

# Greenhouse gas emission projections for Europe

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# Executive summary

This report supports and complements the annual evaluation, by the European Commission, of progress made towards the European Community's commitment under the United Nations Framework Convention on Climate Change (UNFCCC). The EEA support consists of three complementary reports:

- *Environmental Issue* report *Greenhouse gas emission trends and projections in Europe* (No 33, 2002), which is an indicator-based summary;
- topic report *Greenhouse gas emission trends in Europe* (No 7, 2002), with a detailed analysis of past and current trends;
- technical report (this report) *Greenhouse gas emission projections for Europe* (2003), with a detailed analysis of projections and of policies and measures. The main findings of this analysis are summarised here.

Aggregate *with existing measures* projections for the EU show total greenhouse gas emissions decreasing by 4.7 % between 1990 and 2010, taking into account domestic policies and measures only. This leaves a gap of 3.3 % to reach the EU's Kyoto Protocol target of an 8 % reduction in emissions. However, this relies on over-delivery by some Member States compared to their burden-sharing targets.

Savings from additional measures being planned by Member States, but not yet agreed and implemented, would result in further emission reductions sufficient to meet the gap between the *with existing measures* projections and the Kyoto Protocol target. However, this also relies on over-delivery by some Member States (Germany, United Kingdom, Sweden, France, Finland, Italy and Ireland) compared to their burden-sharing targets.

If no over-delivery by Member States is considered, the EU as a whole is projected to achieve a 0.5 % greenhouse gas reduction *with existing policies and measures* and a 6 % reduction *with additional policies and measures*. This leads to a shortfall of 7.5 % and 2 %

respectively in 2010, taking into account domestic policies and measures only.

The majority of savings from both implemented and planned policies and measures are in the energy sector, with savings in the end-use sectors being greater than those from energy supply.

Greenhouse gas emissions from energy supply and demand (including transport) are projected to decrease by 3 % between 1990 and 2010 under the *with existing measures* scenario. If transport emissions are excluded, from the total energy-related emissions, then the decrease in emissions from the energy sector is 16 %.

Transport-related greenhouse gas emissions are projected to increase by 28 %, if no additional policies and measures are introduced.

Agricultural (– 17 %), process (– 10 %) and waste emissions (– 60 %) are all projected to decline between 1990 and 2010 under the *with existing measures* scenario.

All greenhouse gas emissions except the fluorinated gases are expected to decrease between 1990 and 2010. Carbon dioxide emissions are projected to decrease by 2 % under the *with existing measures* scenario, while methane and nitrous oxide are expected to fall by 38 % and 23 % respectively. Fluorinated gas emissions are forecast to increase by 72 %, although their total contribution will remain small.

An analysis of the types of policies and measures being used by Member States shows that, across all sectors, regulatory and fiscal policies and measures are the most popular and are projected to generate the largest proportion of greenhouse gas reductions.

Six accession countries have prepared third national communications, and of these countries five have reported projections. All projections indicate that, *with existing measures*, their Kyoto commitments will be met.

# 1. Introduction

## 1.1. The Kyoto Protocol and EU burden sharing

At the third Conference of the Parties (COP3) to the UNFCCC held in Kyoto in December 1997, the parties adopted the Kyoto Protocol (KP) to the UNFCCC, which sets different binding emission targets for a number of parties including the European Community (EC). Under this agreement the EC agreed to reduce its greenhouse gas emissions by 8 % by 2008–12 from 1990 levels. The implementation rules for the Kyoto Protocol were agreed at the sixth Conference of the Parties held in Bonn in July 2001 ('Bonn Agreement') and further elaborated at the seventh Conference of the Parties held in Marrakech in November 2001 ('Marrakech Accords'). The EU and Member States ratified the Protocol on 31 May 2002. The overall target of – 8 % was distributed on a differentiated basis to individual Member States under an 'EU burden-sharing' mechanism agreed upon by the Council of Ministers in March 2002 (Council Decision

2002/358/EC). The agreed targets are shown in Figure 1.

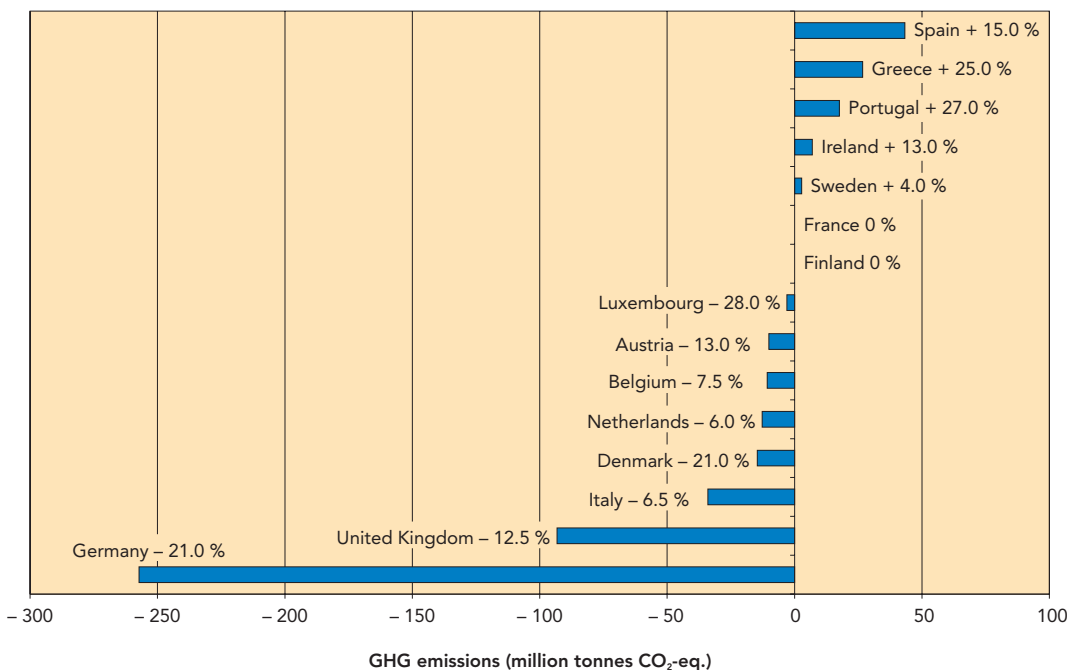
For eight Member States the targets imply a reduction in emissions from base year levels, with five countries allowed increased emissions and two countries having stabilisation targets. These differences take account of the particular circumstances of each Member State and in all cases imply a reduction against the business-as-usual trend in emissions.

## 1.2. The monitoring mechanism and the purpose of this report

The monitoring mechanism for anthropogenic CO<sub>2</sub> and other greenhouse gases was established in June 1993, following the adoption of Council Decision 93/389/EEC, by the Council of Environment Ministers. This was revised in April 1999 (Council Decision 99/296/EC) to allow for the updating of the monitoring process in line with the requirements of the Kyoto Protocol.

Member States' commitments in accordance with Article 4 of the Kyoto Protocol agreed upon by the Council of Ministers (EU burden sharing, March 2002)

Figure 1



The monitoring mechanism is an instrument to assess accurately and regularly the extent of progress being made towards the Community's commitments under the UN Framework Convention on Climate Change and the Kyoto Protocol. Progress is evaluated by the Commission, in consultation with the Member States, and is based on national programmes and updates supplied by the Member States as described in Article 2(2) of Council Decision 1999/296/EC and other relevant information. These national programmes should include (a) information on actual progress, and (b) information on projected progress.

Member States are required by 31 December each year to submit inventory data for the two previous years <sup>(1)</sup> and any updates of previous years (including the base year 1990 <sup>(2)</sup>) and their most recent projected emissions for the years 2005, 2010, 2015 and 2020 <sup>(3)</sup>. Any updates to the national programmes, for example new policy

measures, should also be reported to the Commission by 31 December. If no change has occurred, this should be formally indicated to the Commission.

For the purpose of facilitation and harmonisation of collection, reporting and evaluation of data the Monitoring Committee, established under Council Decision 1999/296/EC, set up two working groups. These working groups developed a set of guidelines <sup>(4)</sup> covering both the collection and evaluation of emission inventories and national programmes. The Monitoring Committee approved the guidelines on 1 September 2000.

This report presents the results of the evaluation process under the EC monitoring mechanism and assesses the projected progress of Member States towards fulfilling the Community's commitments under the Kyoto Protocol.

- 
- (1) Member States have to report annually their inventories to the Commission by 31 December year n: anthropogenic CO<sub>2</sub> emissions and CO<sub>2</sub> removals by sinks for the year n-1; emissions by source and removals by sinks of the other greenhouse gases; final data for the year n-2 and provisional data for the year n-1.
  - (2) Base year is 1990, except for HFC, PFC, SF<sub>6</sub> for which the base year can be selected by the party to be either 1990 or 1995.
  - (3) Decision 99/296/EC requires reporting of projected emissions and removals for the period 2008 to 2010 and, as far as possible, for 2005. However, in addition the monitoring mechanism 'Guidelines for the methodology of the evaluation of progress towards the KP targets and for reporting of national programmes' requires the projected emissions and removals also for the years 2015 and 2020.
  - (4) Guidelines: 'Part 1: Guidelines for Member States and EC annual inventories'; 'Part 2: Methodology for the evaluation of progress and for the contents of national programmes', Brussels, 1 September 2000.

## 2. Member State projections and policies and measures

Aggregate *with existing measures* <sup>(5)</sup> projections for the EU show total greenhouse gas emissions decreasing by 4.7 % between 1990 and 2010. This leaves a shortfall of 3.3 % to reach the EU's Kyoto target of an 8 % reduction in emissions.

Savings from additional measures being planned by Member States would result in further emission reductions of 321 MtCO<sub>2</sub>-eq. in 2010, more than sufficient to meet the shortfall. However, this relies on over-delivery by some Member States compared to their burden-sharing targets. If it is assumed that no Member State will over-deliver on their burden-sharing agreement, an additional 95 MtCO<sub>2</sub> (2 %) of reductions will be needed from new policies and measures.

The majority of savings from both implemented and planned policies and measures are in the energy sector, with savings in the end-use sectors being greater than those from energy supply.

### 2.1. Introduction

This chapter presents the latest greenhouse gas emission projections reported by Member States under the EC monitoring mechanism and compares these projections with the EU's Kyoto commitment and the targets set under the EU burden-sharing agreement.

Two types of emission projections are shown for each Member State (where available):

- *with (existing) measures* projection,
- *with additional measures* projection.

A *with existing measures* projection encompasses currently implemented and

adopted policies and measures. This is also sometimes called a 'baseline projection'. A *with additional measures* projection encompasses planned policies and measures <sup>(6)</sup>.

### 2.2. With existing measures projections

This section compares the latest with existing measures projections from Member States with their EU burden-sharing commitments for 2010. This comparison is useful in revealing the gap between what implemented policies and measures are expected to deliver and the Member States' and EU's commitment under the Protocol.

Figure 2. shows the actual progress between 1990 and 2000 and the aggregate with existing measures projections for the Member States in 2010. Since 1990, greenhouse gas emissions have fallen by 3.5 %. However, this trend is not projected to continue and the aggregate projections for 2010 show a further small fall to 4.7 % below 1990 levels. This leaves a shortfall of 3.3 % to reach the EU's Kyoto commitment of an 8 % reduction in emissions in 2010 compared to 1990 levels.

