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Accompanying the

COMMUNICATION FROM THE COMMISSION

**FIFTH NATIONAL COMMUNICATION FROM THE EUROPEAN COMMUNITY
UNDER THE UN FRAMEWORK CONVENTION ON CLIMATE CHANGE
(UNFCCC)**

**(required under Article 12 of the United Nations Framework Convention on Climate
Change)
Part 1**

[COM(2009) 667 final]

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1. INTRODUCTION

This document represents the European Community's (EC) 5th National Communication (NC) required under the United Nations Framework Convention on Climate Change (UNFCCC). It provides a comprehensive overview of climate change-related activity at the EC level. The 27 Member States of the European Union submit separate NCs to the UNFCCC, however, in the EC's submission the chapters on Greenhouse Gas Inventory Information (see section 3) and Projections and the Total Effect of Policies and Measures (see section 5) reflect the sum of information compiled across the Member States.

A summary table outlining the location of supplementary information required under Article 7, paragraph 2, of the Kyoto Protocol within this National Communication is provided in Appendix I.

As part of the preparation of the European Community's 5th National Communication (NC) a 6 week consultation was held from end of March to beginning of May 2009. This invited feedback from European organisations with a relationship to the climate change agenda, to help enhance the quality of the new NC. Ten responses were received as part of the exercise.

An online questionnaire asked stakeholders the following questions:

1. What did the European Commission report well in the Fourth National Communication?
2. What would your organization have liked to have seen reported differently in the Fourth National Communication? Do you have any specific suggestions for improvements?
3. Does your organization have access to particular information that you believe could add value to the Fifth National Communication, noting that the primary information in the Fifth National Communication must come from official EU sources.
4. Does your organization have illustrative examples of recent European activities on climate change?
5. Please make a statement about your view of the recent progress of EU Climate Change policy (either in general or on a specific aspect most relevant to your organization).

The responses to question 1 highlighted the comprehensiveness of the document and its usefulness in communicating the wide-range of EC activity on climate change and so this has been maintained in the 5th NC.

The responses to question 2 provided a small number of potential improvements to the 4th NC. Some of these were not possible to include directly within the 5th NC as, for example,

they were based on non-official sources of information. However, where possible they have been incorporated – for example, with respect to the presentation of additional information in tables and figures.

Similarly, the responses to question 3 provided a range of suggestions for additional information, but many of these were not from official sources. However, information from a small number of EC commissioned studies (e.g. on climate change and unemployment) that had not been included in earlier drafts of the 5th NC was subsequently added.

The responses to questions 4 and 5 are most relevant within the context of EC policies and measures and so are discussed in section 4.11.

2. NATIONAL CIRCUMSTANCES RELEVANT TO GREENHOUSE GASES

Key developments

Population

- The EU now comprises 27 Member States following the accession of Bulgaria and Romania on 1st January 2007. The EU-27's population has continued to grow, at around 0.3 % per annum, a similar trend to the 4th NC.

Economy

- EU-27 GDP has continued to grow steadily (at around 2.3 % from 1995-2007) and at a similar rate to the 4th NC. This has been driven primarily by strong growth in the services sector.

Energy

- Total primary and final energy consumption grew over the period from 1990-2007 (around 0.5 % per annum), although this has stabilized in recent years.
- The trend reported in the 4th NC of a shift in the primary fuel mix from coal to gas has continued. However, the rate of growth in renewables (driven largely by biomass and waste) has increased from 2002 onwards. A similar trend can be seen in the fuel mix for electricity generation, with renewables now contributing 16 %.
- EU-27 per capita energy consumption grew over the period from 1990 to 2003, but has started to decline slowly from this point. By comparison, the gradual decline in energy primary energy intensity from around 1996 onwards has continued.
- The EU's dependence on imported fossil fuels has increased more rapidly in the period since the 4th NC, leading to concerns about energy security.

Transport

- The rise in final energy consumption has been driven to a large extent by continued growth in demand for energy in transport.
- As reported in the 4th NC both freight and passenger transport has continued to grow strongly since 1990. Growth in freight transport has exceeded GDP growth in recent years, however growth in passenger transport is beginning to show a slight decoupling from economic growth.

Land-use, agriculture and forestry

- In general the share of land used for agriculture has declined in most Member States by around 10 % from 1990 to 2005. Forested area (excluding other wooded land area) has increased by around 8 % over the same period.

2.1. Introduction

This chapter documents the national circumstances of the European Community (EC). It illustrates a number of key characteristics that relate directly or indirectly to the greenhouse gas emissions and include energy, transport, land use, climatic conditions and trade patterns. The chapter analyses how these various factors have influenced greenhouse gas emissions to-date and how the historic trends observed might influence emissions going forward.

Data is reported as the aggregate of the Member States which comprise the European Union (EU), both the EU-15 and EU-27¹ (where data is available), as the former has a collective emissions reduction target under the Kyoto Protocol. Information is also reported at the Member State level where appropriate.

The 4th National Communication focused primarily on the period from 1990 to 2002. This communication extends the analysis to the most recent years for which data is available (generally 2005 to 2007), changes in trends since 2002 are highlighted. A number of additional indicators have also been included²:

- An updated average EU temperature profile map (section 2.5)
- GDP (Gross Domestic Product) in PPS (Purchasing Power Standards) across EU Member States (section 2.6.1)
- Primary energy intensity (GDP in PPS) and per capita consumption across Member States (section 2.7.1)
- Share of renewable energy in final energy consumption by Member State (section 2.7.2)
- Change in end-user energy prices (section 2.7.4)
- Level of car ownership across Member States (section 2.8.2)
- Road transport fuel prices and tax levels (section 2.8.3)

¹ The *EU-15* comprises the Member States: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Ireland, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom. The *EU-27* comprises the Member States of the EU-15 and: Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia
In some cases, due to data availability, the *EU-25* is referred to – this is as per the EU-27 but excluding Bulgaria and Romania.

² In other cases, the information in previous indicators has been expanded or consolidated within other indicators.

- Decomposition of drivers of the change in household energy consumption (section 2.11)
- Per employee and per m² energy consumption in the services sector (section 2.11)
- Index of EU-15 nitrogenous fertilizer consumption and livestock numbers per capita (section 2.12)

2.2. Government structure

The European Union's institutional system is unique. The Member States (of which there are currently 27) delegate sovereignty for certain matters to independent institutions, which represent the interests of the Union as a whole, its member countries and its citizens³. Each national government is represented within the Council of the European Union and its citizens directly elect the European Parliament. The European Commission is the executive body of the Union and is responsible for drafting and implementing legislation. It also represents the Union on the international stage and negotiates international agreements, chiefly in the field of trade and co-operation. The structure is described in detail in the 3rd National Communication.

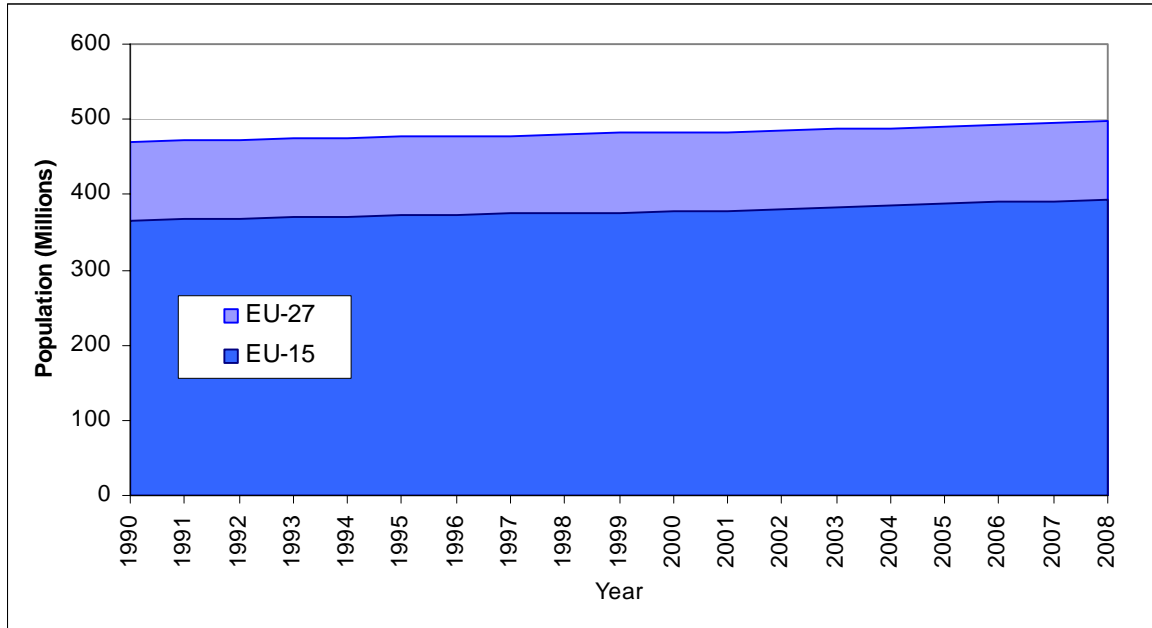
The sixth enlargement to the EU took place on 1st January 2007 with the accession of Romania and Bulgaria.

2.3. Population profile

In general, aggregate increases in population in the EU will be drivers for increasing consumption, energy use and greenhouse gas emissions. Over the last 18 years the EU-27's population has increased steadily by an average of 0.3 % annually. The total population increase compared to 1990 is a 5.8 % increase. There is a similar trend in the EU-15 countries, with an annual average increase of around 0.4% over the same period. The trend has not changed significantly since the 4th NC. Trends in per capita GHG emissions are shown in section 3.2.6.1.

³ http://europa.eu/institutions/index_en.htm

Illustration 2-1 Aggregate EU-27 population



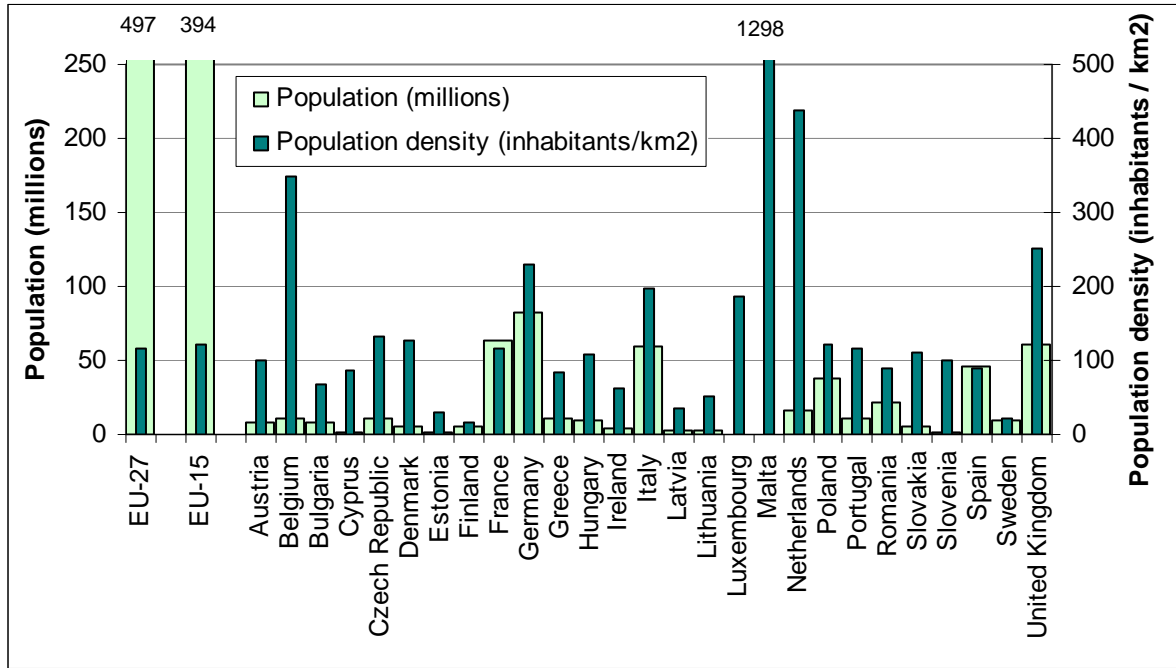
Note: Population on 1st January of each year. Data for population in French overseas territories in 1990 is not available from Eurostat. This has been added based on data from the French statistical office INSEE.

Source: Eurostat

Populations of Member States vary considerably, between 0.4 million for Malta and 82.2 million for Germany. In addition, population density varies between 15.7 inhabitants/km² in Finland to 1,298 inhabitants/km² in Malta. The four most populous states (Germany, France, the United Kingdom and Italy) all have population densities of over 100 inhabitants/km².

Most EU Member States have a relatively high population density when compared to other Parties to the UN Convention. As higher population densities have implications for settlement and building patterns, this leads to differences in energy consumption and a tendency for shorter transport distances. However, shorter transport distances in turn facilitate economic integration among communities and regions, resulting in a tendency for higher transport intensity. So in this respect population density can have both a positive and negative impact on greenhouse gas emissions.

Illustration 2-2 EU Member State population and population density, 2008



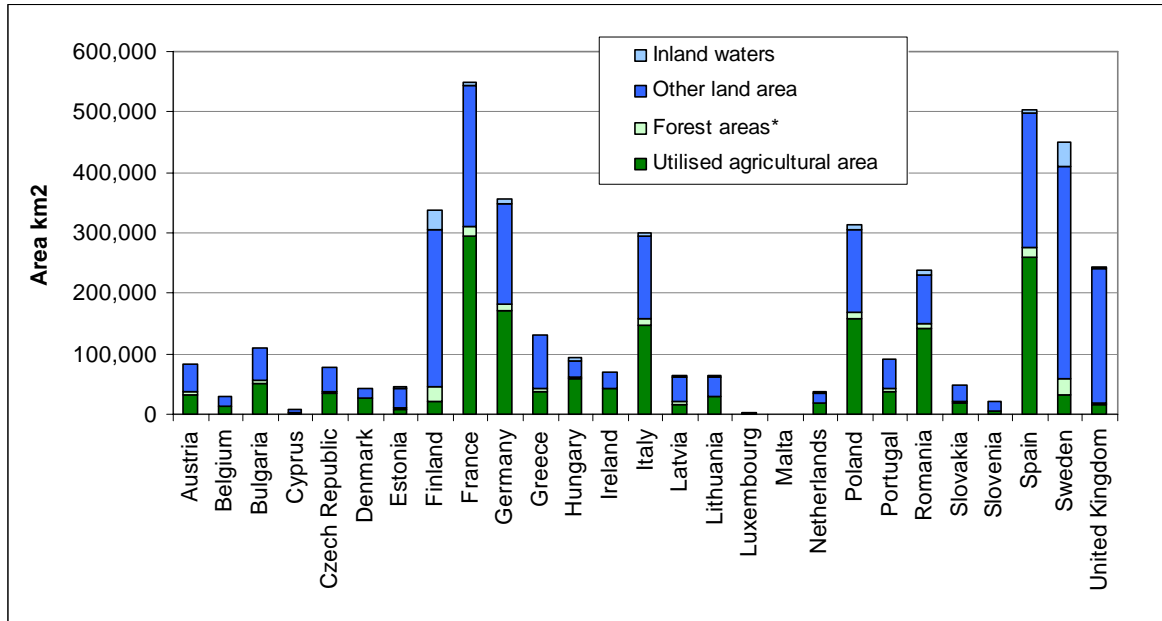
Note: Population on 1st January of each year.

Source: Eurostat

2.4. Geographic profile

Total land area and its use varies widely across the EU. The proportion of land that is used for agricultural purposes varies throughout the Member States, from as low as 7 % in Finland to 66% in the United Kingdom in 2005. Furthermore, how the agricultural land is used also varies widely between Member States. Agriculture generates significant greenhouse gas emissions, this is discussed in more detail in Section 2.12. Forest and other wooded areas are also important for greenhouse gas emissions in terms of their role as carbon sinks, see section 2.13 for further details. Changes in land-use will be driven to some extent via policy actions in the agricultural sector (see section 4.7), particularly the Common Agricultural Policy as well as those in the forestry sector (see section 4.8).

Illustration 2 - 3 Land use patterns in the EU by Member State, 2005



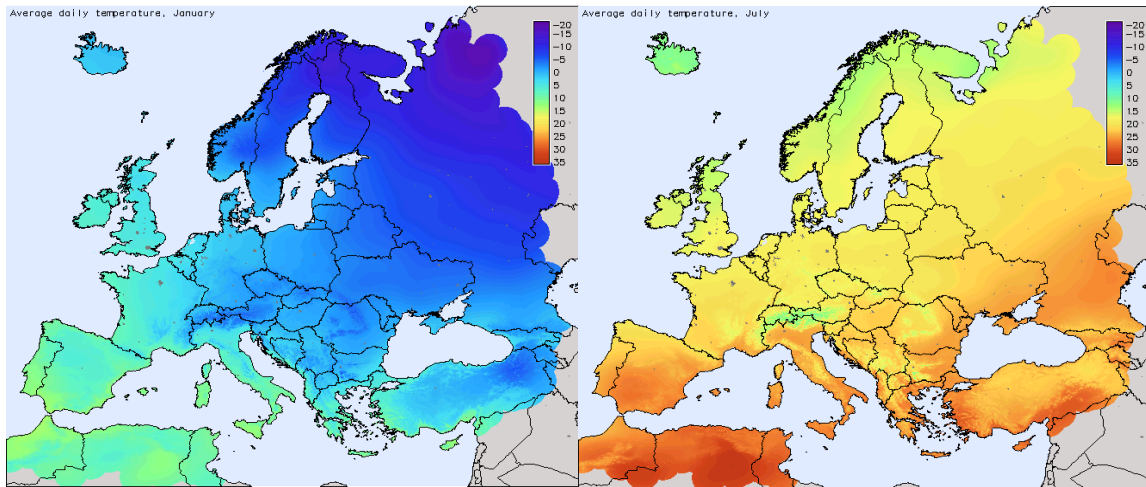
Note: Forest areas excludes Other Wooded Land given overlap in some definitions between this and Utilised Agricultural Area, see section 2.13 for further data. For consistency, 2005 data have been used as far as possible (N.B. there is negligible difference in total land area between years). In some cases gap filling is necessary, Utilized agricultural area for the UK and Bulgaria are based on 2003 and 2006 data respectively – see section 2.12 for further details on agriculture. Inland water area for Germany and Portugal are based on 2001 data.

Source: Eurostat, UNECE Forestry Statistics

2.5. Climate profile

EU Member States close to the Atlantic Ocean or the North Sea generally experience relatively low temperature variations between summer and winter and relatively high rainfall. By contrast, Scandinavian countries (i.e. Denmark, Finland and Sweden) tend to have mild summers and cold winters. The central European States have mild winters and mild summers, with more continental climatic conditions further east. The countries bordering the Mediterranean Sea (Spain, France, Italy, Malta, Slovenia and Greece) generally have a hot, dry summer climate and mild, often rainy winters, although there are differences between regions.

Illustration 2 - 4 Average daily EU temperature in January and July (1995-2006)



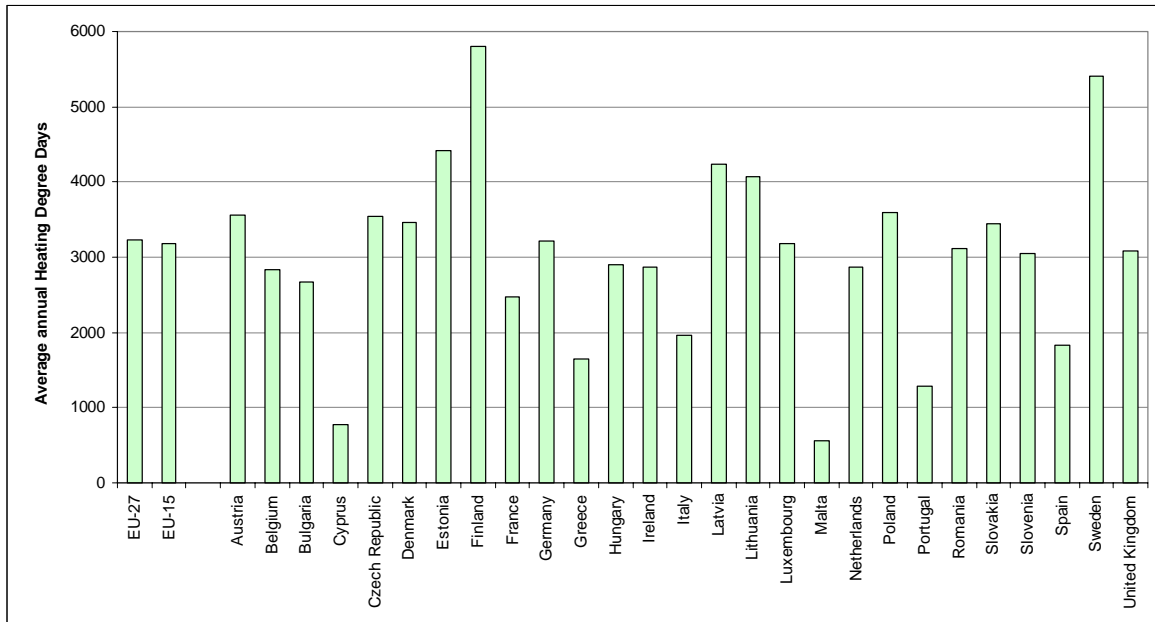
Source: PVGIS © European Communities, 2001-2008⁴

The energy requirements and emissions in both winter months (for space heating) and summer months (for air conditioning) vary according to the temperature. The figure above illustrates the average daily temperatures in January and July, and the figure below shows the average annual number of heating degree days in each Member State. Requirements for space heating are particularly high in the northern and eastern Member States, whilst in summer months the Southern and Eastern states will often experience average temperatures of more than 25 degrees Celsius. Tracking of cooling degree days⁵ will also become of increasing importance, particularly given the demand this places on electricity consumption for space cooling. In some countries, such as Greece, peak electricity demand tends to occur in summer months whereas for the majority of others it is still over the winter period.

⁴ Huld T.A., Šúri M., Dunlop E.D., Micale F., *2006*. <http://dx.doi.org/10.1016/j.envsoft.2005.07.010> Estimating average daytime and daily temperature Profiles within Europe <http://dx.doi.org/10.1016/j.envsoft.2005.07.010> Environmental Modelling & Software, 21, 12, 1650-166, <http://re.jrc.ec.europa.eu/pvgis/>

⁵ EU-27 data is generally more limited at present.

Illustration 2 -5 Average annual heating degree days by Member State (1980 to 2007)



Note: ADD: Actual heating degree-days express the severity of the cold in a specific time period taking into consideration outdoor temperature and room temperature. To establish a common and comparable basis, Eurostat defined the following method for the calculation of heating degree days $(18\text{ }^{\circ}\text{C} - T_m) \times d$ if T_m is lower than or equal to $15\text{ }^{\circ}\text{C}$ (heating threshold) and are nil if T_m is greater than $15\text{ }^{\circ}\text{C}$ where T_m is the mean $(T_{min} + T_{max} / 2)$ outdoor temperature over a period of d days. Calculations are to be executed on a daily basis ($d=1$), added up to a calendar month -and subsequently to a year- and published for each Member State separately.

Source: Eurostat

In addition, as noted in the 4th National Communication, the base year for Kyoto reduction commitments was relatively warm compared to the long-run average temperature. If the first commitment period (2008-2012) conforms to the long-run average there may be additional pressure on emissions due to higher heating requirements.

2.6. Economic profile

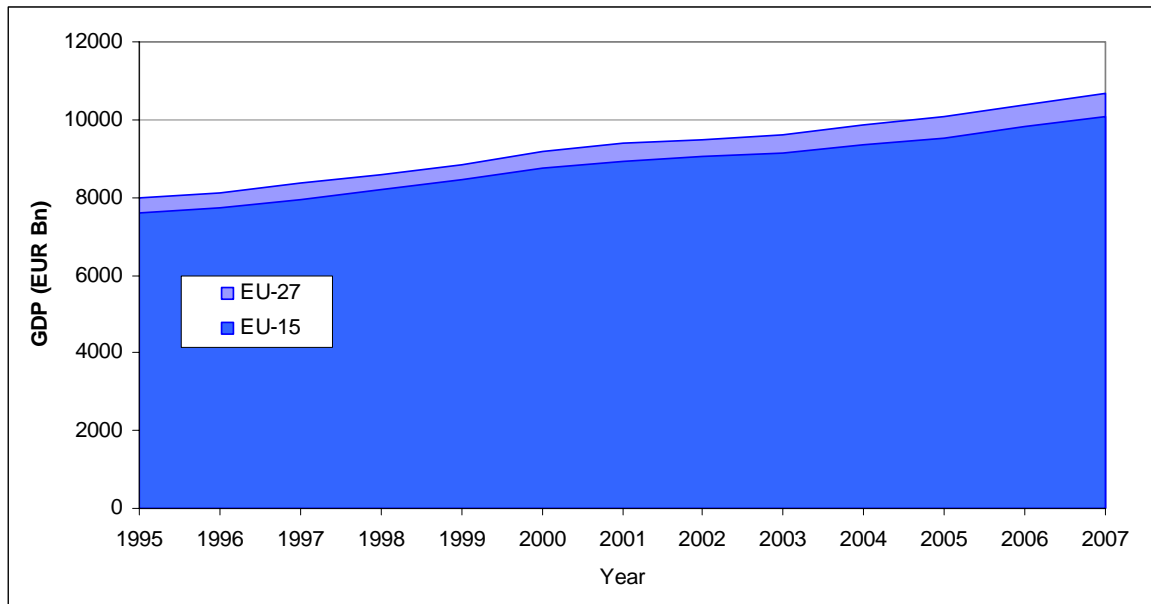
The economic profile of a country has a strong link to greenhouse gas emissions, with the overall level and types of economic activity, strongly correlated to energy use. However, this is also dependent on factors such as energy efficiency and the structure of the economy. Trends in these key economic factors are discussed below with the overall impact on energy intensity discussed in Section 2.7; trends in emissions intensity are shown in section 3.2.6.1.

2.6.1. Changes in overall Gross Domestic Product (GDP)

For the EU-27, GDP has increased 34 % (in absolute terms) from 1995 to 2007. When looking only at the EU 15 states, GDP has roughly followed the same pattern as the wider EU-27 with an overall increase in GDP of 32 %. The EU-15 countries account for around

94 % of all EU GDP. The trend in economic growth has not changed significantly since the 4th NC, although the graph obviously does not account for the most recent economic changes in 2008/2009.

Illustration 2 - 6 Development of GDP over time

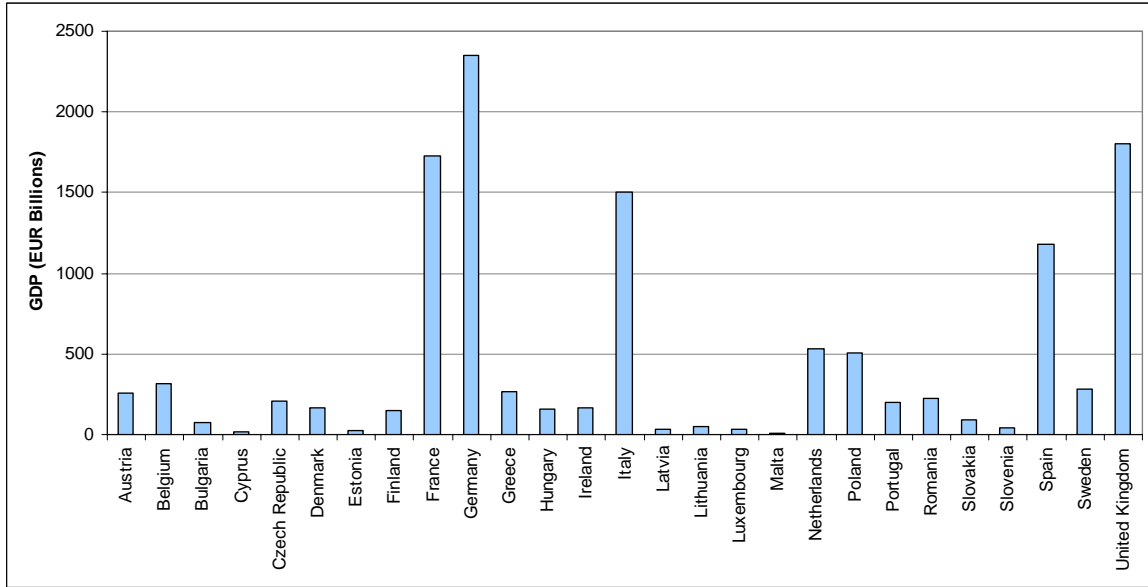


Note: Figures in chain-linked volumes, reference year 2000 (at 2000 exchange rates). Data for all Member States is not available prior to 1995.

Source: Eurostat (Data Explorer)

The chart below shows GDP in purchasing power standards (PPS). This provides a better comparison of the potential for total consumption in each country (based on the purchasing power for a “representative” basket of goods and services). France, Germany, Italy, Spain and the United Kingdom have significantly higher PPS than other Member States. This will allow for greater consumption within these countries and consequently a trend toward higher greenhouse gas emissions.

Illustration 2- 7 GDP in PPS (purchasing power standards) across Member States, 2007



Source: Eurostat

2.6.2. *Development of economic sectors*

The sectoral breakdown of the EU, in terms of the relative shares of Gross Value Added (GVA) across the sectors, has not changed significantly since the last National Communication. Emissions can vary significantly across sectors due to their transport and energy intensities, which tend to be higher and lower in services, respectively, compared to industry. A more detailed breakdown for GVA in industry is given in Section 2.9.

Table 2-8 Gross value added (at basic prices) of main economic sectors

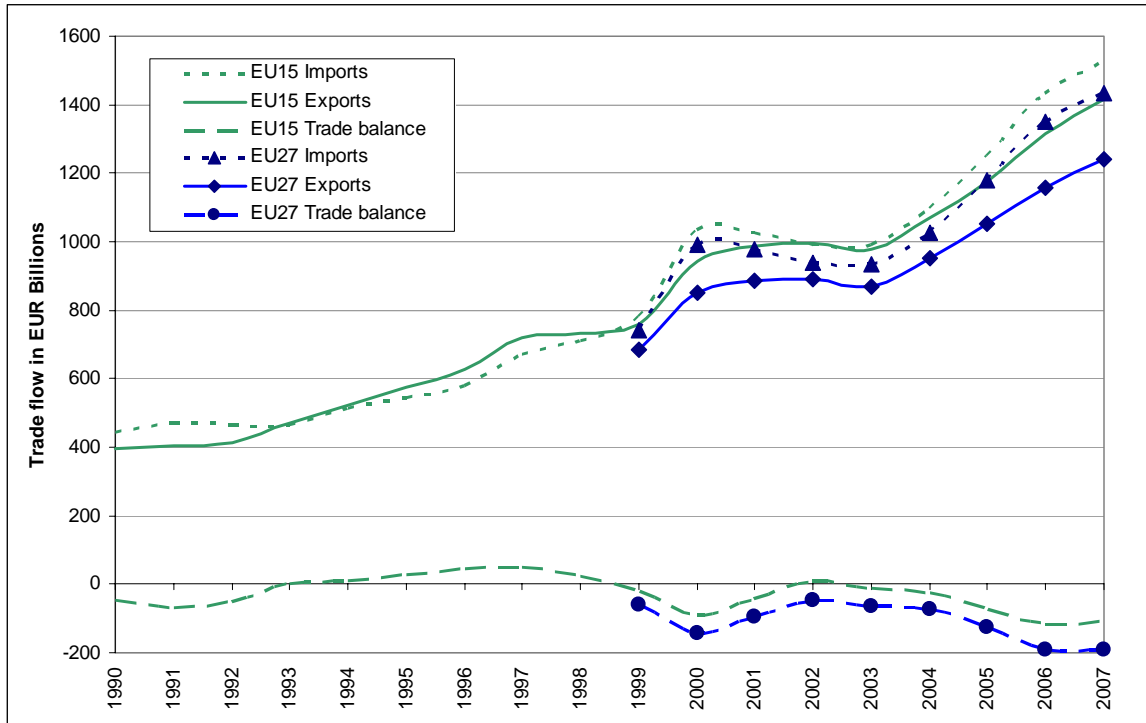
| Unit = € Billion | EU-15 | | | | EU-27 | | | |
|---|-------|------|------|------|-------|------|------|------|
| Branch | 1995 | % | 2007 | % | 1995 | % | 2007 | % |
| All branches – Total | 6796 | 100% | 9002 | 100% | 7126 | 100% | 9544 | 100% |
| Agriculture, hunting, forestry and fishing | 154 | 2 % | 167 | 2 % | 177 | 2 % | 191 | 2 % |
| Total industry (excluding construction) | 1523 | 22 % | 1926 | 21 % | 1605 | 23 % | 2081 | 22 % |
| Construction | 424 | 6 % | 488 | 5 % | 448 | 6 % | 525 | 5 % |
| Wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods; hotels and restaurants; transport, storage and communication | 1397 | 21 % | 1966 | 22 % | 1478 | 21 % | 2116 | 22 % |
| Financial intermediation; real estate, renting and business activities | 1682 | 25 % | 2520 | 28 % | 1740 | 24 % | 2621 | 27 % |
| Public administration and defence, compulsory social security; education; health and social work; other community, social and personal service activities; private households with employed persons | 1620 | 24 % | 1932 | 21 % | 1682 | 24 % | 2010 | 21 % |

Note: Figures in chain-linked volumes, reference year 2000 (at 2000 exchange rates). Data for all Member States is not available prior to 1995.

Source: Eurostat

2.6.3. Trade patterns

Illustration 2 - 9 Development of Extra-EU trade



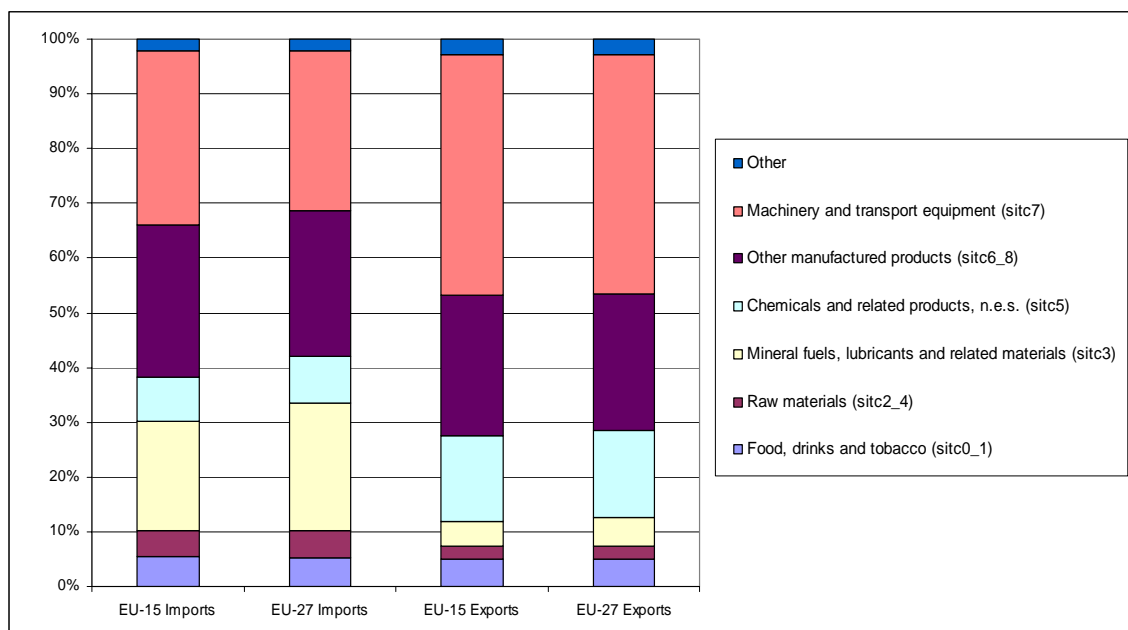
Note: Data for EU-27 is not available before 1999.

Source: Eurostat

Since the late 1990s, the EU has experienced a negative trade balance although the trend reversed slightly in the early part of the 2000s. Since the 4th NC the trade balance has deteriorated again, in particular in 2006 and 2007 imports exceeded exports by approximately €200 billion.

Significant import of goods such as this can be seen as “exporting” emissions – the emissions involved in the manufacture of goods are accounted for outside the EU. Therefore the graph above demonstrates that present trading patterns will have a broadly positive effect on decreasing the EU’s own greenhouse gas emissions, although the exact impact will depend on the composition of imports and exports, which is shown in the figure below.

Illustration 2 - 10 Composition of Extra-EU trade by value in 2007



Note: SITC = Standard International Trade Classification

Source: Eurostat

The graph above shows the percentage (as a proportion of total trade value) of extra-EU-27 trade by SITC (Standard International Trade Classification) category, for imports and separately for exports, in 2007. As in the 4th National Communication manufactured products such as *Machinery and transport equipment* and *Chemicals and related products* make up a higher proportion of the EU's exports than they do for its imports. These tend to have lower emissions intensity, given the much higher value added of the products compared to energy use, than *mineral fuels, lubricants and related materials* and other *raw materials*, which make up a higher proportion of imports.

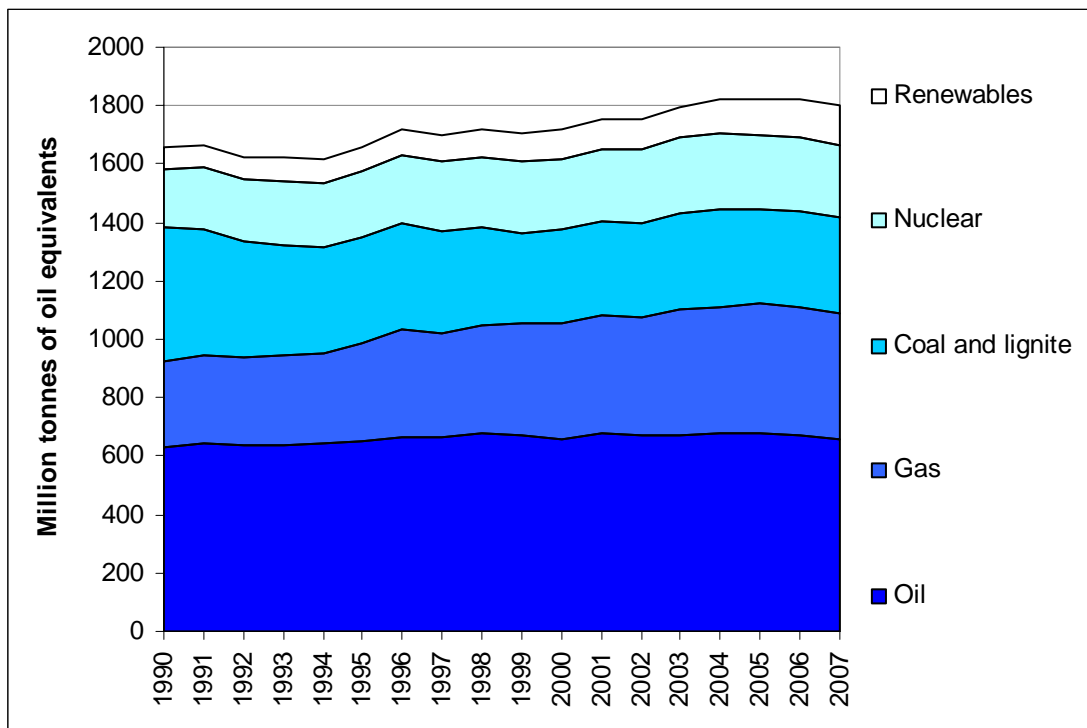
2.7. Energy profile

Energy use is the largest source of GHG emissions. The following sections provide a high-level overview of the most relevant factors. The recent "2008 Energy and Environment" report published by the European Environment Agency⁶ provides more detail on the key drivers, environmental pressures and impacts from the production and consumption of energy. Climate policy drivers have had some impact on changes in the EU-27 energy system to-date (for-example leading to improvements in energy efficiency or increases in the share of renewables), although to a large extent these have been driven by other factors (e.g. the shift to gas as a result of price differentials with other fuels). Historic trends in GHG emissions from energy-related activities are shown in sections 3.2.3.

⁶ http://www.eea.europa.eu/publications/eea_report_2008_6

However, the impacts of future climate policy in the energy sector (see section 4.4 for further details) are likely to be far more significant, particularly as a result of the new energy and climate package (see section 4.1.2.4). These will lead to more sizeable shifts in energy use towards renewables (and also gas) as well as an overall impact on primary and final energy consumption due to improvements in energy efficiency; these effects should become more noticeable within these indicators in coming years.

Illustration 2 - 11 Primary energy consumption by fuel for EU-27



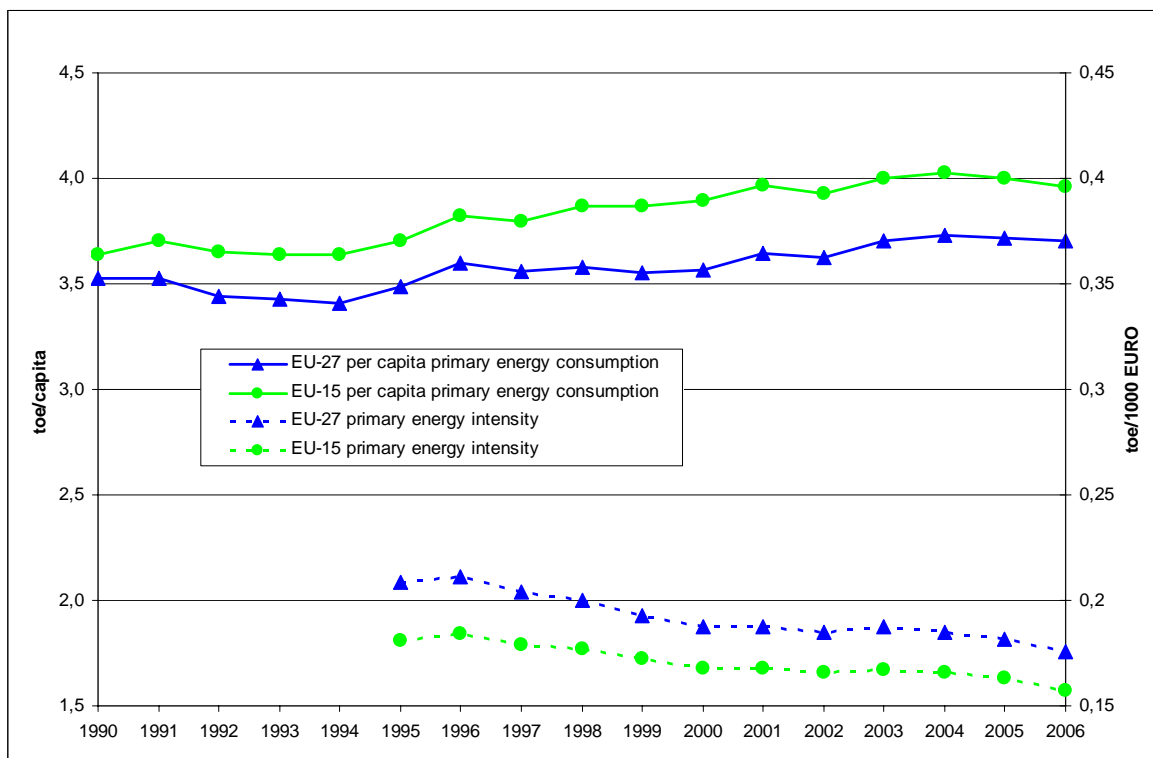
Source: EEA, Eurostat

Total primary energy consumption (see Section 2.7.2 for details of final energy consumption) in the EU-27 rose over the period from 1990 despite continued efforts to improve energy efficiency. However, since the 4th NC total consumption appears to have stabilized slightly in the period from 2004 onwards.

Trends in the consumption of different energy types within the total have changed significantly since 1990 and those trends reported in the 4th NC have broadly continued. Since 1990 there has been a decrease of nearly 30 % in the consumption of carbon intensive coal and lignite. Meanwhile there has been an increase of nearly 50 % in gas consumption which, in comparison to other fossil fuels, produces lower greenhouse gas emissions. The consumption of oil increased by just under 4 % between 1990 and 2007. Renewables have seen the most marked increase with consumption increasing by 93 % from 1990 levels. Consumption of energy generated from nuclear power has also increased by 19 % on 1990 levels.

These increases have had a positive effect on the EU's GHG emissions as shown in section 3.2.3. However, fossil fuels continue to dominate total energy consumption and the share of renewable energy sources remains small despite the increase in use. The overall increase in total primary energy consumption has also acted to counteract some of the environmental benefits from fuel switching.

Illustration 2 - 12 Primary energy intensity and per capita energy consumption

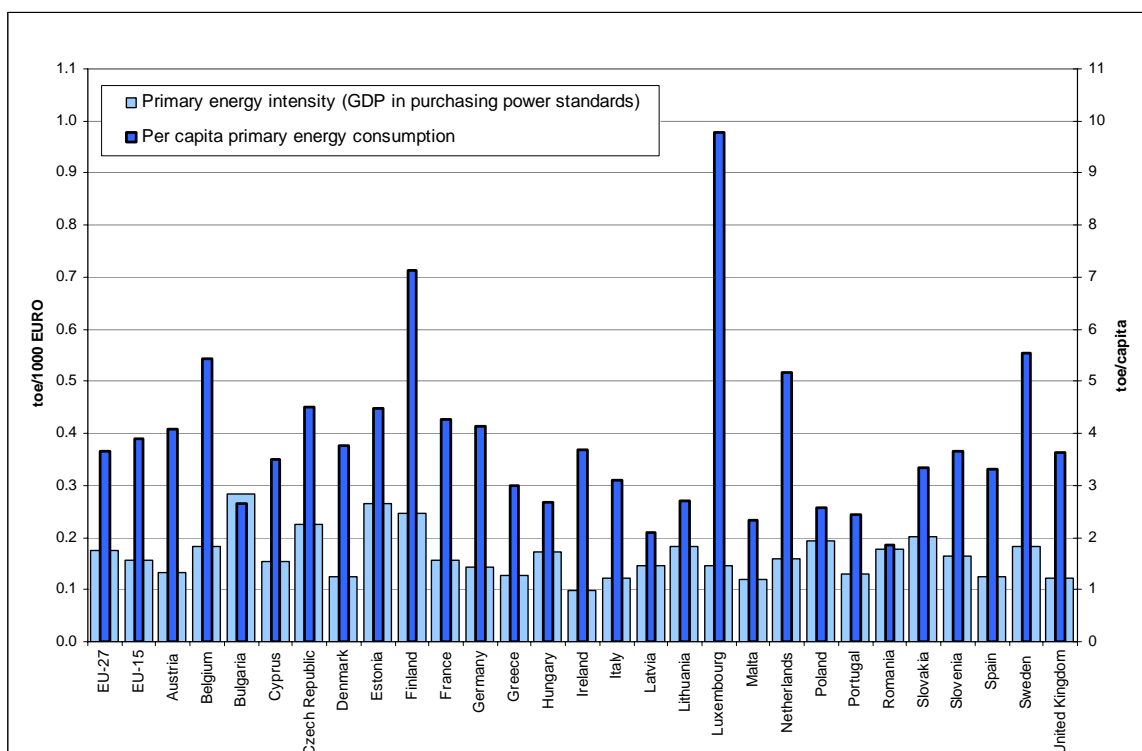


Source: Eurostat

Note: As per section 2.6.1 GDP figures (used to calculate primary energy intensity) are in chain-linked volumes, reference year 2000 (at 2000 exchange rates) - data for all Member States is not available prior to 1995.

The above graph shows primary energy intensity (toe/unit GDP) and per capita primary energy consumption for both the EU-15 and EU-27 Member States from 1990-2007. In comparison to the 4th NC, per capita energy use has actually decreased slightly since 2004. In addition, energy intensity has decreased steadily since 1996 for both the EU-27 and EU-15 states. Both these trends are having a positive impact in reducing greenhouse gas emissions.

Illustration 2 - 13 Primary energy intensity and per capita consumption by Member State in 2007



Source: Eurostat

The above bar graph shows primary energy intensity (toe/unit GDP at purchasing power standards) for each Member State and for the EU as a whole in 2007. The final energy needs of the EU economy represent less than 2/3 of the EU's primary energy consumption. There are very significant energy losses linked to the transformation and distribution of useful energy (e.g. as heat and electricity) to the end users. Energy losses broadly depend on the average efficiency of conventional thermal power stations and CHP plants, the use of nuclear power for electricity production, and the penetration of non-thermal renewables.

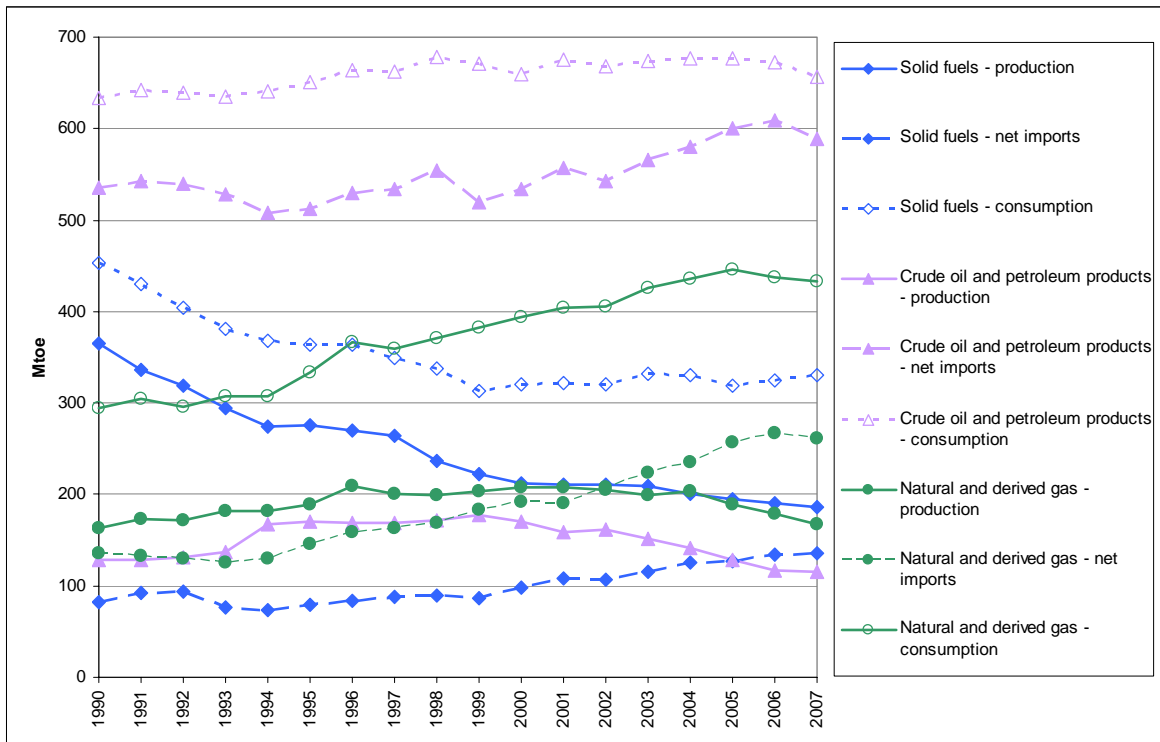
Countries with lower energy intensity may also have an economy structured less around heavy industry and more around the service industries. In addition or alternatively, they may have a higher degree of energy efficiency (both in energy generation and end-use) throughout the economy.

New Member States generally have higher energy intensities. However, six of those countries (namely Romania, Latvia, Lithuania, Poland, Bulgaria and Hungary) have particularly low per capita energy consumption – less than 2.8 toe/capita - compared with the EU-27 average of 3.6 toe/capita. Per capita energy consumption is particularly high in Luxembourg due to road fuel exports.⁷

⁷ Purchase of road transport fuels by non-residents, which are allocated to Luxembourg's energy consumption, but consumed in other Member States.

