

Special Feature on the Kyoto Protocol

Implementing the Kyoto Protocol in the European Community

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This paper describes the role of the European Community (EC) in negotiating the Kyoto Protocol and then focuses on the progress of the European Union (EU) towards meeting its Kyoto commitments. The EC ratified the Kyoto Protocol on May 31, 2002. It has pledged to meet the implied target of an 8 percent reduction in greenhouse gas emissions between 2008 and 2012 compared to 1990 levels. The European Union, as well as its Member States, is putting in place a set of policies and measures to achieve this. An analysis of greenhouse gas projections by the Member States themselves and Europe-wide model projections, however, show that this target is unlikely to be met with the envisaged domestic policies alone. The remaining gap would have to be closed using the Kyoto mechanisms or by developing and implementing additional domestic policies. So far, few EU Member States have yet taken concrete steps to realise this.

Keywords: Kyoto Protocol, European Union, European Climate Change Programme, Monitoring mechanisms, Emissions trading.

1. Introduction

The United Nations Framework Convention on Climate Change (UNFCCC) has as its ultimate objective the stabilisation of greenhouse gases (GHG) concentrations in the atmosphere at safe levels (EEA 1995). As a part of the processes towards this goal, UNFCCC Parties adopted the Kyoto Protocol in 1997. Under Article 3.1 of the protocol, industrialised countries (Annex I Parties) are committed to individual, legally-binding targets to limit or reduce their GHG emissions, adding up to a total cut of at least 5 percent from 1990 levels in the protocol's first commitment period of 2008 to 2012.

The European Community (EC) was one the major industrialised leaders in this international climate policy process. At the first session of the UNFCCC Conference of the Parties (COP 1), the EC succeeded in persuading the group of the developing countries (G77) to support its proposal to establish

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a negotiating process for legally-binding commitments for developed countries (Yamin 2000). If the EC had not called for these binding targets, the quantitative commitments in the Kyoto Protocol may have been significantly weaker or not agreed at all. Furthermore, if the EC had not prepared proposals on how to deal with issues that were as yet unspecified in the protocol (e.g., rules for compliance, flexible mechanisms, reporting and review), the Marrakesh Accords—the agreement that provided the final details needed to allow the Parties to begin the ratification effort (UNFCCC 2001)—may not have come into existence in 2001 (Gupta 2002). The EC and its Member States also proceeded to an early ratification of the protocol on May 31, 2002, reaffirming once more its commitment to the protocol.

By ratifying the Kyoto Protocol, the European Community agreed to reduce its GHG emissions by 8 percent in 2008 to 2012 compared to the 1990 base-year level, and started putting in place a set of policies and measures to achieve this target. The European Union (EU)¹ climate policy making process, however, has exhibited in the past strong discrepancies between declared targets and implemented action (Michaelowa 1998), as seen with several policies that have been weakened before being adopted and therefore not always effectively implemented.

In the next sections we will summarise the EU burden-sharing arrangement; the European Climate Change Programme (ECCP), designed to meet the Kyoto commitments; the GHG monitoring mechanism, developed to monitor emissions; and finally we discuss what the GHG emissions trends and projections tell us about the progress made in the European Union towards meeting the targets.

2. EU targets and burden-sharing regime under the Kyoto Protocol

2.1. The EU15

Under the Kyoto Protocol the European Community agreed to reduce its GHG emissions as a whole by 8 percent by 2008 to 2012 from 1990 levels, which corresponds in absolute terms to a reduction of 336 million tonnes (Mt) of carbon dioxide (CO₂) equivalent in 2010 with respect to 1990 (EEA 2003b). This means that as long as the European Union as a whole meets its target not all Member States will have to reduce their GHG emissions by 8 percent (EEA 2004).

This rule is commonly known as the emissions bubble and was introduced in Article 4 of the protocol due to pressure from the European Union, which wanted to differentiate targets internally (Michaelowa and Betz 2001).²

As such, the EC's Kyoto target is shared among 15 Member States. The so-called burden-sharing agreement (EC 2002), agreed upon in 2002, sets different emission limitations and reduction targets for each Member State according to economic circumstances and different development patterns of each (table 1). Eight Member States agreed to reduction targets by 2008 to 2012, five agreed to limit their increases, and two agreed to keep their emissions at the same level as in their base year. In all cases,

1. The European Community is a legal entity and is able to sign international treaties such as the Kyoto Protocol. The EC is represented by the European Commission. The EU exists only in the 1993 Maastricht Treaty and stands for European Community and the co-operation between its Member States. The European Union is not a legal entity.

2. In regard to the emissions bubble, under Article 4 of Kyoto Protocol all countries are allowed to conclude an agreement for a joint target equal to the sum of the targets of the participating countries.

these differences imply reduction against emissions without climate policies, as projected at the time of the negotiations (EEA 2004).

Table 1. GHG emissions limitation or reduction commitments of EU Member States for 2008–2012 in accordance with Article 4 of the Kyoto Protocol

EU Member State	Percent change ^a
EU15 Kyoto target	–8.0
Austria	–13.0
Belgium	–7.5
Denmark	–21.0
Finland	0.0
France	0.0
Germany	–21.0
Greece	25.0
Ireland	13.0
Italy	–6.5
Luxembourg	–28.0
Netherlands	–6.0
Portugal	27.0
Spain	15.0
Sweden	4.0
United Kingdom	–12.5

Source: EC 2002.

^aThe percent changes shown are compared to 1990 emissions.

The burden-sharing agreement is an innovative achievement in international climate policy and the only Kyoto mechanism that is actually operational. It could be argued, however, that there are some weak points in the agreement concerning the issues of uncertainty, vulnerability, and equity (Dessai 1999). Uncertainty regarding future emissions is a major concern because there is no room left for possible “surprises” in the EU bubble. If some Member States can not cope with their reductions, they could undermine the whole EU position. The burden-sharing agreement is also vulnerable because there is a clear reliance on particular Member States reaching their reduction targets. For example, a slower coal phase-out in Germany could increase EU emissions by 1 percent by 2010. Equity among Member States could also be questioned, mostly because of concerns about the differentiation of abatement obligations between poorer and richer countries of the European Union not going far enough (Eyckmans et al. 2000).

2.2. New EU Member States

In May 2004 the following ten countries joined the European Union: the Czech Republic, Estonia, Lithuania, Latvia, Hungary, Poland, Slovenia, Slovakia, Cyprus, and Malta. All of them also belong to the group of countries going through the process of transition to a market economy, with the exception

of Cyprus and Malta. These new Member States are not included in the EU burden-sharing regime because, according to Article 4 of the Kyoto Protocol, the target of the European Union (–8 percent) would still refer to the 15 members as of 1997 (Michaelowa and Betz 2001). New Member States can not be incorporated into the EU burden-sharing agreement until 2013.

Most of the new Member States, however, have a target under the Kyoto Protocol and are members of Annex I of the UNFCCC. The Czech Republic, Estonia, Lithuania, Latvia, Slovenia, and Slovakia each have a GHG emissions reduction target of 8 percent from the base year,³ while Hungary and Poland have a reduction target of 6 percent. Cyprus and Malta are not Annex I countries and have no targets under the protocol. All new Member States had ratified the Kyoto Protocol by January 2003. This was part of the EU environmental standards that had to be adopted by the new Member States before joining the European Union.⁴

3. Preparing for implementation of the Kyoto Protocol

In the European Union, policies and measures are developed both at the Member State level and at the level of the European Union. The policies and measures developed by the European Union, with implementation of the majority by all Member States being compulsory, are called common and coordinated policies and measures.

The Sixth Environmental Action Programme (EAP) for the European Union, presented in 2001, sets the environmental objectives of the European Community's strategy for sustainable development, detailing the common measures to be implemented over the next five to ten years. Tackling climate change was highlighted as one of four key objectives (EC 2001), and ratification of the Kyoto Protocol and implementation of the Kyoto target is a first priority.

3.1. The European Climate Change Programme

Within this framework, the EU's Council of Environment Ministers requested the European Commission to put forward a list of priority actions and policy measures to help the EC achieve the Kyoto target. The European Climate Change Programme (ECCP), set up as a multi-stakeholder consultative process, was launched in June 2000 to identify all the necessary elements of a strategy to implement the protocol.

Different working groups⁵ identified the contribution of each sector to the set emissions reduction objective and the precise intensity of this effort based on calculations of cost-effectiveness.⁶ In June 2001 the first ECCP report was published, presenting 42 emissions reduction options in different stages of preparation (ECCP 2001). On the basis of this report, a specified Action Plan outlined the priority

3. Bulgaria, Hungary, Slovenia, and Poland have a different base year than 1990 (1988, average 1985–87, 1986, and 1988, respectively).