Looking at the projections at a country level (Figure 3.), the situation varies significantly between Member States. The United Kingdom, Sweden and Germany project that existing policies and measures will be sufficient to meet their burden-sharing targets. Spain, Portugal, the Netherlands, Ireland, Finland, Belgium and Austria are all projected to be significantly above their commitment on the basis of their with existing measures projections. If the UK, Sweden and Germany meet but do not

(5) Policies and measures in this report include only domestic policies and measures. Countries are also allowed to make use of the Kyoto mechanisms to achieve their UNFCCC and EU burden-sharing targets. 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. However, for many countries the extent to which they intend to use either the Kyoto mechanisms or 'carbon sinks' for achieving their targets is not clear from the currently available information.

(6) 'Implemented 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. 'Adopted policies and measures' are those for which an official government decision has been made and there is a clear commitment to proceed with implementation. 'Additional (planned) policies and measures' are options under discussion and having a realistic chance of being adopted and implemented in future.

Figure 2 Actual and projected progress for the EU based on Member State projections

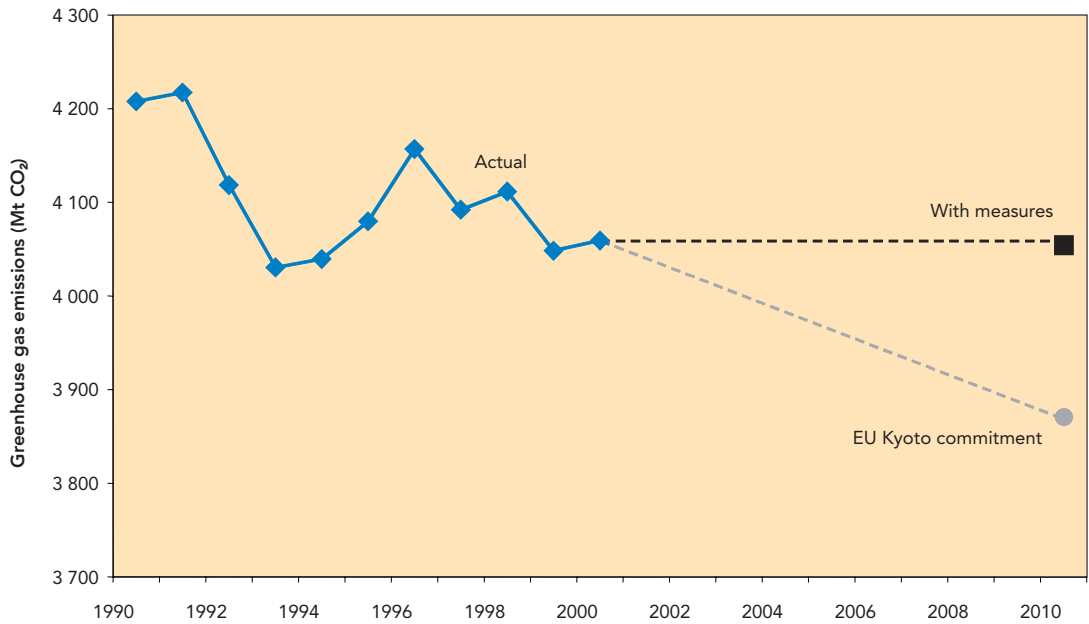
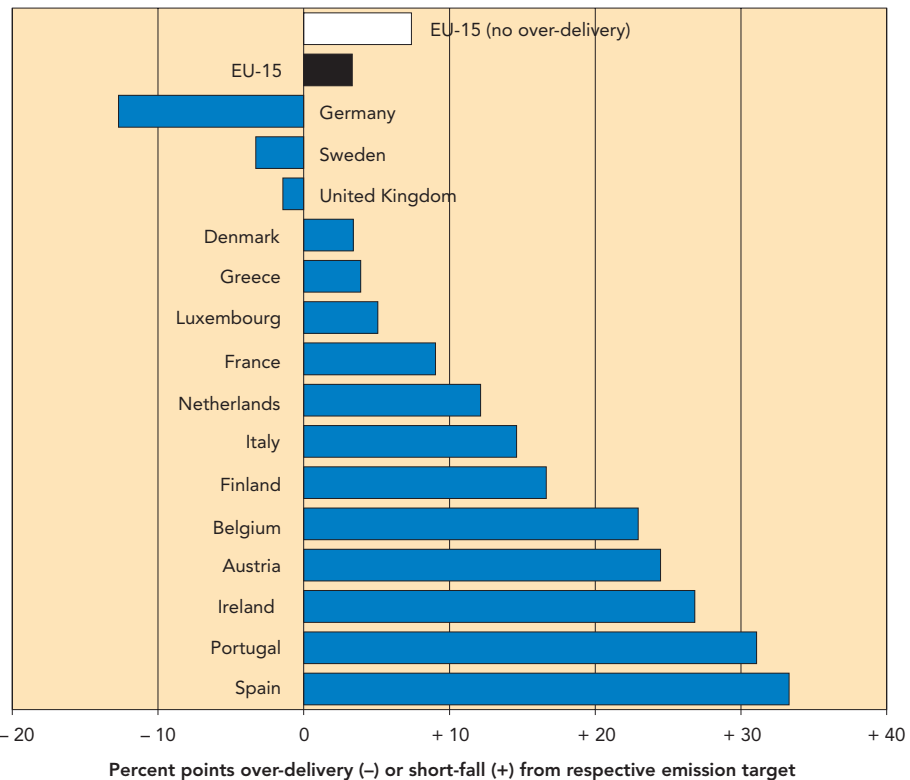


Figure 3 Relative gap (over-delivery or shortfall) between with existing measures projections and targets for 2010 for EU-15 and Member States (7)



exceed their target, the gap for the EU as a whole increases to around 7.5 %.

These projections do not take into account emissions and removals from land-use change and forestry (LUCF). Belgium,

Denmark, France, Ireland, Portugal, Sweden and the UK all provide an estimate of the possible contribution from LUCF. However, the rules governing exactly how such activities are taken into account are still being developed.

(7) The projections exclude emissions and removals from land-use change and forestry (LUCF).



In 2001, the gap between the aggregate *with existing measures* projections and the Kyoto commitment for the EU was around 8 %. This gap has been reduced largely due to policy action in Germany where many of the policies and measures that were additional are now in the *with existing measures* projections. The projection for Sweden is also for reduced emissions in 2010 compared to the previous projections. The *with existing measures* projection for Spain has been revised and projects higher growth in emissions and hence a larger gap than previously forecast.

### 2.3. With additional measures projections

In Section 3.2, *with existing measures* projections for the Member States were presented that indicated that in 2010, on the basis of implemented policies and measures, there would be a shortfall of 3.3 % between the projected level of greenhouse gas emissions and the EU’s Kyoto commitment. Most Member States have also reported on planned (additional) policies and measures

that they are developing to achieve further reductions in greenhouse gas emissions.

Figure 4 shows a comparison for each Member State of the relative gap between the *with additional measures* projection and their Kyoto commitment. If all existing and additional measures are taken into account, then the EU as a whole will deliver savings 4 % higher than the Kyoto commitment. Under the *with additional measures* projections, several other Member States are projected to exceed their targets (Finland, France, Ireland and Italy) in addition to those that have already exceeded their targets in the *with existing measures* projection (Germany, Sweden and the UK). If all these Member States are assumed to meet, but not to exceed, their targets in the *with additional measures* projections, this would mean for the EU as a whole a shortfall of 2 % to the target.

Italy, Ireland, Finland and Denmark have identified savings from planned measures that meet or almost meet the shortfall between the *with existing measures* projection and their commitment.

Relative gap (over-delivery or shortfall) between with additional measures projections and targets for 2010 for EU-15 and Member States

Figure 4

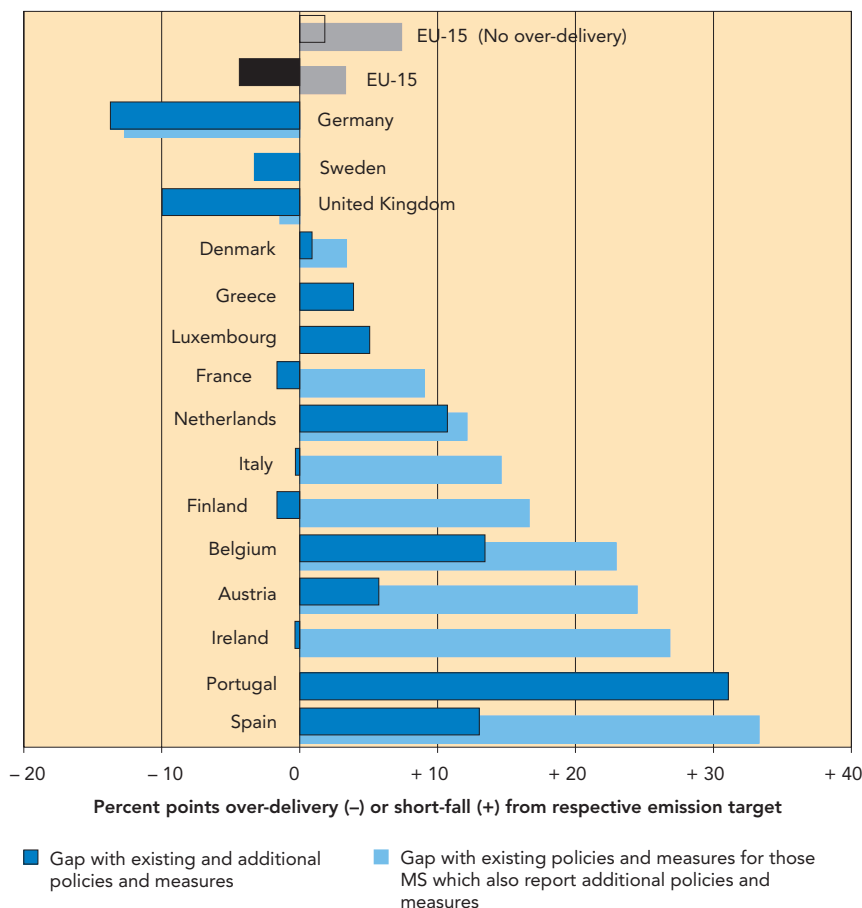
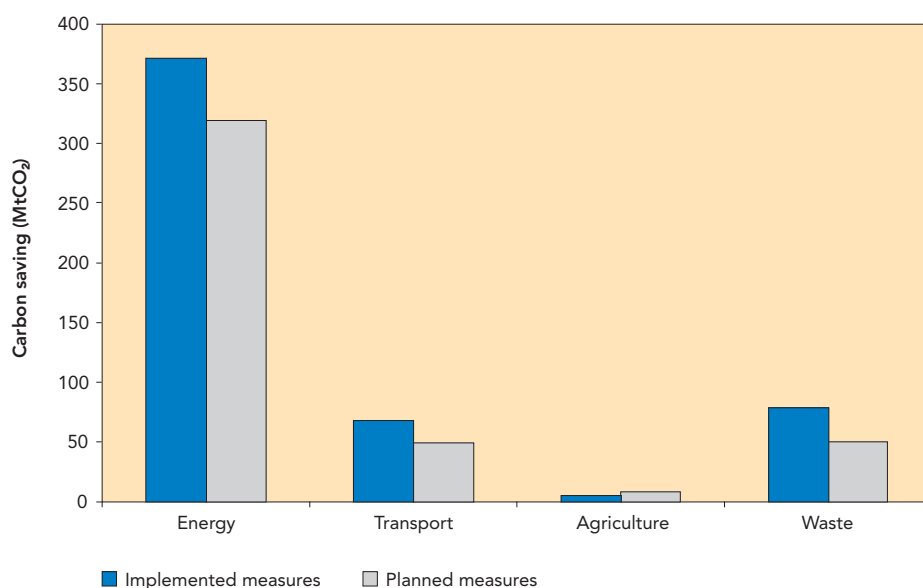


Figure 5 EU-15 projected greenhouse gas saving by sector in 2010



**Note:** Seven Member States provided information on the savings from at least some existing (implemented) policies and measures and nine Member States reported quantified savings from additional (planned) policies and measures.

