to have the largest effect on EU greenhouse gas emissions (Figure 5.5) with a move to cleaner fuels and renewable energy. But there are also many zero or low-cost improvements in energy efficiency that can be made in manufacturing industries and commerce, stimulated by economic instruments and voluntary agreements, which may make businesses more competitive.

Two key policies aimed at reducing greenhouse gas emissions in energy supply are further analysed in the next section:

- renewable energy sources (RES)
- combined heat and power (CHP) technologies.

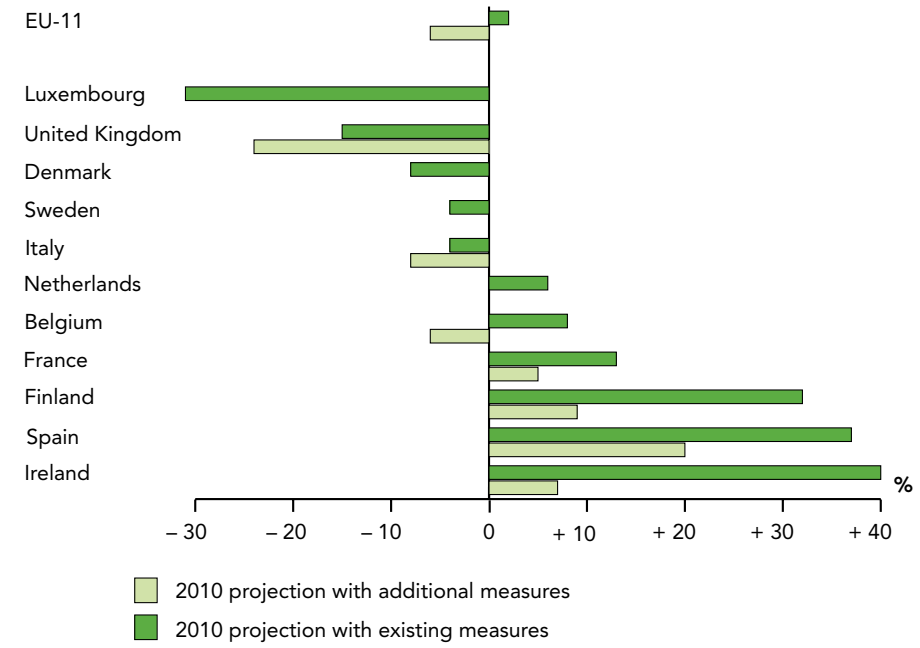
Renewable energy developments compared with targets for 2010

The share of renewable energy (wind energy, solar energy, biomass and hydropower) in the EU's electricity consumption grew slightly from 13.4 % to 14.7 % between 1990 and 2000 (Figure 5.6). This was achieved through an average annual growth in output

(23) This is because the preliminary information provided by Germany in mid-2003 contained total greenhouse gas emission projections, but no projections by sector.

Source: EEA, 2003a.

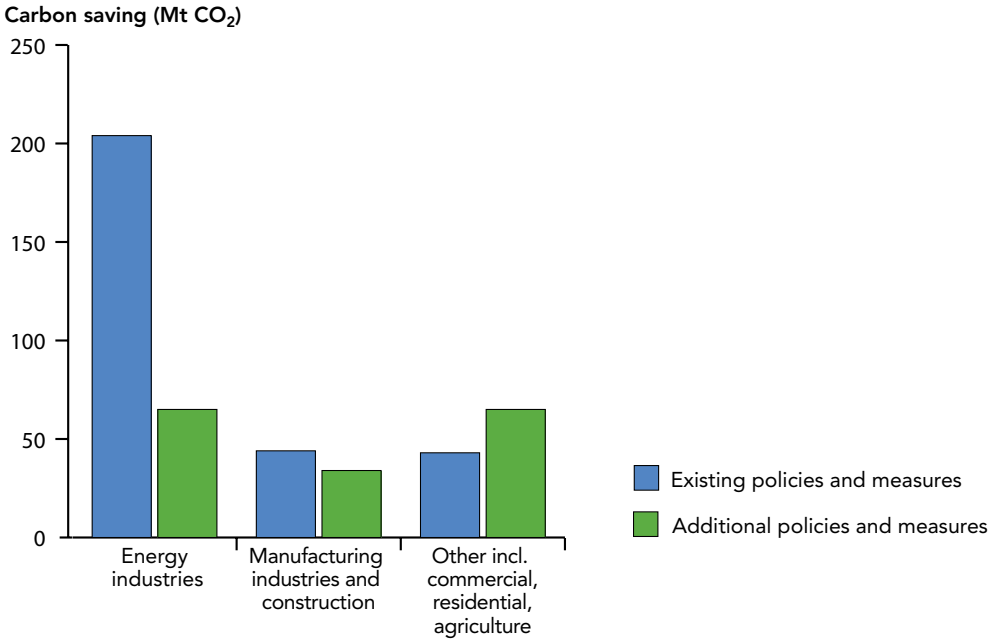
Figure 5.4 **Projected changes 1990–2010 in greenhouse gas emissions from energy supply and use, excluding transport**



Note: EU-11 emission projections are presented only for those MS that reported projections (B, DK, E, F, FIN, IRL, I, L, NL, S, UK).

Source: EEA, 2003a.

Figure 5.5 **EU-15 projected greenhouse gas emission savings in energy supply and use**



Note: Member States did not provide quantification for all reported policies and measures.

of 3.3 % per year over the 1990–2000 period (EEA, 2003b). In 2000, Austria and Sweden were by far the largest users of renewables for their national electricity production with shares of about 70 % and 55 %, respectively.

Between 1999 and 2000, the share of renewables in gross electricity production increased most in Portugal, Sweden, Denmark and Spain by about 9, 5, 4 and 3 %, respectively. In absolute terms electricity production by renewables grew most in Spain, Sweden and Germany, by between 9 and 8 TWh.

Renewable electricity was dominated by large hydropower, which had an 83 % share of output in 2000, followed by biomass/waste (10 %) and wind power (6 %). Large hydro is an established technology, but its capacity is not expected to increase substantially because of concerns about its impact on the environment through the loss of land and the resultant destruction of natural habitats and ecosystems.

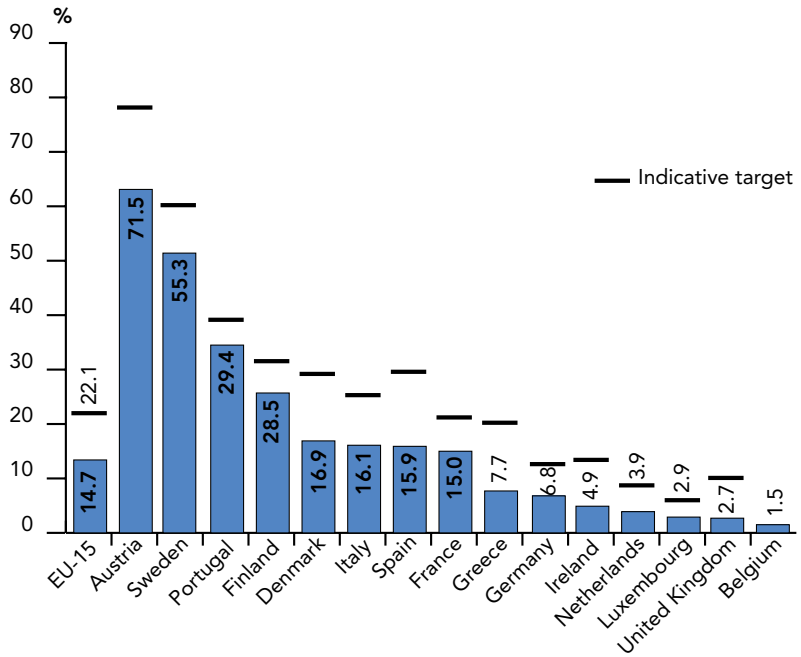
For 2010, the EU has proposed indicative targets for Member States and agreed to an overall indicative target of 22.1 % for the EU for the contribution of renewable energy sources to gross electricity consumption ([24]). That target is unlikely to be met under current trends (Figure 5.7).

Growth in renewable electricity is expected to come from increases in wind energy, solar power, biomass and small hydro (EEA, 2002b). The target for 2010, therefore, is very ambitious because the current growth rate of wind, solar, bio and small hydro has to double between 1999 and 2010, assuming the share of large hydropower plants remains stable. Apart from hydropower, wind energy is playing a leading role in renewable energy sources.

Member States have implemented a number of policies and measures (EEA, 2002b) that are expected to lead to further increases in the share of renewables. For example, the rapid

Figure 5.6 **Targets for 2010 and share of electricity consumption met by renewable energy sources in 2000**

Source: Eurostat.

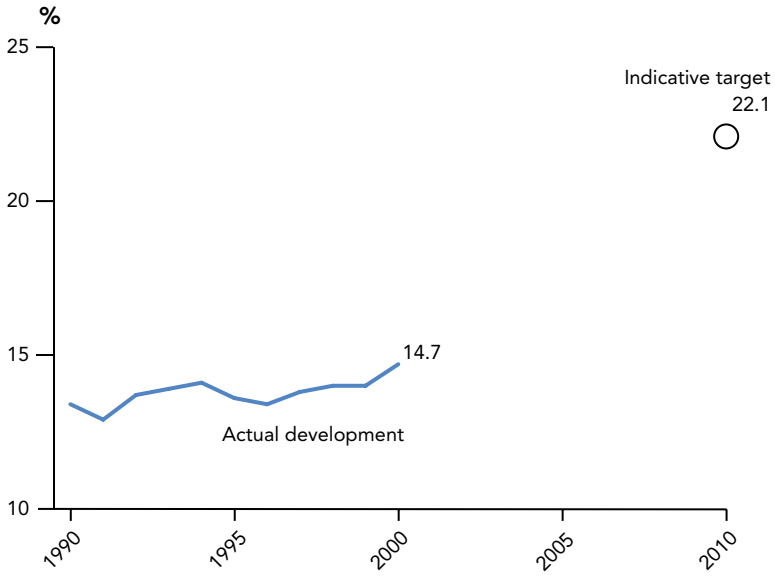


Note: National indicative targets shown are reference values that Member States agreed to take into account when setting their indicative targets by October 2002, according to the EU renewable electricity directive. Concerning waste, only electricity generated from biodegradable industrial and municipal waste is considered renewable under the directive. However, the figures shown above also include electricity from non-biodegradable waste since separate data are not available. They therefore overestimate the share of renewable electricity in gross electricity consumption by an amount equivalent to the electricity produced from non-biodegradable waste.

(24) Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources in the internal electricity market, September 2001.

Source: Eurostat.

Figure 5.7 **EU-15 trend in electricity consumption met by renewable energy sources and indicative target for 2010**



expansion of wind power (increasing by a factor of 30 in the EU during the period 1990–2000) was driven by Denmark, Germany and Spain, and was the result of support measures including 'feed-in' arrangements that guarantee a fixed favourable price for renewable electricity producers. Similarly, the rapid expansion of solar (photovoltaic) electricity was driven by Germany and Spain, mainly as a result of a combination of 'feed-in' arrangements and high subsidies.

Biomass/waste resources have also expanded rapidly (150 % increase between 1990 and 2000) and have the added benefit that they can be used in high-efficiency combined heat and power plants. The largest absolute increases in the amount of electricity produced from biomass and waste during the 1990s were seen in Finland and the UK. The largest share of biomass is wood/waste (covering wood waste, straw and some other solid waste), besides biogas and industrial and municipal waste. In Austria, Finland and Sweden, all countries with extensive forested areas, wood/wastes account for over 90 % of biomass and waste production. In absolute values, the amount of electricity produced from wood/waste was by far the highest in Finland, followed by Sweden. Both countries provided considerable research and development support and subsidies to the biomass power industry. In Sweden, the introduction of CO_2 and energy taxes from which biomass is exempted also helped the expansion of biomass power plants (EEA, 2003b).

Combined heat and power developments compared with targets for 2010

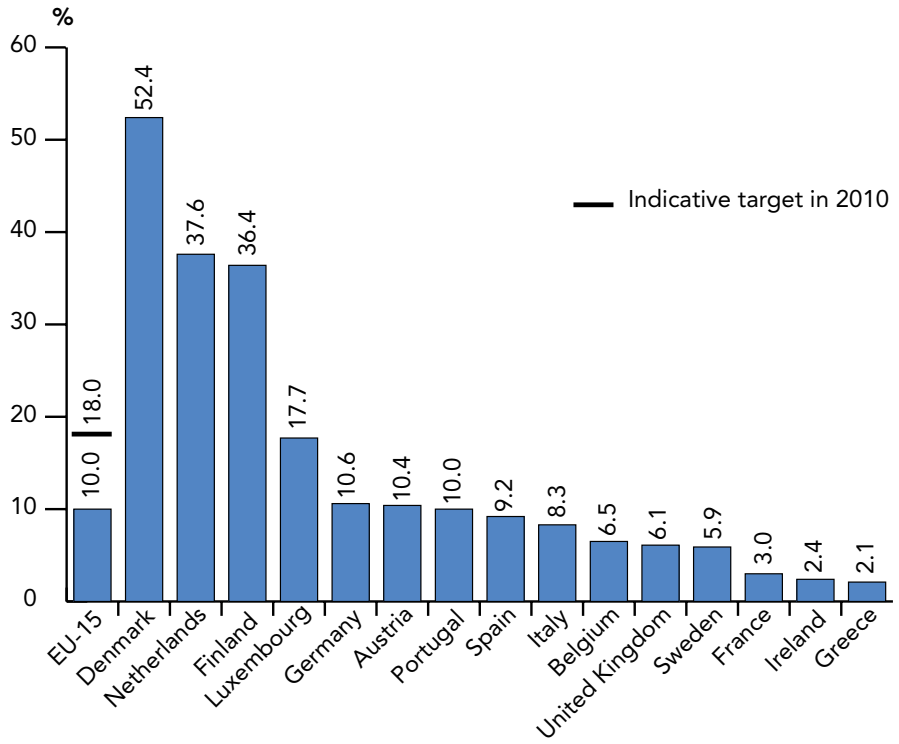
Combined heat and power technology uses fossil fuels, biomass or waste to supply end-users with heat as well as electricity. In so doing it avoids much of the waste heat losses associated with normal electricity production: CHP utilises over 85 % of the energy in the fuel rather than the average of about 35 to 45 % in current plants producing only electricity. CHP schemes are particularly effective where there exist large, dense heat loads for long periods of the year, such as those provided by collective housing schemes in relatively cold climates (EEA, 2003b).

In the EU, CHP increased its share in electricity production to about 10 % in 2000 (Figure 5.8).

Growth was highest in Member States with programmes and targets providing incentives for that technology such as Denmark, Finland, Italy, the Netherlands and Spain. High market penetration of CHP electricity in Denmark was achieved as a result of strong government policy support, providing tax incentives and subsidies. Government support was also an important factor in Austria and the Netherlands. In Finland, the introduction of liberalised energy

Figure 5.8 **Target for 2010 for the EU and share of gross electricity production from combined heat and power plants in 2000**

Source: Eurostat.



Note: The data include combined heat and power production from public electricity and heat producers as well as from autoproducers (at specific industrial sites). Eurostat has adopted a new methodology to calculate the share of CHP in gross electricity production designed to better identify electricity production from combined heat and power. This revision has resulted in different (lower) figures for some countries. The 18 % indicative target for 2010 was set by the European Commission in 1997 on the basis of a previous methodology and may therefore not be directly comparable with the new methodology. The proposed directive on CHP (2002) does not contain an indicative target.

markets stimulated investment in CHP. In recent years, however, many Member States have had problems with intensification of CHP use, in particular Germany, the Netherlands and the United Kingdom. In Germany CHP capacity fell by 16 % between 1998 and 2000 due mainly to a decrease in electricity prices that resulted from the liberalisation of the electricity market in 1998 and an increase in gas prices on international energy markets. In 2000 Germany implemented a CHP support law (KWK-Vorschaltgesetz) to improve the economic position of public CHP plants and, in 2002, a new CHP support law to enforce the Federal Government's target to double CHP electricity production by 2010. This law allows CHP producers to put a surcharge on the price of power they feed into the public grid.

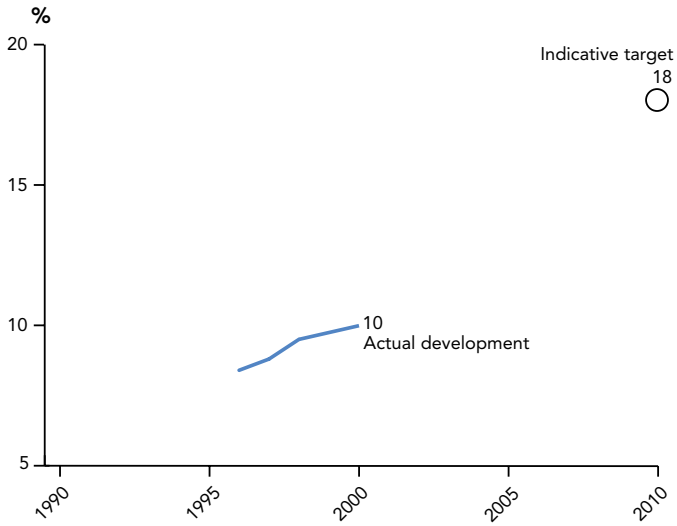
The EU has set an indicative target of doubling all electricity production from CHP between 1994 and 2010 (from 9 % to 18 %) (European Commission, 1997a). The current rate of increase is not sufficient to achieve the EU target of 18 % by 2010 (Figure 5.9). The proposed directive on CHP (2002) does not contain this indicative target.