4. Part of the preconditions to enter the European Union is the adoption of the European "acquis communautaire," which consists of the entire body of European laws.

5. The working groups are Flexible Mechanisms (with subgroups on emissions trading and JI/CDM), Energy Supply, Energy Demand, Energy Efficiency in End-use Equipment and Industrial Processes, Transport, Industry (subgroups on fluorinated gases, renewable raw materials, voluntary agreements), and Research and Agriculture.

6. The criterion "below €20€/tCO₂ equivalent" was used as a benchmark to evaluate the cost-effectiveness of each measure. Other criteria were the time frame for implementation and the impact on other policy areas.

actions of the European Commission to be implemented in 2002 and 2003. The following is a list of the 12 suggested measures categorised by their focus (EC 2003a):

- Cross-cutting
 1. Effective implementation of the Integrated Pollution Prevention and Control Directive
 2. Link joint implementation (JI) and the Clean Development Mechanism (CDM) to the EU Emissions Trading Scheme (EU ETS)
 3. Review the monitoring mechanism
- Energy
 4. Directive on minimum energy-efficiency requirements for end-use equipment
 5. Energy services directive
 6. Combined heat and power (CHP) directive
 7. Energy-efficient public procurement initiative
 8. Public awareness campaign/campaign for take-off on energy efficiency
- Transport
 9. Proposal for shifting the balance between modes of transport
 10. Proposal for improvements in infrastructure use and charging
 11. Biofuels directive
- Industry
 12. Regulatory framework on fluorinated gases

The ECCP's second report reviewed progress and updated information on policies and measures (ECCP 2003). Implementation of measures concerning the transport sector has proven to be the most difficult, and progress in this field is still slow except for the agreement between the Commission and car manufacturers to reduce the average CO₂ emissions of new passenger cars.

For the Commission's package of 12 measures, a technical reduction potential of 122 to 178 MtCO₂ equivalent was estimated, which could be increased by another 100 MtCO₂ equivalent from policies in the field of CHP and biofuels, particularly promising for the long term but not qualified under the criterion of below 20 euros (€) per tCO₂ equivalent (EC 2001). The total technical reduction potential of all policies and measures of the first ECCP report was estimated at 664 to 765 MtCO₂ equivalent. This is twice the emissions reduction required by the European Union in the Kyoto Protocol's first commitment period and slightly more optimistic than the estimate in the second ECCP report, which was 578 to 696 MtCO₂ equivalent. The legislative measures already adopted by the European Union or proposed by the Commission (some of which are presented in table 2) represent a GHG emissions reduction potential of 276 to 316 MtCO₂ equivalent.

It must be noted that the technical reduction potential of the common and co-ordinated policies and measures was evaluated by expert judgment without using any model. The methodologies for EU-wide projections on the effectiveness of climate policy impacts might need further elaboration, since there is the risk of double-counting because Member States might have already reported some of the potential reductions of these policies as part of their domestic policies and measures. Furthermore, the technical potential of the measures does not necessarily represent the actual emissions reduction potential.

Whether this potential can be realized will depend on how swiftly Member States implement European Community legislation, as well as a number of other factors such as acceptance by the public and other stakeholders, and other factors determining the effectiveness of implementation (EC 2003d).

Table 2. Key measures, their estimated GHG emissions reduction potentials, and their status of implementation

Measure	Status	Estimated technical potential	Reference
Directive establishing a scheme of GHG emissions trading within the European Community	Adopted by Council and Parliament	Not applicable	2003/87/EC from 13/10/03, OJ L275, 25/10/2003, p.32-46
Implementation of energy efficiency in the Integrated Pollution Prevention and Control Directive (IPPC) directive on pollution prevention and control in large industrial and agricultural installations to achieve co-benefits from air quality improvements for GHG reductions	Work on an IPPC reference document on generic energy efficiency techniques started in 2003	60–70 MtCO ₂ equivalent	http://www.europa.eu.int/comm/environment/ippc/index.htm
Linking project-based mechanisms to GHG emissions trading	Proposal adopted by the Commission	Not applicable	COM(2003)403 of 23/07/03
Review of the monitoring mechanism	Proposal adopted by the Commission	Not applicable	COM(2003)51 of 05/02/2003
Directive on improving the energy performance of new buildings as well as larger existing buildings when they undergo major renovations	Adopted by Council and Parliament in 2002	35–45 MtCO ₂ equivalent	2002/91/EC, OJ L 001 of 04/01/2003, p. 65–71
Directive on the promotion of electricity from renewable energy (RES-E Directive), with an indicative target of a 22% contribution of renewable energy sources to gross electricity consumption by 2010	Adopted by Council and Parliament, implemented in 2001	100–125 MtCO ₂ equivalent	2001/77/EC, OJ L 283 of 27/10/2001, p. 33–40
Proposal for a directive on combined heat and power to promote high efficiency cogeneration, with an indicative target of 18% contribution to electricity production from CHP by 2010	Proposal adopted by the Commission in 2002	65 MtCO ₂ equivalent	COM(2003)416, O J C 291 E of 26/11/2002, p. 182–209
Motor Challenge Programme, an EC voluntary program to improve the energy efficiency of motor-driven systems in industrial companies	Launched in 2003	30 MtCO ₂ equivalent	http://energyefficiency.jrc.cec.eu.int/motorchallenge/index.htm
Proposal for a framework directive on eco-efficiency requirements for energy using products	Proposal adopted by the Commission	180 Mt CO ₂ equivalent	COM(2003)453 of 23/07/03
Agreements between the Commission and car manufacturers (ACEA, JAMA, KAMA) to reduce the average CO ₂ emissions of new passenger cars to 140 grams/kilometer by 2008/09	Implemented before the ECCP, monitored through yearly report	75–80 MtCO ₂ equivalent	COM (1998) 495 final COM (1999) 446 final

Table 2—*Continued*

Measure	Status	Estimated technical potential	Reference
Proposal for the promotion of biofuels in the transport sector	Adopted by Council and Parliament	35–40 MtCO ₂ equivalent	2003/30/EC, OJ L 123 E of 17/05/2003, p. 42–46
Landfill Directive to recover gases from biodegradation of waste	Implemented before the ECCP	41 MtCO ₂ equivalent	Council Directive 1999/31/EC
Proposal for a regulation on certain fluorinated gases	Proposal adopted by the Commission	23 MtCO ₂ equivalent	COM (2003) 492 of 11/08/2003

3.2. The European Community Emissions Trading Scheme

The European Union had historically been rather sceptical of the use of flexible mechanisms in the process of negotiating the Kyoto Protocol. In recent years, however, this position has changed. The proposal for the Directive on Emission Trading Scheme (ETS), adopted in 2003, is an example of this.

Christiansen and Wettestad (2003) argue that there is a synergistic and multilevel mix of explanatory factors for this change, including developments at the international, European Union, and Member States levels. At the international stage, slow progress in the Kyoto process and increasing uncertainty about its ratification by the United States opened up a political window of opportunity for moving emissions trading up on the EU agenda. At the EU level, the failure to get a carbon tax adopted served as reinforcement for more acceptable policy instruments, such as emissions trading, to be successfully adopted. Also, the fact that domestic trading systems began to appear at the Member State level, and the perceived risk of having in place a patchwork of schemes with different rules and modalities, provided further incentive to the Commission's efforts to develop and implement a harmonised EU trading scheme.

The aim of the proposed emissions trading directive is to reduce GHG emissions in a cost-effective way, including the introduction of GHG emissions ceilings and trading. The EU ETS is designed to be compatible with international emissions trading rules under the Kyoto Protocol. During the first phase of the trading scheme (2005–2007), it will apply only to CO₂ emissions. The cap-and-trade scheme will initially cover emissions from large industrial and energy activities (e.g., combustion plants), which will capture approximately 45 percent of the total CO₂ emissions projected in the European Union for 2010.⁷ Smaller emissions sources not captured by the emissions trading system could be covered by equivalent policies and measures, with the option of trading into the regime via credit creation. The European Commission will decide on extending the directive to cover other sectors and GHGs in 2004 (EC 2003b).

Member States are responsible for allocating permits and therefore the total quantity of allowance (cap) to companies covered under the directive. Between 2005 and 2007, Member States will grant permits free of charge in accordance to national allocation plans (NAPs) approved by the Commission. Companies that fail to limit their emissions according to their allocated permits and do not buy credits to

7. The installations to be covered are combustion plants, oil refineries, coke ovens, iron and steel plants, and factories making cement, glass, lime, brick, ceramics, pulp and paper.

make up for any shortfall will have to pay a penalty of €40/tCO₂ for non-compliance. From 2008, countries can agree to auction 5 percent of the allowances, while the remaining 95 percent should be given for free. The penalty for non-compliance from 2008 will increase to €100/tCO₂. New entrant companies would be allocated permits on similar terms as those established for companies in the same sector (INFORSE 2004).