For Austria, Belgium, the Netherlands and Spain the savings identified from planned policies and measures are not sufficient to achieve their burden-sharing targets and these countries have indicated they will use the Kyoto mechanisms help meet their targets.

Luxembourg, Portugal and Greece have yet to quantify the savings from any planned policies and measures that they are considering.

#### 2.4. Savings from implemented and planned policies and measures

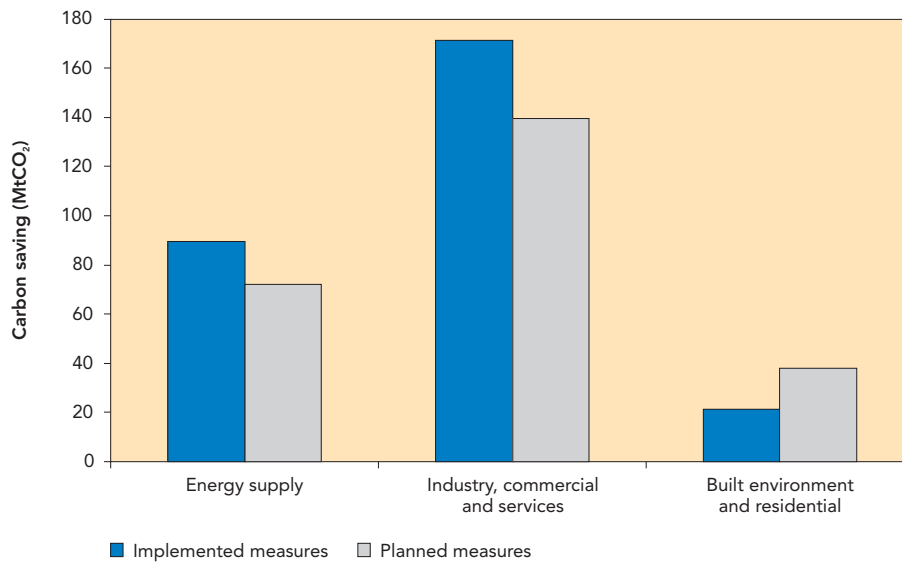
Figure 5 provides an overview of the estimated effects of national policies and measures on total EU greenhouse gas emissions in each of the main sectors. The projected savings are shown for implemented measures (those included in the *with existing measures* projection) and planned policies and measures (those in the *with additional measures* projection). All Member States provided sectoral breakdowns for at least one of the projections except for Portugal and Greece. Not all Member States quantified the savings from all policies and measures; seven Member States have provided information on the savings from at least some implemented policies and measures and nine Member States report quantified savings from planned policies and measures.

Policies and measures in the energy sector account for 63 % of the total savings from implemented measures and 75 % of the planned measures savings for the EU as a whole. The high contribution of this sector is because the majority of both implemented and planned 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 waste sector. As transport is the most rapidly growing source of greenhouse gases, the measures implemented and planned by Member States only go a small way to addressing this, providing 18 % and 16 % of the total savings from implemented and planned policies and measures respectively. Finally, savings from measures in the agriculture sector are expected to be small over the period in question.

Figure 6 provides a breakdown of projected greenhouse gas savings in the energy sector. Policies and measures applied to the end-use sectors of industry, commerce and services are projected to have the largest effect on EU greenhouse gas emissions. This possibly reflects the fact that in the EU as a whole there are many zero or low cost improvements in energy efficiency which can be made in industry and commerce, stimulated by economic instruments and voluntary agreements, making businesses

Breakdown of projected greenhouse gas emission savings in the energy sector

Figure 6



potentially more competitive. Savings from policies and measures acting on energy supply are also significant, with countries

such as Germany continuing to move to cleaner fuels.

### 3. Sectoral assessment of projections and policies and measures

Greenhouse gas emissions from the energy sector (including transport) are projected to decrease by 3 % between 1990 and 2010 under the *with existing measures* scenario. If transport emissions are excluded then the decrease in emissions from the energy sector is 16 %.

Transport-related greenhouse gas emissions are projected to increase by 28 %, if no additional policies and measures are introduced.

Agricultural (– 17 %), process (– 10 %) and waste emissions (– 60 %) are all projected to decline between 1990 and 2010 under the *with existing measures* scenario.

All greenhouse gas emissions except the fluorinated gases are expected to decrease between 1990 and 2010. Carbon dioxide emissions are projected to decrease by 2 % under the *with existing measures* scenario, while methane and nitrous oxide are expected to fall by 38 % and 23 % respectively. Fluorinated gas emissions are forecast to increase by 72 % between the base year (1995 for most Member States) and 2010, although their total contribution will remain small.

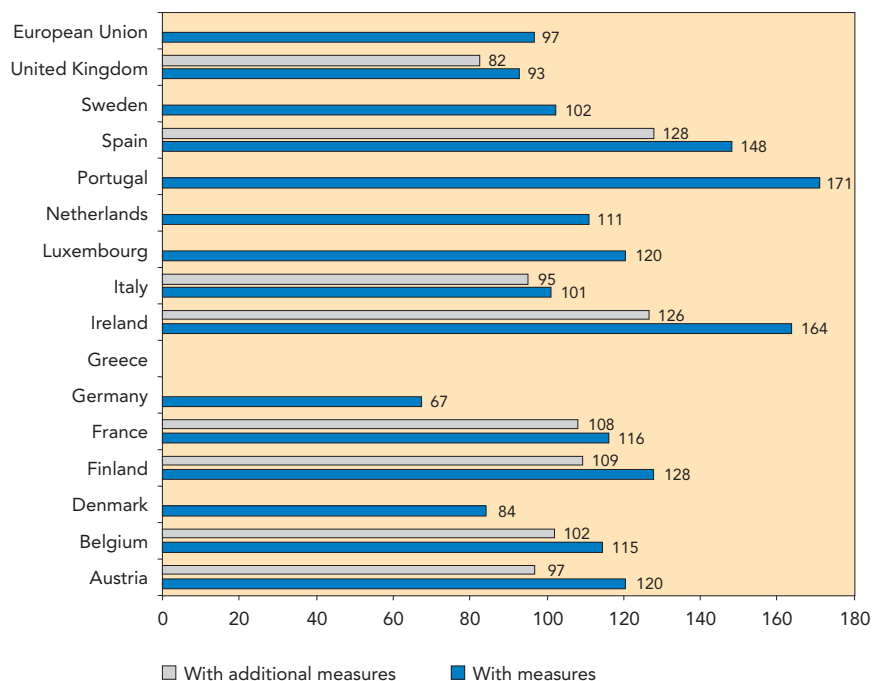
An analysis of the types of policies and measures being used by Member States shows that, across all sectors, regulatory and fiscal policies and measures are the most popular and are predicted to generate the largest proportion of greenhouse gas cuts. Education, research and information appear to be used very little apart from in the transport sector where education and information are significant.

#### 3.1. Energy

Figure 7 shows the total greenhouse gas emission projections for the whole energy sector (supply and use), including transport, from Member States and the European Union. Not all Member States have provided *with additional measures* projections. Therefore in this and following figures only the aggregate *with existing measures* projection is presented for the EU. Emissions from the energy sector in the EU are projected to decrease by 3 % compared to 1990. Except for the UK, Germany and Denmark, the *with existing measures* projections show increased emissions compared to 1990. Additional measures reduce this to below the 1990 level for Italy and Austria.

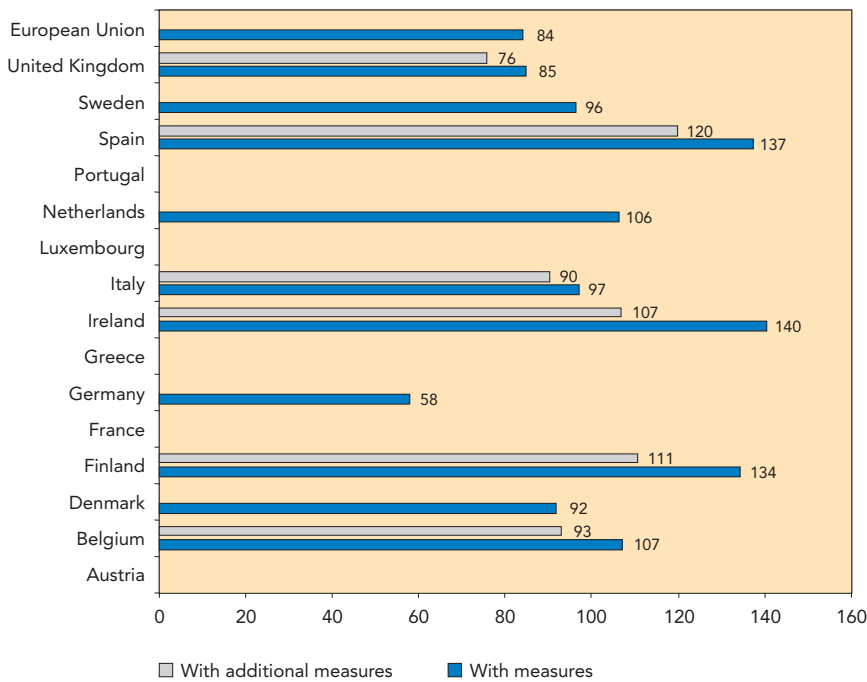
Figure 7

Member State projections for emissions in 2010 from energy supply and use, including transport (1990 = 100)



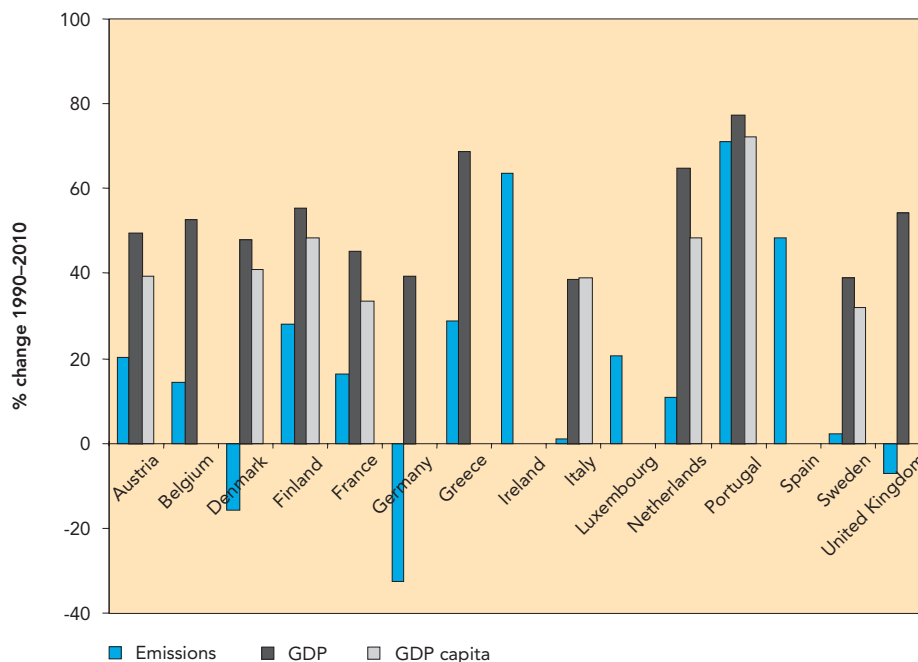
Member State projections for emissions in 2010 from energy supply and use, excluding transport (1990 = 100)

