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SECOND EVALUATION OF NATIONAL PROGRAMMES UNDER THE MONITORING MECHANISM OF COMMUNITY CO_2 AND OTHER GREENHOUSE GAS EMISSIONS

Progress Towards the Community CO_2 Stabilisation Target

CONTENTS

1 INTRODUCTION

1.1 THE MONITORING MECHANISM AND THE SECOND EVALUATION REPORT

In the Monitoring Mechanism decision [1], the Commission is requested to report on an annual basis to the Council and the European Parliament, on whether progress in the Community as a whole is sufficient to ensure stabilisation of CO_2 emissions by 2000 at 1990 levels. This objective was agreed at the joint Energy/Environment Council of 29 October, 1990. The first evaluation was carried out on the basis of national programmes received by the Commission in 1993. Due to major differences in the level of detail and treatment of issues in these programmes, the initial evaluation was limited in scope.

This report is the result of the second evaluation process which has been undertaken on the basis of National Communications/Programmes [2] which have been submitted under the Framework Convention on Climate Change and under the Monitoring Mechanism (apart from the Belgian programme which was submitted directly to the Monitoring Mechanism), and updates which have been officially communicated to the Commission before 1 July, 1995. The report is a first attempt to use the methodology for the evaluation of progress and content of national programmes, which has been developed and adopted by the Monitoring Mechanism Committee [3]. This second evaluation report is therefore based on considerably improved information compared to the first evaluation report which was based on the existing national programmes which, at that time, were not complete, comparable or transparent due to the lack of detailed specification of common contents and structure [4].

Following the Council Decision, six Committee Meetings under the Monitoring Mechanism have taken place. The summary records of these meetings include some updated information communicated by the Member States and this information has also been taken into account in the evaluation.

The remainder of this project is set out in the following subsections. *Section 2* reports on the CO_2 and other greenhouse gas emissions inventories and removals by sinks for EU-15. The 1990 inventory is presented and historical trends, especially in energy related CO_2 emissions, are discussed. The greenhouse gas emissions inventory is only provisional at this point since the Member States have not yet provided their *final* emissions inventories. *Section 3* provides an evaluation of progress towards the CO_2 stabilisation target. It reviews the content of the national programmes, the trajectories and the effect of measures. It focuses on the impact on CO2 emission levels of national measures, as described in the National Communications/Programmes, rather than assessing the real effectiveness of these measures in reaching the Member States targets and objectives. Further details of the individual Member States' national programmes are given in the *Annex*. It compares the Member States own trajectories for the year 2000 with alternative trajectories prepared by the Commission services. *Section 4* draws conclusions on the content and structure of the national programmes, the uncertainty in projections and the likely range of CO_2 emissions for the year 2000.

[1] Council Decision 93/389/EEC

[2] In order to ensure consistency between the reporting requirements under the Framework Convention on Climate Change (FCCC) and the EC Monitoring Mechanism, Member States may submit their National Communications under the FCCC also to the Monitoring Mechanism as their National Programmes.

[3] Fifth meeting of the Monitoring Mechanism Committee, 18 May, 1995.

[4] COM(94) 67 final, page 2.

1.2 *THE COMMUNITY TARGET*

In 1993, the Council Decision for a monitoring mechanism of Community CO_2 and other greenhouse gas emissions was adopted 'in the framework of a Community strategy to limit CO_2 emissions and to improve energy efficiency', to ensure that the Community is on course to fulfil both the stabilisation of CO_2 emissions in the Community as a whole by the year 2000 at 1990 levels, and the commitments under the UN Framework Convention on Climate Change [5]. Most, but not all, Member States have set national or EU CO_2 limitation targets or objectives which give an indication of the contribution they expect to be making to meeting the Community target.

Greece, Ireland and Portugal have not adopted an official CO_2 target. Instead they have set out objectives in their National Communications/Programmes to limit the increase in CO_2 emissions to 15% (+/- 3%), 20% and 40% respectively. Finland has no base year for its target to 'stop the growth in energy related CO_2 emissions by the end of the 1990s', thus making the target unclear in numerical terms. Germany only has a target for 2005, a 25% reduction in emissions compared to 1990 levels.

France and Spain have targets that allow some increase over current levels of emissions but which restrict the extent of that increase. France's position concerning the general commitment of maintaining the per-capita emissions of fossil carbon under 2 tonnes (which is equivalent to a 13% increase in emissions by 2000 over 1990 levels) is maintained [6] but it should not be considered as a specific target for the year 2000; instead, the preference is for commitments on policies and measures rather than to any quantified emissions limitations.
According to new calculations which take into consideration the operational optimization of the nuclear power plants generating electricity, this first hypothesis of emissions increase has been revised downwards to + 7%.

Denmark has a national target of a 20% reduction of its CO_2 emissions from energy and transport by the year 2005 compared to 1988. This target is formulated in terms of emissions corrected for net electricity trade, in both the base and the target year. Electricity trade fluctuates with water availability in the other Scandinavia countries, with exports in some years and imports in others.
In 1990, with relatively large electricity imports emissions were at 10 % below the corrected emissions. Apart from its national CO_2 reduction target, Denmark has committed itself to achieve a 5% reductions in 2000 compared to 1990 as a contribution to the EU stabilization target. This commitment is also based on the corrected 1990 CO_2 emissions figures.
The official Dutch target is a reduction of 3% in CO_2 emissions in 2000 compared with the 1989/1990 levels. The Netherlands consider that teperature corrections is relevant for the development of adequate climate and energy policies. To enable policy development and evaluation , the Netherlands takes temperature variations into account by adjusting CO_2 emissions. Therefore its 1990 base years has also been corrected for the weather conditions prevalent in 1990. The Netherlands strategy to reduce its CO_2 emissions by 3% therefore is built around this 1990 adjusted figure.

Taking account of these targets and objectives, there is only a negligible gap between emissions targeted by the aggregate of Member State targets and the Community target. However, the assumptions made for the three countries that have neither a numerical target or an objective for the year 2000 (Finland, France and Germany) are critical for this outcome; their emissions represented 43% of total Community emissions in 1990.

[5] Council Decision 93/389/EEC.

[6] COM (94) 67 final of 10.3.1994 p. 20

2 GREENHOUSE GAS INVENTORIES

2.1 COMMUNITY INVENTORIES

Member State	CO_2	CH_4	N_2O	NO_x	CO	NMVOC	CO2 Removals
Austria	59200	603	4	222	1692	445	NE
Belgium	114500	359	22	338	1219	361	NE
Denmark	52100	406	11	270	770	165	2600
Finland	53900	252	22	295	487	219	<31000
France	366500	2896	176	1722	10947	2424	32200
Germany	1013000	6218	223	2944	10768	2978	20000
Greece	86100	936	24	543	1143	325	NE
Ireland	30720	796	42	114	429	197	NE
Italy	436300	3889	116	2034	9258	2401	36700
Luxembourg	13300	24	1	23	171	19	NE
Netherlands	151800	1067	59	575	1029	459	100
Portugal	42500	227	11	214	1083	199	NE
Spain	227300	2151	94	1189	4725	1120	23200
Sweden	61300	329	15	373	1612	540	34300
UK	577000	4531	108	2740	6682	2540	6100
EU-15	3285620	24671	928	13546	52006	14397	

Table 1 Emission Inventories for EU-15 for CO_2 and Other Greenhouse Gases 1990 (Gg)

- Provisional Estimates: Estimates of Community greenhouse gas emissions are based on estimates of emissions submitted by the Member States. National estimates will be checked/confirmed with each country prior to finalising the totals for the EU.
- The CO_2 removals are from Land use and Forestry.
- Emissions from Final Non Energy Consumption (including feedstocks) have not been included in total emissions. Therefore, total emissions are underestimated in comparison with the IPCC methodology. Emissions from Final Non Energy Consumption (FNEC) are based on the total carbon contained in the products. The addition of total emissions and emissions from FNEC would therefore produce an overestimation compared to the IPCC methodology.
- The UK and the Spanish emissions are based on recently updated national estimates adjusted to be in line with the IPCC guidelines.
- The Spanish CO_2 emissions of 18700 G from agriculture and 2200 Gg from Waste are not included in the total national emissions since Spain has indicated that it considers all such emissions are of organic origin.

- DK: Denmark has corrected its fuel combustion emissions for electricity imports/exports in 1990. This correction (6300Gg of CO_2) has been excluded from the estimates presented in this report for reasons of consistency, no other Member States having made such a correction.
- FR: CO_2 emissions of 8000 Gg from Waste are not included in the total national emissions since France has indicated that it considers all waste emissions are of organic origin.
- IRL: In its national communication Ireland provided an estimate of NMVOC emissions from land use change and forestry of 17 Gg and was the only Member State to provide such an estimate. At the request of Ireland, this estimate has been included in the estimates presented in this report.
- NL: In its National Communication the Netherlands provided estimates of CO_2 for actual emissions from feedstock (14800 Gg) and statistical differences (1000 Gg) which have not been included in the results presented in this report for reasons of consistency. Also it applied a correction for temperature influences which was not applied by other Member States and hence has also been ignored for reasons of consistency.

Source: European Environmental Agency (EEA), June 1995.

The most detailed and accurate emissions data are available for 1990 because it is the base year for the setting of policy targets within the EU and internationally. The Table below shows the emission inventories for the EU-15 for CO_2 and other greenhouse gases as also included in the EU Communication under the UN Framework Convention on Climate Change [7].

The compilation of Community greenhouse gas inventories for 1990 provides a baseline against which the evolution of emissions can be measured. The Community inventory is based on the Member States' inventories which are submitted to the Commission under the Decision for a monitoring mechanism, using the same format as that required for reporting under the UN Framework Convention on Climate Change (FCCC). In the fifth Monitoring Committee meeting the Member States agreed to a systematic process of reviewing the data submitted to the Commission, described in the document 'Proposal for the Methodology for the Evaluation of Progress and for the Contents of National Programmes' [8]. The change in emissions over time can then be measured by comparing the equivalent inventories for subsequent years with the 1990 baseline inventory. As the procedures for reviewing the data submitted by Member States have not yet been formalised, the inventories shown in the *Table 1* are only provisional.

This inventory data for 1990 is the most up to date and consistent Community data; it may differ from the 1990 data reported in some National Communications/Programmes, either because it is more recently estimated or because it has been produced using a different methodology. Since it provides a consistent basis for Member State inventories, it will be used as the baseline throughout the report. Complete inventories for other greenhouse gases were submitted for the year 1990 only.

[7] The EC greenhouse inventories are subject to review in the light of new scientific knowledge. The CO_2 inventory does not include sinks.

[8] Fifth meeting of the Monitoring Mechanism Committee, 18 May, 1995.

According to the Monitoring Mechanism methodology, the Member States should submit in July every year, provisional CO_2 inventories for the previous year and final inventories for the year previous to that. Community inventories are then compiled on the basis of the received data. The Member States are also encouraged to submit inventories of other greenhouse gases with their CO_2 inventories.

In all Member States, CO_2 is the most important contributor to total anthropogenic greenhouse gas emissions. Data on the three main gases, CO_2, CH_4 and N_2O, aggregated to show the climate change effect using IPCC direct global warming potentials (GWPs) [9], indicate that the contribution of CO_2 in the Community is approximately 79%. Since the stabilisation target relates only to CO_2, the evaluation of progress in this report concentrates on that gas and not on other greenhouse gases.

Total anthropogenic CO_2 emissions in the Community amounted to an estimated 3,329,750 Gg in 1990 which is approximately 13% of total global anthropogenic emissions [10]. Since there is no agreed CO_2 inventory for the EU-15 for 1993, it is not possible to make a comparison of review year data (1993) with base year data (1990), as is required by the Monitoring Mechanism methodology.

2.1.1 Historical Trends in Energy Related CO_2 Emissions

Within the Community CO_2 emissions arise largely (95%) from the combustion of fossil fuels used as energy sources for power generation, industry, transport and households. Since the contribution of energy related CO_2 emissions to total CO_2 emissions is so significant, it is possible to get an indication of the historical CO_2 emission trends by studying energy related emissions only.