Credits from Kyoto mechanisms projects are not explicitly included in the ETS. Therefore, a new directive linking the ETS to JI and CDM projects (a measure under the ECCP) was agreed upon in April 2004 (ENDS 2004). The directive will allow companies in the ETS to use the credits from JI/CDM projects up to a percentage of their allowed emissions, which will be decided by each Member State. Exempted are credits from nuclear energy projects and (until 2006) credits from carbon sinks (EC 2004a).⁸

Environmentalists argue that this directive could weaken the effort for making domestic emissions cuts the primary means for achieving the Kyoto target. Action must now be taken at the Member State level to agree upon a harmonised cap on the use of Kyoto project credits (CAN 2004). On the other hand, combining the two systems will considerably reduce the compliance costs for the European Union as a whole, and JI projects—a powerful strategy to integrate the new Member States into the EU climate policy strategy (Jepma 2003)—as well as CDM projects would be given an important boost for development (EC 2004a).

4. “Community greenhouse gas emissions” monitoring mechanism

The European Union established a mechanism for monitoring community CO₂ and other GHG emissions in order to annually assess the progress of Member States in GHG emissions reductions towards their commitments under the UNFCCC and the Kyoto Protocol (EC 1999). The European Council’s Decision of 1999 (EC 1999) was revised in 2004 (EC 2004b).

The 2004 revision reflects the new reporting obligations and guidelines for the implementation of the Kyoto Protocol. This includes the insertion of new monitoring and reporting requirements for land use, land-use cover, and forestry activities (LULUCF) and flexible mechanisms. Provisions on projections of GHG emissions will be strengthened, since experience with the current provisions has shown that there is a need for more comprehensive and detailed data in this area.

Member States are required by January 15 each year to submit inventory data for the previous year and any updates of previous years (including the 1990 base year),⁹ and by March 15, 2005, and every two years thereafter they must report their most recent projected emissions for the years 2005, 2010,

8. Human induced activities in the land use, land-use change and forestry sector, which may lead to additional sequestration by the terrestrial ecosystems, are known as carbon sinks.

9. Member States have to report annually their inventories to the Commission by January 15 of the year X, as follows: their anthropogenic emissions of GHGs listed in Annex A to the Kyoto Protocol—carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF₆) during the year before last (X – 2); provisional data on their emissions of carbon monoxide (CO), sulphur dioxide (SO₂), nitrogen oxides (NO_x), and volatile organic compounds (VOC) during the year before last (year X – 2), together with final data for the year three years previously (year X – 3).

2015, and 2020 (EC 2004).¹⁰ Reporting under the monitoring mechanism is voluntary for acceding and candidate countries but becomes mandatory once they join the European Union.¹¹ The Central and Eastern European countries, however, are already required to report their GHG emissions and national programmes to the UNFCCC (EEA 2003b). Based on the data provided by the Member States, the European Commission compiles every year the Community Greenhouse Gas Inventory.

5. Greenhouse gas trends and projections in Europe

The European Environment Agency (EEA) supports the Commission in this task with an annual environmental issue report, titled *Greenhouse Gas Emission Trends and Projections in Europe* (EEA 2003b), and its background technical report, *Analysis of Greenhouse Gas Emission Trends and Projections in Europe* (EEA 2004). The EEA reports prepared for the year 2003 are the main sources of information for the results discussed here. The reports evaluate the actual progress and the projected (future) progress of Member States. On one hand, actual progress is assessed by an annual analysis of EU GHG emissions starting in 1990.¹² The evaluation of actual progress is performed by comparing the latest annual GHG emissions (in 2003 this means 2001 data) with values of emissions interpolated between 1990 and their commitment for 2008 to 2012 (the so-called linear target path).¹³ On the other hand, projected progress is assessed by identifying the gap (over-delivery or shortfall) between emissions projections in 2010 and the Kyoto targets. Two types of projections are considered: (1) with (existing) measures projections and (2) with additional measures projections.

5.1. Actual progress of the EU15

a. Actual progress of the EU15 as a whole

GHG emissions in the European Union decreased by 2.3 percent from the 1990 base-year level in 2001 (figure 1) and reached a level of 4,108 MtCO₂ equivalent. The reduction is approximately one-quarter of the EU's Kyoto target for 2010. After an initial decrease in total GHG emissions of more than 4 percent in the early 1990s, emissions fluctuated in the second half of the 1990s between reduction levels of 1 percent and 4 percent compared with the 1990 base-year level. Assuming a linear target path from 1990 to 2010, total EU GHG emissions were 2.1 index points, the distance-to-target indicator (DTI), above this target path in 2001 (figure 1).¹⁴

10. Member States have to report information on national policies and measures that limit and/or reduce GHG emissions by sources or enhance removals by sinks, presented on a sectoral basis for each GHG, and national projections of GHG emissions by sources and their removal by sinks as a minimum, organised by GHG and by sector.

11. The countries that joined the European Union on May 1, 2004, were known until that date by the term *acceding countries*, and the countries that have applied to become members of the European Union are known as *candidate countries* (Bulgaria, Romania, Turkey).

12. For the fluorinated gases most Member States have indicated they have selected 1995 as their base year, as allowed for under the Kyoto Protocol. Therefore, for the purpose of this analysis of EU GHG emissions trends, 1995 is used as the base year for fluorinated gases for all Member States.

13. The target path is used to analyse, for example, 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 (including emissions trading within the EU).

14. The distance-to-target indicator (DTI) measures the deviation of actual emissions in 2001 from the (hypothetical) linear burden-sharing target path between base-year emissions and the burden-sharing target in 2010. A positive value suggests an under-achievement and a negative a 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.

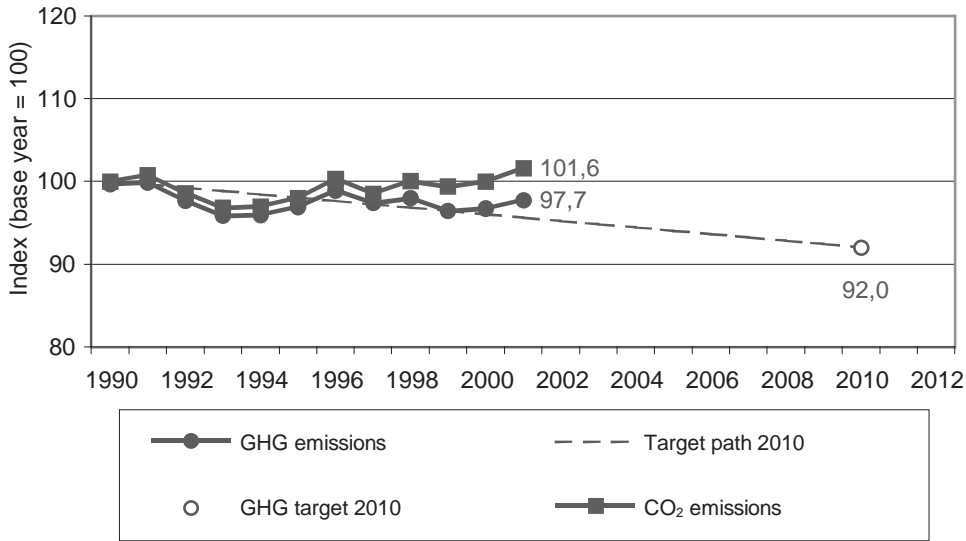


Figure 1. EU15 greenhouse gas emissions compared with the Kyoto target for 2010 (excluding land-use cover and forestry)

Source: EEA 2003a, 2004.

GHG emissions per unit of gross domestic product (GDP) decreased by 21 percent from 1990 to 2001. Figure 2 shows the development of the main driving forces of CO₂ emissions from fossil fuel combustion. Energy consumption increased by 10 percent between 1990 and 2000 but decoupled from GDP between 1990 and 2001. CO₂ emissions from fossil fuels were slightly above 1990 levels in 2001 but also decoupled from both GDP and energy consumption.