Figure 8



Projections and assumptions for total energy-related emissions, GDP and GDP per capita

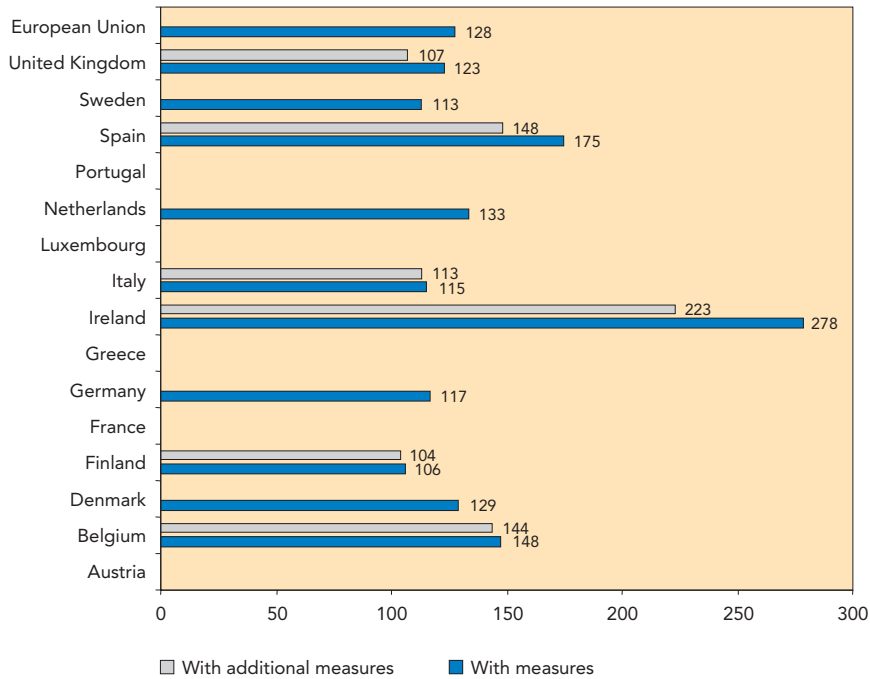
Figure 9



Some Member States give separate projections for transport, allowing projections for the energy sector excluding transport to be calculated as shown in Figure 8. The aggregate projection for the EU includes only those Member States that gave a separate transport projection and so is not strictly comparable with the aggregate projection in Figure 7.

The *with existing measures* projections of energy (including transport) are compared with the assumptions in the projections regarding GDP and GDP per capita in Figure 9. For all Member States where data are available, the projected increase in total energy-related emissions is well below the GDP growth over the period. For most countries GDP per capita is assumed to

Figure 10

**Member State projections for emissions in 2010 from transport (excluding international transport) (1990 = 100)**


**Note:** Passenger growth in passenger km for all countries, except Austria and Ireland, for which growth is in number of passenger cars.

increase more slowly than GDP. Denmark, Germany and the UK project decreases in energy-related emissions even though GDP increases. For Germany and the UK, this relates in part to decreasing carbon intensity in the electricity supply industry in the 1990s and to structural changes in Germany.

### 3.2. Transport

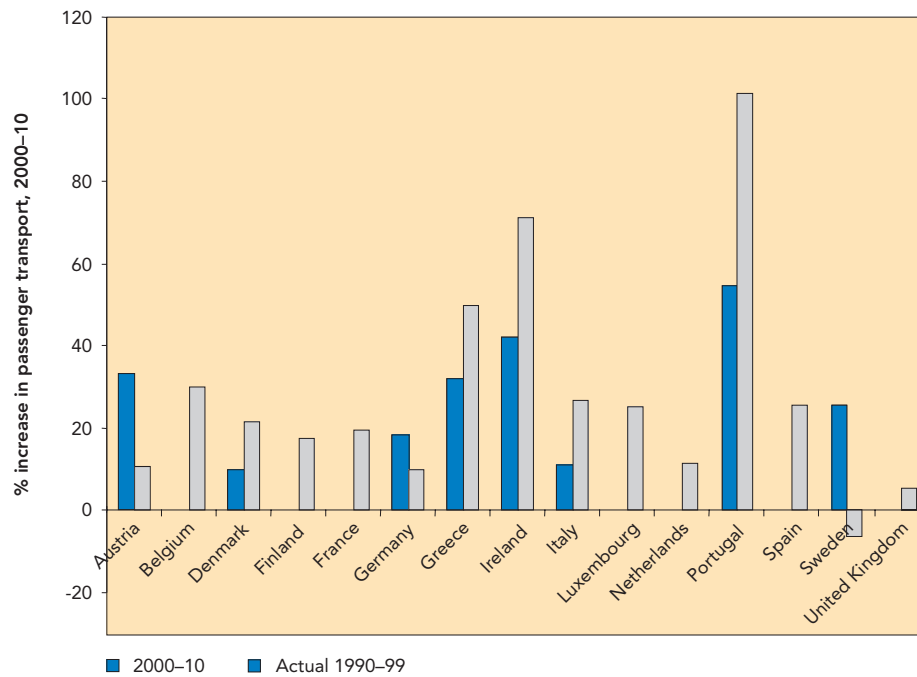
Nine Member States have reported separate emission projections for the transport sector and all project increased emissions in 2010 compared to 1990. Transport emissions exclude emissions from international transport (aviation and maritime), which is in line with the reporting under UNFCCC and the EU GHG monitoring mechanism. Emissions from international transport were approximately 6 % of total EU emissions in 2000. On aggregate, EU transport emissions are projected to increase by 28 % compared to 1990 in the *with existing measures* projections. Ireland, Spain and Belgium project strong growth, with Ireland projecting that emissions will more than double by 2010. Ireland, Spain and the UK expect that additional measures will significantly reduce the projected growth in emissions. For the other Member States, any additional measures are more limited in their effect.

The assumptions made on growth rates in the transport sector that underlie the emission projections are only available for a few Member States (Figure 11 and Figure 12).

For those Member States where both the projections and growth rates are available, the *with existing measures* projections are largely in line with the growth rate assumed for passenger transport. The *with existing measures* projection for Sweden is for a growth in emissions that is significantly less than the increase in transport (13 % compared to 25 %). A number of measures are in place to decrease energy or emission intensity of road transport in Sweden, including promotion of economical driving and more environmentally compatible cars. The projected trends suggest that these measures are assumed to be effective. The historical growth between 1990 and 1999 is also shown in Figure 11. For most countries the historical growth over the last 10 years has been faster than the rate assumed for 2000 to 2010, although in Sweden there has been a decrease in the period 1990–99. For freight transport, Portugal projects a much more rapid increase over the period 2000 to 2010 than has been seen in the past.

Assumptions for growth in passenger transport (passenger km) and actual growth from 1990–99

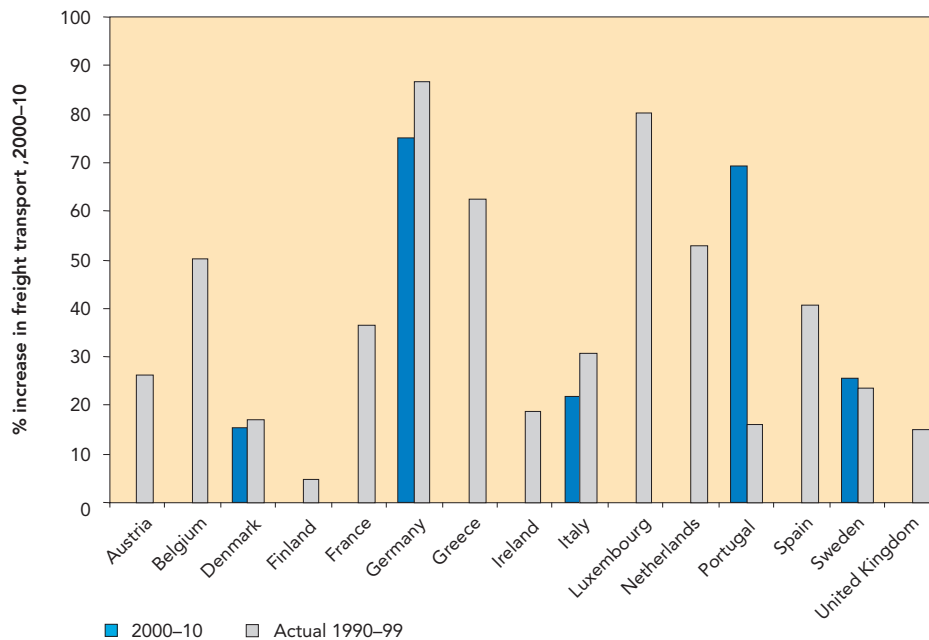
Figure 11



**Note:** Passenger growth in passenger km for all countries, except Austria and Ireland, for which growth is in number of passenger cars.

Assumptions for growth in freight transport (tonnes km) and actual growth from 1990–99

Figure 12



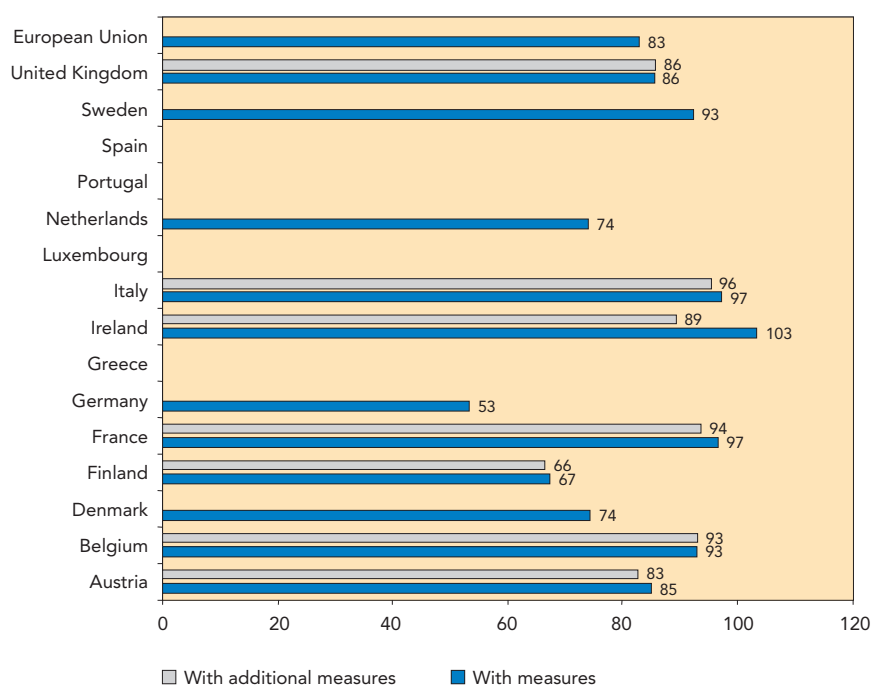
### 3.3. Agriculture

Figure 13 shows emission projections for the agricultural sector. For most Member States, emissions are expected to decrease compared to 1990 in both the *with existing measures* and *with additional measures* projections. For the EU as a whole, the aggregate *with existing measures* projection

shows a 17 % decrease in 2010 compared to 1990. Very few Member States have significant additional measures in the agriculture sector. In Ireland and the Netherlands, emissions are projected to increase in the *with existing measures* projection and additional measures are identified to reduce this increase. Few Member States provide information on the