Between 1990 and 1993 (the review year in the second evaluation process) energy related CO_2 emissions in the Community as a whole fell by 2.2% [11] and CO_2 intensity both on a per capita and per GDP basis has fallen [12]. It is important to note, however, that, as opposed to Member State emission inventories and the Community CO_2 inventory, the CO_2 estimates on which these figures are based have been calculated using harmonised emission factors [13]. The absolute emission figures by country will therefore not correspond to the EU inventory figures. However, the 2.2% reduction is *indicative* of the evolution of CO_2 emissions over the review period.

Energy related CO_2 emissions have fallen only in three out of the fifteen Member States (Austria, Germany, and the UK). Developments in Germany are of particular importance to changes in emission levels in the Community, contributing 30% of

[9] Radiative Forcing of Climate Change: the 1994 Report of the Scientific Assessment Working Group of IPCC. Global Warming Potentials (GWPs) of 24.5 and 320 tonnes of CO_2 equivalent for CH_4 and N_2O respectively, based on IPCC Direct GWPs on a 100 year time horizon.

[10] Radiative Forcing of Climate Change: the 1994 Report of the Scientific Assessment Working Group of IPCC.

[11] Eurostat, May 1995. Energy related emission data, based on harmonised emission factors.

[12] GDP and population figures from Eurostat, June 1995.

[13] The use of emission factors may vary between countries simply because the chemical composition of the fuels actually are different in different countries. However, differences may also arise because the underlying assumptions about the conversion of carbon to CO_2 differ, i.e. assumptions regarding complete and incomplete combustion. Some international organisations use harmonised emission factors for all countries, a method which inevitably will mask differences in chemical fuel composition which often actually exist across the Member States.

Community emissions in 1990. As a result of reunification in 1990 there has been considerable economic restructuring in the former GDR and a significant switch in fuel use away from brown coal. In the new Länder, CO_2 emissions decreased by 50% between 1987 and 1993 while emissions increased in former West Germany by 2% over the same period. It is doubtful if the total fall in emissions in the former GDR can be sustained once the economy is consolidated in that region. Emissions are likely to grow with development and economic growth although ongoing investments in very energy efficient technologies can maintain some of the emission reduction which has been realised between 1990 and 1994.

While the period between 1990 and 1993 was characterised by low economic growth in the Community (annual percentage change of 0.7% [14]), 1994 was a year of recovery which is expected to be consolidated over the next few years. Projections indicate that annual economic growth between 1995 and 2000 could be 3.3% [15]. Part of the emission decrease over the review period must be attributed to low economic growth in the Community. Apart from economic growth projections, other factors indicate that the CO_2 trend is likely to turn upwards between 1995 and 2000 and continue to rise thereafter. Forecasts from the International Energy Agency (IEA) which are based on country energy forecasts for EU-15, show an increase in energy related CO_2 emissions between 1990 and 2000 of 6%, and for the eight EU countries that have submitted forecasts post-2000, a 7% increase by 2010 [16].

Whereas energy related emissions in most sectors have levelled off during the review period, or substantially fallen, as is the case in industry largely due to reduced production levels, they are still rising in the transport sector (7% increase 1990-1993). Transport demand and traffic in the Community are expected to increase significantly in the future, especially following the completion of the internal market. Since 1970 annual growth in inland transport has averaged 3.1% for passengers and 2.3% for goods [17]. Emissions from this growth in traffic volume will only be partially offset by improvements in efficiency but emission levels overall are projected to increase.

Both in 1990 and in 1993, eight of the Member States generated more than 20% of their electricity from carbon-free sources, nuclear or hydro. However, in three of the eight countries that have nuclear power plants, the contribution (% of total) of nuclear in power generation has decreased as has the contribution (% of total) of hydro power in eight of the Member States.

[14] European Commission, Medium Term Projections 1995-2000, June 1995.

[15] European Commission, Medium Term Projections 1995-2000, June 1995. The OECD Economic Outlook (57), June 1995 also projects a consolidation of the economic recovery in Europe over the next few years.

[16] IEA, projections based on country energy forecasts, 1994.

[17] Commission of the European Communities (1993). Towards Sustainability. A European Community programme of policy and action in relation to the environment and sustainable development.

2.2 *REMOVAL BY SINKS*

Greenhouse gas sequestration is an option applicable mainly for CO_2 since it is the only greenhouse gas which has large natural sinks, in the oceans and in biomass. Other greenhouse gases are mostly broken down in the atmosphere so the absorption option is not relevant to them. The removal of CO_2 by sinks can make an additional contribution to the overall reduction of CO_2 in the atmosphere, particularly in those Member States that have a significant potential to increase forest areas. The national programmes contain only very limited information on the actual removal of CO_2 by sinks and the policies and measures which Member States have taken to increase the sequestration of CO_2 emissions.

2.3 *CONCLUSIONS*

Based on Member States' own targets and objectives, five countries expect to reduce CO_2 emissions by the year 2000, while four countries aim at stabilising emissions and six countries plan to increase CO_2 emissions by the year 2000.

The 1990 inventory of CO_2 and other greenhouse gas emissions has been prepared, based on the national inventories and other up-to-date information supplied by the Member States to the Commission. Since this information is more recent than that used in some Member States national programmes, and also that some differences in inventory methodologies exist, the EU inventory differs from some of the Member States national programmes. The 1990 EU inventory forms the baseline for evaluating progress towards the CO_2 stabilisation target. The compilation of an EU inventory for subsequent years, especially the 1993 review year, has not been possible due to the inadequate information submitted by Member States.

3 *EVALUATION OF PROGRESS TOWARDS THE TARGET*

3.1 CONTENT OF NATIONAL PROGRAMMES

This report takes into account Member States' National Communications/Programmes and their updates received officially by the Commission by 30 June 1995. In accordance with the Council Decision for the Monitoring Mechanism for CO_2 and other greenhouse gases, all Member States have submitted national programmes (for all countries but Belgium, the national programme is the Communication under the Framework Convention for Climate Change [18]), to the Commission, containing 1990 emission inventories, details of national policies and measures, measures for the implementation of Community legislation and policies, and trajectories of future emissions.

Considerable progress has been made since the submission of the first, very heterogeneous national programmes [19] in 1993. Nevertheless, the second evaluation of progress towards the CO_2 stabilisation target is complex due to the fact that the information contained in the National Communications/Programmes still is either not comparable between the Member States or incomplete, even though Member States have made considerable efforts to satisfy the requested reporting requirements. The main factors that make an evaluation problematic are:

- The EU inventory is based on the latest information, and not all Member States have provided updates to their national programmes to recalculate the measurement and targets in relation to this inventory. Therefore there is some inconsistency between the inventories in the Member States national programmes and the EU inventory.

- Insufficient information about measures, to give an accurate picture of the state of implementation, progress and availability of funding for these measures, make it difficult to evaluate the effect that the measures will have on CO_2 emissions before 2000.

- Not all countries adequately distinguish between policies and measures put in place prior to the base year of their climate policy and measures which are formally part of their programme.

- CO_2 trajectories for the year 2000, developed through different models and based on different assumptions, make it difficult to compile a Community trajectory for 2000 based on the sum total of the Member State trajectories. The total lack of trajectories, either with or without measures or both, for certain Member States further complicate the process.

[18] For 1995 it was agreed by the Monitoring Mechanism Committee that the EC would accept the National Communications as the national programmes. All Member States have ratified the convention except Belgium, which is in the process of doing so. For the next evaluation, updates to the national programmes are expected.

[19] The agreed format for content and structure of national programmes, and the reporting guidelines under the Framework Convention, were not available early enough to ensure consistency for the first evaluation.

3.2 *CO_2 LIMITATION STRATEGIES IN THE COMMUNITY*

CO_2 emission strategies exist at both the Community and the Member State level. The Community strategy was adopted by the Council in 1991 [20]. It includes:

- non-fiscal measures in the framework of Community programmes (SAVE, ALTENER, JOULE, THERMIE);
- a proposal for a combined CO_2/energy tax (now a revised proposal for common guidelines for a combined CO_2/energy tax);
- a Monitoring Mechanism.

The Community strategy will only be effective to the extent that the measures which have been adopted at the Community level, actually are implemented in the Member States. Most Member States have included the Community measures in their national CO_2 strategies. In particular, energy efficiency labelling is considered to have great potential, and five countries have indicated that a carbon/energy tax at Community level is necessary to achieve their national targets (Belgium, Denmark, Germany, Italy, Netherlands).

Only Denmark, Finland, the Netherlands and Sweden have introduced CO_2 taxes to date but most countries apply VAT on energy at various rates and many countries have introduced taxes on fuels. The Nordic countries which have CO_2 taxes in place would like to increase these taxes further to fully exploit the potential of the measure, but they are reluctant to do so for reasons of competitiveness, unless a similar tax is introduced at the Community level.

France has indicated that a CO2 taxation at the EU level is necessary in order to limit its CO2 emissions at their level indicated in their National Communication.

Belgium and the Netherlands have declared that unless there is progress on the EU CO_2/energy tax proposal, they will introduce a tax unilaterally in 1995. Similarly, the new government in Austria says that it is considering introducing a CO_2 tax in 1996 or at the latest in 1998 [21]. If the revised Commission proposal for guidelines for the introduction of a combined CO_2/energy is adopted by the Council, the introduction of a tax would be done within a common framework by the Member States.

At the national level, all Member States have developed and adopted CO_2 limitation strategies which are described in the National Communications/Programmes. In general, there are three main approaches to the limitation of CO_2 emissions: (examples of these approaches in various Member States may be seen in the *Annex*).

- *Efficiency improvements* which result in a reduction in the level of inputs to achieve a given level of output. Generally for CO_2 emissions we are concerned with levels

[20] SEC(91)1744 final, October 1991.

[21] Fifth meeting of the Monitoring Mechanism Committee, 18 May 1995.

of energy efficiency. Energy efficiencies can be brought about through technological advances or improved management practices, or changes at the energy system level (eg reducing the total emissions from power and heat production through combined production of heat and power).

- *Consumption changes* including conservation measures which result in an overall reduction in consumption, for example through cutting out unnecessary uses of energy and modal shifts especially in transport involving changes from one energy intensive form (eg private motor cars) to a less energy intensive mode (public transport).

- *Fuel switching* from fuels with high to those with low or zero carbon coefficients, for example shifting from coal to gas for power generation, or to renewables.

An additional measure is the sequestration Sequestration of CO_2 by soils and vegetation which similarly reduces the level of CO_2 in the atmosphere and, which has a similar effect to reducing emissions.

There are a range of different measures that are used in the Member States to implement CO_2 limitation strategies to achieve the effects described above:

- *Economic instruments* such as CO_2 or energy taxes are used in order to provide incentives to improve efficiency in the use of energy, changes in consumption or to encourage switching to less carbon intensive fuels - they are also used to encourage expansion of forested areas and thus increases in rates of CO_2 sequestration, eg via planting subsidies.

- *Regulations* introducing energy efficiency standards or restricting uses of particular fuels encourage energy efficiency improvements or fuel switching.

- *Information & education programmes* are used to encourage energy efficiency improvements in industry and energy conservation by firms and householders - these schemes include energy labelling and advertising campaigns.

- *Government direct action* is significant where it is a major user of energy - this might include improvements in energy efficiency in buildings, investment in new electricity generation capacity or increased afforestation of state-owned land. Government action to de-regulate energy markets may create incentives for improvement in the thermal efficiency of generating plants, reduced electrical losses from transmission and distribution systems and can result in switching towards fuels with lower carbon content.

- *Research & development* mostly has long term impacts, eg through encouraging the development of energy efficient and renewable energy technologies or on methods for CO_2 disposal.

3.3 *TRAJECTORIES AND EFFECTS OF MEASURES*

3.3.1 *The Effect of Policy Measures*

The Member States have introduced or are in the process of implementing a broad range of policy measures in order to tackle CO_2 emissions. The most wide spread measures are aimed at energy conservation and energy efficiency measures in end-use. A number of countries have programmes to encourage fuel switching, particularly via government action in the energy sector. The national CO_2 strategies are summarised in the country summary pages in the *Annex*.