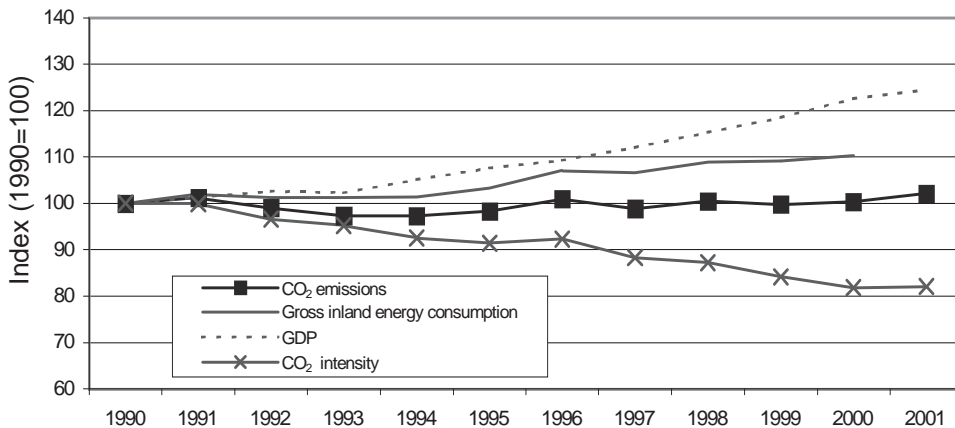


Figure 2. GDP, gross inland energy consumption, CO₂ emissions from fossil fuel combustion, and CO₂ intensity of GDP (as an index) for the EU15

Source: EEA 2004.

CO₂ emissions increased from 1990 to 2001 mainly because of growing transport demand. Most of the other greenhouse gases have been reduced since 1996. Methane (CH₄) emissions account for 8 percent of total EU GHG emissions, and these decreased by 21 percent between 1990 and 2001. The main reasons for declining CH₄ emissions were the decline of coal mining (mainly in France, Germany, and the United Kingdom), reductions in solid waste disposal on land, and declining cattle populations. Nitrous oxide (N₂O) emissions are responsible for 8 percent of total GHG emissions and these decreased by 16 percent. The main reason for the large cut in N₂O emissions was the reduction measures instituted in the chemical industry (reduction of emissions from adipic acid production). Fluorinated gas emissions account for only 1 percent of total GHG emissions. Hydrofluorocarbons (HFC) emissions increased by 11 percent between 1995 and 2001, mainly because of the phase-out of ozone-depleting substances such as chlorofluorocarbons under the Montreal Protocol.

b. Actual progress by sector

Energy industries represent the largest sector accounting for 28 percent of total EU GHG emissions.¹⁵ Between 1990 and 2001, emissions declined 2 percent largely due to efficiency improvements in German coal-fired power plants and to switching fuels in the power industry in the United Kingdom. Transport accounts for 21 percent of total EU GHG emissions. In 2001, CO₂ emissions increased by 20 percent compared to 1990, mainly due to road transport growth in almost all Member States. Increases in N₂O emissions from transport are mainly because of the increased use of catalytic converters. For newer catalytic converters, however, N₂O emissions have been reduced dramatically (figure 3).

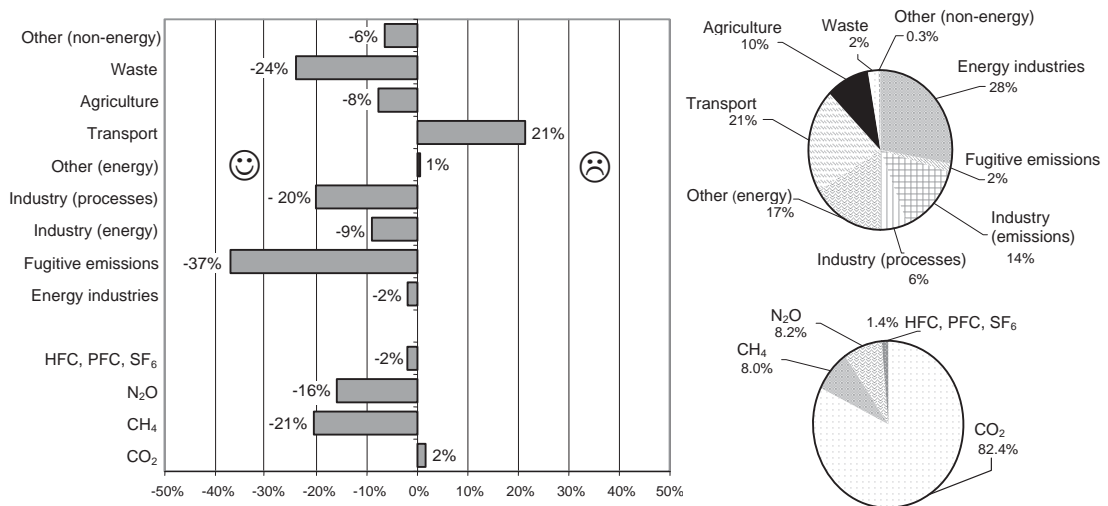


Figure 3. Change in sectoral greenhouse gas emissions of EU15 from the 1990 base year to 2001 and share of sectors and gases in 2001

Source: EEA 2003b.

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

15. The sector includes emissions from electricity and heat production, oil refineries, and manufacturing of solid fuels.

Households and services represent the third largest sector (17 percent of total EU GHG emissions). Emissions were 1 percent above 1990 levels in 2001, but they fluctuate to a certain extent according to annual changes in outdoor temperature. Industry (energy) emits 14 percent of total EU GHGs. Emissions decreased 9 percent from the 1990 level largely due to the restructuring of industries in Germany and efficiency improvements after German reunification. Industry (processes) in the European Union accounts for 6 percent of total GHG emissions. Emissions decreased by 20 percent mainly due to reductions in N₂O emissions. Agriculture accounts for 10 percent of total EU GHG emissions. Emissions decreased by 8 percent mainly due to a decline in the use of nitrogenous fertilisers and manure and a decline in the cattle population.

c. Actual progress of the EU15 Member States

The overall trend of GHG emissions in the European Union is dominated by Germany and the United Kingdom, the two largest emitters, which account for 40 percent of total EU GHG emissions. These two Member States have achieved a total reduction in GHG emissions of 313 million tonnes compared to the 1990 base year. The main reasons for the favourable trend in Germany are increasing efficiency in power and heating plants and the economic restructuring of the five new Länder established after German reunification.¹⁶ The reduction of GHG emissions in the United Kingdom was primarily the result of liberalising the energy market, the subsequent fuel switches from oil and coal to gas in electricity production, and N₂O emissions reduction measures in the chemical industry.

In general, the trend in GHG emissions from 1990 to 2001 range between the 15 Member States from -44.2 percent to +36.4 percent. If the GHG emissions of the Member States are compared with their linear target path for 2008 to 2012, the following conclusions with regard to actual progress of Member States could be drawn (figure 4):

- Five Member States (United Kingdom, Sweden, Germany, Luxembourg, and France) were near or below their Kyoto target paths, thus fully on track towards fulfilling their Kyoto-targets.
- Ten Member States were well above their Kyoto target paths (with Ireland, Spain, Portugal, Austria, Denmark, Italy, and Belgium by more than 10 index points).
- Belgium, Greece, the Netherlands, Denmark, Italy, Portugal, Ireland, and Austria were above their target paths in 2000 and they moved further away from their target paths in 2001.
- Compared to 2000, only Spain reduced its emissions in 2001. Sweden was the only EU country that moved further below the hypothetical Kyoto target path in 2001. Emissions reductions were substantial within the Spanish energy industries (CO₂ emissions decreased by 5 percent) mainly due to reduced coal use in thermal power production and increases in electricity production by hydro power plants.
- France and Finland were both below their target paths in 2000, but one year later they were above their paths.