Figure 13

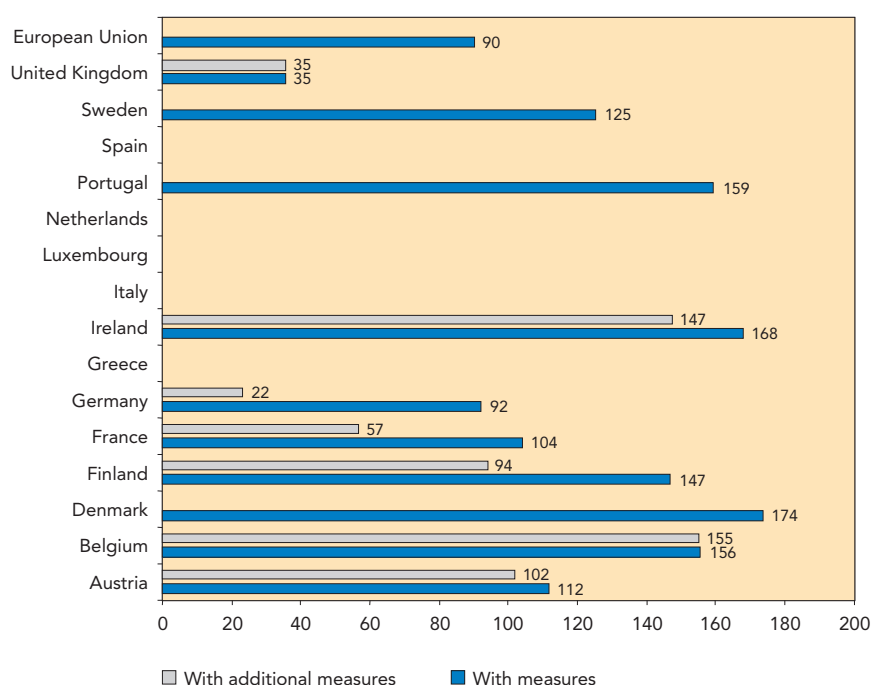
## Member State projections for emissions in 2010 from agriculture (1990 = 100)



**Note:** Where a *with additional measures* projection is shown equal to the *with existing measures* projection, the Member State has provided the data but there are no additional measures in that sector. Where there is no *additional measures* projection shown, the Member State has not provided disaggregated data for this projection.

Figure 14

## Member State projections for emissions in 2010 from non-energy related industrial processes (1990/95 = 100) (\*)



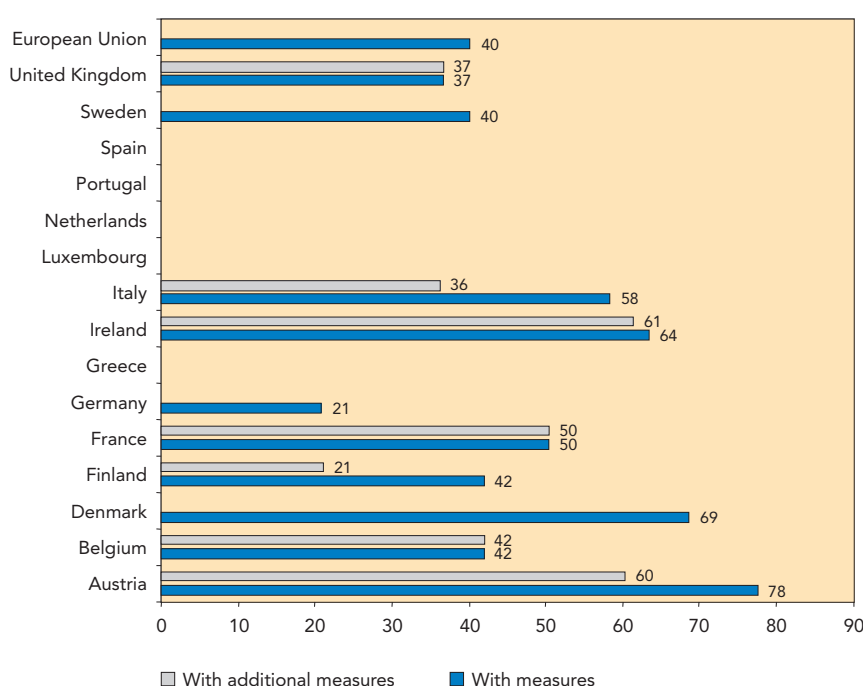
(\*) Depending on the base year for F-gases chosen by the Member State.

**Note:** Where a *with additional measures* projection is shown equal to the *with existing measures* projection, the Member State has provided the data but there are no additional measures in that sector. Where there is no *additional measures* projection shown, the Member State has not provided disaggregated data for this projection.



Member State projections for emissions in 2010 from waste management (1990 = 100)

Figure 15



**Note:** Where a *with additional measures* projection is shown equal to the *with existing measures* projection, the Member State has provided the data but there are no additional measures in that sector. Where there is no *additional measures* projection shown, the Member State has not provided disaggregated data for this projection.

drivers for the agricultural sector. Factors such as decreases in fertiliser use and increases in the productivity of cattle will contribute to decreasing emissions.

### 3.4. Industrial processes (non-energy related)

Member State projections from industrial processes (non-energy related) are shown in Figure 14. These emissions include, for example, CO<sub>2</sub> from cement manufacture, nitrous oxide from adipic and nitric acid production and HFCs from HCFC-22 manufacture. The projected trends are quite different in different Member States because of the variety of sources. In the UK, emissions are projected to decrease by 65 % in the *with existing measures* projections due to improved abatement in the manufacture of adipic acid and other industries. France already decreased by 60 % its emissions of nitrous oxide from industrial process between 1990 and 1999, by imposing strong regulations on the industry, and projects additional reductions with additional measures. Most other Member States project increases compared to 1990 as growth in some of these industrial sectors is strongly linked to GDP.

### 3.5. Waste management

The *with measures* projections for the waste sector from Member States (Figure 15) are generally for a significant decrease compared to 1990 and this leads to an aggregate projected decrease for the EU of 60 %. The decrease in emissions for the other Member States largely arises from the implementation of the landfill directive, which limits the amount of biodegradable waste disposed to landfills and implements controls and landfill gas recovery. National measures have also been introduced in some countries, for example Germany. Only a few Member States have reported the assumptions made in the waste sector regarding tonnes of waste disposed to landfill.

### 3.6. Policies and measures by type

Table 1 to Table 5 show the types of policy or measure being used by Member States in each of the five main sectors. Across all Member States and all sectors, regulatory and fiscal policies and measures are the most popular and are predicted to generate the largest proportion of greenhouse gas emission reductions. Education, research and information are used very little apart from in the transport sector where education and information are significant.

Table 1 Type of policies and measures applied to energy supply and use <sup>(8)</sup>

	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	✓✓✓		✓✓✓			✓	✓	✓	✓✓				✓		✓	
UK		✓	✓	✓✓✓		✓	✓✓✓	✓✓✓								

Notes: Imp = implemented (existing); Add = additional.

Table 1 shows that fiscal and regulatory policies are projected to have the greatest impact on emissions in the energy sector (supply and use, excluding transport). Economic instruments and voluntary agreements are also used to significant effect. Research, education and information are predicted to have a low impact on future emissions in the energy sector.

The most favoured and effective methods to change behaviour in the transport sector are through voluntary agreements and fiscal incentives, subsidies and taxes. The results in Table 2 indicate that these measures will have a significant impact on transport emissions. In contrast to the energy sector, Member States have given economic and regulatory transport policies the same significance as information and education policies.

There are far fewer policies for agriculture than for energy and transport and the overall

greenhouse gas savings to come from this sector will be small. Table 3 shows that Member States favour the use of regulatory policies, backed up by fiscal measures to control agricultural emissions. Voluntary agreements, education, information and research are rarely used. Spain is unique in that it has predicted a high contribution to total country emission savings to come from agricultural policies which include economic and regulatory measures. Five countries are using less than three types of agricultural policies and measures, including the UK, which only uses fiscal measures.

The waste sector policy instrument used follows a similar pattern to that in agriculture, with regulatory measures being the most commonly used instrument, followed by fiscal measures. Other types of policy are rarely used; only Austria has taken advantage of a full suite of policy instruments to achieve its goals in this sector.

(8) For most Member States, the number of ticks in the tables relate to the magnitude of the contribution of the policy instrument to the country's total carbon saving. For example, for the Netherlands, policy instruments saving < 1 MtCO<sub>2</sub> receive one tick, 1–2 MtCO<sub>2</sub> receive two ticks and > 2 MtCO<sub>2</sub> receive three ticks. The size of these bands varies between countries depending on the magnitude of savings. For countries that only provide qualitative details of policies (indicated by italics), the number of policies of each type are scored. For example, Belgium has two implemented regulatory policies for energy and thus has two ticks. Portugal has not provided information on the types of policy instruments used.

Type of policies and measures applied to transport <sup>(8)</sup>

Table 2

Source: EEA, 2002b.

	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					✓								✓		✓✓	
UK			✓	✓		✓✓										

Notes: Imp = implemented (existing); Add = additional.

Type of policies and measures applied to agriculture <sup>(8)</sup>

Table 3

Source: EEA, 2002b.

	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	✓						✓								✓	
UK				✓												

Notes: Imp = implemented (existing); Add = additional.

The results in Table 5 show that regulatory policies and measures are projected to have the largest impact on industrial process emissions. The Netherlands has a high contribution from measures in this sector to

total savings. This sector has not been targeted at all in several cases: six Member States have no policies and measures in place specifically to target industrial processes.

Table 4 Type of policies and measures applied to waste management <sup>(8)</sup>

Source: EEA, 2002b

	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							✓									
UK																

Notes: Imp = implemented (existing); Add = additional.

Table 5 Type of policies and measures applied to non-energy related industrial processes <sup>(8)</sup>

Source: EEA, 2002b

	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			✓				✓✓✓									
UK			✓				✓									

Notes: Imp = implemented (existing); Add = additional.

### 3.7. Assessment of projections by gas

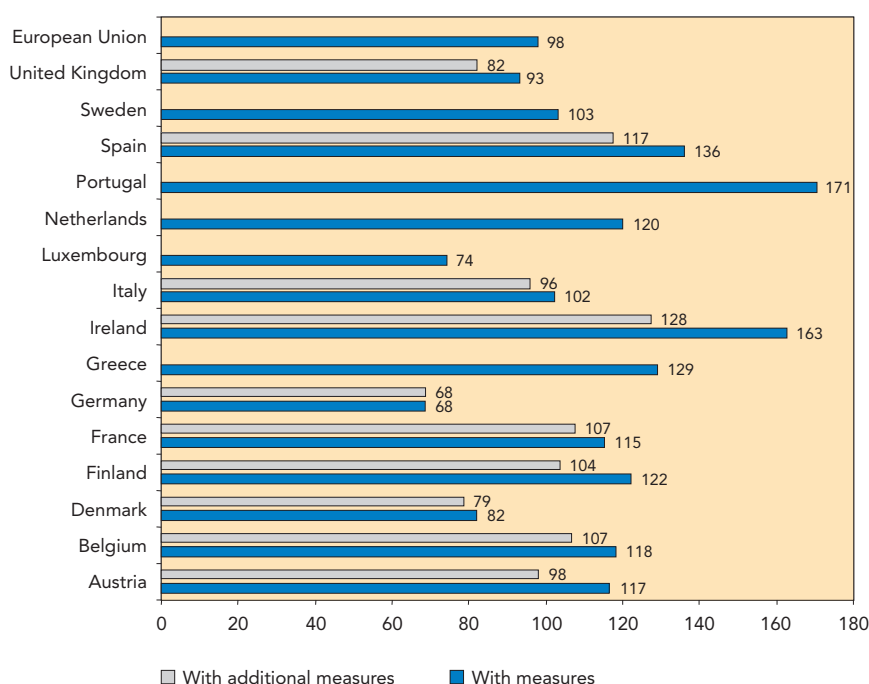
#### 3.7.1. Carbon dioxide emissions

Member State projections for CO<sub>2</sub> emissions in 2010 are shown in Figure 16. Overall in the EU, CO<sub>2</sub> emissions are projected to decrease by 2 % in the *with existing measures* projection.