2.7.1. Energy Supply

Illustration 2 - 14 Supply of fossil fuels, EU-27



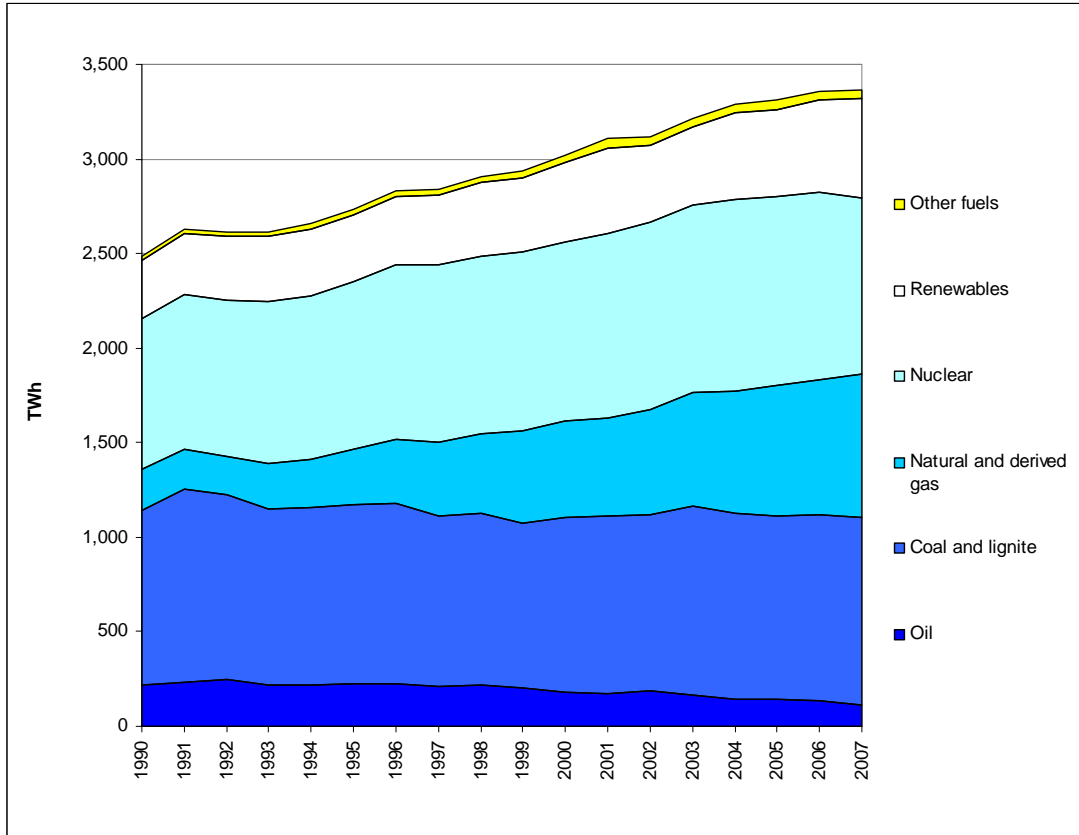
Source: Eurostat

The graph shows primary production, gross inland consumption and net imports of solid fuels, oil and gas in the EU-27 as a whole from 1990 to 2007. The vast majority of oil consumed is from imports and the trend, although cyclical since 1990, has been upwards with an annual growth of 0.6% since 1990. Overall oil consumption has stayed relatively constant over this period - there has been a decline in production at an average rate of 0.6% annually.

The same also applies to gas consumption with imports exceeding production for the first time in 2002. Imports now make up approximately two thirds of EU gas consumption. In the case of solid fuels, overall consumption is decreasing. Although imports have risen in recent years, production volumes still exceed imports. If current trends continue however it is likely that imports will exceed production volumes in the next few years.

In general, since the 4th NC the EU has seen a more rapid increase in its dependence on all imported fossil fuels (around 55 % of primary energy), which has led to growing concerns over security of supply. As in the 4th National Communication, oil still accounts for the largest share (46 %) of the EU's fossil fuel consumption. Next is gas at 30 % and then solid fuels, which contribute to 23 % of the fossil fuels the EU-27 consumes.

Illustration 2 - 15 Gross electricity production by fuel for EU-27

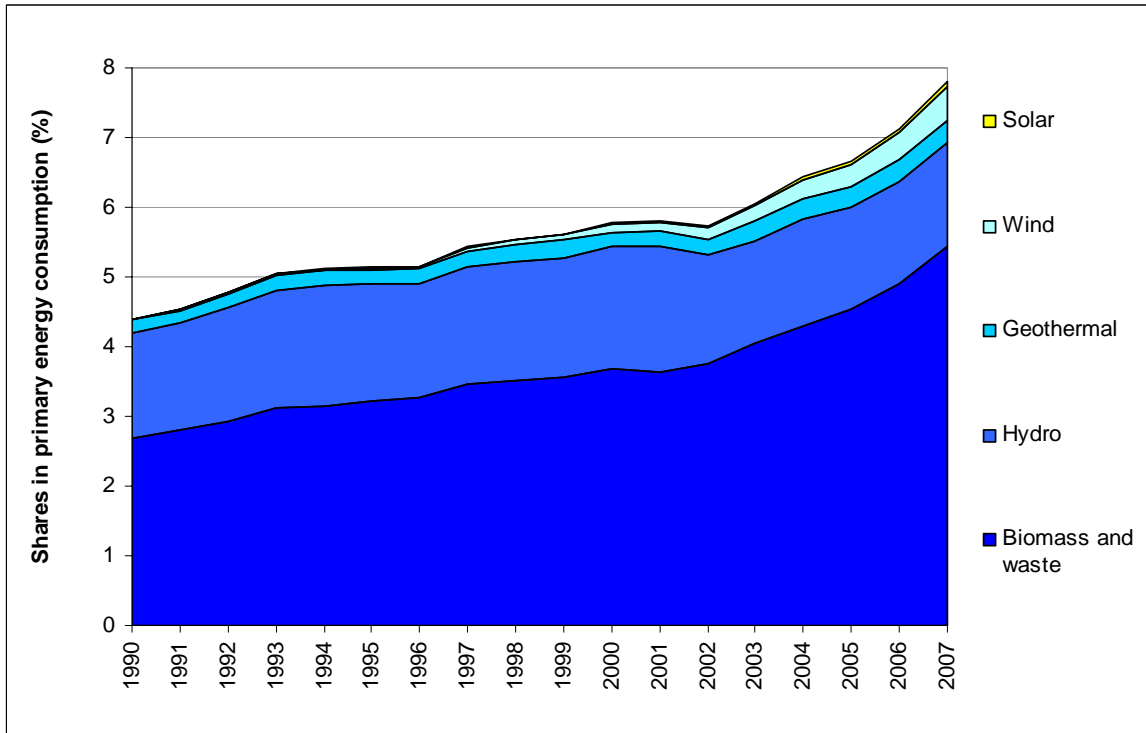


Source: Eurostat

Although the absolute amount of electricity production from renewables has increased by over two-thirds since 1990, renewable electricity still makes only a 16 % contribution to total generation. The proportion produced by nuclear has remained fairly constant and in 2007 it was approximately 28 % of total electricity production. There have been big decreases in both oil and coal and lignite production, together they accounted for one third of total production in 2007 (down from 44 % in 1990). Production from gas has increased from 8 % of the overall mix in 1990 to 23 % in 2007.

Overall, the generation mix of electricity in the EU-27 has become less carbon intensive since the beginning of the 1990s, with the trends seen in the 4th NC broadly continuing. However, the lower carbon intensity has been counterbalanced somewhat by the overall rise in total electricity production – an increase of 30 % from 1990 to 2007.

Illustration 2 - 16 Share of renewable energy in total primary energy consumption, EU-27

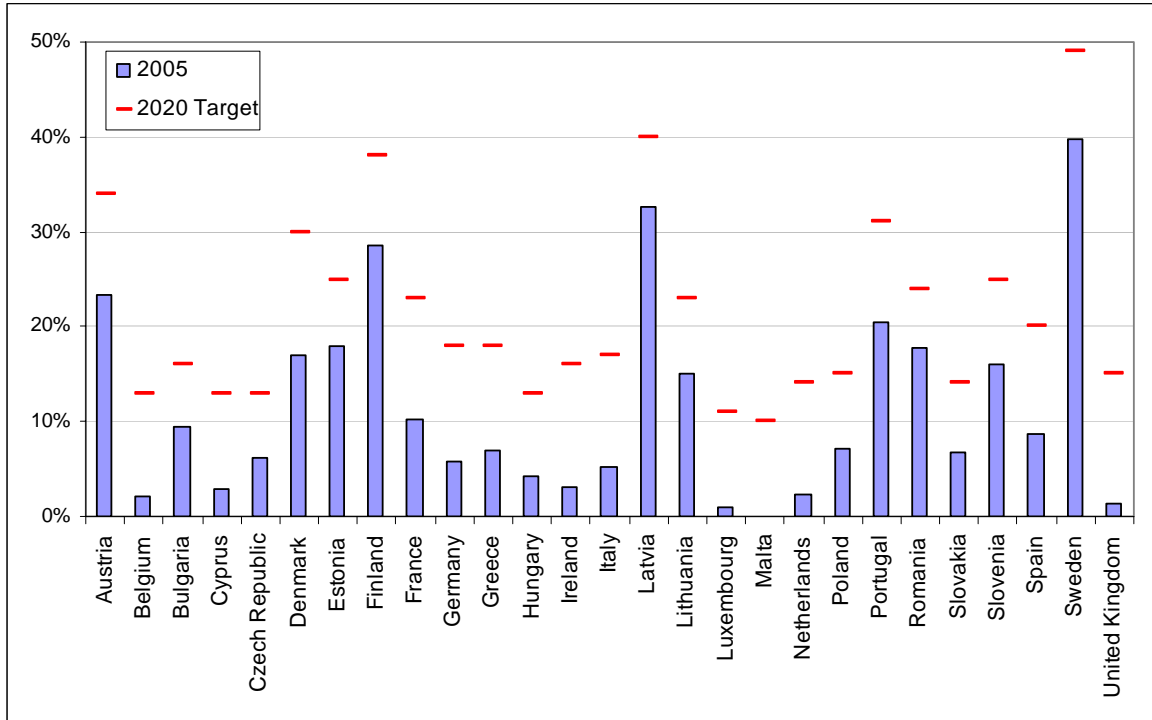


Source: Eurostat

The share of primary energy met by renewables has increased steadily over time to around 8 % of total primary energy consumption, however, in comparison to the 4th NC a more rapid increase in the share from biomass and waste was seen from 2002 onwards.

The bulk of renewable energy consumed, over two thirds, comes from biomass and waste. Hydro is the next biggest contributor, providing one fifth of total renewable energy, however hydro's relative contribution to overall renewables has decreased significantly (from a third in 1990). Wind has seen the biggest increase - from less than 0.1 % in 1990 to contributing around 6 % of total renewable energy in 2007.

Illustration 2 - 17 Share of renewable energy in gross final energy consumption in 2005



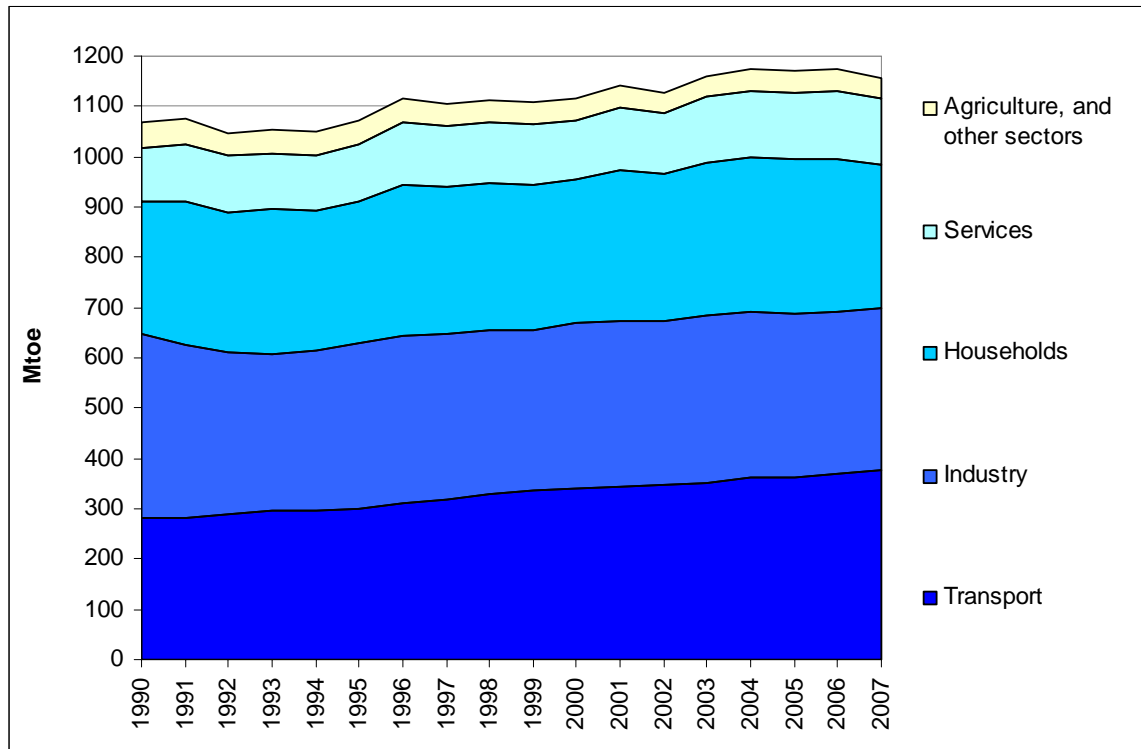
Source: Eurostat

Based on 2005 figures all EU countries have a significant challenge ahead to reach the new Renewable Energy Sources (RES) targets for 2020 (see section 4.4.2.2). The RES targets include all sources of electricity, heat and transport fuel. The country with the highest target is also the closest to meeting it, in 2005 39.8 % of Sweden’s final energy consumption was from renewable sources close to its 2020 target of 49 %. Denmark, Portugal, Austria, Finland and Latvia also have renewable energy targets of at least 30 % and all are over halfway to meeting these targets.

Conversely, the United Kingdom, Ireland and the Netherlands have 2020 targets of 15 %, 16 % and 14 % respectively but in 2005 were sourcing 3.1 % of final energy or less from renewable sources. In absolute terms the UK needs to make the biggest increase – a further 13.7 % must come from renewable sources for the UK to meet its target of a 15 % share in final energy consumption.

2.7.2. Energy consumption in different sectors

Illustration 2- 18 Final energy consumption by sector in the EU-27



Source: Eurostat

Final energy consumption in the EU-27 increased by about 8 % between 1990 and 2007. The transport sector has seen the biggest increase in overall energy consumption in the last two decades – increasing its consumption by over 34 % since 1990. This is further explored in Section 2.8. Due to the relatively small proportion of low carbon transport or transport fuels in the EU this is having a significant impact on GHG emissions (see section 3.2.3). The Services sector has also increased its energy consumption markedly, by one quarter since 1990, which correlates with an increasing share of GVA coming from this sector (as noted in Section 2.6.2).

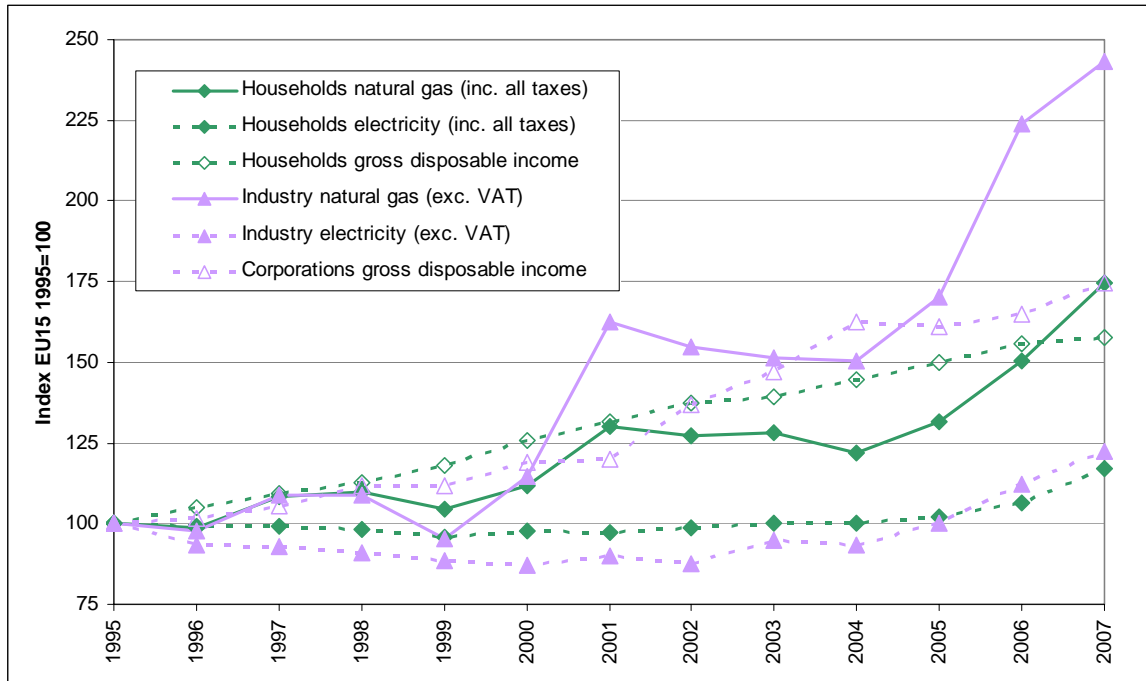
Households are also one of the largest consumers of final energy in the EU. Space heating and cooling are the most significant components of household energy demand, and can vary substantially from year to year depending on climatic conditions. In very recent years, household energy consumption has declined partly as a result of higher fuel prices and warmer weather conditions. Final energy consumption in industry has fallen since 1990, largely as a result of a shift towards less energy-intensive manufacturing industries, as well as the continuing transition to a more service-oriented economy.

2.7.3. Liberalisation and privatisation of energy markets

With respect to the structuring of energy markets, one major change since the 4th National Communication is the EU's Third Energy Package⁸ introduced on 19th September 2007. More details on these changes are described in section 4.4.

2.7.4. Energy Prices

Illustration 2 - 19 Change in average end-user energy prices in the EU-15, 1990-2007



Note: Data for Ireland is not available from 1995 to 2001, and hence the values to 2001 represent the evolution of the average nominal prices for the EU-15 excluding Ireland. Data is not available to compile a similar trend for the EU-27.

Source: Eurostat, DG ECFIN

The graph above illustrates how the average end-user prices of both electricity and gas have varied since 1995 for industry and households in the EU-15. In addition, it illustrates how disposable income has varied over this period, as this provides a very broad indication of how expenditure on energy varies as a share of income.

The price of natural gas has generally increased over the period with a spike in 2001 and dips in 1999 and 2004, with a sharp increase from this point onwards. The peak and troughs are more pronounced in the case of industry compared to households. The price of electricity decreased for both groups until 2002 and has since increased gradually.

⁸ Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EC) No 1775/2005 Establishing an Agency for the Cooperation of Energy Regulators [COM\(2007\) 0530](#)

Increasing gas and electricity prices should have a positive impact on the EU's GHG emissions as both industry and households make efforts to conserve energy and, improve their level of energy efficiency.

2.8. Transport profile

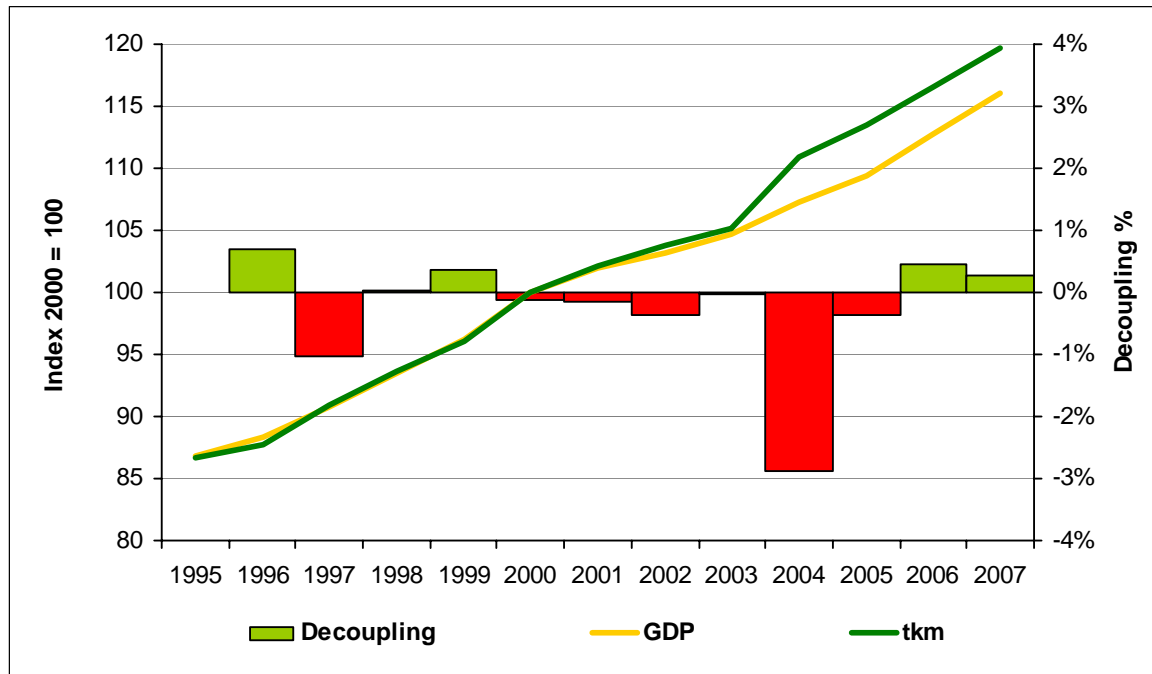
The following sections provide a high-level overview of the most relevant factors related to transport; however, the 2008 report on "Climate for a transport change" published by the European Environment Agency⁹ provides more detail on the key drivers, environmental pressures and impacts from transport in the EU.

As reported in the 4th National Communication, both freight and passenger transport has continued to grow strongly since 1990 with continued growth in GHG emissions as shown in section 3.2.3. Growth in freight transport has exceeded both growth in GDP and industrial production, whilst growth in passenger transport, from the late 1990's onwards, has grown more slowly relative to GDP. This is particularly important as the transport sector is now the largest consumer of energy within the EU-27 and the issue of growing greenhouse gas emissions from this sector needs to be addressed. There now appears to be gradual decoupling of passenger transport growth from GDP, although this has not yet occurred for freight transport. However, there are a number of recent and newly proposed policies (such as mandatory efficiency requirements for road vehicles) that aim to accelerate such decoupling in the coming years, which are outlined in more detail in section 4.5.

⁹ Climate for a transport change TERM 2007: indicators tracking transport and environment in the European Union http://www.eea.europa.eu/publications/eea_report_2008_1/at_download/file

2.8.1. Freight transport

Illustration 2- 20 Growth in freight transport EU-27



Note: Air and Sea: only domestic and intra-EU-27 transport; provisional estimates. Road: national and international haulage by vehicles registered in the EU-27. Decoupling is calculated as the percentage change in freight intensity (tkm per unit of GDP) compared to the previous year. Data and definitions are taken directly from Eurostat and DG TREN sources and hence the figure is not identical to EEA indicator CSI036. The large change in 2004 appears to be tied to a change in methodology but no correction figure exists. The change appears to affect in particular data from Spain, Italy, Portugal, Poland and Romania.

Source: Eurostat, DG TREN

Since 2000 the demand for freight transport in the EU has increased at an average rate of around 3 % per year – this is a greater rise than that of GDP. Historical data shows that GDP is a key driver of freight transport demand and as GDP rises so does transport demand. This will have a negative effect on the EU’s GHG emissions. As shown in Section 2.7.2 transport accounts for a significant portion of the EU’s final energy consumption and on present trends this does not appear to be decreasing. On the other hand, the ratio of energy consumption of transport to GDP has decreased slightly compared to 2000¹⁰. Nevertheless, a decoupling of demand for freight transport from GDP has not yet been observed.

¹⁰ Eurostat (2007) Measuring progress towards a more sustainable Europe: 2007 monitoring report of EU sustainable development strategy http://ec.europa.eu/sustainable/docs/estat_2007_sds_en.pdf

Table 2-21 Modal split of freight transport in EU-27

| Modal split | tkm | | % | |
|------------------|------|------|-------|-------|
| | 1995 | 2007 | 1995 | 2007 |
| Road | 1289 | 1927 | 42 % | 46 % |
| Rail | 386 | 452 | 13 % | 11 % |
| Inland Waterways | 122 | 141 | 4 % | 3 % |
| Oil Pipelines | 115 | 129 | 4 % | 3 % |
| Sea | 1150 | 1575 | 38 % | 37 % |
| Air | 2 | 3 | 0.1 % | 0.1 % |
| Total | 3064 | 4228 | 100% | 100% |

Note: Air and Sea: only domestic and intra-EU-27 transport; provisional estimates. Road: national and international haulage by vehicles registered in the EU-27. Decoupling is calculated as the percentage change in freight intensity (tkm per unit of GDP) compared to the previous year.

Source: Eurostat, DG TREN

The table above shows the total tonne-kilometres for different modes of freight transport (road, rail, inland waterways, oil pipelines, sea and air) – comparing 2007 with 1995. Overall freight transport has increased by 38 % and indeed every mode of transport in the table has increased, by between 16 % (inland waterways) and 55 % (air). Road is still by far the most popular mode of freight transportation.

This overall increase in freight transport demand has had an adverse effect on greenhouse gas emissions. In addition, there has been an increase in the share of freight transport by road, which is generally more carbon intensive than alternative modes (excluding air transport)¹¹.

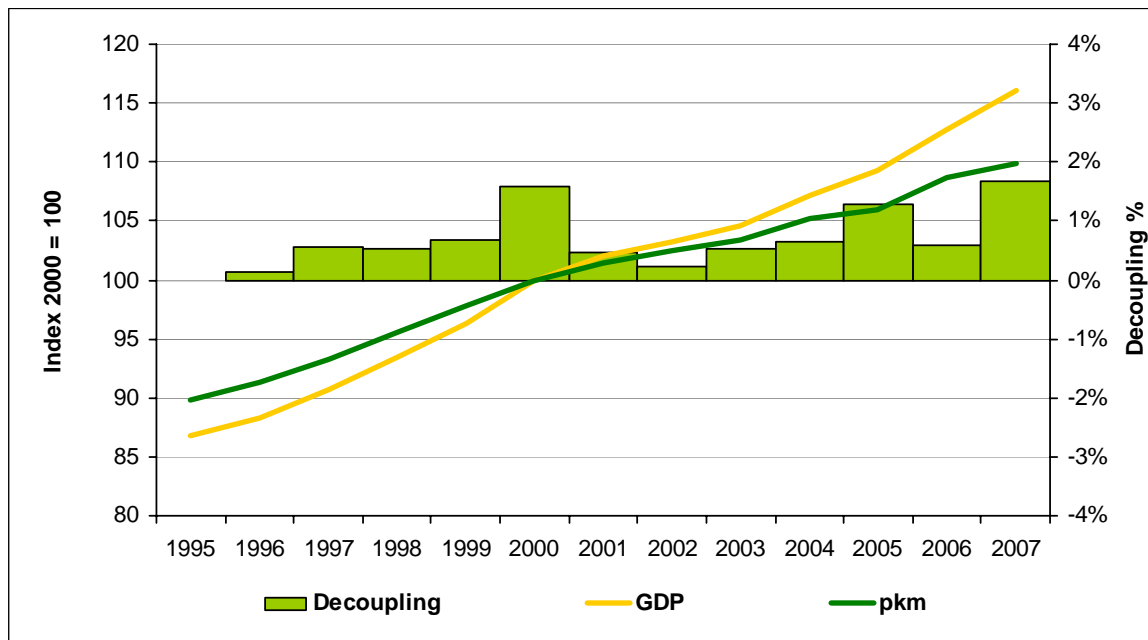
2.8.2. *Passenger transport*

Since 2000 the demand for passenger transport in the EU has increased at an average rate of just 1 % per year but (in contrast to freight transport) at a relatively lower rate than GDP. It appears that the desired outcome, of a gradual decoupling in passenger transport from GDP, has been observed since 2000. Although this is more positive for greenhouse gas emissions than the situation seen with freight transport, overall passenger kilometres

¹¹ European Environment Agency: Transport and environment: on the way to a new common transport policy - EEA Report No 1/2007
www.eea.europa.eu/publications/eea_report_2007_1/eea_report_1_2007.pdf

are still increasing. Given the continuing upward trend in demand, a reduction in absolute carbon emissions in this sector will need to come primarily via improved vehicle efficiency, modal shift to less energy intensive transport modes, and the shift to less carbon intensive transport fuels (e.g. sustainably produced biofuels or low carbon electricity).

Illustration 2 - 22 Growth in passenger transport EU-27



Note: Air and Sea: only domestic and intra-EU-27 transport; provisional estimates. Road: national and international haulage by vehicles registered in the EU-27. Decoupling is calculated as the percentage change in passenger intensity (pkm per unit of GDP) compared to the previous year. Data and definitions are taken directly from Eurostat and DG TREN sources and hence the figure is not identical to EEA indicator CSI035.

Source: Eurostat, DG TREN

The table below shows the total distance travelled by passenger transport – comparing 2007 with 1995. Overall passenger transport has increased by 22 %, largely as a consequence of the 21 % increase in car transport. The only mode of passenger transport to have decreased is sea travel. Air travel has seen the biggest percentage increase, up 70 % from 1995. In 2007, it accounted for nearly one tenth of total passenger transport. This is important as growth in demand for air transport has exceeded improvements in efficiency, leading to significant increases in emissions⁹.

Table 2 - 23 Modal split of passenger transport in EU-27

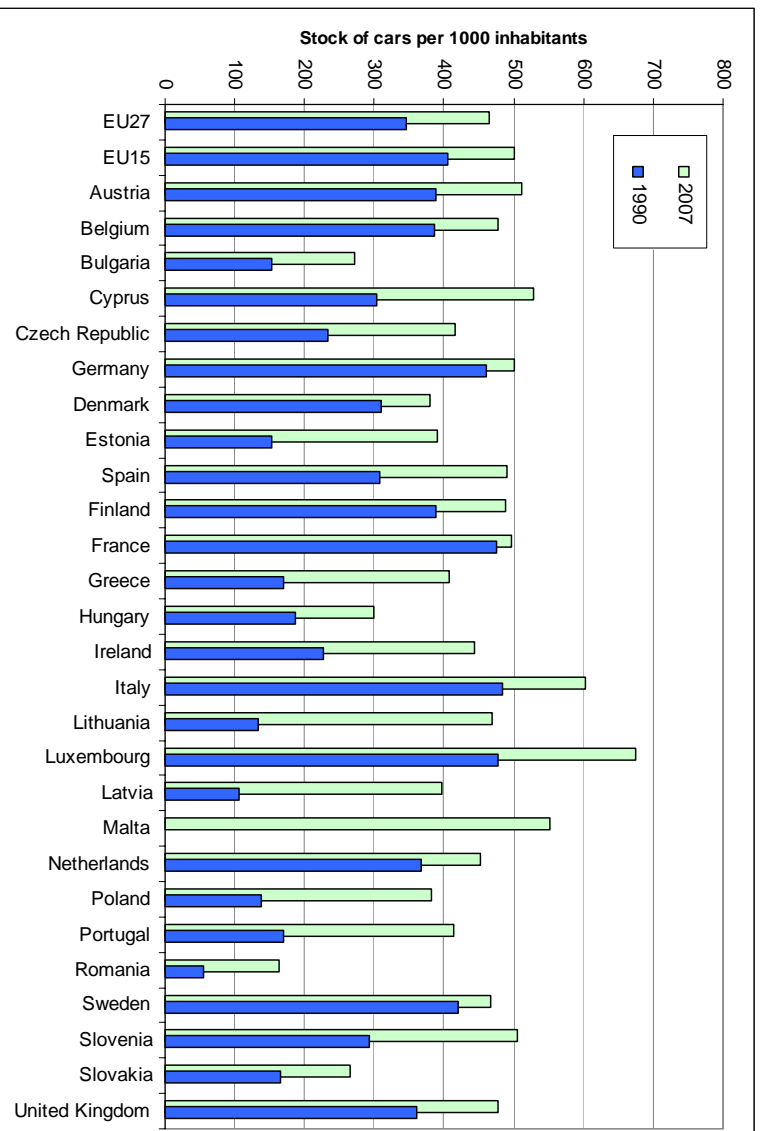
| Modal split | pkm | | % | |
|----------------------|------|------|-------|-------|
| | 1995 | 2007 | 1995 | 2007 |
| Passenger Cars | 3863 | 4688 | 73 % | 72 % |
| Powered Two-wheelers | 123 | 154 | 2 % | 2 % |
| Bus & Coach | 504 | 539 | 10 % | 8 % |
| Railway | 351 | 395 | 7 % | 6 % |
| Tram & Metro | 71 | 85 | 1 % | 1 % |
| Air | 335 | 571 | 6 % | 9 % |
| Sea | 44 | 41 | 1 % | 1 % |
| Total | 5291 | 6473 | 100 % | 100 % |

Note: Air and Sea: only domestic and intra-EU-27 transport; provisional estimates. Road: national and international haulage by vehicles registered in the EU-27. Decoupling is calculated as the percentage change in passenger intensity (pkm per unit of GDP) compared to the previous year. Data and definitions are taken directly from Eurostat and DG TREN sources and hence the figure is not identical to EEA indicator CSI035.

Source: Eurostat, DG TREN

The graph below shows that in every one of the EU-27 Member States the level of car ownership is increasing, overall ownership in the EU-27 increased by 21 % between 1995 and 2007. In Romania, Latvia and Lithuania car ownership levels have more than trebled. Although this still leaves Romania with the lowest level of ownership in the EU-27, Lithuania is now on a par with Sweden, Belgium, the United Kingdom, and Finland.

Illustration 2 - 24 Level of car ownership

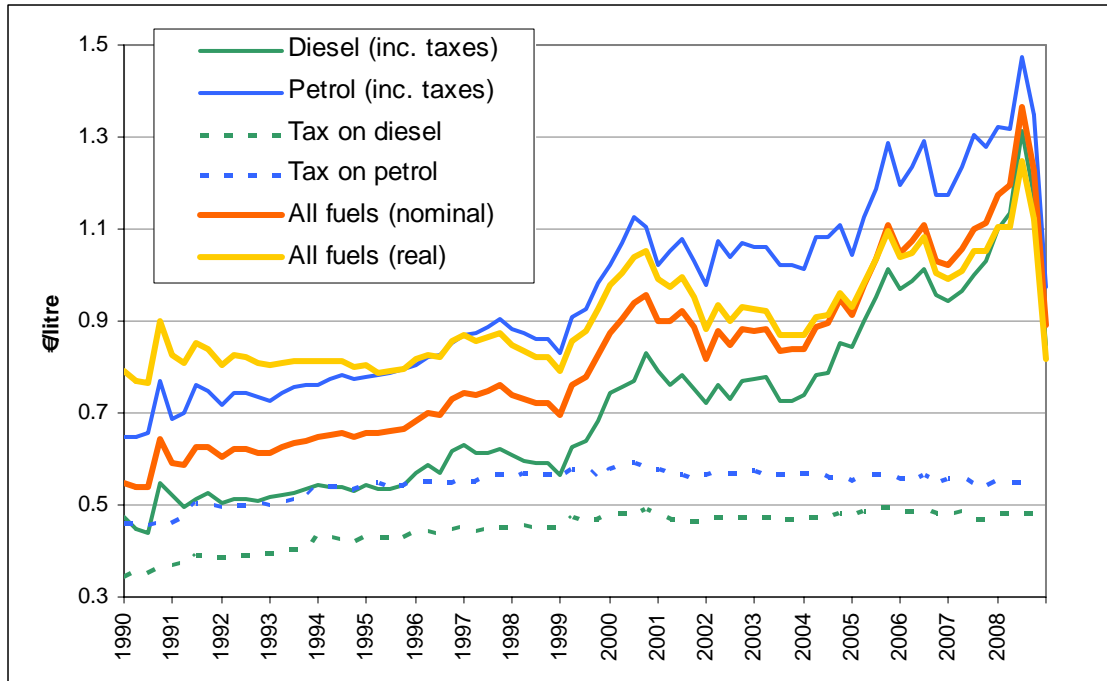


Note: Passenger car stock at end of year n divided by the population on 1st January of year n+1. Data is not available for Malta in 1990 and 2007, only 2006 data are used.

Source: Eurostat, DG TREN

2.8.3. Taxes on and prices of transport fuels

Illustration 2 - 25 Average (nominal) EU road transport fuel prices and tax levels

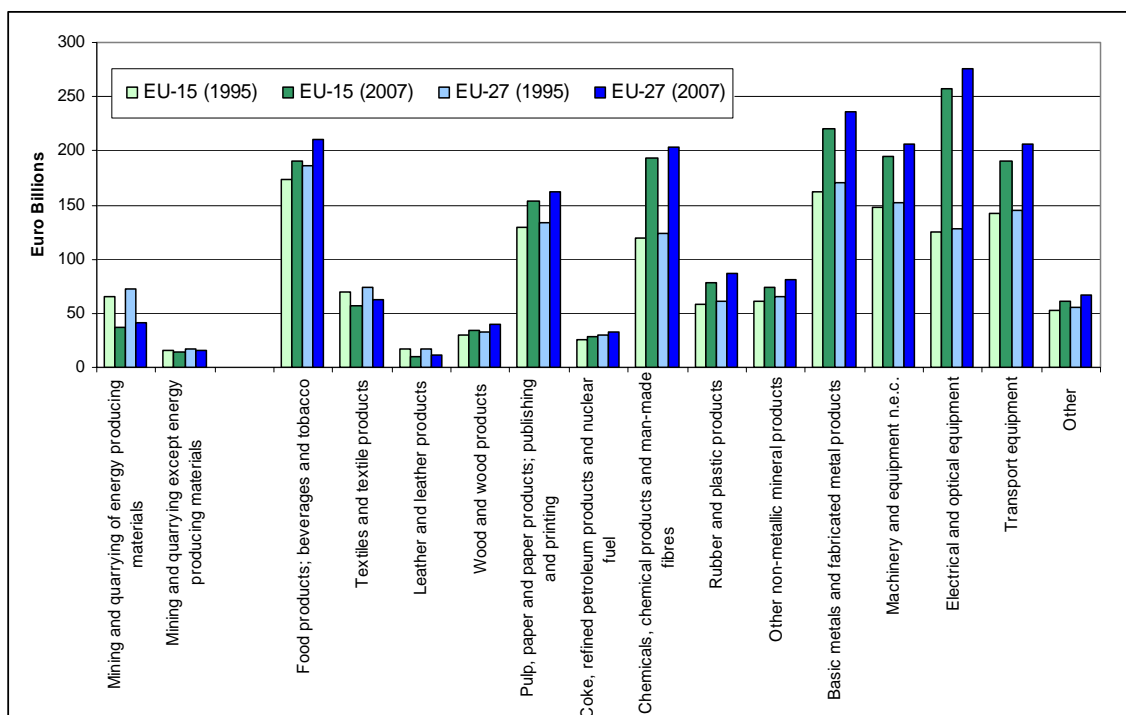


Source: DG TREN, EEA

The above line graph shows how average diesel and petrol prices have evolved in the EU Member States since 1990. Overall, the prices for both fuels approximately doubled between 1990 and 2007 due to substantial increases in oil prices (when adjusting for inflation, real prices increased by around a third over the same period). The tax on petrol increased by only 20 % and the tax on diesel increased 41 % over the same period, so the proportion of tax in the price of fuels has decreased. Despite this increase in prices, both freight and passenger transport are continuing to increase. However, rising prices will also help stimulate demand for more efficient vehicles. Road fuels have declined sharply from their peak in 2008 as the price of oil has declined, with (nominal) prices again similar to those in the early 2000s.

2.9. Industry

Illustration 2 - 26 Composition of industry based on gross value added (at basic prices) of main economic sectors



Note: NACE 31 branch level, for all C and D subsectors. Figures in chain-linked volumes, reference year 2000 (at 2000 exchange rates). Data for all Member States is not available prior to 1995. N.e.c = not elsewhere classified.

Source: Eurostat

The figure above shows the GVA of main sectors at NACE 31 branch level, for all C and D industrial subsectors in constant (2000) prices, in 1991/1995 and 2008 for both the EU-15 and EU-27. The energy and emissions intensity of different branches of manufacturing can change significantly. For example, manufacture of steel, paper and chemicals (including refining) is generally more intensive than other branches of manufacturing. GVA in manufacturing in the EU increased by 27 % from 1995 to 2007, and increased in most subsectors excluding textiles and leather. GVA in mining (both energy and non-energy products) declined by around 60 % over the same period. The structure of industry has also changed slightly from 1995 to 2007, with an increasing share of GVA in total EU-27 industrial GVA (excluding construction) from chemicals and electrical equipment manufacture (by 2 and 5.5 percentage points respectively).

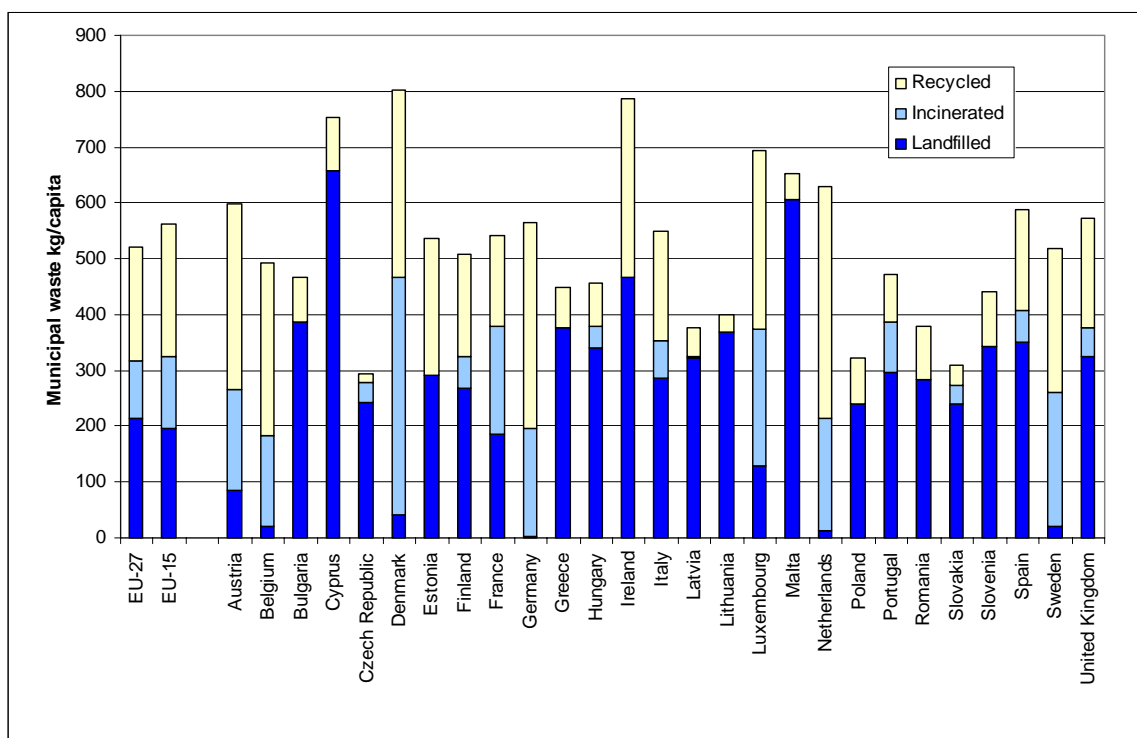
2.10. Waste

Greenhouse gas emissions from waste depend on the quantity of waste and how it is disposed of (including recycling, landfill and incineration). All routes have an impact on emissions through the consumption of energy in the collection, treatment and production of

waste – trends in emissions from waste can be seen in section 3.2.3. Waste to landfill produces large methane emissions if not managed correctly (e.g. via methane recovery and diversion of biodegradable municipal waste from landfill). Recycling and incineration of waste with energy recovery generally result in lower greenhouse gas emissions than disposing of the waste to landfill, and these routes are increasingly used, in part as a result of the policy drivers discussed in section 4.9.

The chart below shows the amount of municipal waste generated for each Member State (in 2007) broken down by different treatment route. For the EU-27 on average two fifths of waste is sent to landfill, two fifths is recycled and the remainder is incinerated. The lowest recycling rates are in Czech Republic, Malta and Lithuania – at less than 10 %. The amount of municipal waste is expected to grow by 25 % within the EU from 2005 to 2020, with great variability between Member States¹².

Illustration 2 - 27 Generation and treatment of municipal waste per capita in 2007



Note: The level of municipal waste recycled is assumed to be total waste generated minus that incinerated and sent to landfill

Source: Eurostat

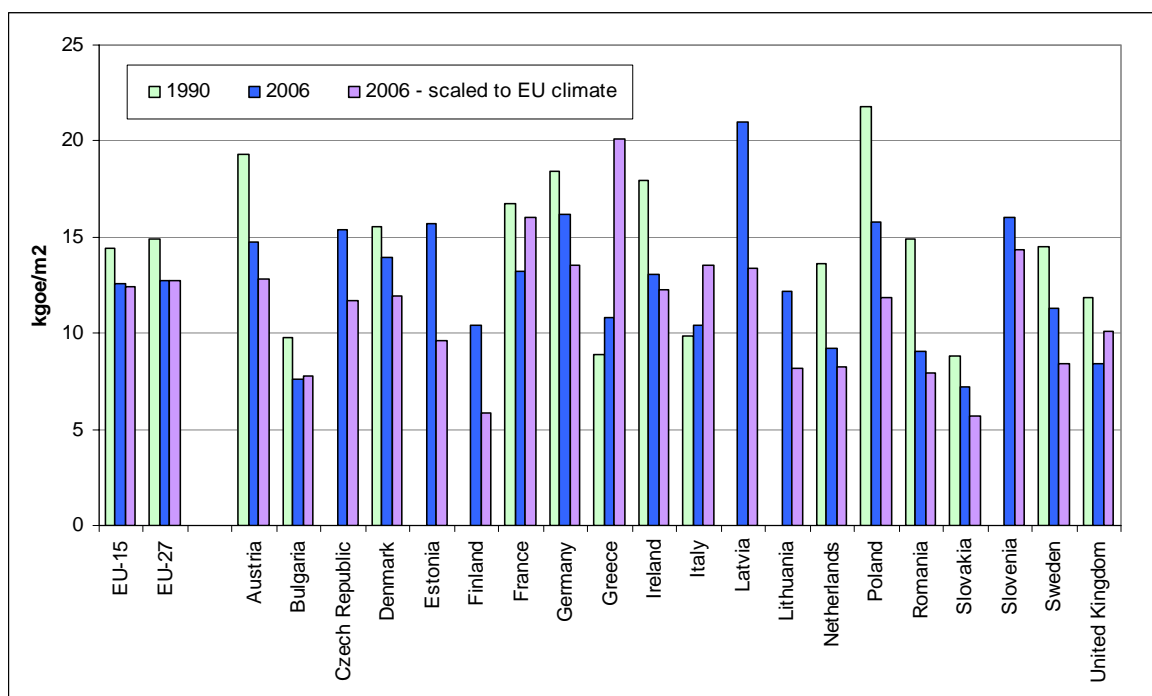
¹²

http://www.eea.europa.eu/publications/briefing_2008_1/Supporting_document_to_EEA_Briefing_2008-01.pdf

2.11. Building stock and urban structure

Energy consumption for space heating within buildings forms a significant component of all EU energy consumption. Overall energy consumption in households alone consumes 26 % of total energy in the EU-27 (as shown in Section 2.7.2). The level of energy consumption within buildings is primarily affected by: the thermal properties of the building (in terms of insulation, building type – e.g. flat/house); the efficiency of the heating system; and the stock/efficiency of the appliances used. In general, newer dwellings are likely to be more energy efficient than older buildings.

Illustration 2 - 28 Household energy consumption, space heating per m², climate corrected



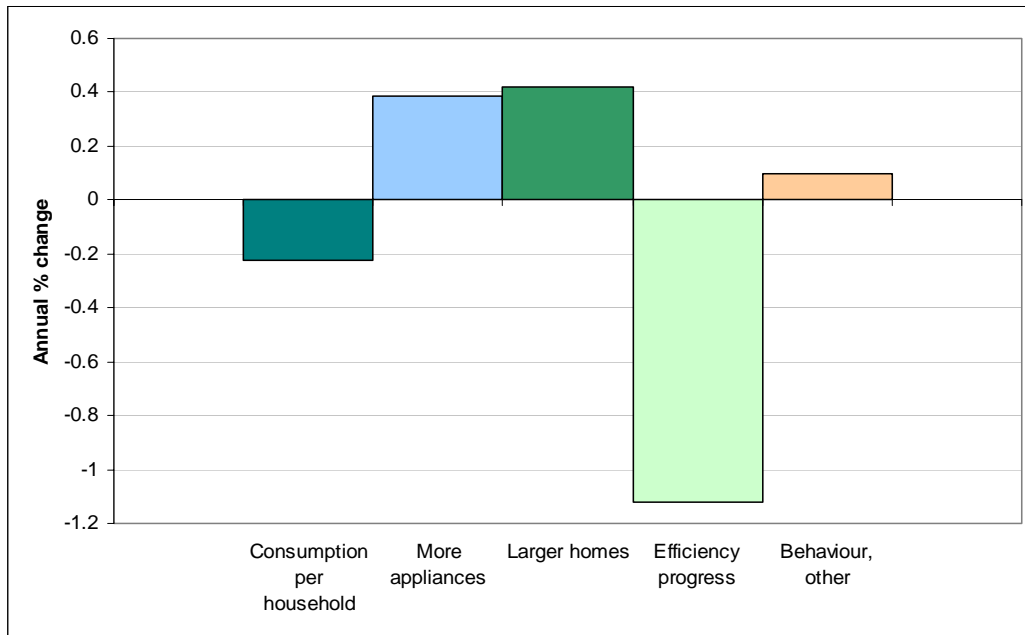
Note: 1990 and 2006 data are climate corrected against each country's long-term average climate, whereas the last series is climate corrected and scale against the EU long-term average climate to account for temperature differences between countries. Complete data is only available for the Member States shown. Data is not available for all EU Member States, values for the EU-15 and EU-27 reflect the average across available Member States within those groupings.

Source: Odyssee

The level of climate corrected household space heating energy consumption per m² provides a good proxy for the thermal and heating system efficiency of households (as it controls for the effect of size of building and temperature on consumption). This has on average, fallen for the EU-15 and EU-27 countries from 1990 to 2006 - indicating a slight improvement in energy efficiency. However, there is significant variation in the housing stock between the Member States as to the extent of this decrease – indeed in Greece and Italy it has increased.

However, the building sector has one of the highest potentials for improved energy efficiency and measures to reduce the space heating/cooling demand in buildings represent a significant part of this potential. Many of these measures (such as improved insulation) are highly cost-effective, but a number of other barriers to their implementation exist. These are being addressed by a number of the policies related to end-use energy efficiency described in section 4.4.4.