Member States have the option of introducing different types of measures, the choice of which has a significant influence on the degree of uncertainty related to the effectiveness of the measures. The following aspects influence the effect of measures:

- *Compulsory versus voluntary measures*

  Compulsory measures or 'hard measures', such as taxes, regulations and standards that must be complied with, and which have a fixed date of implementation, tend to generate more secure results than voluntary measures or other 'soft measures' such as information and education. Compulsory measures are mostly introduced in the household and commercial sectors in the form of efficiency standards and regulations. These measures can be very effective even in a reasonably short period of time.

  For the four countries that have introduced CO_2 taxes, carbon and energy taxation are a fundamental part of these countries' CO_2 strategies. These taxes tend to be cross-sectoral. For reasons of competitivity, the CO_2 tax on industry is lower than for other sectors in Denmark and Sweden (where power generation is totally exempt from the tax). In Denmark and Finland, rates for all sectors are significantly lower than they would be had the tax been introduced in all Member States. In an indirect way the CO_2 tax is an important part of the CO_2 strategies of Belgium, Germany, Italy and the Netherlands since all of these countries have stated that the tax is necessary for them to reach their respective targets. France is also convinced that the CO_2 taxation is an important part of its CO_2 strategy and in terms of excise taxes it has increased the latter on diesel fuel by 20% in real terms between 1990 and 1995.

  Voluntary measures in some form are included in the CO_2 strategy of several Member States, and mainly introduced in the industry sector with the aim of promoting energy conservation. Voluntary agreements, supported by a system of environmental permits, are at the core of the Dutch CO_2 strategy. The efficiency of such measures depend on the size and structure of the industrial sector, the efficiency of monitoring and enforcement and on the system of cooperation between the social partners. The results, which can be very efficient, will therefore vary from country to country.

  Other 'soft measures' include information and training but in most strategies this is viewed as a support measure for the enhancement of energy conservation in particular, rather than a core measure.

- *Funding Status*

Measures that have secure funding, for example through the fixed allocation of tax revenues or EU grants, will be more secure than measures that depend on annual decisions regarding continued funding, as do for example subsidies and investments, both public and private. Subsidies are included in most CO_2 strategies and are often given for the promotion of renewable energy sources, for the promotion of public transport and for demand-side-management (DSM).

Funding is an important factor influencing the outcome of all CO_2 strategies, particularly in times of recession and unemployment. The UK expects emissions reductions as a result of the establishment of an Energy Saving Trust. Due to changes in the anticipated levels of funding the contribution is now expected to be lower (at a minimum of 0.3 MtC) than originally estimated - although further schemes are being developed by the Trust which will contribute further savings.

- *Long term measures*

Long term measures, such as R&D measures or major investments in infrastructure, are uncertain by nature, since they span over a longer time frame. Funding, political backing or other important determinants for the implementation of these measures could change with, for example, fluctuations in economic growth. The measures in the French national CO_2 strategy are mostly expected to have a long term impact, beyond the year 2000. The measures included in the strategies of the southern Member States tend to focus on infrastructure investments which are also for the longer term. Often the measures in the transport sector are for the longer term; eg the development of public transport or energy efficient vehicles and modal shift, are medium to long term measures.

The likelihood of achieving the Community stabilisation target for CO_2 emissions is dependent on a number of factors, but the effect of policy measures is of key importance, illustrated by the magnitude of difference between the with and without measures scenarios (see *Annex A, Table A2)*. Due to the uncertainty related to the implementation and actual effect of measures, the with measure scenario could be viewed as an estimated reduction potential, although the real outcome in 2000 could be very different. It is therefore very important to be able to estimate the effect of measures, but very difficult to do so on the basis of the National Communications/Programmes since the information provided in them is generally inadequate. As a rule, the National Communications/Programmes are unclear regarding the following points.

- The status of policy measures, whether adopted, in the process of adoption or merely options being considered. Even where this is indicated it is difficult to discern whether implementation has begun, the level of effort related to the implementation of the measure, and whether funding is secured for the future.

- Whether or not the measure is introduced as part of the national climate change policy or for some other policy reason.

- The effects of a measure on levels of emissions measured in CO_2 emission reduction, consistent with the difference between the with and without measures scenarios.

Even where this information is provided it would be useful to have progress indicators for the implementation of the measures so as to be able to evaluate the likelihood that the full effect of the measure will be realised by the year 2000. The effects of measures are only partially comparable across countries since they have been estimated using different models and assumptions.

- The trajectories do not give projected CO_2 emissions with and without measures for every year between 1990 and 2000, against which the effect of measures to date could be evaluated.

3.3.2 The Effect of Removal by Sinks

The enhancement of removal of CO_2 by sinks, generally through the encouragement of forestry, is not counted as part of achieving the Community CO_2 target, which is currently based only on emissions. One problem with including the removal by sinks in the achievement of targets is that trees can remove carbon from the atmosphere for long periods, particularly if the wood is harvested and used for construction materials or other long term purposes, but not permanently. Afforestation does not halt the gross growth in emissions or affect the main cause of rising CO_2 emissions, namely the combustion of fossil fuels. This may be an issue particularly for countries where the increase in sinks would otherwise mask an increase in emission levels over time.

It is estimated that, within the Community, there may be a total of 350,000 ha of new planting over the period 1990-2000 including 100,000 ha on former agricultural land as a result of reforms to the Common Agricultural Policy (CAP) and 250,000 ha in response to Member State policies and commercial incentives [22].

Member States have, in most cases, included measures for sink enhancement in the national CO_2 strategies. Four countries have no measures for the enhancement of sinks and one country's measures are only in the conceptual phase. The measures which are being implemented are very similar in all the countries, including for the most part afforestation, forest maintenance and forest management and promotion of long-lived wood products.

3.3.3 Member State Trajectories for the Year 2000

In order to provide an up to date picture of the likely achievement of the Community stabilisation target, *Table A1* (in the *Annex*) provides an aggregation of country trajectories of emissions for 2000. These trajectories are based on Member State submissions in National Communications/Programmes, and updates which have been officially communicated to the Commission. The trajectories are based on the assumption that there is no Community CO_2/energy tax in the countries that have not yet introduced such a tax.

[22] Environmental Resources Management (1994) Forests as CO_2 sinks Final Report to the European Commission DGXI/B/4.

The trajectories and projections for 2000 have been adjusted to be consistent with the same 1990 baseline, the EU CO_2 inventory for 1990 (see section 2.1). Where the Member States have provided both a with and without measure scenario, the effect of measures has been calculated as the difference between the two. In the cases where only one projection has been given by the Member States (generally with measures), the other scenario is derived on the basis of information in the National Communication on the effects of measures, and using a consistent set of assumptions regarding economic growth rates and fuel prices. However, Table A1 does not show the 'without measures' trajectories since they were not submitted by all countries.

By *adding up* the individual Member State trajectories and projections, we can estimate Community CO_2 emissions in 2000. It should be noted, however, that this method of compiling a Community trajectory only can give *indicative* results, since the broad range of models and assumptions that have been used by the Member States introduces a certain amount of inconsistency between their trajectories. In addition, some Member States have made trajectories of projections for all CO_2 emissions whereas others only for energy related emissions. The figures in the table do not take account of these differences. Finally, in virtually all cases, the base year data which have been used in the trajectories and projections do not correspond with the EU CO_2 inventory. By using the magnitudes of change rather than absolute levels, a link can be established between the trajectories and the EU inventory, but this method further results in the trajectories in *Table 3* differing from those reported by the Member States.

Bearing the above limitations in mind, this analysis *indicates* that the Community may stabilise emissions at 1990 levels by the year 2000 if the Member States achieve their trajectories. Germany continues to be a main contributor to CO_2 emissions, but its share would fall from 30% in 1990 to 24% in 2000. Due to the exceptional situation in Germany as a result of unification in 1990, Germany will likely make a significant contribution to Community CO_2 emission reductions. However, it is doubtful whether this reduction is permanent if economic growth in the new Länder is faster than it has been since 1990. In 1994, GDP expansion was estimated to be 9% in the Eastern Länder, and it is expected that the former GDR will continue to be the fastest growing region in Europe over the next couple of years [23]. Projections for Germany will therefore be particularly sensitive to assumptions about GDP growth; the assumption underlying the minus 13% scenario is not specified.

The trajectories and projections are in general sensitive to assumptions both about GDP growth and about international fuel prices. A major source of uncertainty pertaining to the results described in the table above, therefore, relates to the fact that not all countries have specified the assumptions that they have used. Where assumptions are transparent, they tend to differ from country to country (eg Italy assumed that oil prices in 2000 will be $15/bbl while Sweden assumed that the same international prices will be $28/bbl). Some such differences may reflect real differences in costs of delivered fuel, but as regards, for example, international fuel prices, assumptions across Member States should have an underlying consistency.

[23] OECD Economic Outlook (57), June 1995.

Another source of uncertainty is the estimated implementation of measures, both as regards the technical calculation of the effect of measures, and the level of actual implementation. In the table above the effect of measures has been assumed to be the difference between the with and the without measures scenario. Not all Member States have provided a without measures scenario, but even where it has been submitted, it has a different meaning for different Member States. Most countries have, in some way or other, included measures in the without measures scenario, although some leave them undefined, for example only describing them as 'optimising the use of energy' as in the case of Austria, while others explicitly state that the measures implemented up until a specific date have been included in the without measures scenario, as in the case of the Netherlands.

If the with and without measures scenarios have been generated at different times, their underlying external assumptions may differ. Such differences will then be masked as being part of the effect of the measures, particularly when the underlying assumptions are not transparent.

In the with measures scenario, Member States have used widely different models and methods of estimating the impact that measures would have. Regardless of method used, the estimation is complicated by the fact that, for example, some measures may only have an effect if implemented jointly while the effect of other measures may not be fully additive because their reduction potential may overlap. The way in which countries incorporate, into their macro-economic models, the effect of measures which have been calculated at the micro level, also varies greatly across Member States.

Only four Member States have clearly quantified each measure which is included in the with measures scenario (Belgium, Greece, Sweden and UK). In other cases, where the sum of the quantified measures exceeds the difference between the with and without scenarios, the assumption has been made that the sum of quantified measures constitutes a potential rather than an actually achievable impact (eg for Finland 16000-18000 $GgCO_2$ is assumed to be the potential but only 9000 $GgCO_2$ is taken to be achievable effect of the measures, since this is the difference between the two scenarios).

Germany has listed 109 measures but none of them has been quantified. The German estimate is further complicated by the fact that no projections have been provided at all for 2000. The 13% reduction figure is a rough estimate which has been communicated to the Commission [24] but none of the underlying assumptions or measures which are taken account of are known (an emission reduction range of 13%-16% was communicated to the Commission; the lower estimate has been assumed in Table 3).

Related to the calculation of the effect of measures is the uncertainty regarding the implementation of measures discussed in the section above. All countries have measures that remain to be implemented and for some Member States such measures constitute the major part of the CO_2 strategy (eg Belgium). If implementation is not started soon, the measures cannot be expected to have an effect by 2000.

[24] Oral communication, Monitoring Mechanism Committee meeting, February 14, 1995.

Given that four countries, namely France, Germany, Italy and the UK accounted for 72% of Community CO2 emissions in 1990, minimising uncertainties associated with the implementation of their respective measures is of particular importance. The French measures are mainly for the long term beyond 2000 [25]. According to the German Communication, 88 measures are under implementation but there is very little indication of what that means in terms of level of effort, duration, political commitment, availability of funding etc and as noted above, the impact of the measures has not been quantified. The Italian plan shows an unusually large effect of measures although it is not indicated where this reduction would come from. The stage of implementation of the measures is very unclear and none of the measures have been separately quantified. In the UK, following changes in the anticipated level of funding, the contribution of the Energy Saving Trust is now expected to be lower than originally estimated.