However, most Member States project an increase in CO<sub>2</sub> emissions in the *with existing measures* projections. Only Germany, Denmark, Luxembourg and the UK project decreased emissions compared to 1990. In the *with additional measures* projections more Member States project a decrease in

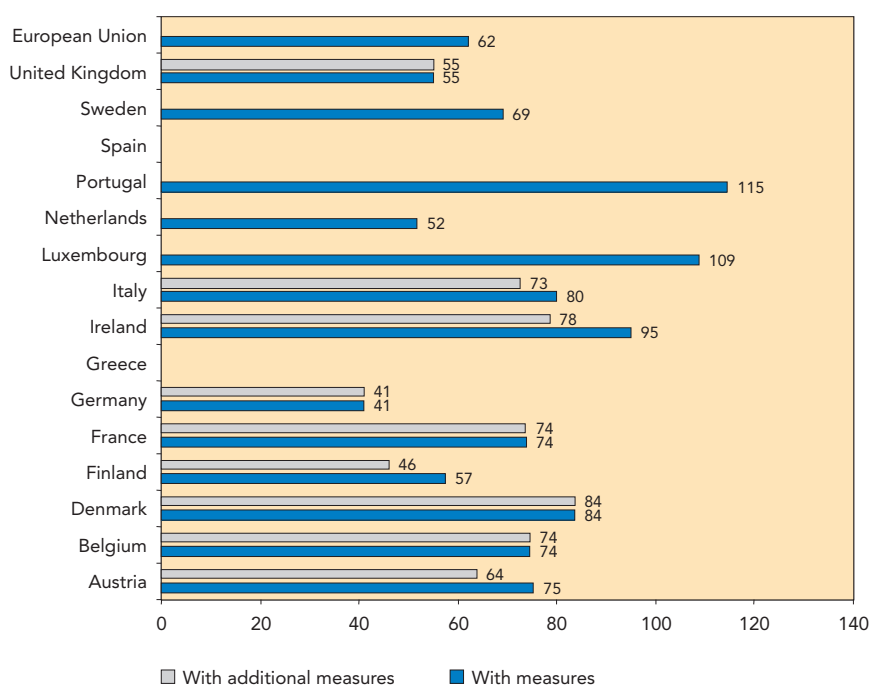
Member State projections of carbon dioxide emissions in 2010 (1990 = 100)

Figure 16



Member State projections of methane emissions in 2010 (1990 = 100)

Figure 17



emissions between 1990 and 2010. Spain, the Netherlands and Ireland project a significant increase in CO<sub>2</sub> emissions even in the *with existing measures* projections. These projections are mainly driven by developments in the energy sector (supply and use).

### 3.7.2. Methane emissions

Methane emissions arise predominantly from waste and agriculture and trends in these sectors determine the projections. Overall methane emissions are projected to decrease by around 38 % for the *with existing measures* projections (Figure 17). Most of this

Figure 18 Member State projections of nitrous oxide emissions in 2010 (1990 = 100)

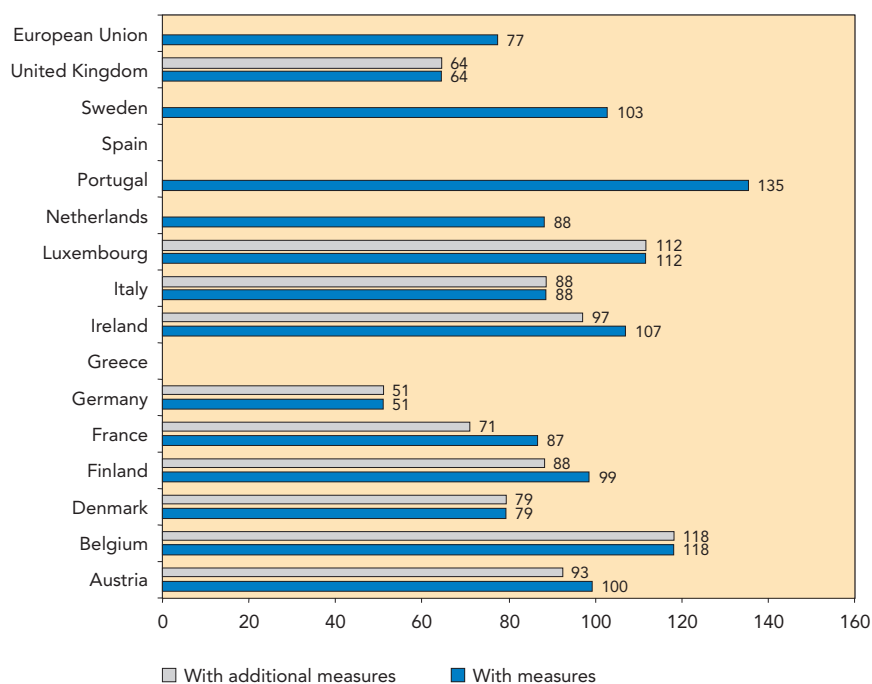
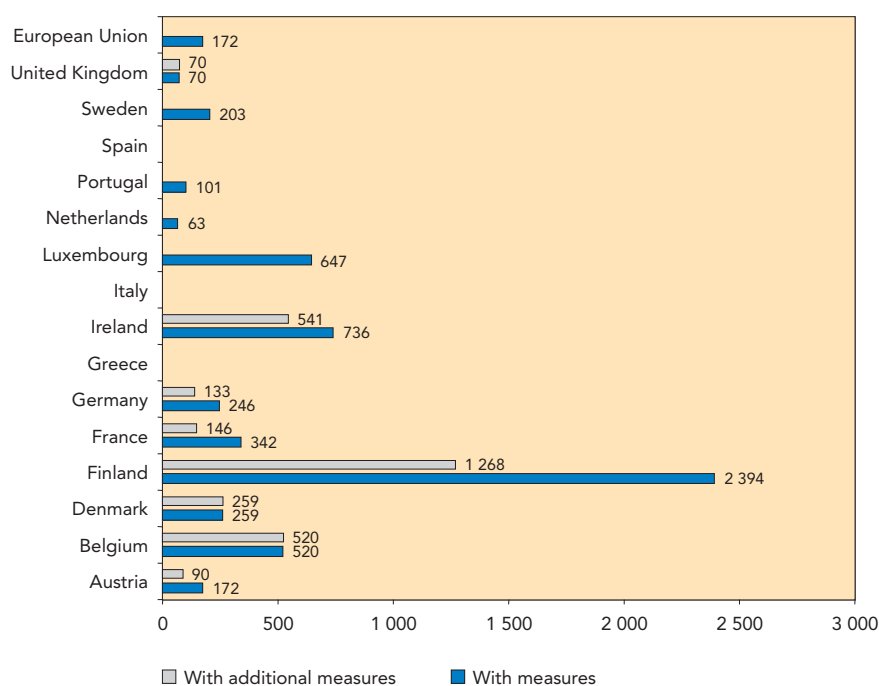


Figure 19 Member State projections of fluorinated gas emissions in 2010 (1990/95 = 100) (\*)



(\*) Depending on base year chosen by the Member State.

reduction arises from the implementation of the landfill directive and other national waste policies. In contrast to other Member States, Portugal and Luxembourg project increased emissions.

### 3.7.3. Nitrous oxide

Nitrous oxide emissions arise mainly from industry and from agriculture. Emissions are projected to decrease in most Member States under both projections, leading to an EU-

wide reduction of 23 % in the *with existing measures* projection (Figure 18). This decrease is linked to reductions in the agricultural sector, particularly in France and Germany, and to abatement of emissions from adipic acid manufacture in some Member States. Emissions are projected to increase significantly compared to 1990 in the *with existing measures* projections for Portugal, Luxembourg and Belgium.

#### 3.7.4. Fluorinated gases

Reporting on fluorinated gases has improved considerably in the latest Member States' reports, but some of the trends given in Figure 19 still reflect some uncertainty in base year figures. Overall, the EU projection

is for a 72 % increase compared to the base year. This reflects increased activity in this area mainly from the phasing out of ozone depleting substances, but also other factors such as increased use of air conditioning. The UK has introduced measures to reduce certain process emissions of fluorinated gases and their *with existing measures* projection is for 70 % compared to the base year of 1995. Most other Member States project an increase in emissions in the *with existing measures* projections, but Austria and the Netherlands have additional measures that bring the total to below the base year level. France, Germany, Ireland and Finland also have additional measures that reduce the emissions of fluorinated gases significantly.

## 4. EU-wide projections and policies and measures

### 4.1. EU-wide projections

In Figure 20 the *with existing measures* projections for combustion related CO<sub>2</sub> emissions from 14 Member States have been aggregated and compared with the corresponding EU-wide projection from the latest preliminary results using the 'Primes' model. The results from Primes have been prepared as part of a forthcoming EU-wide study which is making new energy and CO<sub>2</sub> projections on behalf of the European Commission (information from Energy and Transport DG, September 2002).

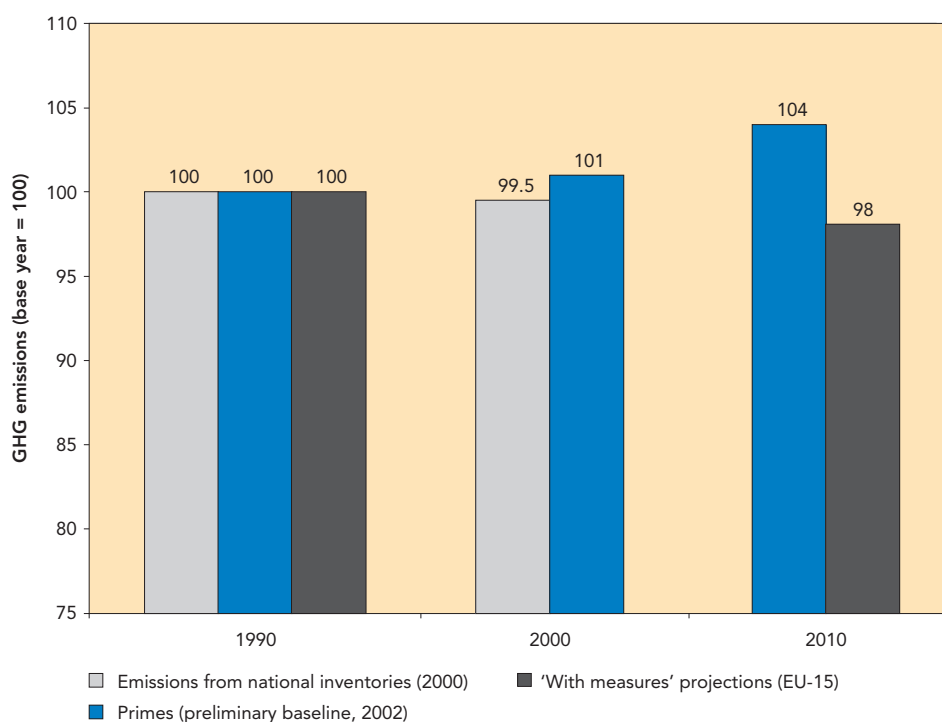
The projections for 2010 from the Member States and from Primes show considerable differences. The aggregate Member States' *with existing measures* projections for energy-related CO<sub>2</sub> show a decline in emissions by 2 % compared to 1990. The new Primes projections are for an increase in energy-related CO<sub>2</sub> emissions of 4 % over the same period. The projections from Primes are based on updated assumptions (e.g. energy import prices, GDP, industrial production by

branch) compared to earlier studies using the model, and also take into account the most recent statistical data. The Primes results for CO<sub>2</sub> emissions in 2000 are in reasonable agreement with the actual figures.