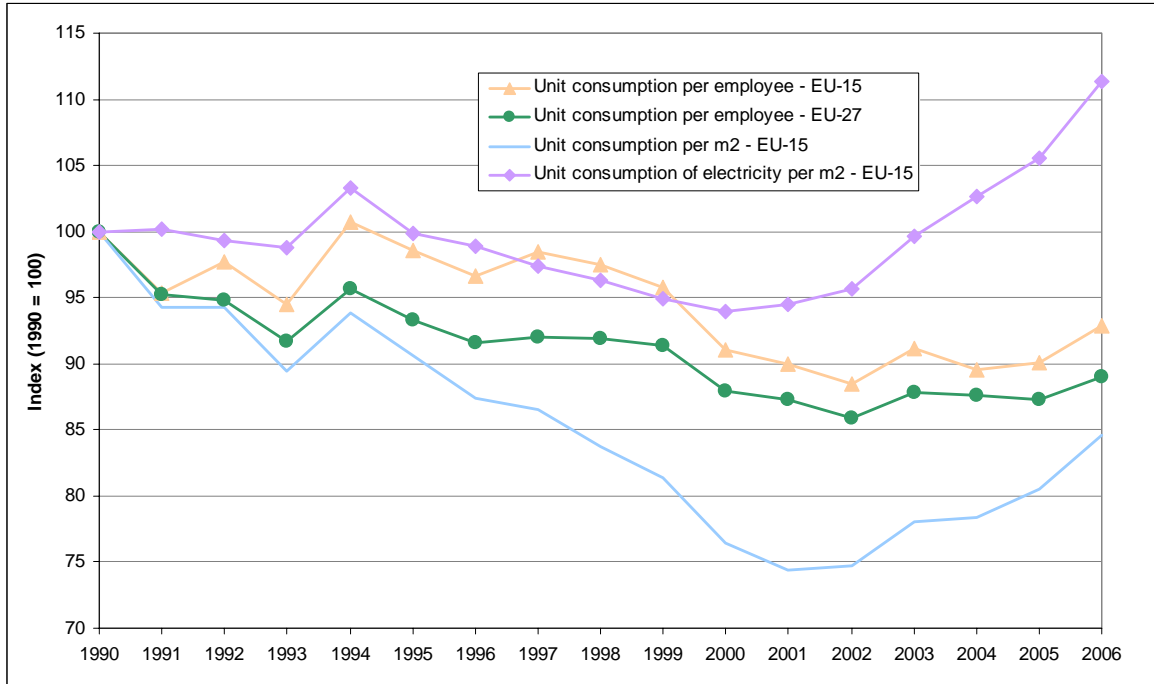
Illustration 2 - 29 Drivers of the change in average annual energy consumption per household in the EU-27 from 1990 to 2006



Source: Odyssee

Although the total amount of energy consumed by households has increased by 15 % (due primarily to rising population and corresponding increases in the building stock) the consumption per household has decreased on average by around 0.2 % annually from 1990 to 2006. This overall change contains a set of opposing drivers. Improved energy efficiency has helped to bring down the energy consumed and consequent greenhouse gas emissions for this sector. By contrast an increase in the number of appliances, larger homes and other factors (e.g. behavioural changes such as maintaining higher internal room temperatures) has acted to counteract this to a large extent by increasing energy use. For appliance consumption, higher levels of ownership acts to increase the overall level of energy consumption, but that has been counteracted to some extent by an increase in end-use efficiency of individual appliances.

Illustration 2 - 30 Services sector building energy consumption indicators



Source: Odyssee

Note: Data is not available to provide EU-27 values for all indicators

Data on energy efficiency in service sector buildings is generally more uncertain, but the indicators in the graph above provide a ‘reasonable’ proxy for this as most energy consumed within buildings is for space heating, cooling and appliances (such as for IT equipment). Unit consumption per m² controls for the effect of building size on energy consumption and consumption per employee controls, broadly, for the effect of total equipment ownership.

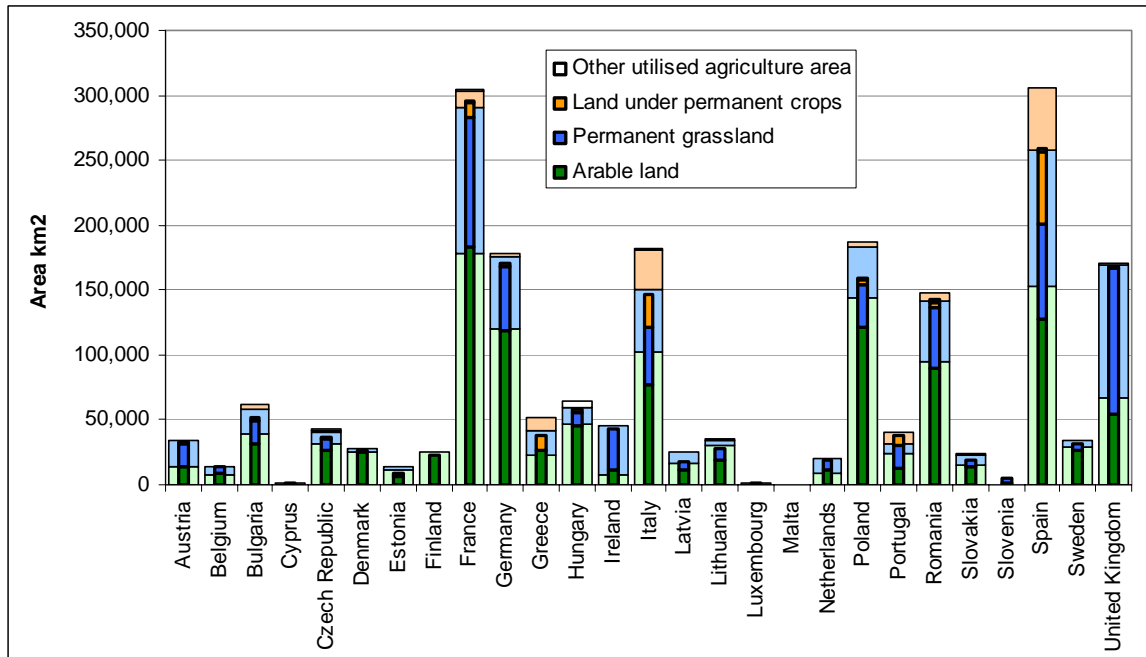
Total, unit consumption per employee and per m² have declined steadily since 1990, indicating a likely overall improvement in efficiency. The decrease is higher than for households, in part due the higher stock turnover in the services sector, which leads to a greater proportion of retrofitting and new buildings. However, since around 2001 these trends have stabilised or even strongly reversed in the case of unit consumption per m². A significant factor in this is rising electricity consumption, e.g. for I.T. equipment and air conditioning.

2.12. Agriculture

Overall the area of land under agricultural use across the EU-27 states has decreased by approximately 10 % from 1990 to around 2005. Estonia, Greece, Italy, and Slovakia have seen a decrease of over one-fifth. Agriculture is a significant source of GHG emissions, for example, due to N₂O associated with fertilizer use and CH₄ from livestock (as well as energy consumption in the sector itself). These trends are highlighted in more detail in the

figure below (trends in agriculture emissions are outlined in section 3.2.3), but the overall decrease in agricultural activity will have a generally positive effect on total greenhouse gas emissions within the EU. Land-use has not changed significantly since 2000 (the period shown in the 4th NC).

Illustration 2 - 31 Total utilised agricultural land and usage patterns, 1990 and 2005

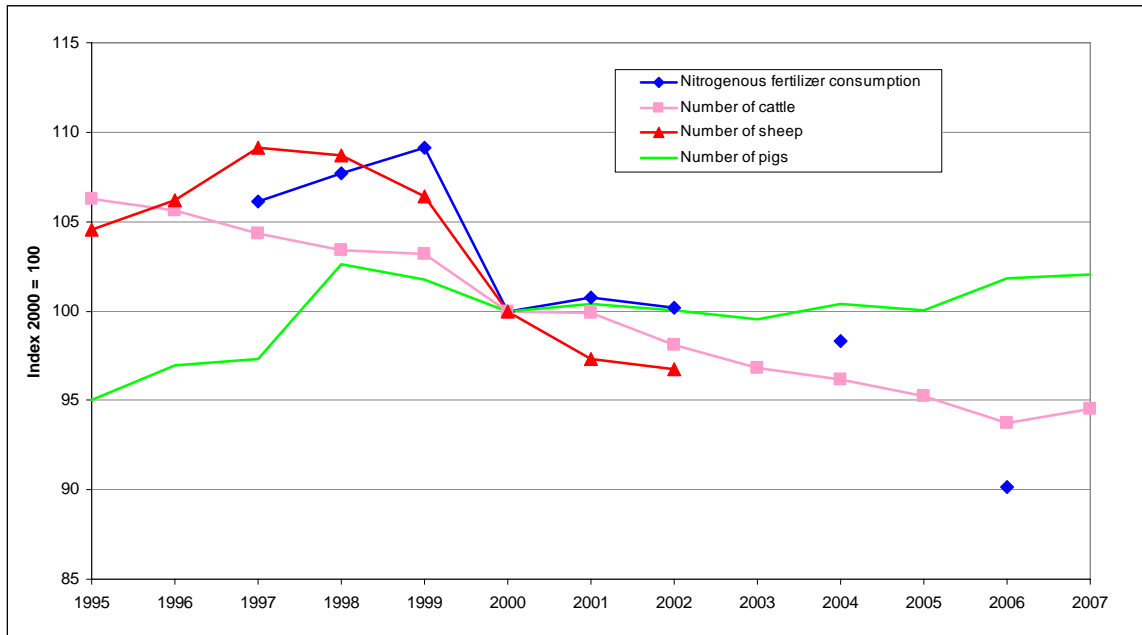


Note: Narrow bars indicate values for 2005, wider bars indicate values for 1990. Gap filling is necessary in some cases. 2003 data is used for the UK. For Bulgaria 2006 data is used for Arable Land and the Total Utilised Agriculture Area. 2004 Data is used for the Czech Republic and Land Under Permanent Crops.

Source: Eurostat

The consumption of nitrogenous fertilizer has fallen steadily in more recent years, by around 10 % since 2000, which will lead to an overall positive impact on total greenhouse gas emissions. In addition, the impact from livestock, has also decreased in the EU-15 due to falling cattle and sheep numbers. However, the number of pigs reared per capita has not fallen as rapidly and has stabilised in more recent years, albeit with a small increase in 2006 / 2007.

Illustration 2 - 32 Index of EU-15 fertilizer consumption and livestock numbers



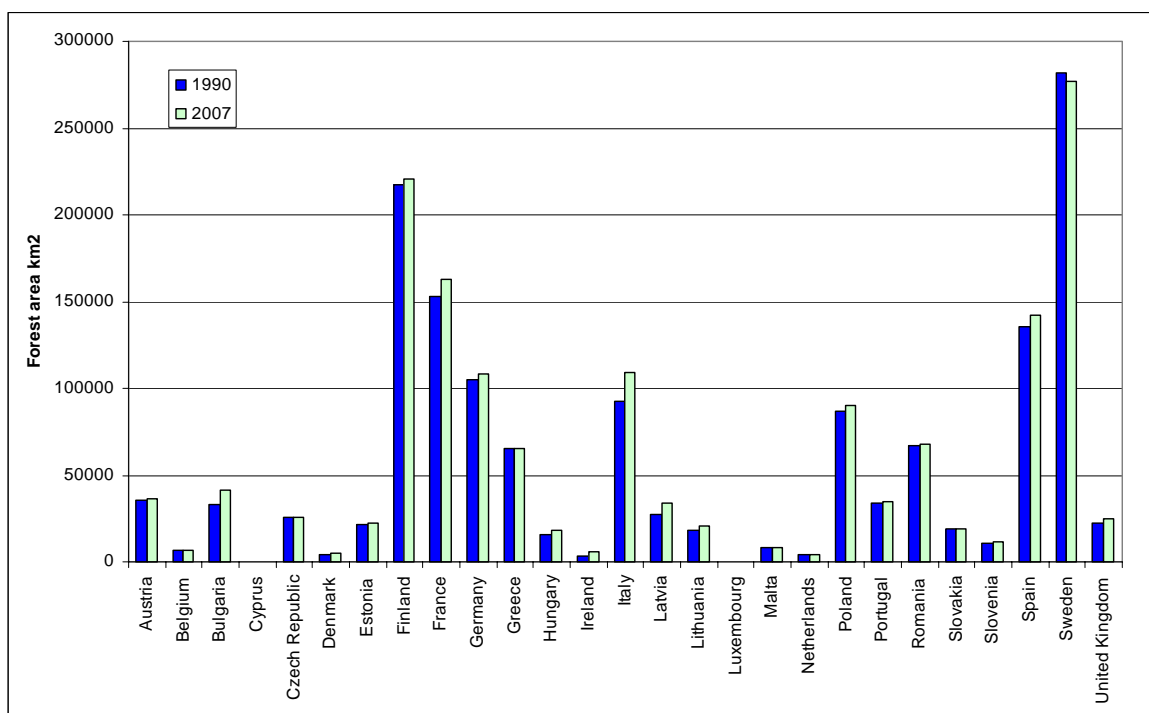
Note: Survey of livestock numbers (December). Time series data for the EU-27 is limited.

Source: Eurostat

2.13. Forest

Overall, the total forested area across the EU-27 Member States increased by 4.5 % between 1990 and 2007, the annual rate of increase (approximately 0.25 % per year) is similar to that seen in the 4th NC (including Other Wooded Land in the total, the increase was 5% over the period). With the exceptions of Sweden and Belgium (that have shown a decrease of 1.8 % and 3.1 % respectively between 1990 and 2007) there has been an increase in forested area in all Member States. Two thirds of the total forested area is comprised of just six countries: Finland, France, Germany, Italy, Spain and Sweden. The increase in forested and wooded areas throughout the EU is important for greenhouse gas emissions given their role as a carbon sink (trends in emissions related to Land-Use, Land-Use Change and Forestry are provided in section 3.2.3).

Illustration 2- 33 Changes in Forest area, 1990 and 2007



Note: Data is based on national definitions of forest area and may differ between countries and do not include other wooded areas.

Source: Member State [Submissions to UNFCCC 2009](#), JRC

2.14. Other circumstances

One of the main factors that may have an impact on the EU's greenhouse gas emissions in the near future is the global economic downturn. However, reliable estimates of this impact are not yet available.

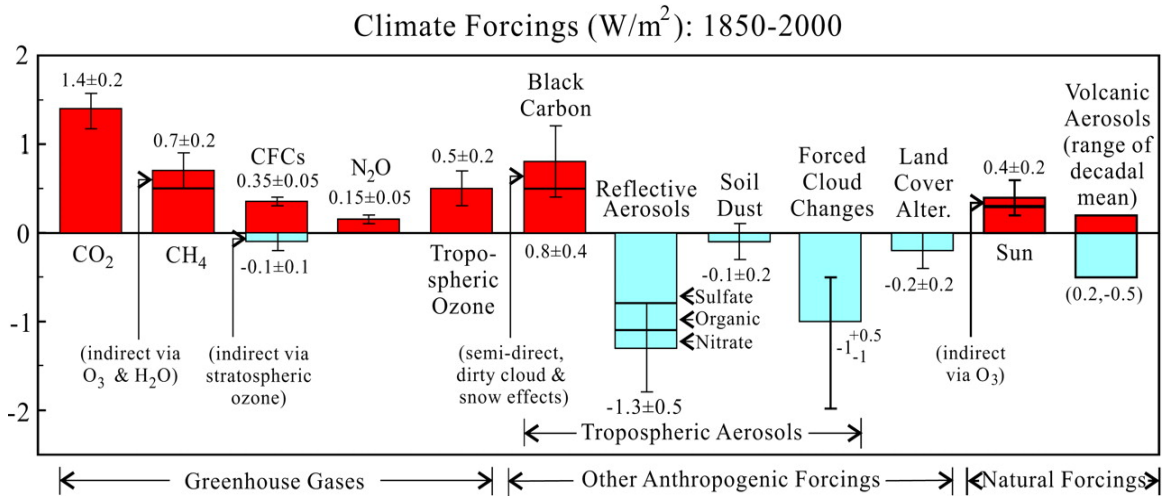
In addition, the impact of high oil prices in 2007/2008 is not fully accounted for in this National Communication given the coverage of available data (primarily to 2006/2007). This may have prompted recent investment in longer term energy saving measures, although the crash in oil prices toward the end of 2008 may well have ended such an investment cycle.

As discussed in more detail in the chapter on Policies and Measures many of the policies that were put in place to encourage renewable energy and energy efficiency were only implemented in more recent years. Therefore the impact of these policies will generally not yet be visible in the time series presented in this chapter. The effect of policies would also need to be separated from the other national circumstances influencing emissions described above.

Finally, whilst the focus of National Communications is on the basket of 6 main greenhouse gases (CO₂, CH₄, N₂O, HFCs, PFCs, SF₆) it is also important to highlight the

impact of, and interaction with, other air pollutants on radiative forcing (which can be both positive and negative). The radiative impact of short-lived species such as tropospheric ozone and aerosols may be particularly significant, but the uncertainties surrounding the level of impact are still large¹³.

Illustration 2 - 34 Example of estimated climate forcings from different emission types



Note: Estimated climate forcings; error bars are partly subjective 1σ uncertainties.

Source: Hansen J. E., Sato M. PNAS (Proceedings of the National Academy of Sciences) 2001;98:14778-14783.

¹³ JRC (2007) Presentation on interactions between atmospheric pollution and climate at regional scale, European Commission Joint Research Centre http://www.enero.eu/files/files/AIR_Climate_Wshp_2008/03_enero_aq_climate_rscale_080214_jrc_j_p_putaud_fr_raes.pdf

3. GREENHOUSE GAS INVENTORY INFORMATION

Key developments:

- Total GHG emissions in the EU-15 (without LULUCF) decreased by 4.3 % from 1990 to 2007. Over the same period, EU-27 GHG emissions decreased by 9.3 %. In both EU-15 and EU-27 the biggest relative change has been in the waste sector where the emissions of CH₄ from managed solid waste landfills decreased substantially.
- Averaged over the latest five years, EU-15 emissions (without LULUCF) were 3.1 % below their base year emission level.
- Emissions of total greenhouse gases decreased by 1.6 % in the EU-15 and 1.2 % in the EU-27 between 2006 and 2007. This was largely due to the reduction in CO₂ emissions from the household and service sectors, because of the warmer weather conditions of 2007 compared to the previous year and due to shifts in fuel purchase (from 2007 to 2006 and 2008) because of fuel price variations.
- The EEA produced preliminary EU-wide estimates of total greenhouse gas emissions for 2008, using verified EU ETS emissions for 2008 and other national and European statistical data sources, available as of mid-July 2009. The estimates indicate that EU greenhouse gas emissions decreased in 2008 for the fourth consecutive year. Compared to the 2007 emission data, the annual reduction is estimated to be about 1.3 % for the EU-15 and 1.5 % for the EU-27. In addition to these estimates, a number of Member States have also produced early estimates of 2008 emissions, including Denmark, Finland, Germany, Greece, Italy, Luxembourg, Slovenia and Spain. Official 2008 greenhouse gas emissions for the EU will be available in 2010, when the European Community Greenhouse Gas Inventory 1990–2008 and Inventory Report 2010 is published for submission to the UNFCCC.

3.1. Introduction and summary tables

This chapter presents greenhouse gas emission trends of the European Community (EC), for the EU-15 and EU-27 for the period 1990–2007. The legal basis of the compilation of the EC inventory and the inventory methodology and data availability are also described briefly. The greenhouse gas data presented in this chapter are consistent with the 2009 submission of the EC to the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat¹⁴. Summary tables of GHG emissions for the EU-15 in the common reporting format are presented in Appendix A.

¹⁴ European Environment Agency, Technical Report No 04/2009 Annual European Community greenhouse gas inventory 1990–2007 and inventory report 2009

The submission to the UNFCCC also contains details of contacts, relevant institutions and the development and procedural arrangements of the inventory, beyond those presented in this chapter. The EC inventory has been compiled from data delivered by the Member States by 15th January 2009 under Council Decision 280/2004/EC and subsequent updates to these data received before 28th May 2009.

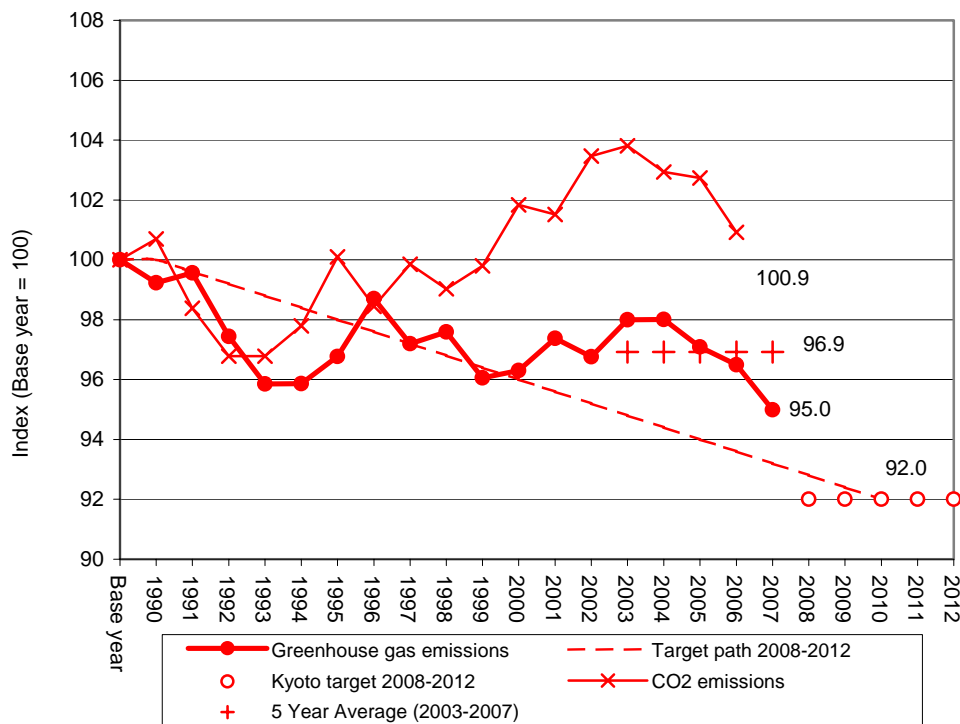
In addition, Appendix B also includes the emissions inventory summary tables of the EU-27 for 1990-2007. These data and the complete submissions of the Member States under Council Decision 280/2004/EC are available on the EEA website¹⁵.

3.2. Descriptive summary of EC GHG Emissions trends

3.2.1. Overall Greenhouse Gas Emissions Trends

Total GHG emissions excluding LULUCF (land-use, land-use change and forestry) in the EU-15 decreased by 4.3 % between 1990 and 2007. Emissions decreased by 1.6 % between 2006 and 2007. Averaged over the last five years EU-15 emissions stood 3.1 % below their base year emissions – this measure is used because the Kyoto target itself is based upon a five-year average from 2008-2012 – which is shown in the illustration below.

Illustration 3-1 EU-15 GHG emissions 1990-2007 compared with Kyoto target for 2008-2012 (excluding LULUCF)



¹⁵ <http://www.eea.europa.eu/publications/european-community-greenhouse-gas-inventory-2009>

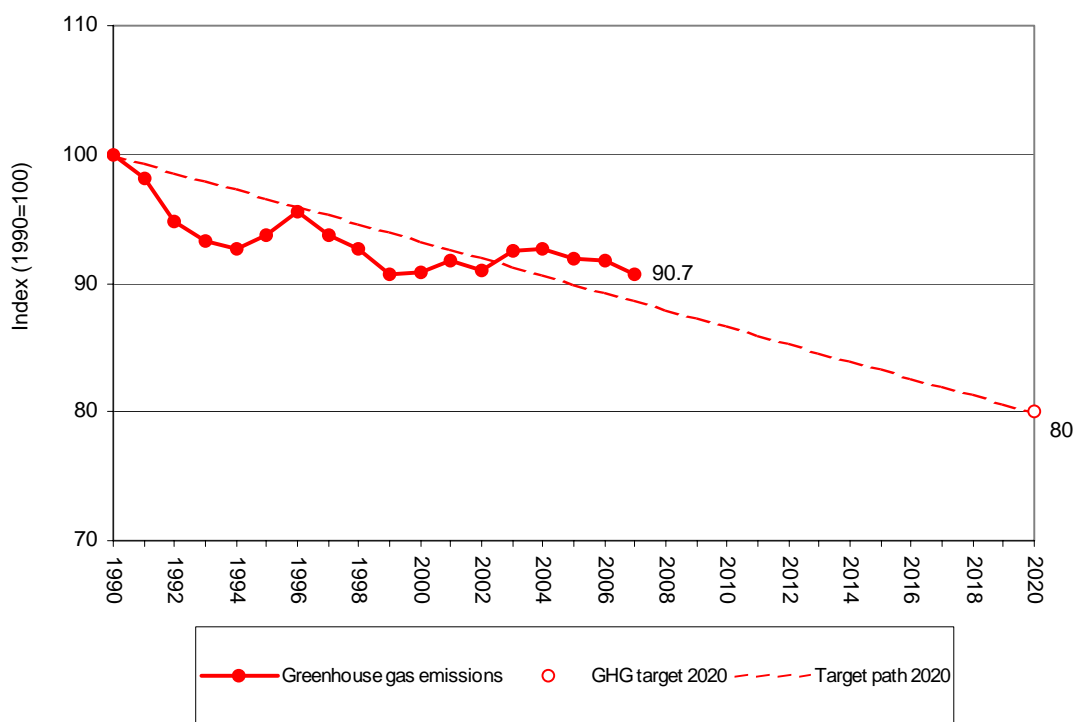
Notes: The linear target path is not intended as an approximation of past and future emission trends. It provides a measure of how close the EC emissions in 2007 are to a linear path of emissions reductions from 1990 to the Kyoto target for 2008–2012, assuming that only domestic measures will be used. Therefore, it does not deliver a measure of (possible) compliance of the EC with its GHG targets in 2008–2012, but aims at evaluating overall EC GHG emissions in 2007. The unit is index points with base year emissions being 100. GHG emission data for the EC as a whole do not include emissions and removals from LULUCF. In addition, no adjustments for temperature variations or electricity trade are considered.

For the fluorinated gases the EC base year emissions is the sum of Member States' emissions in the respective base years. Twelve Member States have chosen to select 1995 as base year under the Kyoto Protocol. Austria, France and Italy have chosen to use 1990. Therefore, the EC base year estimates for fluorinated gas emissions are the sum of 1995 emissions for 12 Member States and 1990 emissions for Austria, France and Italy.

For this reason and because of recalculations for the emissions in 1990, the emissions in 1990 need not be exactly 100. The Kyoto target relates to average emissions over the five-year period 2008–2012, the latest five-year available (2003–2007) is shown, in addition to the GHG emission trends for 1990–2007.

Total GHG emissions excluding LULUCF (land-use, land-use change and forestry) in the EU-27 decreased by 9.3 % between 1990 and 2007. Emissions decreased by 1.2 % between 2006 and 2007.

Illustration 3-2 EU-27 GHG emissions 1990–2007 compared with the EC's target for 2020 (excluding LULUCF)



In the EU-15, the change of total GHG emissions excluding LULUCF between the fixed Kyoto base year and 2007 was -5.0 %. The effect of the recalculation in 2006, comparing the 2008 and 2009 inventories, was 0.8 %. This means that of the 5.0 % reduction in

emissions between the Kyoto base year and 2007, 0.8 % has been due to recalculations. These were mainly due to the revised energy balance in Germany and the use of a revised emission factor for agriculture (nitrogen leaching) in Germany. The other main reason was more widespread use of the N₂O emission factors in the COPERT4 model for estimating emissions from road transport. The N₂O emission factor in COPERT4 is lower than in COPERT3. This has the effect of reducing N₂O emissions more in later years because of the upward trend in the use of catalysts to reduce NO_x emissions. In the EU-15, recalculations for the year 1990 had only a small affect (-0.3 % between the 2008 and 2009 submissions). In the EU-27, recalculations affected the year 1990 by -0.2 % and the year 2006 by -0.7 %.

3.2.2. *Emission Trends by Gas*

Table 3—1 gives an overview of the main trends in the EU-15 GHG emissions and removals for 1990–2007. Also in the EU-15 the most important GHG is CO₂, accounting for 83.7 % of total EU-15 emissions in 2007 excluding LULUCF. In 2007, EU-15 CO₂ emissions without LULUCF were 3,391 Tg, which was 0.9 % above 1990 levels. Compared to 2006, CO₂ emissions decreased by 1.8 %.

Table 3—1 Overview of EU-15 GHG emissions and removals from 1990 to 2007 in CO₂ equivalents (Tg)

| GREENHOUSE GAS EMISSIONS | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Net CO ₂ emissions/removals | 3,138 | 3,122 | 3,051 | 3,004 | 2,995 | 3,024 | 3,080 | 3,025 | 3,077 | 3,037 | 3,087 | 3,135 | 3,111 | 3,156 | 3,190 | 3,156 | 3,158 | 3,126 |
| CO ₂ emissions (without LULUCF) | 3,360 | 3,383 | 3,306 | 3,252 | 3,252 | 3,286 | 3,363 | 3,308 | 3,355 | 3,328 | 3,354 | 3,422 | 3,411 | 3,477 | 3,488 | 3,459 | 3,452 | 3,391 |
| CH ₄ | 436 | 432 | 426 | 423 | 414 | 411 | 406 | 394 | 385 | 376 | 366 | 354 | 344 | 331 | 320 | 314 | 309 | 305 |
| N ₂ O | 387 | 383 | 376 | 363 | 370 | 371 | 375 | 374 | 354 | 334 | 331 | 323 | 315 | 313 | 314 | 309 | 295 | 292 |
| HFCs | 28 | 28 | 29 | 31 | 36 | 41 | 47 | 53 | 54 | 47 | 46 | 44 | 46 | 50 | 50 | 53 | 54 | 57 |
| PFCs | 17 | 15 | 13 | 12 | 12 | 11 | 11 | 10 | 9 | 9 | 7 | 6 | 8 | 7 | 5 | 4 | 4 | 3 |
| SF ₆ | 11 | 11 | 12 | 13 | 14 | 15 | 15 | 14 | 13 | 11 | 11 | 10 | 9 | 9 | 9 | 9 | 9 | 9 |
| Total (with net CO₂ emissions/removals) | 4,016 | 3,992 | 3,907 | 3,846 | 3,840 | 3,873 | 3,934 | 3,870 | 3,891 | 3,813 | 3,848 | 3,873 | 3,834 | 3,866 | 3,888 | 3,845 | 3,828 | 3,793 |
| Total (without CO₂ from LULUCF) | 4,239 | 4,253 | 4,162 | 4,095 | 4,097 | 4,136 | 4,218 | 4,153 | 4,170 | 4,104 | 4,114 | 4,160 | 4,134 | 4,187 | 4,187 | 4,148 | 4,122 | 4,058 |
| Total (without LULUCF) | 4,233 | 4,247 | 4,157 | 4,089 | 4,089 | 4,128 | 4,210 | 4,146 | 4,163 | 4,098 | 4,108 | 4,154 | 4,127 | 4,180 | 4,180 | 4,141 | 4,116 | 4,052 |

When the 4th National Communication from the EC was produced¹⁶, CO₂ emissions without LULUCF in 2003¹⁷ were 3.4 %, above 1990 levels, although emissions of CH₄ and N₂O had declined over the same period. These features in the emission data have remained in the 2007 GHG inventory, although the increase in CO₂ emissions has been less significant. Emissions of CO₂ and F-gases increased slightly from 1990 to 2007 by 31 Tg (0.9 %) and 13 Tg CO₂ eq. (24 %), respectively. Emissions of CH₄ decreased by 131 Tg CO₂ eq. (-30 %) and emissions of N₂O decreased by 95 Tg CO₂ eq. (-25 %).

Table 3-2 gives an overview of the main trends in EU-27 GHG emissions and removals for 1990–2007. The most important GHG by far is CO₂, accounting for 83 % of total EU-27 emissions in 2007 excluding LULUCF. In 2007, EU-27 CO₂ emissions excluding LULUCF were 4,187 Tg, which was 4.8 % below 1990 levels. Compared to 2006, CO₂ emissions decreased by 1.3 %.

¹⁶ Summary of 4th National Communication in Communication from the Commission (COM(2006) 40 final). See http://eur-lex.europa.eu/LexUriServ/site/en/com/2006/com2006_0040en01.pdf

¹⁷ At the time of the 4th National Communication, 2003 was the latest inventory data available.

Table 3—2 Overview of EU-27 GHG emissions and removals from 1990 to 2007 in CO₂ equivalents (Tg)

| GREENHOUSE GAS | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Net CO ₂ emissions/removals | 4,057 | 3,943 | 3,791 | 3,738 | 3,710 | 3,755 | 3,838 | 3,753 | 3,741 | 3,669 | 3,714 | 3,758 | 3,722 | 3,793 | 3,819 | 3,783 | 3,794 | 3,771 |
| CO ₂ emissions (without LULUCF) | 4,400 | 4,343 | 4,191 | 4,126 | 4,103 | 4,150 | 4,251 | 4,163 | 4,152 | 4,084 | 4,106 | 4,184 | 4,158 | 4,252 | 4,264 | 4,232 | 4,243 | 4,187 |
| CH ₄ | 602 | 588 | 571 | 561 | 548 | 547 | 541 | 525 | 505 | 494 | 481 | 466 | 457 | 446 | 433 | 426 | 422 | 416 |
| N ₂ O | 513 | 485 | 466 | 447 | 454 | 455 | 460 | 458 | 434 | 411 | 409 | 403 | 392 | 391 | 394 | 389 | 375 | 374 |
| HFCs | 28 | 28 | 29 | 31 | 36 | 41 | 48 | 54 | 55 | 48 | 48 | 46 | 49 | 53 | 54 | 59 | 60 | 63 |
| PFCs | 20 | 18 | 15 | 14 | 14 | 14 | 13 | 11 | 10 | 10 | 8 | 8 | 9 | 8 | 6 | 5 | 5 | 4 |
| SF ₆ | 11 | 11 | 12 | 13 | 15 | 16 | 15 | 14 | 13 | 11 | 11 | 11 | 10 | 9 | 9 | 9 | 10 | 10 |
| Total (with net CO₂ emissions/removals) | 5,230 | 5,073 | 4,885 | 4,806 | 4,776 | 4,827 | 4,915 | 4,814 | 4,759 | 4,643 | 4,671 | 4,692 | 4,639 | 4,700 | 4,717 | 4,672 | 4,666 | 4,638 |
| Total (without CO₂ from LULUCF) | 5,573 | 5,473 | 5,284 | 5,194 | 5,169 | 5,223 | 5,328 | 5,224 | 5,170 | 5,059 | 5,063 | 5,118 | 5,074 | 5,160 | 5,162 | 5,120 | 5,114 | 5,054 |
| Total (without LULUCF) | 5,564 | 5,464 | 5,276 | 5,186 | 5,159 | 5,213 | 5,318 | 5,214 | 5,160 | 5,049 | 5,054 | 5,109 | 5,066 | 5,150 | 5,153 | 5,111 | 5,105 | 5,045 |

3.2.3. *Emission Trends by Main Source*

Table 3—3 gives an overview of EU-15 GHG emissions, for 1990–2007, presented in the same sectors used for reporting the EU-27 emissions. Emissions from international aviation and shipping are presented in the table but are excluded from national totals. The emissions from the largest sector, energy, with 58.5 % the total emissions, decreased by 189 Tg CO₂ equivalents (-7.4 %). Emissions from the industrial processes sector decreased by 40 Tg CO₂ eq. (-10.8 %); emissions from the transport sector increased by 165 Tg CO₂ eq. (-23.6 %) emissions from the agriculture sector decreased by 48 Tg CO₂ equivalents (-11.5 %); emissions from the waste sector decreased by 66 Tg CO₂ eq. (-39 %); and emissions from ‘other’ sector decreased by 4 Tg CO₂ eq. (-28.6 %).

Table 3—3 Overview of EU-15 GHG emissions in the main source and sink categories 1990 to 2007 in CO₂ equivalents (Tg)¹⁸

| GHG SOURCE AND SINK | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| 1. Energy | 2,558 | 2,577 | 2,479 | 2,423 | 2,399 | 2,418 | 2,486 | 2,409 | 2,428 | 2,383 | 2,397 | 2,459 | 2,434 | 2,487 | 2,477 | 2,452 | 2,438 | 2,369 |
| 2. Industrial Processes | 372 | 361 | 349 | 339 | 361 | 371 | 369 | 378 | 357 | 325 | 330 | 321 | 320 | 325 | 331 | 332 | 325 | 332 |
| 3. Transport | 699 | 713 | 738 | 746 | 750 | 760 | 777 | 786 | 810 | 830 | 831 | 840 | 850 | 856 | 867 | 862 | 863 | 864 |
| 4. Agriculture | 419 | 410 | 405 | 398 | 400 | 402 | 406 | 407 | 407 | 406 | 403 | 394 | 389 | 385 | 383 | 377 | 373 | 371 |
| 5. Land-Use, Land-Use Change and Forestry | -217 | -255 | -250 | -242 | -249 | -255 | -276 | -276 | -271 | -284 | -260 | -280 | -294 | -314 | -292 | -296 | -288 | -259 |
| 6. Waste | 171 | 173 | 172 | 170 | 168 | 165 | 161 | 153 | 148 | 141 | 136 | 129 | 123 | 117 | 112 | 109 | 107 | 105 |
| 7. Other | 14 | 13 | 13 | 13 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 11 | 11 | 11 | 10 | 10 | 10 | 10 |
| Total (with net CO₂ emissions/removals) | 4,016 | 3,992 | 3,907 | 3,846 | 3,840 | 3,873 | 3,934 | 3,870 | 3,891 | 3,813 | 3,848 | 3,873 | 3,834 | 3,866 | 3,888 | 3,845 | 3,828 | 3,793 |
| Total (without LULUCF) | 4,233 | 4,247 | 4,157 | 4,089 | 4,089 | 4,128 | 4,210 | 4,146 | 4,163 | 4,098 | 4,108 | 4,154 | 4,127 | 4,180 | 4,180 | 4,141 | 4,116 | 4,052 |
| International aviation | 62 | 62 | 67 | 71 | 75 | 80 | 84 | 89 | 96 | 104 | 110 | 109 | 106 | 110 | 119 | 124 | 129 | 133 |
| International marine | 104 | 103 | 104 | 108 | 105 | 107 | 114 | 124 | 130 | 124 | 130 | 135 | 140 | 142 | 150 | 158 | 168 | 170 |

¹⁸

7. 'Other' includes emissions from Solvent and Other Product Use reported in sector 3 and sector 7 from the CRF

Table 3—4 gives an overview of EU-27 GHG emissions in seven sectors for 1990–2007. Emissions from international aviation and shipping are presented in the table but are excluded from the national totals. The energy sector is the largest sector by far, accounting for 59.8 % of total EU-27 emissions in 2007. The second largest sector is transport (19.5 %), followed by agriculture (9.2 %). The increase in emissions between 1990-2007 from the transport sector is due to both growth in passenger transport and freight transport (see section 2.8) although there have been policies and measures implemented in this sector to mitigate emissions (see section 4.5).

Table 3—4 Overview of EU-27 GHG emissions in the main source and sink categories 1990 to 2007 in CO₂ equivalents (Tg)¹⁹

| GHG SOURCE AND SINK | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| 1. Energy | 3,498 | 3,460 | 3,289 | 3,227 | 3,171 | 3,194 | 3,280 | 3,164 | 3,123 | 3,046 | 3,052 | 3,122 | 3,079 | 3,155 | 3,134 | 3,095 | 3,090 | 3,017 |
| 2. Industrial Processes | 478 | 441 | 425 | 410 | 438 | 456 | 453 | 460 | 432 | 393 | 405 | 394 | 390 | 401 | 413 | 420 | 418 | 431 |
| 3. Transport | 780 | 785 | 808 | 816 | 823 | 838 | 863 | 873 | 901 | 918 | 918 | 931 | 944 | 954 | 973 | 972 | 978 | 983 |
| 4. Agriculture | 579 | 549 | 526 | 506 | 505 | 504 | 506 | 507 | 505 | 501 | 493 | 485 | 479 | 474 | 473 | 466 | 463 | 462 |
| 5. Land-Use, Land-Use Change and Forestry | -334 | -391 | -392 | -380 | -383 | -385 | -403 | -400 | -401 | -406 | -383 | -417 | -427 | -450 | -436 | -439 | -440 | -407 |
| 6. Waste | 213 | 215 | 213 | 212 | 210 | 207 | 203 | 196 | 184 | 178 | 172 | 164 | 160 | 154 | 149 | 146 | 144 | 141 |
| 7. Other | 16 | 16 | 15 | 15 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 13 | 13 | 13 | 13 | 12 | 13 | 12 |
| Total (with net CO₂ emissions/removals) | 5,230 | 5,073 | 4,885 | 4,806 | 4,776 | 4,827 | 4,915 | 4,813 | 4,758 | 4,643 | 4,671 | 4,692 | 4,638 | 4,700 | 4,717 | 4,671 | 4,665 | 4,638 |
| Total (without LULUCF) | 5,564 | 5,464 | 5,276 | 5,186 | 5,159 | 5,213 | 5,318 | 5,214 | 5,159 | 5,049 | 5,053 | 5,109 | 5,066 | 5,150 | 5,153 | 5,111 | 5,104 | 5,045 |
| International aviation | 66 | 66 | 71 | 75 | 79 | 84 | 88 | 92 | 100 | 107 | 114 | 113 | 111 | 115 | 123 | 129 | 135 | 139 |
| International marine | 110 | 108 | 109 | 112 | 109 | 110 | 117 | 127 | 133 | 127 | 133 | 138 | 145 | 148 | 156 | 164 | 174 | 176 |

¹⁹ 7. 'Other' includes emissions from Solvent and Other Product Use reported in sector 3 and sector 7 from the CRF

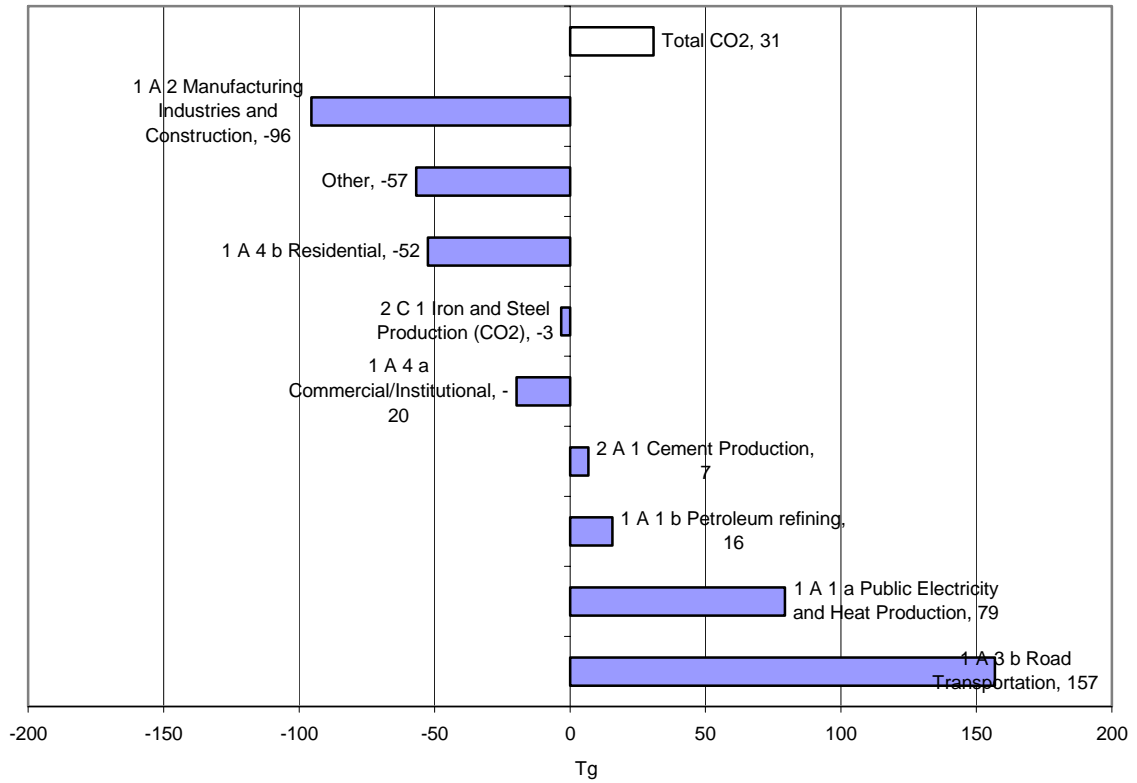
International bunker emissions of the EC inventory are the sum of the Aviation bunker and Maritime bunker emissions of the Member States²⁰. Between 1990 and 2007, greenhouse gas emissions from international bunker fuels increased by 82 % in the EU-15 and by 79 % in the EU-27. Greenhouse gas emissions from maritime bunkers (international shipping) account for 56 % and emissions from aviation bunkers (international aviation) accounts for 44 % of the total international bunkers in the EU-27. These emissions are reported as memo items but excluded from national totals. The emissions from these two sources are equivalent to 4.2 % (170 Mt) and 3.3 % (133 Mt) of total EU-27 GHG emissions in 2007.

3.2.4. *Change in Emissions from Key Source Categories for EU-15*

Key source categories are defined as the sources of emissions that have a significant influence on the inventory as a whole, in terms of the absolute level of the emissions, the trend, or both. Road transport is a key source category in the EC inventory, and the main reason for the increase in EU-15 CO₂ emissions between 1990 and 2007 was the growth in road transport. The growth in passenger transport and freight is presented in section 2.8. The large increase in road transport-related CO₂ emissions was only partly offset by reductions in energy-related emissions from manufacturing industries and ‘other’ sectors. Emissions from the sector ‘other’ are the sum of the reductions from sources not categorized as key sources. Carbon dioxide emissions from public electricity and heat production have increased despite some switching to lower carbon sources (see section 2.7.1) since 1990.

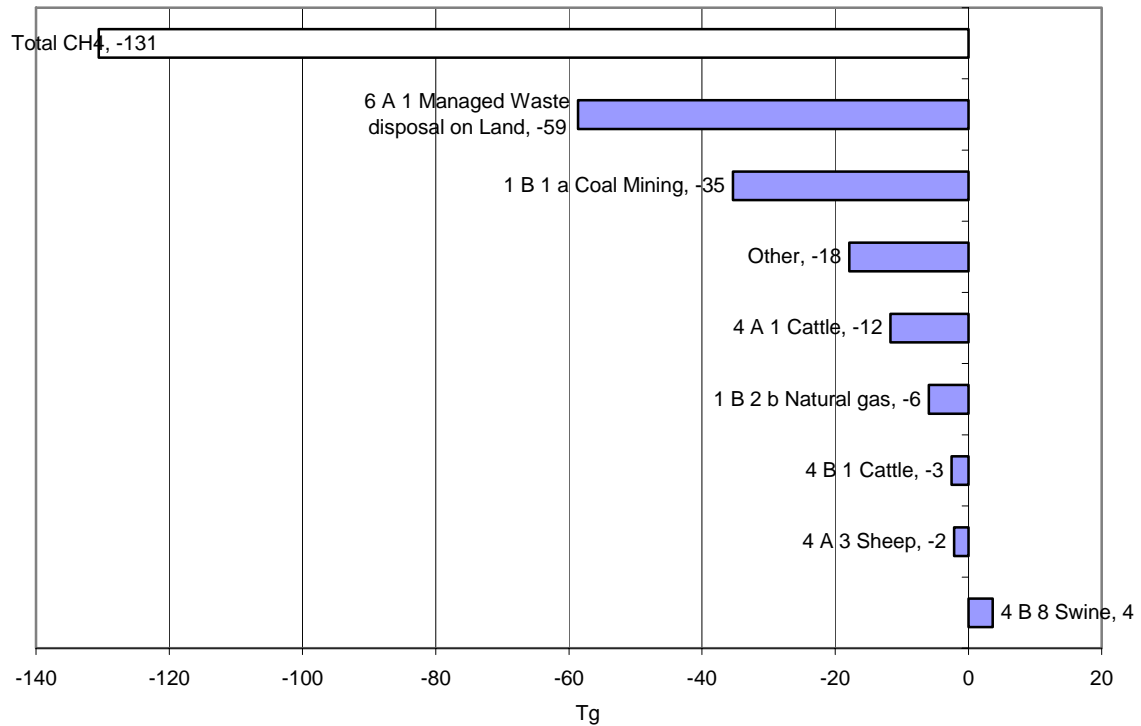
²⁰ The definitions in Tables 2.8 and 2.9 of the IPCC good practice guidance are based on activities within ‘one country’. This means domestic aviation is defined for individual countries. The decision tree in Figure 2.8 of the IPCC good practice guidance considers ‘national fuel statistics’ for domestic aviation. As the EC is neither a country nor a nation, the EC’s interpretation of the good practice guidance is that the emission estimate at EC level has to be the sum of Member States estimates for domestic air or marine transport as they are the countries or nations addressed in the definition and decision trees of the IPCC good practice guidance.

Illustration 3-3 Absolute change of CO₂ emissions by large key source categories 1990 to 2007 in CO₂ equivalents (Tg) for EU-15



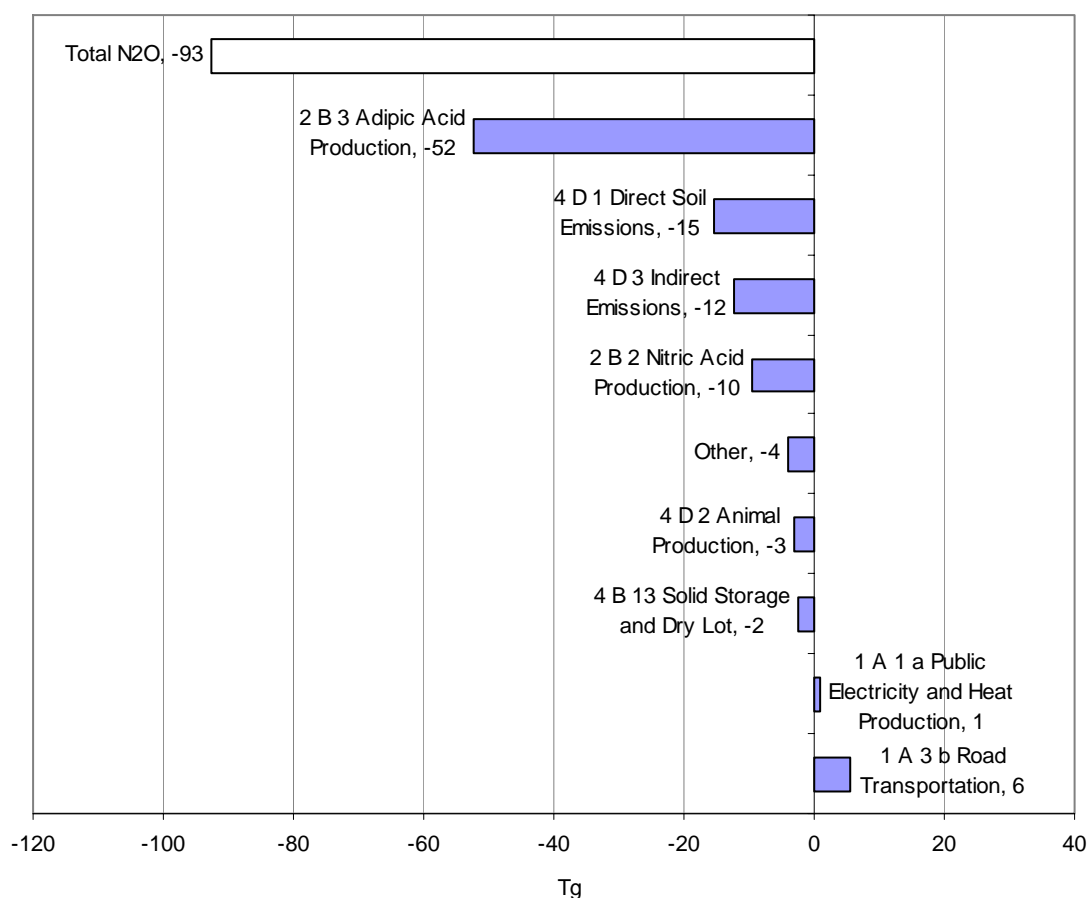
Methane emissions account for 7.5 % of total EU-15 GHG emissions excluding LULUCF and the net emissions and removals decreased by 30 % since 1990 to 305 Tg CO₂ eq. in 2007. The two largest key sources account for 55.2 % of CH₄ emissions in 2007. The illustration below shows the change in CH₄ emissions. The main reasons for declining CH₄ emissions were 1) reductions in solid waste disposal on land, due to the increased use of recycling and incineration of waste with energy recovery as a result of the policy drivers discussed in section 4.9 and, 2) the decline of coal-mining.