The disappointing trends in CHP development are due to the following factors:

- rising natural gas prices (gas is the preferred fuel for new CHP) have reduced the cost competitiveness of CHP;
- falling electricity prices, resulting from market liberalisation and increased competition, have also hit the cost competitiveness of CHP;

Source: Eurostat.

Figure 5.9 **EU-15 development of the share of electricity production met by combined heat and power technology and indicative target for 2010**



- uncertainty over the evolution of electricity markets as liberalisation is progressively extended is making companies reluctant to invest in CHP;
- aggressive pricing has been used by electricity utilities to protect their markets.

Key policies in the energy supply and use sector (excluding transport) and main emission savings

All Member States have provided information on policies and measures, including quantification of their emission savings, except Belgium, Finland and Luxembourg. For the energy supply and use sector, Member States' key policies and measures are in the following areas: renewable energy, CHP, building standards and energy-efficient appliances (Figure 5.10).

Savings from existing renewable energy policies and measures play the major role, amounting to about 90 Mt CO_2-equiv. For additional measures as well, the largest savings are projected to come from renewable energy. Savings from existing measures on building standards and CHP are each estimated to amount to almost 30 Mt CO_2-equiv.

The main types of policies and measures reported by Member States for energy supply and use (excluding transport), existing as well as additional, are economic, fiscal and regulatory instruments (Figure 5.11).

Key policies and measures in industry (energy use)

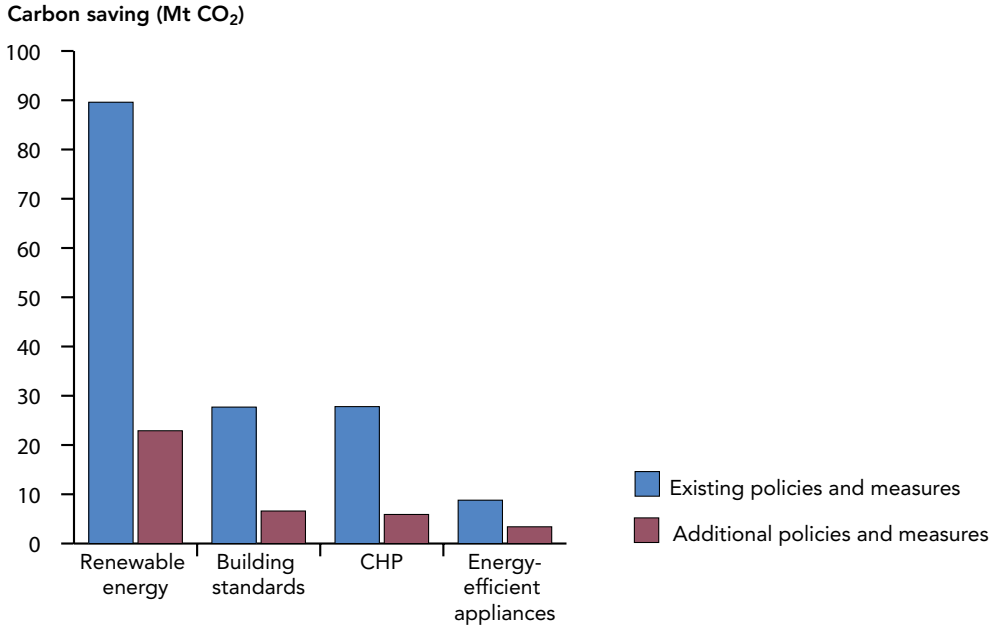
The reduction in CO_2 emissions from manufacturing industries in the past was due to an improvement in energy intensity (ratio of energy use to value added) in industry of about 1 % per year over the last decade (EEA, 2002b). This was due to structural changes in favour of higher value-added products, changes in some industries to less energy-intensive processes, improvements in the energy efficiency of processes and import substitution. Only part of these developments was due to specific policies and measures aimed at reducing greenhouse gas emissions. The improvement in energy intensity is projected to continue or be enhanced, with the help of existing and additional policies and measures. Member States reported various types of national policies and measures, aimed at further improving energy intensity in the future, including voluntary/negotiated agreements with individual industry sectors (Figure 5.11). The promotion of CHP in industry is also expected to improve energy intensity.

Key existing policies and measures for households

The decoupling of CO_2 emissions from the number of dwellings in the last decade was due to efficiency improvements through thermal insulation of buildings, fuel switch and increases in solar thermal energy production and biomass district heating.

Figure 5.10 **EU-15 projected greenhouse gas emission savings from key policies in energy supply and use**

Source: EEA, 2003a.



Note: Member States did not provide quantification for all reported policies and measures.

Figure 5.11 **Types of policies and measures adopted by Member States for energy supply and use (excluding transport)**

Source: EEA, 2003a.

	Economic		Fiscal		Voluntary /negotiated		Regulatory		Information		Education		Research		Other	
	Imp	Add	Imp	Add	Imp	Add	Imp	Add	Imp	Add	Imp	Add	Imp	Add	Imp	Add
Austria	✓✓	✓	✓		✓	✓✓	✓✓	✓	✓✓✓	✓✓	✓					
Belgium	✓✓✓	✓✓	✓✓✓	✓	✓✓✓	✓✓	✓✓	✓✓✓	✓		✓✓✓					
Denmark	✓✓✓		✓✓		✓		✓✓✓		✓				✓		✓	
Finland	✓✓✓	✓	✓✓	✓✓	✓✓		✓✓	✓✓	✓	✓✓	✓	✓✓				✓
France	✓✓✓	✓	✓	✓	✓	✓✓	✓✓	✓			✓	✓			✓	✓
Germany	✓✓✓		✓✓✓		✓✓✓		✓✓✓				✓✓✓					
Greece	✓✓✓	✓✓					✓	✓✓	✓							
Ireland		✓		✓		✓		✓								✓✓✓
Italy	✓	✓		✓		✓✓✓	✓	✓		✓		✓				✓✓✓
Luxembourg		✓	✓✓✓	✓✓	✓	✓	✓✓	✓								
Netherlands	✓✓		✓✓✓		✓✓✓		✓✓✓								✓✓	
Portugal	✓✓✓		✓				✓✓✓						✓			
Spain	✓✓✓	✓	✓✓✓				✓✓✓	✓				✓			✓✓✓	✓✓✓
Sweden	✓✓✓		✓✓✓			✓	✓	✓	✓✓				✓		✓	
United Kingdom		✓	✓	✓✓✓		✓	✓✓✓	✓✓✓								

Note: Imp = implemented (existing); Add = additional. For most Member States, the number of ticks relates to the magnitude of the contribution of the policy instrument to the country's total carbon saving. For countries that provide only qualitative details of policies (indicated by italics), the number of policies of each type is scored.

Member States project that these efficiency improvements will continue, helped by policies and measures. A key policy is the EU directive on the energy performance of buildings, which includes minimum standards for new buildings and for existing buildings when they are renovated, and the requirement for all buildings to have energy performance certificates. Other key policies are the EU appliances labelling scheme and schemes for energy efficiency standards. Some Member States already have similar policies and measures in place.

5.4.2 Transport

☹ Greenhouse gas emissions from transport are projected to increase by 34 % from 1990 levels by 2010 in the 'with existing domestic measures' projections.

😐 Average specific carbon dioxide emissions of new passenger cars were reduced by about 10 % from 1995 to 2001 due to fuel efficiency improvements and a shift in fleet composition from petrol to diesel passenger cars, suggesting that the EU target of 140 g CO_2/km (by 2008/09 at the latest) agreed with the European, Japanese and Korean car industries is achievable if these improvements continue. However, past and projected increases in passenger transport by road will make a reduction or even an absolute limitation of carbon dioxide emissions from passenger cars by 2010 difficult to achieve.

☹ Nitrous oxide emissions from transport currently account for only 0.6 % of total EU greenhouse gas emissions, but emissions have grown by 126 % since 1990 and are projected to rise still further due to the forecast increase in transport carried out by petrol cars equipped with catalysts.

Projections of emissions from transport
For the EU, aggregated projections of transport greenhouse gas emissions for 2010 cannot be given with any certainty because only 11 Member States have reported separate emission projections for the transport sector. The analysis is limited, in particular, because the projections for Germany, the largest emitter in the EU, are missing.

For those 11 countries that reported, aggregated EU transport emissions are projected to increase by 34 % compared with 1990 when existing domestic measures are taken into account (Figure 5.12). As with past transport emissions (see Section 3.3.3), by far the largest contribution is from road transport, although the exact contribution cannot be given due to lack of information on the shares of the various transport modes in the projections reported by Member States. These projections exclude emissions from international transport. However, emissions from international transport, especially aviation, are also projected to increase substantially.

All reporting Member States project growing transport emissions, indicating that policies and measures are not sufficient. Belgium, Ireland, Luxembourg and Spain expect the strongest growth, with Ireland projecting that emissions will more than double by 2010. Ireland, Italy, Spain and the United Kingdom expect that additional measures will significantly reduce the projected growth in transport emissions. For the other Member States, any additional measures are regarded as having less effect. Unfortunately, Member States with quite high increases in 2001 from 1990 levels (see Section 3.3.3), such as Austria and Portugal, did not report any projections.

Key existing policies for road transport
Carbon dioxide emissions contribute substantially to the total greenhouse gas emissions from transport (see Section 3.3.3) and measures to reduce these emissions are therefore important.

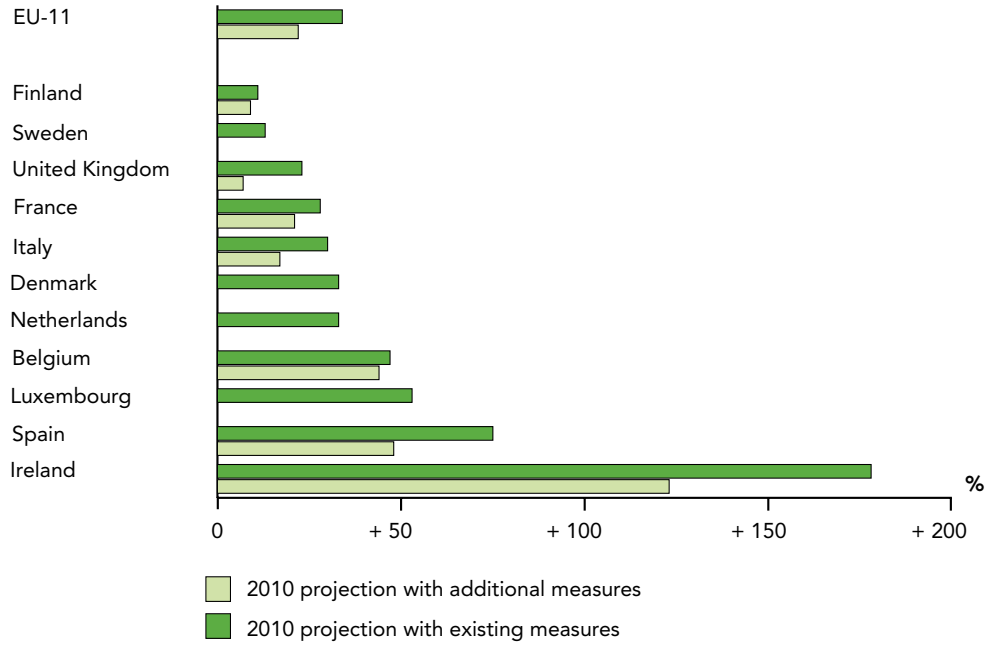
As far as passenger cars are concerned, the EU aims to reduce the average specific CO_2 emissions of new cars to 120 g CO_2/vehicle-km by 2005, and by 2010 at the latest. In order to meet these targets, voluntary agreements between the European Commission and the European, Japanese and Korean automobile manufacturers' associations (ACEA, JAMA, KAMA ([25])) have been concluded. In these voluntary agreements the automobile industry commits itself to aim at average specific CO_2 emissions of 140 g CO_2/vehicle-km for new passenger cars by 2008 (ACEA) and 2009 (JAMA/KAMA).

According to the third annual report on the effectiveness of the strategy to reduce CO_2 emissions from cars (European Commission, 2002), the average specific

(25) ACEA: European Automobile Manufacturers Association; JAMA: Japan Automobile Manufacturers Association; KAMA: Korea Automobile Manufacturers Association.

Figure 5.12 **Projected changes 1990–2010 in greenhouse gas emissions from transport**

Source: EEA, 2003a.



Note: EU-11 emission projections are presented only for those MS that reported projections (B, D, DK, E, FIN, IRL, I, L, NL, S, UK). Emissions exclude international aviation and navigation.

CO_2 emissions of new passenger cars fell by 9.7 % from 186 g CO_2/vehicle-km in 1995 to 168 g CO_2/vehicle-km in 2001 (Figure 5.13). However, it should be noted that the total number of passenger cars sold increased by 24.4 % in the same period, thereby offsetting efficiency improvements. In order to meet the EU's final target of 120 g CO_2/km, additional efforts are necessary.

One of the reasons for the specific emission reductions between 1995 and 2001 was the technological development in diesel cars and a shift in fleet composition from petrol to diesel passenger cars. All associations increased the diesel share of their fleets: in 2001, more than one third of cars sold in the EU were diesel cars. The increased share of diesel cars raises concerns because this could result in higher emissions of particulates and nitrogen oxides and thus negatively affect air quality.

There are considerable differences in the specific fuel emissions of new cars in different Member States, ranging from 157 g CO_2/km in Portugal and Italy to 200 g CO_2/km in Sweden. For Sweden this is due to the very low share of new diesel cars.

The estimated emission savings from the implementation of the ACEA agreement for the EU as a whole is about 20 Mt CO_2-equiv., as assessed by Member States.

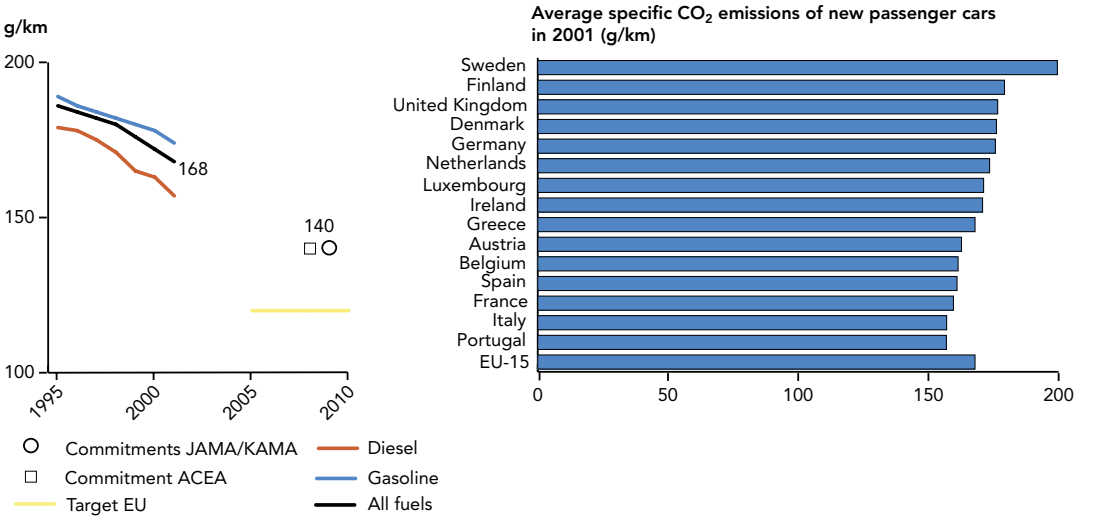
The car-labelling directive (1999/94/EC) that came into force in 2001, but still has to be implemented by several countries, will complement the ACEA agreement with important information on energy efficiency for car buyers, with the aim of increasing sales of more energy-efficient cars.

Currently road freight transport and other transport modes are not included in any EU strategy to reduce carbon dioxide emissions. There have been no improvements in the energy efficiency of rail, but this remains the most energy-efficient mode. Despite improvements during the 1990s, aviation is generally the least energy-efficient mode (EEA, 2002c).

The most favoured and effective methods to change behaviour in the transport sector, towards more energy-efficient modes, are through voluntary agreements and fiscal incentives, subsidies and taxes (Figure 5.14).

Sources: European Commission, 2002; EEA, 2003a.

Figure 5.13 Average specific CO_2 emissions of new passenger cars per fuel type, and targets



Source: EEA, 2003a.