16. Germany is a federation of 16 states called Länder or Bundesländer.

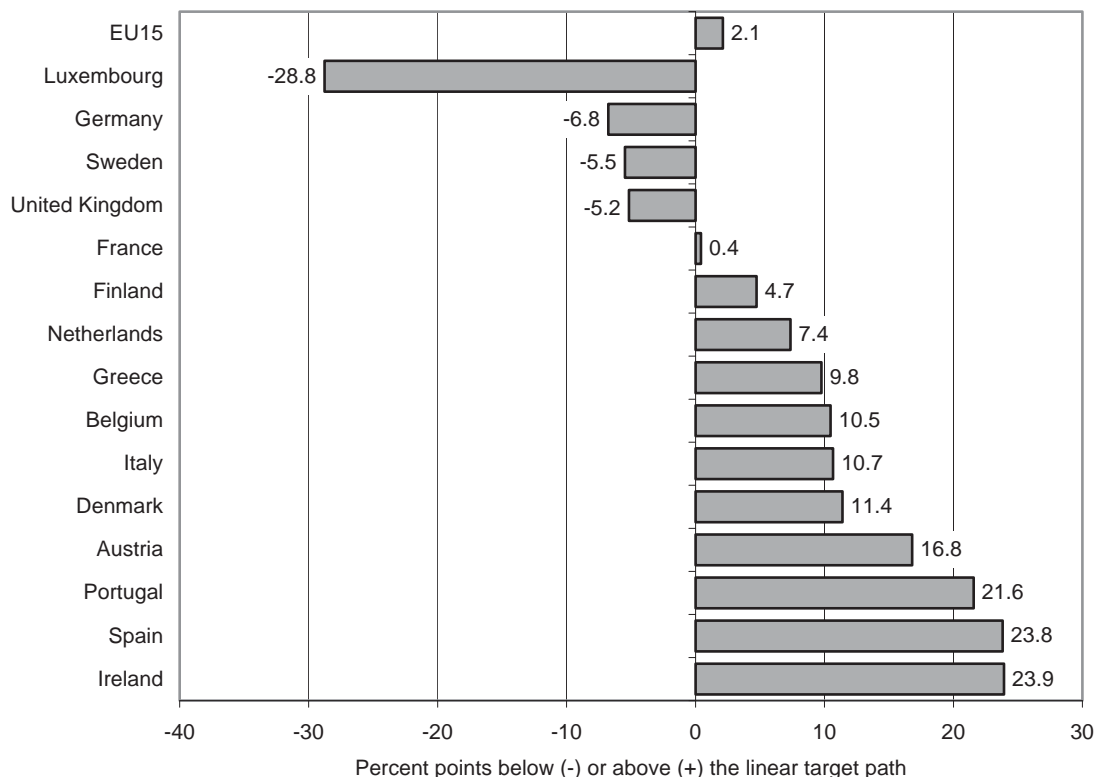


Figure 4. Distance-to-target (burden-sharing targets) for the EU15 Member States in 2001 (with domestic policies and measures)

Source: EEA 2003b.

5.2. Actual progress of the new Member States and candidate countries

The restructuring or closure of heavily polluting and energy-intensive industries led to a significant decline in total GHG emissions in the new Member States and candidate countries between 1990 and 2001. Nine countries were below their Kyoto target path, with distance-to target indicators ranging from -14.4 index points to -56.4 index points. Only in Slovenia were emissions above the target path (+6 index points) (figure 5).

Although the GDP data are not available for all countries for the whole period, it can be said that GDP is growing faster than GHG emissions in all countries. The increasing gap between emissions and GDP shows that energy use must have decoupled considerably from economic activities. Gross inland energy consumption shows the same trend as CO₂ emissions. CO₂ intensity was almost 40 percent below 1990 levels in 2000 (figure 6).

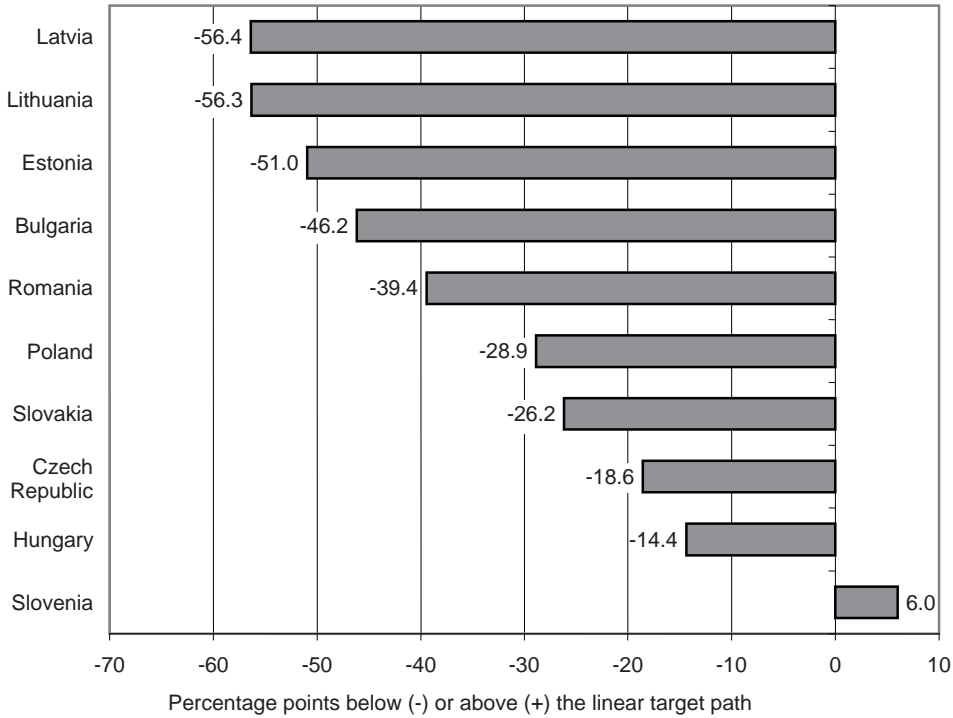


Figure 5. Distance-to-target indicators (in index points) for the Kyoto Protocol of the new Member States and candidate countries in 2001

Source: EEA 2004.

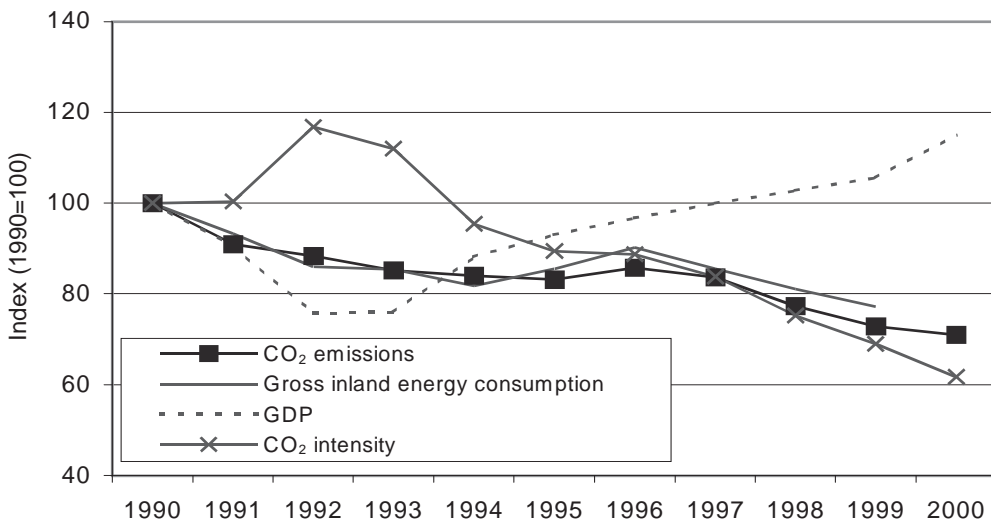


Figure 6. CO₂ emissions of the new Member States and candidate countries in relation to GDP^a and energy consumption^b (excluding land-use cover and forestry)

Source: EEA 2004

^aIt is difficult to calculate consistent GDP values for economies in transition for the whole period from 1990 to 2001. In most countries the GDP calculation methods changed in the years 1992, 1993, and 1994. The GDPs for earlier years are not always available (Baltic countries, Slovenia, Slovakia) or they were estimated retrospectively.

^bData on gross inland energy consumption provided by Eurostat are not complete for all years and countries, therefore the presented trend is indicative only.

In the European Union, CO₂ is the most important greenhouse gas (about 80 percent); second comes methane (CH₄), and third is N₂O. Fluorinated gas emissions are not yet reported consistently in most of the new Member States and candidate countries, but in general they do not contribute more than 1 percent to national totals. Figure 7 shows that emissions decreased in all sectors except transport (+4 percent). CO₂ emissions from transport decreased by 19 percent between 1990 and 1995 but increased afterwards. In 2001, GHG emissions from transport were above 1990 levels for the first time (4 percent). Most significant decreases occurred in the sectors related to fossil fuels combustion (from -32 percent to -58 percent). Changes in agriculture (-24 percent), industry (-26 percent), and waste (-26 percent) were significant as well.