Illustration 3-4 Absolute change of CH₄ emissions by large key source categories 1990 to 2007 in CO₂ equivalents (Tg) for EU-15



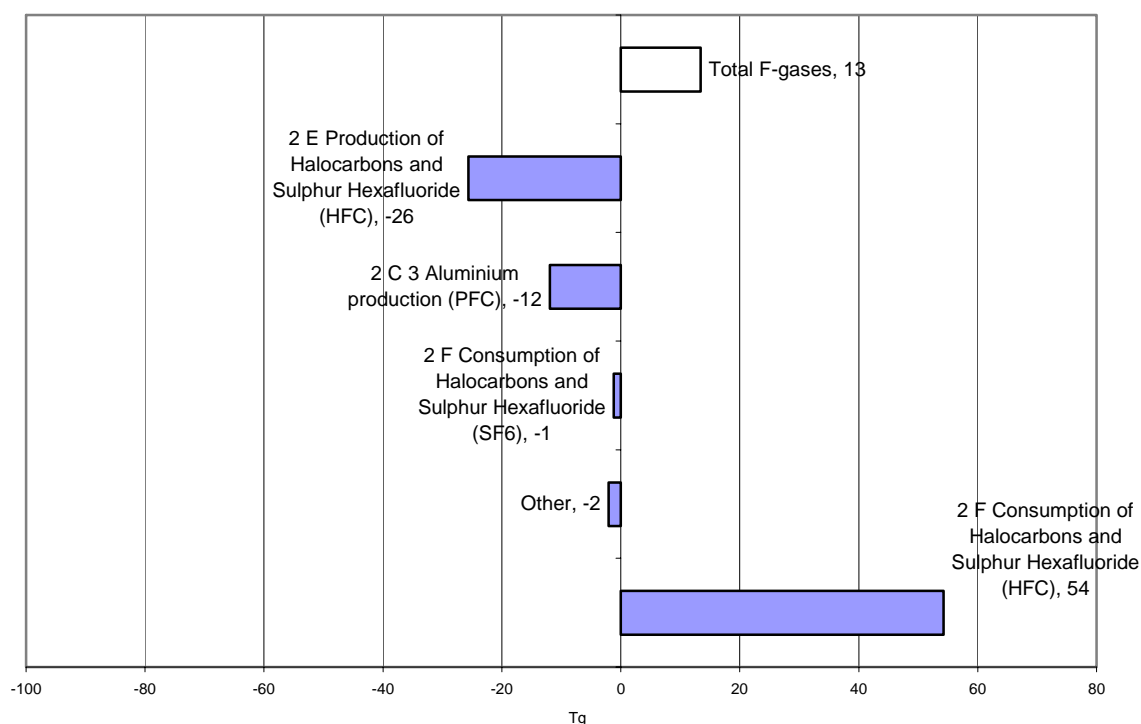
Nitrous oxide emissions are responsible for 7.2 % of total EU-15 GHG emissions excluding LULUCF and the net emissions and removals decreased by 24.5 % to 292 Tg CO₂ eq. in 2007. The two largest key sources account for 53 % of N₂O emissions in 2007. The figure below shows the change in N₂O emissions. The main reasons for the large reductions in N₂O emission were abatement measures to mitigate emissions from adipic acid production and reductions in direct soil emissions. The consumption of nitrogenous fertilizer has fallen steadily by approximately 10 % since 2000 (see section 2.12).

Illustration 3-5 Absolute change of N₂O emissions by large key source categories 1990 to 2007 in CO₂ equivalents (Tg) for EU-15



Fluorinated gas emissions account for 1.7 % of total EU-15 GHG emissions. In 2007, emissions were 69 Tg CO₂ eq., which was 24.1 % above 1990 levels. The two largest key sources account for 88 % of fluorinated gas emissions in 2007. The figure below shows that emission of HFCs from consumption of halocarbons and sulphur hexafluoride showed large increase between 1990 and 2007. The main reason for this is the phase-out of ozone-depleting substances such as chlorofluorocarbons under the Montreal Protocol and the replacement of these substances with HFCs (mainly in refrigeration, air conditioning, foam production and as aerosol propellants). On the other hand, HFC emissions from production of halocarbons and sulphur hexafluoride decreased substantially.

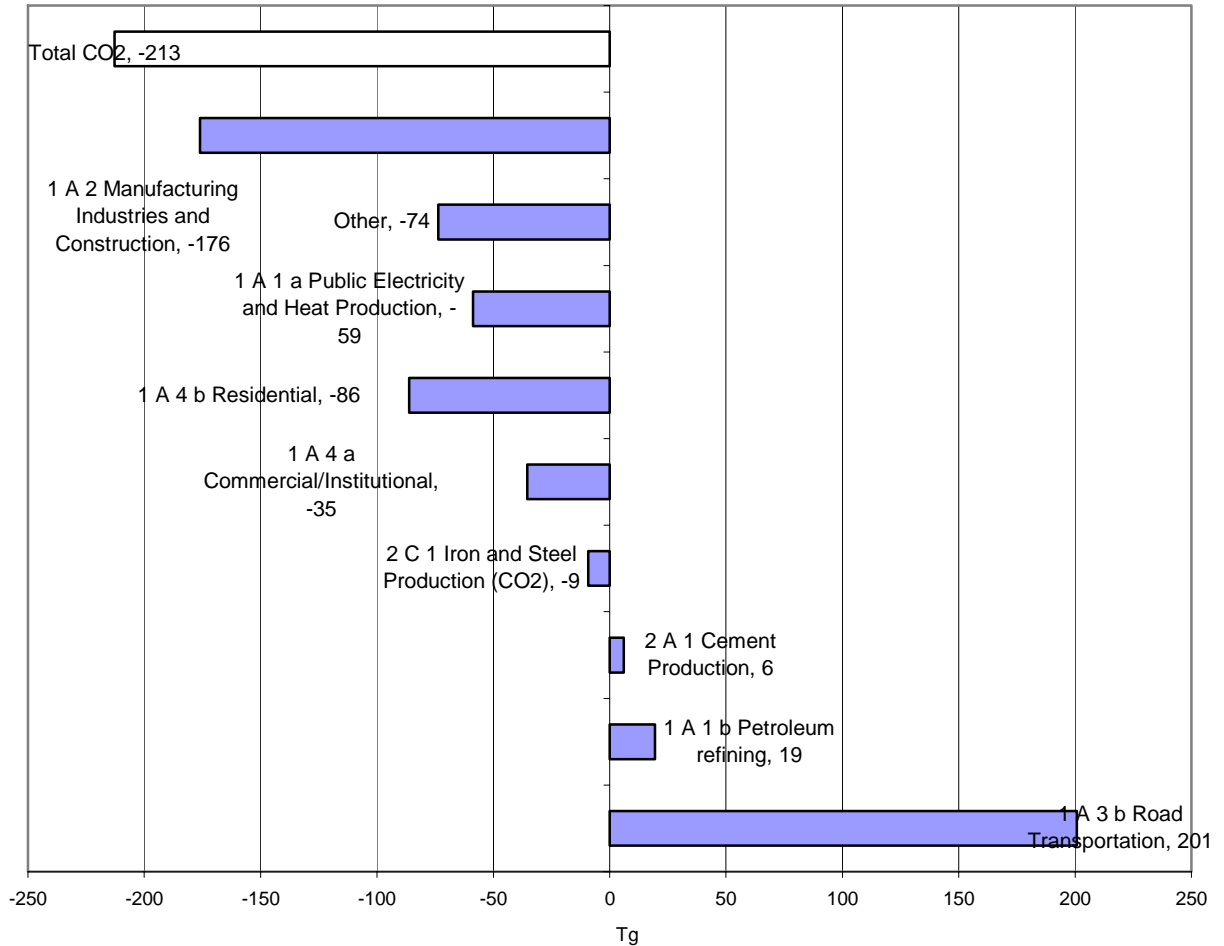
Illustration 3-6 Absolute change of fluorinated gas emissions by large key source categories 1990 to 2007 in CO₂ equivalents (Tg) for EU-15



3.2.5. Change in Emissions from Key Source Categories for EU-27

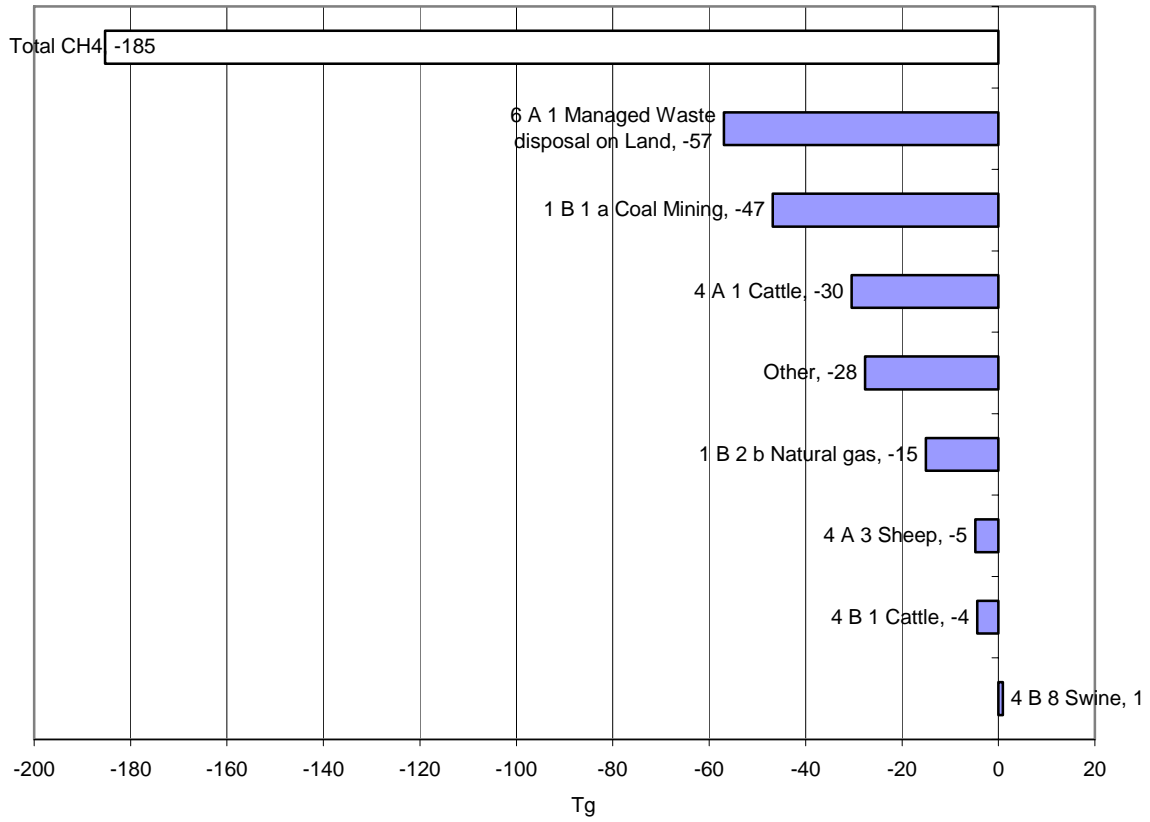
In the EU-27 inventory, many of the key source categories emissions reduced between 1990 and 2007. The main reasons for the decrease in EU-27 CO₂ emissions was due to the reduction in emissions from the manufacturing and construction industries and from public electricity and heat production. Emissions from the sector 'other' are the sum of the reductions from sources not categorized as key sources. Similar to the EU-15, road transport contributed significantly to the increase in CO₂ emissions, although in the case for the EU-27 the magnitude of the increase was less than the overall reduction that occurred in the other sectors.

Illustration 3-7 Absolute change of CO₂ emissions by large key source categories 1990 to 2007 in CO₂ equivalents (Tg) for EU-27



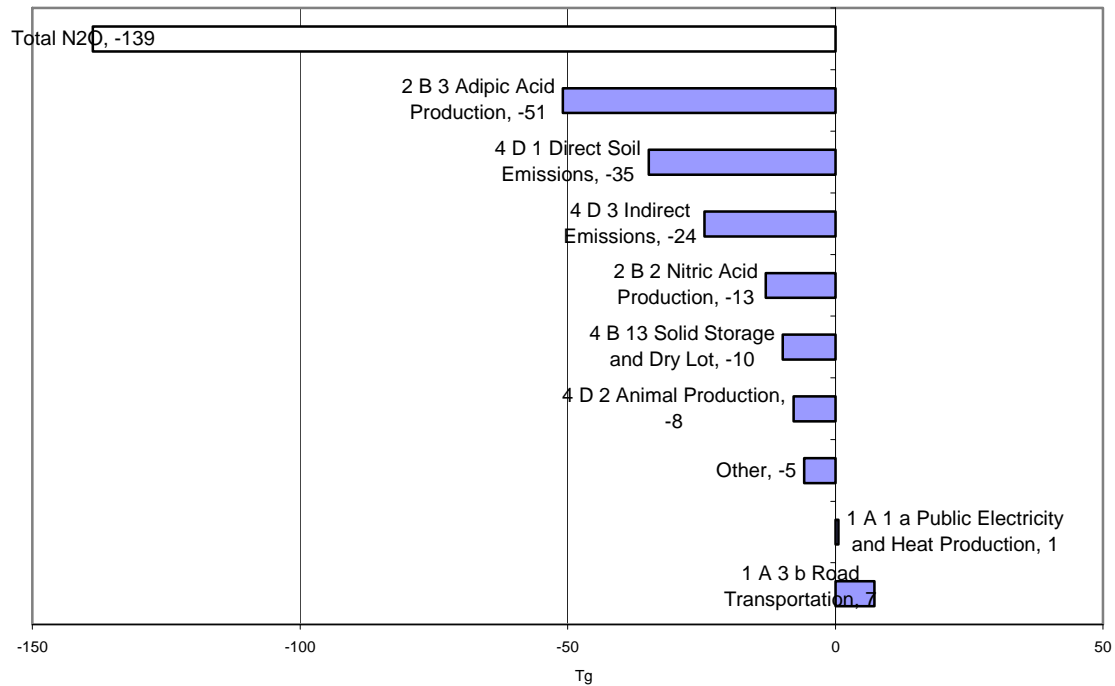
Methane emissions account for 8.3 % of total EU-27 GHG emissions excluding LULUCF and the net emissions and removals decreased by 31 % since 1990 to 416 Tg CO₂ eq. in 2007. The two largest key sources account for 50 % of CH₄ emissions in 2007. The illustration below shows that the change in CH₄ emissions.

Illustration 3-8 Absolute change of CH₄ emissions by large key source categories 1990 to 2007 in CO₂ equivalents (Tg) for EU-27



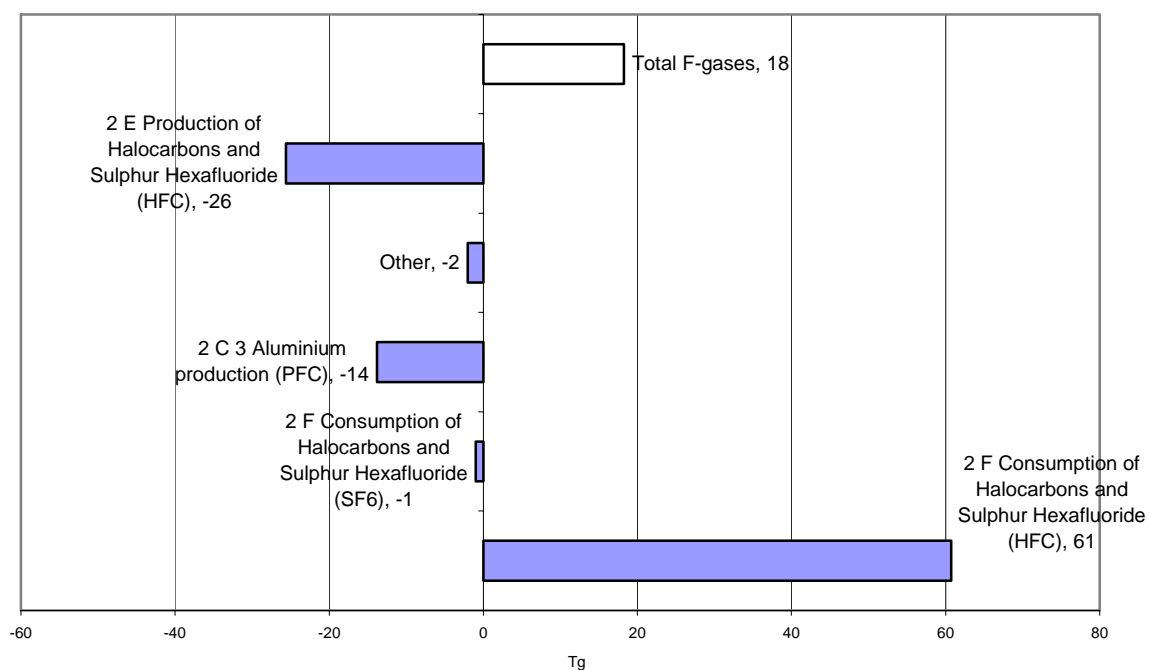
Nitrous oxide emissions are responsible for 7.4 % of total EU-27 GHG emissions excluding LULUCF and the net emissions and removals decreased by 27 % to 374 Tg CO₂ eq. in 2007. The two largest key sources account for 53 % of N₂O emissions in 2007. The figure below shows the change in N₂O emissions. The main reasons for the large reductions in N₂O emission were for the same reasons as the EU-15.

Illustration 3-9 Absolute change of N₂O emissions by large key source categories 1990 to 2007 in CO₂ equivalents (Tg) for EU-27



Fluorinated gas emissions account for 1.5 % of total EU-27 GHG emissions excluding LULUCF. In 2007, emissions were 77 Tg CO₂ eq., which was 31 % above 1990 levels. The two largest key sources account for 88 % of fluorinated gas emissions in 2007. The figure below shows that HFC emissions from the consumption of halocarbons and sulphur hexafluoride increased by 61 Tg between 1990 and 2007. The main reason for this is the phase-out of ozone-depleting substances such as chlorofluorocarbons under the Montreal Protocol and the replacement of these substances with HFCs (mainly in refrigeration, air conditioning, foam production and as aerosol propellants). On the other hand, HFC emissions from production of halocarbons and sulphur hexafluoride decreased substantially.

Illustration 3-10 Absolute change of F-gas emissions by large key source categories 1990 to 2007 in CO₂ equivalents (Tg) for EU-27



3.2.6. Key Drivers affecting Emission Trends

The sections below summarise the main reasons for the changes in emissions in the EU during the period 2006-2007. The main reasons for the changes during the period 1990-2007 are described in more detail in section 2 - National Circumstances.

Emission decrease

Contribution by EU-15:

- CO₂ emissions from households and the service sector²¹ fell by 66.8 million tonnes or -10.8 %. The use of fossil fuels (i.e. oil, gas and coal) decreased by 10.1 %, particularly in households, mainly due to a lower number of heating degree days and due to shifts in fuel purchases (from 2007 to 2006 and 2008) because of fuel price variations.

²¹ This includes emissions from fuel combustion in commercial and institutional buildings, and all emissions from fuel combustion in households. It also includes a smaller source category covering fuel combustion emissions from agriculture, forestry and fishing. It should be noted that greenhouse gas emissions from households and services do not include indirect emissions. That is, greenhouse gas emissions resulting from the production of heat and electricity supplied to households and services are included under public electricity and heat production. Direct combustion emissions from households are outside the EU ETS.

- CO₂ emissions from manufacturing industries (excluding iron and steel) fell by 8.2 million tonnes or -1.9 %, with the main reductions in Italy, Spain and the United Kingdom.
- Fugitive emissions of CH₄ fell by 2.2 million tonnes or -6.5 % mainly in Germany and the United Kingdom, due to reduced coal mining activity and improvements to the gas distribution network.
- Emissions from iron and steel production fell due to reduced energy use, mainly in Germany (decline of 2.2 million tonnes or -1.4 %).

EU-27:

In addition to the factors driving EU-15 emissions outlined above, EU-27 emissions are also influenced by the following trends in the EU-12:

- CO₂ emissions from households and services fell by 79.1 million tonnes (-10.9 %). Substantial decreases were reported in Poland, Hungary and Czech Republic due to the decrease in use of solid, gaseous and liquid fuels, corresponding to the warmer weather conditions in 2007.
- CO₂ emissions from manufacturing industries excluding iron and steel fell by 4.7 million tonnes (-0.9 %). The decrease is mainly due to EU-15 Member States. Several newer Member States report increased emissions, with the Czech Republic reporting the highest increase.
- Fugitive CH₄ emissions from energy supply fell by 3.1 million tonnes (-4.4 %), with significant reductions reported by Czech Republic and Poland.

Emission increase

Contribution by EU-15

- CO₂ emissions from public electricity and heat production increased by 10.7 million tonne (1.0 %). CO₂ emissions from public electricity and heat production increased mainly in Germany, Greece, the Netherlands and Spain, due to higher electricity production in conventional thermal power plants. Denmark, Finland and the United Kingdom reported decreases in emissions from this sector. Denmark produced less electricity from coal and had higher imports and lower exports in 2007 relative to 2006; Finland reduced electricity production from coal and made more use of hydropower. The UK's reductions were mainly due to a further shift from coal to gas. In the EU-15 the use of liquid fuels decreased by 21 %, while the use of solid fuels was constant and the use of gaseous fuels increased by 8 %. These trends are reflected in the decrease in emissions
- HFC from the consumption of halocarbons increased by 3.1 million tonnes (6.1 %). The increase in emissions came from the refrigeration and air conditioning sectors. France, Germany and Italy report the highest increases.

EU-27:

In addition to the factors driving EU-15 emissions outlined above, EU-27 emissions are also influenced by the following trends in the EU-12:

- CO₂ from public electricity and heat production increased by 15.0 million tonnes (1.1 %). Among the EU-12 increases were reported by Bulgaria, Czech Republic and Estonia due to increased electricity generation from conventional thermal power plants. Poland and Slovakia reported decreases due to increased electricity imports.
- CO₂ from road transportation increased by 5.3 million tonnes (0.6 %). The highest increases are reported by Slovakia, Lithuania, the Czech Republic and Slovenia, mostly due to increased traffic volume.
- CO₂ emissions from cement production in Poland increased by 4.5 million tonnes (4.4 %). Beside increases in the EU-15 Member States, Poland reported a major increase in emissions from cement production.
- HFC from the consumption of halocarbons increased by 4.0 million tonnes (7.0 %) from refrigeration and air conditioning. From the new Member States, Poland and Czech Republic report the highest increases.
- CO₂ emissions from the manufacture of solid fuels increased by 3.6 million tonnes (5.4 %). Poland contributed most to this increase in emissions.

The trends in emissions of the EU-15 normally dominate the trends of the EU-27. The reductions in emissions from many sources are also driven by the Policies and Measures (PAMs) which have been implemented within the EU. Further detail can be found in section 4.

3.2.6.1. Per capita and intensity trends

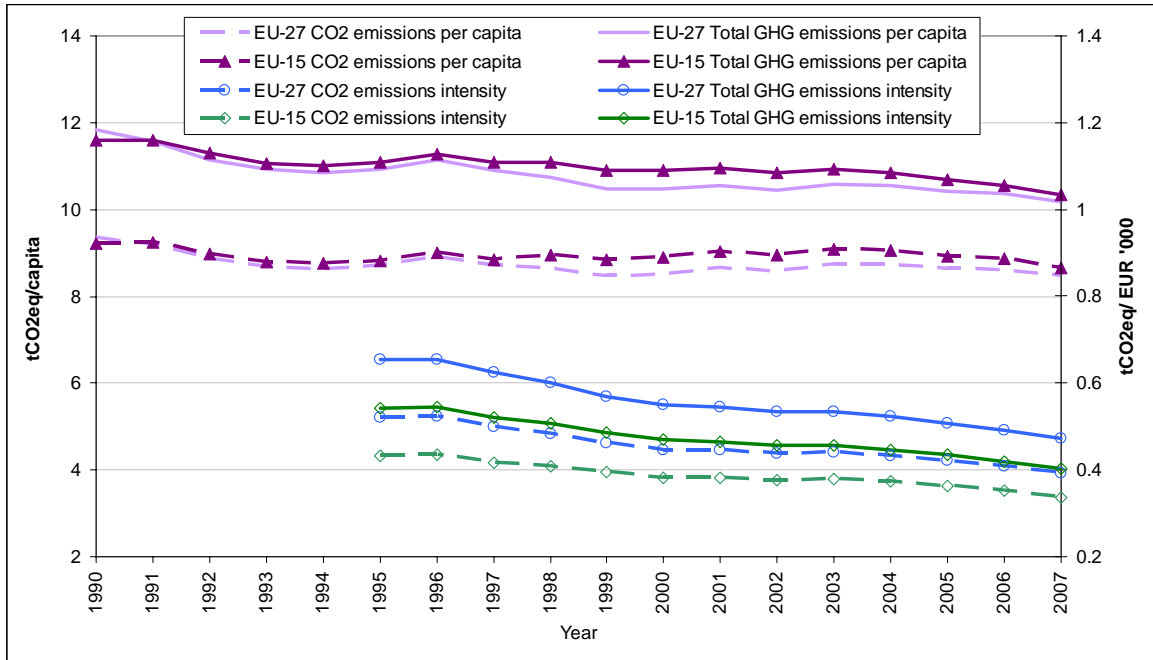
The previous sections highlighted overall trends in absolute emissions. It is also useful to view the trends in terms of emissions per capita as well as emissions intensity (per €k of GDP). Emissions intensity has declined for both the EU-15 and EU-27 over the period 1995 to 2007. This has been the result of a steady increase in GDP (as shown in section 2.3) over the period with a decline in emissions - with the exception of a slight increase in EU-15 CO₂ emissions, however, the increased in GDP was greater than this leading to a decline in emissions intensity overall.

A similar pattern is broadly observed in terms of total emissions per capita, but the increase in population over the period has been lower than that of GDP, hence the decline in emissions per capita is more gradual. In the case of EU-15 CO₂ the two trends, increase in CO₂ and population, roughly offset each other, hence EU-15 CO₂ emissions per capita has remained broadly stable over the period.

In 2007, average emissions per EU-27 citizen were approximately 10.2 tCO₂eq, with an EU-15 average of 10.3 tCO₂eq. This is above the world average of 6.7 tCO₂ eq. per

capita²². Greenhouse gas emissions show significant differences across European countries, correlated to the energy intensity (primary energy consumption per GDP) and the energy mix (affecting the level of emissions by energy unit produced) of each country.

Illustration 3-11 Trends in emissions per capita and intensity (excluding LULUCF)



Note: GDP data for emissions intensity based on chain-linked volumes, reference year 2000 (at 2000 exchange rates). Values start only in 1995 for emission intensity because of missing data for 13 Member States (Belgium, Bulgaria, Cyprus, Czech Republic, Greece, Hungary, Ireland, Lithuania, Luxembourg, Malta, Poland, and Romania)

Source: Eurostat (Data Explorer)

3.2.6.2. Contribution of MS to Greenhouse reduction trends

The tables below give an overview of Member States' contributions to the EC GHG emissions excluding LULUCF, for 1990–2007. The emission trends of the Member States are highly variable.

²² IEA, 2008: CO₂ emissions from fuel combustion, Edition 2008, International Energy Agency. Data refer to 2005 population and greenhouse gas emissions.

Table 3—5 Overview of Member States' contributions to EC GHG emissions excluding LULUCF from 1990 to 2007 in CO₂ equivalents (Tg)

| Member State | 1990 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|----------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Austria | 79 | 81 | 84 | 83 | 82 | 81 | 81 | 85 | 87 | 93 | 92 | 93 | 92 | 88 |
| Belgium | 143 | 149 | 154 | 145 | 151 | 144 | 145 | 145 | 143 | 146 | 146 | 142 | 137 | 131 |
| Bulgaria | 118 | 89 | 87 | 84 | 75 | 70 | 69 | 70 | 67 | 72 | 71 | 71 | 72 | 76 |
| Cyprus | 5 | 7 | 7 | 7 | 8 | 9 | 9 | 9 | 9 | 9 | 10 | 10 | 10 | 10 |
| Czech Republic | 195 | 153 | 160 | 153 | 145 | 141 | 147 | 149 | 145 | 146 | 147 | 146 | 149 | 151 |
| Denmark | 69 | 76 | 90 | 80 | 76 | 73 | 68 | 69 | 69 | 74 | 68 | 63 | 71 | 67 |
| Estonia | 42 | 21 | 22 | 21 | 20 | 18 | 18 | 19 | 18 | 20 | 20 | 20 | 19 | 22 |
| Finland | 71 | 71 | 77 | 76 | 72 | 72 | 70 | 75 | 77 | 85 | 80 | 69 | 80 | 78 |
| France | 563 | 556 | 571 | 565 | 578 | 562 | 557 | 558 | 549 | 552 | 552 | 554 | 542 | 531 |
| Germany | 1,215 | 1,085 | 1,105 | 1,068 | 1,042 | 1,010 | 1,008 | 1,025 | 1,006 | 1,007 | 997 | 969 | 980 | 956 |
| Greece | 106 | 110 | 113 | 118 | 123 | 123 | 127 | 128 | 128 | 131 | 131 | 132 | 128 | 132 |
| Hungary | 99 | 80 | 82 | 80 | 80 | 80 | 78 | 80 | 78 | 81 | 80 | 80 | 79 | 76 |
| Ireland | 55 | 59 | 61 | 63 | 66 | 67 | 69 | 71 | 69 | 69 | 69 | 70 | 70 | 69 |
| Italy | 516 | 530 | 523 | 529 | 540 | 546 | 550 | 555 | 556 | 570 | 574 | 574 | 563 | 553 |
| Latvia | 27 | 13 | 13 | 12 | 12 | 11 | 10 | 11 | 11 | 11 | 11 | 11 | 12 | 12 |
| Lithuania | 49 | 22 | 23 | 23 | 23 | 21 | 19 | 20 | 21 | 21 | 22 | 23 | 23 | 25 |
| Luxembourg | 13 | 10 | 10 | 10 | 9 | 9 | 10 | 10 | 11 | 12 | 13 | 13 | 13 | 13 |
| Malta | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Netherlands | 212 | 225 | 233 | 226 | 227 | 215 | 214 | 216 | 215 | 217 | 218 | 212 | 209 | 208 |
| Poland | 459 | 446 | 454 | 449 | 414 | 400 | 389 | 385 | 371 | 384 | 384 | 387 | 399 | 399 |
| Portugal | 59 | 70 | 68 | 71 | 76 | 84 | 82 | 84 | 89 | 84 | 86 | 89 | 85 | 82 |
| Romania | 243 | 181 | 187 | 167 | 149 | 132 | 136 | 140 | 147 | 154 | 155 | 149 | 154 | 152 |
| Slovakia | 73 | 53 | 51 | 50 | 50 | 49 | 48 | 50 | 49 | 50 | 50 | 49 | 49 | 47 |
| Slovenia | 19 | 19 | 19 | 20 | 19 | 19 | 19 | 20 | 20 | 20 | 20 | 20 | 21 | 21 |
| Spain | 288 | 319 | 312 | 333 | 343 | 372 | 386 | 386 | 403 | 410 | 426 | 441 | 433 | 442 |
| Sweden | 72 | 74 | 77 | 73 | 73 | 70 | 68 | 69 | 70 | 70 | 70 | 67 | 67 | 65 |
| United Kingdom | 771 | 712 | 733 | 708 | 704 | 671 | 674 | 677 | 656 | 661 | 658 | 653 | 648 | 637 |
| EU-15 | 4,233 | 4,128 | 4,210 | 4,146 | 4,163 | 4,098 | 4,108 | 4,154 | 4,127 | 4,180 | 4,180 | 4,141 | 4,116 | 4,052 |
| EU-27 | 5,564 | 5,213 | 5,318 | 5,214 | 5,160 | 5,049 | 5,054 | 5,109 | 5,066 | 5,150 | 5,153 | 5,111 | 5,105 | 5,045 |

Note: For some countries the data provided in this table is based upon the gap filling procedure, see section 3.3.6 for more details.

Table 3—6 Greenhouse gas emissions excluding LULUCF (CO₂ equivalents) and Kyoto Protocol targets for 2008-2012

| MEMBER STATE | 1990 | Kyoto Protocol base year ⁽¹⁾ | 2007 | Change 2006–2007 | Change 1990–2007 | Change base year–2007 | Targets 2008–12 under Kyoto Protocol an "EU burden sharing" |
|----------------|------------------|---|------------------|------------------|------------------|-----------------------|---|
| | (million tonnes) | (million tonnes) | (million tonnes) | (%) | (%) | (%) | (%) |
| Austria | 79.0 | 79.0 | 88.0 | -3.9 | 11.3 | 11.3 | -13.0 |
| Belgium | 143.2 | 145.7 | 131.3 | -3.9 | -8.3 | -9.9 | -7.5 |
| Bulgaria | 117.7 | 132.6 | 75.8 | 5.4 | -35.6 | -42.8 | -8.0 |
| Cyprus | 5.5 | 5.5* | 10.1 | 1.6 | 83.6 | 83.6 | Not applicable |
| Czech Republic | 194.7 | 194.2 | 150.8 | 1.2 | -22.5 | -22.4 | -8.0 |
| Denmark | 69.1 | 69.3 | 66.6 | -6.2 | -3.5 | -3.9 | -21.0 |
| Estonia | 41.9 | 42.6 | 22.0 | 14.8 | -47.5 | -48.3 | -8.0 |
| Finland | 70.9 | 71.0 | 78.3 | -2.0 | 10.6 | 10.3 | 0.0 |
| France | 562.6 | 563.9 | 531.1 | -2.0 | -5.6 | -5.8 | 0.0 |
| Germany | 1215.2 | 1232.4 | 956.1 | -2.4 | -21.3 | -22.4 | -21.0 |
| Greece | 105.6 | 107.0 | 131.9 | 2.9 | 24.9 | 23.2 | 25.0 |
| Hungary | 99.2 | 115.4 | 75.9 | -3.7 | -23.5 | -34.2 | -6.0 |
| Ireland | 55.4 | 55.6 | 69.2 | -0.7 | 25.0 | 24.5 | 13.0 |
| Italy | 516.3 | 516.9 | 552.8 | -1.8 | 7.1 | 6.9 | -6.5 |
| Latvia | 26.7 | 25.9 | 12.1 | 3.5 | -54.7 | -53.4 | -8.0 |
| Lithuania | 49.1 | 49.4 | 24.7 | 8.1 | -49.6 | -49.9 | -8.0 |
| Luxembourg | 13.1 | 13.2 | 12.9 | -2.9 | -1.6 | -1.9 | -28.0 |
| Malta | 2.0 | 2.0* | 3.0 | 2.6 | 49.0 | 49.0 | Not applicable |
| Netherlands | 212.0 | 213.0 | 207.5 | -0.5 | -2.1 | -2.6 | -6.0 |
| Poland | 459.5 | 563.4 | 398.9 | -0.1 | -13.2 | -29.2 | -6.0 |
| Portugal | 59.3 | 60.1 | 81.8 | -3.4 | 38.1 | 36.1 | 27.0 |
| Romania | 243.0 | 278.2 | 152.3 | -1.0 | -37.3 | -45.3 | -8.0 |
| Slovakia | 73.3 | 72.1 | 47.0 | -4.1 | -35.9 | -34.8 | -8.0 |

| | | | | | | | |
|----------------|---------------|----------------|---------------|-------------|-------------|---------------|-----------------------|
| Slovenia | 18.6 | 20.4 | 20.7 | 0.7 | 11.6 | 1.8 | -8.0 |
| Spain | 288.1 | 289.8 | 442.3 | 2.1 | 53.5 | 52.6 | 15.0 |
| Sweden | 71.9 | 72.2 | 65.4 | -2.2 | -9.1 | -9.3 | 4.0 |
| United Kingdom | 771.1 | 776.3 | 636.7 | -1.7 | -17.4 | -18.0 | -12.5 |
| EU-15 | 4232.9 | 4265.5 | 4052.0 | -1.6 | -4.3 | -5.0 | -8.0 |
| EU-27 | 5564.0 | 5767.1* | 5045.4 | -1.2 | -9.3 | -12.5* | Not applicable |

Notes: ⁽¹⁾ The base year for CO₂, CH₄ and N₂O is 1990; for the fluorinated gases 12 Member States have been chosen to select 1995 as the base year, whereas Austria, France and Italy have chosen 1990. As the EC inventory is the sum of Member States' inventories, the EC base year estimates for fluorinated gas emissions are the sum of 1995 emissions for 12 Member States and 1990 emissions for Austria, France and Italy.

* Additionally, as Cyprus, Malta, and EU-27 do not have targets under the Kyoto Protocol they do not have applicable Kyoto Protocol base years. However, for comparison between the base year and 2007 for the EU-27 it has been assumed that base year emissions for Cyprus and Malta are the same as their 1990 emissions.

The overall EC GHG emission trend is dominated by the two largest emitters Germany and the United Kingdom, accounting for about one third of total EU-27 GHG emissions. These two Member States achieved total GHG emission reductions of 393 million tonnes compared to 1990²³. The main reasons for the trend in Germany were increasing efficiency in power and heating plants and the economic restructuring of the five new Länder after the German reunification. Reduced GHG emissions in the United Kingdom were primarily the result of liberalising energy markets and the subsequent fuel switching from oil and coal to gas in electricity production, and N₂O emission reduction measures in adipic acid production.

Italy and France are the third and fourth largest emitters in the EU-27 with shares of 11 % and 10.5 % respectively. Italy's GHG emissions are 7.1 % above 1990 levels in 2007. Italian GHG emissions increased since 1990 primarily from road transport, electricity and heat production and petroleum-refining. France's emissions were 5.6 % below 1990 levels in 2007. In France, large reductions were achieved in N₂O emissions from adipic acid production, but CO₂ emissions from road transport increased considerably between 1990 and 2007.

Spain and Poland are the fifth and sixth largest emitters in the EU-27 each accounting for 8.8 % and 7.9 % of total EU-27 GHG emissions. Spain increased emissions by 54 % between 1990 and 2007 (+53 % since the base year). This was largely due to emission increases from road transport, electricity and heat production, and manufacturing industries. Poland decreased GHG emissions by 13.2 % between 1990 and 2007 (-29.2 %

²³ This is equivalent to 20.7 % since the Kyoto Protocol base year for the two countries. The EU-15 as a whole needs emission reductions of total GHG of 8 %, i.e. 341 million tonnes on the basis of the 2007 inventory in order to meet the Kyoto target. This can be achieved by a combination of existing and planned domestic policies and measures, the use of carbon sinks and the use of Kyoto mechanisms.

since the base year, which is 1988 in the case of Poland). The main factors in decreasing emissions in Poland, as for other new Member States, were the decline of energy inefficient heavy industry and the overall restructuring of the economy in the late 1980s and early 1990s. The notable exception was transport (especially road transport) where emissions have increased.

Table 3—6 shows that 10 Member States (including Cyprus and Malta, which do not have a Kyoto target) were above base year levels in 2007 and 17 Member States were below. The percentage changes of GHG emissions from the base year to 2007 range from –53.4 % (Latvia) to +52.6 % (Spain).

3.2.7. Information on indirect greenhouse gas emissions for EU-15

Emissions of CO, NO_x, NMVOC and SO₂ have to be reported to the UNFCCC Secretariat as they have an indirect influence on climate change: CO, NO_x and NMVOC are precursor substances for ozone which itself is a greenhouse gas. Sulphur emissions produce microscopic particles (aerosols) that can reflect sunlight back out into space and also affect cloud formation. Table 3—7 shows the total indirect GHG and SO₂ emissions in the EU-15 between 1990–2007. All emissions were reduced significantly from 1990 levels: the largest reduction was achieved in SO₂ (– 75 %) followed by CO (– 58 %) NMVOC (– 48 %) and NO_x (– 35 %).

Table 3—7 Overview of EU-15 indirect GHG and SO₂ emissions for 1990–2007 (Gg)

| GREENHOUSE GAS EMISSIONS (Gg) | 1990 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|--------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| NO _x | 13,448 | 11,870 | 11,610 | 11,209 | 11,039 | 10,761 | 10,494 | 10,279 | 10,007 | 9,916 | 9,704 | 9,442 | 9,141 | 8,812 |
| CO | 52,273 | 41,593 | 40,008 | 38,062 | 36,410 | 34,028 | 31,691 | 29,885 | 28,046 | 27,186 | 26,076 | 24,120 | 23,083 | 22,083 |
| NMVOC | 15,877 | 12,941 | 12,441 | 12,230 | 11,806 | 11,333 | 10,631 | 10,153 | 9,676 | 9,735 | 9,113 | 8,875 | 8,704 | 8,205 |
| SO ₂ | 16,464 | 9,941 | 8,914 | 8,163 | 7,623 | 6,756 | 6,072 | 5,807 | 5,567 | 5,096 | 4,879 | 4,562 | 4,354 | 4,163 |

3.2.8. *Information on indirect greenhouse gas emissions for EU-27*

In the EU-27, SO₂ emissions decreased by 70 %, followed by CO (-55 %), NMVOC (-45 %) and NO_x (-34 %).

Table 3—8 Overview of EU-27 indirect GHG and SO₂ emissions for 1990–2007 (Gg)

| GREENHOUSE GAS EMISSIONS (Gg) | 1990 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|--------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| NO _x | 16,740 | 14,488 | 14,287 | 13,807 | 13,423 | 12,997 | 12,314 | 11,965 | 11,674 | 11,640 | 11,845 | 11,538 | 11,352 | 10,977 |
| CO | 64,251 | 50,994 | 50,048 | 47,649 | 45,400 | 42,717 | 37,559 | 35,139 | 33,148 | 32,295 | 34,142 | 31,738 | 30,139 | 28,914 |
| NMVOC | 17,949 | 14,754 | 14,352 | 14,096 | 13,630 | 13,078 | 12,280 | 11,755 | 11,301 | 11,392 | 10,742 | 10,468 | 10,403 | 9,799 |
| SO ₂ | 24,952 | 16,622 | 15,463 | 14,414 | 12,741 | 11,287 | 9,978 | 9,650 | 9,167 | 8,671 | 8,458 | 7,956 | 7,799 | 7,587 |

3.2.9. Accuracy/Uncertainty of the data

By 27th May 2009, Tier 1 uncertainty analyses were available for all EU-15 Member States. The EU-15 Tier 1 analysis was made on the basis of the Tier 1 uncertainty estimates of the Member States for seven sectors²⁴. After calculating the uncertainty estimates for each source category, the uncertainty estimates for the sectors and for total GHG emissions were calculated.

The EC uncertainty estimate is complicated due to potential correlations between Member State uncertainties. Therefore, an analytical method, which allows more flexibility than IPCC Tier 1 was compiled. A quantitative overview of information provided by Member States on uncertainty estimates in their 2007 national inventory reports and the methodology used for estimating the trend uncertainty is contained within the 2009 submission of the EC inventory report to the UNFCCC Secretariat¹⁴.

Table 3—9 Tier 1 Uncertainty estimates of EU-15 GHG emissions

| Source category | Gas | Emissions 1990 | Emissions 2007 | Emission trends 1990-2007 | Level uncertainty estimates based on MS uncertainty estimates | Trend uncertainty estimates based on MS uncertainty estimates |
|-------------------------------|-----|----------------|----------------|---------------------------|---|---|
| Fuel combustion in stationary | all | 2,460,749 | 2,318,619 | -6 % | 1% | 0.4 |
| Transport | all | 698,690 | 863,981 | 24 % | 2% | 1 |
| Fugitive emissions | all | 97,247 | 50,436 | -48 % | 22% | 22 |
| Industrial processes | all | 372,437 | 332,326 | -11 % | 4% | 4 |
| Agriculture | all | 418,905 | 371,482 | -11 % | 68 % (45 %-102 %) | 8 |
| LULUCF | all | -216,593 | -259,416 | 20 % | 41% | - |
| Waste | all | 171,149 | 104,645 | -39 % | 18% | 9 |
| Total (incl LULUCF) | all | 4,002,585 | 3,782,074 | -6 % | 7.3 % (5.4 %-10.5 %) | - |
| Total (excl LULUCF) | all | 4,219,177 | 4,041,490 | -4 % | 6.7 % (4.6 %-10.1 %) | 1.2 |

An overview of information provided by Member States on uncertainty estimates in their national inventory reports is contained within the 2009 submission of the EC inventory to the UNFCCC Secretariat.

²⁴ Stationary fuel combustion, transport, fugitive emissions, industrial processes, agriculture, LULUCF and waste.

3.2.10. Changes from the 4th National Communication

Since the publication of the 4th National Communication, various updates and revisions to methodologies have been implemented in the EC GHG inventory, which have impacted on the time-series of emissions. Overall, recalculations for the EU-15 and EU-25²⁵ are insignificant. Large recalculations in absolute terms were, however, made in Germany, the UK and Poland. These are highlighted in the table below:

Table 3—10 Major revisions to the EC GHG inventory since publication of 4th National Communication

| Country (Year of Change) | Change |
|--------------------------|--|
| Germany (2006) | Revised emission factor and change to Tier 2 methods in agriculture |
| Germany (2009) | New emission factors applied in Agriculture (IPCC 2006 guidelines) |
| UK (2006) | Updates to the inventory resulted in an increase in methane emissions from solid waste disposal over the entire time series (mainly due to oxidation factor) |
| Poland (2007) | Changes of emission factors in energy industries Updated share of Animal Waste Management System for livestock for entire period Corrected area for crops, correction of N ₂ O IEF from synthetic fertilizers |

At the time of the 4th National Communication, the trend of EU-15 GHG excluding LULUCF between 1990-2003 was -1.7 %. In the 2009 submission this trend between 1990-2003 has decreased to -1.2 %. In the EU-25, the trend of GHG excluding LULUCF between 1990 and 2003 changed from -5.5 % in the 2005 submission to -5.3 % in the latest submission.

²⁵

At the time of the 4th National Communication, Bulgaria and Romania were not yet part of the European Community.

3.3. National systems

3.3.1. *The EC Monitoring Mechanism and National Inventory System*

The legal basis of the compilation of the EC inventory is Council Decision No 280/2004/EC concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol. More details of the decision are given in section 4.1.1 of this document. The Directorate General for the Environment of the European Commission is responsible for preparing the inventory of the European Community. Each Member State is responsible for the preparation of its own inventory and these inventories provide the necessary data for the inventory of the European Community. All Member States of the EU are Annex I parties to the UNFCCC, except Cyprus and Malta, and have committed themselves to prepare individual GHG inventories and submit those inventories to the UNFCCC secretariat by 15th April each year.

The EC GHG inventory is the direct sum of the sectoral emissions data contained in the national inventories of the EU-27 and EU-15 Member States. Emissions of CO₂ can also be calculated using the Reference Approach (RA)²⁶ based on Eurostat energy data. The Reference Approach is a top-down approach, using high-level energy supply data to calculate the emissions of CO₂ from combustion of mainly fossil fuels. Appendix A and B present emissions from both the sectoral approach and the reference approach.

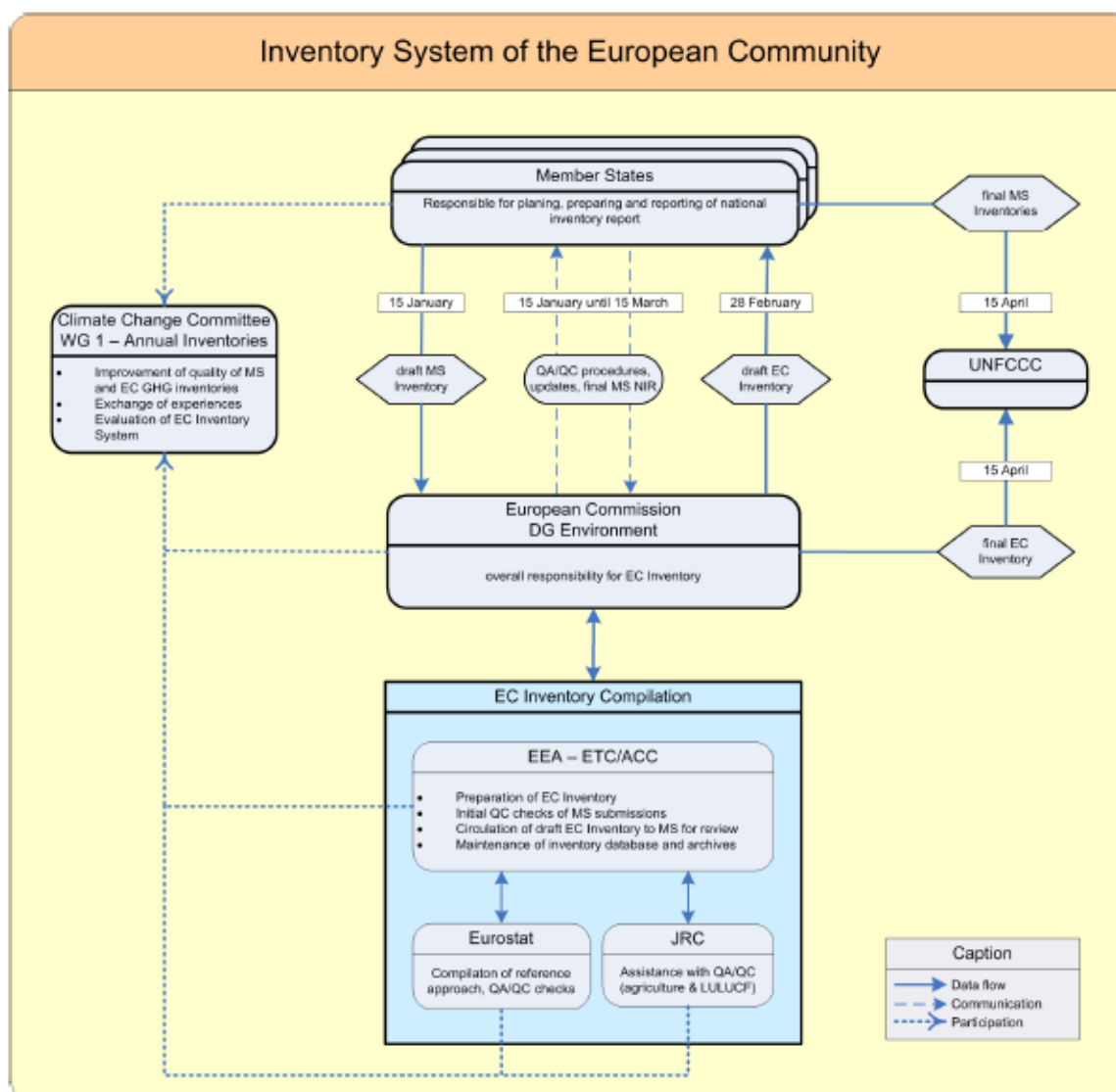
The main institutions involved in the compilation of the EC GHG inventory are the:

- Member States,
- the European Commission Directorate General for the Environment (DG ENV),
- the European Environment Agency (EEA) and its European Topic Centre on Air and Climate Change (ETC/ACC),
- Eurostat, and
- The Joint Research Centre (JRC).

The roles and responsibilities of various agencies and entities in relation to the inventory development process, as well as the institutional, legal and procedural arrangements made to prepare the inventory are shown in Illustration 3-12 below.

²⁶ [2006 IPCC Guidelines for National Greenhouse Gas Inventories Chapter 6: Reference Approach](http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_6_Ch6_Reference_Approach.pdf), http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_6_Ch6_Reference_Approach.pdf

Illustration 3-12 Inventory System and procedure of the European Community



The DG Environment of the European Commission is responsible for preparing the inventory of the EC while each Member State is responsible for the preparation of its own inventory which is the basic input for the inventory of the EC. DG Environment is supported in the establishment of the inventory by the following other institutions listed above. Further detail is provided in the 2009 submission of the EC inventory to the UNFCCC.