Greece, Ireland, Portugal and Spain all have 'objectives' that take account of their expected higher economic growth. These objectives correspond to their respective projections. Greece revised its 'realistic objective' downwards from a 25% increase to 15% +/- 3% increase [26]. This is more related to revised expectations about economic growth than to a higher than expected effect of measures. Emissions in these countries are likely to be more linked to economic growth in the years up to 2000 than to the implementation of the measures in their national CO_2 strategies. It is therefore likely that if economic growth proceeds as forecasted in these countries, emissions will follow. The measures in these plans are not fully elaborated (with the exception of Greece), highly dependent on the availability of funding and therefore unlikely to counteract the increase in emissions.

Several of the countries that use nuclear power are finding it increasingly difficult to acquire the public's consent to build new power plants (eg in Finland Parliament rejected the application to build a fifth nuclear power plant.

In France four 1450 MW PWR units are now under construction and expected to be commissionned before the year 2000. Having regard to current forecasts of electricity consumption, the improved availability of French nuclear plants and the expected extent of its exports, it is not expected that further nuclear reactors will be ordered before the year 2000. However, if the level of 70 ECU a tonne of carbon not emitted were to be regarded as necessary to stabilise emissions from the European Union, the French nuclear investment policy would be revised.
Sweden has made its projection on the assumption that the planned phase-out of nuclear power is not initiated before 2000. Even if that is the case, new energy demand must be met with power generation from fossil fuels, especially since there is, in principle, a ban on expanding hydro power. Once the phase-out is begun emissions from the power generation sector are likely to increase significantly.

[25] Summary record of the Committee meeting of the Monitoring Mechanism, 19 October, 1994.

[26] Summary record of the Committee Meeting of the Monitoring Mechanism, February 14, 1995.

3.3.4 Alternative Trajectories for 2000

Since there is considerable uncertainty related to the trajectories and projections discussed above, it is useful to compare them to alternative projections; a modified projection based on the Member State trajectories but using a few common assumptions, especially a sensitivity analysis on growth rates, and a further Commission projection based on new energy scenarios.

In the 'modified projection', country GDP growth rates (in place of those given by the Member States) have been used that are consistent with the projected Community growth rate and fuel import prices, (particularly for crude oil) pertaining to the EU [27]. For the years 1990-1993, estimated actual CO_2 emission growth from energy only has been used [28]. Thereafter, emissions are estimated forecasted based on OECD GDP projections for 1993-1995, and Commission Services' projections for 1995-2000 [29].

The 'Commission projection' is based on a provisional result from a recently updated energy scenario using the Commission's energy models (Conventional Wisdom scenario 2020). It shows an increase in emissions from energy consumption of approximately 5%.

The Member States are committed to their trajectories shown in *Table A 2* (in the *Annex*) column (a). However, the alternative scenarios shown in columns (b) and (c) highlight the uncertainty present in any future projections.

As all projections, the two alternatives which are presented in *Table A 2* have shortcomings. The different results in these trajectories show the importance of the underlying assumptions. In the Member State trajectories the assumptions about GDP tend to be lower and assumptions about fuel prices higher than the ones used in the modified trajectory. This partially explains why the Member State trajectory for EU-15 shows an emission decrease while the other two projections show an increase. Another reason may be that the Member State trajectories may assume successful implementation of all measures while the alternative trajectories may allow for some slippage in implementation. As regards these underlying assumptions, it is likely that the modified and the Commission projections are more consistent since they are based on common external assumptions. The methodological problems discussed in the section above are identical for the Member State and the modified trajectories as is the uncertainty pertaining to the implementation of measures. The 'bottom-up' approach used in the Member State trajectories may be contrasted with the Commission trajectory which is based on 'top down' analysis.
Based on the projections above and the uncertainty related to the implementation of measures, the most likely development is an increase by the year 2000 in the range of 0-5%. This range also takes account of uncertainty in fuel prices and GDP growth rates.

[27] Assumptions regarding GDP growth from Commission Services (DGII), 'Medium Term Projections 1995-2000', June 1995. GDP figures 1992-1995 from OECD Economic Outlook (57), June 1995. Import prices for oil taken from OECD Green model (June 1995), which projects a change of $4979-$4052 per terrajoule from 1985-2000 for the EU. Energy price assumptions have also been taken from 'A View to the Future', September 1992.

[28] Eurostat, June 1995. Harmonised emission factors.

[29] The 2000 emission data have been projected using a 'change index' constructed on the basis of the OECD/Commission GDP growth rates and fuel prices taken from the OECD Green model, the GDP growth rates included in the National Communications, and assumptions about income and price elasticities.

4 *CONCLUSIONS*

There has been considerable improvement in the quality of reporting in the National Communications/Programmes since the first National Programmes were submitted for evaluation in 1993. However, the information provided in them is still insufficient, in terms of specific details, to evaluate progress towards the Community stabilisation target in a satisfactory way. Overall there is still considerable uncertainty regarding the expected outcome in the year 2000. Due to lack of key information, it has not been possible to fully apply the methodology adopted by the Monitoring Mechanism Committee [30]. Notably, the following important compromises have been made for lack of information and lead to additional uncertainty about the expected outcome for 2000:

- Since there is no Community CO_2 inventory available for the review year 1993, it has not been possible to review the trend in emissions between the base year 1990 and the review year.

- The compilation of a Community trajectory for 2000, which should be based on the trajectories supplied by Member States, was not possible due to difference in methodology and assumptions used by the Member States. Two alternative trajectories have therefore been presented. One is a modified trajectory with consistent growth and fuel price assumptions, the other is based on the Commission's energy scenarios for 2020. Both of these alternative scenarios estimate higher CO_2 emission for 2000 than the Member States' own trajectories.

- There is insufficient information about the implementation of measures. This is a crucial element in the assessment of progress. The reliability of the trajectory results are particularly hampered by the fact that the reporting of implementation of measures in four of the largest contributors to CO_2 emissions, Germany, France, Italy and the UK (representing 72% of emissions in 1990), is insufficient. In general, it is impossible to make an assessment about the effectiveness of implementation of measures based on the national programmes since adequate information is not provided.

These are shortcomings in this evaluation report that should be addressed in the third evaluation due to take place in 1996. More consistent and transparent data are required to allow better presentation and evaluation in subsequent reports; the documents [31] agreed at the Fifth meeting of Monitoring Mechanism Committee on 18 May, will help provide such data. Furthermore, amongst other possibilities, it has been suggested that a workshop might be arranged in which the development of trajectories could be discussed. The Monitoring Mechanism Committee also foresees a working group to assist in the process.

[30] Fifth Monitoring Committee meeting, May 18, 1995.

[31] Fifth Monitoring Committee meeting, May 18, 1995: 'Proposal for the Contents and Format of Annual Inventories' and 'Proposal for the Methodology for the Evaluation of Progress and for the Contents of National Programmes'.

According to the results of this evaluation process, it cannot be excluded that Community emissions will increase within the range of 0-5% by 2000 over 1990 levels. The lower end of this range is based on the assumption that the maximum potential of the estimated effect of measures as reported in the 'with measures trajectories' of the Member States, is actually realised. Since current emissions are below 1990 levels, even stabilisation by 2000 implies that emissions will be growing between now and then. If energy prices remain low and GDP growth is faster than expected the increase could be at or above the top of the range. Such an increase of 5 % or more would be a serious departure from the agreed stabilisation commitment.

As mentioned above there is also uncertainty linked to the implementation of measures and many will only have an impact after 2000. Five countries have said that they can only meet their targets if a CO_2/energy tax is implemented at the Community level. If the full potential is not realised, CO_2 emissions could increase more, unless additional measures are implemented.

This evaluation takes account of the emissions and national programmes of 15 Member States, and the picture has therefore changed since the previous evaluation which only included 12. Subsequent evaluations are expected to be based on improved information by including recent updates by Member States of their national programmes and a reporting format more closely aligned to the adopted methodology.

It appears therefore that, at this stage, the Commission is not in a position to claim that the adopted policies will be sufficient to meet the agreed targets and certainly not to ensure reductions in CO_2 emissions after the year 2000.

The Council of 22/23 June 1995 invited the Commission to modify the Monitoring Mechanism decision of 1993 to extend the monitoring of greenhouse gases beyond the year 2000. This is important since it is likely that the Community emissions will be increasing after 2000 event though measures implemented will have a continuing effect. IEA energy projections, recalculated as CO_2 projections, show that for the eight EU countries that have submitted post-2000 projections, energy related emissions in 2010 could be 7% higher than in 1990 [32]. Taking a post-2000 perspective therefore also becomes increasingly important for subsequent evaluations.

[32] IEA Energy related CO_2 projections, June 1995. The eight countries are: Belgium, Finland, France, Germany, Ireland, Luxembourg, Netherlands and the UK.

Annex A

Tables Showing CO_2 Inventories, Trajectories and Effects of Measures for the 15 Member States

Table A1 Member State Trajectories and Projections and Effect of Measures [5] 1990-2000($GgCO_2$)-Adjusted on a Common 1990 baseline ($GgCO_2$)

Member State	(a) CO_2 Inventory 1990 [1]	(b) Change 1990/2000 [2]	(c) % change 1990/2000	(d) Trajectory 2000 (With Measures) [3]	(e) Effect of Measures [4]	Comments[5]
Austria	59200	380	0.6	59580	5520	STAB scenario is 'with measure' scenario. STAB aims at stabilising emissions at 1990 levels by 2005 (reduction of 8800 $GgCO_2$ over IER reference scenario for 2005). Effect of measures interpolated for 2000.
Belgium	114500	-1300	-1.1	113200	13630	Projection is temperature corrected. Bureau de Plan scenario without a CO_2 tax is 'with measure' scenario.
Denmark	52100	-6200	-11.9	45900	13500	Energy 2000 follow-up trajectory 1990/2000 is 'with measure' scenario. Aim is to achieve 20% reduction by 2005 compared to 1988 levels.
Finland	53900	16000	29.7	69900	9000	Energy related emissions only. Assumption that all imported electricity produced domestically in future (see country summary).
France	366500	31840	8.7	398340	73200	Scenario 1 from note to Monitoring Mechanism Committee is 'with measure' scenario, including sinks.
Germany	1013000	-131560	-13.0	881440	144330	'Without measure' scenario is derived based on assumptions of consistent set of fuel prices and GDP growth rate. 'With measure' scenario for 2000 is 13% reduction over 1990 levels, as communicated to Commission in Monitoring Mechanism Committee meeting in February 1995.
Greece	86100	12320	14.3	98420	9590	'With measure' scenario is 'most realistic objective' of 15% increase by 2000 over 1990 levels.
Ireland	30720	6300	20.5	37020	1390	'Without measure' scenario is derived based on assumptions of consistent set of fuel prices and GDP growth rate. 'With measure' scenario 20% increase by 2000 over 1990 levels. Insufficient quantification of measures.
Italy	436300	12630	2.9	448930	54370	'With measure' scenario 1-5% (average 3%) increase by 2000 over 1990 levels, as communicated to Commission in Monitoring Mechanism Committee meeting in February 1995. Insufficient quantification of measures.
Luxembourg	13300	-3200	-24.1	10100	7820	'Without measures' scenario derived based on assumptions of consistent set of fuel prices and GDP growth rate. Insufficient quantification of measures.

[1] CO2 inventory 1990, June 1995.
[2] Absolute change 1990/2000 based on Member State trajectories.
[3] 'With measures' scenario, based on CO_2 inventory for EU-15 1990. These trajectories and projections have been adjusted to be consistent with the same 1990 CO_2 baseline inventory for 1990.
[4] Difference between 'with' and 'without' measures scenarios, Member State trajectories.
[5] Some of the measures are understood in a very broad sense

The trajectories and projections for 2000 have been adjusted to be consistent with the same 1990 baseline, the Corinair inventory 1990 shown in column (a). For all but five countries, the Corinair inventory figure is higher than the 1990 trajectory baselines used by the Member States. For France, Ireland and Sweden the 1990 trajectory baseline corresponds with the Corinair emission figure for 1990, while for the Netherlands and the UK the Corinair figure is lower.