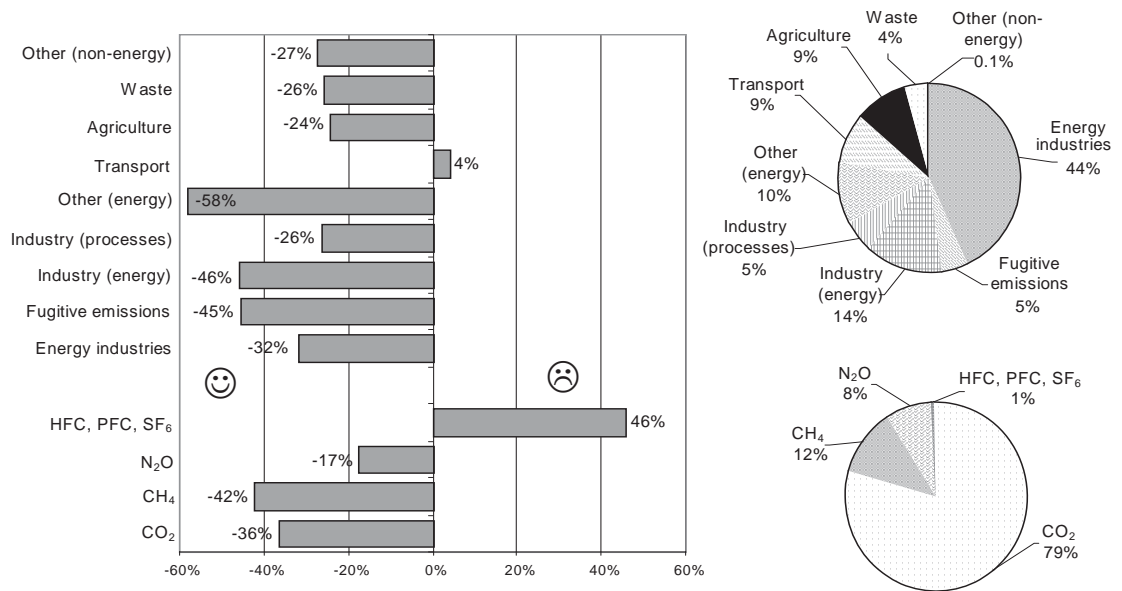


Figure 7. Change in sectoral greenhouse gas emissions in ten new Member States and candidate countries from the base year to 2001 and share of sectors and gases in 2001

Source: EEA 2004.

5.3. Projected progress of the EU15

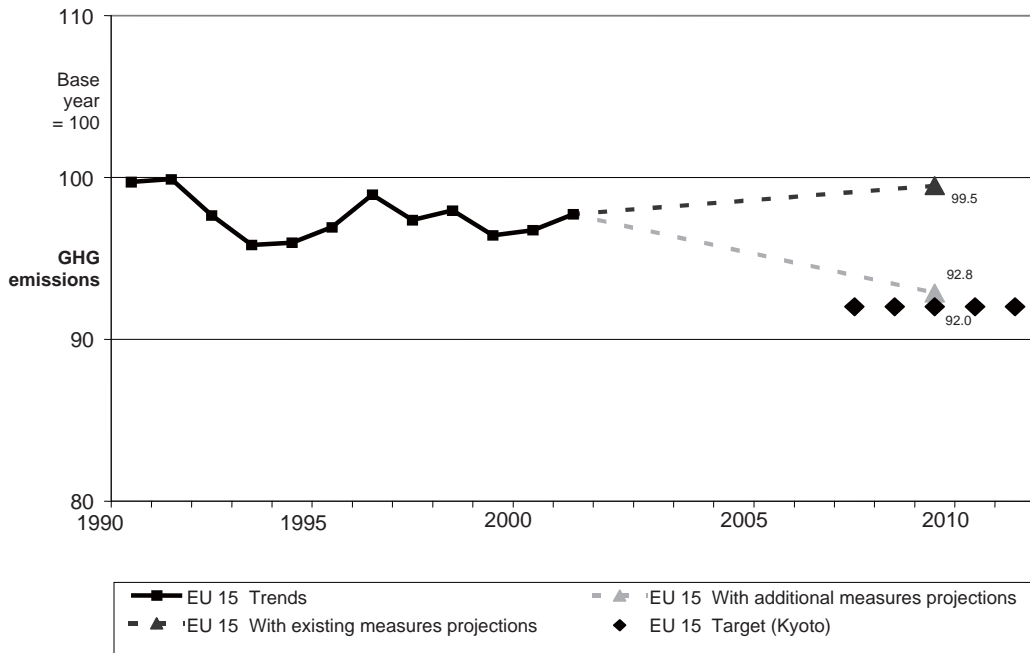


Figure 8. Greenhouse gas emission trends and projections for the EU15

Source: EEA 2003b.

a. Projected progress with existing measures of the EU15 as a whole

Figure 8 shows the aggregated *with (existing) measures* projections for the EU15 as a whole in 2010, which shows emissions rising to just 0.5 percent below 1990 levels in 2010. This leaves a shortfall of 7.5 percent to reach the EU’s Kyoto commitment in 2010 compared to 1990 levels. The gap is significantly larger than that calculated for the year before, because Germany has updated its projections under a monitoring process of its existing policies and measures with assumptions that some consider conservative.

Under the *with measures* projections, EU CO₂ emissions are projected to increase by 4 percent, while CH₄ and N₂O are expected to fall by 32 percent and 12 percent, respectively, for those countries that reported information on these gases. EU fluorinated gas emissions are forecast to increase by 98 percent, although their total contribution to total EU emissions will remain small.

The aggregated projections for the European Union under the *with measures* scenario show that GHG emissions from the energy sector (excluding domestic transport) will probably increase by 2 percent between 1990 and 2010.¹⁷ EU domestic transport-related GHG emissions are projected to increase by 34 percent if no additional policies and measures are introduced. EU agricultural (–11 percent), process (–2 percent), and waste emissions (–51 percent) are all projected to decline between 1990 and 2010.

17. The aggregate total is based on only those Member States that provided disaggregated projections by sector and therefore represents the trends for only part of the European Union.

EU-wide projections of CO₂ emissions, calculated using the PRIMES model (EC 2003c),¹⁸ were in line with the aggregated Member State projections (increase of 4 percent between 1990 and 2010). There are, however, significant differences in the two sets of projections for individual Member States and for specific sectors. Significant differences (more than 10 percent) are observed for Luxembourg and Spain, where the EU-wide projections are higher than those projected by Member States, and also for Denmark, Finland, and Belgium, where the Member States project a greater increase in CO₂ emissions.

There are a number of reasons why the projections do not agree, including differences in sector coverage (e.g., approach on dealing with bunker fuels), base-year data, emission factors, types of models, and key assumptions such as GDP and population changes (EEA 2004).

b. Projected progress of the EU15 Member States with existing measures

Looking at the projections at the country level (figure 9), the situation varies significantly between Member States. The United Kingdom and Sweden are the only ones to project that existing policies and measures will be sufficient to meet their burden-sharing targets. Their relative gap share is about -3 percent and -1.4 percent, respectively, meaning that these countries may even over-deliver on their targets. If the United Kingdom and Sweden meet but do not exceed their targets, the gap for the European Union as a whole increases to around 7.8 percent.

Denmark, Spain, Ireland, Austria, Belgium, Finland, the Netherlands, Portugal, and Greece are all projected to be significantly above their commitment on the basis of their *with measures* projections. The relative gaps for these Member States range between more than +30 percentage points for Denmark and Spain to slightly below +10 percentage points for France and Italy.

c. Projected progress with additional measures of the EU15 as a whole

Figure 8 also shows the aggregate with additional measures projections for the EU15 in 2010. Savings from additional policies and measures being planned by Member States would result in total emission reductions of about 7.2 percent from 1990—almost sufficient to meet the shortfall for the European Union 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 percent.

As not all Member States have provided *with additional measures* projections, aggregated projections with additional measures for the European Union for the assessment by sector and by gas must be treated with caution.¹⁹ Under the *with additional measures* scenario EU GHG emissions from the energy sector (excluding domestic transport) are projected to decrease by 6 percent between 1990 and 2010. EU domestic transport-related GHG emissions are projected to reduce the increase of 34 percent to 22 percent, at the least. EU agricultural (-13 percent), process (-22 percent), and waste emissions (-54 percent) are all projected to decline further between 1990 and 2010.

18. PRIMES is a modelling system that simulates a market equilibrium solution for energy supply and demand in the European Union Member States. It is currently used by Transport and Energy as well as Environment Directorate General when energy related questions are analyzed. For details, see <http://www.e3mlab.ntua.gr/models.asp?title=primes>.

19. In most sectors only eight Member States have reported projections. The aggregated projections by sector are mainly based on the data provided by these countries.