3.3.2. Quality assurance/quality control (QA/QC) procedures

The quality of EC GHG inventory depends on the quality of the Member States' inventories, the quality assurance and quality control (QA/QC) procedures of the Member States, and the quality of the compilation process of the EC inventory. Most EU Member

States, and also the European Community as a whole, are currently implementing QA/QC procedures to comply with the IPCC good practice guidance.

The EC QA/QC programme describes the quality objectives and the inventory quality assurance and quality control plan for the EC GHG inventory including responsibilities and the time schedule for the performance of the QA/QC procedure. Definitions of QA, QC and related terms used are those provided in IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories and Guidelines for National Systems under the Kyoto Protocol. The EC QA/QC programme is reviewed annually and modified or updated as appropriate.

The European Commission (Directorate General for the Environment) is responsible for coordinating QA/QC activities for the EC inventory and ensures that the objectives of the programme are implemented. The European Environment Agency (EEA) is responsible for the annual implementation of QA/QC procedures for the EC inventory. A number of specific objectives have been elaborated to ensure that the EC GHG inventory complies with the UNFCCC inventory principles of transparency, completeness, consistency, comparability, accuracy and timeliness. The QA/QC procedures are discussed in detail in Section 1.6 of the 2009 submission of the EC inventory report to the UNFCCC.

3.3.3. *Further improvement of QA/QC procedures*

As reported in the 4th National Communication, in September 2004 a ‘Workshop on quality control and quality assurance of greenhouse gas inventories and the establishment of national inventory systems’ was organised. The Workshop facilitated the exchange of experience of Member States in the implementation of QC/QA procedures and the implementation of National Inventory Systems. The workshop brought together experts from 17 Member States, the European Commission (DG ENV, JRC), EEA, ETC/ACC and an observer from the UNFCCC secretariat. More details of the workshop are available within the workshop report available on the website of the ETA/ACC²⁷.

Workshops and expert meetings under the EC GHG Monitoring Mechanism are important activities for improving the quality of national and EC GHG inventories. For this reason, a number of other workshops and expert meetings have been organised in recent years with a focus on sector-specific quality improvements. This is listed in detail in Section 1.6.3 of the 2009 EC inventory report.

In addition, a collaborative internal review mechanism has been established within the European Community so that all participants (MS, EEA, Eurostat, and JRC) may contribute to the identification of shortcomings and propose amendments to existing procedures. The review activities with experts from Member States are coordinated by the ETC/ACC under Working Group I and take place during the period from April through September each year. The synthesised findings of collaborative reviews provide a basis for the planned progressive development of inventories both at Member state and at EC level. More information is provided in Section 1.6.1 of the 2009 EC inventory report.

²⁷ ETA/ACC, http://air-climate.eionet.eu.int/docs/meetings/040902_GHG_MM_QAQC_WS/meeting040902.html

3.3.4. The EC Inventory Methodology and Data

This National Communication has been compiled using the EC inventory and with regards to the UNFCCC guidance for parties preparing their 5th National Communications²⁸. The EC inventory is compiled, as far as possible, in accordance with the recommendations for inventories set out in UNFCCC guidelines²⁹, on the basis of the inventories of the 15 or 27 Member States. The estimates of emissions in the EC inventory are, where appropriate and feasible, consistent with the IPCC Revised 1996 Guidelines for National Greenhouse Gas Inventories³⁰, the 2000³¹ Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories and the 2003³² Good Practice Guidance for Land Use, Land-Use Change and Forestry. In addition Council Decision No 280/2004/EC and the Commission Decision 2005/166/EC applies to the compilation of the EC GHG inventory.

The emissions of each source category are the sum of the emissions of the respective source and sink categories of the 15 or 27 Member States. This also applies for the base year estimate of the EU-15 GHG inventory. Currently, 12 Member States have selected 1995 as the base year for fluorinated gases, while Austria, France and Italy have chosen 1990.

Member States use different national methodologies, national activity data or country specific emission factors in accordance with IPCC and UNFCCC guidelines. The EC believes that this is consistent with the UNFCCC reporting guidelines and the IPCC good practice guidelines, provided each methodology is consistent with the IPCC good practice guidelines. In general, no separate methodological information is provided at EC level except summaries of methodologies used by Member States. Details can be found in the Annual European Community greenhouse gas inventory 1990-2007 and inventory report 2009 submission to the UNFCCC Secretariat. For some sectors quality improvement projects, including expert workshops, have been started with the aim of further improving estimates at Member State level. These sectors include energy background data, emissions from international bunkers, emissions and removals from LULUCF, emissions from agriculture, and waste. The 2009 EC GHG inventory data consist of GHG submissions of the Member States to the European Commission in 2009.

²⁸ Annotated Outline for Fifth National Communications of Annex I Parties under the UNFCCC, including Reporting Elements under the Kyoto Protocol. See http://unfccc.int/files/national_reports/annex_i_natcom/_application/pdf/nc5outline.pdf

²⁹ UNFCCC guidelines for the preparation of national communications by parties included in Annex 1 to the Convention, Part 1: UNFCCC reporting guidelines on annual inventories. FCCC/SBSTA/2004/8. See <http://unfccc.int/resource/docs/2004/sbsta/08.pdf>

³⁰ Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, <http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.html>

³¹ Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, <http://www.ipcc-nggip.iges.or.jp/public/gp/english/index.html>

³² Good Practice Guidance for Land Use, Land-Use Change and Forestry, <http://www.ipcc-nggip.iges.or.jp/public/gp/lulucf/gp/lulucf.html>

3.3.5. CRF Tables

Appendix A and B contain greenhouse gas emission data for the European Community for 1990 to 2007 in accordance with the sectoral breakdown specified in the Common Reporting Format (Summary Tables 1.A). The complete CRF tables (including all background tables and reference approach) for individual Member States are available on the UNFCCC website³³.

3.3.6. Data gap filling procedure

The EC GHG inventory is compiled by using the inventory submissions of the EC Member States. If there are data gaps in Member States' inventory submissions by the 15th March of a reporting year, the following procedure is applied by the ETC/ACC³⁴ in accordance with the implementing provisions under Council Decision No 280/2004/EC to complete the EC inventory:

If a consistent time series of reported estimates for the relevant source category is available from the Member State for previous years that has not been subject to adjustments under Article 5.2 of the Kyoto Protocol, extrapolation of this time series is used to obtain the emission estimate. As far as CO₂ emissions from the energy sector are concerned, extrapolation of emissions should be based on the percentage change of Eurostat CO₂ emission estimates if appropriate.

If the estimate for the relevant source category was subject to adjustments under Article 5.2 of the Kyoto Protocol in previous years and the Member State has not submitted a revised estimate, the basic adjustment method used by the expert review team as provided in the 'Technical guidance on methodologies for adjustments under Article 5.2 of the Kyoto Protocol 5.2'³⁵ is used without application of the conservativeness factor.

If a consistent time series of reported estimates for the relevant source category is not available and if the source category has not been subject to adjustments under Article 5.2 of the Kyoto Protocol, the estimation should be based on the methodological guidance provided in the 'Technical guidance on methodologies for adjustments under Article 5.2 of the Kyoto Protocol' without application of the conservativeness factor.

The Commission prepares the estimates by 31st March of the reporting year, following consultation with the Member State concerned, and communicates the estimates to the other Member States. The Member State concerned shall use the estimates referred to for its national submission to the UNFCCC to ensure consistency between the Community inventory and Member States' inventories.

Data gaps are shown in the Table below.

³³ UNFCCC, National Inventory Submissions 2009
http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/4771.php

³⁴ European Topic Centre on Air and Climate Change

³⁵ As included in FCCC/SBSTA/2003/10/Add.2

Table 3—11 Overview of missing data

| Member State | CO ₂ | CH ₄ | N ₂ O | HFCs | PFCs | SF ₆ |
|--------------|-----------------|-----------------|------------------|------|-----------|-----------------|
| Bulgaria | | | | | 1990-2007 | |
| Malta | | | | | 1990-2007 | |

On the basis of the general approaches mentioned above, it was checked if aluminium production occurs in the above countries, which was not the case. For other PFC emission no emission estimates were prepared because of the lack of data. Therefore no gap filling was made for this GHG inventory submission.

3.4. National registry

The description of the EC's national registry follows the reporting guidance set down in Decision 15/CMP.1, part II (Reporting of supplementary information under Article 7, paragraph 1, E. National registries) under the Kyoto Protocol. A description of the EC's national registry was provided in the EC initial report³⁶, which has consequently been updated in 2008. The revised description is provided in detail as Annex 13 to the 2008 EC GHG inventory report³⁷.

Referring to paragraph 22 of the annex to Decision 15/CMP.1, the following changes have occurred in the Community Registry since the last report:

- The name and contact information of the registry administrator designated by the Party to maintain the national registry: the registry administrator changed from Mr M. P. Carl to Mr Karl Falkenberg.
- No further changes have occurred to the EC's national registry compared to the description provided in the 2008 submission of the NIR.

Publicly available information on the EC registry is accessible on http://ec.europa.eu/environment/climat/gge_registry.htm

³⁶ EEA 2006, The European Community's initial report under the Kyoto Protocol (No 10/2006)

³⁷ EEA, 2008, Annual European Community greenhouse gas inventory 1990-2006 and inventory report 2008 (6/2008)

4. POLICIES AND MEASURES

Key developments

- Focus on the need to tackle mitigation and adaptation to climate change has increased significantly in the EC since the 4th National Communication.
- The EC has adopted a historic Energy and Climate Package that proposes binding targets for 2020 and an integrated package of policies and measures covering greenhouse gas emissions, renewable energy and energy efficiency.
- Many existing EC-level policies and measures are being strengthened to meet these goals.
- The EC has made a commitment to reduce greenhouse gas emissions by at least 20% compared to 1990 by 2020, with a firm commitment to increase this target to 30% in the event of a satisfactory international agreement being reached.
- The EC has committed to supplying 20 % of total EU gross final energy consumption from renewable sources (including electricity, heat and transport) by 2020, supplemented by a target requiring the share of energy from renewable sources in all forms of transport in 2020 to be at least 10 % of final consumption of energy in transport.
- The EC has committed to a 20 % reduction of total primary energy consumption by 2020, compared to a Business as Usual baseline.
- The EU Emissions Trading Scheme is now into its second phase (2008-2012), strengthened by lessons learned from the first (2005-2007). Further strengthening and expansion is planned for Phase III, including the incorporation of the aviation sector into the scheme (already from 2012).
- Recent developments include also new legislation concerning reduction of GHG emissions from sectors not covered by the EU ETS, carbon capture and storage, emission performance standards for new passenger cars, production of transport fuels and energy-efficient road transport vehicles.
- A successful conclusion to the international climate change negotiations at Copenhagen in December 2009 is a key priority for the EC.

4.1. The policy making process

The most commonly used procedure for Europe to adopt new legislation is the so-called co-decision procedure: both the Council of the European Union (Council of Ministers) and the European Parliament amend, adopt or reject legislation proposed by the Commission. The Parliament and the Council are on an equal footing, although the Parliament has a right of veto.

In the European Community, there are two distinct levels of policies and measures that impact on greenhouse gas emissions:

- (1) European Community policies that are proposed by the Commission and subsequently approved, amended or rejected by the Council of the European Union and the European Parliament. These common and coordinated policies and measures (CCPM) are applicable to all Member States, though Member States may implement Directives at different points in time.
- (2) National policies developed and implemented by Member States themselves. As such, these policies and measures are outside the scope of this National Communication.

With regards to the policy making process, there are four key stages:

- (1) Policy demands are made and articulated. While the impetus or demonstration of the need for a policy can come from a variety of sources, only the Commission has the power to initiate formally a proposal for policy.
- (2) Policy demands are translated into policy proposals. Within the EC, the initial creation of the policy proposal can only be done formally by the Commission. Once the proposal has been initiated, the Council and the European Parliament, depending on procedure, can amend the proposal. This means that all three institutions can play an active role during translation of policy.
- (3) Policy proposals must then be formally agreed by both the European Parliament and the Council.
- (4) Policy proposals are then implemented. While the Commission takes the lead in implementation, it remains the responsibility of individual Member States to implement EC policies at the national level. Failure to do so can invoke infringement proceedings, which are dealt with by the European Court of Justice.

A key step towards the formulation and implementation of any EC policy is to carry out an Impact Assessment³⁸ of the proposed policy or key policy changes. European Commission Impact Assessment Guidelines set out a number of key steps in the process. The Impact Assessment is carried out by the Directorate General who takes the lead on a particular policy.

There are a number of legal instruments available to the European Community to reach its objectives, with due respect for the subsidiarity principle³⁹: Regulations, Directives, Decisions and Recommendations (see fourth National Communication for further detail).

³⁸ EC SEC(2009) 92 Impact Assessment Guidelines:
http://ec.europa.eu/governance/impact/docs/key_docs/iag_2009_en.pdf

³⁹ The principle whereby the Union does not take action (except in the areas which fall within its exclusive competence) unless it is more effective than action taken at national, regional or local level, http://europa.eu/scadplus/glossary/subsidiarity_en.htm

The purpose of this chapter is to report on developments to existing CCPMs presented in the EC's fourth National Communication, as well as detail new EC policies and measures. For each sector there is a summary table of policies and measures followed by a description of the policies and measures, where this was not already included in the 4th National Communication. The summary table gives a quantitative estimate of the GHG emission savings due to the policy or measure in 2005 (where appropriate) and expected savings in future years (2010, 2015, 2020). These ex-ante estimates have been produced by the European Commission in individual policy impact assessments and policy appraisals such as the 2003 ECCP review and assume full implementation of the CCPMs. However, estimates are not available for all CCPMs. Some older estimates are also for the EU-15 while more recent estimates are for the EU-27.

In contrast, the estimates of expected GHG emission savings presented in the Projections Chapter 5 are uniquely derived from aggregating MS estimates. This approach is used to achieve consistency with the projections presented in this report which are also an aggregation of MS projections. Two methods are used to assemble Member State estimates of GHG savings from policies and measures. A bottom-up approach aggregates Member State estimates of the impact of individual policies and measures. However, not all Member States quantify the expected impact of (all) their policies. This approach nonetheless provides the best available MS estimate of the impact of existing policies and measures. A top-down approach calculates total savings from policies and measures by taking the difference between Member State projection scenarios. This approach provides the best available MS estimate of the impact of additional policies and measures. The results from both approaches are presented in the projections chapter to provide the best available estimate of the expected total effect of policies and measures. Both methods estimate savings from all measures and therefore include the impact of national measures related to EU CCPMs as well as strictly national policies.

4.1.1. Monitoring and evaluation

The European Commission prepares an annual communication to the European Parliament and to the Council, the "Progress Report", based on the European Community's annual GHG inventory prepared with the help of the European Environment Agency and submitted to the UNFCCC by 15th April each year.

This Progress Report is now required under Decision⁴⁰ 280/2004/EC concerning a mechanism for monitoring Community GHG emissions and for implementing the Kyoto Protocol, the "Monitoring Mechanism". The report assesses the actual and projected progress of Member States and the Community towards fulfilling their emission reduction commitments under the UNFCCC and the Kyoto Protocol.

⁴⁰ Decision No [280/2004/EC](#) of the European Parliament and of the Council of 11th February 2004 concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol

There have been no significant changes to the process since the fourth National Communication but a review of the Monitoring Mechanism is scheduled in the near future. The revised Decision will:

- Further clarify reporting requirements by providing more comprehensive guidance and potentially making use of reporting templates;
- Accommodate the new 2020 Climate and Energy Package;
- Incorporate recommendations from Member States;
- Incorporate recommendations from recent studies on:
 - Projections methodologies;
 - Policies and measures;
 - Ex-post policy evaluation;
- Streamlining of reporting with other environmental legislation.

Monitoring and evaluation is also carried out by Commission departments for individual EC policies.

4.1.2. Overall policy context

4.1.2.1. The Lisbon Strategy

At the Lisbon summit in March 2000, the EC set out a new strategy to become, within a decade, “the most competitive and dynamic knowledge-based economy in the world, capable of sustainable growth with more and better jobs and greater social cohesion”. The “Lisbon Strategy” covered areas including research, education, training, internet access and on-line business.

After initially moderate results, the Lisbon Strategy was simplified and re-launched in 2005, placing greater emphasis on growth and jobs and transferring more ownership of the initiative to Member States via national action plans. The strategy is now making a strong contribution to Europe's economic growth.

On 28th January 2009, the Commission adopted Member State specific reports and recommendations under the Lisbon Growth and Jobs Strategy⁴¹, for endorsement by the Spring European Council. Member States will now agree collectively on the areas each Member State should address with the highest priority to build up the strength of their economies in the medium-term. These will also help ensure the European Economic Recovery Plan is implemented in a way that builds for the future as well as responding to the current economic crisis.

⁴¹ http://ec.europa.eu/growthandjobs/index_en.htm

4.1.2.2. Economic Recovery Plan

An Economic Recovery Plan for growth and jobs was presented by the European Commission in November 2008 and approved by the European Council in December 2008⁴². The Plan is worth around €200 billion, a figure equivalent to approximately 1.5 % of the Gross Domestic Production (GDP) of the EU. Beside other actions, the Recovery Plan supports:

- An intervention of the European Investment Bank of €30 billion in 2009/2010, especially for small and medium-sized enterprises, for renewable energy and for clean transport, with particular attention to the automotive industry's effort to produce more eco-friendly vehicles;
- The creation of the 2020 European Fund for Energy, Climate Change and Infrastructure in partnership with national institutional investors;
- An improvement of programmes financed by the European Regional Development Fund and the European Agricultural Fund for Rural Development to strengthen investments in infrastructure as well as energy efficiency and renewable energy in the housing sector;
- The intensification of actions to improve energy efficiency of buildings and energy infrastructure, to promote green products.

In January 2009 as part of the ongoing implementation of the Economic Recovery Plan⁴³, the Commission mobilised €3.5 billion in 2009-2010 for investment in energy. This fund will focus on two main areas: offshore wind and carbon, capture and storage.

An Offshore Wind Energy Programme of €500 million is proposed to support new large-scale offshore demonstration projects in different Member States. The Programme is to encourage investment that might otherwise be neglected due to barriers such as the technological and logistical complexity of some offshore wind projects, and the need for cross-border infrastructure, as well as the need for further technological development.

The wind industry aims to deliver 12–14 % of European electricity consumption by 2020 and more than one quarter of this can come from offshore applications. By 2030, the contribution of offshore wind should reach up to 15 % of the overall European electricity production⁴⁴.

Five projects related to carbon capture and storage will also be supported by the Recovery Plan with €250 million in investment for each one to ensure their launch. The projects will help the EC to take full advantage of its indigenous resources of coal, oil and gas and at the

⁴² COM (2008) 800 final of 26th November 2006 A European Economic Recovery Plan
http://ec.europa.eu/economy_finance/publications/publication13504_en.pdf

⁴³ <http://europa.eu/rapid/pressReleasesAction.do?reference=IP/09/142>

⁴⁴ Press release European Union, MEMO/09/36,28 January 2009

same time to achieve sustainable power generation from those fossil fuels and to reduce greenhouse gas emissions.

These projects will represent a mix of technologies, geological conditions and will take place in different Member States.

4.1.2.3. European Climate Change Programme

The European Climate Change Programme (ECCP) was established in June 2000 to provide a cohesive framework to identify and develop the necessary elements of an EC strategy to implement the Kyoto Protocol. In autumn 2005, the Commission launched ECCP II as a continued programme for policy preparation and development. This second phase investigated new policy areas such as adaptation, aviation and carbon capture and storage, as well as reviewing and further implementing policies and measures that were the focus of ECCP I. Further information is included in the EC's 4th National Communication.

4.1.2.4. Energy and Climate Package

On 17th December 2008 the European Parliament agreed on the EC Energy and Climate Package⁴⁵, which for the first time provides an integrated and ambitious package of policies and measures to tackle climate change.

The package took substantial development, beginning with a Green Paper⁴⁶ in March 2006, followed by a Communication⁴⁷ in January 2007, which proposes an integrated package of energy and climate change measures. These included a Strategic Energy Review focusing on both external and internal aspects of EC energy policy built on three core objectives: sustainability, competitiveness and security of supply.

The so-called “20-20-20” Energy and Climate package, adopted by the Commission on 23rd January 2008⁴⁸, contains proposals for specific targets for 2020:

- A target to reduce greenhouse gas emissions by at least 20 % compared to 1990 by 2020, with a firm commitment to increase this target to 30 % in the event of a satisfactory international agreement being reached;

⁴⁵ European Parliament texts adopted at the sitting of Wednesday 17th December 2008.

<http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//NONSGML+TA+20081217+SIT+DOC+WORD+V0//EN&language=EN>

⁴⁶ COM(2006) 105 final of 8th March 2006 – Green Paper, A European Strategy for Sustainable, Competitive and Secure Energy. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2006:0105:FIN:EN:PDF>

⁴⁷ COM(2007) 1 final of 10th January 2007 – An energy policy for Europe. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2007:0001:FIN:EN:PDF>

COM (2007) 2 final of 10th January 2007 – Limiting Global Climate Change to 2 degrees Celsius: the way ahead for 2020 and beyond. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2007:0002:FIN:EN:PDF>

⁴⁸ COM(2008) 30 final of 23rd January 2008 – 20 20 by 2020, Europe's climate change opportunity. http://www.energy.eu/directives/com2008_0030en01.pdf

- To achieve 20 % of energy from renewable sources by 2020 (as a share of total EU gross final energy consumption), supplemented by a target to achieve a minimum of 10 % renewable transport fuel; and
- A reiteration of the commitment to save 20 % of total primary energy consumption by 2020, compared to a Business as Usual baseline (see section 4.4.4.1).

The package contains proposals for three new Directives and a Decision covering: renewable energy, the emissions trading scheme, shared efforts of Member States to reduce emissions, and geological storage of carbon dioxide. A Directive on monitoring and reduction of greenhouse gas emission from fuels (adopted on 31st January 2007), and proposals on emissions performance of new passenger cars (adopted on 19th December 2007), although not part of the package, were also negotiated by the institutions in parallel. An overview of the package is given here, with individual legislation detailed in the relevant sectors.

The new Directive on the promotion of the use of energy from renewable sources⁴⁹ sets differentiated and legally binding targets for each Member State to reach an overall EU target of a 20 % share of renewable energy in total gross final energy consumption (including electricity, heating and cooling and transport) by 2020. The Directive includes cooperation mechanisms to help Member States to work together to achieve the targets in a cost-effective manner. The Directive also includes a target of a minimum 10% share of renewables in transport, which includes sustainability criteria for biofuels (further detail is included in section 4.4.2.2.)

Revisions to the existing Directive to improve and extend the Community's greenhouse gas emission trading system⁵⁰ contains a number of new aspects for the scheme (see section 4.1.2.6 for further detail). Key changes mean that from the start of the third phase in 2013 the overall emissions cap will be set at the EU level. The cap will be decreased each year to reach a 21 % cut in 2020 compared to 2005. The Directive also increases the level of auctioning in the system – percentages of allowances to be auctioned vary according to the sector and the risk of carbon leakage⁵¹ but overall more than 50 % of allowances will be auctioned from 2013, and this proportion will increase each year.

A Decision puts in place measures to ensure a shared effort⁵² of Member States to reduce greenhouse gas emissions outside the EU ETS to meet the Community's overall greenhouse gas emission reduction commitment of 20 % by 2020. Sectors outside the EU

⁴⁹ Directive 2009/28/EC on the promotion of the use of energy from renewable sources amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:EN:PDF>

⁵⁰ Directive 2009/29/EC amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0063:0087:EN:PDF>

⁵¹ Carbon leakage refers to an increase in GHG emissions in a third country (outside the EU) as a direct result of a cap in emissions in the EU.

⁵² Decision No 406/2009/EC of the European Parliament and of the Council of 23rd April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020 <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0136:0148:EN:PDF>

ETS (e.g. transport, buildings, agriculture and waste) will reduce their emissions by an average of 10 % compared to 2005, shared out between Member States according to differences in GDP per capita. The agreement maintains the national targets for Member States, together with a linear legally binding trajectory for the period 2013-2020 with annual monitoring and compliance checks.

A Directive on geological storage of carbon dioxide⁵³ provides a legal framework to manage possible environmental risks and liability issues for carbon capture and storage (CCS). Up to 300 million allowances will be included in the new entrants reserve under the EU ETS to stimulate the construction and operation of up to 12 commercial demonstration projects to capture and store carbon dioxide, and for innovative renewable energy demonstration technologies in the EU. (Further detail is included in section 4.4.6.)

The final texts of the Energy and Climate Package were published in June 2009 and it is intended to come into force in all Member States by January 2011.

4.1.2.5. Second Strategic Energy Review - Securing our Energy Future

The achievement of Europe's ambitious goals will require substantial change in Europe's energy system, with public authorities, energy regulators, infrastructure operators, the energy industry and citizens all actively involved, and tough choices to be made. The EC therefore published a first Strategic Energy Review in 2007 as part of the wider communication on energy and climate.

The Commission published the Second Strategic Energy Review⁵⁴ on 13th November 2008 as a further step towards achieving the core energy objectives of sustainability, competitiveness and security of supply.

The Second Strategic Energy Review looks at the challenges that Europe will face between 2020 and 2050 and sets out a five-point EU Energy Security and Solidarity Action Plan, focusing on:

- (1) Infrastructure needs and the diversification of energy supplies;
- (2) External energy relations;
- (3) Oil and gas stocks and crisis response mechanisms;
- (4) Energy efficiency; and
- (5) Making the best use of the EU's indigenous energy resources.

⁵³ Directive 2009/31/EC of the European Parliament and of the Council of 23rd April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No 1013/2006 <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0114:0135:EN:PDF>

⁵⁴ COM(2008) 781 final of 13th November 2008 – Second Strategic Energy Review, An EU Energy Security and Solidarity Action Plan. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0781:FIN:EN:PDF>

Specifically the review recognises a number of priorities for development of infrastructure, notably cross-border infrastructures. Examples include the development of a Baltic interconnection plan and a blueprint for a North Sea offshore grid to interconnect national electricity grids and connect planned offshore wind projects⁵⁵.

The mid-term review of the 2006 Energy Efficiency Action Plan in 2009 was also announced, as well as a 2008 Energy Efficiency Package. This package focuses on improvements in the legislation on the energy performance of buildings and on energy labelling and on intensification of the implementation of eco-design and cogeneration Directives (see section 4.4.4). The strengthening of these measures is expected to have a substantial impact on Europe's energy consumption and energy security.

A new Sustainable Energy Financing Initiative is being prepared jointly with the European Investment Bank and other financial organisations, to mobilise large-scale funding from capital markets for investments in energy efficiency as well as renewable energies, clean use of fossil fuels and combined heat and power from renewables in Europe's cities.

The Second Strategic Energy Review also lays the path for a Strategic Energy Technology (SET) Plan (see section 4.4.5.1).

The EC's agenda for 2020 has set out the essential first steps in the transition to a high-efficiency, low-carbon energy system. The EC will also now look to develop a vision for 2050 and a policy agenda for 2030. The fundamental technological shifts involved in decarbonising the EU electricity supply, ending oil dependence in transport, low energy and positive power buildings, a smart interconnected electricity network will only happen with a coordinated agenda for research and technological development, regulation, investment and infrastructure development.

4.1.2.6. EU Emissions Trading Scheme

The European Emissions Trading Scheme (EU ETS) is a cornerstone in the fight against climate change in Europe. It is the first international multi-sector trading system for GHG emissions in the world, promoting the reduction of GHG emissions in a cost effective and economically efficient manner.

In October 2003 the European Council and the European Parliament adopted Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading (the Emissions Trading Directive). The Directive introduces a mandatory cap and trade system: an emission ceiling for the whole ETS is set, and the available quantity of the emission allowances is distributed over the installations covered by the system. If an installation emits more than the allowances it has received it has to purchase additional allowances from other participants with excess allowances.

⁵⁵ See also First Annual Report by European Coordinator Adamowitsch (http://ec.europa.eu/energy/infrastructure/tent_e/doc/off_shore_wind/2008_off_shore_wind_annual_report_2007_2008_en.pdf), and COM(2008) 768 final of 13th November 2008, Offshore Wind Energy: Actions needed to deliver on the Energy Policy objectives for 2020 and beyond. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0768:FIN:EN:PDF>

Directive 2003/87/EC distinguishes between the first (pilot) phase, which ran from 1 January from 2005 to 31st December 2007, and subsequent 5-year phases, for which revised rules and procedures are in place to reflect the learning-by-doing part of the first phase. Lessons learned during Phase I and from the review of the Directive, as required by Article 30 of the Directive, led to a revised ETS Directive in December 2008⁵⁶. The revision, amongst many other changes, foresees a longer third trading period, from 2013 to 2020.

The original ETS Directive covering Phases I (2005-2007) and II (2008-2012)

Around 10,500⁵⁷ energy-intensive installations across the EU are covered by the Directive.

The Directive requires each Member State to develop a National Allocation Plan (NAP) for each trading phase⁵⁸, stating the total quantity of allowances that it intends to allocate for that period (cap) and how it proposes to allocate them. NAPs are developed on the basis of objective and transparent criteria, listed in Annex III of the Directive and of the European Commission's guidance⁵⁹ and are subject to approval by the European Commission. Table 4-1 shows an overview of Member State caps for Phase II of the EU ETS, following approval by the European Commission.

Table 4-1 Member State cap under Phase II EU ETS, following approval by European Commission⁶⁰

| Member State | Annual Phase II cap 2008-2012 (MtCO ₂ -eq), following approval by European Commission |
|--------------|--|
| Austria | 30.7 |
| Belgium | 58.5 |
| Bulgaria | 42.3 |
| Cyprus | 5.5 |

⁵⁶ On 17th December 2008 the European Parliament agreed on the proposal for a Directive amending Directive 2003/87/EC

⁵⁷ http://ec.europa.eu/environment/climat/emission/citl_en.htm

⁵⁸ Romania and Bulgaria are only covered by the EU ETS as of the date of their accession, 1st January 2007. A NAP covering the last year of Phase I and a Phase II NAP were developed by these countries.

⁵⁹ COM (2003) 830 final of 7th January 2004 on Guidance to assist Member States in the implementation of the criteria listed in Annex III to Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC, and on the circumstances under which force majeure is demonstrated <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2003:0830:FIN:en:PDF>

⁶⁰ Adapted from SEC(2008) 2636 of 16.10.2008 – Commission Staff Working Document, Accompanying document to the Communication to the Commission, Progress towards achieving the Kyoto Objectives (required under Article 5 of Decision 280/2004/EC of the European Parliament and of the Council concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol)

| Member State | Annual Phase II cap 2008-2012 (MtCO ₂ -eq), following approval by European Commission |
|-----------------|--|
| Czech Republic | 86.8 |
| Denmark | 24.5 |
| Estonia | 12.7 |
| Finland | 37.6 |
| France | 132.8 |
| Germany | 453.1 |
| Greece | 69.1 |
| Hungary | 26.9 |
| Ireland | 22.3 |
| Italy | 195.8 |
| Latvia | 3.4 |
| Lithuania | 8.8 |
| Luxembourg | 2.5 |
| Malta | 2.1 |
| Netherlands | 85.8 |
| Poland | 208.5 |
| Portugal | 34.8 |
| Romania | 75.9 |
| Slovak Republic | 32.6 |
| Slovenia | 8.3 |
| Spain | 152.3 |
| Sweden | 22.8 |

| Member State | Annual Phase II cap 2008-2012 (MtCO ₂ -eq), following approval by European Commission |
|----------------|--|
| United Kingdom | 246.2 |
| EU-27 | 2082.6 |

Every year each participant is granted a specified number of allowances. The Directive includes three possible allocation methodologies: auctioning, grandfathering (for free, based on historical emissions) and benchmarking (for free, based on performance).

After each year installations must surrender the number of “European Union Allowances” (EUAs) which corresponds to their emissions during that year. Member States are required to ensure that emissions are monitored and reported in accordance with the guidelines elaborated by the Commission⁶¹.

Member States each have a national registry to track the allowances (and project credits) held and surrendered. In case of non-compliance, a penalty must be paid for any emissions in excess of the number of EUAs surrendered. For Phase I the penalty was set at €40/tonneCO₂eq, while for Phase II it is €100/tonneCO₂eq. Payment does not release the operator from the obligation to surrender an amount of allowances equal to the excess emissions (the so-called “make-good provision”).

At the European level a Community Independent Transaction Log (CITL)⁶² records the issuance, transfer, cancellation, retirement and banking of allowances under the EU ETS. As of 16th October 2008 the connection of the CITL and Member State registries with the UNFCCC International Transaction Log (ITL) was completed.

The revised ETS Directive covering Phase III (2013-2020)

The experiences in the first two trading periods of the EU ETS have led to significant changes for the post-2012 period, agreed in December 2008 by the European Parliament. The main reasons for doing so were the different approaches taken by different Member States, leading to an unequal playing field for participants in different countries and a very cumbersome process to establish the EU-wide cap through NAPs.

The new Directive⁶³ is based on the following main changes:

- Establishment of one Europe-wide ETS cap, laid down in the Directive. The cap for Phase III has been set at -21% below 2005 emissions in 2020⁶⁴;

⁶¹ The guidelines have been adopted on 29th January 2004 and reviewed on July 2007 taking into account experiences with their application and taking effect from 1 January 2008.

⁶² http://ec.europa.eu/environment/climat/emission/citl_en.htm

⁶³ Directive 2009/29/EC amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0063:0087:EN:PDF>

- Longer trading periods: Phase III will last 8 years, from 2013 to 2020;
- Expansion of the scope, to include a large part of the chemical industry⁶⁵, non-ferrous metals industry, and, by means of a separate legal instrument, the aviation sector (see section 4.5.13 for further details);
- Auctioning is the default allocation methodology meaning that a specific sector will have to acquire its allowances through auctions or on the secondary market;
- Industrial sectors will face a transition to full auctioning starting from 20 % to 70 % in 2020 with a view to reaching full auctioning by 2027. Exemptions for the sectors vulnerable to leakage⁶⁶ are provided, since these sectors will receive 100 % of their allowances determined by benchmarks for free across the whole period;
- Free allocation of allowances will be based on ambitious, EU-wide harmonised, ex-ante benchmarks, taking into account the lowest emitting and most energy efficient techniques, substitutes, and alternative production processes;
- 88 % of the auctioning revenues to be distributed over the Member States based on their share of 2005 verified emissions in the EU ETS. The remainder of the revenues will be distributed based on a Member State's per capita GDP and on the basis of early action taken towards Kyoto targets; and
- Opt-out for small installations with emissions less than 25,000 tonnes CO₂/year and below 35 MW capacity.

In October 2008 the EU ETS registry architecture was revised⁶⁷. This revision assures the independence of the EU ETS from January 2012 onwards and facilitates the inclusion of aviation activities from 2012 and the ability of the EU ETS to link to other emissions trading systems. Differences in the Phases of the EU ETS are outlined in the table below.

⁶⁴ This is assuming the EU independent target of -20% of total EU emissions in 2020 compared to 1990 levels. If an international agreement is reached on post-2012 targets, the EU will adopt (under certain conditions) a target of -30 %.

⁶⁵ CO₂ from petrochemicals and ammonia production, and nitrous oxide from the production of nitric, adipic and glycolic acid production as specifically mentioned sectors, not only as part of the combustion installations category.

⁶⁶ In the event that other developed countries and other major emitters of greenhouse gases do not participate in this international agreement, this could lead to an increase in greenhouse gas emissions in third countries where industry would not be subject to comparable carbon constraints ("carbon leakage"), and at the same time could put certain energy-intensive sectors and sub-sectors in the Community which are subject to international competition at an economic disadvantage.

⁶⁷ COM (2008) 994 of 8th October 2008 for a standardised and secured system of registries pursuant to Directive 2003/87/EC of the European Parliament and of the Council and Decision No 280/2004/EC of the European Parliament and of the Council. It repeals and replaces the existing Registry Regulation no. 2216/2004/EC

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:271:0003:0040:EN:PDF>

Table 4-2 Summary of the main changes over the three trading periods

| Element | PHASE I 2005-2007 | PHASE II 2008-2012 | PHASE III 2013-2020 |
|--------------------------------|---|--|---|
| Scope | ~10,500 installations | ~10,500 installations | Estimate not available yet |
| Participants | Refineries, cokes, iron and steel, cement, lime, glass, ceramics, pulp & paper. All large combustion installations larger than 20 MWth (includes electricity sector). Possibility of unilateral opt-in subject to approval by Commission. Possible opt-out of installations subject to approval by Commission. | As in Phase I, with further specification of which combustion installations to include. Member States can unilaterally include other sectors and gases. Some Member States have included N2O emissions from the chemical sector. Small-size (below 3MW) installations are excluded. | As Phase II + parts of the chemical industry, the non-ferrous metals industry and aviation ⁶⁸ . Possible exclusion of small size installations (<25,000 tonnes of CO ₂ eq. equivalent and, where they carry out combustion activities, have a rated thermal input below 35MW. |
| GHGs included | Directive does not say only CO ₂ , so formally it is all GHGs. In practice, phase I was only CO ₂ , as no others were opted in | CO ₂ Unilateral opt-in of Nitrous Oxide emissions from the chemical sector in some Member States | CO ₂ , Nitrous Oxide (from nitric acid, adipic acid and glyoxal and glyoxylic production) and Perfluorocarbons (primary aluminium production) |
| Allocation methodology | Minimum 95% free allocation, possibility to auction remainder; Member States to decide on allocation methodology | Minimum 90% free allocation, possibility to auction remainder; MS to decide on allocation methodology | Auctioning as default allocation method; free allocation only on EU-wide harmonised ex-ante benchmarks |
| Decision on cap and allocation | Each Member State develops a NAP stating the total quantity of allowances and how to allocate them to participants. NAP to be approved by COM. | As in Phase I, with further guidance from Commission; NAP to be approved by COM. | Allocation methodology and rules are set at the EU level and implemented by Member States by means of National Implementation Measures (NIMs). |
| Trading period | Three years | Five years | Eight years |
| Compliance | In-house reductions; Trade in allowances; Purchase of CDM credits. | As in Phase I + purchase of JI/CDM credits (up to limit specified by Member States – most around 10%) | As in Phase II, Purchase of JI/CDM credits up to limit specified by EC (limit will be at least 11%). But new quality requirements for CDM credits. |
| Penalty | €40 /tonneCO ₂ eq + “make-good provision” | €100 /tonneCO ₂ eq + “make-good provision” | €100 /tonneCO ₂ eq adjusted in accordance with European Index of Consumer Prices + “make-good provision” |

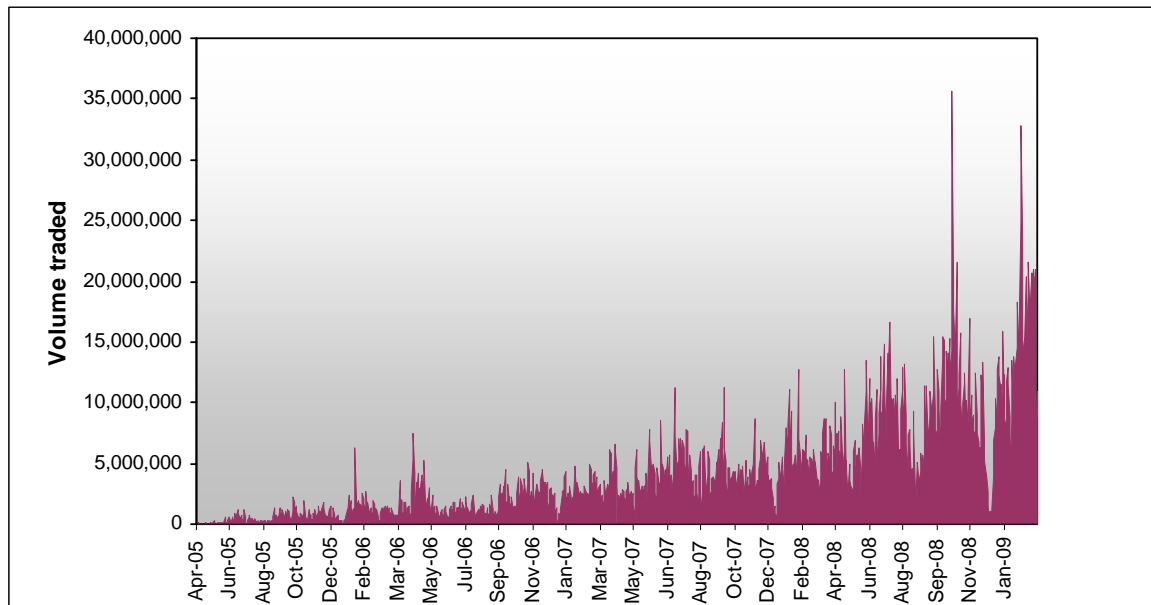
⁶⁸ And some smaller products (e.g. the non-metallic minerals sector).

EUA market: prices and volumes

The EU ETS has developed to become the biggest global carbon trading market, both in transaction volume and monetary value.

In 2007 more than two billion EUAs were traded, representing a total market value of €37 billion. Average weekly volume of EUAs traded continues to rise steadily into 2009 (see figure below).

Illustration 4-1 Historic EUA trading volumes (Apr 05 – Mar 09)



Source: Aggregate from European Climate Exchange (<http://www.ecx.eu>), Bluenext (<http://www.bluenext.eu>) and London Energy Brokers' Association (<http://www.leba.org.uk>).

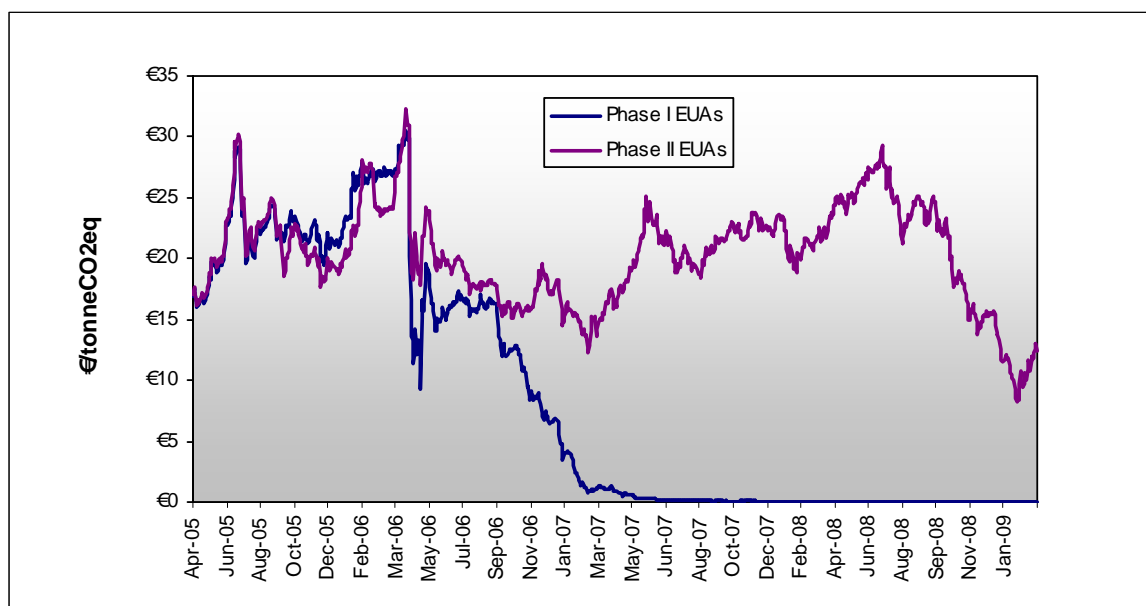
The figure below shows average EUA trading prices for the “most traded EUA contract” at the time, differentiating between EUAs valid for Phase I and Phase II.

In the first quarter of 2006, once the first verified emissions data was published for participants in the scheme, it became clear to the market that there should be sufficient supply of EUAs in Phase I. As EUAs cannot be banked from one phase to the next, prices for Phase I EUAs began to drop and, despite a small recovery, declined steadily to the end of Phase I.

However the market price for Phase II EUAs remained strong and the average EUA market price increased to around €20/tCO_{2eq} through 2007.

Phase II itself started strongly in 2008 with average EUA prices rising to around €30/tCO_{2eq}. However, the market has more recently been impacted by the global financial uncertainty and by falling fossil fuel prices and EUA prices remain volatile. As a general trend prices declined through late 2008 to reach about €8/tCO_{2eq} in the first quarter of 2009.

Illustration 4-2 Historic EUA trading price (Apr 05 – Mar 09)



Source: Simple (unweighted) average from European Climate Exchange (<http://www.ecx.eu/>), Point Carbon (<http://www.pointcarbon.com/>) and London Energy Brokers' Association (<http://www.leba.org.uk/>).

Linking the EU ETS to the international carbon market

The EU ETS is linked to the international carbon market in various ways and additional opportunities exist in linking the EU ETS with other national and/or regional emissions trading systems.

In October 2004 the European Parliament and the Council adopted the Directive 101/2004/EC linking the EU ETS with the Kyoto Protocol's project mechanisms. The Directive regulates the use of Joint implementation (JI) and Clean Development Mechanism (CDM) credits by the EU ETS participants⁶⁹. Emission Reduction Units (ERUs), originated by JI projects, and Certified Emission Reductions (CERs), originated by CDM projects, are converted into EUAs by Member States. Member States must inform the European Commission in their NAPs of the maximum amount of credits that can be used, which must in turn be consistent with the individual Member State's complementarity obligations under the Kyoto Protocol.

From 2008 every international transfer of an EUA must be accompanied by an Assigned Amount Unit (AAU)⁷⁰, to make sure that this is taken into account at the national level for Kyoto accounting.

⁶⁹ Directive 2004/101/EC of the European Parliament and of the Council of 27th October 2004 Amending Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms, Article 1 paragraph 1 and 2.

⁷⁰ A country-level tradable carbon credit unit under the Kyoto Protocol

The use of project credits in Phase III is allowed as follows:

- In existing EU ETS sectors operators can use an amount of credits corresponding to a certain maximum percentage. This percentage will be determined at the EU level and will be at least 11 % of allocation during the period 2008-2012 (minimum 1.5 billion credits).
- New entrants and new sectors can use credits up to an amount corresponding to a certain maximum percentage, again to be determined at the EU level, which will be at least 4.5 % of their verified emissions during the period from 2013 to 2020.
- Aviation operators can use credits up to an amount corresponding to a certain percentage, which will be set at least at 1.5 % of their verified emissions during the period from 2013 to 2020.
- The overall use of credits allowed cannot exceed 50 % of the Europe-wide reductions of the existing sectors over the period 2008 to 2020 and 50 % of the Europe-wide reductions below the 2005 levels of new sectors and aviation over the period 2013 to 2020, to comply with the complementarity requirement of the Kyoto Protocol (see section 4.2.2).

Linking with external emissions trading schemes

The EC recognises that linking the EU ETS to GHG emission trading schemes in third countries will increase the cost-effectiveness of achieving the EC emission reductions targets⁷¹. In October 2007 the first such linking was effected by the EC and Norway, Iceland and Liechtenstein. The newly linked systems cover, as of 2008, 30 countries, with the authority to approve NAPs for the 3 new countries resting with the European Free Trade Authority.

In addition, the EC is a founding member of the International Carbon Action Partnership (ICAP)⁷² which was set up in October 2007. ICAP is a partnership of 15 governments to provide a forum to share experiences and knowledge among countries and regions that have implemented or are actively pursuing the implementation of carbon markets through mandatory cap and trade systems.

The EC has stated its priorities for linking of the EU ETS as: environmental effectiveness, economic efficiency, avoidance of leakage and fairness and accessibility⁷³. Factors such as

⁷¹ Directive 2003/87/EC of the European Parliament and of the Council of 13th October 2003 establishing a scheme for a greenhouse gas emission allowance trading within the Community and amending council Directive 96/61/EC. Recital 18.

⁷² ICAP <http://www.icapcarbonaction.com>

⁷³ SEC(2008) 52 Commission staff working document on Accompanying document to the Proposal for a Directive of the European Parliament and of the Council amending Directive 2003/87/EC so as to improve and extend the EU greenhouse gas emission allowance trading system Impact Assessment - COM(2008) 16 final.

http://www.cdep.ro/docs_comisii/IE/CE/2008/SEC_2008_52_EN_DOCUMENTDETRAVAIL_p.pdf

impacts on competition impacts on employment and administrative costs are considered important as well.

4.1.2.7. EC Climate Change Strategy post-2012

The EC's agreed objective is to limit the average global temperature increase to less than 2°C compared to pre-industrial levels. If current emission trends continue, the 2°C threshold may already be crossed in 2050. Significant adaptation efforts will be required even if global average temperature increase is kept below 2°C.

A successful conclusion to the international climate change negotiations at Copenhagen in December 2009 is therefore a key priority for the EC, and on 28th January 2009 the European Commission published a Communication⁷⁴ setting out a strategy towards a new climate change agreement in Copenhagen. The Communication sets out concrete proposals to achieve this goal, addressing three key challenges: targets and actions; financing; and building an effective global carbon market.

To limit global temperature increase to not more than 2°C, developed countries as a group should reduce their emissions by 30 % below 1990 levels in 2020. Globally GHG emissions must be reduced to less than 50 % of 1990 levels by 2050.

Towards this goal, as part of the new Energy and Climate Package (section 4.1.2.4), the EC has adopted a binding target to reduce emissions by 20 % by 2020 irrespective of whether or not an international climate change agreement is reached, with a firm commitment to increase this effort to a 30 % reduction if such an agreement is secured.

An international agreement must be sufficiently ambitious and comprehensive, providing for comparable reductions by other developed countries, and including appropriate reductions from developing countries.

Developing country emissions are increasing rapidly and, if not addressed, will outweigh developed country efforts to reduce their GHG emissions. Developing countries as a group will need to limit the rise in their emissions through nationally appropriate actions to 15-30 % below business as usual by 2020. This reduction should be on top of reductions that result in the transfer of carbon credits to developed countries. Appropriate actions should include a rapid decrease in emissions from tropical deforestation. By 2020, gross tropical deforestation should be reduced by at least 50 % compared to current levels and by 2030 global forest cover loss should be halted.

The EC also sets out a number of key elements that should be included in a framework for adaptation that should be included in a Copenhagen agreement (see section 6 for further information):

- The need for all to adapt – support should be provided to the most vulnerable and the poorest; potentially adverse effects should be anticipated early;

⁷⁴ COM(2009) 39 final of 28th January 2009 – Towards a comprehensive climate change agreement in Copenhagen

- A commitment to systematically integrate adaptation into national strategies of both developed and developing countries;
- Improving the tools to define and implement adaptation strategies.

Significantly increased financial resources will be needed to support the necessary adaptation and mitigation action in developing countries. This should come from domestic sources, from the global carbon market, but also from contributions from developed countries.

Estimates for adaptation costs vary widely. The UNFCCC Secretariat provides an indicative scale of need in developing countries in the order of €23 - 54 billion per year in 2030.

In terms of mitigation, the European Commission estimates that net global incremental investment, both public and private, needs to increase to around €175 billion per year in 2020 to reduce global GHG emissions to a level compatible with the 2°C objective. More than half of this investment will have to be made in developing countries.

Significantly enhanced research, development and demonstration (RD&D) as well as deployment and diffusion of mitigation and adaptation technologies is also needed to support the practical implementation by all countries. A commitment on this should form an integral part of the Copenhagen agreement, working towards at least a doubling of global energy-related RD&D by 2012 and increasing it to four times its current level by 2020. The emphasis of RD&D should be towards safe and sustainable low GHG-emitting technologies, especially renewable energy.

A global carbon market can and should be built by linking domestic emissions trading systems. However, as these systems are domestic climate policy tools of individual countries or regions, such linking should be subject to bilateral arrangement between interested Parties and not negotiated under the UNFCCC. The EC is reaching out to other countries to ensure an OECD-wide market by 2015 and an even broader market by 2020.