Member State	(a) CO_2 Inventory 1990 [1]	(b) Change 1990/2000 [2]	(c) % change 1990/2000	(d) Trajectory 2000 (With Measures) [3]	(e) Effect of Measures [4]	Comments[5]
Netherlands	151800	-600	-0.4	151200	10500	'With measures' and 'without measures' scenarios from Energy Policy Scenario. Sectoral quantification of measures.
Portugal	42500	15300	36	57800	7030	'Without measures' scenario derived based on assumptions of consistent set of fuel prices and GDP growth rate. 'With measures' scenario is 40% increase in emissions by 2000 over 1990 levels. No quantified measures.
Spain	**227300**	54100	23.8	281400	59470	'Without measures' scenario is derived based on assumptions of consistent set of fuel prices and GDP growth rate. 'With measures' scenario is 25% increase by 2000 over 1990 levels. No clear quantification of measures.
Sweden	61300	2700	4.4	64000	10200	'With measure' scenario is 4% increase by 2000 over 1990 levels, not temperature corrected, and stabilisation if temperature corrected. All measures included in the scenario are quantified.
UK	579800	-35140	-6.1	544660	71740	'With measures' scenario from EP-65, central GDP growth, high fuel prices , reduction of 6% by 2000 compared to 1990 levels. All measures in scenario quantified.
EU-15	**3,285,620**	-26430	-0.8	3,260,900	491,290	

[1] CO_2 inventory 1990, June 1995.
[2] *Absolute change 1990/2000 based on Member State trajectories.*
[3] 'With measures' scenario, based on CO_2 inventory for EU-15 1990.
[4] Difference between 'with' and 'without' measures scenarios, Member State trajectories.
[5] Some of the measures are understood in a very broad sense.
The trajectories and projections for 2000 have been adjusted to be consistent with the same 1990 baseline, the Corinair inventory 1990 shown in column (a). For all but five countries, the Corinair inventory figure is higher than the 1990 trajectory baselines used by the Member States. For France, Ireland and Sweden the 1990 trajectory baseline corresponds with the Corinair emission figure for 1990, while for the Netherlands and the UK the Corinair figure is lower.

Table A2 Alternative Trajectories for the Year 2000 (percentage change 1990/2000)

Member State	(a) Member State Trajectories/ Projections [1]	(b) Modified Trajectories/ Projections [2]	(c) Commission Projection [3]	Notes
Austria	1	8		Growth rates differ marginally but fuel prices assumed in (a) are very high compared to (b) which explains low emission growth in (a).
Belgium	-1	3		Due to lack of information about GDP growth rate, the assumed growth rate is 0.7% lower than in modified trajectory.
Denmark	-12	7		GDP growth assumptions differ marginally between the (a) and (b) but fuel prices are very high in (a) and price elasticity is very high, leading to fall in emissions in (a).
Finland	30	33		Lower GDP growth rate and higher fuel prices in (a) than in (b) but the income effect is higher leading to higher emissions in (b).
France	9	13		GDP growth rate lower and fuel prices higher in (a) than in (b), leading to lower emissions in ~~(b)~~.(a)
Germany	-13	-10		Due to lack of information about growth rate, it is assumed to be 0.7% lower than in modified trajectory.
Greece	14	19		Due to lack of information about growth rate, it is assumed to be 0.7% lower than in modified trajectory.
Ireland	20	25		Due to lack of information about growth rate, it is assumed to be 0.7% lower than in modified trajectory.
Italy	3	6		Much higher GDP growth rate in (b) than in (a) and higher fuel price increase. Income effect outweighs price effect leading to higher emissions in (b).
Luxembourg	-24	-20		Growth rate in (a) lower than in (b). Fuel prices are the same. Emission reduction greater in (a).
Netherlands	0	10		Higher GDP growth rate in (b) than (a) and high income elasticity explains higher growth in emissions. Fuel prices higher in (a) than in (b).
Portugal	36	36		Due to lack of information about growth rate, it is assumed to be 0.7% lower than in modified trajectory.
Spain	21	23		Lower growth rate and higher fuel prices in (a) than in (b), explains higher emissions in (b).
Sweden	4	6		Lower growth rate and higher fuel prices in (a) than in (b). Price effect dominates leading to lower rise in emissions in (a).
UK	-6	-2		Higher GDP growth rate in (b) leading to higher emissions than in (a).
EU-15	-1	3	5.4	Aggregate figure for EU-total.

[1] Trajectory 1990/2000, based on Corinair CO_2 inventory (column (c) in Table A1).
[2] Trajectory 1990/2000, based on modified common assumptions for GDP and fuel prices.
[3] Trajectory 1990/2000 from Commission Services (DGXVII), Conventional Wisdom scenario 2020.

Annex B

Country Summaries

	1990 Emissions ($GgCO_2$)	Trajectory 1990/2000 on CO_2 inventory baseline (%)	Effect of Measures ($GgCO_2$)
Member State Trajectory [1]	59200	0.6	5520
Modified Trajectory		8	

Target/Objective and Comments: - Stabilization scenario (by 2000)
- Reduction target committed to : 20% by 2005 based on emission in 1988 (Toronto target)

Summary of measures: Most measures focus on reducing end use energy consumption rather than on fuel switching. The quantified measures are geared towards the promotion of renewables for heating purposes, through subsidies and tariff restructuring. The same instruments are used to promote district heating. Attention is also given to reducing energy consumption in the transport sector, for example a vehicle tax which reflects fuel consumption. Measures geared towards industry are largely voluntary. Measures to enhance sinks include afforestation, forest management, increase in long-lived wood products.

Quantified measures

1.	Use energy of surplus straw (agricultural, district heating and building subsidies; regulations on supply of electricity to public grid	0.60 $MtCO_2$
2.	Use of biogas as fuel and raw material (district heating and building subsidies; regulation on supply of electricity to public grid	2.90 $MtCO_2$
3.	Use of solar energy especially for water heating; use of solar collectors; passive solar energy use (subsidies, building regulations)	0.60-1.30 $MtCO_2$
TOTAL	**4.10-4.80 $MtCO_2$**	

Categorisation of measures: The measures are divided into measures under implementation, measures which are planned to be undertaken under the next legislative period (1994-1998) and measures at the conceptual stage. The quantified measures are all under implementation.

Projected CO_2 emissions in 2000 relative to target [2]: In the with measure scenario [3], Austria expects to stabilise CO_2 emissions by 2000. It is not clear which measures are included in the projection. The assumption made is that energy savings and structural changes will reduce emissions, but only a third of the potential is realised. Energy and carbon intensity are assumed to fall by 2.1% and 0.5% respectively per year to 2005. If the measures which are planned for the legislative period 1994-1998 are required for stabilisation, the outcome will only be secured if implementation is begun immediately. Measures in the conceptual phase are not likely to have an impact before the year 2000. This projection can also be put in question by the fact that very high fuel prices have been assumed for 2000.

The new government has expressed a political will to introduce a CO_2 tax by 1996. Depending on the timing and the rate at which the tax is introduced, it could make a substantial contribution to meeting the stabilisation target.

[1] Adjusted to be consistent with the same 1990 baseline, the CO_2 inventory for the EU-15.

[2] The discussion is based on Member State trajectories, not applied to the inventory for the EU-15. Therefore there may be small discrepancies between the figures mentioned in the text and the figures provided in the box under Member State Trajectory above.

[3] Stabilisation scenario (STAB).

BELGIUM

	1990 Emissions ($GgCO_2$)	Trajectory 1990/2000 on CO_2 inventory baseline (%)	Effect of Measures ($GgCO_2$)
Member State Trajectory [1]	114500	-1.1	13630
Modified Trajectory		3	

Target/Objective and Comments: 5% reduction by 2000 compared to 1990 level. Temperature corrected target.

Summary of measures: Greatest impact expected from increased efficiency in electricity generation and shift to electric steel industry. Substantial impact also expected in the residential sector through a broad range of measures of different types and effects including: promotion of cogeneration (combined heat & power); promotion of energy efficiency household appliances and discouragement of electric heating; fiscal instruments include changes to tax benefits and parking fees in the transport sector, and grants to encourage energy conservation in public buildings. No measures to enhance sinks.

Quantified measures

1.	Improvement of insulation in new buildings in the residential and commercial sectors	0.40 $MtCO_2$
2.	Increased use of natural gas, improved performance of heating installations and hot water boilers	1.90 $MtCO_2$
3.	Promotion of energy efficiency household appliances and lighting	0.75 $MtCO_2$
4.	Discouraging of use of electric heating	0.10 $MtCO_2$
	Subtotal for residential/commercial sector	**3.15 $MtCO_2$**
5.	Transport plans for company employees	0.125 $MtCO_2$
6.	Reduced access by passenger and transport vehicles to city centres	0.12 $MtCO_2$
7.	Other measures for the promotion of public transport in urban areas	0.10 $MtCO_2$
8.	Reduced road transport	0.05 $MtCO_2$
9.	Fiscal policy in transport	0.75 $MtCO_2$
10.	Increased enforcement of speed limits	0.60 $MtCO_2$
	Subtotal for transport	**1.75 $MtCO_2$**
11.	Measures in the industrial sector: energy audits for suppliers	0.64 $MtCO_2$
12.	Promotion of renewable energy	0.20 $MtCO_2$
13.	Promotion of cogeneration	2.00 $MtCO_2$
	Subtotal of all additional measures	**7.74 $MtCO_2$**
14.	Shift towards electric steel production (implemented)	2.00 $MtCO_2$
15.	Increased efficiency in electricity production	4.00 $MtCO_2$
TOTAL	**13.74 $MtCO_2$**	

[1] Adjusted to be consistent with the same 1990 baseline, the CO_2 inventory for the EU-15.

Categorisation of measures: The measures have been divided into those which are currently being implemented (adopted before 1994), complementary measures which are the focus of the plan (to be implemented after 1994), and other associated measures which are for the longer term. The two most important measures under implementation are the technical improvements to the nuclear plants and the installation of electric steel works. The quantified measures fall into the complementary measures category. They have, however, been subject to a ministerial decision.

Projected CO_2 emissions in 2000 relative to target [1]: Belgium has clearly stated that in the absence of a CO_2 tax, the target will not be reached, it will just do a little better than stabilisation [2]. With a CO_2 tax, however, the 5% reduction target for 2000 could be reached. The tax is expected to reduce emissions by 7%-10%. Belgium is considering implementing a CO_2 tax in 1995.
implementation of some of the quantified measures is uncertain and sometimes for the longer term, e.g. voluntary measures in industry and measures in the transport sector which are dependent on the development of public transport. If the measures are to have an impact before 2000, implementation must be initiated immediately.

[1] The discussion is based on Member State trajectories, not applied to the inventory for the EU-15. Therefore there may be small discrepancies between the figures mentioned in the text and the figures provided in the box under Member State Trajectory above.

[2] Two projections presented, Bureau de Plan and Centre d'etude economiques de la KUL, and although they provide a range, they show largely the same result.

DENMARK

	1990 Emissions ($GgCO_2$)	Trajectory 1990/2000 on CO_2 inventory baseline (%)	Effect of Measures ($GgCO_2$)
Member State Trajectory [1]	52100	-11.9	13500
Modified Trajectory		7	

Target/Objective and Comments: Target for CO_2 emissions adjusted for imports of electricity in base year, i.e. CO_2 emissions are calculated on the assumption that all electricity was generated in Denmark in base year. Using unmodified data, the target is equivalent to a rise of 6.4% over 1990 levels.

Denmark imports electricity from Norway and Sweden but the quantity varies over time depending on water availability and therefore the level of production from hydro sources in the two exporting countries. Denmark has a largely fossil fuel based energy supply system whereas Norway and Sweden have high contributions from hydro and nuclear (Sweden only). In 1990 Denmark imported significant quantities of electricity. Therefore its CO_2 emission levels were lower than might be expected in a typical year, and 10.7% lower than if all electricity had been generated in Denmark.