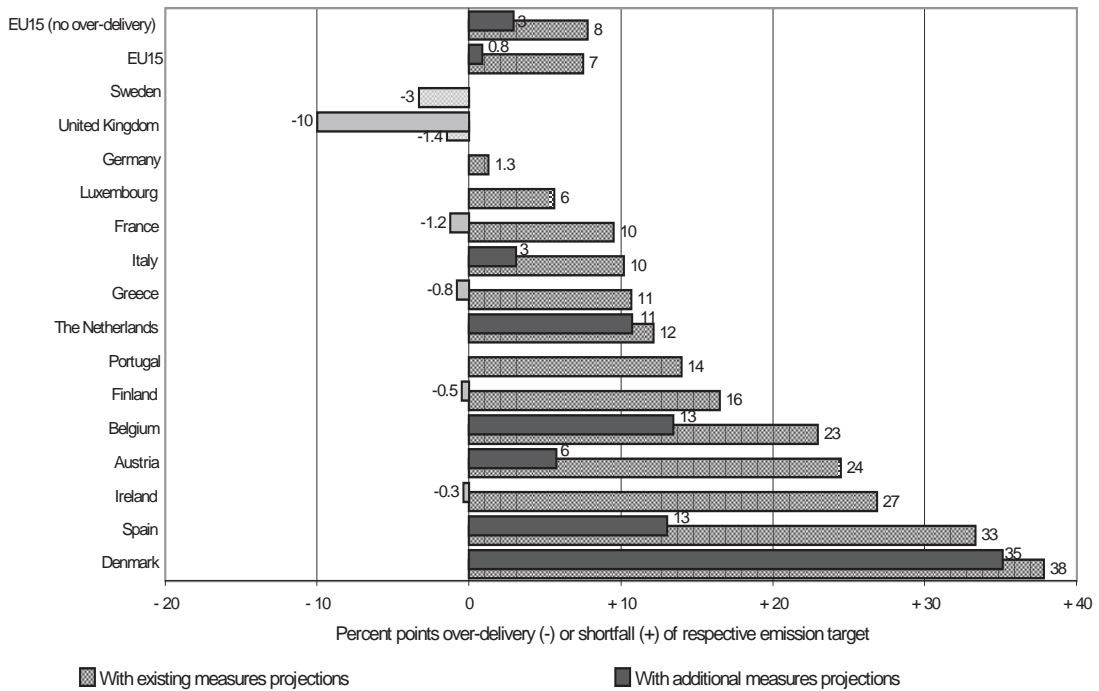


Figure 9. Relative gap (over-delivery or shortfall) between projections and targets for 2010 for EU15 and Member States

Source: EEA 2003b.

d. Projected progress of the EU15 Member States with additional measures

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 (figure 9). If all these countries, which under the *with additional domestic measures* are projected to exceed their targets, are assumed instead to meet but not to exceed their targets, this would mean for the European Union a reduction below 1990 emissions of 5.1 percent and thus a 2.9 percent shortfall on the EU target. 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 percent 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 million tonnes of CO₂ equivalent.

5.4. Projected progress of the new Member States and candidate countries

The analysis of projections for the new Member States and candidate countries is based on the third national communications to the UNFCCC. Seven countries (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Poland, and Slovakia) had submitted their third national communications by June 2003. In addition, Slovenia has produced its first national communication. Figure 10 shows the relative gap between projections based on existing domestic policies and measures, and with additional domestic policies and measures, and with the Kyoto commitments.

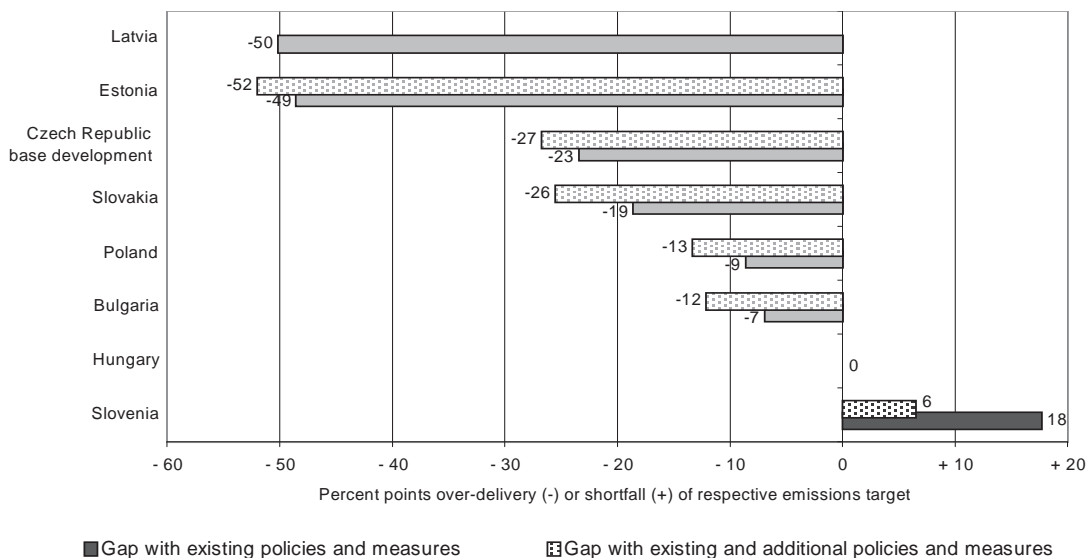


Figure 10. Relative gap (over-delivery or shortfall) between projections and targets for 2010 for new Member States and candidate countries

Source: EEA 2003b.

All *with measures* projections, except for Slovenia, result in emissions in 2010 to be lower than the Kyoto commitments. For Estonia and Latvia, emissions are projected to be significantly lower than in 1990. The new Member States and candidate countries project that they will meet their Kyoto commitments with existing domestic policies and measures. Slovenia is still not expecting to meet its Kyoto commitment even under the *with additional measures* projection.

5.5. Policies and measures

An analysis of the types of policies and measures being used by the EU15 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 GHG reductions. Education and information appear to be significant only in the transport sector. In the new Member States and candidate countries, a whole range of types of policies and measures is used, although the use of voluntary agreements is limited (EEA 2003b).

a. Effects of national policies and measures

Figure 11 provides an overview of the estimated effects of national policies and measures on total EU GHG emissions in each of the main sectors. For the EU Member States that have provided information, policies and measures in the energy sector (all energy-related emissions except transport) account for 62 percent of the total savings from implemented measures and 58 percent of the planned measures savings for the European Union as a whole. Savings from policies and measures acting on energy supply are the most significant, accounting for 70 percent and 40 percent of savings in the energy sector from implemented and planned measures, respectively. The high contribution of this sector is because the majority of both implemented and planned policies and measures are targeted at moving to cleaner fuels, renewable energy, and more efficient energy production or energy use.

Transport measures are expected to deliver the second highest savings, followed by the effect of measures on industrial processes. As transport is the most rapidly growing source of GHGs, the measures implemented and planned by Member States only go a small way to addressing this, providing 14 percent and 23 percent of the total savings from implemented and planned policies and measures, respectively.

Finally, savings from measures in the waste and agriculture sectors in 2010 are expected to be small.

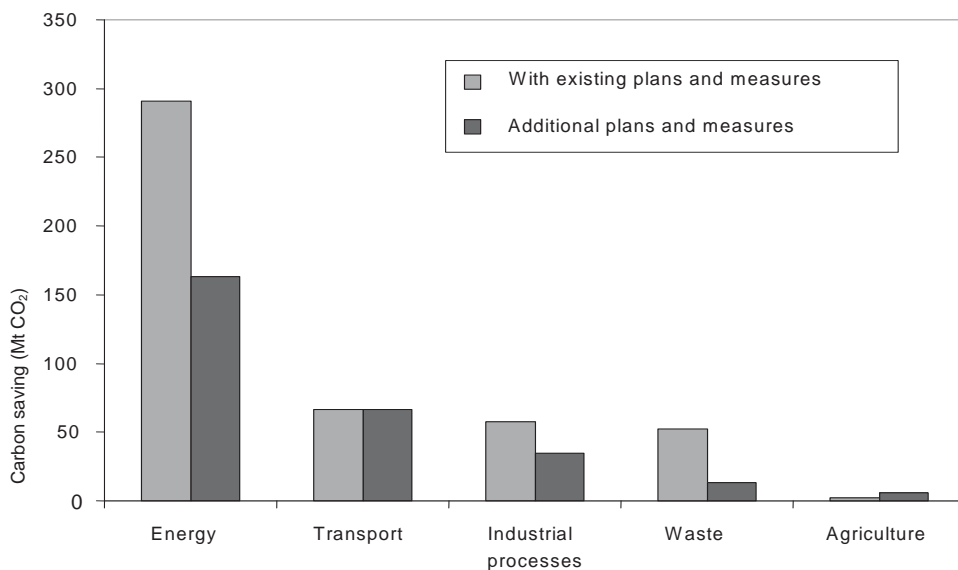


Figure 11. EU15 projected greenhouse gas savings by sector in 2010

Source: EEA 2004.