The EC would also like to see some reform of the CDM mechanism to ensure that only those projects that deliver real additional reductions and go beyond low cost options are credited. In addition, for advanced developing countries and highly competitive economic sectors, the project based CDM should be phased out in favour of moving to a sectoral carbon market crediting mechanism. Such mechanisms can be an efficient tool to drive development and deployment of low-carbon technologies in developing countries, and pave the way for the development of cap and trade systems.

The EC wishes to ensure that the Copenhagen agreement lays the basis for a long-term international framework that raises overall ambition and increases contributions from both developed and developing countries, guided by scientific knowledge.

A long term vision of emissions reductions to 2050 is needed with a clear path of how to get there. A periodic review of overall progress and the adequacy of commitments and action should form an integral part of a Copenhagen agreement, including a comprehensive

review in 2016. On this basis, the global goal should be reassessed and further mid-term commitments, action and financial flows set in line with the latest scientific findings. If, in the context of a comprehensive review of the Copenhagen agreement in 2016, the combined mitigation efforts of developed and developing countries are insufficient, the UN climate change conference should set new national ambition levels for the subsequent commitment period.

4.2. Additional information required under the Kyoto Protocol

The following section contains information new to the 5th National Communication, in accordance with UNFCCC Decision 15/CMP.1, and contains supplementary information required under Article 7 paragraph 2 of the Kyoto Protocol.

4.2.1. Member State use of Kyoto Mechanisms

Member States provided information on their intended use of the Kyoto Mechanisms in 2009 through a questionnaire under the EC mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol (Council Decision 280/2004/EC). For the remaining Member States, information provided previously through the questionnaire or the use of Kyoto Mechanisms as indicated the second NAP under the EU ETS Directive (2003/87/EC) was used.

A number of Member States have allocated resources to use the Kyoto Mechanisms and the details are given in the table below. The contribution of Kyoto Mechanisms by these countries is for the closure of the gaps between greenhouse gas projections and 2010 targets. For the EU-15, the use of flexible Kyoto Mechanisms (including International Emissions Trading, Joint Implementation and the Clean Development Mechanism) amounts to approximately 93.1 Mt CO₂eq per year of the commitment period.

Member States may also undertake activities in relation to Article 3.3 (emissions and removals from forestry activities) and Article 3.4 (emissions and removals from activities including Forest Management, Cropland Management, Grazing Land Management or Revegetation) of the Kyoto Protocol. When including the use of carbon sinks under these articles the total use of Kyoto Mechanisms in the EU-15 rises to 134.3 MtCO₂eq per year.

Table 4-3 Planned use of Kyoto Mechanisms by Member States

| Member State | Achievement of Kyoto target planned through domestic action only | Planned use of Flexible Mechanisms at government level | Type of Flexible Mechanisms (IET, CDM, JI)* | Projected emission reduction 2008-12 through the use of Kyoto Mechanisms [Mt CO ₂ eq per year] | Bu Allocated Budget at government level [Mio €] | Projected use of flexible mechanisms in total emission target compared to Kyoto base year | Projected use of reductions from sinks under Art. 3.3 and 3.4 [Mt CO ₂ eq per year] | Total reduction from Kyoto mechanisms and sinks | Notes |
|----------------|--|--|---|---|---|---|--|---|--|
| Austria | No | Yes | IET, JI, CDM | 9.0 | 531.0 | 88% | 0.7 | 9.7 | |
| Belgium | No | Yes | IET, JI, CDM | 4.4 | 252.4 | 40% | | 4.4 | |
| Bulgaria | Yes | No | - | - | | | | - | |
| Cyprus | Not applicable | No | - | - | | | | - | Cyprus and Malta are non-Annex I Parties to the Kyoto Protocol and do not have an emissions target for the period 2008-2012. |
| Czech Republic | Yes | No | - | - | | | 1.2 | 1.2 | |
| Denmark | No | Yes | IET, JI, CDM | 4.2 | 152.0 | 29% | 2.2 | 6.4 | |
| Estonia | Yes | No | - | - | | | | - | |
| Finland | No | Yes | IET, JI, CDM | 1.4 | 70.0 | n/a | 0.6 | 2.0 | An additional €30M is allocated for post-2012 |
| France | Yes | No | - | - | | | 4.1 | 4.1 | |
| Germany | Yes | No | - | - | | | 4.5 | 4.5 | |
| Greece | Yes | No | - | - | | | 1.1 | 1.1 | |

| Member State | Achievement of Kyoto target planned through domestic action only | Planned use of Flexible Mechanisms at government level | Type of Flexible Mechanisms (IET, CDM, JI)* | Projected emission reduction 2008-12 through the use of Kyoto Mechanisms [Mt CO ₂ eq per year] | Bu Allocated Budget at government level [Mio €] | Projected use of flexible mechanisms in total emission target compared to Kyoto base year | Projected use of reductions from sinks under Art. 3.3 and 3.4 [Mt CO ₂ eq per year] | Total reduction from Kyoto mechanisms and sinks | Notes |
|--------------|--|--|---|---|---|---|--|---|--|
| Hungary | Yes | Yes | IET | -16.5 | | -238% | | -16.5 | Hungary is the only country which has reported quantified projections of AAU selling |
| Ireland | No | Yes | IET, JI, CDM | 3.6 | 290.0 | 50% | 2.2 | 5.8 | |
| Italy | No | Yes | IET, JI, CDM | 17.1 | 78.8 | 51% | 10.2 | 27.3 | |
| Latvia | Yes | No | - | - | | | | - | |
| Lithuania | Yes | No | - | - | | | | - | |
| Luxembourg | No | Yes | IET, JI, CDM | 3.7 | 330 | 100% | | 3.7 | Budget depends on inflow of petrol tax subject to fuel sales and is based on a future price of a 2010-EUA traded at the EEX in Leipzig on 31 st July 2009. This price is being round 15.00 € per t of CO ₂ . |
| Malta | Not applicable | No | - | - | | | | - | See notes for Cyprus |
| Netherlands | No | Yes | IET, JI, CDM | 13.0 | 505.8 | 102% | 0.1 | 13.1 | |
| Poland | Yes | No | - | - | | | 3.0 | 3.0 | |
| Portugal | No | Yes | IET, JI, CDM | 4.8 | 305.3 | 30% | 4.7 | 9.5 | |
| Romania | Yes | No | - | - | | | | - | |
| Slovakia | Yes | No | - | - | | | | - | |

| Member State | Achievement of Kyoto target planned through domestic action only | Planned use of Flexible Mechanisms at government level | Type of Flexible Mechanisms (IET, CDM, JI)* | Projected emission reduction 2008-12 through the use of Kyoto Mechanisms [Mt CO ₂ eq per year] | Bu Allocated Budget at government level [Mio €] | Projected use of flexible mechanisms in total emission target compared to Kyoto base year | Projected use of reductions from sinks under Art. 3.3 and 3.4 [Mt CO ₂ eq per year] | Total reduction from Kyoto mechanisms and sinks | Notes |
|----------------|--|--|---|---|---|---|--|---|---|
| Slovenia | No | Yes | IET, JI, CDM | 1.0 | 80 | 61% | 1.3 | 2.3 | Slovenia plans to acquire units either through project mechanisms or on the carbon market but has not yet decided on the exact quantity. The value depends on the actual development of emissions, especially in the transport sector. |
| Spain | No | Yes | IET, JI, CDM | 31.8 | 408.6 | -73% | 5.8 | 36.6 | |
| Sweden | Yes | No | (JI, CDM) | (2) | 38 | | 2.1 | 2.1 | Sweden intends to achieve its Kyoto target without the use of flexible mechanisms but has made the necessary preparations to use them if necessary. Sweden intends to acquire 2 MtCO ₂ -eq/yr through the Swedish CDM/JI programme. This figure has not been considered in the target assessment for Sweden and EU-15. |
| United Kingdom | Yes | No | - | - | | | 4.0 | 4.0 | |
| EU-15 | No | Yes | IET, JI, CDM | 93.1 | 2962 | 27% | 42.4 | 134.3 | |
| EU-27 | No | Yes | IET, JI, CDM | 77.6 | 3042 | n/a | 47.9 | 124.3 | |

Notes: *IET = International Emissions Trading, JI = Joint Implementation, CDM = Clean Development Mechanism

4.2.2. *Supplementarity*

Supplementarity obligations under the Kyoto Protocol require that any international credit purchases by Member States must be in addition to emissions abatement action domestically. Within the EC the term has not been quantitatively defined.

As part of the EU ETS (see section 4.1.2.6), Member States were required to inform the European Commission in their Phase II NAPs of the maximum amount of JI and/or CDM credits that can be used. This limit was then assessed according to the principle of supplementarity and where appropriate approved or revised by the European Commission. For Phase III an EU-wide limit, yet to be determined, will be set by the Commission.

As indicated in the previous section the total planned use of Kyoto flexible mechanisms amounts to 93.1 MtCO₂eq per year over the commitment period. As a share of the EU-15's target of a -8 % reduction compared to the base year, the planned use of flexible mechanisms to achieve non-domestic reductions accounts for around 2 percentage points (i.e. approximately one-quarter of the reductions).

4.2.3. *Other Policies and Measures promoting Sustainable Development*

Sustainable development is an overarching objective of the EC set out in the Treaty, governing all the Union's policies and activities. The first EU Sustainable Development Strategy (SDS) was adopted in 2001. In February 2005, the Commission assessed progress made on the strategy and concluded that the situation was deteriorating. In a bid to halt the destructive trends leading to the exploitation of natural resources and environmental degradation, the EU Council adopted a Renewed Strategy in June 2006⁷⁵.

The overall aim of the renewed EU SDS is to identify and develop actions to achieve continuous improvement of quality of life both for current and for future generations. This is achieved through the creation of sustainable communities able to manage and use resources efficiently and to tap the ecological and social innovation potential of the economy, ensuring prosperity, environmental protection and social cohesion.

The Strategy addresses seven key challenges:

- (1) Climate change and clean energy
- (2) Sustainable transport
- (3) Sustainable consumption and production
- (4) Conservation and management of natural resources
- (5) Public health

⁷⁵ Renewed EU Sustainable Development Strategy, 26th June 2006, http://ec.europa.eu/sustainable/docs/renewed_eu_sds_en.pdf

- (6) Social inclusion, demography and migration
- (7) Global poverty

The renewed strategy recognises that SDS goals can only be met in close partnership with the Member States and hence sets in motion a new process of review and reporting involving the Commission and the Member States.

In 2007, the Commission's first progress report⁷⁶ concluded that relatively modest progress has been made on the ground. However, development of policy initiatives at both EC and Member State level is more encouraging, in particular in the field of climate and energy. The EC, Member States, citizen groups, NGOs and business are also increasingly focusing on the same issues and working to meet the same goals.

The EC continues to give priority to Sustainable Development in all areas of policy development and action. At the latest by 2011, the European Council will decide when a comprehensive review of the EU SDS is to be launched.

4.2.4. Policies and Measures related to bunker fuels

Pursuant to Article 2, paragraph 2, of the Kyoto Protocol, parties should identify the steps taken to promote and/or implement any decisions by the International Civil Aviation Organization and the International Maritime Organization to limit or reduce GHG emissions not controlled by the Montreal Protocol from aviation and maritime bunker fuels. This information is included in the transport sector, section 4.5.14.

4.2.5. Minimisation of adverse impacts

The Kyoto Protocol was adopted in pursuit of the ultimate objective of the Convention, and hence its full implementation by Annex I Parties is intended to contribute to preventing dangerous anthropogenic interference with the climate system. Ambitious mitigation goals are necessary to ascertain a future for all countries.

In striving to develop policies and measures to reduce greenhouse gas emissions, Parties to the Kyoto Protocol should implement those policies and measures in a way such as to minimise adverse effects, including the adverse effects of climate change, effects on international trade, and social, environmental and economic impacts on other Parties, especially developing country Parties identified in article 4, paragraphs 8 and 9 of the Convention.

Adverse impacts on developing countries are reduced if global temperature increase is limited to 2 degrees Celsius, if dependence on fossil fuels decreases, and if Annex I Parties are able to develop low-carbon energy systems and reduce fossil fuel consumption.

⁷⁶ COM(2007) 642 final, 22/10/2007, Progress Report on the Sustainable Development Strategy 2007 http://ec.europa.eu/sustainable/docs/com_2007_642_en.pdf and accompanying Commission Staff Working Document, http://ec.europa.eu/sustainable/docs/sec_2007_1416_en.pdf

The Community actively undertakes a large number of activities to have positive impacts on third countries and their ability to tackle climate change, specifically capacity building and technology transfer activities. These are detailed in section 7.

Other policies and measures have potential positive impacts on third countries. The Clean Development Mechanism (CDM), for example, is a tool designed into the Protocol to share efforts in reducing greenhouse gases, ensuring that investment is made where the money has optimal greenhouse gas reducing effects, thus ensuring minimal impact on the world economy. Moreover, the CDM, with its dual aim of promoting sustainable development and reducing GHG emissions is important for countries with continuing development needs and contributes to technology transfer.

EC policies and measures on the promotion of renewable energies contribute to reduction of dependence on fossil fuels, meeting rural electricity needs, and the improvement of air quality. Similarly EC activities on the promotion of energy efficiency and CHP measures can reduce energy costs and contribute to the improvement of air quality.

Changes to subsidies under the EC Common Agricultural Policy (CAP) now link payments to environmental, food safety and animal welfare standards, not to agricultural production volume. This encourages responsible agricultural practices.

Other EC policies and measures aim to address market imperfections and reflect externalities. For example the EC is making efforts to liberalise the internal energy market (see section 4.4.1). In addition one of the primary aims of the EU Emissions Trading Scheme is to create the right incentives for forward looking low carbon investment decisions by reinforcing a clear, undistorted and long-term carbon price signal. Extending the scheme to the aviation sector will extend this also to this sector.

A small number of EC policies and measures have the potential to have a negative impact on third countries. Where this is identified, the EC strives to implement policies and measures in a way that minimises any negative effects.

Promotion of biofuels

Promotion of biofuels in the EC has been identified to have potential future negative or less positive impacts related to greenhouse gas emissions or biodiversity. The new EC Renewable Energy Directive (see section 4.4.2.2), which contains a target of a minimum 10% renewable energy in transport in 2020, therefore establishes specific sustainability criteria for biofuels (Article 17 of the Directive), to ensure that biofuels promoted within the Community do not have negative impacts. Such sustainability criteria include not supporting biofuels from land with high biodiversity value (primary forest and wooded land, protected areas or highly biodiverse grasslands), or from land converted from wetlands, peatlands or continuously forested areas. The EC will also report every two years in respect both of third countries and Member States that are a significant source of biofuels or of raw material for biofuels on national measures taken to respect the sustainability criteria and on broader environmental and social aspects, such as air, water and soil quality and labour conditions. The first report shall be submitted in 2012. The

Commission has also been tasked to report on the need for sustainability criteria for broader biomass for energy use and if appropriate propose such criteria.

The EC also has a number of activities and measures aimed at tackling global deforestation, as detailed in the following sections.

Communication on Tropical deforestation

In October 2008, the Commission unveiled two major initiatives to protect forests worldwide. The first was a Communication⁷⁷ setting out the Commission's proposals for tackling tropical deforestation while the second initiative targets a reduction of illegally logged timber imports (see below).

The Communication on tropical deforestation proposes that at the UNFCCC negotiations on the future climate regime, the EC calls for a halt on global forest cover loss by 2030 at the latest and a reduction in gross tropical deforestation by at least 50% by 2020 compared to current levels.

The Commission also proposes to work on the development of a Global Forest Carbon Mechanism, a financial instrument through which developing countries would be rewarded for emissions reductions achieved by reducing deforestation and forest degradation.

The Communication also addresses policies that need to be reinforced in the fields of trade, energy, agriculture, food security and development cooperation to ensure a coherent policy response to address deforestation and forest degradation. The Communication also indicates that at the EC level an appropriate financing scheme is required from 2013 to 2020 to combat deforestation. The total amount of funding will depend on the level of mitigation actions undertaken by developing countries.

Limited Timber Import Legislation

The EC's policy to fight illegal logging and associated trade was defined back in 2003 with the Forest Law Enforcement Governance and Trade (FLEGT) Action Plan⁷⁸. The FLEGT Action Plan consists of three essential elements:

- (1) To conclude FLEGT Voluntary Partnership Agreements with timber-producing countries to improve forest governance and transparency in their forest sectors.
- (2) To encourage EU Member States to develop and implement public procurement policies that give preference to legally harvested timber and timber products.

⁷⁷ Addressing the challenges of deforestation and forest degradation to tackle climate change and biodiversity loss, COM(2008)645 final

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0645:FIN:EN:PDF>

⁷⁸ Council Regulation (EC) No 2173/2005 of 20th December 2005 on the establishment of a FLEGT licensing scheme for imports of timber into the European Community

- (3) To complement these with additional measures to address the problem of illegal logging and associated trade include prevention of the trade in illegally harvested timber, further strengthening of the growing demand for timber from guaranteed legal sources and incentives for timber-producing countries to join FLEGT and improve forest governance.

The objective of the proposed legislation set out by the Commission in October 2008 is to reinforce the measures in the FLEGT Action Plan. The legislative proposal aims to reduce the risk of illegal timber and timber products being placed on the European market for the first time. This encompasses timber and timber products from the internal market as well as third countries. The proposal⁷⁹ requires timber operators to take concrete steps to minimise the risk of putting illegally harvested timber and timber products on the EU market.

4.2.6. *Legislative arrangements and enforcement / administrative procedures relevant to Kyoto Protocol implementation.*

For the EU-15 Member States, the Kyoto Protocol's compliance procedures will only apply if the EU-15 as a whole misses its 8% reduction target. Should this occur, then each Member State will be held to its target under the EU's burden-sharing agreement, and the EU as a whole will be in non-compliance with its obligation to reach the -8 % target. On top of that, the European Commission can decide to start infringement procedures against EU-15 Member States that miss their targets under the burden-sharing agreement.

The remaining Member States with Kyoto targets (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia) are bound to their individual targets as set out in the Kyoto Protocol, both under the Kyoto Protocol's non-compliance procedures and under EU law.

Article 226 of the Treaty establishing the European Community (Nice consolidated version) gives the Commission powers to take legal action against a Member State that is not respecting its obligations.

If the Commission considers that there may be an infringement of EU law that warrants the opening of an infringement procedure, it addresses a "Letter of Formal Notice" (first written warning) to the Member State concerned, requesting it to submit its observations by a specified date, usually two months.

In the light of the reply or absence of a reply from the Member State concerned, the Commission may decide to address a "Reasoned Opinion" (second and final written warning) to the Member State. This clearly and definitively sets out the reasons why it considers there to have been an infringement of EU law, and calls upon the Member State to comply within a specified period, usually two months.

⁷⁹ Regulation of the European Parliament and of the Council laying down the obligations of operators who place timber and timber products on the market, COM(2008)644/3 http://ec.europa.eu/environment/forests/pdf/proposal_illegal_logging.pdf

If the Member State fails to comply with the Reasoned Opinion, the Commission may decide to bring the case before the Court of Justice. Where the Court of Justice finds that the Treaty has been infringed, the offending Member State is required to take the measures necessary to conform.

Article 228 of the Treaty gives the Commission power to act against a Member State that does not comply with a previous judgement of the European Court of Justice. The article also allows the Commission to ask the Court to impose a financial penalty on the Member State concerned.

Further information on infringement procedures, including recent decisions on breaches of EU law, can be found on the Commission's website⁸⁰.

⁸⁰ http://ec.europa.eu/community_law/infringements/infringements_en.htm

4.3. Cross-sector policies and measures

Table 4-4 Summary of cross-sectoral policies and measures

| Name of policy or measure | Objective and/or activity affected | GHG affected | Type of instrument | Status | Implementing entity or entities | Estimate of mitigation impact, by gas (for a particular year, not cumulative, in Mt CO ₂ equivalents) | | | |
|-----------------------------|--|--|--------------------|---|---------------------------------|--|------|------|--|
| | | | | | | 2005 | 2010 | 2015 | 2020 |
| EU ETS | EU wide emissions trading scheme covering combustion plants >20 MW | CO ₂ , N ₂ O, PFCs | Economic | Implemented. First phase (2005-2007). Second phase (2008-2012). Planned third phase (2013-2020). | EC / Member States | | | | ETS cap will lead to a 21 % reduction in emissions in 2020 compared to 2005 levels ⁸¹ . |
| Taxation of energy products | EU-wide rules for taxation of energy | Mainly CO ₂ | Fiscal | Implemented | EC / Member States | | | | |

⁸¹ This amounts to an approximate reduction of over 0.4 GtCO₂ based on verified emissions in 2005 (First Phase). Note the actual reduction will be larger as the scope of the scheme has been expanded in subsequent Phases. The reductions from the EU ETS should not be double counted with other policies, which may also affect the participants either directly or indirectly.

| Name of policy or measure | Objective and/or activity affected | GHG affected | Type of instrument | Status | Implementing entity or entities | Estimate of mitigation impact, by gas (for a particular year, not cumulative, in Mt CO ₂ equivalents) | | | |
|--|---|------------------------|---------------------|-------------|---------------------------------|--|------|------|------|
| | | | | | | 2005 | 2010 | 2015 | 2020 |
| and electricity | products used as motor or heating fuel and consumption of electricity | | | | | | | | |
| FP7 | Non technical measure for funding research | Mainly CO ₂ | Research | Implemented | EC | | | | |
| Competitiveness and Innovation Programme | Non technical measure to remove market barriers and enhance competitiveness of EU companies | Mainly CO ₂ | Economic / research | Implemented | EC | | | | |
| LIFE+ | Non technical measure to support the development and implementation of environmental | Mainly CO ₂ | Economic | Implemented | EC | | | | |

| Name of policy or measure | Objective and/or activity affected | GHG affected | Type of instrument | Status | Implementing entity or entities | Estimate of mitigation impact, by gas (for a particular year, not cumulative, in Mt CO ₂ equivalents) | | | |
|-------------------------------|--|------------------------|--------------------|---|---------------------------------|--|------|------|------|
| | | | | | | 2005 | 2010 | 2015 | 2020 |
| | policy | | | | | | | | |
| Structural and Cohesion funds | Non technical measure to strengthen economic and social cohesion | Mainly CO ₂ | Economic | Implemented (2000-2006) On-going (2007-2013) | EC/Member States | | | | |

4.3.1. *EU Emissions Trading Scheme*

The EU Emissions Trading Scheme is the cornerstone of EC-level policy to reduce emissions from the energy generation and energy intensive industries. Details of the scheme, including the design for the future, can be found in section 4.1.2.6.

4.3.2. *Taxation of energy products and electricity*

Directive 2003/96/EC provides EU-wide rules for taxation of energy products and electricity⁸². The Directive covers all taxes on energy consumption, except for VAT and provides for common taxation rules and common minimum levels of taxation.

The Directive applies to energy products used as motor fuel or heating fuel and electricity. Non-fuel uses of energy and situations when energy serves primarily as a raw material in industrial processing fall out of the scope of the Directive. Electricity is taxed at consumption; fuels used to generate electricity are exempt from taxation.

Based on their typical uses, the most important sectors affected by energy taxation are transport, households, services, agriculture and lighter industrial processes using energy for combustion. Finally, the Directive allows (under certain conditions) for exemptions or reductions to promote renewable sources of energy.

The Commission is currently revising the Energy Taxation Directive to bring it more closely in line with the EU's energy and climate change objectives⁸³.

4.3.3. *Research and innovation in climate and energy*

There are a number of research programmes related to research and innovation in climate and energy including:

- The Framework Programmes
- The Competitiveness and Innovation Framework Programme
- Life Funding

Further information on these can be found in Section 8.

4.3.4. *Structural and Cohesion funds*

The EC has always promoted balanced development and strengthened economic and social cohesion by reducing development disparities between its regions. In addition Cohesion Policy funding also has a key role to play in the Community regarding cross-border transnational and interregional cooperation.

⁸² Directive 2003/96/EC of 27th October 2003 – restructuring the Community framework for the taxation of energy products and electricity

⁸³ COM (2007) 640 final.

The European Council agreed in December 2005 on the budget for the period 2007-2013 and allocated €347 billion (current prices) to the Structural and Cohesion Funds⁸⁴, around 30 % of which (€105 billion) is earmarked for environmental aspects.

The Community Strategic Guidelines, adopted in October 2006, contain the principles and priorities of cohesion policy⁸⁵. Among the priorities, the Strategic Guidelines highlight investments to fight climate change and reach Kyoto targets, appointing as eligible areas for support investment in sustainable energy and transport systems. The Guidelines also list projects to improve energy efficiency and dissemination of low energy intensity development models and the development and use of renewable and alternative technologies as priorities.

In the 2007-2013 programming period the priority themes for funding include:

- €86 billion for Research and technological development, innovation and entrepreneurship, 4 % of which is specifically designated for assistance to SMEs (Small to Medium Enterprises) for the promotion of environmentally-friendly products and production processes;
- €8.7 billion for sustainable energy, of which 7.9 % is designated to wind energy, 12.2 % to solar energy, 20.5 % to biomass energy, 12.5 % to other renewables (hydroelectric and geothermal), and 46.7 % of which is to go towards energy efficiency, co-generation and energy management;
- €50.1 billion for environmental protection and risk prevention (see also section 6 for further information), which includes 12.3 % for promotion of clean urban transport, 12.5 % for waste treatment, 27.8 % for water treatment, and 11.5 % for risk prevention, including natural disasters.

In July 2006 the Council and the European Parliament adopted a package of five regulations⁸⁶ on:

- General common principles, rules and standards for the implementation of the three cohesion instruments, the European Regional Development Fund (ERDF), the European Social Fund (ESF) and the Cohesion Fund⁸⁷;
- The European Regional Development Fund (ERDF)⁸⁸ which aims to promote public and private investments to reduce regional disparities across the EC;
- The European Social Fund (ESF)⁸⁹, which focuses on the employment field;

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<http://europa.eu/rapid/pressReleasesAction.do?reference=DOC/05/4&format=HTML&aged=0&language=EN&guilanguage=fr>

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http://ec.europa.eu/regional_policy/sources/docoffic/2007/osc/index_en.htm

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http://ec.europa.eu/regional_policy/sources/docoffic/official/regulation/newreg10713_en.htm

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[http://ec.europa.eu/regional_policy/sources/docoffic/official/regulation/pdf/2007/general/ce_1083\(2006\)_en.pdf](http://ec.europa.eu/regional_policy/sources/docoffic/official/regulation/pdf/2007/general/ce_1083(2006)_en.pdf)

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[http://ec.europa.eu/regional_policy/sources/docoffic/official/regulation/pdf/2007/feder/ce_1080\(2006\)_en.pdf](http://ec.europa.eu/regional_policy/sources/docoffic/official/regulation/pdf/2007/feder/ce_1080(2006)_en.pdf)

- The Cohesion Fund⁹⁰, which contributes to interventions in the field of the environment and trans-European transport networks; and
- The European Grouping of territorial co-operation (EGTC)⁹¹, which aims to facilitate cross-border, transnational and/or inter-regional co-operation between regional and local authorities.

The EU Cohesion Policy overall contributes a great deal to mitigation and adaptation to climate change across the region through the breadth and depth of investments made.

⁸⁹ [http://ec.europa.eu/regional_policy/sources/docoffic/official/regulation/pdf/2007/fse/ce_1081\(2006\)_en.pdf](http://ec.europa.eu/regional_policy/sources/docoffic/official/regulation/pdf/2007/fse/ce_1081(2006)_en.pdf)

⁹⁰ [http://ec.europa.eu/regional_policy/sources/docoffic/official/regulation/pdf/2007/cohesion/ce_1084\(2006\)_en.pdf](http://ec.europa.eu/regional_policy/sources/docoffic/official/regulation/pdf/2007/cohesion/ce_1084(2006)_en.pdf)

⁹¹ [http://ec.europa.eu/regional_policy/sources/docoffic/official/regulation/pdf/2007/gect/ce_1082\(2006\)_en.pdf](http://ec.europa.eu/regional_policy/sources/docoffic/official/regulation/pdf/2007/gect/ce_1082(2006)_en.pdf)

4.4. Energy Sector

Table 4-5 Summary of policies and measures in the energy sector

| Name of policy or measure | Objective and/or activity affected | GHG affected | Type of instrument | Status | Implementing entity or entities | Estimate of mitigation impact, by gas (for a particular year, not cumulative, in Mt CO ₂ equivalents) | | | |
|--|---|------------------------|--------------------|--|---------------------------------|--|-----------------------|------|------|
| | | | | | | 2005 | 2010 | 2015 | 2020 |
| Developing the internal market | Liberalising energy supply within gas and electricity markets | CO ₂ | Regulatory | Number of Directives adopted, implementation ongoing | EC / Member States | | 80-120 ⁹² | | |
| Renewable Energy ⁹³ | | | | | | | | | |
| Promotion of electricity from RES-E (2001) | Increase in renewable electricity to 2010 | Mainly CO ₂ | Regulatory | Implemented | EC / Member States | | 100-125 ⁹⁴ | | |
| (New) | Binding 20% target | Mainly | Regulatory | Adopted | EC / Member | | | | 600- |

⁹² Second ECCP progress report April 2003, http://europa.eu.int/comm/environment/climat/pdf/second_eccp_report.pdf

⁹³ All figures under Renewable Energy group of policies refer to estimated savings in EU-15 except from the “New renewable Energy Directive” that is for EU-27

⁹⁴ Second ECCP progress report April 2003, http://europa.eu.int/comm/environment/climat/pdf/second_eccp_report.pdf

| Name of policy or measure | Objective and/or activity affected | GHG affected | Type of instrument | Status | Implementing entity or entities | Estimate of mitigation impact, by gas (for a particular year, not cumulative, in Mt CO ₂ equivalents) | | | |
|------------------------------------|---|------------------------|--------------------|---------|---------------------------------|--|-----------------------|------|-------------------|
| | | | | | | 2005 | 2010 | 2015 | 2020 |
| Renewable Energy Directive | for renewables in total EU gross final energy consumption in 2020 (electricity, heat and transport) | CO ₂ | | | States | | | | 900 ⁹⁵ |
| Biomass Action Plan | Increase use of biomass for electricity and heat production and transport | Mainly CO ₂ | Regulatory | Adopted | EC / Member States | | 36 - 48 ⁹⁶ | | |
| Energy Demand ⁹⁷ | | | | | | | | | |

⁹⁵ Directive on the promotion of energy from renewable sources – Citizens' Summary http://ec.europa.eu/energy/climate_actions/doc/2008_res_citizens_summary_en.pdf

⁹⁶ Biomass Action Plan - COM (2005) 628 final, 7.12.2005.

⁹⁷ All figures under the Energy Demand group of policies refer to estimated savings in EU-15 except from the “Energy Performance of Buildings Dir (recast)” that is for EU-27.

| Name of policy or measure | Objective and/or activity affected | GHG affected | Type of instrument | Status | Implementing entity or entities | Estimate of mitigation impact, by gas (for a particular year, not cumulative, in Mt CO ₂ equivalents) | | | |
|--|--|------------------------|------------------------|-----------------------|---------------------------------|--|------------------|------|-------------------|
| | | | | | | 2005 | 2010 | 2015 | 2020 |
| Action Plan on Energy Efficiency | Energy Efficiency improvements in a variety of sectors | CO ₂ | Regulatory Economic | Implemented (ongoing) | EC / Member States | | | | |
| Directive on energy end-use efficiency and energy services | Remove barriers to and promotion of energy efficiency | Mainly CO ₂ | Regulatory | Implemented (ongoing) | EC / Member States | | 92 ⁹⁸ | | |
| Framework Directive Eco-design | Instrument to address environmental performance of energy using products by impacting on product design over entire life-cycle | Mainly CO ₂ | Regulatory | Implemented | EC / Member States / Industry | | | | 200 ⁹⁹ |

⁹⁸

Proposal for a Directive of the European Parliament and of the Council on End-Use Energy Efficiency and Energy Services, COM(2003) 739 final

| Name of policy or measure | Objective and/or activity affected | GHG affected | Type of instrument | Status | Implementing entity or entities | Estimate of mitigation impact, by gas (for a particular year, not cumulative, in Mt CO ₂ equivalents) | | | |
|---------------------------|--|------------------------|--------------------|-----------------------|---------------------------------|--|----------------------|------|------|
| | | | | | | 2005 | 2010 | 2015 | 2020 |
| Cogeneration Directive | Promote high efficiency cogeneration | CO ₂ | Regulatory | Implemented (ongoing) | EC / Member States | | 24–42 ¹⁰⁰ | | |
| Motor challenge | Aid industrial companies in improving the energy efficiency of their electric Motor Driven Systems | Mainly CO ₂ | Research | Implemented | EC / Member States / Industry | | 30 ¹⁰¹ | | |
| Labelling Directive | Extension of products that fall under this Directive | Mainly CO ₂ | Regulatory | Adopted | EC / Member States / Industry | | 26 ¹⁰² | | |

⁹⁹ Actual savings will depend upon subsequent Directives and self commitments by the industry – Proposal for a directive on Eco design of EuP, COM (2003) 453 final

¹⁰⁰ The share of renewable energy in the EU - COM(2004) 366 final, 26.5.2004.

¹⁰¹ Proposal for a Directive of the European Parliament and of the Council on End-Use Energy Efficiency and Energy Services, COM(2003) 739 final

¹⁰² The figure indicates potential savings from the implementation of Dir 2003/66/EC - does not include the 2008 recast proposal - Second ECCP progress report April 2003, http://europa.eu.int/comm/environment/climat/pdf/second_eccp_report.pdf

| Name of policy or measure | Objective and/or activity affected | GHG affected | Type of instrument | Status | Implementing entity or entities | Estimate of mitigation impact, by gas (for a particular year, not cumulative, in Mt CO ₂ equivalents) | | | |
|---------------------------------|---|------------------------|--------------------|--|--|--|--|------|--|
| | | | | | | 2005 | 2010 | 2015 | 2020 |
| Energy performance of buildings | Improving the energy efficiency of buildings, introduction of energy performance certificates | CO ₂ | Regulatory | Implementation of the original Directive ongoing. Proposal of recast Directive adopted by the Commission in 2008 | EC / Member States | | 35 - 45 ¹⁰³ (original Directive) | | 160-210 ¹⁰⁴ (recast) |
| Technology policy | | | | | | | | | |
| SET Plan | Greater cooperation to boost R&D in low carbon technologies | Mainly CO ₂ | Research | Implemented | EC / Member States / Research networks | | | | |

¹⁰³ The figure refers to the Directive 2002/91/EC - Second ECCP progress report April 2003, http://europa.eu.int/comm/environment/climat/pdf/second_eccp_report.pdf

¹⁰⁴ In the first phase of the ECCP, an emission reduction potential of 30Mt CO₂eq was considered achievable for this sector - Second ECCP progress report April 2003, http://europa.eu.int/comm/environment/climat/pdf/second_eccp_report.pdf

| Name of policy or measure | Objective and/or activity affected | GHG affected | Type of instrument | Status | Implementing entity or entities | Estimate of mitigation impact, by gas (for a particular year, not cumulative, in Mt CO ₂ equivalents) | | | | |
|----------------------------|---|--------------------------|----------------------|-------------|------------------------------------|--|----------------------|------|------|----------------------|
| | | | | | | 2005 | 2010 | 2015 | 2020 | |
| Other | | | | | | | | | | |
| Green Public Procurement | Public procurement as a means to kick-start market for eco-innovative goods | Mainly CO ₂ | Education / Economic | Implemented | Public sector - EC / Member States | | 25-40 ¹⁰⁵ | | | |
| CCS Directive | Promote safe geological storage of CO ₂ . | CO ₂ | Regulatory | Adopted | EC / Member States | | | | | 0.875 ¹⁰⁶ |
| Non-GHG policy | | | | | | | | | | |
| National emissions Ceiling | Limits on pollutants responsible for acidification, | Indirect CO ₂ | Regulatory | Implemented | EC / Member States | | | | | |

¹⁰⁵ http://europa.eu.int/comm/environment/climat/pdf/second_eccp_report.pdf

¹⁰⁶ The original figure refers to a cumulative estimate of 7 MtCO₂eq by 2020. Assuming that the effect starts in 2012 when the Directive is expected to enter into force, we calculated the annual saving by dividing the 2020 saving by 8 years

| Name of policy or measure | Objective and/or activity affected | GHG affected | Type of instrument | Status | Implementing entity or entities | Estimate of mitigation impact, by gas (for a particular year, not cumulative, in Mt CO ₂ equivalents) | | | |
|----------------------------------|--|--------------------------|--------------------|-------------|---------------------------------|--|------|------|------|
| | | | | | | 2005 | 2010 | 2015 | 2020 |
| Directive | eutrophication, ozone-depletion | | | | | | | | |
| Large Combustion Plant Directive | Emissions standards for NO _x , SO _x and particulates | Indirect CO ₂ | Regulatory | Implemented | EC / Member States | | | | |

4.4.1. *Developing the internal market*

Creating a genuine internal market for energy is one of the EC's priority objectives. The existence of a competitive internal energy market is a strategic instrument both in terms of giving European consumers a choice between different companies supplying gas and electricity at reasonable prices, and of making the market accessible for all suppliers.

Some time ago the EC adopted Directives on the full liberalisation of the electricity (Directive 2003/54/EC) and gas markets (Directive 98/30/EC). Increased competition between different energy sources favours more flexible, less capital intensive and smaller scale production methods.

Making the internal energy market a reality will depend above all on having a reliable and coherent energy network in Europe and therefore on infrastructure investment. A truly integrated market will contribute to diversification and thus to security of energy supply. To this end, the Commission put forward the Third Energy Package¹⁰⁷ on 19th September 2007.

Ownership issues

The package provides companies in Member States with two options for separating gas and electricity production from supply provision:

Ownership unbundling: Companies that control both energy generation and transmission would be obliged to sell part of their assets. Investors would be able to keep their participation in the dismantled groups via a system of 'share-splitting', whereby two new shares are offered for each existing share.

Independent System Operator (ISO): Companies involved in energy production and supply would be allowed to retain their network assets, but would lose control over how they are managed. Commercial and investment decisions would be left to an independent company (the ISO), to be designated by national governments and approved by the Commission.

More powers to national regulators and new EC agency

A lack of coherence in the remits of national energy regulators is a hurdle towards a well-functioning EC energy market. The Third Energy Package aims to resolve this by:

- Harmonising and strengthening the powers and duties of national regulators;
- Ensuring that all national regulators are truly independent of industry interests and government intervention; and
- Mandating cooperation between all national regulators.

¹⁰⁷ [COM \(2007\) 0530](#) Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EC) No 1775/2005 Establishing an Agency for the Cooperation of Energy Regulators [Third Energy Package]

Co-operation between national transmission system operators for gas and electricity, which currently only takes place on a voluntary basis, will be formalised under the Commission's plans through the establishment of a European Network for Transmission System Operators.

A new European agency is also foreseen in the package to oversee and improve cross-border regulatory cooperation for gas and electricity transmission between Member States.

4.4.2. *Renewable energy*

4.4.2.1. Renewable electricity Directive

A key piece of legislation is the 2001 Directive on the promotion of electricity from renewable energy sources¹⁰⁸. The Directive sets indicative targets, differentiated by Member State, for renewable electricity consumption in 2010, which in total led to an indicative target for the EU of 22.1 % renewable electricity. The Commission's Progress Report shows that in 2006, the overall contribution of renewables to total electricity consumption in the EU-27 was 15.7 %¹⁰⁹. Although growth rates of renewable electricity are increasing in the EU, Commission analysis still suggests that the 2010 target will not be reached without significant additional effort.

4.4.2.2. Renewable energy Directive and bioenergy policy

The new Renewable Energy Directive¹¹⁰ is one of three Directives adopted as part of the EC's Energy and Climate Package (see section 4.1.2.3).

Individual Member State targets are based on their share of renewable energy in 2005, plus a flat rate increase of 5 %, plus a GDP-weighted percentage increase, and then moderated to include a bonus for Member States who started their renewable energy development early. The Directive also includes a target of a minimum 10 % share of renewable energy in transport, which can include biofuels, renewable electricity or hydrogen. The current contribution of renewable energy to total final energy consumption in the EU-27 and its Member States, along with the 2020 targets, can be seen in section 2.7.1.

The Directive requires Member States to prepare National Renewable Energy Action Plans by June 2010, which should state sectoral targets (electricity, heating and cooling, and

¹⁰⁸ Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources in the internal electricity market, adopted October 2001: http://eur-lex.europa.eu/pri/en/oj/dat/2001/l_283/l_28320011027en00330040.pdf

¹⁰⁹ Figure from COM(2009)192 The Renewable Energy Progress Report: Commission Report in accordance with Article 3 of Directive 2001/77/EC, Article 4(2) of Directive 2003/30/EC and on the implementation of the EU Biomass Action Plan: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2009:0192:FIN:EN:PDF>

Figure is based on normalised hydropower following a methodology ifrom Eurostat (which may differ from the methods applied in some Member States)

¹¹⁰ Directive 2009/28/EC on the promotion of the use of energy from renewable sources amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:EN:PDF>

transport) and their policies and measures to achieve these targets. Member States are encouraged to cooperate towards achieving their renewable energy targets, so that targets can be achieved in the most cost efficient manner. Flexibility measures introduced take the form of “statistical transfers” of renewable energy from one country to another, joint projects between Member States and/or joint support schemes.

The Directive also creates a sustainability regime for biofuels and bioliquids, which includes a minimum GHG threshold which increases over time. Further sustainability provisions, including broader environmental and social aspects and indirect effects of biofuels will be monitored by the Commission.

The Commission estimates that achievement of EU renewable energy targets will cost €13-18 billion per year. This investment will however help to drive down the price of the renewable energy technologies that will form a growing part of global energy supply. The implementation of the Directive is expected to realise savings of 600 to 900 million tonnes of CO₂ emissions per year by 2020¹¹¹.

European biomass policy plays a crucial role in any scenario to meet the European target of increasing the share of renewable energies to 20 % by 2020. In December 2005 the Biomass Action Plan¹¹² set out a series of Community actions aimed at increasing the demand for biomass, improving supply, overcoming technical barriers and developing research. A recent Progress Report and accompanying Staff Working document adopted by the Commission (COM(2009)192), assesses the progress made. The potential for biomass use is around 180 million toe by 2010 and the report shows that around 88 Mtoe biomass was consumed in the EU in 2006.

4.4.3. *EU Emissions Trading Scheme*

All large combustion installations with capacity greater than 20 MWth are included in the ETS. Details, including the design for the future, can be found in section 4.1.2.6.

4.4.4. *Energy Demand*

4.4.4.1. Action Plan on Energy Efficiency

The Action Plan on Energy Efficiency is a follow-up to the Commission Communication¹¹³ published in April 1998 on the rational use of energy and the Council resolution on energy efficiency. The Action Plan was adopted in two stages: the first from 2000 to 2006, and the second from 2007 to 2012.

¹¹¹ Directive on the promotion of energy from renewable sources – Citizens' Summary http://ec.europa.eu/energy/climate_actions/doc/2008_res_citizens_summary_en.pdf

¹¹² COM(2005) 628 final of 7th December 2005 "Biomass action plan" http://ec.europa.eu/energy/res/biomass_action_plan/doc/2005_12_07_comm_biomass_action_plan_en.pdf

¹¹³ [Communication](#) from the Commission of 29th April 1998: Energy Efficiency in the European Community - towards a Strategy for the Rational Use of Energy

The first stage¹¹⁴ proposes a target of a 1 % decrease in energy consumption per annum until 2010 over and above that currently envisaged. A wide range of instruments were to be used to implement the plan at European and Member State levels. Many of the proposed actions are not mandatory but action needs to be taken on three distinct levels:

- measures to integrate energy efficiency into other Community policies;
- initiatives to strengthen and extend existing policies;
- development of new policies and measures.

The second stage¹¹⁵ was presented in 2006 and contains a package of priority measures covering a wide range of cost-effective energy efficiency initiatives. These include improved efficiency in energy appliances, buildings, transport and energy generation. Stringent new energy efficiency requirements, promotion of energy services, specific financing mechanisms to support more energy efficient products are proposed.

The objective of the second stage is to control and reduce energy demand and to take targeted action on energy consumption and supply to save 20% of annual consumption of primary energy by 2020, compared to the energy consumption forecasts for 2020 (a target that has been integrated into the new Energy and Climate Package, section 4.1.2.3). Achieving this goal would lead to annual savings of primary energy by 2020 of around 390 mtoe, equivalent to approximately a 1.5 % energy saving per year, in addition to the estimated annual baseline or “business-as-usual” improvements of 1.8 %.¹¹⁶

Between 2007 and 2012, the Plan underlines the importance of minimum energy performance requirements for a wide range of appliances and equipment, and for buildings and energy services. In combination with performance ratings and labelling schemes, minimum performance requirements represent a powerful tool for removing inefficient products from the market, informing consumers of the most efficient products and transforming the market to make it more energy efficient.

The Action Plan proposes targeted instruments to improve the efficiency of both new and existing generation capacity and to reduce transmission and distribution losses.

A comprehensive set of measures for improving energy efficiency in transport is proposed, including ensuring fuel efficiency of cars, developing markets for cleaner vehicles, ensuring proper tyre pressure, improving the efficiency of urban, rail, maritime and aviation transport systems (see section 4.5), and also stressing the importance of behavioural change.

¹¹⁴ [Communication](#) from the Commission of 2000 to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions - Action Plan to improve energy efficiency in the European Community

¹¹⁵ [Communication](#) from the Commission - Action Plan for Energy Efficiency: Realising the Potential

¹¹⁶ Autonomous improvements of 0.85 % annually and the impact of previous Community legislative measures of 0.35 % annually. Annual structural changes of 0.6 % are also estimated.

The Action Plan calls for the development and adoption of new – or the strengthening of existing – European Community Directives.

The 2008 Commission Communication 'Energy efficiency: delivering the 20 % target'¹¹⁷ concluded that "*current energy efficiency legislation alone will not deliver sufficient energy savings to meet the 20 % saving objective*" and that further actions will be necessary. The Commission therefore plans to adopt a new Energy Efficiency Action Plan by the end of 2010.

4.4.4.2. Directive on energy end-use efficiency and energy services

The Commission adopted a Directive¹¹⁸ for energy end-use efficiency and energy services in 2006, with implementation in Member States by 2008. The purpose of the Directive is to make the end use of energy more economic and efficient by:

- Establishing indicative targets, incentives and the institutional, financial and legal frameworks needed to eliminate market barriers and imperfections which prevent efficient end use of energy.
- Requiring Member States to issue national Energy Efficiency Action Plans specifying how they intend to achieve energy savings in energy consumption¹¹⁹.
- Creating the conditions for the development and promotion of a market for energy services and for the delivery of energy-saving programmes and other measures aimed at improving end-use energy efficiency. Member States must ensure that the public sector adopts measures to improve energy efficiency, inform the public and businesses of the measures adopted and promote the exchange of good practice.

The Directive covers all forms of energy, and applies to providers of energy efficiency measures, energy distributors, distribution system operators and retail energy sales companies as well as to all non-ETS energy users.

The Commission estimates that the Directive could reduce CO₂ emissions by 92 Mt/yr¹²⁰ by 2010. Most of the reductions will be achieved using very cost effective investments, i.e. involving no or negative overall costs, and the remaining initiatives will cost less than €20/t CO₂eq¹²¹.

¹¹⁷ COM(2008) 772 final, of 13/11/2008.

¹¹⁸ Directive [2006/32/EC](#) of the European Parliament and of the Council of 5th April 2006 on energy end-use efficiency and energy services and repealing Council Directive [93/76/EEC](#)

¹¹⁹ For an assessment of national Energy Efficiency Action Plans, please see Commission Staff Working Document, Synthesis of the complete assessment of all 27 National Energy Efficiency Action Plans as required by Directive 2006/32/EC on energy end-use efficiency and energy services. Moving forward together on saving energy. SEC(2009)889, of 26/06/2009.

¹²⁰ This figure concerns only EU-15. See Proposal for a Directive of the European Parliament and of the Council on energy end-use efficiency and energy services. COM(2003)739, of 10/12/2003.

¹²¹ Second ECCP progress report April 2003, http://europa.eu.int/comm/environment/climat/pdf/second_eccp_report.pdf

4.4.4.3. Cogeneration Directive

The European Parliament and the Council adopted on 11th February 2004 Directive 2004/8/EC on the promotion of cogeneration based on a useful heat demand in the internal energy market¹²².

This Directive creates a framework for promotion and development of high efficiency cogeneration of heat and power. It does not include targets but urges Member States to carry out analyses of their potential for high efficiency cogeneration and evaluate progress towards increasing the share of this technology.

In the 2006 Action Plan for Energy Efficiency¹²³ the Commission proposed a number of measures to promote cogeneration in the future: harmonising calculation methods and guarantee of origins, improving metering and establishment of European standards, minimum performance requirements and regulations for district heating and micro cogeneration.

In 2007, as part of implementation of the original Directive the Commission established harmonised efficiency reference values for separate production of electricity and heat¹²⁴. These harmonised values will be reviewed for the first time in February 2011, and every four years thereafter, to take account of technological developments and changes in the distribution of energy sources.

4.4.4.4. Motor challenge

Launched in 2003, the Motor Challenge Programme¹²⁵ is a European Commission initiative to aid industrial companies to improve the energy efficiency of their electric Motor Driven Systems. The Challenge focuses on compressed air, fan and pump systems, for which it has been demonstrated that a large technical and economic potential for energy savings exists.

The core of the programme is an Action Plan, by which a Challenge Partner commits to undertaking specific measures to reduce energy consumption. The participating company determines which production sites, and which types of systems, are covered by the commitment. The scope of the commitment is flexible, and can be limited to a single shop, or may include all of the company's European production sites.

Companies will receive aid, advice and technical assistance from the Commission and from participating National Energy Agencies to formulate and carry out their Action Plan.

¹²² <http://europa.eu/scadplus/leg/en/lvb/l27021.htm> and <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:052:0050:0060:EN:PDF>

¹²³ <http://europa.eu/scadplus/leg/en/lvb/l27064.htm> and <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2006:0545:FIN:EN:PDF>

¹²⁴ Commission Decision 2007/74/EC of 21st December 2006 establishing harmonised efficiency reference values for separate production of electricity and heat in application of Directive 2004/8/EC of the European Parliament and of the Council.

¹²⁵ The Motor Challenge: <http://re.jrc.ec.europa.eu/energyefficiency/motorchallenge/index.htm>

4.4.4.5. Energy Using Products

The Energy Using Products Directive¹²⁶ (EuP) is an initiative to improve the environmental performance of products throughout their life-cycle by encouraging integration of environmental aspects at the earliest stages of their design.

Framework Directive for establishing Eco-design requirements for EuP

The eco-design of Energy using Products Directive became law in the EC in August 2005, with transposition by Member States into national law by August 2007. It is the main legal instrument for the EC to address the environmental performance of energy using products. The main objective of the EuP Directive is to bring about improvements in energy efficiency throughout a product's lifecycle, from the mining of the raw material through to recycling at the end-of-life. Its focus is on the design phase and the scope is deliberately broad, covering, in principle, any product which when in use depends on, generates, transfers or measures energy (electricity, fossil fuel or renewable).

The overall impact of the framework Directive will depend on the number of implementing measures adopted, but could become very substantial over time, reaching 200 Mt/yr by the year 2020, when all currently installed equipment has been replaced¹²⁷.

The rules for the eco-design of EuPs are consistent across Europe, but take into consideration national variations. Criteria included are water consumption, energy consumption and waste production as well as the extension of product life. Not all EuPs have quantified environmental obligations against them under the Directive. Those that do will be selected based on volume of sales in the EU and their environmental impact at European level.