Summary of measures: Efficiency improvements in end use through the implementation of efficiency standards for electrical appliances and other equipment are expected to make a large contribution to CO_2 reductions. Also important is promotion of CHP through subsidies. New generating capacity will come from construction of gas-fired plants after 2000. Denmark has a CO_2 tax in place and it was recently increased. Then intention is to introduce more green taxes in all the sectors of the economy. In the transport sector emphasis is on promoting public transport, e.g. investment support for purchase of clean vehicles. Other measures include promotion of energy efficient driving through information and training and promotion of rail transport. No measures to enhance sinks.

Quantified measures: (a more detailed breakdown is only available for the year 2005)

1.	Oil & gas (refineries, North Sea)	0
2.	Transport	0
3.	Energy Sector	13.5$MtCO_2$
TOTAL	**13.5$MtCO_2$**	

Categorisation of measures: The measures are included in a set of plans which have been adopted by government: the 1990 action plans for energy and transport respectively, the 1992 action plan on waste and recycling, the 1993 follow up on the 1990 energy action plan, and the 1993 white paper on transport. The quantified energy measures are all included in the 1993 follow up energy plan. No measures for the transport sector have been quantified. In a separate communication to the Commission it has been announced that a set of green taxes will be introduced.

Projected CO_2 emissions in 2000 relative to target [2]: Based on the 'with measures scenario' [3], Denmark will reach the 5% reduction target (corrected for electricity imports) if all the measures included in the 1993 follow up action plan are implemented. The reduction will come from the energy sector. The effect of measures in the transport sector is assumed to be nil and emissions are expected to increase in this sector between 1990 and 2000.

In an official note to the Commission, Denmark announces that it has problems implementing two important measures: the introduction of efficiency standards and appliances due to delays relating to the EU directive on efficiency standards; and the conversion of electrically heated buildings to central heating by gas or district heating since a voluntary agreement with the power industry has not yet been reached.

[1] Adjusted to be consistent with the same 1990 baseline, the CO_2 inventory for the EU-15.

[2] The discussion is based on Member State trajectories, not applied to the inventory for the EU-15. Therefore there may be small discrepancies between the figures mentioned in the text and the figures provided in the box under Member State Trajectory above

[3] Revised estimate, June 1995, showing total domestic energy emissions 1990-2000, including flaring.

Regarding standards for household appliances, the proposed EU Directive on refrigerators is less ambitious than foreseen Danish standards, both as regards the stringency of the standards and the timing (it would enter into force after 2000). This measure may therefore be lost to the Danish national plan. The two measures were together expected to contribute 3% of the CO_2 reduction planned for 2005.

In the note to the Commission, Denmark also presented a set of new green taxes which have been adopted by Parliament and will enter into force in 1996: an SO_2 tax (1.5 ECU/kg SO_2); a CO_2 tax on natural gas; an increased CO_2 tax on energy for industrial processes and commercial energy use (including electricity), with one rate for light processes (13ECU/t CO_2) and a virtually vanishing rate (0.5ECU/t) for energy intensive processes. The low rate will be conditioned on the implementation of an energy audit and voluntary agreements on energy savings. Without such an agreement, the default tax is 3.5 ECU/t CO_2. The rather elaborate system of exemptions and recycling is necessary to avoid losing competitiveness vis a vis other European countries that have not introduced a similar tax. Until this problem is overcome, Denmark cannot exploit the full potential of the CO_2 tax instrument.

The trajectory can be questioned by the fact that the assumed fuel prices and price elasticity very high, both factors contributing to a large estimated CO_2 emission reduction.

FINLAND

	1990 Emissions ($GgCO_2$)	Trajectory 1990/2000 on CO_2 inventory baseline (%)	Effect of Measures ($GgCO_2$)
Member State Trajectory [1]	53900	29.7	9000
Modified Trajectory		33	

Target/Objective and Comments: The Finnish target is to 'stop growth in energy related CO_2 emissions by the end of the century'. Finland has no base year for its target which makes it unclear in numerical terms.

Summary of measures: The national communication is based on Government programmes approved in the 1990s that relate to climate change policy. Some programmes were approved specifically to implement climate change policies but some were adopted for other reasons. A main focus of the CO_2 strategy is energy conservation in end-use, to be achieved to a large extent through economic instruments. Finland has CO_2 tax (since 1990) and energy taxes in place, encouraging fuel switching, energy conservation, use of renewables, and changes in production and consumption patterns. Other measures to encourage energy conservation include voluntary agreements with industry and information and education. Promotion of biofuels is important (aim to increase consumption by 25% by 2005 over 1994 levels). Measures used in the transport sector have mostly been fiscal and economic instruments aimed at reducing fuel consumption and encouraging modal shift. A new action programme for transport has been adopted aiming at restraining growth in traffic; a main tool is economic instruments. Measures to enhance sinks are important and focus on forest management and commercialisation of wood products.

Quantified measures

1.	Increased CO_2/energy tax (to FIM 38.30/tonne CO_2 and FIM 3.50/MWh.	2000 Gg CO_2
2.	Energy conservation programme, including a gradually increasing energy tax.	6000-8000 Gg CO_2
3.	Promotion of biofuels (25% increased consumption by 2005 over 1994 levels).	3000 Gg CO_2
4.	Energy technology development programmes (1993-1998) to develop technology for renewable energy sources through financing of demonstration projects and R&D.	1000-5000 Gg CO_2
TOTAL 12000-18000 Gg CO_2		

Categorisation of measures: The majority of the Finnish measures in the national communication have been approved by Parliament and are under implementation (e.g. efficiency improvements in energy production and end-use and energy and carbon taxes). All of the quantified measures are under implementation. A second category of measures, mainly aimed at the transport sector, have also been adopted by Parliament, but the stage of implementation is unclear.

Projected CO_2 emissions in 2000 relative to target [2]: Based on the 'with measure scenario' [3], Finland will increase emissions by 16% in 2000 over 1990 levels. This takes account of effects of energy taxation, energy conservation (some overlap in the figures noted above), increased use of bio-energy and the adoption of new technologies (some overlap in the figures noted above).

[1] Adjusted to be consistent with the same 1990 baseline, the CO_2 inventory for the EU-15.

[2] The discussion is based on Member State trajectories, not applied to the inventory for the EU-15. Therefore there may be small discrepancies between the figures mentioned in the text and the figures provided in the box under Member State Trajectory above.

[3] 16% is the median of a range given as the 'with measures scenario' (10-22% increase).

The electricity import situation and the structure of the electricity production capacity is currently being reviewed. Finland has consistently imported a large share of its electricity from neighbouring countries but there are major uncertainties and conditions attached to continuing doing so. In the next few years Finland will have to decide how it is going to produce the base load capacity needed. The expected increase in emissions in Finland is largely due to the assumption that electricity imports are replaced with domestic production capacity. Depending on the choices that are made regarding domestic base load capacity, the increase in emissions could range from 10-22% (16% mentioned above is the median). Recent estimations show, however, that the total increase in domestic electricity production capacity in 2000 would not likely be met by coal fired power plants. The additional reduction would largely come from restructuring the electricity market. The effect of measures are also influenced by the fact that Parliament has decided against the construction of a fifth nuclear power plant. No additional nuclear power plants are likely to be constructed in Finland in the near future.

The impact of the CO_2 tax is reduced by the lack of action at the international level; for reasons of competitiveness the tax remains too low to fully exploit the potential of the measure. The effect of energy taxation is also hampered by the lack of international coordination.

The trajectory assumes rather low GDP growth and high fuel prices, but the assumed income elasticity is on the high side. The effect on estimated emissions might cancel out.

FRANCE

	1990 Emissions ($GgCO_2$)	Trajectory 1990/2000 on CO_2 inventory baseline (%)	Effect of Measures ($GgCO_2$)
Member State Trajectory [1]	366500	8.5	73200
Modified Trajectory		13	

EU target and comments: The initial target was stabilisation at less than 2 tC (7.3 tCO_2) per capita per year by 2000. This is equivalent to a 13% increase relative to 1990 levels, i.e. projected 59.29 million population in 2000. Although this general commitment is still valid, the French have declared that it should no longer be considered as a specific target for the year 2000. Instead there is a commitment to the introduction of measures which should be coordinated and designed relative to a common reference of marginal cost of emission abatement. France suggests that this approach should be taken within the EU as a whole in order to "share" the current stabilisation target, and at the international level in the context of the Berlin Mandate. This target is difficult to express in numerical terms.

Summary of measures: The French Communication recalls that energy policy in France since the first oil shock has already made it possible to significantly reduce CO_2 emissions (more on a per capita basis between 1980-1990 than most other EU countries). Bearing this in mind, the French communication underlines the importance of achieving comparable cost of measures (per tonne of carbon emissions avoided) across the Member States.

Emphasis on energy conservation and fuel switching. Measures include: demand-side management to reduce peak demand generally met by fossil-fuel generation; tax benefits for industry energy efficiency improvements; road tariff increases; subsidies for rail transport. Measures to enhance sinks include afforestation, land-use change (CAP reform) and promotion of wood in construction.

Quantified measures: No link between quantification of measures and projection. The information given in the National Communication is not sufficient to derive a quantitative estimation of the global effect of the set of measures.

Categorisation of measures: The state of implementation of measures remains an uncertainty as the effort made by France is linked to the marginal effort (expressed in ECU/t of equivalent carbon) accepted by other Member States. It would seem that the expected impact is largely expected after 2000.

Projected CO_2 emissions in 2000 relative to target [2]: According to the 'with measures scenario', emissions are expected to increase by 7% in 2000 over 1990 levels. It is very hard to assess the uncertainty pertaining to this projection since it is not clear which measures should contribute to the expected emission reductions. The assumption made is that voluntary energy saving measures such as those described in the communication, are undertaken. The uncertainty is increased by the fact that the assumptions made in the trajectory about GDP growth rates seem low while the assumptions about fuel prices seem high, thus yielding lower emission projections for 2000 (see comparison with modified trajectory in Table A2 or the box above).

[1] Adjusted to be consistent with the same 1990 baseline, the CO_2 inventory for the EU-15.

[2] The discussion is based on Member State trajectories, not applied to the inventory for the EU-15. Therefore there may be small discrepancies between the figures mentioned in the text and the figures provided in the box under Member State Trajectory above.

	1990 Emissions ($GgCO_2$)	Trajectory 1990/2000 on CO_2 inventory baseline (%)	Effect of Measures ($GgCO_2$)
Member State Trajectory [1]	1013000	-13	144330
Modified Trajectory		-10	

Target/Objective and Comments: 25% reduction compared to 1990 levels by 2005. Germany has yet to set a target for the year 2000. The measures described in the German Communication are intended to have an impact by 2005. However, they can be expected to have an effect on emissions already by the year 2000 (possibly contributing to a CO_2 emission reduction in order of magnitude of 13-15% as was mentioned by the German delegate at the fifth Monitoring Committee meeting on 18 May, 1995 and reported in the August 1995 update report to the Commission), although the full effect of measures tend to be achieved in the final implementation stages rather than pro rata throughout the implementation period.

Summary of Measures: A very broad range of measures targeting all sectors. Some of the main measures implemented now are :

- Federal government / länder district heating modernisation programme for the new Bundesländer
- Act on the sale of electricity to the GRID
- Support for local and regional climate protection concepts
- Funding for the use of renewable energies
- Tax breaks for cogeneration under the mineral-oil tax act
- Increase of the mineral-oil tax
- Emissions-oriented motor-vehicle : tax
- Federal traffic infrastructure plan
- Railway structural reform

Measures to enhance sinks include afforestation and forest conservation.

Quantified measures: No measures have been quantified.

Categorisation of Measures: 115 measures listed, 92 of which have been or are under implementation. 21 measures are planned and await adoption.