In general, there are six broad areas of policy that are widespread among Member States that could be considered as key policies and therefore very important in helping the European Union achieving its emission reduction commitments. In the energy supply and use sectors these were the use of renewable energy, CHP, energy-efficient appliances and building standards, the EU-wide ACEA (European

Automobile Manufacturers Association) Agreement in transport, and for the waste sector, the Landfill Directive. Three of the energy policies were adopted under the ECCP. Out of the six policies, for the Member State that provided information, renewable energy seems to have the highest impact for the additional measures projections, as is the case for implemented policies.

For the new Member States countries, all have policies and measures in place to reduce GHG emissions. These are primarily aimed at energy use and waste management, but there are a limited number of policies and measures in other sectors. Policies and measures implemented or proposed in most of the AC/CCs include clean air legislation to reduce air pollution, energy market liberalisation, changes in building regulations to improve energy efficiency, measures to reduce traffic growth, and limits on the disposal of biodegradable waste in landfills. The most important reason, however, for the projected reductions in most of the new Member States and candidate countries is the result of the economic restructuring that has already occurred in these countries.

Harmonisation with EU environmental legislation is also ongoing in most of the AC/CCs. In the Guide to the Approximation of EU Environmental Legislation, however, climate change does not appear as an individual chapter (Armenteros and Michaelowa 2003). Thus, the AC/CCs have to comply with all EU directives that are relevant to reduction of GHG emissions, not in the context of the implementation of the Kyoto Protocol but on a directive-to-directive basis.

b. Taking into account flexible mechanisms and sinks

Eight Member States—Austria, Belgium, Finland, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom—have provided information (so far by 2003) on their intended use of the flexible mechanisms of the Kyoto Protocol (Kyoto mechanisms) to achieve their targets in the commitment period 2008 to 2012. The Netherlands projects that it will achieve its target by a combination of 50 percent domestic policies and measures and 50 percent by the use of Kyoto mechanisms.

The initial limited information available shows that so far around 21 MtCO₂ equivalent of savings per year of the commitment period from the flexible mechanisms under the Kyoto Protocol have been identified. These result from quantification delivered by the Netherlands (20 MtCO₂ equivalent/year) and Portugal. The Netherlands have made the greatest progress in the implementation of JI projects with industrialised countries with economies in transition, and CDM projects with developing countries, and allocated one of the largest budgets (€225 million for the five-year commitment period). Other Member States also started pilot projects and allocated budgets for JI or CDM projects (Austria, at a maximum €88 million; Finland, €8.5 million). Sweden is also exploring this possibility (€37.5 million budget allocated), but from the projections of GHG emissions for 2010 presented above, it is one of the two countries indicating that they will be able to reach their burden-sharing targets only through domestic measures.

Eight Member States—Austria, Belgium, Finland, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom—have provided information (so far by 2003) on their intended use of carbon sinks to achieve their targets by 2008 to 2012. The initial limited information available shows that so far the removal potential from forestry activities by 2008 to 2012 is estimated to be about 10 MtCO₂ per year, and from agricultural activities an additional 3 MtCO₂ per year. These removal estimates represent

almost 4 percent of the total reduction required by the European Union by 2008 to 2012 (336 Mt). The European Climate Change Programme estimates that potentially 93 to 103 MtCO₂ could be sequestered through the enhancement of sink activities in the agricultural and forestry sector (ECCP 2003).

6. Discussion and conclusion

The European Community has been a key force behind the agreement of the Kyoto Protocol, and hence has felt a strong obligation to meet its commitments since the protocol was adopted. The European Union established the ECCP to evaluate the technical potential of mitigation options with costs below €20/tCO₂ equivalent and identified emission reduction options of up to 664 MtCO₂ equivalent, while 336 MtCO₂ equivalent is needed to reach the Kyoto target. Nevertheless, an analysis of the projections of the individual Member States, as well as Europe-wide model projections, shows that just with envisaged domestic policies it is very uncertain if the targets can be met. The gap between the projected emissions and the Kyoto target at the EU15 level is dependent on assumptions with respect to policies implemented by Member States additional to those in place today, as well as the accounting for over-delivery of a few Member States. Even taking into account additional envisaged domestic policies and accounting for over-delivery, a gap still remains, which would have to be met by using the Kyoto mechanisms. There appears to be a large gap between the technical potential identified at the European level and the actual potential in the various countries and sectors. As for use of the Kyoto mechanisms, even if their own projections suggest that neither Member States nor the EU15 as a whole will meet the Kyoto targets through domestic policies alone, only few countries have seriously taken action to put the mechanisms in practice.

The reasons behind the difficulties encountered in meeting the Kyoto targets are various and complex. Many Member States are slow with adopting and implementing EU directives and developing and implementing domestic policies. As a consequence, for example, targets in the area of renewable energy and CHP may not be reached. Emissions in the transport sector are increasing rapidly, and few concrete and feasible options appear to be available to stop this growth. The European Union has adopted an interesting emissions trading system, which could minimise the costs of emissions reductions across the participating emissions sources. Currently, Member States prepare allocation plans, which still have to be agreed by the Commission. The main criterion for the allocation of emission permits is that the total quantity of allowances should be consistent with the obligation of the Member State to limit its emissions under the EU burden-sharing agreement and the Kyoto Protocol (EC 2003b). There appears to be the risk, however, that if allocations are too generous in relation to the Kyoto targets, the burden of emissions reduction could move to sectors not participating in the trading regime, such as transport, small industries, and consumers. An evaluation of 18 NAPs, which were submitted at the time of writing this article, showed that, with some exceptions, the caps imposed by Member States are below the expected business-as-usual emissions, but they are less strict than would be required if these sectors were to make an equal contribution to meeting the Kyoto commitments as other sectors, or if no use of the Kyoto mechanisms was envisaged (Gilbert et al. 2004). Another potential problem in these 18 NAPs is related to the fact that not all countries use the same definition of installations to be included in the

system. This means that the same installations can fall under the trading system in some countries, but not in others, giving rise to competitiveness problems (Gilbert et al. 2004). Nevertheless, in the ETS directive, provisions have already been made for other sectors' participation in a later stage, and in principle the potential cost reductions of the scheme are considerable.

Another reason for the slowness of developing and implementing policies that would help meeting the Kyoto targets could be the uncertainty about the entering into force of the protocol. Even though at the highest political level the European Union has pledged to meet its commitments without such entering into force, the non-ratification of the protocol by countries such as the United States and (at the time of writing this paper) the Russian Federation boosts the protests of adversaries of the protocol in European countries, such as industries which fear competitive disadvantages. Politicians in several EU countries (e.g., Finland, Italy, and Spain) have recently voiced their concerns about this situation. In general, the perceived importance of environmental issues has decreased in most Member States since the Kyoto Protocol was agreed, due to economic downturn, security issues, and other priority problems that have gained political importance since 1997. Even the exceptionally warm years in the 1990s, continuing into the new century, did not appear to have a significant impact on the perceived risk of climate change and the willingness to respond with action to reduce emissions.

An interesting question is to what extent European energy and climate policies were affected by the Kyoto Protocol agreement. Because of serious concerns in Europe about climate change in the 1980s and early 1990s, and perceived opportunities for meeting broader environmental objectives and boosting energy efficiency, the European Union and several of its Member States not only played a proactive role in the international negotiations but also started to develop and implement measures to control GHG emissions well before the protocol was agreed. The agreement of the Kyoto Protocol, signing and ratifying it, facilitated the development of the ECCP and a number of "common and co-ordinated policies," such as the Landfill Directive, targets for renewable energy in power production and transport fuels, and a voluntary agreement with international car manufacturers. Additionally, economic measures such as the liberalization of the gas and electricity markets also had a major impact on GHG emissions reduction. It is hard to judge if these environmental measures would have been taken anyway as part of the general EU environmental policy even without the Kyoto Protocol. Within the European Union, some countries such as Germany, the Scandinavian Member States, and the Netherlands have played a proactive role, while other countries such as some southern European countries have acted more reactively. Many of these proactive countries still play a stimulating role in the current debate about the possible strategies to meet the Kyoto targets. Also for these countries, however, 1997 is quite some time ago, economic growth is slow, and political changes in many countries have reflected a decreasing importance of environmental problems such as climate change.

Nevertheless, the EC continues to support the implementation of the set of policies, measures, and instruments that have been developed under the Kyoto Protocol in order to accomplish its set objectives. That the necessary emissions reductions are technically possible is relatively undisputed. It is as yet uncertain which share of the commitment will be achieved through domestic policies and which share through international mechanisms. At this moment, it appears quite possible for the EC to meet the objectives and demonstrate that GHG emissions can indeed be reduced in industrialised countries

without necessarily having a destructive impact on their economies. Whether or not this will be realised will depend on the actions that will be taken in the next few years and the political will of the EU governments to use the opportunities available.

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