The Directive is being applied to the following product groups as a matter of priority, with others to follow:

- heating and water heating equipment¹²⁸,
- electric motors,
- lighting in the residential and tertiary sectors,
- domestic appliances,
- office equipment in the residential and tertiary sectors,

¹²⁶ Directive 2005/32/EC http://ec.europa.eu/enterprise/eco_design/directive_2005_32.pdf of the European Parliament and of the Council of 6th July 2005 establishing a framework for the setting of eco-design requirements for energy-using products and amending Council Directive 92/42/EEC and Directives 96/57/EC and 2000/55/EC of the European Parliament and of the Council

¹²⁷ Proposal for a Directive on Eco design of EuP, COM (2003) 453 final

¹²⁸ Replacing, in some cases, older Directives specific to a certain product group such as Directive 92/42/EEC on Efficiency of new boilers

- consumer electronics,
- HVAC (heating, ventilation and air conditioning) systems.

In 2008, the Commission issued a proposal to recast¹²⁹ the Eco-design Directive. The aim of the recast is allow for the inclusion of all energy-related products (e.g. windows) as well as energy-using products.

Labelling Directive

The EuP Directive is expected to increase the effectiveness and synergies of other EC legislation. One such affected Directive is the Energy Labelling Directive¹³⁰. Since the original Directive¹³¹ of 1992, the Energy Labelling Directive has been amended to include further energy using household appliances such as refrigerators and freezers.

In 2008, the Commission submitted a proposal to further extend the scope of this Directive¹³² to energy-using products used in the industrial and commercial sectors, as well as other products which have an impact on energy consumption during use.

In addition, the new proposal establishes a harmonised base for public procurement and incentives provided by the EC and the Member States. The product-specific implementing measures will indicate the energy-performance level below which public authorities should not procure or grant incentives. These levels will be set to guarantee net savings for public finances while providing the industry with an EU-wide level-playing field.

4.4.4.6. Energy performance of buildings

The existing Energy Performance of Buildings Directive¹³³, adopted in 2003 for transposition into Member State law in 2005, is a key piece of legislation to improve the energy performance of buildings in the EU.

The original Directive was expected to be able to reduce emissions by around 220 Mt CO₂eq in total at a cost of less than €20/tonne of CO₂, of which 150 MtCO₂eq would be reduced at no or negative cost (i.e. a cost saving). The emission reduction potential by 2010 is estimated at 35-45 Mt/yr¹³⁴.

¹²⁹ Proposal COM(2008) 399 final for a Directive of the European Parliament and of the Council establishing a framework for the setting of eco-design requirements for energy related products <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0399:FIN:EN:PDF>

¹³⁰ Commission Directive [2003/66/EC](#) (energy labelling of household electric refrigerators, freezers and their combinations)

¹³¹ Council Directive [92/75/EEC](#) of 22nd September 1992 on the indication by labelling and standard product information of the consumption of energy and other resources by household appliances

¹³² [Proposal for a Directive](#) (COM/2008/0778 final) of the European Parliament and of the Council on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products

¹³³ Directive [2002/91/EC](#) of the European Parliament and of the Council of 16th December 2002 on the energy performance of buildings

¹³⁴ Second ECCP progress report April 2003, http://europa.eu.int/comm/environment/climat/pdf/second_eccp_report.pdf

The Directive obliges Member States to set minimum standards for the energy performance of new buildings and for existing buildings subject to major renovation works. The Directive also includes:

- Criteria for a common methodology for calculating the integrated energy performance of buildings;
- Systems for the energy certification of new and existing buildings and, for public buildings, prominent display of the certificate and other relevant information. Member States shall ensure that, when buildings are constructed, sold or rented out, an energy performance certificate is made available to the owner or by the owner to the prospective buyer or tenant, as the case might be; and
- Regular inspection of boilers and central air-conditioning systems in buildings and an assessment of heating installations in which the boilers are more than 15 years old.

To further strengthen the effectiveness and the impact of this Directive, the original Directive is currently being recast. The recast Directive¹³⁵ has a broader scope and helps citizens to improve the energy efficiency of their houses and the construction industry to build better quality buildings. The revision will create a simplified and improved framework for energy savings. The minimum total impact of the options identified as being most beneficial and for which quantification was possible, is: 160 - 210 Mt/year CO₂ savings in 2020¹³⁶.

With the proposed changes, energy performance certificates become a real, active energy label for individual houses within the Community. The energy performance indicator of the certificate has to be included in all advertisements for sales or letting, and the certificate along with its energy saving recommendations, have to be part of the sales and letting documentation.

If the Commission proposal is adopted, the specific energy performance requirements will be implemented in national or regional building codes. Their level of ambition should be improved using a specific benchmarking system that is currently under development.

Likewise, the Commission proposal requires Member States to develop plans for increased numbers of low or zero energy and carbon buildings, such as passive houses. The public sector should show a leading example investing in such buildings.

¹³⁵ Proposal for a Directive of the European Parliament and of the Council on the energy performance of buildings

http://ec.europa.eu/energy/strategies/2008/doc/2008_11_ser2/buildings_directive_proposal.pdf

¹³⁶ Energy performance of buildings – Impact Assessment on the revised Directive SEC(2008) 2864

4.4.5. *Technology Policy*

4.4.5.1. Strategic Energy Technology Plan (SET)

The EC considers speeding up research into low-carbon technologies as key to tackling the twin challenges of climate change and energy-supply security. On 10th January 2007 the European Commission outlined a proposal for a Strategic Energy Technology (SET) Plan as part of its Energy and Climate package proposals. Detailed proposals were tabled by the Commission on 22nd November 2007¹³⁷.

The SET Plan improves collaboration between the EC and Member States on low carbon technology research and therefore seeks to build on existing efforts, such as the EC research framework programme (FP7), European technology platforms and the European Institute of Technology.

The SET Plan calls for greater cooperation at European level to boost innovation and proposes the following measures:

- European Industrial Initiatives in six areas: wind, solar, bio-energy, nuclear fission, carbon capture and storage (CCS) and electricity grids;
- A European Research Alliance featuring research coordination between universities and specialised institutes;
- Establishment of a high-level Steering Group on Strategic Energy Technologies;
- A new Energy Technology Information System; and
- The organisation in 2009 of a European Energy Technology Summit to agree a financial plan.

4.4.6. *Green Public Procurement*

The EC promotes the use of public procurement in Member States as a means of kick-starting the market for eco-innovative goods and services and achieving its environmental goals in a cost-efficient manner.

Public authority spending in the EU is worth an estimated €2,000 billion per year, around 16 % of EU GDP. Greening public procurement rules at EC and national level can substantially reduce unsustainable production and consumption patterns and could serve to place new environmental technologies on the market.

A 2003 Communication on Integrated Product Policy encouraged Member States to adopt national action plans on Green Public Procurement (GPP) by the end of 2006. In March 2004, the EC adopted two new public procurement Directives, which included provisions

¹³⁷ COM(2007) 723 final, of 22nd November 2007 – A European Strategic Energy Technology Plan (SET-Plan) http://ec.europa.eu/energy/res/setplan/doc/com_2007/com_2007_0723.pdf

regarding integration of environmental considerations into public procurement strategies. The Directives are estimated to have an emission reduction potential of 25-45 Mt CO₂eq per annum, most of which comprises investments that cost less than 20€/tonne CO₂eq¹³⁸.

In June 2006, the EC adopted a renewed Sustainable Development Strategy (section 4.2.3), including the goal of bringing the average level of EU GPP up to the standard currently achieved by the best-performing Member States by 2010.

On 16th July 2008, the Commission presented a proposal to set ambitious targets for GPP as part of a broader action plan for 'sustainable consumption and production'.

The draft law also identifies ten priority sectors for the introduction of GPP. These sectors are: construction, food and catering services, transport and transport services, energy, office machinery and computers, clothing, uniforms and other textiles, paper and printing services, furniture, cleaning products and services and health sector equipment.

4.4.7. Carbon Capture and Storage

ECCP II, launched in October 2005, set up a Working Group on Carbon and Capture and Geological Storage (CCS) with the mandate to explore this technology as a means of reducing climate change.

The need for the development of both policy and regulatory frameworks for CCS was stressed by the Working Group and by the European Commission¹³⁹.

On 17th December 2008 the European Parliament adopted its resolution on the proposal for a Directive on the geological storage of carbon dioxide and amending Council Directives 85/337/EEC, 96/61/EC, Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC and Regulation (EC) No 1013/2006.

The Directive establishes a legal framework for the environmentally safe geological storage of carbon dioxide, to prevent and eliminate as far as possible negative effects and any risk to the environment and human health.

Members States undertake the selection of storage sites pursuant to the requirements of the Directive and they retain the right to issue storage permits. The Directive defines criteria for the applications procedure, the content of the permits and the conditions for issuing the permits. The European Commission reserves the right to review and pass opinion on draft storage permits.

¹³⁸ Second ECCP progress report April 2003, http://europa.eu.int/comm/environment/climat/pdf/second_eccp_report.pdf

¹³⁹ COM (2006) 843 final, of 10th January 2007 – Sustainable power generation from fossil fuels: aiming for near-zero emissions from coal after 2020
http://ec.europa.eu/energy/energy_policy/doc/16_communication_fossil_fuels_en.pdf

The Directive defines criteria for monitoring and reporting regimes to verify storage and adequate remediation for any damage or significant irregularities or leakages that may occur.

CCS is also covered under the third phase of the EU ETS. In the context of the new framework for Phase III of the EU ETS the legislation includes several financial incentives for this technology for 2013 onward varying from direct funding to indirect financial mechanisms.

For the purpose of the EU ETS, installations with CCS technology will not be required to return allowances to the extent that the carbon dioxide is stored.

Member States determine the use of revenues generated from the auctioning of allowances. However, the legislation requires that at least 50 % of the revenues generated from the auctioning of allowances is used for specific activities among which is the environmentally safe capture and geological storage of carbon dioxide.

The construction and operation of twelve commercial demonstration projects including geological storage of carbon dioxide as well as the demonstration projects of innovative renewable energy technologies will be stimulated through the creation of a fund equal to €300 million allowances in the new entrants reserve until 31st December 2015.

Preliminary estimates of the impact of the proposed Directive and referred to in the Commission Impact Assessment, indicate that 7 MtCO₂ could be stored by 2020, and up to 160 Mt by 2030. This assumes a 20 % reduction in GHG emissions by 2020, provided that CCS obtains private, national and Community support and proves to be an environmentally safe technology. The CO₂ emissions avoided in 2030 could account for some 15 % of the reductions required in the EU¹⁴⁰.

4.4.8. *Non-greenhouse gases*

The following two Directives aim to introduce measures to improve air quality, but their provisions will also affect emissions of greenhouse gases through control of combustion.

4.4.8.1. National Emissions Ceiling Directive

Directive 2001/81/EC¹⁴¹ on National Emission Ceilings for certain pollutants sets upper limits for each Member State for the total emissions in 2010 of the four pollutants responsible for acidification, eutrophication and ground-level ozone pollution (sulphur dioxide, nitrogen oxides, volatile organic compounds and ammonia).

¹⁴⁰ EUROPEAN PARLIAMENT, CCS, text adopted at the sitting of 17 DEC 2008 (P6_TA-PROV (2008) 12-17)

¹⁴¹ Directive 2001/81/EC of 23rd October 2001 on national emission ceilings for certain atmospheric pollutants <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2001:309:0022:0030:EN:PDF>, amended from 2007 for inclusion of new Member States http://ec.europa.eu/environment/air/pdf/nec_eu_27.pdf

The Directive is currently being amended¹⁴² to set emissions ceilings for 2020 for the four pollutants already regulated as well as for primary emissions of PM2.5. The revision builds upon the evaluation and review of the National Programmes 2002 and 2006, the work performed under the Clean Air for Europe Programme¹⁴³, the Thematic Strategy on Air Pollution, and new scientific and technical work. The revision also takes into account (proposals for) the Community legislation for specific source categories, like Euro 5/6, EURO VI, the revision of the IPPC-Directive and the EC's 2020 targets for greenhouse gas emissions and renewable energy.

4.4.8.2. Large Combustion Plant Directive

The Large Combustion Plant Directive¹⁴⁴ sets emission requirements for Member States for nitrogen oxides, sulphur dioxide and particulates from all power stations with an installed capacity greater than 50 MW. Under the Directive power stations that do not meet the specified emission requirements must either retrofit appropriate pollution control equipment or close. Plants that 'opt out' of meeting the new requirements can operate for a maximum of 20,000 hours after January 2008 and, at the latest, must be shut down by 2015. The Directive is currently being reviewed as part of an overall package of measures to streamline industrial emissions legislation, see section 4.6.4.

¹⁴² http://ec.europa.eu/environment/air/pollutants/rev_nec_dir.htm

¹⁴³ <http://ec.europa.eu/environment/archives/air/cafe/index.htm>

¹⁴⁴ Directive 2001/80/EC of the European Union Parliament and the Council on the limitation of emissions of certain pollutants into the air from large combustion plants
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2001:309:0001:0021:EN:PDF>

4.5. Transport sector

Table 4-6 Summary of policies and measures in the transport sector

| Name of policy or measure ¹⁴⁵ | Objective and/or activity affected | GHG affected | Type of instrument | Status | Implementing entity or entities | Estimate of mitigation impact, by gas (for a particular year, not cumulative, in Mt CO ₂ equivalents) | | | |
|--|--|------------------------|--------------------|---|---------------------------------|--|----------------------|------|---------------------|
| | | | | | | 2005 | 2010 | 2015 | 2020 |
| Measures to promote renewable energy in transport | | | | | | | | | |
| Directive on promotion of biofuels (2003) | Indicative targets for liquid and gaseous biofuels in 2010 | Mainly CO ₂ | Regulatory | Implemented | EC/ Member States | | 35-40 ¹⁴⁶ | | |
| Fuel Quality Directive | Review of fuel quality criteria in order to lower their environmental impact | Mainly CO ₂ | Regulatory | First implemented 1998 – revisions adopted 2009 | EC / Member States | | | | 62.5 ¹⁴⁷ |

¹⁴⁵ Second ECCP progress report April 2003, http://europa.eu.int/comm/environment/climat/pdf/second_eccp_report.pdf

¹⁴⁶ Second ECCP progress report April 2003, http://europa.eu.int/comm/environment/climat/pdf/second_eccp_report.pdf

| Name of policy or measure ¹⁴⁵ | Objective and/or activity affected | GHG affected | Type of instrument | Status | Implementing entity or entities | Estimate of mitigation impact, by gas (for a particular year, not cumulative, in Mt CO ₂ equivalents) | | | |
|---|--|--------------------------------------|--------------------|-------------|---------------------------------|--|------|------|------------------------|
| | | | | | | 2005 | 2010 | 2015 | 2020 |
| (New) Renewable Energy Directive (transport measures) | Binding minimum target for renewable energy in transport in 2020 | Mainly CO ₂ | Regulatory | Adopted | EC / Member States | | | | 600-900 ¹⁴⁸ |
| Other Measures | | | | | | | | | |
| Taxation of energy products and electricity | EU-wide rules for taxation of motor fuels | Mainly CO ₂ | Fiscal | Implemented | EC / Member States | | | | |
| Infrastructure charging for heavy goods vehicles | Recover infrastructure costs with the possibility of integrating the | Mainly non-GHG emissions, indirectly | Fiscal | Implemented | EC / Member States | | | | |

¹⁴⁷ Estimate derived from “Questions and answers on the EU strategy to reduce CO₂ emissions from cars, MEMO/07/46.” Cumulative estimate of 500 MtCO₂eq by 2020. Assuming that the effect of policy starts in 2012, annual emissions saving estimate is calculated by dividing 2020 saving by 8 years.

¹⁴⁸ Note this includes all the savings from the Directive and should not be double counted with e.g. those in section 4.4. Directive on the promotion of energy from renewable sources – Citizens' Summary http://ec.europa.eu/energy/climate_actions/doc/2008_res_citizens_summary_en.pdf

| Name of policy or measure ¹⁴⁵ | Objective and/or activity affected | GHG affected | Type of instrument | Status | Implementing entity or entities | Estimate of mitigation impact, by gas (for a particular year, not cumulative, in Mt CO ₂ equivalents) | | | |
|--|---|------------------------|---------------------|-------------|---------------------------------------|--|----------------------|------|-------------------|
| | | | | | | 2005 | 2010 | 2015 | 2020 |
| | external costs of road transport into toll prices | CO ₂ | | | | | | | |
| Voluntary agreements with European, Japanese and Korean car manufacturers | Reduce average CO ₂ emissions of newly sold cars to 140 g/km until 2008/2009 (25% reduction compared to levels in the mid-90s) | CO ₂ | Voluntary agreement | Implemented | EC / manufacturers' associations | | 75-80 ¹⁴⁹ | | |
| Strategy for car CO ₂ (Regulation setting emission performance) | Reduction of emission thresholds, phasing-in | Mainly CO ₂ | Regulatory | Adopted | EC/Member States/ Automotive industry | | | | 50 ¹⁵⁰ |

¹⁴⁹ Second ECCP progress report April 2003, http://europa.eu.int/comm/environment/climat/pdf/second_eccp_report.pdf

¹⁵⁰ The original figure refers to a cumulative estimate of 400 MtCO₂eq by 2020. Assuming that the effect starts in 2012 when the decision is expected to enter into force, we calculated the annual saving by dividing the 2020 saving by 8 years

| Name of policy or measure ¹⁴⁵ | Objective and/or activity affected | GHG affected | Type of instrument | Status | Implementing entity or entities | Estimate of mitigation impact, by gas (for a particular year, not cumulative, in Mt CO ₂ equivalents) | | | |
|--|---|--------------------------|--------------------|---------|---------------------------------|--|------|------|------|
| | | | | | | 2005 | 2010 | 2015 | 2020 |
| requirements for new passenger cars to reduce CO ₂ emissions from light-duty vehicles.) | requirements, long-term emission targets, eco-innovation and energy efficiency labelling | | | | | | | | |
| EURO 5&6 standards | Minimum standards for air quality pollutants from new cars | Indirect CO ₂ | Regulatory | Adopted | EC / Member States | | | | |
| Tyre Labelling | Creating a labelling scheme for tyre parameters such as fuel efficiency and environmental performance | CO ₂ | Labelling | Adopted | EC / tyre industry | | | | |
| Rolling Resistance | Enhancing the environmental | Mainly | Regulatory | Adopted | EC / tyre | | | | |

| Name of policy or measure ¹⁴⁵ | Objective and/or activity affected | GHG affected | Type of instrument | Status | Implementing entity or entities | Estimate of mitigation impact, by gas (for a particular year, not cumulative, in Mt CO ₂ equivalents) | | | |
|--|---|------------------------|--------------------|---------|---------------------------------|--|------|------|------|
| | | | | | | 2005 | 2010 | 2015 | 2020 |
| Tyres | performance of tyres by regulating the minimum requirements for tyre rolling resistance | CO ₂ | | | industry | | | | |
| Thematic Strategy on Urban Environment | Guidance and measures related to achieving cleaner urban transport | Mainly CO ₂ | Guidance | Adopted | EC/ Member States | | | | |
| Directive on the promotion of clean and energy efficient road transport vehicles | Market introduction of clean and energy efficient vehicles through public procurement process | CO ₂ | Regulatory | Adopted | EC/ Member States | | | | 1.9 |
| Freight Logistics | Improve efficiency and sustainability | Mainly | Guidance and | Adopted | EC/ Member | | | | |

| Name of policy or measure ¹⁴⁵ | Objective and/or activity affected | GHG affected | Type of instrument | Status | Implementing entity or entities | Estimate of mitigation impact, by gas (for a particular year, not cumulative, in Mt CO ₂ equivalents) | | | |
|---|--|-----------------|--------------------|---------|--------------------------------------|--|-------------------|--------------------|--------------------|
| | | | | | | 2005 | 2010 | 2015 | 2020 |
| Action Plan | of freight transport | CO ₂ | Regulatory | | States | | | | |
| Aviation EU ETS | Including the aviation sector in the EU ETS scheme | CO ₂ | Economic | Adopted | EC/ Member States/ Aviation Industry | | | 122 ¹⁵¹ | 183 ¹⁵² |
| Emissions from air conditioning systems in motor vehicles | Reduce emissions of fluorinated gases used in air conditioning systems | HFCs | Regulatory | Adopted | EC / Member States | | 23 ¹⁵³ | | |

¹⁵¹ Inclusion of Aviation in the EU Greenhouse Gas Emissions Trading Scheme (EU ETS), Summary of the Impact Assessment, SEC(2006) 1685

¹⁵² Inclusion of Aviation in the EU Greenhouse Gas Emissions Trading Scheme (EU ETS), Summary of the Impact Assessment, SEC(2006) 1685

¹⁵³ The figure refers to the overall impact of the proposed Regulation on certain fluorinated gases COM (2003) 492 final. On the basis of this proposal, two separate legal instruments were adopted simultaneously in 2006: Directive 2006/40/EC relating to emissions from air-conditioning systems in motor vehicles and Regulation 842/2006 on certain fluorinated greenhouse gases, which covers all other applications addressed by the 2003 proposal.

4.5.1. Measures to promote renewable energy in transport

4.5.1.1. Biofuels Directive

The 2003 Directive on the use of renewable energy in transport¹⁵⁴ set indicative targets for biofuels and other renewable energy used in the transport sector. Member States were able to set their own targets, but indicative targets were set at a 2 % biofuel share by 2005 and 5.75 % by 2010. The EC also allows Member States to apply a total or partial tax exemption for biofuels, according to energy taxation Directive 2003/96/EC¹⁵⁵ and subject to state aid approval from the Commission. Further information is included in the 4th National Communication.

Based on an approximate (life cycle) CO₂ saving of 2 tCO₂/1000 litres of fuel, achievement of the indicative 2010 target is estimated to correspond to an annual CO₂ saving of 35-40 Mt CO₂eq, although the cost is relatively high at approximately €100/tonne saved¹⁵⁶.

The Commission's progress report COM(2009)192¹⁵⁷ looks at progress made towards achieving the 2010 targets set by Directive 2003/30/EC and shows that in 2007 the use of biofuels in road transport was 2.6% (8.1 Mtoe).

4.5.1.2. Fuel Quality Directive

An amendment to Directive 98/70/EC, the Fuel Quality Directive¹⁵⁸, on environmental quality requirements for fuel further tightens these requirements for a number of fuel parameters.

The amended Directive introduces a binding target on (fossil) fuel suppliers to reduce life cycle GHG emissions from fuel supplied by 6 % by 2020 as first step, with additional indicative targets totalling 4 %, including 2 % to be achieved by the use of CDM credits for reductions in the fuel supply sector. To facilitate implementation of the target the amended Directive also introduces a mechanism for reporting the life cycle GHG emissions from fuels (including fossil fuel and renewable fuels), which includes crude oil production, refining, distribution and retail as well as fuel combustion.

¹⁵⁴ Directive 2003/30/EC of the European Parliament and of the Council of 8th May 2003 on the promotion of the use of biofuels or other renewable fuels for transport

¹⁵⁵ Second ECCP progress report April 2003, http://europa.eu.int/comm/environment/climat/pdf/second_eccp_report.pdf

¹⁵⁶ [Proposal](#) for a Regulation of the European Parliament and of the Council setting emission performance standards for new passenger cars as part of the Community's integrated approach to reduce CO₂ emissions from light-duty vehicles

¹⁵⁷ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2009:0192:FIN:EN:PDF>

¹⁵⁸ Directive 2009/30/EC of the European Parliament and of the Council of 23rd April 2009 amending Directive 98/70/EC as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and reduce greenhouse gas emissions and amending Council Directive 1999/32/EC as regards the specification of fuel used by inland waterway vessels and repealing Directive 93/12/EEC <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0088:0113:EN:PDF>

In 2012, the Commission will review the potential need for adjustments to the indicative targets in order to assess further possible contributions for reaching a greenhouse gas reduction target up to 10 %.

As the scope of the Directive covers fuel production right through to combustion of the fuel, biofuels will play a key part in achievement of the targets. The Directive therefore incorporates the same sustainability criteria and minimum GHG savings requirements for biofuels as those introduced in the Renewable Energy Directive (see section 4.4.2.2).

To encourage and enable a more widespread use of ethanol in transport fuels, the Directive will phase in a 10 % blending limit for ethanol in petrol (E10), while continuing the production and supply of 5 % bioethanol (E5) on the market for older cars. For diesel, the maximum biodiesel blend will be increased from the current 5 % to 7 % (B7), with an option to increase that further in the future and allowing Member States to permit higher blends already.

It is estimated that the 1 % annual reduction in GHG emissions from transport fuels over their lifecycle required under the revised Directive will bring a cumulative saving by 2020 equivalent to around 500 million tonnes of CO₂¹⁵⁹.

4.5.1.3. Renewable Energy Directive

On 17th December 2008, the EC agreed upon the Energy and Climate Package, which includes a Directive on the promotion of renewable energies (see section 4.4.2.2). As part of the new Directive, a binding target is set for all Member States to achieve a minimum of 10 % renewable energy in land transport by 2020. The target is set on the basis of gross final energy consumption and can be met by biofuels (including hydrogen from renewable sources) as well as renewable electricity. Second-generation biofuels produced from waste, residues, non-food cellulosic material or ligno-cellulosic biomass will count double towards the 10 % target. Renewable electricity consumed in transport will count 2.5 times its input.

In addition, the Directive sets a number of sustainability criteria that must be met for biofuels and bioliquids to count towards the target, including minimum greenhouse gas savings from those biofuels and bioliquids (see section 4.4.2.2 for further detail).

4.5.2. *Taxation of energy products and electricity*

Directive 2003/96/EC (see section 4.3.2) is particularly important in the transport sector since it provides for common rules for taxation of motor fuels in all modes of transport on the internal market (international maritime and aviation transport are exempt from taxation).

¹⁵⁹ Directive [2003/30/EC](#) of the European Parliament and of the Council of 8th May 2003 on the promotion of the use of biofuels or other renewable fuels for transport

The ongoing revision of the Energy Taxation Directive which intends to give greater consideration to CO₂ emissions will contribute to the objectives of the EU strategy for the internalisation of external costs in transport¹⁶⁰.

4.5.3. *Infrastructure charging for heavy goods vehicles – revised Eurovignette*

The 2006 reviewed “Eurovignette” Directive¹⁶¹ amended the 1999 Directive on the charging of heavy goods vehicles for the use of certain infrastructures with a view to establishing a new Community framework for charging for the use of road infrastructure. This makes it possible to improve the efficiency of the road transport system and ensure the proper functioning of the internal market. The Directive lays down rules for the application by Member States of tolls or user charges on roads of the trans-European network and roads in mountainous regions.

From 2012 onwards Directive 2006/38/EC will apply to vehicles weighing between 3.5 and 12 tonnes.

The Directive allows Member States to levy distance-based tolls to recover the cost of construction, maintenance and operation of infrastructure. Within this limit Member States are able to differentiate tolls according to a vehicle's emission category ("EURO" classification) and the level of damage it causes to roads, the place, the time and the amount of congestion. This is a first step to tackle the problems of traffic congestion, including damage to the environment, on the basis of the "user pays" and "polluter pays" principles.

In 2008, the Commission proposed a revision of the Directive (COM(2008) 436 final). The proposal would enable Member States to add an amount which reflects the cost of air pollution and noise pollution caused by traffic to the tolls levied on heavy goods vehicles. During peak periods, it would also allow a mark-up to be calculated on the basis of the cost of congestion imposed upon other vehicles. The amounts would vary with the distance travelled, location and time of use of roads to better reflect these external costs. The proceeds would have to be used by Member States for making transport more sustainable through projects such as research and development on cleaner and more energy efficient vehicles, mitigating the effects of road transport pollution or providing alternative infrastructure capacity for users.

4.5.4. *Strategy for car CO₂*

The EC agreed that average CO₂ emissions from new passenger cars should not exceed 120 gCO₂ per km by 2012.

As part of the ECCP, the Commission in 2006 carried out a review of the voluntary strategy (see 4th NC for further details), concluding that, given the slower than expected progress to date, the 120 gCO₂/km target would not be met by 2012 without additional

¹⁶⁰ COM(2008) 435

¹⁶¹ Directive [2006/38/EC](#) of the European Parliament and of the Council of 17th May 2006 amending Directive [1999/62/EC](#) on the charging of heavy goods vehicles for the use of certain infrastructures

measures. For that reason in 2008 the European Parliament voted to adopt a Regulation¹⁶² on CO₂ from cars based on a proposal by the Commission¹⁶³ (the Council adopted the Regulation on 6th April 2009).

Some key elements of the adopted regulations are as follows:

- Limit value curve: the average emissions from the EU fleet to be achieved by all cars registered in the EU is 130 g/km. A so-called limit value curve sets a guide for higher emissions being allowed from heavier cars rather than lighter cars while preserving the overall fleet average.
- Phasing-in of requirements: in 2012, 65 % of each EU manufacturer's newly registered cars must comply on average with the limit value curve set by the legislation. This will rise to 75 % in 2013, 80 % in 2014, and 100 % from 2015 onwards.
- Excess emissions premium: If the average CO₂ emissions of a manufacturer's fleet exceed its limit value in any year from 2012, the manufacturer has to pay an excess emissions premium of €95 for each car registered. Money raised from the scheme will go into EC funds. Lower penalty payments apply for small excess emissions (until 3g CO₂/km) until 2018.
- Long-term target: a target of 95g/km is specified for the year 2020. The modalities for reaching this target and the aspects of its implementation including the excess emissions premium will be defined in a review to be completed no later than the beginning of 2013.
- Eco-innovations: manufacturers can be granted a maximum of 7g/km of emission credits on average for their fleet if they equip vehicles with innovative technologies, based on independently verified data.

Compared to today's situation, reaching the EC target of average CO₂ emissions from new cars of 120 gCO₂/km by 2012 will deliver 10 % of the reduction effort that is still needed to meet the EC's Kyoto Protocol commitment.

Taking a longer-term perspective, with the gradual renewal of the EU car fleet the Commission calculates that the *cumulative* CO₂ savings by 2020 of reaching the 120 gCO₂/km target in 2012 will be over 400 million tonnes¹⁶⁴.

With regards to car labelling, the Commission will adopt amendments to improve the fuel efficiency labelling Directive 1999/94/EC¹⁶⁵. The objective is to ensure that information

¹⁶² Regulation (EC) No 443/2009 of the European Parliament and of the Council of 23rd April 2009 setting emission performance standards for new passenger cars as part of the Community's integrated approach to reduce CO₂ emissions from light-duty vehicles <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0001:0015:EN:PDF>

¹⁶³ Questions and answers on the EU strategy to reduce CO₂ emissions from cars, MEMO/07/46

¹⁶⁴ Directive 1999/94/EC of the European Parliament and the Council relating to the availability of consumer information on fuel economy and CO₂ emissions in respect of the marketing of new passenger cars <http://ec.europa.eu/environment/air/transport/co2/9994/en.pdf>

related to the fuel economy and CO₂ emissions of new passenger cars is made available to enable the consumer to make an informed choice. This will be achieved by extending the scope of the labelling scheme, harmonising the design of the label and introducing energy efficiency classes.

4.5.5. *EURO 5 and 6 standards*

To limit pollution caused by road vehicles, this Regulation introduces new common minimum requirements for air quality emissions from motor vehicles and their replacement parts (Euro 5 and Euro 6 standards). Air quality emissions limits are set separately for petrol and diesel vehicles.

With regard to the EURO 6 standard, all vehicles equipped with a diesel engine will be required to substantially reduce their emissions of nitrogen oxides as soon as the Euro 6 standard enters into force. For example, NO_x emissions from transport vehicles will be capped at 80 mg/km (an additional reduction of more than 50 % compared to the Euro 5 standard). Combined emissions of hydrocarbons and nitrogen oxides from diesel vehicles will also be reduced. These will be capped at, for example, 170 mg/km for cars and other vehicles intended to be used for transport.

Some air pollutant abatement technologies (such as Lean NO_x Trap catalysts) could have a negative impact on fuel efficiency and CO₂ emissions, however, others (such as SCR catalysts) and overall improvements in energy design could improve fuel efficiency. It is broadly expected that the impact of the EURO 6 standards will not lead to a change in fuel efficiency¹⁶⁶.

4.5.6. *Emissions from air conditioning systems in motor vehicles*

The Directive 2006/40/EC¹⁶⁷ aims to reduce the emissions of fluorinated greenhouse gases used in air conditioning systems in motor vehicles by introducing maximum permissible leak rates for air conditioning systems containing fluorinated greenhouse gases (e.g. HFC-134a), by 2008 and 2009, in new types of vehicles and all new vehicles respectively and eventually by introducing:

- As of 2011: A ban on F-gases with a global warming potential of more than 150 for new car model types designed by automakers. This effectively rules out the use of HFC-134a but would allow less potent HFCs, including HFC-152a, which has a global warming potential of 124 as well as non-HFC refrigerants such as R-744 (carbon dioxide).

¹⁶⁵ Regulation (EC) [No 715/2007](#) of the European Parliament and of the Council of 20th June 2007 on type approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information.

¹⁶⁶ Commission Staff Working Document - Impact Assessment for Euro 6 emission limits for light duty vehicles
http://ec.europa.eu/enterprise/automotive/pagesbackground/pollutant_emission/impact_assessment_euro6.pdf

¹⁶⁷ Directive [2006/40/EC](#) of the European Parliament and of the Council of 17th May 2006 relating to emissions from air conditioning systems in motor vehicles

- As of 2017: A ban on F-gases with global warming potential of more than 150 for all new cars coming out of factories.

4.5.7. *Tyre Labelling and Minimum rolling resistance*

A proposal regarding the energy labelling of tyres¹⁶⁸ was announced in 2008 as part of both the Energy Efficiency Action Plan and the Communication on Greening Transport. The objective is to influence energy demand by promoting the market transformation towards fuel-efficient tyres, also known as low rolling resistance tyres (LRRT).

The labelling will complement the type approval legislation on tyres that addresses the supply side by means of minimum requirements for tyre manufacturers. The minimum requirements governing tyre performance factors such as rolling resistance, wet grip and external rolling noise are scheduled to take effect by October 2012 and fall under “a Proposed Regulation Concerning Type-Approval Requirements For The General Safety Of Motor Vehicles”¹⁶⁹.

The impact of these regulations could be substantial. Figures from the Impact Assessment identified a savings potential of between 0.56 and 1.51 Mtoe per year depending on the market uptake. For the minimum rolling resistance requirement, a study by TNO estimates that use of LRRT could reduce fuel consumption by 3 % for a given vehicle and thus save on average 0.09 tCO₂/yr and vehicle.

4.5.8. *Thematic Strategy on the Urban Environment*

The EC sets out cooperation measures and guidelines to enable Member States and their local authorities to improve urban environmental management. This strategy is to improve the quality of the urban environment by making cities more attractive and healthier places in which to live, work and invest, and by reducing their adverse environmental impact.

The main measure with regards to transport is the publication of guidelines for sustainable urban transport plans, one of the impacts of which will be to reduce CO₂ emissions from transport. Effective transport planning should embrace both passengers and goods and promote safe and efficient use of less polluting, high-quality modes.

Following the Commission’s commitment to the Thematic Strategy on the Urban Environment, a preparatory document on Sustainable Urban Transport Plans¹⁷⁰ was published in 2007. Sustainable Urban Transport Plans comprise a combination of urban mobility management measures and should cover all modes and forms of transport in a relevant geographical area. It addresses vehicle movements and parking, public and private transport, passenger and freight movements and motorised and non-motorised modes.

¹⁶⁸ [Proposal for a Directive of the European Parliament and Council on labelling of tyres with respect to fuel efficiency and other essential parameters](#), November 2008

¹⁶⁹ [Proposal for a Regulation of the European Parliament and of the Council concerning type-approval requirements for the general safety of motor vehicles](#), May 2008

¹⁷⁰ Preparatory document on Sustainable Urban Transport Plans
http://ec.europa.eu/environment/urban/pdf/transport/2007_sutp_prepdoc.pdf

On 17th December 2008, the EC agreed upon the Energy and Climate Package, which includes a Directive on the promotion of renewable energies (see section 4.4.2.2). As part of the new Directive, a binding target is set for all Member States to achieve a minimum of 10% renewable energy in land transport by 2020. The target is set on the basis of gross final energy consumption and can be met by biofuels (including hydrogen from renewable sources) as well as renewable electricity. Second-generation biofuels produced from waste, residues, non-food cellulosic material or ligno-cellulosic biomass will count double towards the 10 % target. Renewable electricity consumed in transport will count 2.5 times its input.

In addition, the Directive sets a number of sustainability criteria that must be met for biofuels and bioliquids to count towards the target, including minimum greenhouse gas savings from those biofuels and bioliquids (see section 4.4.2.2 for further detail).

4.5.9. *Taxation of energy products and electricity*

Directive 2003/96/EC (see section 4.3.2) is particularly important in the transport sector since it provides for common rules for taxation of motor fuels in all modes of transport on the internal market (international maritime and aviation transport are exempt from taxation).

The ongoing revision of the Energy Taxation Directive which intends to give greater consideration to CO₂ emissions will contribute to the objectives of the EU strategy for the internalisation of external costs in transport¹⁷¹.

4.5.10. *Infrastructure charging for heavy goods vehicles – revised Eurovignette*

The 2006 reviewed “Eurovignette” Directive¹⁷² amended the 1999 Directive on the charging of heavy goods vehicles for the use of certain infrastructures with a view to establishing a new Community framework for charging for the use of road infrastructure. This makes it possible to improve the efficiency of the road transport system and ensure the proper functioning of the internal market. The Directive lays down rules for the application by Member States of tolls or user charges on roads of the trans-European network and roads in mountainous regions.

From 2012 onwards Directive 2006/38/EC will apply to vehicles weighing between 3.5 and 12 tonnes.

The Directive allows Member States to levy distance-based tolls to recover the cost of construction, maintenance and operation of infrastructure. Within this limit Member States are able to differentiate tolls according to a vehicle's emission category ("EURO" classification) and the level of damage it causes to roads, the place, the time and the amount of congestion. This is a first step to tackle the problems of traffic congestion,

¹⁷¹ COM(2008) 435.

¹⁷² Directive [2006/38/EC](#) of the European Parliament and of the Council of 17th May 2006 amending Directive [1999/62/EC](#) on the charging of heavy goods vehicles for the use of certain infrastructures

including damage to the environment, on the basis of the "user pays" and "polluter pays" principles.

In 2008, the Commission proposed a revision of the Directive (COM(2008) 436 final). The proposal would enable Member States to add an amount which reflects the cost of air pollution and noise pollution caused by traffic to the tolls levied on heavy goods vehicles. During peak periods, it would also allow a mark-up to be calculated on the basis of the cost of congestion imposed upon other vehicles. The amounts would vary with the distance travelled, location and time of use of roads to better reflect these external costs. The proceeds would have to be used by Member States for making transport more sustainable through projects such as research and development on cleaner and more energy efficient vehicles, mitigating the effects of road transport pollution or providing alternative infrastructure capacity for users.

4.5.11. Public Procurement of Vehicles

On 21st December 2005 the Commission made a proposal for a Directive on the promotion of clean vehicles through public procurement (COM(2005) 634) to reduce CO₂ emissions from the vehicles covered by public procurement by 29% by 2017, giving a total of 1.9 Mt CO₂ avoided annually¹⁷³.

The Council and the European Parliament, in First Reading, supported the objectives, but proposed a broader approach. In that context additional legislative measures on the reduction of CO₂ emissions from cars were announced by the Commission in its Communication on the new Community strategy in this field (COM(2007) 19).

The Directive was proposed in 2007 and subsequently adopted and published on 15th May 2009¹⁷⁴. Member States shall implement it by 4th December 2010. The Directive extends to all purchases of road transport vehicles, as covered by the public procurement Directives and the public service Regulation.

The Directive requires that purchase decisions take into account energy and environmental impacts linked to the operation of vehicles over their whole lifetime. These lifetime impacts of vehicles shall include at least energy consumption, CO₂ emissions and emissions of the regulated pollutants of NO_x, NMHC and particulate matter. Purchasers may also consider other environmental impacts.

This internalisation of external costs into new vehicle procurements will improve the contribution of the transport sector to the environment, climate and energy policies of the Community by reducing energy consumption, CO₂ emissions and pollutant emissions.

This Directive is expected to result, in the longer term, in a wider deployment of clean and energy efficient vehicles. Increased sales will help reduce costs through economies of

¹⁷³ Directive on the promotion of clean and energy efficient road transport vehicles, 2005/0283 (COD)

¹⁷⁴ Directive 2009/33/EC of 23rd April 2009. Official Journal L120, 15.05.2009, p.5-12

scale, resulting in progressive improvement in the energy and environmental performance of the whole vehicle fleet.

4.5.12. Freight Logistics Action Plan¹⁷⁵

In 2006, the European Commission presented a Communication¹⁷⁶ on promoting sustainable mobility through advanced freight transport. In 2007, it adopted a package of measures¹⁷⁷ on logistics, including a Freight Transport Logistics Action Plan¹⁷⁸ and separate proposals for improving the competitiveness of rail freight and boosting maritime and short sea shipping.

The present Freight Logistics Action Plan is one of a series of policy initiatives jointly launched by the European Commission to improve the efficiency and sustainability of freight transport in Europe. It presents a number of short- to medium-term actions that will help Europe address its current and future challenges and ensure a competitive and sustainable freight transport system in Europe.

The Logistics Action Plan places a key focus on measures to facilitate the use of several transport modes in one trip, so-called co-modality, notably by improving connections between the different modes, investing in modern trans-shipment hubs, establishing common European standards on loading units and creating a single transport document for all carriage of goods, irrespective of the mode.

4.5.13. Inclusion of Aviation in EU Emissions Trading Scheme

In December 2006 the European Commission adopted a proposal for a Directive to amend the EU ETS Directive 2003/87/EC¹⁷⁹ to include aviation activities in the EU emissions trading scheme. This proposed Directive was formally adopted in November 2008, referred to as Directive 2008/101/EC¹⁸⁰.

The Directive aims to incorporate aviation activities in the EU ETS. The scheme will cover flights between EU airports and all flights arriving at or departing from airports in the Community from 1st January 2012. Aircraft operators will be responsible for complying with the scheme requirements. It is also proposed that the allowance allocation method be

¹⁷⁵ Freight Transport Logistics in Europe – the key to sustainable mobility, COM(2006)336 final http://ec.europa.eu/transport/logistics/documentation/highlights/doc/2006_06_28/2006_06_28_com_munication_en.pdf

¹⁷⁶ Communication from the Commission - The EU's freight transport agenda: Boosting the efficiency, integration and sustainability of freight transport in Europe, [COM\(2007\)0606 final](http://ec.europa.eu/transport/logistics/freight_logistics_action_plan/doc/memo/memo_logistics_freight_en.pdf)

¹⁷⁷ Action Plan to keep freight moving http://ec.europa.eu/transport/logistics/freight_logistics_action_plan/doc/memo/memo_logistics_freight_en.pdf

¹⁷⁸ All figures refer to EU-15 except from the “Aviation EU ETS” that is for EU-27

¹⁷⁹ Directive [2003/87/EC](http://ec.europa.eu/transport/logistics/freight_logistics_action_plan/doc/memo/memo_logistics_freight_en.pdf) of the European Parliament and of the Council of 13th October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community

¹⁸⁰ Directive [2008/101/EC](http://ec.europa.eu/transport/logistics/freight_logistics_action_plan/doc/memo/memo_logistics_freight_en.pdf) of the European Parliament and of the Council of 19th November 2008 amending Directive 2003/87/EC so as to include aviation activities in the scheme for greenhouse gas emission allowance trading within the Community

harmonised across the EU and that each aircraft operator, including operators from third countries, be administered by one Member State only. For more details on the EU ETS mechanism, refer to section 4.1.2.6.

4.5.14. Steps to implement decisions of relevant international organisations

International Civil Aviation Organisation (ICAO)

In September 2005, the European Commission appointed its Representative to ICAO. The main role of the Representative is to:

- follow the work of ICAO;
- increase awareness at ICAO of relevant Community policies and to increase awareness at the Community of relevant developments in ICAO, with a view to promoting a consistent development of activities in the two organisations;
- foster the influence and effectiveness of the Community in the policies of ICAO;
- strengthen the cooperation between EU Member States in ICAO;
- support the Presidency to develop common EC positions.

International Maritime Organisation (IMO)

The EU maintains a continuous dialogue with all the EC shipping and trading partners in the world through the participation of its Member States and the Commission in the IMO. The EU has no status so far in this international organisation, while the Commission has an observer status.

The Commission has a permanent representative to IMO, who follows closely the work of the IMO and takes appropriate initiatives to implement in EU law the instruments/rules agreed at IMO. The presence of the Commission at IMO also increases the awareness of relevant Community policies, ensuring consistencies in the development of activities and measures.

The Commission also plays a key role in the coordination of Member States' positions prior to IMO meetings in Community Competence or Community interests related to maritime safety, maritime security and prevention of pollution caused by shipping. Such ongoing coordination often results in joint EU (MS and Commission) submissions to IMO, confirming the important contribution by the EU in the initiation and development of high international rules and standards.

4.6. Industry sector

Table 4-7 Summary of policies and measures in the industry sector

| Name of policy or measure ¹⁸¹ | Objective and/or activity affected | GHG affected | Type of instrument | Status | Implementing entity or entities | Estimate of mitigation impact, by gas (for a particular year, not cumulative, in Mt CO ₂ equivalents) | | | |
|--|---|-----------------------------|--------------------|---------|---------------------------------|--|----------------------|------|------|
| | | | | | | 2005 | 2010 | 2015 | 2020 |
| Regulation on certain Fluorinated gases | Improve monitoring and verification, improve containment and apply marketing and use restrictions | HFCs, PFCs, SF ₆ | Regulatory | Adopted | EC / Member States | | 23 ¹⁸² | | |
| IPPC | Integration of pollution issues into permits for plant operation based on BAT | All gases | Regulatory | Adopted | EC / Member States | | 60-70 ¹⁸³ | | |

¹⁸¹ All figures on the table are for EU-15

¹⁸² The figure refers to the overall impact of the proposed Regulation on certain fluorinated gases COM (2003) 492 final. On the basis of this proposal, two separate legal instruments were adopted simultaneously in 2006: Directive 2006/40/EC relating to emissions from air-conditioning systems in motor vehicles and Regulation 842/2006 on certain fluorinated greenhouse gases, which covers all other applications addressed by the 2003 proposal.

¹⁸³ The figure refers to Directive 96/61/EC of 24th September 1996 based on a study performed for DG Environment on 'Energy Management and Optimisation in Industry' - Second ECCP progress report April 2003, http://europa.eu.int/comm/environment/climat/pdf/second_eccp_report.pdf

| Name of policy or measure ¹⁸¹ | Objective and/or activity affected | GHG affected | Type of instrument | Status | Implementing entity or entities | Estimate of mitigation impact, by gas (for a particular year, not cumulative, in Mt CO ₂ equivalents) | | | |
|--|--|--------------|--------------------|---------|---------------------------------|--|------|------|------|
| | | | | | | 2005 | 2010 | 2015 | 2020 |
| Proposal for a Directive on industrial emissions | Proposal to combine and streamline existing legislation impacting industrial emissions | All gases | Regulatory | Planned | EC / Member States | | | | |

4.6.1. *EU Emissions Trading Scheme*

All combustion installations with capacity greater than 20 MWth are included in the EU ETS, as well as specifically named sectors including: oil refineries, coke ovens, iron and steel plants, and factories making cement, glass, lime, brick, ceramics, and pulp and paper.

Details of the scheme, including the design for the future, can be found in section 4.1.2.6.

4.6.2. *Fluorinated gases*

In 2003, the Commission adopted a proposal¹⁸⁴ for a Regulation on fluorinated greenhouse gases (HFCs, PFCs, and SF₆) covering all main applications aiming at reducing emissions by 23 MtCO₂eq by 2010 (see 4th National Communication for further details).

The containment measures in the 2003 proposal were estimated to have an average cost of around €18 per tonne CO₂eq reduced. The marketing and use restrictions have an average cost less than €1 per tonne CO₂eq¹⁸⁵.

On the basis of the 2003 proposal, in 2006 two separate legal instruments were adopted simultaneously: Directive 2006/40/EC relating to emissions from air-conditioning systems in motor vehicles (see section 4.5.6 for further detail) and Regulation 842/2006 on certain fluorinated greenhouse gases, which covers all other main applications. EC Regulation 842/2006 was adopted in July 2006 and most measures apply in Member States from July 2007.

Under Directive 2006/40/EC measures on car air conditioning systems equivalent to the measures foreseen in the original proposal are incorporated into the type approval system. Regulation 842/2006 aims to reduce emissions of fluorinated greenhouse gases (mainly) in stationary applications through application-specific requirements covering all stages of the life cycle of F-Gases.

4.6.3. *Integrated Pollution Prevention and Control (IPPC)*

In 1996 the EC set common rules for permitting and controlling industrial installations in the Integrated Pollution Prevention and Control (IPPC) Directive¹⁸⁶. In 2008 the Directive was codified¹⁸⁷.

In essence, the IPPC Directive aims to minimise pollution from industrial sources throughout the EU, and has a potential impact on emissions of all GHG, depending on the industrial sector. Operators of industrial installations covered by Annex I of the IPPC

¹⁸⁴ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2003:0492:FIN:EN:PDF>

¹⁸⁵ Regulation proposal on certain fluorinated greenhouse gases - COM (2003) 492 final

¹⁸⁶ Council Directive [96/61/EC](#) of 24th September 1996 concerning integrated pollution prevention and control

¹⁸⁷ Directive 2008/1/EC of the European Parliament and of the Council of 15th January 2008 concerning integrated pollution prevention and control (Codified version) <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32008L0001:EN:NOT>

Directive are required to obtain an environmental permit from Member State authorities based on best available techniques (BAT). About 52,000 installations are covered by the IPPC Directive across the EU.

New installations, and existing installations subject to "substantial changes", have been required to meet the requirements of the IPPC Directive since 30th October 1999. Other existing installations had to be brought into compliance by 30th October 2007. This was the key deadline for the full implementation of the Directive.

A number of plants are covered by both EU ETS and IPPC legislation. Where this occurs the GHG emissions from the plant are effectively included within the EU ETS and as such ETS installations are not directly subject to the same energy efficiency requirements when obtaining an IPPC permit, however all non-GHG emissions requirements (such as VOCs limits) must be complied with.

4.6.4. *Activity to streamline industrial emissions legislation*

In December 2007 the Commission proposed a package (a communication¹⁸⁸ and proposed directive¹⁸⁹) to streamline and improve existing EC policy on industrial emissions¹⁹⁰. The Proposal for a Directive on industrial emissions would recast seven existing Directives related to industrial emissions into a single clear and coherent legislative instrument.

The recast includes directives relevant to greenhouse gas emissions such as the IPPC Directive (see section 4.6.3), the Large Combustion Plants Directive (see section 4.4.8.2), and the Waste Incineration Directive (see section 4.9.9) as well as others on solvents emissions and titanium dioxide.

The Commission's proposal will lead to significant benefits to the environment and human health by reducing harmful industrial emissions across the EU, in particular through better application of BAT. For large combustion plants alone the proposed Directive is estimated to achieve net benefits of €7-28 billion per year, including the reduction of premature deaths and years of life lost by 13,000 and 125,000 respectively.

The streamlining of permitting, reporting and monitoring requirements as well as a renewed cooperation with Member States to simplify implementation will lead to a reduction in unnecessary administrative burden estimated between €105 and €255 million per year.