Figure 5.14 Types of policies and measures adopted by Member States for transport

	Economic		Fiscal		Voluntary /negotiated		Regulatory		Information		Education		Research		Other	
	Imp	Add	Imp	Add	Imp	Add	Imp	Add	Imp	Add	Imp	Add	Imp	Add	Imp	Add
Austria			✔	✔	✔		✔	✔	✔ ✔	✔	✔	✔	✔			
Belgium			✔	✔ ✔ ✔	✔ ✔	✔		✔			✔ ✔ ✔	✔			✔ ✔ ✔	✔ ✔
Denmark				✔			✔		✔	✔						
Finland	✔ ✔	✔ ✔	✔	✔	✔ ✔	✔	✔		✔ ✔ ✔	✔ ✔	✔ ✔	✔ ✔				
France	✔	✔	✔	✔	✔	✔	✔ ✔	✔			✔	✔			✔ ✔	✔
Germany	✔ ✔ ✔	✔	✔						✔							
Greece		✔			✔		✔	✔								
Ireland				✔		✔		✔				✔				
Italy		✔		✔		✔ ✔		✔		✔						✔
Luxembourg				✔												✔
Netherlands			✔		✔ ✔		✔				✔				✔	
Portugal																
Spain	✔		✔		✔		✔	✔	✔		✔					
Sweden					✔								✔		✔ ✔	
United Kingdom			✔	✔		✔ ✔										

Note: Imp = implemented (existing); Add = additional. See note to Figure 5.11.

5.4.3 Agriculture

☺ EU-wide greenhouse gas emissions in agriculture are projected to decrease to 11 % below the 1990 level by 2010 in the 'with existing domestic measures' projection. Reductions in emissions are expected primarily from continuing reform of the common agricultural policy and the implementation of the nitrate directive, resulting in reductions in the number of cattle and in fertiliser use.

Projections of emissions from agriculture
For the EU, aggregated greenhouse gas emissions projections for 2010 cannot be given with any certainty because only eleven Member States have reported separate emission projections for agriculture. The analysis is limited, in particular, because the projections of Germany, the second largest emitter in the EU, are missing.

For the eleven countries reporting, aggregated total greenhouse gas emissions for the EU are forecast to decline by 2010 by 11 % and 13 % below 1990 levels in the 'with existing domestic measures' and the 'with additional domestic measures' projections, respectively (Figure 5.15).

For all Member States except Ireland, total greenhouse gas emissions in agriculture are expected to decrease by 2010 from 1990 in both the existing measures and the additional measures projections. Finland and the Netherlands project significant decreases of more than 25 %. In Ireland, however, emissions are projected to increase in based on existing domestic measures but additional measures are identified that would result in a projected decrease. Unfortunately Spain, with a high increase in 2001 from 1990 levels (see Section 3.3.4), did not report any agricultural emission projections.

Key policies and measures for agriculture
Decreases in fertiliser use are likely to reduce N_2O emissions, while decreases in the number of cattle and increases in cattle productivity are likely to contribute to a decline in emissions of methane.

The drop in fertiliser use between 1990 and 2001 was achieved partly through the 1992 reform of the common agricultural policy (CAP), resulting in a shift from production-based support mechanisms to direct area payments in arable production. In addition, reduction in fertiliser use has also been achieved due to the implementation of EU directives such as the nitrate directive, and the agro-environment programmes supporting extensification measures.

National policies and measures assume the continuation of the reform of the CAP and thus expect reductions of emissions in the 'with existing measures' projections. Most EU Member States favour the use of regulatory and fiscal policies and measures (Figure 5.16). Spain is the only country that expects a high contribution to total country emission savings in the agricultural sector from the use of economic and regulatory instruments.

☺ EU-wide emissions of nitrous oxide and hydrofluorocarbons from industrial processes are projected to decrease by 2 % with existing domestic measures and by 22 % with additional domestic measures. Additional measures are expected to be particularly effective in Finland, France, Greece and Ireland.

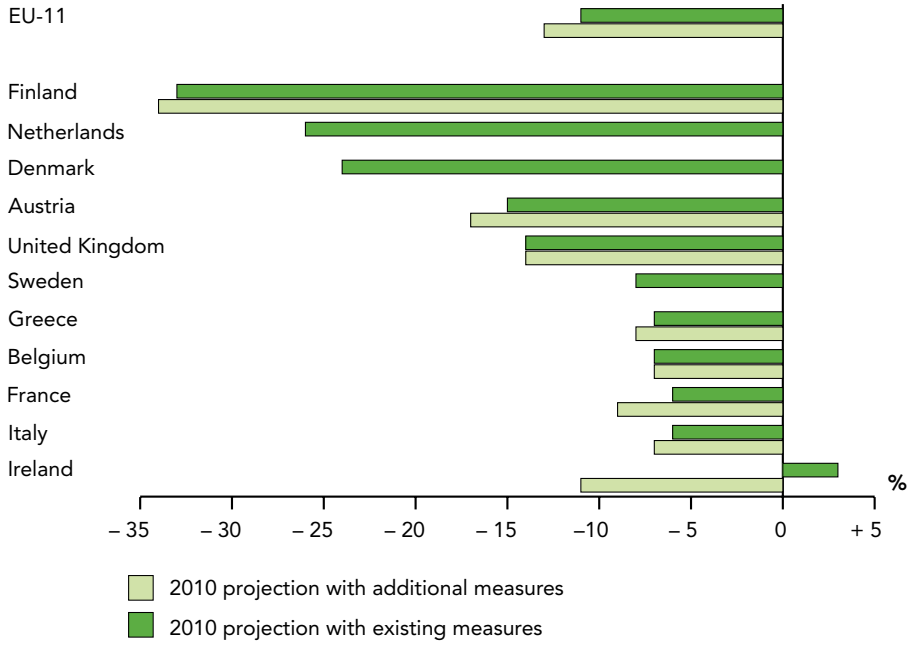
😐 Substantial projected reductions in nitrous oxide emissions arise from adipic and nitric acid production, but are offset by substantial projected increases in hydrofluorocarbon emissions (86 % from the base year to 2010), due to the continuing replacement of chlorofluorocarbons which are being phased out to protect the ozone layer.

5.4.4 Industry (non-energy-related)

Projections of non-energy-related emissions from industrial processes
For the EU, aggregated greenhouse gas emission projections for 2010 cannot be given with any certainty because only ten Member States have reported separate emissions projections for the industrial processes sector. The analysis is limited, in particular, because projections for

Source: EEA, 2003a.

Figure 5.15 **Projected changes 1990–2010 in greenhouse gas emissions from agriculture**



Note: EU-11 emissions and projections are given only for those MS that have reported projections (A, B, DK, F, FIN, GR, IRL, I, NL, S, UK).

Source: EEA, 2003a.

Figure 5.16 **Types of policies and measures adopted by Member States for agriculture**

	Economic		Fiscal		Voluntary /negotiated		Regulatory		Information		Education		Research		Other	
	Imp	Add	Imp	Add	Imp	Add	Imp	Add	Imp	Add	Imp	Add	Imp	Add	Imp	Add
Austria			✔				✔	✔	✔	✔			✔	✔		
Belgium			✔ ✔ ✔	✔ ✔ ✔		✔	✔	✔ ✔ ✔				✔ ✔ ✔	✔			
Denmark			✔				✔									
Finland	✔						✔									
France	✔	✔	✔				✔								✔	
Germany							✔									
Greece		✔						✔								
Ireland				✔ ✔				✔ ✔						✔		
Italy			✔	✔				✔								✔
Luxembourg																
Netherlands	✔		✔		✔ ✔		✔ ✔								✔ ✔	
Portugal																
Spain		✔ ✔ ✔				✔ ✔		✔ ✔ ✔				✔				✔
Sweden	✔						✔								✔	
United Kingdom				✔												

Note: Imp = implemented (existing); Add = additional. See note to Figure 5.11.

Germany, the largest emitter in the EU, are missing.

For the ten countries reporting, aggregated greenhouse gas emissions for the EU are projected to decline by 2 % between 1990 and 2010 based on existing domestic measures and significantly by more than 20 % based on additional domestic measures (Figure 5.17). The projected reductions in N_2O emissions from adipic and nitric acid production offset substantial projected increases in hydrofluorocarbon emissions (86 % from the base year to 2010), due to continuing replacement of chlorofluorocarbons which are being phased out to protect the ozone layer.

However, for most Member States total greenhouse gas emissions from industrial processes are expected to increase by

2010 compared with 1990 in the 'with existing measures' projections. In particular Belgium, Denmark, Finland and Ireland forecast strong growth. But Finland and Ireland expect that additional measures will significantly reduce the projected growth in emissions. Only in the United Kingdom are emissions projected to decrease significantly, by 65 %, with existing domestic measures. This is due to improved abatement in the manufacture of adipic acid and other industries. With additional measures France also projects large decreases (of 42 %). Unfortunately Spain, with high increases in 2001 from 1990 levels (see Section 3.3.5), did not report any projections of non-energy industrial emissions.

Key policies and measures for non-energy-related industrial processes
Policies and measures are mainly aimed at abatement measures in adipic and nitric acid production (to reduce N_2O emissions) and on alternatives (substitutes) for HFCs in refrigeration and air conditioning. Measures aimed at adipic acid production are mainly in the 'with existing measures' projections, but some countries report both existing and additional domestic measures for the other process emissions. However, most EU Member States did not report any policies and measures for these source categories. The few reporting Member States expect some greenhouse gas savings in industrial processes to be achieved by regulatory policies and measures (Figure 5.18).

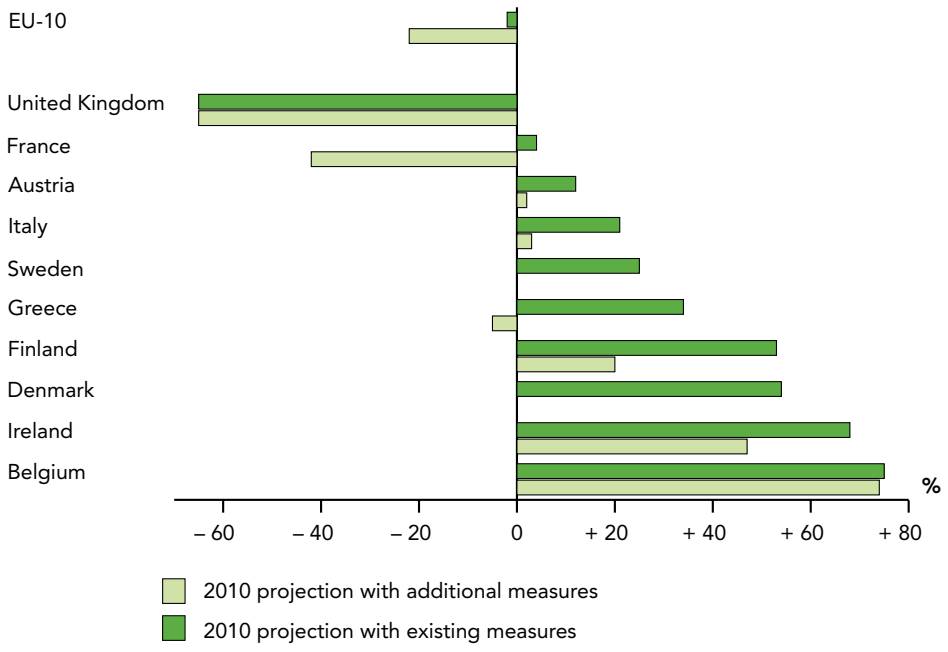
☺ EU-wide greenhouse gas emissions in the waste sector are projected to decrease by about 50 % between 1990 and 2010, mainly due to implementation of the EU landfill directive.

5.4.5 Waste management

Projections of emissions from waste management (landfills)
For the EU, aggregated greenhouse gas emission projections for 2010 cannot be given with any certainty because only ten Member States have reported separate emission projections for waste. The analysis is limited in particular because projections for Germany, the largest emitter in the EU, are missing.

Figure 5.17 **Projected changes 1990–2010 in greenhouse gas emissions from non-energy-related industrial processes**

Source: EEA, 2003a.



Note: EU-10 emission projections are presented only for those MS that reported projections (A, B, DK, F, FIN, GR, I, IRL, S, UK).

Source: EEA, 2003a.

Figure 5.18 **Types of policies and measures adopted by Member States in non-energy-related industrial processes**

	Economic		Fiscal		Voluntary /negotiated		Regulatory		Information		Education		Research		Other	
	Imp	Add	Imp	Add	Imp	Add	Imp	Add	Imp	Add	Imp	Add	Imp	Add	Imp	Add
Austria						✔	✔	✔						✔		
Belgium							✔	✔ ✔								
Denmark			✔				✔									
Finland																
France		✔	✔				✔ ✔ ✔	✔				✔		✔		✔
Germany		✔			✔ ✔ ✔	✔	✔	✔	✔	✔		✔				
Greece						✔		✔								
Ireland						✔										
Italy																
Luxembourg																
Netherlands	✔ ✔ ✔		✔ ✔ ✔		✔ ✔ ✔		✔ ✔ ✔								✔ ✔ ✔	
Portugal	✔						✔									
Spain		✔														✔
Sweden							✔									
United Kingdom																

Note: Imp = implemented (existing); Add = additional. See note to Figure 5.11.

For the ten countries reporting, aggregated greenhouse gas emissions from waste for the EU are expected to decline significantly to more than 50 % below 1990 levels by 2010 both in the 'with existing domestic measures' projections and in the 'with additional domestic measures' projections (Figure 5.19).

For the ten Member States with projections, total greenhouse gas emissions from waste processes are forecast to decrease by at least 22 % from 1990 levels by 2010 in 'with existing domestic measures' projections (Austria having the lowest fall). By far the largest reductions are projected for the United Kingdom (63 %), and with additional measures for Finland (79 %). Unfortunately Portugal and Spain, with the highest increases in 2001 from 1990 levels (see Section 3.3.6), did not report any emission projections for waste management.

Key policies and measures for waste management (landfills)

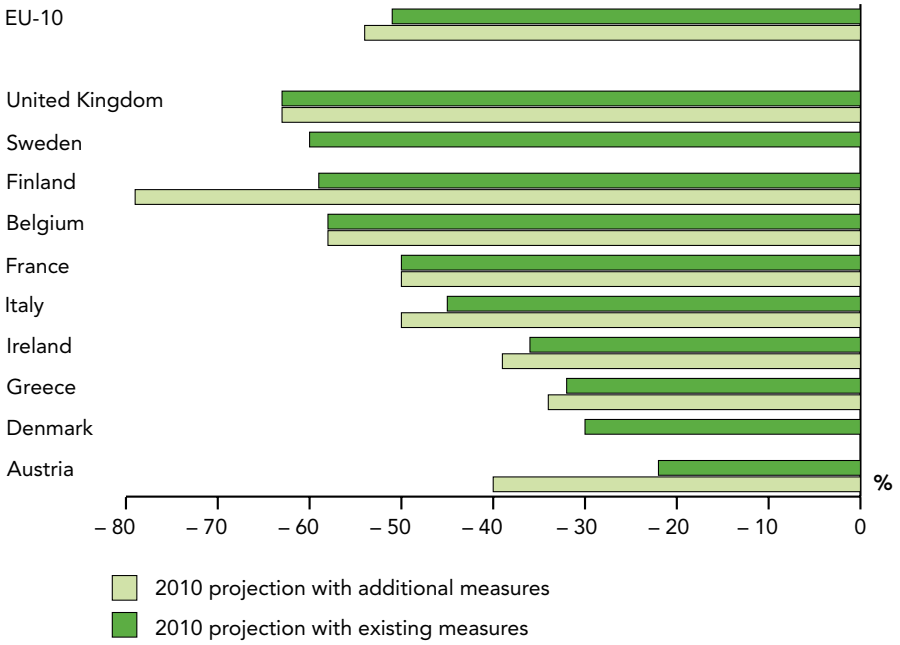
The emission reductions of 28 % up to 2001 were partly achieved due to the (early) implementation of the landfill waste directive and similar legislation in Member States. The landfill waste directive is one of the EU's common and coordinated policies and measures and was adopted in 1999. Member States are obligated to reduce the amount of biodegradable waste disposed untreated in landfills, and to install landfill gas recovery at all new sites. The 'with existing domestic measures' and 'with additional domestic measures' projections assume that the implementation of the landfill directive will occur according to the required time schedules.

Domestic measures arising from the landfill directive account for reductions of about 40 Mt CO_2-equiv., according to EU-wide estimates (European Commission, 2003b).

Many Member States did not report any additional specific domestic policies and measures. Most of the reporting EU Member States expect some greenhouse gas savings in waste to be achieved by regulatory policies and measures (Figure 5.20).

Figure 5.19 **Projected changes 1990–2010 in greenhouse gas emissions from waste management**

Source: EEA, 2003a.



Note: EU-10 emission projections are presented only for those MS that have reported projections (A, B, DK, F, FIN, GR, IRL, I, S, UK).

Figure 5.20 **Types of policies and measures adopted by Member States in waste management**

Source: EEA, 2003a.

	Economic		Fiscal		Voluntary /negotiated		Regulatory		Information		Education		Research		Other	
	Imp	Add	Imp	Add	Imp	Add	Imp	Add	Imp	Add	Imp	Add	Imp	Add	Imp	Add
Austria	✔	✔	✔		✔	✔	✔	✔ ✔	✔	✔	✔	✔	✔	✔		
Belgium						✔	✔ ✔ ✔	✔ ✔			✔				✔	
Denmark			✔				✔									
Finland			✔	✔ ✔ ✔			✔ ✔	✔ ✔ ✔								
France							✔ ✔	✔								
Germany		✔					✔ ✔ ✔	✔								
Greece		✔					✔ ✔	✔								
Ireland				✔												
Italy			✔	✔		✔	✔	✔							✔	
Luxembourg																
Netherlands															✔	
Portugal							✔									
Spain		✔						✔								
Sweden			✔				✔ ✔ ✔									
United Kingdom			✔				✔									

Note: Imp = implemented (existing); Add = additional. See note to Figure 5.11.