This means that the latest aggregated Member State projections result in CO<sub>2</sub> emissions in 2010 that are 6 percentage points below the results of Primes. According to a preliminary analysis, the main reasons for this inconsistency are differences in the coverage of emissions and in the results for one Member State. Following the format of Eurostat energy statistics, the Primes projections include emissions from international aviation, whereas the sum of the national projections excludes these. However, the main reason is a significant difference in the expected reductions of emissions in Germany, which are projected to be much larger in the national projection than in the Primes results. For other Member States, there are only minor differences between the national projections and Primes.

Figure 20

Comparison of the aggregated with existing measures projections for CO<sub>2</sub> emissions with EU-wide model results

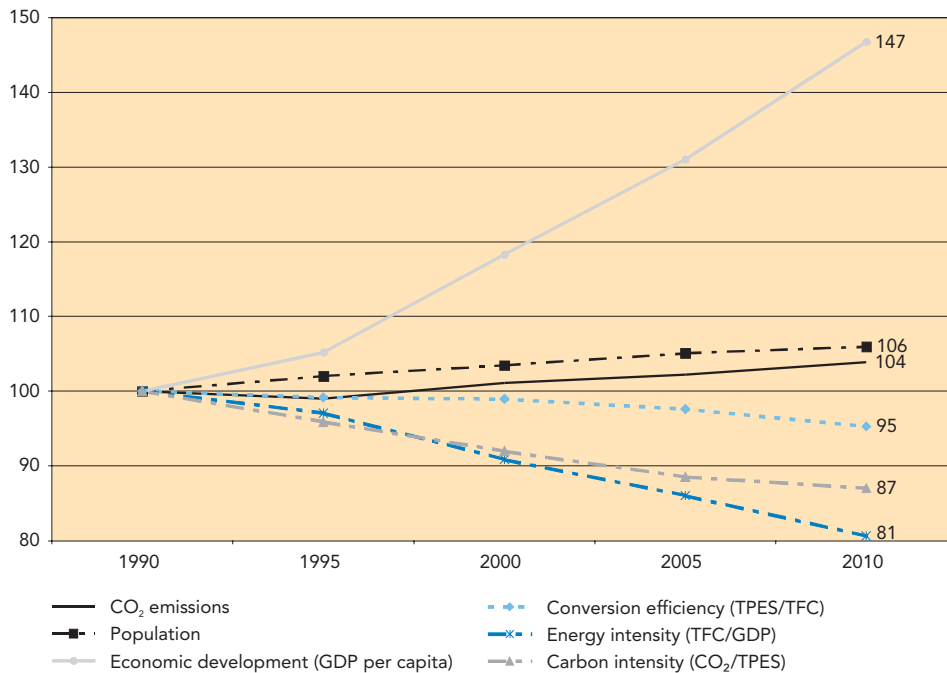


**Note:** There is no disaggregated emission projection for Greece.



Driving forces of CO<sub>2</sub> emissions in the new Primes baseline projection (comparable to the with existing measures projections)

Figure 21



**Note:** The results from the new Primes run are preliminary and may be subject to change.

To examine these differences further requires additional information (e.g. breakdown of CO<sub>2</sub> emissions by sector and underlying assumptions for all Member States). Such data are currently not available from national projections for all Member States and also the detailed Primes projections (by sector and country) are not yet available. The Commission expects to publish these early in 2003.

In Figure 21, the key factors that influence the development of CO<sub>2</sub> emissions in the new Primes results are plotted as indicators (1990 = 100). From 1990 to 1995, CO<sub>2</sub> emissions decreased slightly but started to increase again thereafter. They are projected to exceed their 1990 level by 4 % in 2010. This result is a product of several contributory trends:

- GDP per capita is forecast to increase by 47 % and population by 6 %, putting upward pressure on the demand for energy.
- However, the carbon intensity will decline by 13 % due *inter alia* to increasing share of renewable energies.
- Also the conversion efficiency measured in units of total primary energy needed for the consumption of one unit of final energy is

also projected to improve by 5 % (which can be seen at the declining trend of the respective line).

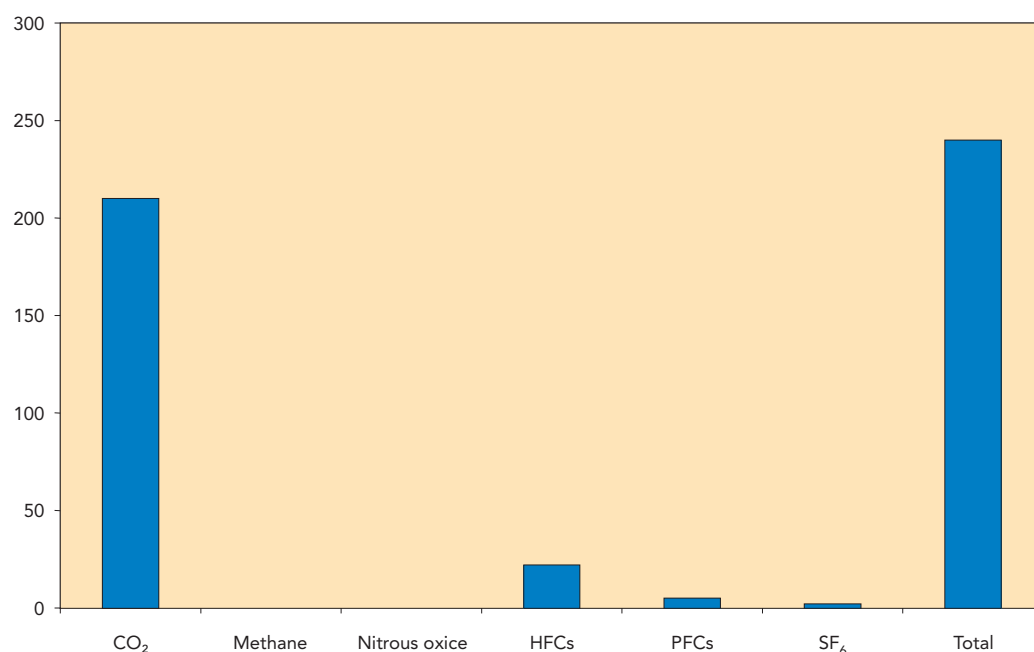
- The overall energy intensity measured in units of final energy needed to produce one unit of GDP is projected to improve by 19 % due to structural changes in the economy and efficiency measures in final consumption.

Not all of these improvements are the result of energy and climate policy because a part of these developments relate to business-as-usual trends that would occur without policy interventions. Although such business-as-usual developments cannot be separated at this stage, it is believed that energy and climate policies have a substantial effect on the projected development of CO<sub>2</sub> emissions.

Nevertheless, CO<sub>2</sub> emissions are projected to increase by 4 % over the period to 2010 because of the effects of a growing population and economy. The population grew slightly faster than energy-related CO<sub>2</sub> emissions in the 1990s and is expected to grow at the same pace as CO<sub>2</sub> emissions up to 2010. This leads to a stabilisation of per capita CO<sub>2</sub> emissions in this decade after a slight decline in the last decade. GDP per capita, according to the new Primes results, is expected to be 47 % higher in 2010 than it

Figure 22

Emission-saving potential of additional common and coordinated policies and measures (EU third national communication)



was in 1990, which represents an average annual growth rate of 1.9 %. This illustrates the underlying the upward pressure on CO<sub>2</sub> emissions and the challenge for climate policies.

One of the major reasons for increasing CO<sub>2</sub> emissions is the growing demand for transport services. Transport demand is projected to grow by 2.0 % per year (passenger transport 1.8 % per year, freight transport 2.6 % per year), even faster than GDP per capita. According to the latest Primes results, transport demand will be almost 50 % higher in 2010 than in 1990.

These results therefore serve to highlight the challenges which climate policy faces: climate mitigation targets will have to be met despite underlying macro trends tending to increase CO<sub>2</sub> emissions. As a result, climate policy has to be as effective as possible to compensate for the underlying growth trends of CO<sub>2</sub> emission. The latest preliminary results from Primes show that, under baseline conditions, this is not yet the case.

#### 4.2. Common and coordinated policies and measures

In the European Union, policies and measures are developed both at the Member State level and at the level of the EU. Those

policies and measures developed by the EU and applying across Europe are called common and coordinated policies and measures (CCPMs).

The third national communication of the European Union to the UNFCCC identified certain CCPMs as additional measures being in an advanced state of preparation. The aggregate effects of these measures are shown by gas in Figure 22. The total savings are 240 MtCO<sub>2</sub>-eq., mainly in energy-related CO<sub>2</sub> but also in fluorinated gases. The CCPMs included in this potential for additional measures are listed in Table 6 and described in the third national communication.

Developments in CCPMs since the preparation of the third national communication are described in detail in Annex II and summarised here.

In October 2001, the Commission published a communication on the implementation of the first phase of the ECCP<sup>(9)</sup>. The communication presented a concrete set of implementation measures to be addressed in the Commission's work programme over the next two years. The measures are grouped in four sections: cross-cutting, energy, transport and industry. They represent a cost-effective reduction potential of some 122–178 MtCO<sub>2</sub>-

(9) Communication on the implementation of the first phase of the European climate change programme, COM(2001) 580 final, 23 October 2001.

CCPMs included in the EU-wide projections (EU third national communication)

Table 6

Sector	With additional measures
Energy supply	<ul style="list-style-type: none"> <li>• Directive on renewable energy sources and biofuels</li> <li>• Directive on emissions trading</li> <li>• Campaign for take-off</li> </ul>
Tertiary	<ul style="list-style-type: none"> <li>• Directive on energy efficiency in buildings</li> <li>• Amended SAVE directive</li> <li>• Directive on public procurement in buildings</li> </ul>
Transport	
Industry	<ul style="list-style-type: none"> <li>• Framework directive for fluorinated gases</li> </ul>
Waste	
Agriculture	

eq. (out of the 240 MtCO<sub>2</sub>-eq. previously identified) <sup>(10)</sup>.

In the energy sector, the Commission proposed a new multiannual programme for actions in the field of energy <sup>(11)</sup>, 'Intelligent energy for Europe' (2003–06). It aims at strengthening security of supply, fighting against climate change and stimulating the competitiveness of European industry. 'Intelligent energy for Europe' implements the strategy outlined in the Green Paper on security of supply <sup>(12)</sup> and will be the main European instrument for non-technical support activity in the energy field. Financial support will be provided to local, regional and national initiatives in the fields of renewable energy (Altener), energy efficiency (SAVE), energy aspects of

transport (STEER) and their international promotion (Coopener). The Commission envisages a budget of EUR 215 million.

Although not aimed directly at reducing greenhouse gas emissions, improvements in the railway system should have the effect of reducing emissions from transport. The Commission has published a communication on an integrated European railway area. Revitalising the railways is one of the key components in the strategy proposed by the Commission in the White Paper on European transport policy <sup>(13)</sup> to shift the balance between different modes of transport. The White Paper proposed an action programme revolving round three types of measures to revitalise the railways.