Projected CO_2 emissions in 2000 relative to target [2]: Given that Germany has not provided a trajectory or a quantification of measures, it is difficult to assess where emissions could be in 2000. In the Monitoring Mechanism Committee Germany announced it expected to reduce emissions by 13-15% by 2000 compared to 1990 levels [3]. It is not clear which measures need to be implemented to achieve this emission reduction or what the current level and effort of implementation is. Given that Germany is a key contributor to CO_2 emissions in the Community, this uncertainty regarding the effect of measures and the level of emissions in 2000, has a significant influence on the level of uncertainty of the assessment of progress towards the Community CO_2 target.

Germany has stated that it will have difficulties reaching the national target (-25% by 2005 compared to 1990 levels) unless a CO_2/energy tax is introduced at the Community level. In this report the assumption has been made that the 13% reduction does not take account of a CO_2/energy tax..

[1] Adjusted to be consistent with the same 1990 baseline, the CO_2 inventory for the EU-15.

[2] The discussion is based on Member State trajectories, not applied to the inventory for the EU-15. Therefore there may be small discrepancies between the figures mentioned in the text and the figures provided in the box under Member State Trajectory above.

[3] Monitoring Mechanism Committee meeting, May 1995.

GREECE

	1990 Emissions ($GgCO_2$)	Trajectory 1990/2000 on CO_2 inventory baseline (%)	Effect of Measures ($GgCO_2$)
Member State Trajectory [1]	86100	14.3	9590
Modified Trajectory		19	

Target/Objective and Comments: Greece has no official target. In the national communication it has set the 'realistic objective' to restrict the total increase in CO_2 emissions between 1990 and 2000 to 15% (with a margin of error of +/-3%).

Summary of measures: The CO_2 strategy is mainly composed of an energy conservation policy covering all sectors and promotion of natural gas and renewable energy sources. In the domestic sector energy conservation measures include energy efficient building/equipment design, new lighting technologies and boiler maintenance. In industry the conservation measures include improvement in auxiliary operations and production modernisation. Measures in the transport sector include promotion of alternative fuels, improved vehicle maintenance, traffic management and development of public transport. No measures regarding the enhancement of sinks (only in conceptual phase).

Quantified Measures:

1.	Introduction of natural gas in electricity generation.	4.2 Mt CO_2
2.	Introduction of natural gas in industry.	0.7 Mt CO_2
3.	Introduction of natural gas in residential-commercial-service sector.	1.1 Mt CO_2
4.	Promotion of CHP.	0.2 Mt CO_2
5.	Improvement in lignite-fired power stations.	0.3 Mt CO_2
6.	Promotion of wind farms.	1.0 Mt CO_2
7.	Promotion of solar energy applications.	1.0 Mt CO_2
8.	Promotion of biomass utilisation.	0.9 Mt CO_2
9.	Promotion of small hydroelectric works.	0.2 Mt CO_2
10.	Promotion of geothermal energy utilisation.	0.06 Mt CO_2
11.	Renewable energy pilot projects.	0.1 Mt CO_2
12.	Energy efficient building/equipment design for household and tertiary sector.	0.0 Mt CO_2
13.	New lighting technologies for household and tertiary sector.	0.7 Mt CO_2
14.	Boiler maintenance in household and tertiary sector.	0.4 Mt CO_2
15.	Improvement in auxiliary operations in industry.	0.5 Mt CO_2
16.	Production modernisation in industry.	0.8 Mt CO_2
17.	Promotion of alternative fuels in transport.	0.05 Mt CO_2
18.	Improved maintenance of vehicles and use of more energy efficient vehicles.	0.3 Mt CO_2
19.	Rational management of transport system.	0.45 Mt CO_2
20.	Up-grading and modernisation of public transport.	0.4 Mt CO_2
TOTAL	**13.4 Mt CO_2**	

[1] Adjusted to be consistent with the same 1990 baseline, the CO_2 inventory for the EU-15.

Categorisation of Measures: The plan focuses on measures which have already been adopted by the Government.

Projected CO_2 Emissions in 2000 Relative to Target/Objective[1]: In the most realistic scenario, Greece estimates that it will increase its emissions by 15 % ,+/- 3% by the year 2000 compared to 1990 levels if the measures quantified above are introduced. The underlying assumption is that the measures in the power generation sector has a 100% impact but that the penetration of natural gas and other measures only have a 75% and 67% impact respectively.

In a worst case scenario, emissions could increase by 18% in 2000 compared to 1990 levels. This could happen if there is a major failure on the part of administration particularly regarding the funding of the implementation of measures, if the funds have not been distributed as they should or if they have been misused. Other problems that could arise are delays in the construction of natural gas power plants or drastic changes in the demand for energy e.g. through the spreading of air-conditioning to the whole domestic sector.

In a best case scenario, the increase in emissions could be limited to 12%. This could happen if the power generation sector accelerates the introduction of new technologies in the lignite-fuelled stations, if the penetration of natural gas was 100% successful by 2000, if gas-fired stations are used to meet base load, if a target is set to achieve maximum possible substitution to natural gas in the household and tertiary sector, if availability of private funding for the promotion of renewables is larger than expected, if the energy efficient technology available on the market penetrated the household and tertiary sector, if energy efficiency standards and labelling are introduced, and if public funding is made available for investment in core infrastructure.

While models show that the effect of a CO_2 tax of between $3-$10/bbl, would have a limited effect on the level of CO_2 emissions, such a tax could increase the availability of public funding for the financing of technological interventions. That would secure the outcome of the most likely scenario, namely a 15% emission increase, and improve the chances of achieving the best case scenario, an increase of only 12%.

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[1] The discussion is based on Member State trajectories, not applied to the inventory for the EU-15. Therefore there may be small discrepancies between the figures mentioned in the text and the figures provided in the box under Member State Trajectory above.

	1990 Emissions ($GgCO_2$)	Trajectory 1990/2000 on CO_2 inventory baseline (%)	Effect of Measures ($GgCO_2$)
Member State Trajectory [1]	30720	20.5	1390
Modified Trajectory		25	

Target/Objective and Comments: Ireland has no official target but an objective of limiting the increase in emissions to 20% above 1990 levels by 2000.

Summary of measures: Emphasis on energy conservation plus government action on fuel switching. Measures include combined heat and power projects, promotion of alternative energy sources, construction of efficient peat-fired power plant, establishment of an energy centre to coordinate the energy conservation programme, information campaigns for energy conservation, improved insulation in buildings, development of public transport in urban centres. Industry will contribute to reducing CO_2 emissions through voluntary agreements. Measures aimed at enhancing sinks include afforestation and reafforestation.

Quantified Measures:

1.	Demand-side management in domestic, tertiary and industrial sector.	0.27 Mt CO_2
TOTAL 0.27 Mt CO_2		

Categorisation of Measures: Most measures described in the plan are under implementation, including those aimed at enhancing sinks.

Projected CO_2 Emissions in 2000 Relative to Target/Objective [2]: Ireland estimates that by implementing the measures described in the plan, it can limit the increase in CO_2 emissions to 20% over 1990 levels. This assessment does not take account of the potential introduction of a combined CO_2/energy tax.

Ireland was the fastest growing economy in the OECD area in 1994 [3] and the ability to meet the 20% objective and maintain emissions at that level is more linked to the future level of economic growth than to the implementation of the measures in the CO_2 strategy.

[1] Adjusted to be consistent with the same 1990 baseline, the CO_2 inventory for the EU-15.

[2] The discussion is based on Member State trajectories, not applied to the inventory for the EU-15. Therefore there may be small discrepancies between the figures mentioned in the text and the figures provided in the box under Member State Trajectory above.

[3] OECD Economic Outlook (57), June 1995.

	1990 Emissions ($GgCO_2$)	Trajectory 1990/2000 on CO_2 inventory baseline (%)	Effect of Measures ($GgCO_2$)
Member State Trajectory [1]	**436300**	2.9	54370
Modified Trajectory		6	

Target/Objective and Comments: Stabilisation at 1990 levels by 2000.

Summary of measures: Broad range of measures including decommissioning of oil-fired electricity plant and establishment of gas-fired generation; new investment in renewables; traffic limitation measures; encouragement of public transport; new energy efficiency standards for the household sector; voluntary agreements with industry for environmental quality improvements. The measures aimed at enhancing sinks focus on reforestation, forest management and promotion of forest and brushwood products.

Quantified measures: No quantified measures.

Categorisation of measures: Measures divided into those which are already adopted and additional initiatives to limit CO_2 emissions. The former category includes measures for the power generation sector (NEP 1988) and measures for co-generation and auto-production, which were adopted independently of the CO_2 limitation strategy. The latter category includes measures for the residential/commercial and transport sector and for industry.

Projected CO_2 emissions in 2000 relative to target [2]: Italy does not expect to stabilise emissions in 2000 (overshoot of 1-5%). It is not clear which measures are in included in this trajectory or what the stage of implementation is of the measures described in the CO_2 strategy. In spite of this uncertainty, the calculated effect of measures is very high. Based on the imprecise information in the national communication, it is difficult to understand how Italy plans to achieve even its projected emission level. Italy has stated that stabilisation can only be achieved if a CO_2/energy tax is introduced at Community level.

Considering that Italy is one of the main contributors to Community CO_2 emissions, this uncertainty regarding its emissions in 2000 has an important influence on the assessment of progress towards the Community target.

[1] Adjusted to be consistent with the same 1990 baseline, the CO_2 inventory for the EU-15.

[2] The discussion is based on Member State trajectories, not applied to the inventory for the EU-15. Therefore there may be small discrepancies between the figures mentioned in the text and the figures provided in the box under Member State Trajectory above.

	1990 Emissions ($GgCO_2$)	Trajectory 1990/2000 on CO_2 inventory baseline (%)	Effect of Measures ($GgCO_2$)
Member State Trajectory [1]	13300	-24.1	7820
Modified Trajectory		-20	

Target/Objective and Comments: Stabilisation by the year 2000 at 1990 levels.

Summary of measures: The plan focuses on the power generation sector and the transport sector. Some measures include feasibility studies on the use of gas vapour turbines, pilot project with gas turbine and hydro power, introduction of cogeneration in buildings and investigation of other uses of cogeneration, investigation of potential for renewable energy sources, promotion of public transport, development of intermodal freight transport, promotion of rail transport and internal waterways, investigation of vehicle tax based on energy consumption. Luxembourg is also considering to introduce a CO_2 tax. No measures to enhance sinks.

Quantified Measures: None.

Categorisation of Measures: Measures which fall in the category under implementation include for the most part the legislative framework for environmental policy and certain subsidies for energy efficiency measures in the domestic sector. The majority of the measures are planned, including measures for the power generation sector and the transport sector. Some are even on a conceptual stage. The most important 'measure' is the restructuring of the steel industry which will make the principal contribution to reducing CO_2 emissions but which is being undertaken for other policy reasons than climate change.

Projected CO_2 Emissions in 2000 Relative to Target/Objective [2]: Luxembourg expects CO_2 emissions to fall by 33% by 2000 compared to 1990 levels. The bulk of the reduction comes from the restructuring of the steel industry, where electric steel works will replace old steel works. This restructuring has already been initiated and is well under way. The construction of a gas-vapour turbine for residential heating is planned. There is no reason to believe that the 33% reduction will not be achieved in 2000.

[1] Adjusted to be consistent with the same 1990 baseline, the CO_2 inventory for the EU-15.

[2] The discussion is based on Member State trajectories, not applied to the inventory for the EU-15. Therefore there may be small discrepancies between the figures mentioned in the text and the figures provided in the box under Member State Trajectory above.

	1990 Emissions ($GgCO_2$)	Trajectory 1990/2000 on CO_2 inventory baseline (%)	Effect of Measures ($GgCO_2$)
Member State Trajectory [1]	151800	-0.4	**9900**
Modified Trajectory		10	

Target/Objective and Comments: Temperature corrected target is reduction of 3% .

1990 was an unusually warm year so emissions from space heating were lower than in a normal year. The Dutch inventory for 1990 on which the target is based has been adjusted using degree-day statistics to produce a 1990 total which is 3.8% higher than actual emissions. This means that the Dutch target, a 3% reduction from 1990 temperature corrected levels, is equivalent to a 0.7% increase over unadjusted emissions. Since the Community inventory for 1990 is not temperature corrected, it is more appropriate to refer to the non-temperature corrected target which is generally accepted to be a "return to target".