6 Use of Kyoto mechanisms in Member States

😐 The projected use of Kyoto mechanisms for achieving the EU Kyoto target is so far limited to about 21 Mt CO_2 -equiv. per year in the commitment period (by the Netherlands and Portugal), and only a few countries have allocated resources (Austria, Finland, the Netherlands, Sweden).

😐 The Netherlands expects to achieve its target by a combination of domestic policies and measures and the use of Kyoto mechanisms.

In addition to domestic measures, Member States are also allowed to make use of the flexible mechanisms under the Kyoto Protocol (Kyoto mechanisms) to achieve their EU burden-sharing targets. The Kyoto mechanisms are explained further in Box 6.1.

Eight Member States — Austria, Belgium, Finland, the Netherlands, Portugal, Spain, Sweden and the United Kingdom — have provided information on their intended use of the Kyoto mechanisms through a questionnaire sent out in 2002 under the EU GHG monitoring mechanism (EEA, 2003a). Six countries have already decided to use the Kyoto mechanisms (Table 6.1). Two countries (Finland and Sweden) have not yet taken final decisions on their use. However, activities to implement project-based mechanisms have been started in these countries.

Box 6.1: Flexible mechanisms under the Kyoto protocol (Kyoto mechanisms)

Joint implementation (JI) is provided for under Article 6 of the Kyoto Protocol. It enables industrialised countries to work together to meet their emission targets. A country with an emissions reduction target can meet part of that target through a project aimed at reducing emissions in any sector of another industrialised country's economy. Any such projects need to have the approval of the countries involved and must result in emission reductions that would not otherwise have occurred in the absence of the JI project. The use of carbon sinks (e.g. forestry projects) is also permitted under JI.

Article 12 of the Kyoto Protocol sets out a clean development mechanism (CDM). This is similar to joint implementation, but project activities must be hosted by a developing country. As with JI, CDM projects must result in reductions that are additional to those that would have been achieved in the absence of the project. They also have the additional aim of promoting sustainable development in the host developing country. The CDM is supervised by an Executive Board, which approves projects. CDM projects have been able to generate credits since January 2000 and these can be banked for use during the first commitment period (2008–12). The rules governing CDM projects allow only certain types of sinks project (afforestation and reforestation), and countries will not be able to use credits generated by nuclear power projects towards meeting their Kyoto targets. To encourage small-scale projects, special fast-track procedures are being developed.

Emissions trading: Article 17 of the Kyoto Protocol allows countries that have achieved emissions reductions over and above those required by their Kyoto targets to sell the excess to countries finding it more difficult or expensive to meet their commitments. In this way, it seeks to lower the costs of compliance for all concerned.

Table 6.1 **Planned use of Kyoto mechanisms in EU Member States**

Source: EEA, 2003a.

Member State	Planned use of Kyoto mechanisms	Which Kyoto mechanisms? (ET, CDM, JI)	Achieving the burden-sharing target through domestic action (no use of Kyoto mechanisms)?	Projected emission reduction 2008–12 through the use of Kyoto mechanisms (Mt CO_2-equiv. per year)
Austria	Yes	Priority on JI and CDM		No quantitative targets foreseen
Belgium	Yes Trading simulation to gain experience	Not yet decided	Not yet decided	Not yet decided
Finland	Not yet decided (pilot programme to gain experience)	Not yet decided	Not yet decided	Not yet decided
Netherlands	Yes	ET, CDM, JI	No	20.0
Portugal	Yes	ET, CDM, JI	No	Total international: 0.68–1.3
Spain	Yes	Priority on ET and CDM	No	Not yet decided
Sweden	Not yet decided	ET, CDM, JI	Yes	Not yet decided
United Kingdom	Yes	ET, CDM, JI	Yes (domestic trading scheme considered as domestic action)	Domestic trading scheme: 2.0

Note: Austria assumes a maximum of 50 % of the efforts required for compliance with its burden-sharing target to be accomplished by means of JI and CDM. The Netherlands expects a contribution of 100 Mt CO_2-equiv. from flexible mechanisms in 2008–12 (20.0 Mt CO_2-equiv. per year). By 2003 8.4 million tonnes (JI) and 36 million (CDM) have already been contracted. Portugal expects that of its total projected use of international trading 0.32 to 0.40 Mt CO_2-equiv. will be acquired within the EU emissions trading scheme.

Quantitative estimates for the use of Kyoto mechanisms (JI and CDM) were only provided by the Netherlands and Portugal. The Netherlands is planning to use Kyoto mechanisms to meet 50 % of the effort required to reach the Kyoto target (20.0 Mt CO_2-equiv. per year in the commitment period). Portugal's estimate of total contributions from the use of Kyoto mechanisms (0.68–1.3 Mt CO_2-equiv.) amounts to approximately 8–14 % of the gap between projected Portuguese greenhouse gas emissions in 2010 with existing domestic measures and the burden-sharing target. Austria has set a maximum of 50 % for use of Kyoto mechanisms to cover its reductions commitment (gap between base-year emissions and target). Sweden and the United Kingdom indicate that they will reach their burden-sharing targets through domestic measures without the use of flexible mechanisms under the Kyoto Protocol.

The status of preparations for the use of JI and CDM project-based activities differ greatly between Member States. The Netherlands has made the strongest progress in the implementation of JI and CDM projects and allocated one of the largest budgets (EUR 225 million for the five-year commitment period). However, other Member States have also started to implement activities such as the preparation of the national legal framework (Austria, Belgium, Spain, Sweden), the start of pilot programmes (Finland) and the allocation of budgets for JI or CDM projects. Currently allocated budgets for the period 2008–12 total for Austria a maximum of EUR 288 million (of which EUR 36 million between 2003 and 2010), for Finland EUR 8.5 million and for Sweden EUR 37.5 million.

Up to now, most agreements or contracts have been arranged for joint implementation; however, two countries (Netherlands and Spain) prefer CDM project activities according to their responses. Most of the project-based activities initiated by Member States are at an early stage that does not yet allow an assessment of their quantitative contribution to the burden-sharing target during the commitment period.

Taking into account the level of preparations and in particular the formal allocation of budgets and the starting of projects, it could be concluded that only the Netherlands is projected to get near to achieving its burden-sharing target through a combination of domestic policies and measures and project-based Kyoto mechanisms (JI and CDM).

The information from Member States presented in this chapter suggests that so far for each year of the commitment period around 21 Mt CO_2-equiv. of savings have been identified from the flexible mechanisms under the Kyoto Protocol. This corresponds to 6.3 % of the total required emission reduction for the EU as a whole of 336 Mt CO_2-equiv. These mostly result from the Netherlands' proposed use of the mechanisms (20 Mt CO_2-equiv.).

7 Accounting of carbon sinks by Member States

Eight Member States intend to use carbon sinks options under the Kyoto Protocol. So far CO_2 sequestration of 10 and 3 Mt CO_2 has been quantified according to Article 3.3 and 3.4, respectively, of the Kyoto Protocol.

In addition to reducing or limiting emissions of greenhouse gases, Member States can make use of CO_2 removals by land-use change and forestry (LUCF) activities, or carbon sinks, under the Kyoto Protocol to achieve their UNFCCC and EU burden-sharing targets. These carbon sinks include mandatory activities covered by Article 3.3 of the Protocol (afforestation, reforestation and deforestation) and voluntary activities under Article 3.4 (forest management, cropland management, grazing-land management and revegetation). Further information on the use of carbon sinks under the Kyoto Protocol is given in Box 7.1.

Box 7.1: Carbon sinks under the Kyoto Protocol

The rules about how carbon sinks are accounted for under the Kyoto Protocol are described in Articles 3.3 and 3.4 and in the UNFCCC Marrakesh Accords (2001).

Article 3.3 activities
Article 3.3 describes how net changes in greenhouse gas emissions by sources and removals by sinks resulting from certain land-use change and forestry activities are accounted for in meeting the Kyoto Protocol targets. These activities are defined as direct human-induced land-use change and forestry activities, limited to afforestation, reforestation and deforestation (ARD) since 1990.

Article 3.4 activities
Article 3.4 identifies additional human-induced activities related to changes in greenhouse gas emissions by sources and removals by sinks in the agricultural soils and other land-use change and forestry categories which a country may choose to use in order to meet its Kyoto Protocol target. In the Marrakesh Accords, activities under this Article were defined as forest management, revegetation, cropland management and grazing-land management. The extent to which Parties can account for emissions and removals from these activities, for the first commitment period, is limited by a capping system.

Eight Member States — Austria, Belgium, Finland, the Netherlands, Portugal, Spain, Sweden and United Kingdom — have provided information on their intended use of carbon sinks through a questionnaire sent out in 2002 under the EU GHG monitoring mechanism (EEA, 2003a).

Member States have to account for afforestation, reforestation and deforestation (ARD) activities under Article 3.3 of the Kyoto Protocol. Only Austria, the Netherlands, Portugal, Spain and the United Kingdom provided estimates for their projected annual net carbon stock change under Article 3.3 during the commitment period (Table 7.1). Austria and Sweden expect net CO_2 emissions from afforestation, reforestation and deforestation activities during the commitment period, whereas the Netherlands, Portugal, Spain and the United Kingdom estimate net sequestration effects from these activities. Belgium, Finland and Sweden have not yet quantified the expected effects from Article 3.3 activities.

With regard to Article 3.4 activities for accounting in the first commitment period, three countries (Austria, Portugal and Spain) that provided information in the questionnaire have already decided to account for forest management under Article 3.4 (Table 7.2). The United Kingdom has presented the amount of its net carbon stock change but without any decision on accounting for it. Sweden has neither presented a definite amount nor yet taken a decision on the use of sinks under Article 3.4.

Portugal expects to use its maximum allowance for the accounting of forest management under Article 3.4 according to the Marrakesh Agreements. Most countries have not yet taken a final decision with regard to accounting of Article 3.4 activities.

Most of the Parties reported considerable co-benefits from the increase in sinks, such as restoration of degraded and abandoned areas, protection against forest fires, pests and diseases, biodiversity and quality of life. These co-benefits are mostly the reasons why measures were adopted. Policies related to carbon sinks are at least partly adopted in five of the eight Member States that provided information (Austria, Belgium, the Netherlands, Spain and the United Kingdom). Only Belgium has given legal status to its plans to increase terrestrial carbon sequestration. Reported activities and quantitative effects are generally included in the national climate change strategy except for Finland. Belgium and Spain have allocated specific budgets for carbon sequestration activities under Articles 3.3 and 3.4. The remaining countries have either not allocated a budget or did not provide any information on this subject.

The preliminary and incomplete information from Member States presented in this chapter shows that so far a total of carbon sinks of about 10 Mt CO_2 per year of the commitment period has been identified from the enhancement of Article 3.3 activities, with a further 3 Mt CO_2 per year identified from Article 3.4 activities. These figures are very modest when compared to the EU's Kyoto commitment (almost 4 % of the total of 336 Mt CO_2-equiv. to be reduced by the EU in total). The European climate change programme estimates that potentially 93–103 Mt CO_2 (equivalent to about 30 % of the EU reduction) could be sequestered through the enhancement of sink activities in the agricultural and forestry sector (European Commission, 2003b).

Table 7.1 **Projected net carbon stock changes under Article 3.3 for the Kyoto Protocol commitment period 2008–12 (afforestation, reforestation and deforestation)**

Member State	Net carbon stock change during 2008–12 (Mt CO_2 per year)	Type of carbon pools included
Austria	+ 0.733 (large uncertainties)	Not indicated
Belgium	Estimates not yet available	—
Finland	Estimates not yet available	—
Netherlands	– 0.11	—
Portugal	– 1.4 to – 1.7	—-
Spain	– 6.82	Not indicated, probably only above-ground biomass
Sweden	Probably small net debit	—
United Kingdom	– 2.2	Above-ground and below-ground biomass, litter and soil organic matter
EU total	**– 9.8 to – 10.1**	

Source: EEA, 2003a.

Note: Consistent with the reporting of emission inventories a negative sign '–' is used for removals and a positive sign '+' for emissions.

Table 7.2 **Potential projected net carbon stock changes from forest management under Article 3.4 for the Kyoto Protocol commitment period**

Member State	Net carbon stock change during 2008–12 (Mt C per year)	Maximum allowance for forest management (Mt C per year)	Carbon pools included
Austria	No data provided	– 0.63	
Belgium	No data provided	– 0.03	
Finland	No data provided	– 0.16	
Netherlands	No data provided	– 0.01	
Portugal	– 0.43	– 0.22	Not clearly indicated
Spain	– 0.22	– 0.67	Not clearly indicated, probably only above-ground biomass
Sweden	Amount is likely to be larger than maximum allowance	– 0.58	Not clearly indicated
United Kingdom	– 3.4 to – 3.7	– 0.37	Above-ground and below-ground biomass, litter and soil organic matter
EU total		**– 2.67**	

Note: Consistent with the reporting of emission inventories a negative sign '–' is used for removals and a positive sign '+' for emissions.

8 The reporting scheme

☺ Under the monitoring mechanism all Member States provided greenhouse gas inventory data for 1990 to 2001 for all gases. Two Member States have gaps in their data on fluorinated gases (Greece, Luxembourg).

☹ Several acceding and candidate countries did not provide greenhouse gas inventory data for 1990 to 2001 for all gases (Bulgaria, Czech Republic, Estonia, Hungary, Lithuania, Slovenia).

☺ The quality of reporting of emission projections and policies and measures has improved for most Member States.

😐 Further improvements in reporting inventories, projections, and policies and measures are still needed, and proposals are being developed as part of the process of revising the monitoring mechanism during 2003 and 2004.

8.1 State of current reporting

Reporting of greenhouse gas inventories by EU Member States
For the preparation of this report, EU greenhouse gas inventories as compiled under the EU monitoring mechanism and submitted by the European Commission to the UNFCCC (April 2003) have been used (EEA, 2003a).

All Member States reported data for 2001. Data availability has improved over previous years. Gaps still exist for Belgium (HFCs, PFCs, SF_6 for 1990–94), Greece (SF_6 for 1990–2001), Ireland (HFCs, PFCs, SF_6 for 1990–94) and Luxembourg (CO_2, CH_4, N_2O for 1991–93; HFCs, PFCs, SF_6 for 1990–2000). A data gap-filling procedure was applied in accordance with the guidelines of the monitoring mechanism for Luxembourg (CO_2, CH_4, N_2O for 1991–93 and fluorinated gases for 1990–2000) and Belgium and Ireland (fluorinated gases for 1990–94). Data on CO_2, CH_4 and N_2O emissions used in this report do not include emissions and removals from land-use change and forestry. Although outstanding methodological decisions on CO_2 sinks under the Kyoto Protocol were agreed at COP7 in November 2001 (Marrakesh Accords), comprehensive methods for estimating changes of carbon pools (sinks) under the Protocol are not yet available but are currently being developed by IPCC.

Some of the indicators presented in the report contain sectoral driving force data. Two main data sources have been used:

- data supplied by Member States under the monitoring mechanism in the common reporting format (CRF) tables;
- data from Eurostat (New Cronos database).

The geographical coverage of emission data and Eurostat statistics is not fully consistent (i.e. inclusion of overseas territories in emission data). However, this is not expected to distort overall trends and the main conclusions.

Reporting of greenhouse gas inventories by acceding and candidate countries
The reporting under Council Decision 1993/389/EEC as amended by Decision 1999/296/EC for a monitoring mechanism of Community CO_2 and other greenhouse gas emissions is not obligatory for acceding and candidate countries (AC/CC) yet, but should be implemented when they join the EU. AC/CC are required to report GHG emissions under the UNFCCC and the Convention on Long-Range Transboundary Air Pollution (CLRTAP). AC/CC are Annex I parties to the UNFCCC and some of the AC/CC have already ratified the Kyoto Protocol.

The completeness of the datasets reported under the UNFCCC, UNECE/EMEP and Council Decision

1999/296/EC differs among the parties (EEA, 2003a). The timeliness, completeness and consistency of reports of GHG emissions in 2003 improved significantly compared with the previous year; however, there are still areas for improvement:

- fluorinated gases are not reported in complete time series and the base year for fluorinated gases is not always reported;
- estimation methods are not consistently applied for the whole period;
- emissions are not reported for all gases and years from 1990 to 2001 (Bulgaria, Czech Republic, Estonia, Hungary, Lithuania, Slovenia);
- sector emissions are not reported consistently;
- 2001 emissions are not reported in the last submission (2003).

Reporting of projections and policies and measures
The quality of reporting for most Member States has improved in 2002 either through the provision of a third national communication to the UNFCCC or through improved reports to the monitoring mechanism. Greece and Italy provided third national communications in 2003.