(10) There is currently no consistent information on what proportion of the reductions in Member States' *with additional measures* projections are such CCPMs.

(11) [http://europa.eu.int/comm/energy/res/index\\_en.htm](http://europa.eu.int/comm/energy/res/index_en.htm)

(12) [http://europa.eu.int/comm/energy\\_transport/en/lpi\\_lv\\_en1.html](http://europa.eu.int/comm/energy_transport/en/lpi_lv_en1.html)

(13) [http://europa.eu.int/comm/energy\\_transport/en/lb\\_en.html](http://europa.eu.int/comm/energy_transport/en/lb_en.html)

## 5. Accession countries' projections and policies and measures

Greenhouse gas emissions in six accession countries are generally projected to decrease in the *with existing measures* projections and for these countries to meet their Kyoto target.

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

Accession countries do not report formally to the monitoring mechanism, so the discussion in this section is based on third national communications. Six countries (Czech Republic, Estonia, Hungary, Latvia, Poland and Slovakia) had submitted third national communications by August 2002. Hungary did not provide clearly defined *with existing measures* and *with additional measures* projections. Figure 23 shows the relative gap between the *with existing measures* and *with additional measures* projections and the targets for the remaining five accession countries.

The Czech Republic presents two projections, a reference scenario (labelled

base in Figure 23) and a scenario assuming high economic growth. All *with existing measures* projections are for over-delivery against the Kyoto commitment. For Latvia and Estonia, the emissions are projected to be significantly lower than in 1990.

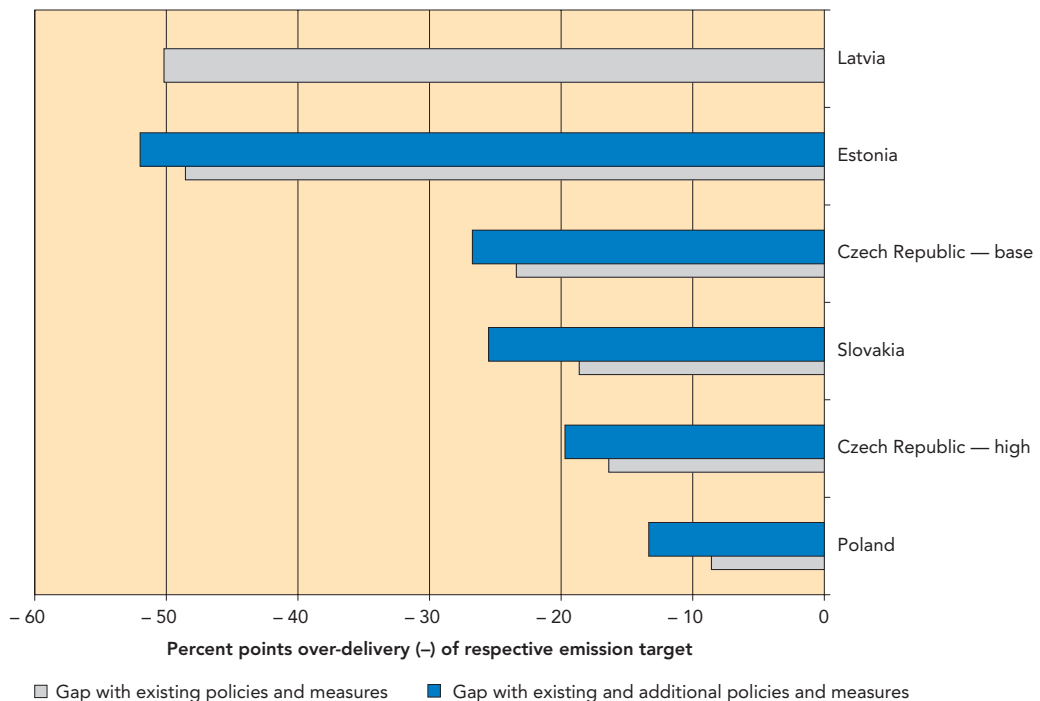
In part, the projected reductions are the result of the economic restructuring that has already occurred in these countries.

However, all countries have policies and measures in place to reduce greenhouse gas emissions. These measures are primarily aimed at energy use and waste but there are a limited number of measures in other sectors. The whole range of types of measures is used, although the use of voluntary agreements is limited. 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;

Figure 23

Relative gap (over-delivery or shortfall) between with existing measures and with additional measures projections and targets for 2010 for five accession countries



**Note:** *With existing measures* reduction for Poland is for the energy sector only.

- changes in building regulations to improve energy efficiency;
- harmonisation with EU environmental legislation;
- measures to reduce traffic growth; and
- limitation on the disposal of biodegradable waste to landfills.

These accession countries project that they will meet their Kyoto commitment, but additional measures have still been identified.

Projections split by gas and sector are only available for a limited number of these accession countries so further analysis of the projections is not presented in this report.

## 6. Quality and transparency of reporting

### 6.1. Current reporting

The quality of reporting for most Member States improved in 2002 either through the provision of a third national communication to the UNFCCC or through improved reports to the monitoring mechanism.

The reporting of projections has been enhanced but is still facing some challenges. There are still some inconsistencies and areas for improvement. Disaggregation of the projections by gas and sector is more detailed and consequently more analysis has been possible than in previous years. Reporting of underlying parameters has also been more extensive although there is still a limited number that can be compared between 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.

Accession countries are not formally required to report 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 accession countries gives reasonable levels of detail, including in many cases quantitative information on emissions reductions. *With existing measures* and *with additional 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 parameters used is presented but not always in detail.

### 6.2. What is the sensitivity (range) in emission projections?

A number of Member States have provided information on the sensitivity of the projections to changes in some of the key

assumptions in the underlying socioeconomic scenarios as well as in the effect of (packages of) policies and measures. However, at the moment there is not sufficient information from all Member States to draw firm conclusions about the sensitivity to key assumptions in the aggregated EU projections.

One way of quantifying the sensitivity in the EU emission projections is to compare previous projections with the actual current trend.

This section shows the results of such a comparison between earlier Member State projections of CO<sub>2</sub> for the year 2000 and actual emissions in 2000. The earlier projections are *with existing measures* projections that were available in 1997–98 <sup>(14)</sup>.

The results show that approximately half the Member States' *with existing measures* projections underestimated emissions in 2000 while a similar number overestimated estimated actual emissions. While there were large differences in the Member State emission projections, for the EU the previous (1997–98) aggregated *with existing measures* projection was 1.6 % below the actual emissions for 2000.

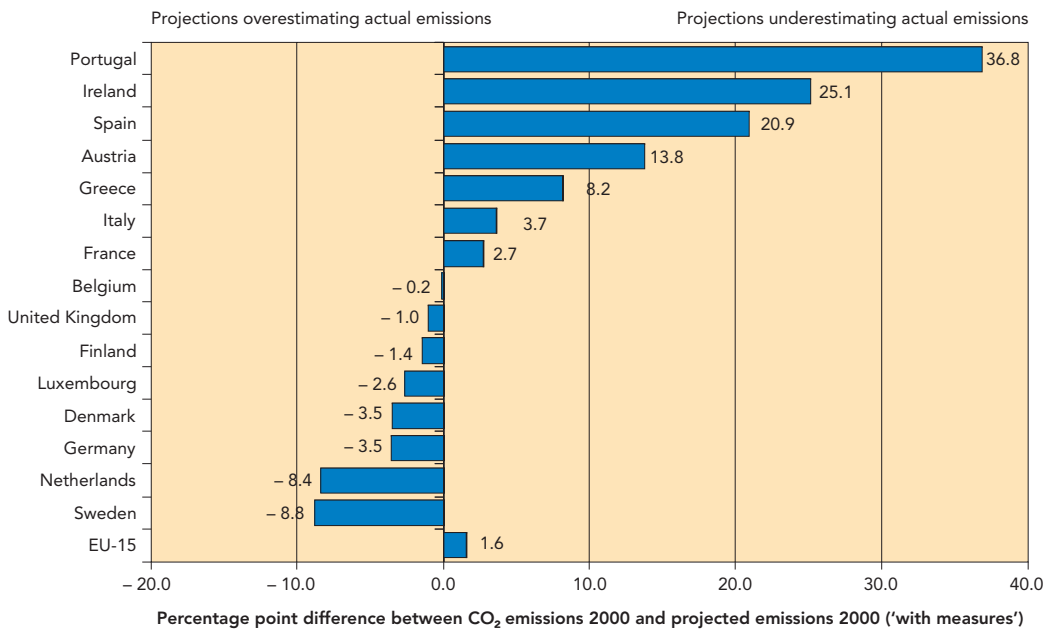
### 6.3. Improving reporting and quality of projections

Under the monitoring mechanism the European Commission and Member States, assisted by EEA, are addressing possible further improvements in the quality of the reported information on projections and policies and measures. The Commission has prepared a proposal for revision of the EU greenhouse gas monitoring mechanism, to incorporate requirements for reporting under the Kyoto Protocol and requirements under the EU emission-trading directive. This also includes improved reporting of projections and policies and measures.

(14) Typically the latest national programmes and/or second national communications to the UNFCCC date from 1997 or 1998 (see EEA, 1999).

Difference between actual CO<sub>2</sub> emissions in 2000 and the with existing measures projections

Figure 24



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. At the workshop, current practice for reporting was discussed and suggestions made for improvements, aimed primarily at improving the transparency and the comparability of the information.

The workshop agreed on the following overall recommendations.

Small working groups of projection experts involved in the monitoring mechanism will be set up to develop:

- 1) a proposal for a sectoral breakdown for reporting on projections based on IPCC CRF sectoral categories and taking into account the lower level of disaggregation

used for projections compared with annual inventories;

- 2) a proposal for a list of mandatory and suggested parameters for projections to be reported;
- 3) a proposal for reporting of projected energy balances;
- 4) a paper on sensitivity analysis and robustness of projections.

A good practice manual on evaluation of policies and measures, to be developed in the future, was also considered helpful.

These proposals will be further elaborated in guidelines under the revised monitoring mechanism.

## 7. Glossary

ACEA	European Automobile Manufacturers Association (EU-wide agreement with ACEA and similarly also with Japanese (JAMA) and Korean (KAMA) automobile manufacturing industries)
CCPMs	Common and coordinated policies and measures at EU level
CHP	Combined heat and power generation
CFR	Common reporting format for greenhouse gas inventories
ECCP	European climate change programme
EEA	European Environment Agency
ETC/ACC	European Topic Centre on Air and Climate Change
GDP	Gross domestic product
GHGs	Greenhouse gases
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
JAMA	Japanese Automobile Manufacturers Association
KAMA	Korean Automobile Manufacturers Association
KP	Kyoto Protocol
LULUCF	Land-use and land-use change and forestry
MtCO <sub>2</sub> -eq.	Mega (million) tonnes of CO <sub>2</sub> equivalents
UNFCCC	United Nations Framework Convention on Climate Change
<i>With existing measures</i> projection	Projections, including domestic policies and measures, that are currently adopted and implemented (excluding use of the Kyoto mechanisms and use of carbon sequestration, through land-use change and forestry)
<i>With additional measures</i> projection	Projections, including planned domestic policies and measures, that are currently under discussion and that have a realistic chance of being adopted and implemented in future (excluding use of the Kyoto mechanisms and use of carbon sequestration, through land-use change and forestry)



# Annexes

The annexes are available on the EEA website only (<http://www.eea.eu.int/>)

- 1) Annexes by Member State (policies and measures; emission projections; methodologies)
- 2) Annexes by accession country (policies and measures; emission projections; methodologies)
- 3) Annex on EU common and coordinated policies and measures



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