Summary of measures: Focus on energy conservation and energy efficiency improvements using voluntary agreements in the industrial, agricultural and public sectors. The plan includes the following measures: investment in cogeneration and subsidies for renewable energy; voluntary agreements for energy conservation in industry, public and agricultural sectors; energy conservation programme for SMEs; energy efficiency standards and regulations for households and buildings; demand-side management based on subsidies and information. Fuel taxes have been introduced and the rate is determined on the basis for energy and carbon content. A legislative proposal is being considered to increase the CO_2 rate for small consumers, but it is considered that unless there is progress on an EU tax, the rate for large consumers must remain unchanged. Measures in transport sector taken for other reasons than climate change but include vehicle related measures to improve energy efficiency, limiting growth of mobility by using economic instruments, encouraging modal shift through a comprehensive investment programme in infrastructure, promotion of intermodal freight transport. Measures to enhance sinks include afforestation and land-use change under CAP.

Quantified Measures:

TOTAL 9900 Gg

Categorisation of Measures: The measures described above have been approved by Parliament and necessary funds for the implementation of the measures have been set aside in the annual budget. Some important measures are already under implementation, primarily the voluntary agreements for industry and agriculture. In industry 20 agreements and 9 declarations of intent are in place, covering 75% of industrial energy use. In agriculture, the agreement with glasshouse horticulture covers 85% of agricultural energy use.

However, the measures in the transport sector have been implemented for other reasons than climate change. Although there is a commitment to implement the transport measures before 2000, there is no defined time frame for the implementation.

Measures under consideration include the introduction of a regulatory tax on energy. Other measures under consideration include efficiency requirements for electric appliances and efficiency requirements for passenger cars, both at Community level.

Projected CO_2 Emissions in 2000 Relative to Target/Objective [2]: If the above mentioned measures are implemented, then the Netherlands could stabilise emissions at 1990 levels by 2000, based on unadjusted figures which is the equivalent of just over a 3% reduction in emissions using temperature adjusted figures. The contribution of the transport sector to this reduction is assumed to be zero, so the uncertainty related to the implementation of the measures in that sector does not influence projected emission levels in 2000.

[1] Adjusted to be consistent with the same 1990 baseline, the CO_2 inventory for the EU-15.

[2] The discussion is based on Member State trajectories, not applied to the inventory for the EU-15. Therefore there may be small discrepancies between the figures mentioned in the text and the figures provided in the box under Member State Trajectory above.

PORTUGAL

	1990 Emissions ($GgCO_2$)	Trajectory 1990/2000 on CO_2 inventory baseline (%)	Effect of Measures ($GgCO_2$)
Member State Trajectory [1]	42500	36	7030
Modified Trajectory		36	

Target/Objective and Comments: Portugal has no official target but an 'objective' to limit the increase in CO_2 emissions to 40% over 1990 levels.

Summary of measures: The plan presents a broad range of measures, for all sectors. The measures include the introduction of natural gas, CHP, improved efficiency in power generation, energy conservation in end-use, subsidies and information campaigns for energy efficiency improvements in industry, promotion of rail transport, modernisation of road infrastructure, traffic management. Measures to enhance sinks include forest maintenance, afforestation, forest protection.

Quantified Measures: None.

Categorisation of Measures: Measures under implementation include those for the energy, industrial and residential sectors which are linked to programmes (often EU programmes) that have been in place for some time. The stage of implementation of the measures in the transport sector is unclear, but it would seem that they are only in the conceptual or at best in the planned phase.

Projected CO_2 Emissions in 2000 Relative to Target/Objective [2]: Assuming that all of the measures included in the plan are implemented, Portuguese CO_2 emissions are expected to increase by 40%. However, it would seem that the implementation of the measures in the transport sector is uncertain. Since it is not clear to what extent the transport sector is expected to contribute to limiting the increase in CO_2, it is difficult to assess the impact of this uncertainty on the expected emission level in 2000. However, as in the other cohesion countries, emission levels are more linked to economic growth than to the implementation of the measures included in the CO_2 strategy. The actual increase in emissions between 1990 and 1993, years of low economic growth, indicates that a lower increase than 40% could be achieved in 2000.

[1] Adjusted to be consistent with the same 1990 baseline, the CO_2 inventory for the EU-15.

[2] The discussion is based on Member State trajectories, not applied to the inventory for the EU-15. Therefore there may be small discrepancies between the figures mentioned in the text and the figures provided in the box under Member State Trajectory above.

	1990 Emissions ($GgCO_2$)	Trajectory 1990/2000 on CO_2 inventory baseline (%)	Effect of Measures ($GgCO_2$)
Member State Trajectory [1]	227300	20.8	59470
Modified Trajectory		23	

Target/Objective and Comments: Spain had initially forecasted a limited increase in emissions of 25% over 1990 levels by 2000. This limited increase has been revised downwards to a band of 11-13% [2]

Summary of measures: Measures focus on energy conservation and fuel switching. The conservation measures are mainly geared towards industry (burners, furnaces, more efficient technology), transport (technical and management measures), and residential/commercial sector (technical regulations, user awareness). Fuel switching measures include promotion of natural gas in industry (e.g. in cement and steel production as well as in combustion equipment), and in the residential sector (for space heating), as well as promotion of renewable energy (e.g. hydro and wind power) and CHP. Other measures include subsidisation of public transport, investment in rail infrastructure, and tax exemptions for gas oil used in rail transport. Measures to enhance sinks include afforestation, forest management, protection against forest fires, damage monitoring.

Quantified Measures: None.

Categorisation of Measures: The energy related measures are included in the Spanish National Energy Plan which runs from 1991-2000. Implementation of those measures has thus begun. The measures specified in the transport sector have been implemented. The measures to enhance sinks are under implementation.

Projected CO_2 Emissions in 2000 Relative to Target/Objective [3]: It is estimated that Spain will meet its objective for 2000, 25% increase over 1990 levels [4]. As in the other cohesion countries, emission levels are more linked to economic growth than to the implementation of measures in the plan. Considering the low economic growth between 1990 and 1993 and depending on the level of economic growth in the coming years, it may even do somewhat better than limiting the emission increase to 25%.

[1] Adjusted to be consistent with the same 1990 baseline, the CO_2 inventory for the EU-15.

[2] **Monitoring Mechanism Committee meeting, May 18, 1995.**

[3] The discussion is based on Member State trajectories, not applied to the inventory for the EU-15. Therefore there may be small discrepancies between the figures mentioned in the text and the figures provided in the box under Member State Trajectory above.

[4] This objective has subsequently been revised downwards to a band of 11-13%. However, in the trajectories on this report, the figure 25% has been used.

SWEDEN

	1990 Emissions ($GgCO_2$)	Trajectory 1990/2000 on CO_2 inventory baseline (%)	Effect of Measures ($GgCO_2$)
Member State Trajectory [1]	61300	4.4	10200
Modified Trajectory		6	

Target/Objective and Comments: Stabilisation at 1990 levels by 2000.

Summary of measures: The focus of the CO_2 strategy is to switch from fossil fuels to renewable energy sources, improving energy management and more efficient use of energy. Measures to improve energy efficiency include technology procurement and demonstration of electricity efficient products, processes and systems in homes, non-housing premises and industry. Economic instruments play an important role in the strategy, e.g. CO_2 and energy taxes which have a cross-sectoral effect. Fuel taxation and R&D (alternative fuels and energy efficient vehicles) are the only measures that have been taken in the transport sector. In the forestry sector, measures include forest maintenance/management, and promotion of long-lived wood products.

Quantified Measures:

1.	Carbon taxes - energy sector.	5.3 $MtCO_2$
2.	Gasoline tax and carbon tax - transport sector.	2.2 $MtCO_2$
3.	Efficiency programme.	2.1 $MtCO_2$
4.	Investment programme - biofuels.	0.6 $MtCO_2$
5.	Others.	0.2 $MtCO_2$
TOTAL 10.4 $MtCO_2$		

Categorisation of Measures: Majority of measures are under implementation.

Projected CO_2 Emissions in 2000 Relative to Target/Objective [2]: With present measures to combat climate change, total emissions of carbon dioxide are projected to increase slightly (eg 4 per cent) above 1990 levels in the year 2000. This projection is based on unadjusted data (non temperature corrected). If temperature adjustment is made for emissions in 1990 (3%) then stabilisation is achieved in 2000. This projection does not take account of energy and carbon tax increases which occurred in 1994. Considering that the majority of measures are in place, including a CO_2/energy tax, there is no reason to believe that Sweden cannot meet this projection.

However, the forecast assumes that the phase-out of nuclear power is not initiated before 2000. Even if it is not begun immediately, it will be difficult to avoid meeting the increasing eneergy demand with fossil fuels. However, there is a large potential to increase biofuels in Sweden, especially in combined heat and power stations and for heating purposes [3]. Once the nuclear phase-out is begun, CO_2 emissions from power generation will increase substantially. A final decision on the nuclear phase out has yet to be taken.

[1] This objective has subsequently been revised downwards to a band of 11-13%. However, in the trajectories of this report, the figure 25% has been used.

[2] The discussion is based on Member State trajectories, not applied to the inventory for the EU-15. Therefore there may be small discrepancies between the figures mentioned in the text and the figures provided in the box under Member State Trajectory above.

[3] According to the Act on Management on Natural Resources the remaining major rivers are protected to hydro power exploitation

	1990 Emissions ($GgCO_2$)	Trajectory 1990/2000 on CO_2 inventory baseline (%)	Effect of Measures ($GgCO_2$)
Member State Trajectory [1]	577000	-6.1	71740
Modified Trajectory		-2	

Target/Objective and Comments: Stabilisation at 1990 levels in 2000.

Summary of measures: Fuel switching and energy efficiency using economic instruments, regulations and information/education including: increased electricity generation from gas, CHP and renewables; establishment of the Energy Savings Trust to promote energy efficiency and conservation; increase in road fuel duties; introduction of VAT on domestic fuel and power; eco-labelling and energy labelling; revision of building standards.

Quantified Measures [2]:

1.	Energy conservation in the home (VAT on domestic fuel use, new Energy Saving Trust, energy efficiency advice/information, eco-labelling, EC SAVE programme, revision of Building Regulations to strengthen energy efficiency requirements).	14664 $GgCO_2$
2.	Energy consumption by business (energy efficiency advice/information, Energy Saving Trust schemes for small businesses, Energy Design Advice Scheme, EC SAVE programme, revision of Building Regulations to strengthen energy efficiency requirements).	9165 $GgCO_2$
3.	Energy consumption in public sector (targets for central and local government and public sector bodies).	3666 $GgCO_2$
4.	Transport (increases in road fuel duties and commitment to real increases of at least 5% on average in future budgets).	9165 $GgCO_2$
TOTAL **36,660 $GgCO_2$**		

Categorisation of Measures: Most of the measures in place. However, many measures are voluntary or dependent on uncertain funding.

Projected CO_2 Emissions in 2000 Relative to Target/Objective [3]: The UK expects emission reductions as a result of the establishmentof an Energy Saving Trust. Due to changes in the anticipated level of funding, the contribution is now expected to be lower (at a minimum of 0.3 MtC, aquivalent to 1.1 $MtCO_2$) than originally estimated - although further schemes are being developed by the Trust which will contribute further savings. However, even taking into account the reduced contribution from the Energy Saving Trust, UK CO_2 emissions are now expected to be below 1990 levels, more as a result of fuel switching than of energy conservation.

[1] Adjusted to be consistent with the same 1990 baseline, the CO_2 inventory for the EU-15.

[2] The re-assessment of the contribution to be made by the Energy Saving Trust is not reflected in the table which is taken from the National Programme.

[3] The discussion is based on Member State trajectories, not applied to the inventory for the EU-15. Therefore there may be small discrepancies between the figures mentioned in the text and the figures provided in the box under Member State Trajectory above.

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