The reporting of projections has been enhanced but is still facing some challenges (EEA, 2003a). There are a number of inconsistencies and actions are needed to remove these. Disaggregation of the projections by gas and sector has improved and consequently more analysis has been possible than in previous years. Reporting of underlying parameters has also improved although there are still a limited number that can be compared among Member States. Reporting of policies and measures is more comprehensive, including more consistent data on the type of measure and status of implementation. However, quantification of individual policies and measures for some Member States is still not available.

Acceding and candidate countries are not required to report formally to the monitoring mechanism and the discussion in this report is based on the third national communications. Reporting of policies and measures for most of the acceding and candidate countries gives a reasonable level of detail, including in many cases quantitative information on emissions reductions. 'With existing domestic measures' and 'with additional domestic measures' projections are generally provided and identified. However, tabulation of the results, particularly by gas and by sector, is not available for all countries. The methodology for projections and the parameters used are presented but not always in detail.

8.2 Sensitivity (range) in emissions projections

Parties to the UNFCCC are advised to publish a sensitivity analysis of their projections, to help identify key parameters and assess uncertainty. The following European countries have provided sensitivity analyses in their third national communications: Austria, Belgium, Finland, the United Kingdom and the Czech Republic (EEA, 2003a).

Austria assessed sensitivity to parameters in the energy, agriculture and waste sectors. The sensitivity of investigated parameters on Austria's total greenhouse gas emission projections ranges from + 2 to – 4 %, around the central (reported) projection.

Belgium assessed sensitivity to the type of model used. The difference between the projections of energy-related emissions of CO_2, N_2O and CH_4 from the two models that were compared is around 4 %.

Finland carried out a qualitative estimate of uncertainty regarding energy-intensive industrial branches and the competitiveness of indigenous electricity production compared with imports.

For projections of the United Kingdom's carbon dioxide emissions different scenarios were analysed, comprising combinations of economic growth and energy prices, the economic modelling process for energy-related CO_2, assumptions on land-use change emissions projections and non-CO_2 greenhouse gases. Combinations of these

different possible scenarios constitute altogether a source of uncertainty of ± 5.6 % of total projected greenhouse gas emissions.

The Czech Republic carried out a sensitivity analysis on the large uncertainty in future economic development using different growth rates for GDP. It was shown that there is no direct proportionality between the rate of economic growth and the rate of increase in projected emissions (e.g. in 2020 GDP is projected to be 60 % higher in the high scenario than in the reference scenario, but greenhouse gas emissions are projected to increase only by 20 %). This is because of the faster assumed rate of decrease in overall energy intensity in the high scenario than in the reference scenario (4.1 % compared to 2.8 % in 2000–20).

Member States provided only limited reporting on sensitivity and use different approaches. More work is needed under the EU GHG monitoring mechanism to achieve sensitivity analyses that are more comparable among countries and to improve the reporting on the outcome of these.

8.3 Required improvements in reporting

Under the monitoring mechanism two working groups consisting of representatives of the Commission (DG ENV), Member States and the EEA are addressing possible further improvements in the quality of the reported information, both for greenhouse gas inventories and for projections and policies and measures. The Commission has prepared a proposal for revision of the EU greenhouse gas monitoring mechanism, and its guidelines, to incorporate requirements for reporting under the Kyoto Protocol, agreed at the seventh (2001) and eighth (2002) Conferences of the Parties to UNFCCC, and requirements under the EU emissions trading directive. This includes, for example, requirements for national greenhouse gas inventory systems.

In support of the work on projections, the EEA prepared a report comparing national (MS) projections with projections using EU-wide models (EEA, 2002d). The report recommended improvements in aspects of the quality of emission projections concerning inclusion of all important source and sink categories, harmonisation of definitions, in particular for sectors, background and underlying information for projections development.

Following up this work, in February 2002, a workshop on energy-related national and EU-wide projections of greenhouse gas emissions was held with the aim of improving the quality of reporting (EEA, 2002e). At the workshop current practice for reporting was discussed and suggestions made for improvements, aimed at reporting on projections based on UNFCCC CRF sectoral categories compared with annual inventories, a list of mandatory and suggested parameters for projections to be reported, reporting of projected energy balances and a paper to be drafted on sensitivity analysis and robustness of projections. These proposals are in process of being elaborated in guidelines under the revised monitoring mechanism.

In February 2003, a workshop on emissions and projections from agriculture was held at the EEA in Copenhagen. Recommendations from the workshop for improving projections and policies and measures included (EEA, 2003d):

- reporting the methodology and describing the projected activity (agricultural scenario) and emissions factors used for major sources of emissions;
- reporting actual values for activity and emissions factors used for at least base year and 2010;
- reporting policies and measures assumed to be implemented in 2010: the policies and measures reported should include any that have a material effect including, for example, measures aimed at reducing air pollution;
- reporting how the effect of the common agricultural policy is incorporated into projections of emissions;

- reporting the basis of underlying activity projections, e.g. any assumptions of trade.

The workshop also recommended the following general improvements in projections:

- for EU-wide projections, sufficient information on the scenarios of agricultural production and the underlying basis of these projections should be given to allow comparison with MS projections;
- good communication between national agricultural economics (scenarios) experts and emissions projections and inventory experts should be promoted at both the MS and EU levels;
- some issues would be better addressed at the regional level and regional networking should be encouraged;
- sharing good practice in preparing GHG emission projections from agriculture should be encouraged, particularly concerning the incorporation of policies and measures and the review of projections, including national agricultural scenario experts;
- the effect of environmental policies on agricultural activity should be included in both MS and EU-wide projections. This may require model development and is thus a medium-term aim.

Annex 1: Actual and projected greenhouse gas emissions by EU Member States

Actual greenhouse gas emissions:

☺ In 2001, five Member States were on track towards reaching their burden-sharing targets (France, Germany, Luxembourg, Sweden and the United Kingdom) with domestic policies and measures.

☹ In 2001, 10 Member States (Austria, Belgium, Denmark, Finland, Greece, Ireland, Italy, the Netherlands, Portugal and Spain) were heading towards missing their burden-sharing targets with domestic policies and measures.

☹ Compared with last year's analysis (for 2000), the situation in 2001 worsened as the distance-to-target path of the total EU GHG emissions increased, and two more Member States are no longer on track with domestic policies and measures.

Projected greenhouse gas emissions:

☺ Sweden and the United Kingdom project that existing domestic policies and measures will be sufficient to meet their burden-sharing targets.

☹ Austria, Belgium, Denmark, Finland, France, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain project that with existing domestic measures their emissions will be significantly above their burden-sharing targets by 2010. Germany projects it will almost reach its target with existing domestic measures.

☺ Finland, France, Greece and Ireland project that with additional domestic policies and measures they are going to meet their burden-sharing targets by 2010.

☹ Austria, Belgium, Denmark, Italy, the Netherlands and Spain project that they will stay above their burden-sharing targets by 2010 even with additional domestic policies and measures. Germany, Luxembourg and Portugal did not report any additional domestic policies and measures.

😐 The Netherlands projects that it will achieve its target by a combination of domestic policies and measures and the use of Kyoto mechanisms.

Figure A1.1 **Greenhouse gas emission trend and projections, with domestic policies and measures, for Austria**

Source: EEA, 2003a.

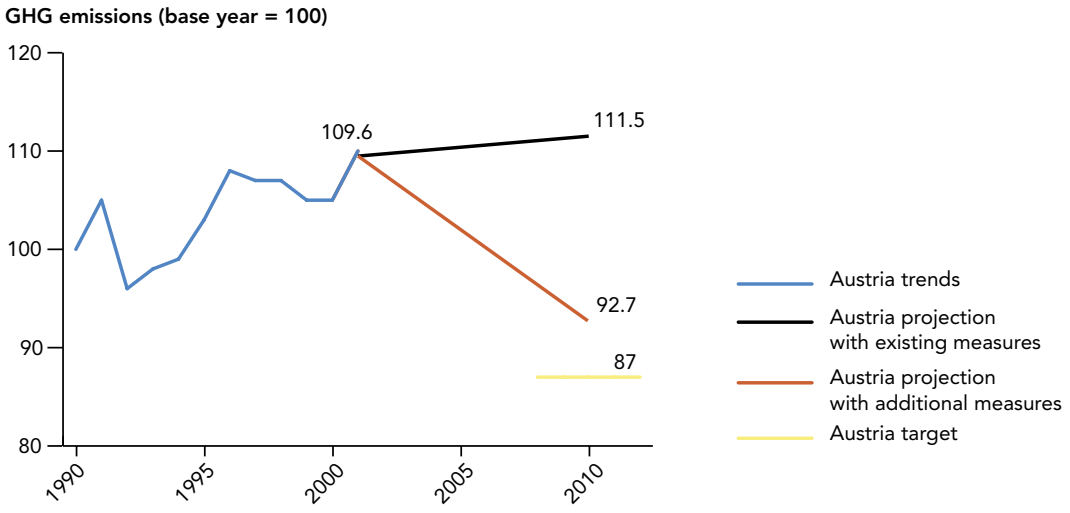
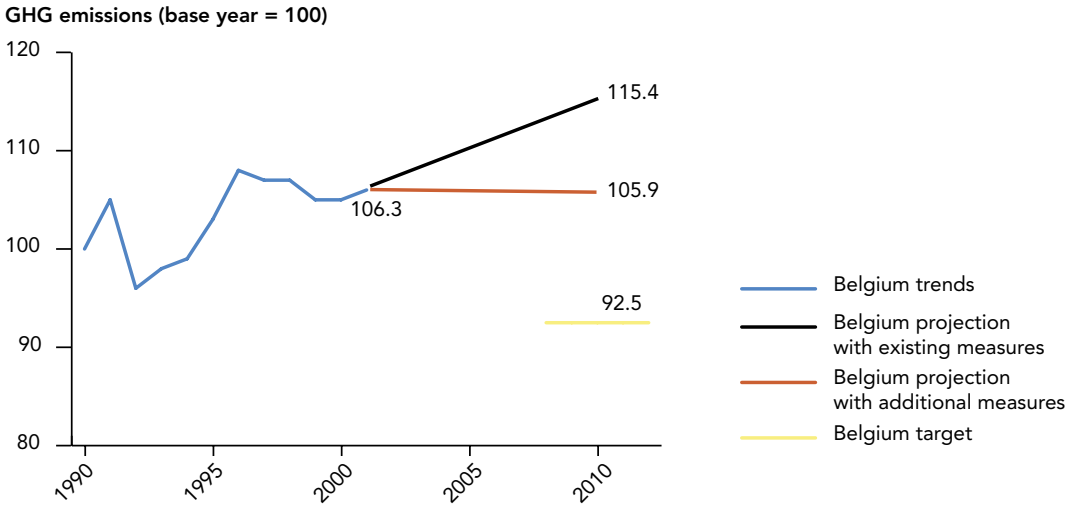


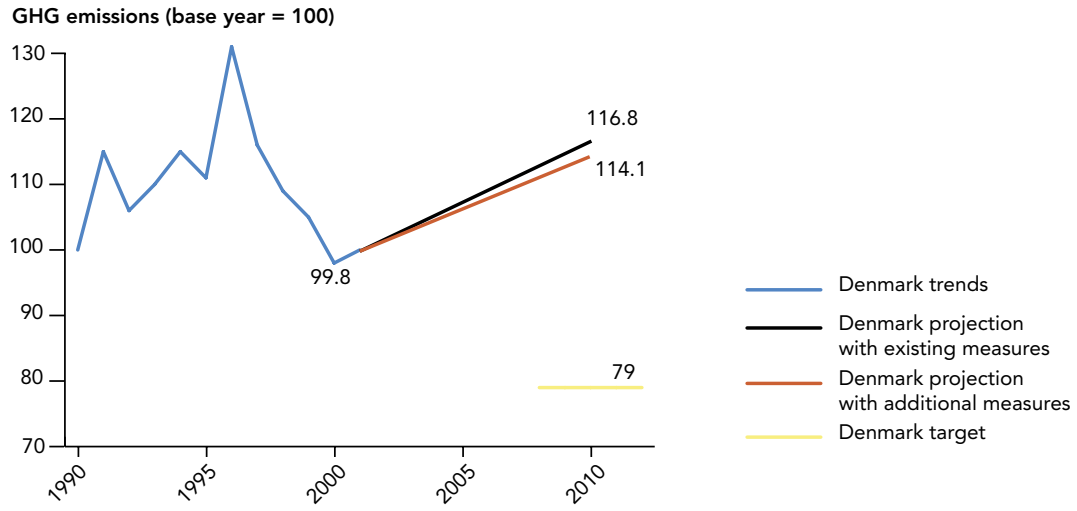
Figure A1.2 **Greenhouse gas emission trend and projections, with domestic policies and measures, for Belgium**

Source: EEA, 2003a.



Source: EEA, 2003a.

Figure A1.3 **Greenhouse gas emission trend and projections, with domestic policies and measures, for Denmark**



Note: For Denmark, data that reflect adjustments for electricity trade (import and export) in 1990 are not provided in this graph but are presented in EEA, 2003a.

Source: EEA, 2003a.

Figure A1.4 **Greenhouse gas emission trend and projections, with domestic policies and measures, for Finland**

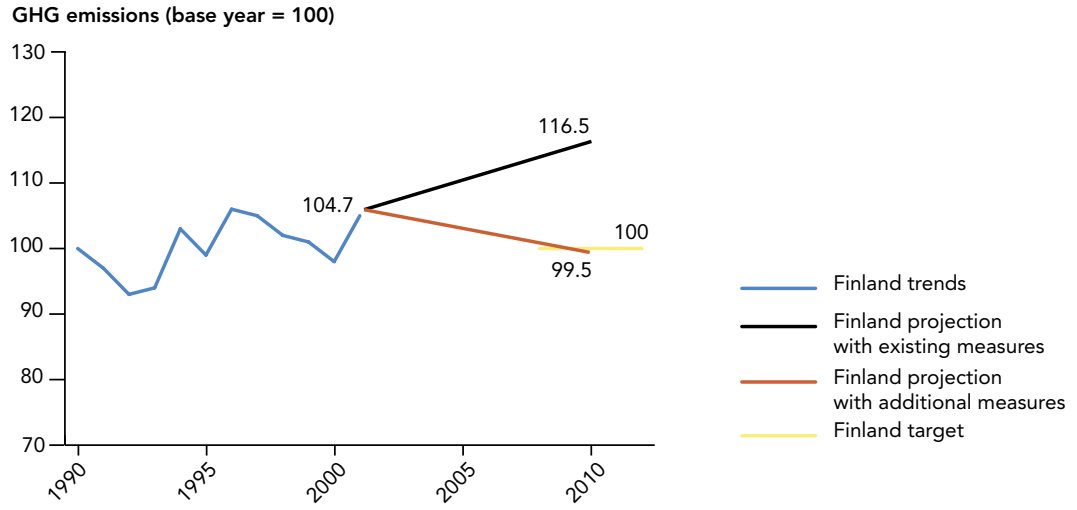


Figure A1.5 **Greenhouse gas emission trend and projections, with domestic policies and measures, for France**

Source: EEA, 2003a.

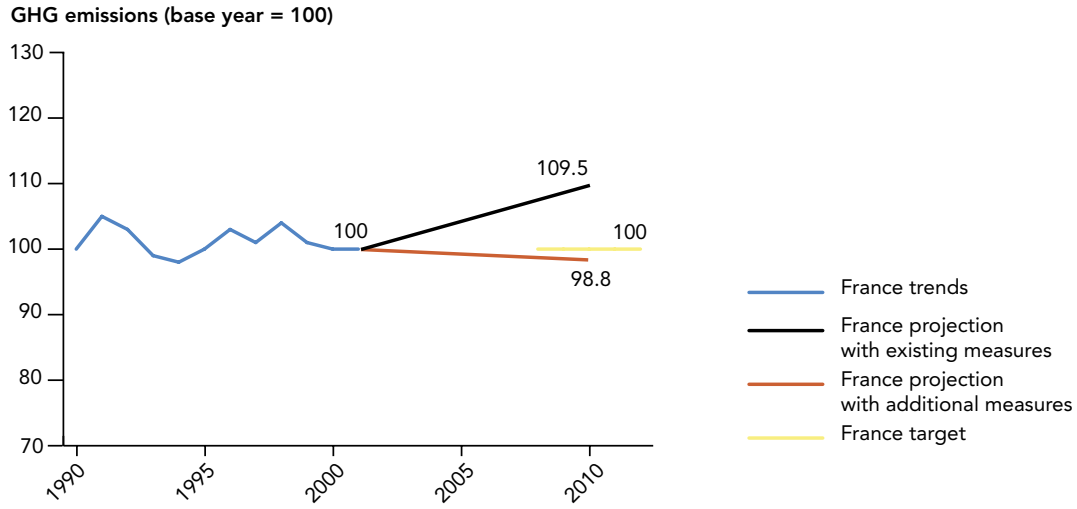
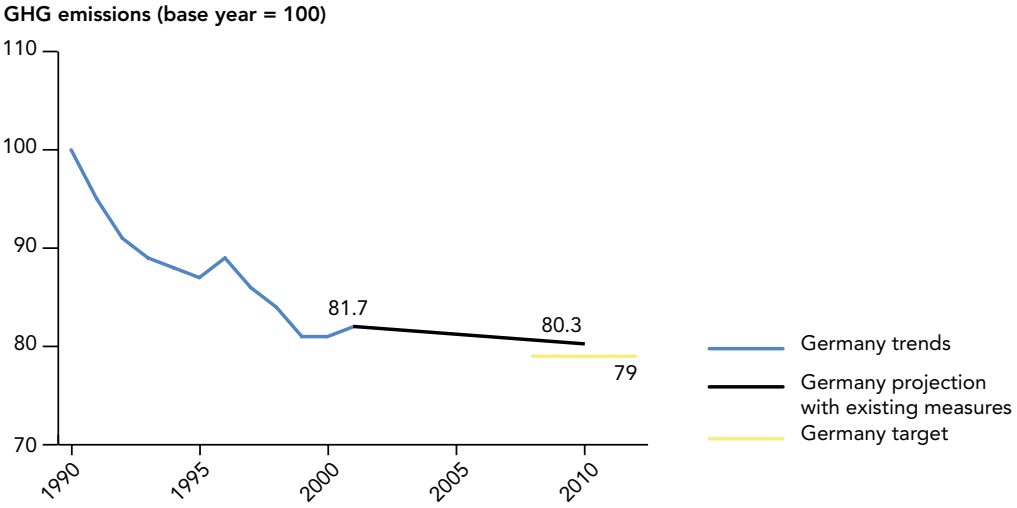


Figure A1.6 **Greenhouse gas emission trend and projection, with domestic policies and measures, for Germany**

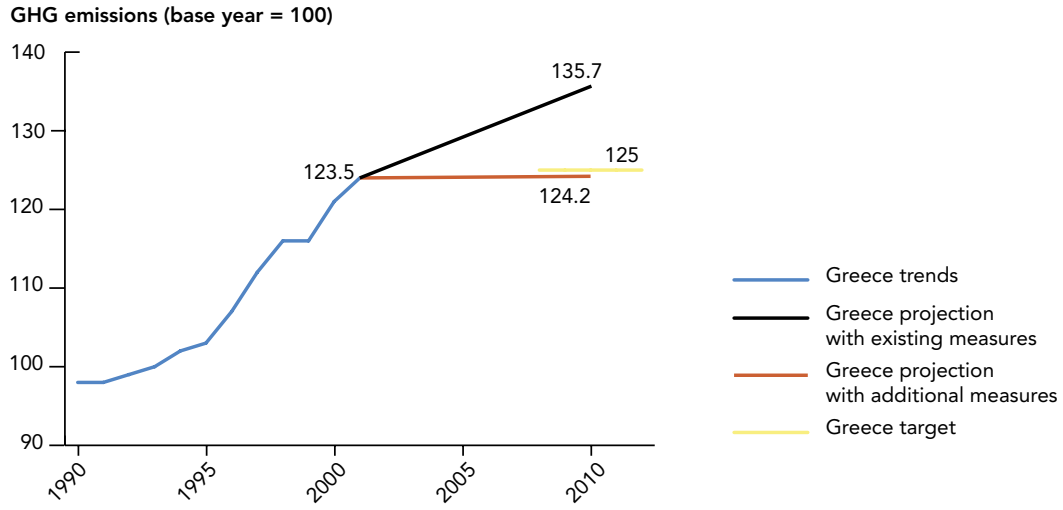
Source: EEA, 2003a.



Note: Germany's projections are preliminary results from an ongoing study provided in June 2003.

Source: EEA, 2003a.

Figure A1.7 **Greenhouse gas emission trend and projections, with domestic policies and measures, for Greece**



Source: EEA, 2003a.

Figure A1.8 **Greenhouse gas emission trend and projections, with domestic policies and measures, for Ireland**

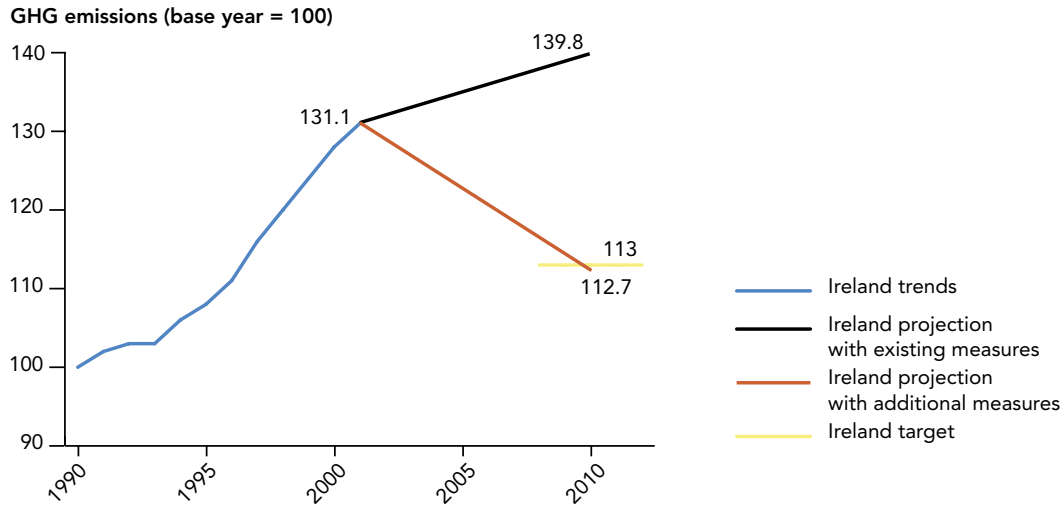


Figure A1.9 **Greenhouse gas emission trend and projections, with domestic policies and measures, for Italy**

Source: EEA, 2003a.

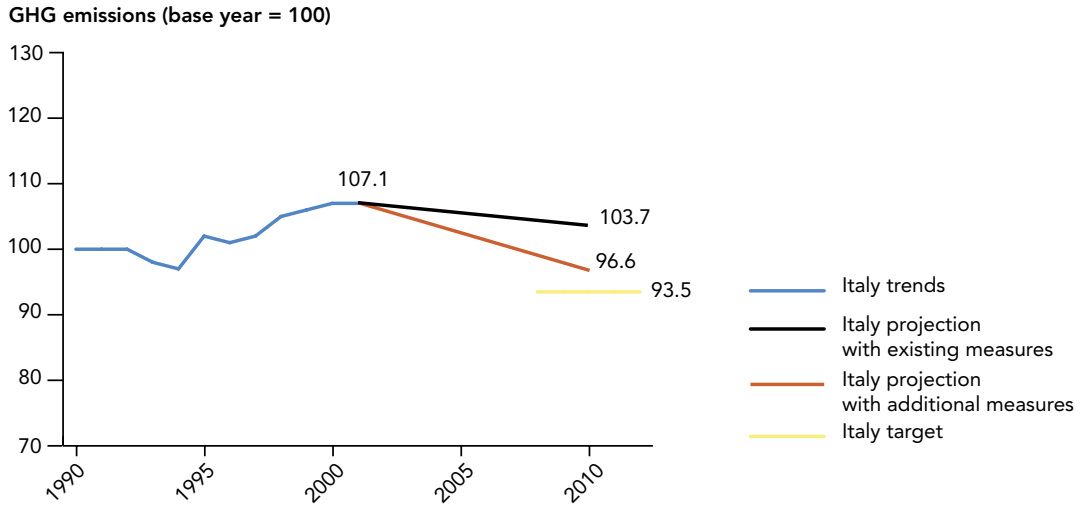
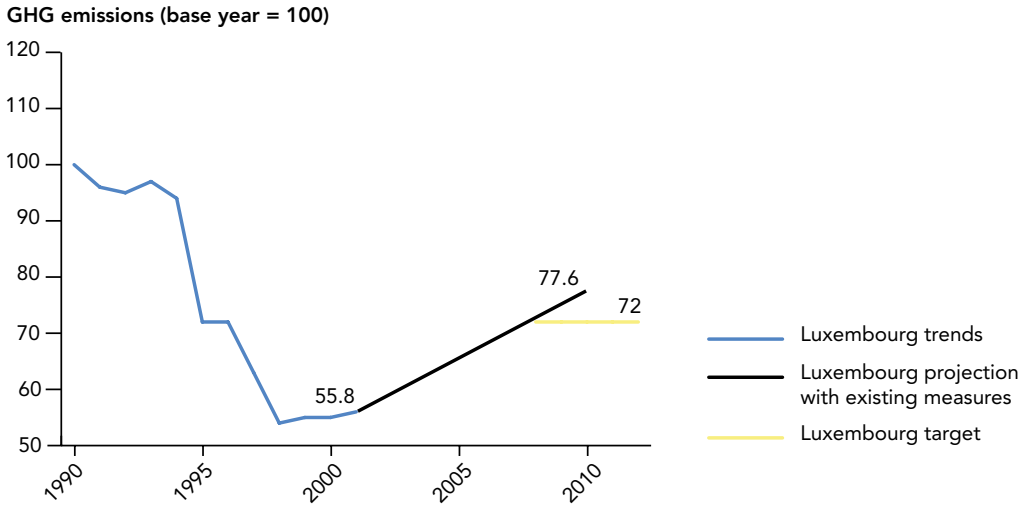


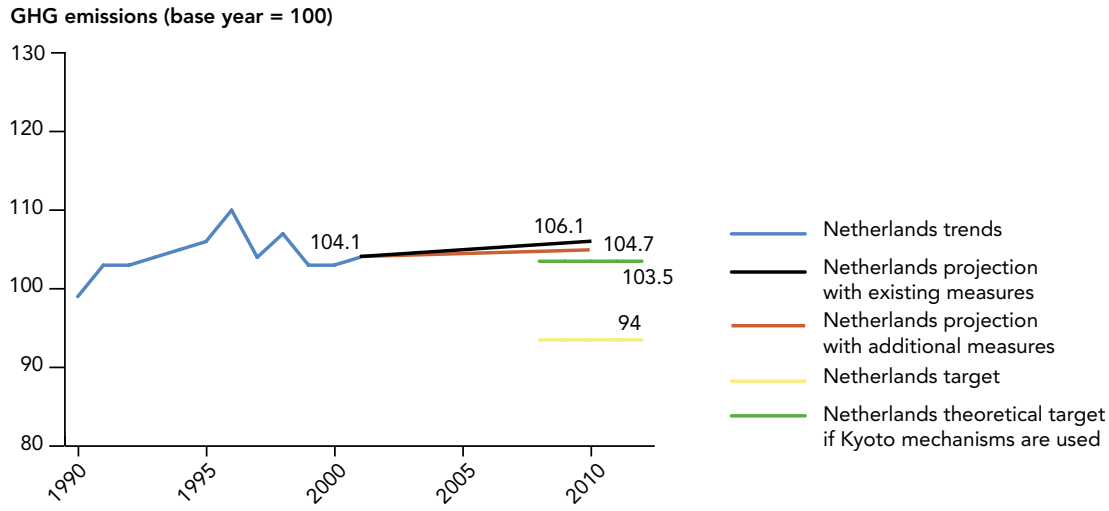
Figure A1.10 **Greenhouse gas emission trend and projection, with domestic policies and measures, for Luxembourg**

Source: EEA, 2003a.



Source: EEA, 2003a.

Figure A1.11 **Greenhouse gas emission trend and projections, with domestic policies and measures, and projected use of Kyoto mechanisms, for the Netherlands**



Source: EEA, 2003a.

Figure A1.12 **Greenhouse gas emission trend and projection, with domestic policies and measures, and projected use of Kyoto mechanisms, for Portugal**

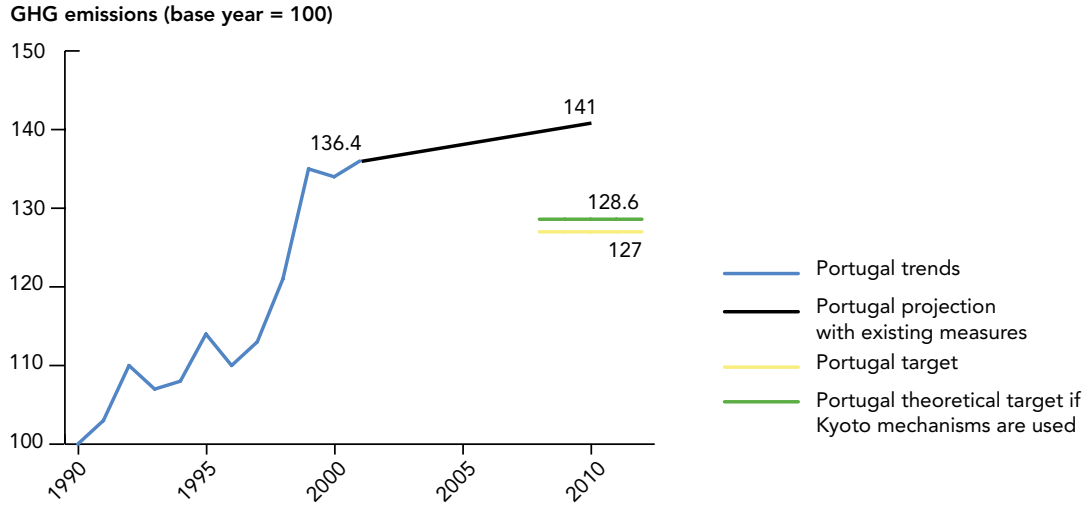


Figure A1.13 **Greenhouse gas emission trend and projections, with domestic policies and measures, for Spain**

Source: EEA, 2003a.

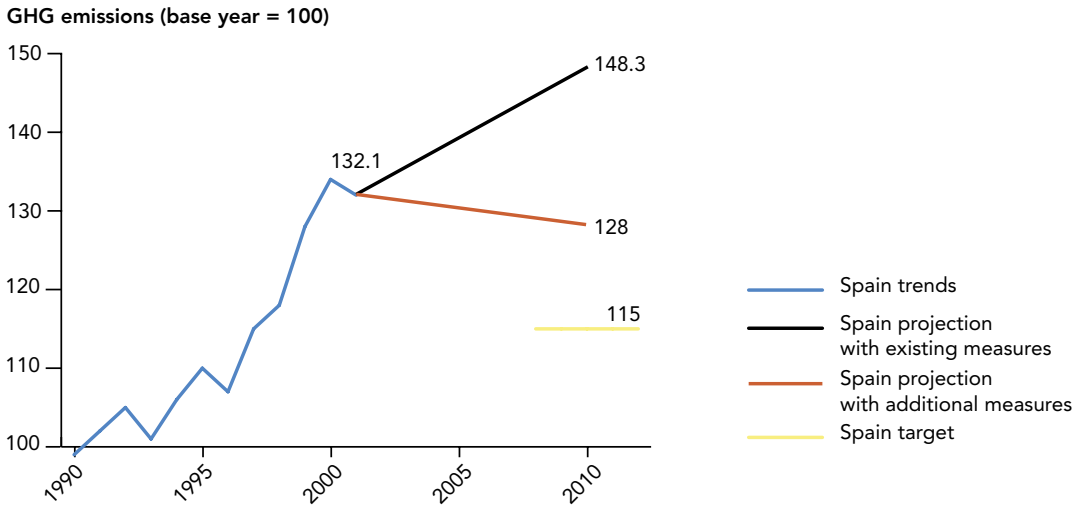
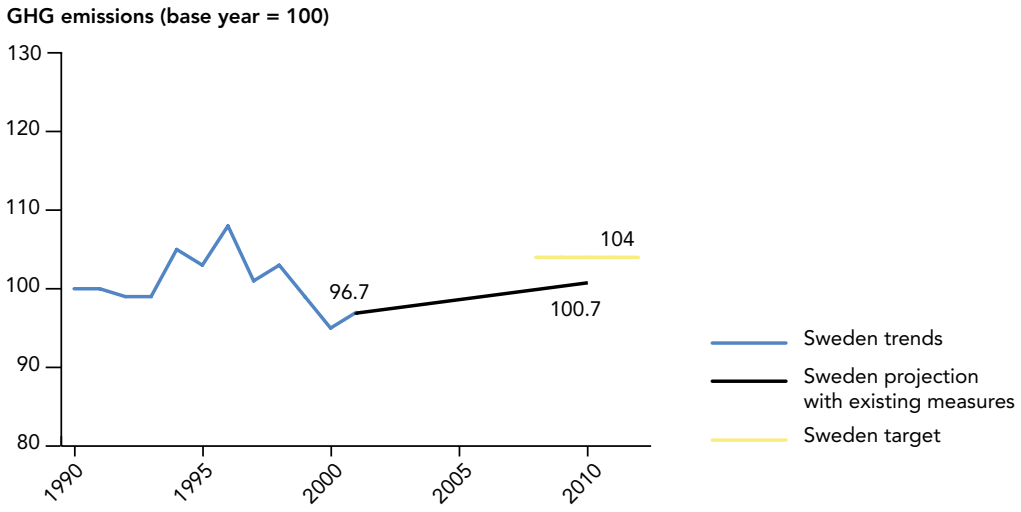


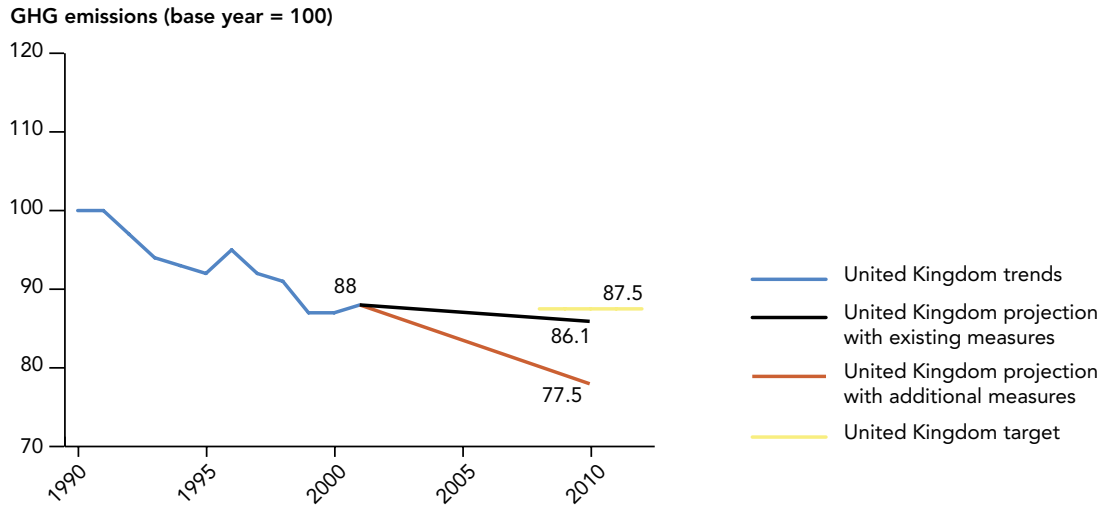
Figure A1.14 **Greenhouse gas emission trend and projection, with domestic policies and measures, for Sweden**

Source: EEA, 2003a.



Source: EEA, 2003a.

Figure A1.15 **Greenhouse gas emission trend and projections, with domestic policies and measures, for the United Kingdom**



Annex 2: Actual and projected greenhouse gas emissions by acceding and candidate countries

Actual greenhouse gas emissions:

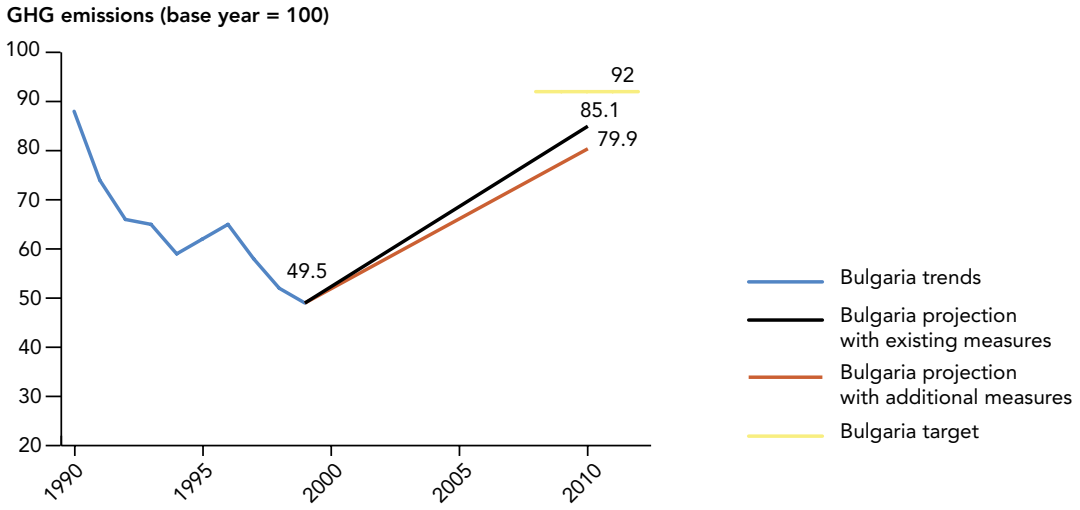
😐 In 2001 all acceding and candidate countries except Slovenia were on track to meet their Kyoto targets, with domestic policies and measures.

Projected greenhouse gas emissions:

☹ Seven acceding and candidate countries (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Poland and Slovakia) project that existing domestic policies and measures will be sufficient to meet their Kyoto targets by 2010, but Slovenia projects increasing emissions by 2010 and therefore a shortfall of its Kyoto target.

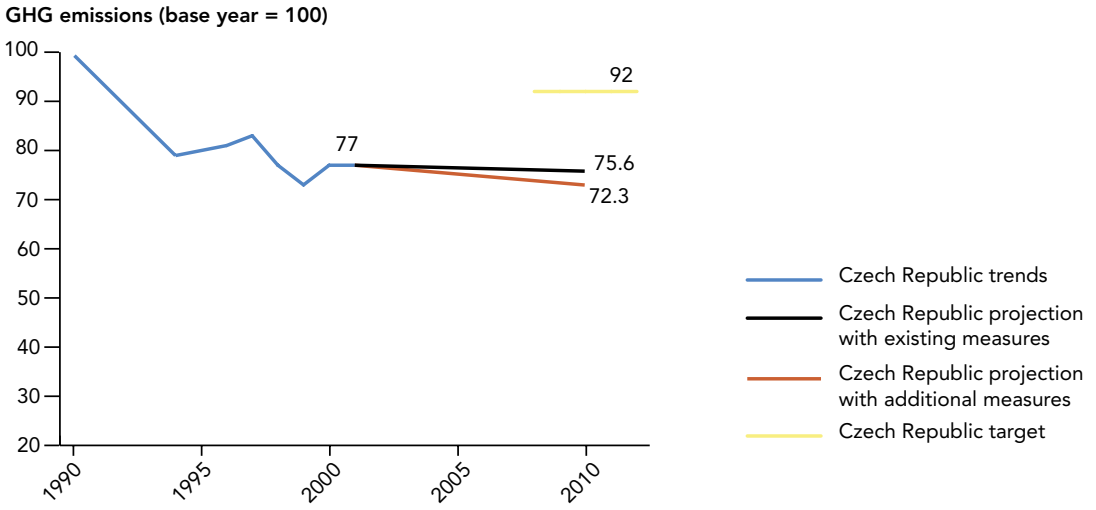
Figure A2.1 **Greenhouse gas emission trend (excl. fluorinated gases and LUCF), with domestic policies and measures, for Bulgaria**

Source: EEA, 2003a.



Source: EEA, 2003a.

Figure A2.2 **Greenhouse gas emission trend and projections (excl. fluorinated gases and LUCF), with domestic policies and measures, for the Czech Republic**



Source: EEA, 2003a.

Figure A2.3 **Greenhouse gas emission trend and projections (excl. fluorinated gases and LUCF), with domestic policies and measures, for Estonia**

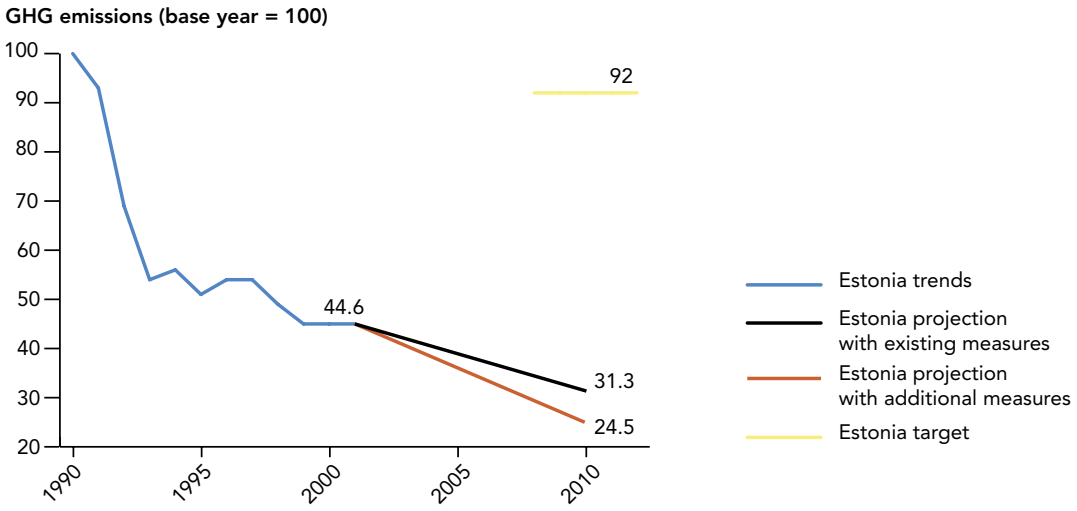


Figure A2.4 **Greenhouse gas emission trend (excl. fluorinated gases and LUCF) for Hungary**

Source: EEA, 2003a.

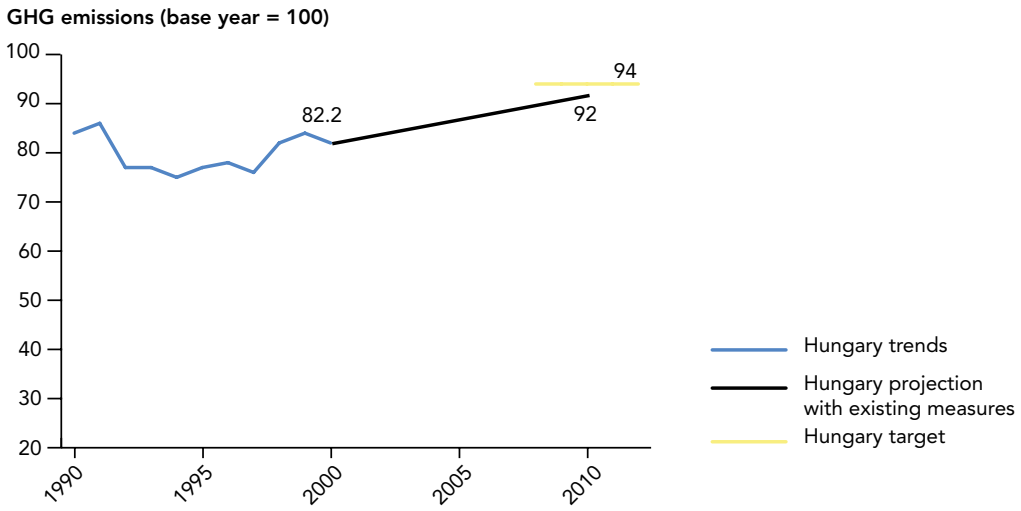
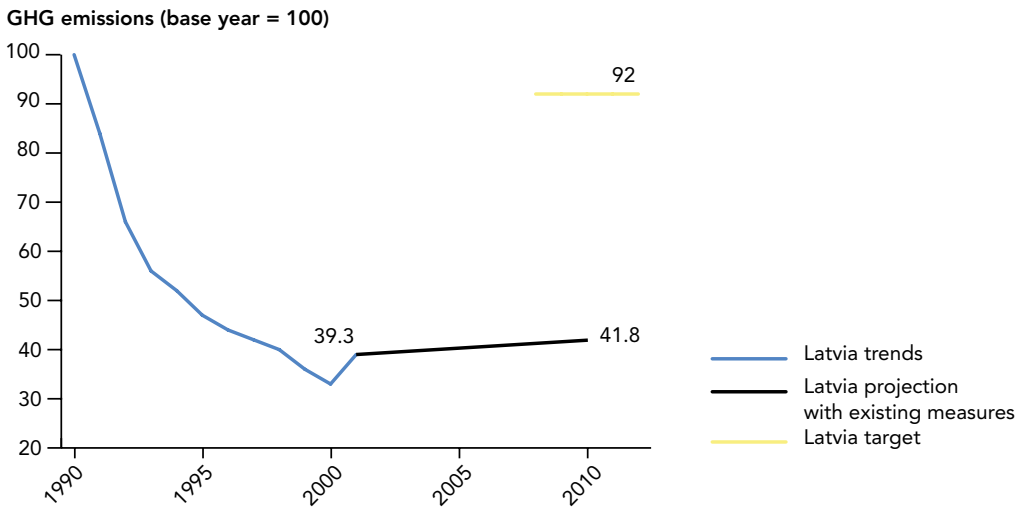


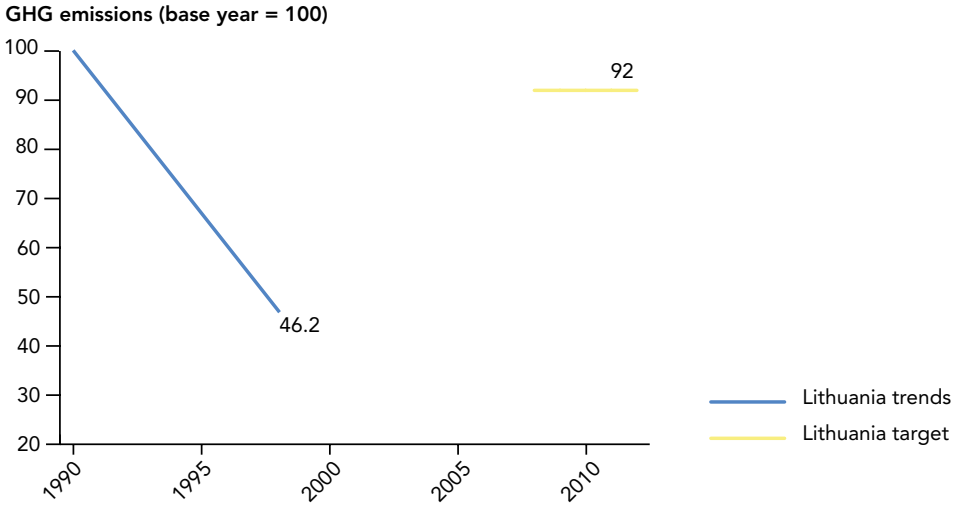
Figure A2.5 **Greenhouse gas emission trend and projection (excl. fluorinated gases and LUCF), with domestic policies and measures, for Latvia**

Source: EEA, 2003a.



Source: EEA, 2003a.

Figure A2.6 **Greenhouse gas emission trend (excl. fluorinated gases and LUCF) for Lithuania**



Source: EEA, 2003a.

Figure A2.7 **Greenhouse gas emission trend and projections (excl. fluorinated gases and LUCF), with domestic policies and measures, for Poland**

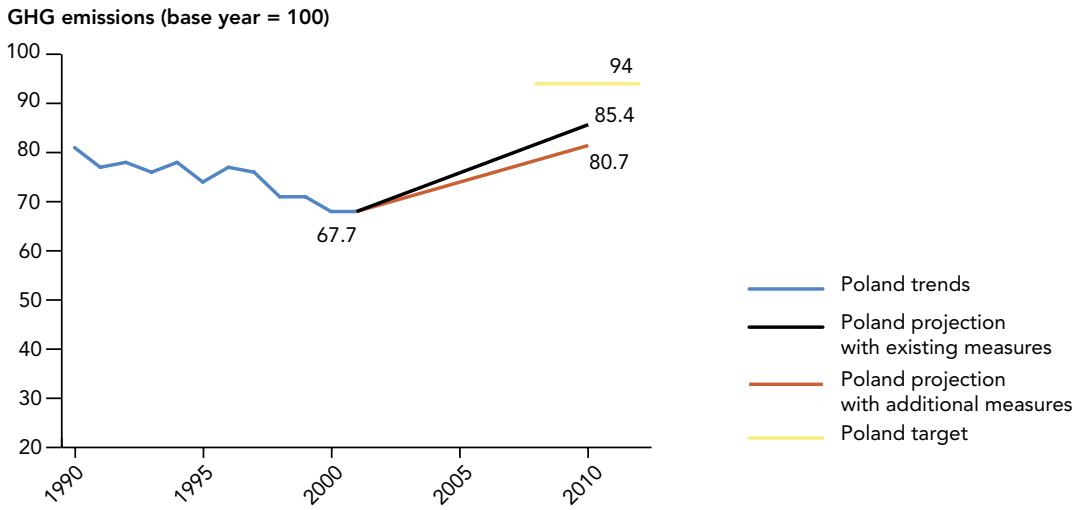


Figure A2.8 **Greenhouse gas emission trend (excl. fluorinated gases and LUCF) for Romania**

Source: EEA, 2003a.

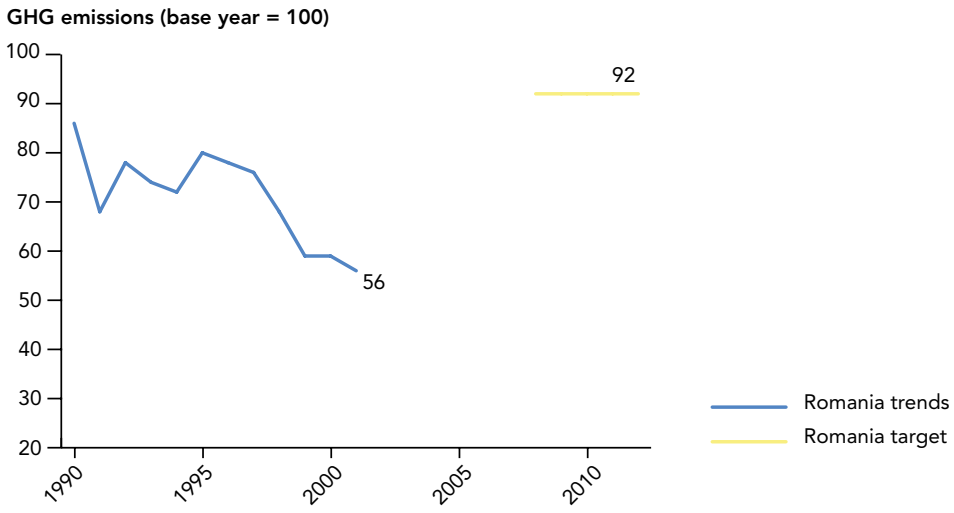
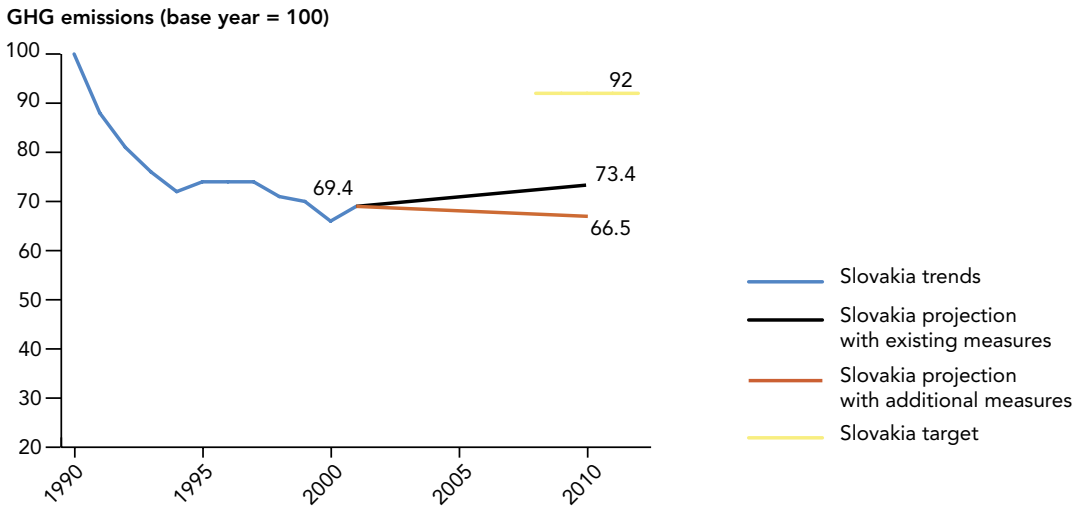


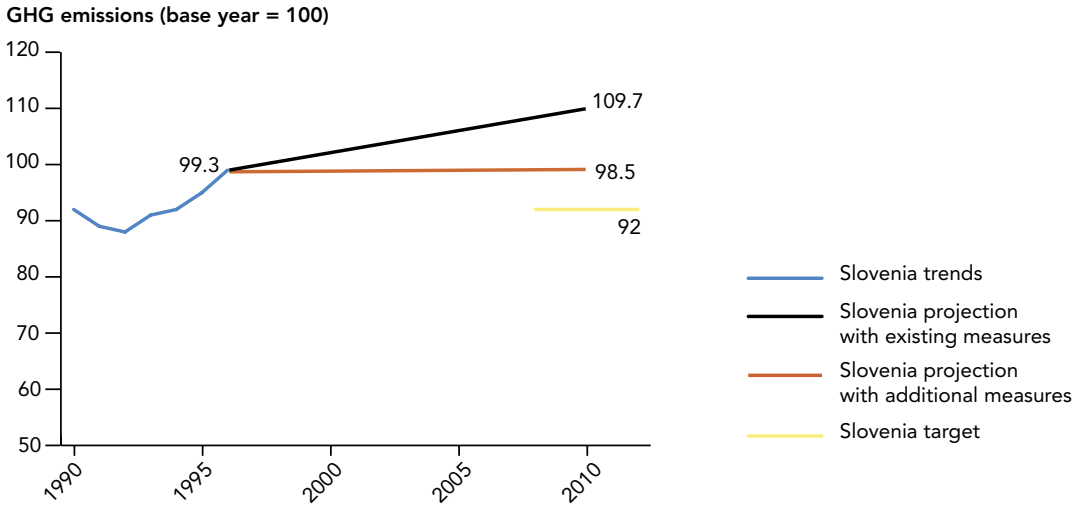
Figure A2.9 **Greenhouse gas emission trend and projections (excl. fluorinated gases and LUCF), with domestic policies and measures, for Slovakia**

Source: EEA, 2003a.



Source: EEA, 2003a.

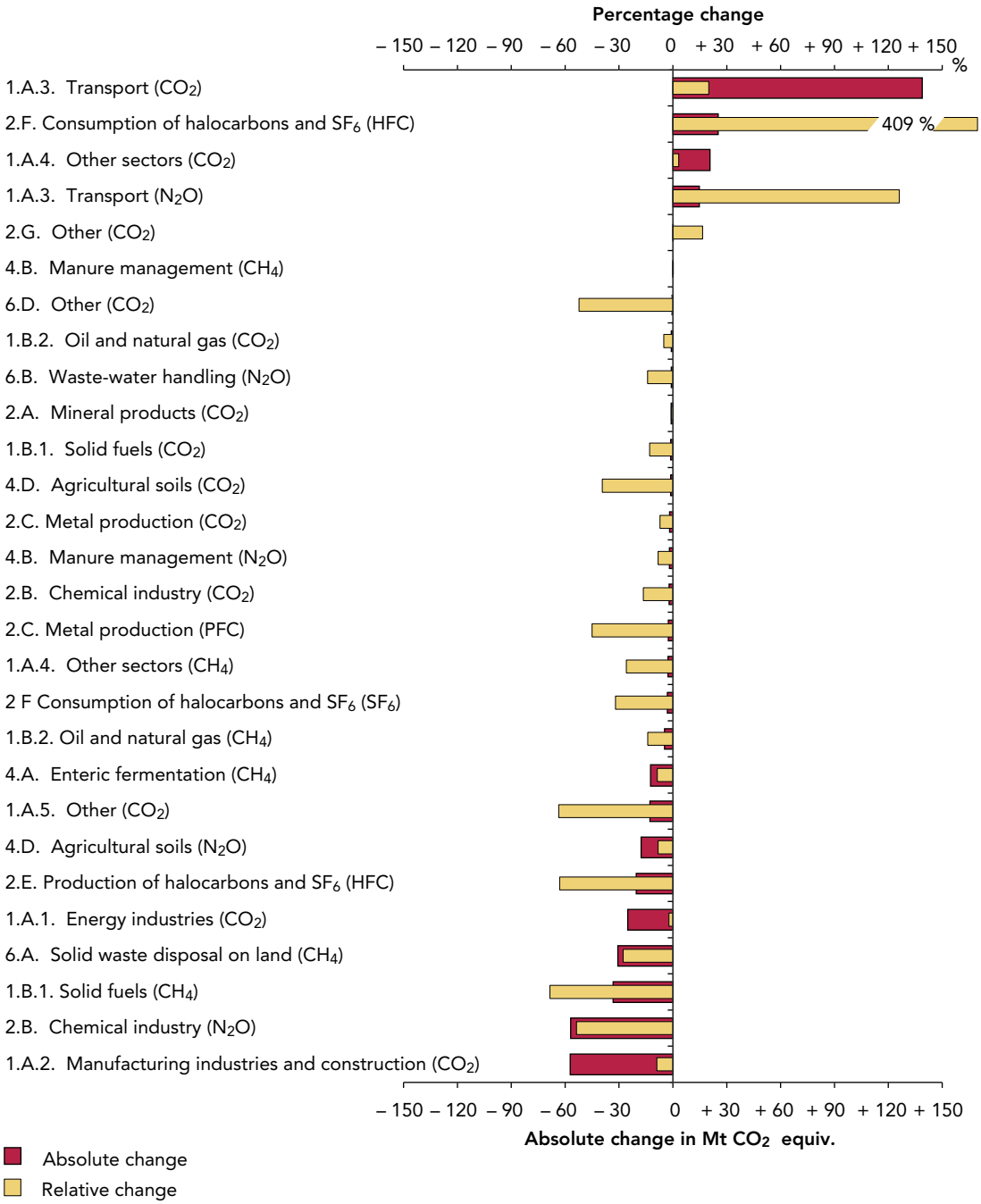
Figure A2.10 **Greenhouse gas emission trend and projections (excl. fluorinated gases and LUCF), with domestic policies and measures, for Slovenia**



Annex 3: Summary of EU greenhouse gas emissions

Figure A3.1 **Absolute and relative (percentage) change from 1990 to 2001 of EU key source emissions (in Mt CO_2-equiv. and % respectively)**

Source: EEA, 2003a.



Note: Excluding emissions and removals from LUCF.

Source: EEA, 2003a.

Table A3.1 **EU and Member States greenhouse gas emission trends and targets (burden-sharing) for 2008–12**

	Base year (1) (Mt CO_2)	GHG emissions 2001 (Mt CO_2)	Change 2000–2001 (in %)	Change 2001 relative to base year (in %)	EU burden-sharing (in %)
Austria	78.3	85.9	4.8	9.6	– 13.0
Belgium	141.2	150.2	0.2	6.3	– 7.5
Denmark (2)	69.5	69.4	1.8	– 0.2 (– 9.0)	– 21.0
Finland	77.2	80.9	7.3	4.7	0.0
France	558.4	560.8	0.5	0.4	0.0
Germany	1 216.2	993.5	1.2	– 18.3	– 21.0
Greece	107.0	132.2	1.9	23.5	25.0
Ireland	53.4	70.0	2.7	31.1	13.0
Italy	509.3	545.4	0.3	7.1	– 6.5
Luxembourg	10.9	6.1	1.3	– 44.2	– 28.0
Netherlands	211.1	219.7	1.3	4.1	– 6.0
Portugal	61.4	83.8	1.9	36.4	27.0
Spain	289.9	382.8	– 1.1	32.1	15.0
Sweden	72.9	70.5	2.2	– 3.3	4.0
United Kingdom	747.2	657.2	1.3	– 12.0	– 12.5
EU total	**4 204.0**	**4 108.3**	**1.0**	**– 2.3**	**– 8.0**

Notes: (1) Base year for CO_2, CH_4 and N_2O is 1990; for fluorinated gases 1995 is used as the base year, as allowed under the Kyoto Protocol, This reflects the reference of most Member States.
(2) For Denmark, data that reflect adjustments for variations in electricity trade in 1990 are given in brackets. This methodology is used by Denmark to monitor progress towards its national target under the EU burden-sharing agreement. For the EU emissions total non-adjusted Danish data have been used.

Table A3.2 **EU and Member States Kyoto Protocol (burden-sharing) targets for 2008–12, compared with emissions projections based on existing and additional domestic policies and measures**

Source: EEA, 2003a.

	Emissions target for 2008–2012 (% of base year emissions) under EU burden-sharing agreement	**Projected emissions change in 2010 based on existing domestic policies & measures** (in % of base year emissions)	**Gap between burden-sharing target and projected emissions in 2010 based on existing domestic policies and measures** (in % of base year emissions)	**Gap between burden-sharing target and projected emissions in 2010 based on both existing and additional domestic policies and measures** (in % of base year emissions)
Austria	– 13.0	11.5	24.5	5.7
Belgium	– 7.5	15.4	22.9	13.4
Denmark	-21.0	16.8	37.8	35.1
Finland	0.0	16.5	16.5	– 0.5
France	0.0	9.5	9.5	– 1.2
Germany	– 21.0	-19.7	1.3	No data provided
Greece	25.0	35.7	10.7	– 0.8
Ireland	13.0	39.8	26.8	– 0.3
Italy	– 6.5	3.7	10.2	3.1
Luxembourg	– 28.0	-22.4	5.6	No data provided
Netherlands	– 6.0	6.1	12.1	10.7
Portugal	27.0	41.0	14.0	No data provided
Spain	15.0	48.3	33.3	13.0
Sweden	4.0	0.7	– 3.3	No data provided
United Kingdom	– 12.5	– 13.9	– 1.4	– 10.0
EU total	**– 8.0**	**– 0.5**	**7.5**	**0.8**
EU total if no over-delivery by MS	**– 8.0**	**– 0.2**	**7.8**	**2.9**

References

EEA, 2003a (forthcoming). *Analysis of greenhouse gas emission trends and projections in Europe*. Technical Report. European Environment Agency, Copenhagen.

EEA, 2003b. *Energy and Environment updated indicator fact sheets*. European Environment Agency, Copenhagen.

EEA, 2003c. *Transport and Environment updated indicator fact sheets*. European Environment Agency, Copenhagen.

EEA, 2003d. Workshop on 'Inventories and Projections of Greenhouse Gas and Ammonia Emissions from Agriculture'. European Environment Agency, Copenhagen. http://air-climate.eionet.eu.int/docs/meetings/030227_AgricEmiss/meeting030227.html.

EEA, 2002a. *Greenhouse gas emission trends and projections in Europe*. Environmental issue report No 33. European Environment Agency, Copehagen.

EEA, 2002b. *Energy and Environment in the EU*. Environmental issue report No 31. European Environment Agency, Copehagen.

EEA, 2002c. *Transport and environment reporting mechanism 2002 — Paving the way for EU enlargement — Indicators for transport and environment integration*. Environmental issue report No 32. European Environment Agency, Copehagen.

EEA, 2002d. *Analysis and comparison of national and EU-wide projections of greenhouse gas emissions*. Topic report No 1/2002. European Environment Agency, Copehagen.

EEA, 2002e. Workshop on 'Energy-related National and EU-wide Projections of Greenhouse Gas Emissions', Brussels. http://air-climate.eionet.eu.int/docs/meetings/0201_EnProjWS_27feb2002/meeting0201.html

Eichhammer, W. *et al.,* 2001. *Greenhouse gas reductions in Germany and the United Kingdom — Coincidence or policy induced? An analysis for international climate policy*. Study for the German Federal Ministry of the Environment (BMU) and the German Federal Environmental Agency (UBA) by the Fraunhofer-Institute Systems and Innovation Research (ISI, Germany), Deutsches Institut für Wirtschaftsforschung (DIW, Germany) and Science Policy and Technology Policy Research (SPRU, UK).

European Commission, 2003a. *Report (2003) under the Council Decision 1999/296/EC for a monitoring mechanism of Community CO_2 and other greenhouse gas emissions*. Commission of the European Communities, Brussels.

European Commission, 2003b. *Second ECCP Progress Report — Can we meet our Kyoto targets?*, http://europa.eu.int/comm/environment/climat/second_eccp_report.pdf

European Commission, 2003c. *European energy and transport trends to 2030*. Commission of the European Communities, Brussels.

European Commission, 2002. *Implementing the Community strategy to reduce CO_2 emissions from cars*. Third annual report on the effectiveness of the strategy (reporting year 2001). COM (2001) 693 final. Commission of the European Communities, Brussels.

European Commission, 2001a. *Environment 2010: Our future, our choice*. Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions. COM (2001) 31 final. Commission of the European Communities, Brussels.

European Commission, 2001b. *A sustainable Europe for a better world: A European Union strategy for sustainable development*. Communication from the Commission to the Council and the European Parliament. COM (2001) 264 final. Commission of the European Communities, Brussels.

European Commission, 1997a. *A Community strategy to promote combined heat and power (CHP) and to dismantle barriers to its development.* COM (1997) 514 final. Commission of the European Communities, Brussels.

German Environmental Agency, 2003. *Politikszenarien für den Klimaschutz — Langfristszenarien und Handlungsempfehlungen ab 2012,* (Politikszenarien III) Umweltforschungsplan 2001 — FKZ 201 41 142), study commissioned by the German Federal Environmental Agency.

IPCC, 2001. *Climate change 2001.* Third assessment report, WMO/UNEP/IPCC.

Glossary

ACEA	European Automobile Manufacturers Association (EU-wide agreement with ACEA and similarly also with Japanese (JAMA) and Korean (KAMA) automobile manufacturing industries)
ARD	afforestation, reforestation and deforestation
CCPMs	common and coordinated policies and measures at EU level
CDM	clean development mechanism as defined in the Kyoto Protocol, Article 12, meaning projects on the reduction of GHG emissions between industrialised countries and developing countries
CER	certified emission reduction unit caused by a CDM project
CFCs	chlorofluorocarbons
CHP	combined heat and power generation
CH_4	methane
CLRTAP	Convention on Long-range Transboundary Air Pollution
CO_2	carbon dioxide
COP	Conference of the Parties
CRF	common reporting format
DG ENV	Environment Directorate-General
ECCP	European climate change programme
EEA	European Environment Agency
ERU	emission reduction unit caused by JI projects
ETC/ACC	European Topic Centre on Air and Climate Change
GDP	gross domestic product
GHG	greenhouse gases
HFCs	hydrofluorocarbons
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
JAMA	Japanese Automobile Manufacturers Association
JI	joint implementation as defined in the Kyoto Protocol, Article 6, meaning projects on the reduction of GHG emissions between industrialised countries and countries in transition
KAMA	Korean Automobile Manufacturers Association
KP	Kyoto Protocol
LUCF	land-use change and forestry
MS	Member States

Mt CO_2-equiv.	mega (million) tonnes of CO_2-equivalent
N_2O	nitrous oxide
PFC	perfluorocarbons
RES	renewable energy sources
SF_6	sulphur hexafluoride
UNECE/EMEP	United Nations Economic Commission for Europe/Co-operative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe
UNFCCC	United Nations Framework Convention on Climate Change