188 <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52007DC0843:EN:NOT>
189 <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52007PC0844:EN:NOT>
190 <http://ec.europa.eu/environment/air/pollutants/stationary/ippc/proposal.htm>

4.7. Agriculture Sector

Table 4-8 Summary of policies and measures in the agriculture sector¹⁹¹

| Name of policy or measure | Objective and/or activity affected | GHG affected | Type of instrument | Status | Implementing entity or entities | Estimate of mitigation impact, by gas (for a particular year, not cumulative, in Mt CO ₂ equivalents) | | | |
|---|-------------------------------------|--|---------------------|-------------|---------------------------------|--|----------------------|------|------|
| | | | | | | 2005 | 2010 | 2015 | 2020 |
| CAP Health Check > Rural development policies > Market Policies | Sustainable agriculture | CO ₂ , CH ₄ , N ₂ O | Regulatory | Adopted | EC/ States Member | | 60-70 ¹⁹² | | |
| Rural development policy | Measures along 3 main thematic axis | CO ₂ , CH ₄ , | Variety of measures | Implemented | EC/ States Member | | 12 ¹⁹³ | | |

¹⁹¹ Figures in the Table refer to EU-15

¹⁹² Potential of up to 60-70 from agricultural sinks. From ECCP working group on agriculture and sub-group on carbon sinks related to agricultural soils. Some of potential for bioenergy crops will be covered within potential from biofuels, cogeneration from biomass, further promotion of RES-H etc.

¹⁹³ Potential of 200-600 from bioenergy crops beyond 2010

| Name of policy or measure | Objective and/or activity affected | GHG affected | Type of instrument | Status | Implementing entity or entities | Estimate of mitigation impact, by gas (for a particular year, not cumulative, in Mt CO ₂ equivalents) | | | |
|---------------------------|--|--|--------------------|---|---------------------------------|--|-------------------|------|------|
| | | | | | | 2005 | 2010 | 2015 | 2020 |
| | | N ₂ O | | | | | | | |
| Soil Directive | Soil protection | CO ₂ , CH ₄ , N ₂ O | Regulatory | Proposal adopted by EC and being negotiated through the EU Institutions | EC/ Member States | | | | |
| Nitrates Directive | Reduced Water pollution and reduced emissions from land by reducing fertilizer use | N ₂ O | Regulatory | Implemented | EC/ Member States | | 10 ¹⁹⁴ | | |

¹⁹⁴ The first ECCP quantified the potential savings from N₂O emission from soils in the EU-15 at 10 MtCO₂eq, by 2010
http://www.eea.europa.eu/publications/eea_report_2008_5/TPReport2008Annexes.pdf

4.7.1. CAP Health Check

In November 2007, the Commission announced its intention to streamline and further modernise the EC's Common Agricultural Policy (CAP)¹⁹⁵. The so-called CAP Health Check builds on the approach, which began with reforms in 2003 (see EC 4th National Communication), to improve the way the policy operates based on experience gathered since 2003.

In May 2008, the European Commission proposed to further modernise, simplify and streamline the CAP and remove certain restrictions on farmers to help them respond to a growing demand for food. The CAP Health Check has further broken the link between direct payments and production and thus allows farmers to follow market signals to the greatest possible extent.

The CAP Health Check¹⁹⁶ targets modifications of three main areas of the CAP:

- Direct aid system
- Market instruments
- Rural development policy

The agricultural sector faces challenges today that were not as pronounced in 2003. These challenges include the increased need for management of production risks, fighting climate change, more efficient management of water, making the most of the opportunities offered by bio-energy and the preservation of biodiversity. Adjusting the CAP to meet these challenges would be costly and hence the Commission is looking at ways of exploiting these opportunities through the Rural Development Policy (see section 4.7.2).

Two key changes to the CAP of particular relevance to the cultivation of crops for bio-energy, and thereby to GHG emissions, are the abolishment of direct payments for energy crop production and the abolishment of set-aside land from 2007. The abolishment of the direct premium paid for the cultivation of energy crops may have a negative impact on bioenergy, while the removal of set-aside brings some land back into cultivation, giving a potentially larger area of land available for energy crop cultivation. However, the removal of the set-aside obligation may also increase CO₂ emissions from soils.

¹⁹⁵ Communication from the Commission: "Preparing for the 'Health Check' of the CAP reform", COM(2007)722 final

¹⁹⁶ Commission Proposal on: establishing common rules for direct support schemes for farmers under the common agricultural policy and establishing certain support schemes for farmers, amending Decision 2006/144/EC on the Community strategic guidelines for rural development (programming period 2007 to 2013), amending Regulation (EC) No 1698/2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD), on modifications to the common agricultural policy by amending Regulations (EC) No 320/2006, (EC) No 1234/2007, (EC) No 3/2008 and (EC) No [...] /2008 http://ec.europa.eu/agriculture/healthcheck/prop_en.pdf

In January 2009, the Council approved Regulation¹⁹⁷ 74/2009 introducing a number of amendments to a previous Regulation concerning the support for rural development by the European Agricultural Fund for Rural Development. This new Regulation includes an indicative list of measures and operations, as well as their potential effect, related to the latest priorities expressed by the CAP Health Check.

4.7.2. *Rural Development Policy*

The most important rules governing rural development policy for the period 2007 to 2013, as well as the policy measures available to Member States and regions, are set out in Council Regulation (EC) No. 1698/2005¹⁹⁸, last amended by Council Regulation (EC) N° 79/2009.

Under this Regulation, Rural Development Policy for 2007 to 2013 is focused on three thematic axes (see Appendix C – C1 for further details for further details).

Rural development policy measures impact GHG emissions via a number of means, for example: measures to promote renewable energy and energy efficiency in the agriculture sector reduce CO₂ emissions; manure management measures to reduce methane emissions; and practices to reduce fertilizer use have a significant impact on N₂O emissions.

As before 2007, every Member State (or region, in cases where powers are delegated to the regional level) must set out a rural development programme, which specifies how funding will be spent in the period 2007 to 2013. Member States and regions are obliged to spread their rural development funding between all three thematic axes.

Measures that the Commission had in place for the protection of forests against fires are now part of the Rural Development Policy. Forestry measures with respect to protection and rehabilitation are part of Axis 2. Of particular importance for the objective of combating forest dieback is the support for restoring forestry potential in forests damaged by natural disasters and fire, and for introducing preventive actions to maintain the environmental and economical role of these forests.

4.7.3. *Soil Directive*

The Kyoto Protocol highlights that soil is a major carbon store which must be protected and increased where possible. Carbon sequestration in agricultural soils by some land management practices can contribute to mitigating climate change. The ECCP Working Group on Sinks Related to Agricultural Soils estimated this potential at equivalent to 1.5 to

¹⁹⁷ Council Regulation 74/2009 amending Regulation (EC) 1698/2005 on support for rural development by the European Agricultural Fund for Rural Development
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:030:0100:0111:EN:PDF>

¹⁹⁸ Council Regulation (EC) [No 1698/2005](#) of 20th September 2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD)

1.7 % of the EC's anthropogenic CO₂ emissions during the first Kyoto commitment period¹⁹⁹.

The Commission adopted a Soil Thematic Strategy²⁰⁰ in 2006 to ensure the appropriate level of protection for soils in Europe and capture the full potential of soil as a major carbon store. This consists of a Communication²⁰¹, a proposal for a Soil Framework Directive²⁰² and an Impact Assessment²⁰³.

The proposed Directive introduces a number of common principles and measures for soil protection. These include, for example:

- The establishment of a common framework to protect soil on the basis of the principles of preservation of soil functions, prevention of soil degradation, mitigation of its effects, restoration of degraded soils and integration in other sectoral policies; and
- Identification of areas at risk of erosion, organic matter decline, salinisation, compaction and landslides, and establishment of national programmes of measures. The extent of the areas at risk of these threats needs to be identified.

The benefits of the full implementation of the Directive are in avoiding the costs of soil degradation. The Commission estimates these benefits to amount to €38 billion annually (for the EU-25 – estimate is not available for the EU-27)²⁰⁴.

4.7.4. Nitrates Directive

The Nitrates Directive²⁰⁵ was adopted in 1991, to reduce water pollution by nitrates from agricultural sources.

Whilst the Nitrates Directive was not specifically designed as greenhouse gas mitigation policy, by reducing the application of nitrogen fertilisers to land, it acts to reduce emissions of N₂O from soils.

¹⁹⁹ COM(2006)231 - Soil Thematic Strategy
http://ec.europa.eu/environment/soil/pdf/com_2006_0231_en.pdf

²⁰⁰ Thematic Strategy on Soil - http://ec.europa.eu/environment/soil/three_en.htm

²⁰¹ COM(2006)231 - Soil Thematic Strategy
http://ec.europa.eu/environment/soil/pdf/com_2006_0231_en.pdf

²⁰² Directive COM(2006) 232 – Directive of the European Parliament and of the Council establishing a framework for the protection of soil and amending Directive 2004/35/EC
http://ec.europa.eu/environment/soil/pdf/com_2006_0232_en.pdf

²⁰³ SEC(2006) 620 http://ec.europa.eu/environment/soil/pdf/sec_2006_620_en.pdf

²⁰⁴ Thematic Strategy for Soil Protection, Impact assessment, SEC(2006)1165

²⁰⁵ Council Directive (91/676/EEC) concerning the protection of waters against the pollution caused by nitrates from agricultural sources

4.8. Forestry Sector

Table 4-9 Summary of policies and measures in the forestry sector

| Name of policy or measure | Objective and/or activity affected | GHG affected | Type of instrument | Status | Implementing entity or entities | Estimate of mitigation impact, by gas (for a particular year, not cumulative, in Mt CO ₂ equivalents) | | | |
|---------------------------------|---|------------------------|---------------------|-------------|---------------------------------|--|-------------------|------|------|
| | | | | | | 2005 | 2010 | 2015 | 2020 |
| Forest Action Plan | Promoting Sustainable and Multi-functional Forestry | Mainly CO ₂ | Variety of measures | Adopted | EC/ Member States | | | | |
| Afforestation and reforestation | Support through rural development | Mainly CO ₂ | Variety of measures | Implemented | EC/ Member States | | 14 ²⁰⁶ | | |
| Forest management | Support through rural development | Mainly CO ₂ | Variety of measures | Implemented | EC/ Member States | | 19 ²⁰⁶ | | |

²⁰⁶

Second ECCP progress report April 2003, http://europa.eu.int/comm/environment/climat/pdf/second_eccp_report.pdf

4.8.1. EC Forest Action Plan

The Forest Action Plan²⁰⁷ presented in June 2006 builds on the EC's Forestry Strategy²⁰⁸ adopted in 1998. Although forestry policies are a competence of the Member States, the 1998 Strategy identified the need for a common approach based on the principles of sustainable forest management and underlining the multifunctional role of forests.

In March 2005, the Commission evaluated the implementation of the Forestry Strategy and saw a need for more EC action to enhance the competitiveness of the strong European forestry sector, but taking into consideration the need to balance the economic viability with environmental and social considerations. The new Forest Action Plan develops a common vision of forestry and of the contribution which forests and forestry make to modern society: “Forests for society: long-term multifunctional forestry fulfilling present and future societal needs and supporting forest-related livelihoods”.

The Forest Action Plan has a time span of five years (2007-2011) and in accordance with the above vision, formulates the following four main objectives:

- improving long-term competitiveness;
- improving and protecting the environment;
- contributing to the quality of life;
- fostering coordination and communication.

The Action Plan defines a framework of eighteen key actions to protect and promote forestry to be implemented the EC and Member State levels. Actions which specifically act to reduce CO₂ include:

- Facilitating EC compliance with the obligations on climate change mitigation of the UNFCCC and its Kyoto Protocol and encourage adaptation to the effects of climate change; and
- Promotion of forest biomass for energy generation.

4.8.2. Rural Development Policy

A number of aspects of the EC Rural Development Policy relate to the forestry sector, in particular measures towards afforestation and forest management (see section 4.7.2 for further detail).

²⁰⁷ Communication from the Commission to the Council and the European Parliament on an EU Forest Action Plan, COM(2006)302 final http://ec.europa.eu/agriculture/fore/action_plan/com_en.pdf

²⁰⁸ Council Resolution on a forestry strategy for the European Union, 1999/C56/01 http://eur-lex.europa.eu/pri/en/oj/dat/1999/c_056/c_05619990226en00010004.pdf

4.8.3. *Tropical deforestation measures*

Activities that the EC is involved in which aim to tackle deforestation outside the EU, and as such impact emissions from third countries, are detailed in section 4.2.5 Minimisation of adverse impacts.

4.9. Waste sector

Table 4-10 Summary of policies and measures in the waste sector

| Name of policy or measure ²⁰⁹ | Objective and/or activity affected | GHG affected | Type of instrument | Status | Implementing entity or entities | Estimate of mitigation impact, by gas (for a particular year, not cumulative, in Mt CO ₂ equivalents) | | | |
|--|--|------------------------------------|--------------------|-------------|---------------------------------|--|-------------------|------|------|
| | | | | | | 2005 | 2010 | 2015 | 2020 |
| Landfill Directive | Amount of waste to landfills as well as methane gas recovery/flaring | CH ₄ | Regulatory | Implemented | EC / Member States | | 41 ²¹⁰ | | |
| Waste Framework Directive | Thematic Strategy on the prevention and recycling of waste | CO ₂ CH ₄ | Regulatory | Implemented | EC / Member States | | | | |
| Directive on management of waste from extractive | Reduction of mining waste, appropriate disposal of waste | CO ₂ CH ₄ | Regulatory | Implemented | EC / Member States | | | | |

²⁰⁹

Figures on the table refer to EU-15

²¹⁰

Second ECCP progress report April 2003, http://europa.eu.int/comm/environment/climat/pdf/second_eccp_report.pdf

| Name of policy or measure ²⁰⁹ | Objective and/or activity affected | GHG affected | Type of instrument | Status | Implementing entity or entities | Estimate of mitigation impact, by gas (for a particular year, not cumulative, in Mt CO ₂ equivalents) | | | |
|--|---|---|--------------------|-------------------------------|----------------------------------|--|-------------------|------|------|
| | | | | | | 2005 | 2010 | 2015 | 2020 |
| industries | and encouraged recycling | | | | | | | | |
| Revised Directive on Waste Packaging | Waste packaging recovery targets | CO ₂ CH ₄ | Regulatory | Implemented | EC / Member States | | 3 ²¹¹ | | |
| Directive on End-of-Life vehicles | Targets for recycling, reuse, recovery of vehicles and their components | CO ₂ CH ₄ Fluorinated gases | Regulatory | Implemented | EC / Member States | | | | |
| Directive on waste electrical and electronic | Reuse, recycle and recovery of waste electrical and electronic | CO ₂ CH ₄ | Regulatory | Implemented 2002 - Amendments | EC / Member States and Producers | | 35 ²¹² | | |

²¹¹ Estimate from internal of review of waste packaging recycling by DG Environment 2005.

| Name of policy or measure ²⁰⁹ | Objective and/or activity affected | GHG affected | Type of instrument | Status | Implementing entity or entities | Estimate of mitigation impact, by gas (for a particular year, not cumulative, in Mt CO ₂ equivalents) | | | |
|--|--|------------------------------------|---------------------------|--------------|---------------------------------|--|------|------|------|
| | | | | | | 2005 | 2010 | 2015 | 2020 |
| equipment (WEEE) | goods | Fluorinated gases | | adopted 2008 | | | | | |
| Green Paper on Biowaste | Proposal with regards to bio-waste management issues | CO ₂ CH ₄ | Regulatory (consultative) | Adopted | EC | | | | |
| Directives on Batteries | Battery recycling and disposal targets, as well as limitations on certain heavy metals | Indirect CO ₂ | Regulatory | Adopted | EC / Member States | | | | |
| Directive on incineration of | Reduce negative impacts of incineration and | Indirect CO ₂ | Regulatory | Adopted | EC / Member States | | | | |

²¹²

Value in 2011 - Directive on waste electrical and electronic equipment (WEEE), (recast) Impact Assessment, {COM(2008) 810}, {SEC(2008) 2933}

| Name of policy or measure ²⁰⁹ | Objective and/or activity affected | GHG affected | Type of instrument | Status | Implementing entity or entities | Estimate of mitigation impact, by gas (for a particular year, not cumulative, in Mt CO ₂ equivalents) | | | |
|--|------------------------------------|-----------------|--------------------|--------|---------------------------------|--|------|------|------|
| | | | | | | 2005 | 2010 | 2015 | 2020 |
| Waste | co-incineration of waste | CH ₄ | | | | | | | |

4.9.1. Landfill Directive

The Landfill Directive²¹³ entered into force in 1999 and required Member State implementation by 2001.

Provisions of the Directive include methane emissions control, in the form of energy production or flaring. No significant changes have been made to the Directive since the 4th National Communication, however in 2007 DG Environment published a study²¹⁴ on the implementation of the Landfill Directive.

It is estimated that the Landfill Directive and national initiatives will reduce the emissions from landfill to approximately 65 MtCO₂eq by 2010 and to 28 MtCO₂eq by 2020²¹⁵ in the EU-15.

4.9.2. Waste Framework Directive

In 2005, the Commission proposed a new strategy on the prevention and recycling of waste. This Thematic Strategy contains a Communication²¹⁶, its associated Technical Annex²¹⁷ and an Impact Assessment. This was followed in 2006 by a new Waste Framework Directive²¹⁸, revising the original Waste Framework Directive²¹⁹ of 1975.

Through the Directive, Member States must prohibit the abandonment, dumping or uncontrolled disposal of waste, and must promote waste prevention, recycling and processing for re-use. Key elements of the new Directive are:

- Life-cycle approach: consider the potential of waste to contribute to a more sustainable use of natural resources and raw materials.
- Prevention: Member States are required to develop waste prevention policies focusing on the individuals and businesses responsible for generating the waste.
- Recycling: EC-wide environmental standards on recycling will be adopted to support the development of an EC market for secondary (recycled) materials.
- Incineration: A revision of the IPPC Directive (see section 4.6.3) will be tabled that will set an ambitious benchmark to improve energy recovery from municipal incinerators.

²¹³ Directive [1999/31/EC](#) of 26th April 1999 on the Landfill of Waste

²¹⁴ Follow-up study on the implementation of Directive 1999/31/EC on the landfill of waste in EU-25
http://ec.europa.eu/environment/waste/pdf/study/cowi_report.pdf

²¹⁵ Second ECCP progress report April 2003 - http://europa.eu.int/comm/environment/climat/pdf/second_eccp_report.pdf

²¹⁶ Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and The Committee of the Regions - Taking sustainable use of resources forward - A Thematic Strategy on the prevention and recycling of waste, [COM/2005/0666 final](#)

²¹⁷ Technical Annex to COM(2005)0666 final
http://ec.europa.eu/environment/waste/pdf/sec_2005_1682_en.pdf

²¹⁸ Directive [2006/12/EC](#) of the European Parliament and of the Council of 2006 on waste

²¹⁹ Council Directive [75/442/EEC](#) of 15th July 1975 on waste

Note the measures do not apply to gaseous effluents, or to radioactive waste, mineral waste, animal waste and agricultural waste, wastewater, and decommissioned explosives where these types of waste are subject to specific Community rules.

In 2008, the Waste Framework Directive was further updated to clarify, modernise and streamline its provisions. The revised Directive²²⁰ 2008/98/EC sets the basic concepts and definitions related to waste management, recovery and disposal to strengthen the impact of measures introduced in 2006.

Reduction of waste overall and specifically the diversion of biodegradable waste from landfill reduces methane emissions. Increasing recycling and recovery of waste contributes to the reduction of GHG emissions through energy savings in primary production.

4.9.3. *Directive on management of waste from extractive industries*

The EC has introduced measures to prevent or minimise any adverse effects on the environment and risks to health resulting from the management of waste from the extractive industries.

In 2006, the Directive²²¹ on the management of waste from extractive industries was introduced to address this waste stream, which is among the most important in the EU. The Directive applies to waste resulting from the extraction, treatment and storage of mineral resources and the working of quarries. Waste covered by this Directive no longer falls within the scope of the 1999/31/EC Landfill Directive.

In accordance with this Directive, Member States must ensure that waste facility operators draw up a waste management plan, to be reviewed every five years. The objectives of the plan are:

- to prevent or reduce the generation of waste and its negative impact;
- to encourage waste recovery through recycling, re-use or reclaiming;
- to encourage the short and long-term safe disposal of waste.

4.9.4. *Revised Directive on Packaging and Packaging Waste*

The 1994 Directive²²² on Packaging and Packaging Waste was amended in 2004²²³. The revision sets increased and binding targets for recovery and recycling for the current five year implementation phase (2005-2009). The amended targets are:

²²⁰ Directive 2008/98/EC of the European Parliament and of the Council of 19th November 2008 on waste and repealing certain Directives
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:312:0003:0030:EN:PDF>

²²¹ Directive [2006/21/EC](#) of the European Parliament and of the Council of 15th March 2006 on the management of waste from extractive industries

²²² European Parliament and Council Directive [94/62/EC](#) of 1994 on packaging and packaging waste

²²³ Directive 94/62/EC on Packaging and Packaging Waste, as amended by [Directive 2004/12/EC](#)

- 60 % as a minimum by weight packaging waste to be recovered or incinerated using recovered energy from waste incineration plants.
- A minimum of 55 % and a maximum of 80 % by weight of packaging to be recycled.

Other amendments include the introduction of material-specific targets, and permitting Member States to count incineration towards recovery targets. Increasing recycling rates reduces CO₂ emissions from primary production and methane emissions from landfill.

4.9.5. *Directive on End-of-Life vehicles*

The original Directive²²⁴ was implemented in 2000 to make vehicle dismantling and recycling more environmentally friendly, to set clear quantified targets for reuse, recycling and recovery of vehicles and their components, and to push producers to manufacture new vehicles with a view to their recyclability. Increasing reuse and recycling reduces CO₂ emissions from primary production and methane emissions from landfill.

Since 2000, the Directive has undergone a series of amendments²²⁵ to keep in line with technical and scientific progress, amending sections and articles on issues such as materials, dismantling procedures and the safe disposal of certain vehicle parts. Currently the fourth adaptation to technical and scientific progress is undergoing stakeholder consultation.

4.9.6. *Directives on waste electrical and electronic equipment*

The Directive on Waste from Electrical and Electronic Equipment²²⁶ (WEEE) aims to increase the re-use, recycling and recovery of waste from consumer products such as light bulbs, computers, and mobile phones, thereby reducing CO₂ emissions from primary production and methane emissions from landfill. The WEEE Directive is complemented by a Directive on the Restriction of the use of certain Hazardous Substances²²⁷ (RoHS) in electrical and electronic equipment.

In 2008, the Commission made proposals for amendments to both Directives²²⁸, including collection and recycling targets.

The potential environmental impacts of WEEE vary depending on the equipment in question. On current trends, GHG emissions from cooling and freezing equipment would

²²⁴ Directive [2000/53/EC](#) on end-of-life vehicles

²²⁵ [Commission Decision 2002/525/EC](#), [Council Decision 2005/673/EC](#), [Council Decision 2008/689/EC](#), [Commission Decision 2005/63/EC](#), [Commission Decision 2005/437/EC](#), [Commission Decision 2005/438/EC](#), [Commission Decision 2003/138/EC](#), [Commission Decision 2001/753/EC](#), [Commission Decision 2002/151/EC](#), [Commission Decision 2005/293/EC](#),

²²⁶ Directive [2002/96/EC](#) of the European Parliament and of the Council of 27th January 2003 on waste electrical and electronic equipment (WEEE)

²²⁷ Directive [2002/95/EC](#) of the European Parliament and of the Council of 27th January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment

²²⁸ Directive [2008/34/EC](#) of the European Parliament and of the Council, March 2008 amending Directive 2002/96/EC on waste electrical and electronic equipment (WEEE) and Directive [2008/35/EC](#) of the European Parliament and of the Council, March 2008 amending Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment

be around 35 MtCO₂eq/yr in 2011 (compared to baseline), with a monetised value of the damage having a magnitude of around €1 billion/year - declining each year to low levels by 2020. This decline comes as a CFC-ban in cooling and freezing equipment feeds through to the WEEE stream.²²⁹

WEEE itself is an economic resource, with material value currently estimated in the order of magnitude of €2 billion a year. The economic costs for society of collection, disposal of and treatment of WEEE are estimated to increase to €5.6 billion a year by 2020.

4.9.7. *Green Paper on Biowaste*

The Green Paper on Biowaste²³⁰ explores options for the further development of the management of biowaste. This is particularly relevant in light of the 2008 revised Waste Framework Directive, which calls upon the Commission to carry out an assessment of the management of biowaste, with a view to submitting a proposal. The Green Paper summarises new research findings in the field, presents core issues for debate, and invites stakeholders to contribute views on how to improve biowaste management as well as the most efficient policy instruments to reach this objective.

4.9.8. *Directive on batteries*

The use of recycled metals in battery production instead of virgin metals indirectly reduces CO₂ emissions through reduced energy use and reduced mining of the virgin source. As an example, using recycled cadmium and nickel require respectively 46 % and 75 % less primary energy than the extraction and refining of virgin metal. These figures are particularly important given the fact that the primary production of metals is the source of approximately 10 % of global CO₂ emissions.²³¹

In 2006, the European Parliament and the EU Council of Ministers agreed on a compromise to revise the 1991 Directive²³² on batteries and accumulators. The new Directive²³³ provides for a minimal ban on cadmium and mercury as well as for collecting and recycling targets to be reached by 2016 at the latest.

4.9.9. *Directive on incineration of waste*

Directive 2000/76/EC on the incineration of waste came into force on 4th December 2000 to prevent or reduce negative effects on the environment caused by incineration of waste. For further details see 4th National Communication. It is one of the directives that will

²²⁹ Directive on waste electrical and electronic equipment (WEEE), (recast) Impact Assessment, {COM(2008) 810}, {SEC(2008) 2933}

²³⁰ Green Paper on Biowaste, 2008
http://ec.europa.eu/environment/waste/compost/pdf/green_paper_en.pdf

²³¹ Extended Impact Assessment, directive on batteries, SEC(2003) 1343

²³² Council Directive [91/157/EEC](#) on batteries and accumulators containing certain dangerous substances

²³³ Directive [2006/66/EC](#) of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators and waste batteries and accumulators and repealing Directives 91/157/EEC

potential be recast as part of a Directive aimed at streamlining industrial emissions legislation – see section 4.6.4 for further details.

4.10. Effect of Policies and Measures on the modification of long-term trends

The precise impact of policies and measures on the EU-27's long-term emission trends, outlined in section 5, is difficult to isolate. In part as it is based on the sum of MS projections (with somewhat different approaches and assumptions, see section 5.8.7) as well as the impact of other factors, such as energy prices, which also drive changes in longer-term trends.

However, looking at the historic trends from 1990-2007 in national circumstances (see section 2) and historic and projected emissions (1990 – 2020) across different sectors (see section 5.2) some high-level effects can be discerned:

In relation to energy use (excluding transport) primary and final energy consumption grew over the period to 2007, but from the early part of the 2000's consumption appears to have started to plateau. However, over the same time period electricity consumption continued to grow rapidly, although generation has shifted towards a lower carbon intensity fuel mix. EU-27 emissions from energy use have declined gradually from 1990 to 2007, and with existing measures are projected to broadly stabilise to 2020, whilst with additional measures they are expected to decline steadily (see section 5.2.1). This indicates that policies are starting to have a sizeable impact on (particularly end-use) energy efficiency and hence overall consumption itself, and are also strongly driving the shift towards low carbon electricity generation, particularly as a result of new renewables policies.

In transport, the historic trend has been a continued growth in both demand for, and emissions from, transport. With existing measures emissions are expected to stabilise from 2010 onwards and with additional measures gradually decline to 2020 (see section 5.2.1.1). This indicates that policies driving improved vehicle efficiency (particularly the strategy for CO₂ in cars – see section 4.5.4), and to a lesser extent the introduction of biofuels, are expected to more than offset the increase in emissions from the continued increase in demand for transport.

Policies and measures in agriculture, coupled with a decrease in activity already appear to have had a significant effect on historic emissions; driving increased productivity, reduced nitrogen fertiliser production, reductions in livestock numbers, improved manure management, etc. Beyond 2010 emissions are estimated to remain broadly static (under both existing and with additional measures – see 5.2.1.3), indicating a more limited impact from policies on longer term trends.

Similarly, in the waste sector emissions have declined strongly from the mid 1990s to 2007, in particular, as a result of policies such as the landfill Directive (see section 4.9.1). From 2010 onwards emissions are expected to decline further, although the rate of decrease declines slightly under both the existing and with additional measure scenarios (5.2.2), indicating that the impact of policies on longer-term trends is also gradually declining.

The impact of policies on long-term emission trends in other key sectors, such as marine and aviation (see section 5.2.4), is more difficult to discern. The underlying trend is a continued and rapid increase in emissions from these sectors, but new policy action such as the incorporation of aviation into the EU ETS will likely reduce the rate of this increase. However, not all MSs have reported projections in these sectors and where they have they do not necessarily include the impact of the latest policy changes.

4.11. Results from the stakeholder consultations

As part of the stakeholder consultation undertaken during the preparation of the EC 5th NC (see section 1), questions 4 and 5 asked for feedback on issues relevant to EU policies and measures.

The responses to question 4 outlined various examples of other activity on climate change at the European level – two particularly relevant ones are given below.

Other examples of recent European activity on climate change

Biofuels sustainability. *A series of activities in the sustainability and certification of bio-energy and liquid biofuels has been created in the EU Member States. These initiatives have simultaneously European and international scope and aim to provide support to the legislative process of promoting renewable energy in the EU, in line with the climate change agenda. The most relevant activities of such nature are the European Centre of Normalization Technical²³⁴ Committee 383 on Sustainable produced biomass for energy applications, the Roundtable on Sustainable Biofuels²³⁵ (RSB), and the International Sustainability and Carbon Certification (ISCC)²³⁶.*

Climate change and major cities. *The C40 global climate group²³⁷ is a partnership of the world's largest cities committed to tackling climate change, given the disproportionate role cities play in energy consumption and responsibility for greenhouse gas emissions. EU cities include Athens, Berlin, London, Madrid, Paris, Rome and Warsaw. Examples of activity include the Mayor of London's pledge to reduce London's CO₂ emissions by 60 % on 1990 levels by 2025 via initiatives such as the Building Energy Efficiency Programme (BEEP)²³⁸. This aims to reduce emissions in public buildings with financing based entirely out of projected cost-savings from reduced energy consumption, and to eventually extend it to major private sector landlords of commercial buildings through the Better Building Partnership. This type of initiative is highly replicable in other cities and is also being explored by other C40 members, supported by extensive cooperation and knowledge sharing.*

Finally, the responses to question 5 highlighted a range of views on the recent progress of EU climate policy. Whilst these were largely positive, particularly with respect to the

²³⁴ <https://www.cen.eu/cenorm/homepage.htm>

²³⁵ <http://cgse.epfl.ch/Jahia/site/cgse/cache/offonce/pid/65660;jsessionid=A4C7FA403B2F4A9EED53909DE836EA6C>

²³⁶ http://www.iscc-project.org/index_eng.html

²³⁷ <http://www.c40cities.org/>

²³⁸ <http://www.london.gov.uk/rp/events/20090210/LCSG-buildings-retrofit-presentation-100209.pdf>

recent Energy and Climate package (see section 4.1.2.4), they also raised some concerns and indicated areas where stakeholders felt further action is needed.

Key points from the responses are summarized below:

- The new 2020 targets for EU GHG emissions reductions were welcomed, but concern was expressed that these are not sufficient to meet the deeper cuts recommended by the IPCC to ensure stabilization of atmospheric emissions at 450ppm. In addition, concerns were raised about the potential for large-scale use of external credits and its impact on domestic action to reduce emissions.
- Similarly, the new 2020 renewable energy targets were seen as a major step forward, but it was highlighted that the onus is now on Member States to ensure that sufficient and timely policy mechanisms are put in place to ensure these are met.
- There was acknowledgement of the new actions taken to address transport emissions such as the new CO₂ targets for road vehicles and incorporation of aviation under the EU-ETS. However, there was a view that action needs to be integrated within a strong overarching strategy for reducing EU transport emissions.
- The EU was praised for acting as a global front-runner on commitments for future emissions reductions. However, it was emphasized that there is now a need to bring all major emitters and economic players on board under a global agreement, to help address concerns about competitiveness and the need for a level playing field.

Continued and additional activity on mitigation was welcomed. However, stakeholders emphasised that there was strong need for rapid and increasing action on adaptation (building on the framework created by the EU Adaptation White Paper - see section 6.3.1) given the potential for significant negative impacts in sectors such as agriculture and employment. The potential for positive employment impacts as part of the transformation to a low-carbon economy was also mentioned, although it was highlighted that there is still a need to manage and address the social implications of this during the transition.

4.12. Policies and measures no longer in place

Since the 4th NC the following policies and measures are no longer in place include:

- A specific aid for energy crops which was introduced as part of the 2003 CAP reform.

5. PROJECTIONS AND THE TOTAL EFFECT OF POLICIES AND MEASURES

Key developments

- Under the Kyoto Protocol, the EU-15 has adopted a target to reduce emissions by 8 % on average between 2008 and 2012, compared to base-year emissions. Emissions of GHG in the EU-15 are projected to be 7.5 % below base year emissions in 2010 (existing measures reduce emissions to 320 Mt against base year emissions of 4266 Mt). The implementation of additional measures is projected to reduce EU-15 emissions to 9.2 % below base year emissions (additional measures reduce emissions by a further 73 Mt against base year emissions) in 2010. EU-15 emissions, considering the expected impact of domestic policies and measures, are therefore projected to be 1.2 percentage points below the Kyoto target in 2010.
- Member States' intended use of flexible mechanisms is expected to increase the projected emission rights for the EU-15 in the commitment period by a *further* 2.2 % (93 Mt) against base year emissions to 94.2 %, while use of carbon sinks is expected to increase this *further* by 1.0 % (42 Mt) to 95.2 % against base year emissions. In addition the acquisition of emission credits stemming from the flexible mechanisms by the EU ETS operators is expected to increase the projected emission rights in the commitment period by a *further* 1.4 % (61.2 Mt) to 96.6 % against base year emissions.

Illustration 5-1 Greenhouse gas emissions and projections in the EU-15 (excluding LULUCF) for the 'with existing measures and 'with additional measures' scenarios

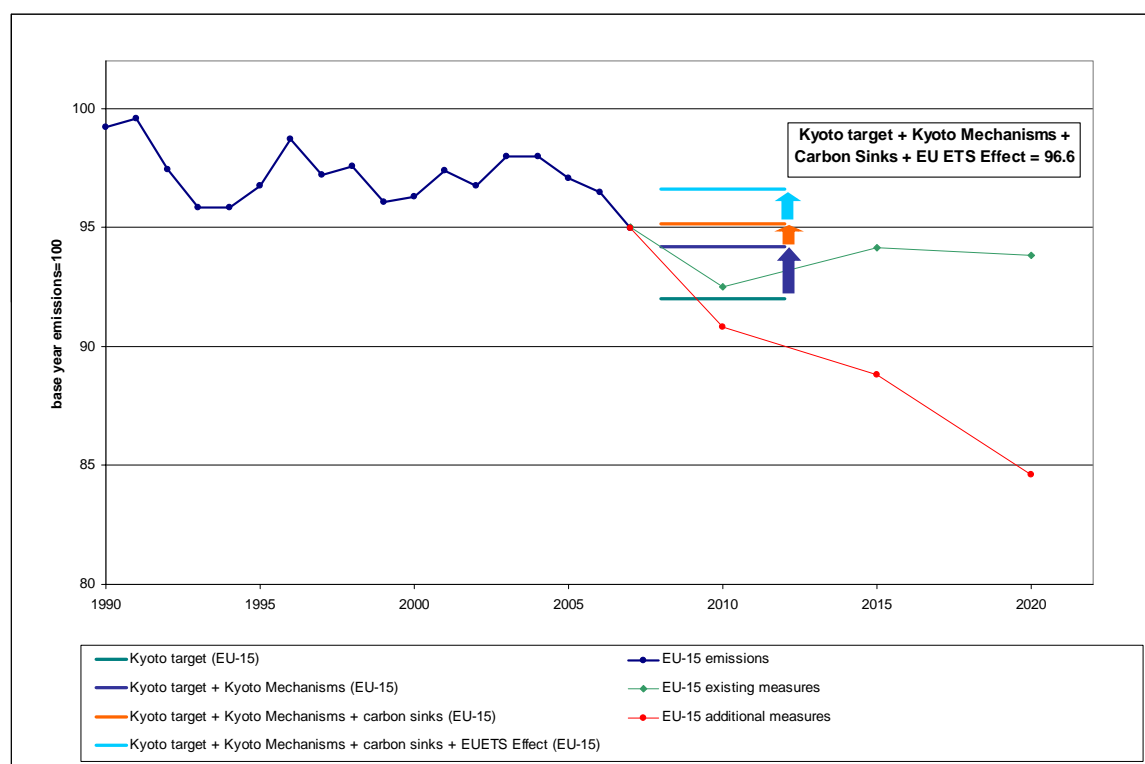
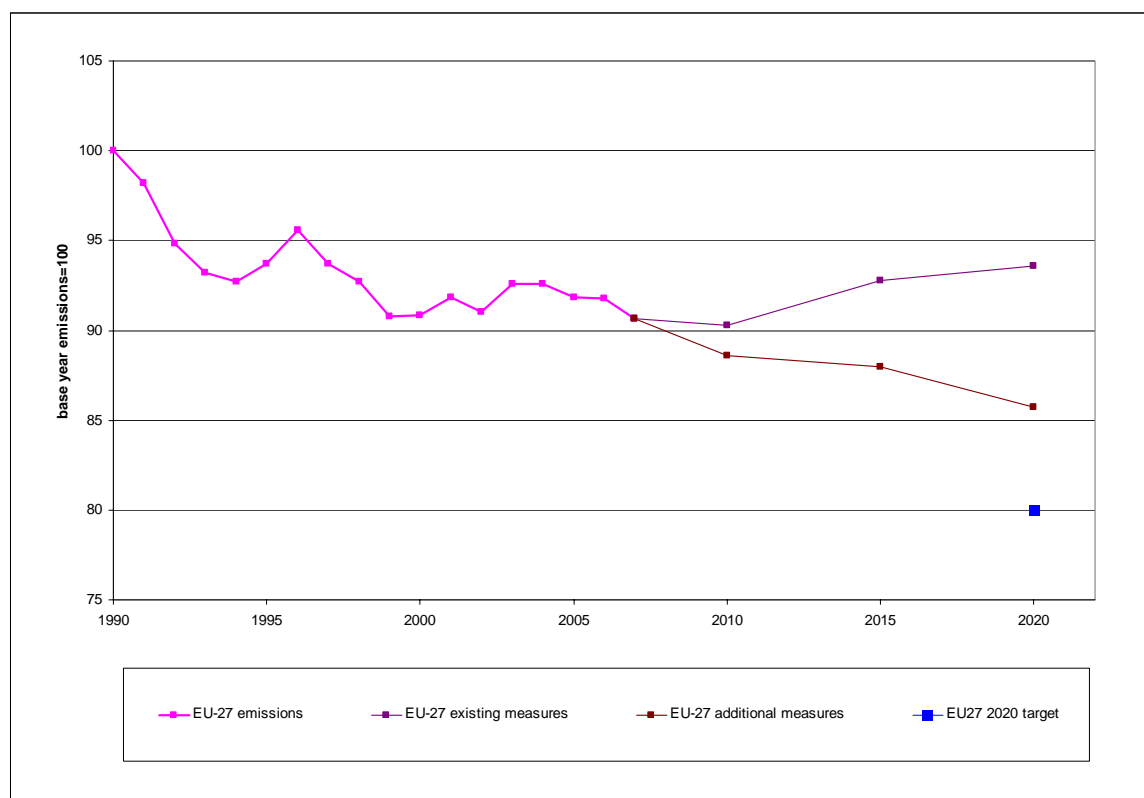


Illustration 5-2 Greenhouse gas emissions and projections in the EU-27 (excluding LULUCF) for the 'with existing measures' and 'with additional measures' scenarios



Note: The index on the vertical axis refers to the base year for the EU-15, that is 1990 emissions for CO₂, CH₄ and N₂O and 1995 emissions for the F gases (with the exception of Austria, France and Italy where the base year for F gases is 1990). This means that the value for 1990 is not exactly 100 for the EU-15. As the EU-27 does not have a collective Kyoto target and therefore no collective base year, the index on the vertical axis refers to 1990 emissions for the EU-27.

Key developments (continued)

- Considering Member States' intended use of Kyoto mechanisms and carbon sinks, in addition to the effect of domestic measures, the EU-15 is expected to overshoot its target by 5.8 percentage points in 2010 (with emissions projected to be 3677 Mt).
- Emissions of GHG in the EU-27 are projected to be 9.7 % below 1990 levels in 2010 as a result of implemented measures and 11.4 % below 1990 levels in 2010 when planned measures are also considered.
- At the time of writing the 4th National Communication (NC), the EU had 25 members. Comparing like for like, EU-25 emission projections for 2010 including all measures and Kyoto mechanisms in 2010 have increased by 0.4 % from the 4th to the 5th NC projections.
- EU-27 emissions are currently projected to be 6.4 % below 1990 levels in 2020 under the 'with existing measures' scenario and 14.3 % below 1990 levels under the 'with additional measures' scenario, compared to the EU's target to reduce emissions by 20 % compared to 1990. However, most Member States (16) have

not yet accounted for the EU's 2020 Climate and Energy Package in their projections estimates.

- 20 Member States have not considered the impact of the financial crisis in their latest projections estimates.

5.1. Introduction

This section presents projections of GHG for three scenarios: “with existing measures”, “with additional measures” and “without measures”, split by sector, by gas and aggregated for the EU-15 and EU-27. Projections are presented for 2010, 2015 and 2020, relative to the latest available, actual inventory data, as included in Section 3. All emissions and projections are displayed in CO₂ equivalents and excluding emissions or removals from Land Use, Land Use Change and Forestry (LULUCF), unless otherwise stated. Projections of emissions related to fuel sold to ships and aircraft engaged in international transport are memo items in the CRF Tables (see Section 3.3.5) and not included in the totals reported in this section. Projections of selected indirect greenhouse gases are provided.

In this section, ex-ante estimates of the total effect of all national policies implemented/adopted and planned are presented. The savings from policies and measures presented here are based on projections and estimates of policies and measures by the Member States. The estimates therefore include the impact of national measures related to EU CCPMs as well as strictly national policies. The figures presented in Section 4 are ex-ante estimates of the effect of individual EU-level initiated policies, and do not therefore correspond to the numbers in this chapter. The section also contains information on complementarity related to mechanisms under Article 6, 12 and 17, of the Kyoto Protocol and an explanation of the methodology used to generate the projections. Finally, Appendix D contains detailed inventory and projections data tables, split by sector and gas and Appendix E contains an overview of Member State projection methodologies.

Information presented in this section for the EU-15 and EU-27 is an aggregation of individual Member State information²³⁹. As such, it is not always possible to present detailed and consistent information at the EU level. For instance, few MS (7²⁴⁰) have factored in the potential impact of the current financial crisis in their projections. As a result MS assumptions for GDP growth in 2010 vary from -2.6 % to 8 %. International oil price assumptions for 2010 also vary considerably from 7 to 84 € per GJ. Further information is provided in Section 5.8.7. Further analysis of projections will also be required when updated projections become available from all Member States.

²³⁹ As reported to the European Commission between 15th March and 15th May 2009 under the EU's Monitoring Mechanism Decision 280/2004/EC. For individual sources, see EEA (2009), GHG Trends and Projections in Europe. Updated information was not made available for Hungary and Poland within this period and is therefore taken from older submissions, as reported in EEA (2008), GHG Trends and Projections Europe EEA Report No 5/2008:.

²⁴⁰ Belgium, Czech Republic, Spain, Greece, Italy, Ireland and Lithuania.

5.1.1. *With existing measures projection*

The ‘with existing measures’ (WEM) projection represents a business as usual scenario where only policies and measures that have been adopted or already implemented are considered. All EU-27 Member States that submitted 2009 projections reported WEM projection scenarios. For Member States that did not submit new projections in 2009²⁴¹, the most recent projections data available was used. Some Member States did not submit the complete sectoral break down of the projections. In this case, a consistent methodology was followed to gap fill missing data.

5.1.2. *With additional measures projection*

The ‘with additional measures’ (WAM) projection represents a scenario where all planned measures are considered to be fully and timely implemented. The WAM projections are therefore lower than the WEM projections. Relative to the WEM scenario for which all Member States reported their projections, less Member States reported a ‘with additional measures’ scenario²⁴². In this case, in order to compile an aggregated data set for the EU-15 and EU-27, the data was gap filled by using WEM projections.

5.1.3. *Without measures projection*

Only 7 of the EU-27 Member States reported a ‘without measures’ projection in their latest submissions. An alternative method has therefore been used to estimate a ‘without measures’ projection for the EU-15 and EU-27, making use of individual Member State projections and estimates of policy impact. This is discussed further in Section 5.4.

5.2. **Projections by sector**

EU-15 and EU-27 projections for 2010, 2015 and 2020 are presented below, excluding Kyoto Mechanisms and carbon sinks for each sector.

The figures below illustrate the expected impact of all policies implemented and planned by Member States, including national measures to implement EU wide policies and measures as well as other national policies and measures.

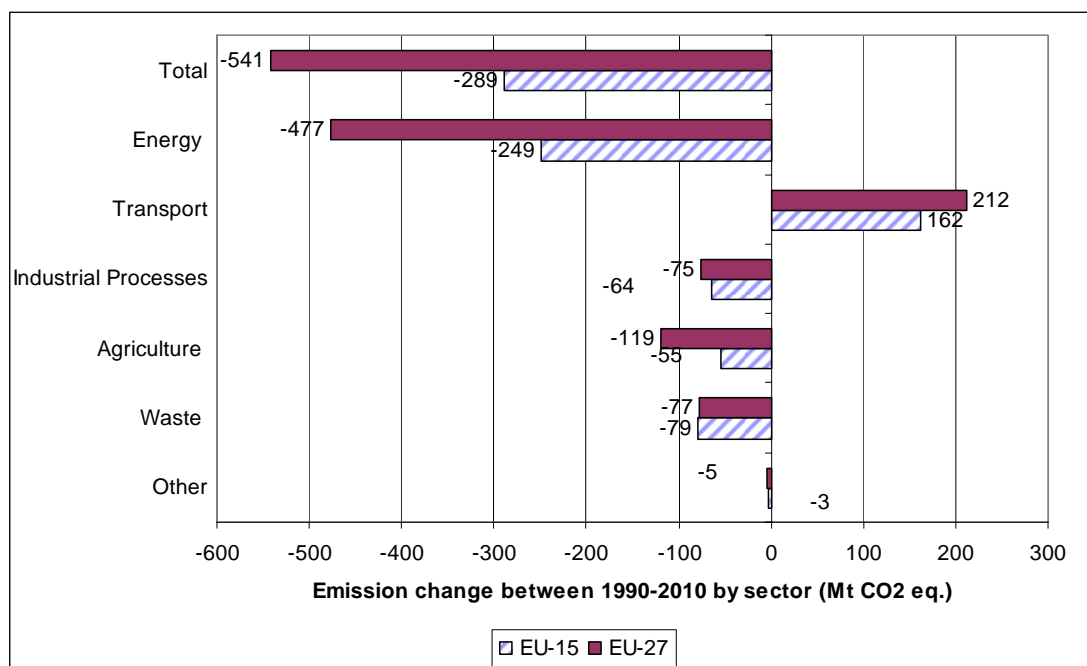
In the “with existing measures” scenario, emissions of GHG in the EU-15 are projected to be 6.8 % (-289 Mt) below 1990 levels in 2010. The emission reduction each sector accounts for varies greatly between the sectors, with the energy sector driving the trend. The most significant portion of absolute emission reductions from 1990 to 2010 is expected to derive from the energy (-249 Mt), followed by the waste (-79 Mt) and industrial processes (-64 Mt) sectors. Emissions from the transport sector are expected to increase dramatically (+162 Mt).

²⁴¹ Hungary and Poland

²⁴² Denmark, Netherlands, United Kingdom, Lithuania and Poland

In the “with existing measures” scenario, emissions of GHG in the EU-27 are projected to be 9.7 % (-541 Mt) below 1990 levels in 2010. Similar to the EU-15, the proportion each sector contributes to the overall emission change varies greatly between the sectors. The most significant portion of absolute emission reductions from 1990 to 2010 are expected to derive from the energy (-477 Mt), agriculture (-119 Mt), and waste (-77 Mt) sectors. Conversely, emissions from the transport sector are expected to increase dramatically (+212 Mt).

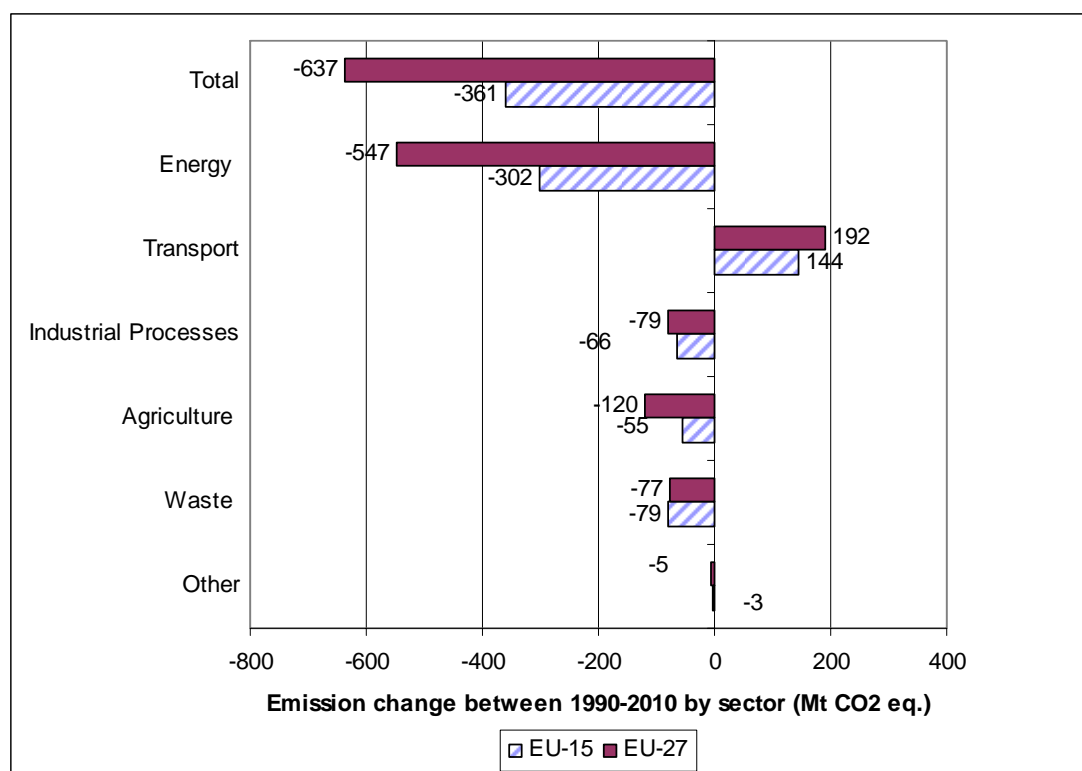
Illustration 5-3 Projected absolute change in greenhouse gas emissions (excluding LULUCF) by sector for the 'with existing measures' scenario, 1990-2010



In the “with additional measures” scenario, emissions of GHG in the EU-15 are projected to be 8.5 % (-361 Mt) below 1990 levels in 2010. The emission reduction each sector accounts for varies greatly between the sectors, with the energy sector driving the trend. The most significant portion of absolute emission reductions from 1990 to 2010 is expected to derive from the energy (-302 Mt), followed by the waste (-79 Mt) and industrial processes (-66 Mt) sectors. Emissions from the transport sector are expected to increase dramatically (+144 Mt).

In the “with additional measures” scenario, emissions of GHG in the EU-27 are projected to be 11.4% (-637 Mt) below 1990 levels in 2010. Similar to the EU-15, the proportion each sector contributes to the overall emission change varies greatly between the sectors. The most significant portion of absolute emission reductions from 1990 to 2010 are expected to derive from the energy (-547 Mt), agriculture (-120 Mt) and the industrial processes (-79 Mt) sectors. Conversely, emissions from the transport sector are expected to increase dramatically (+192 Mt).

Illustration 5-4 Projected absolute change in greenhouse gas emissions (excluding LULUCF) by sector for the 'with additional measures' scenario, 1990-2010



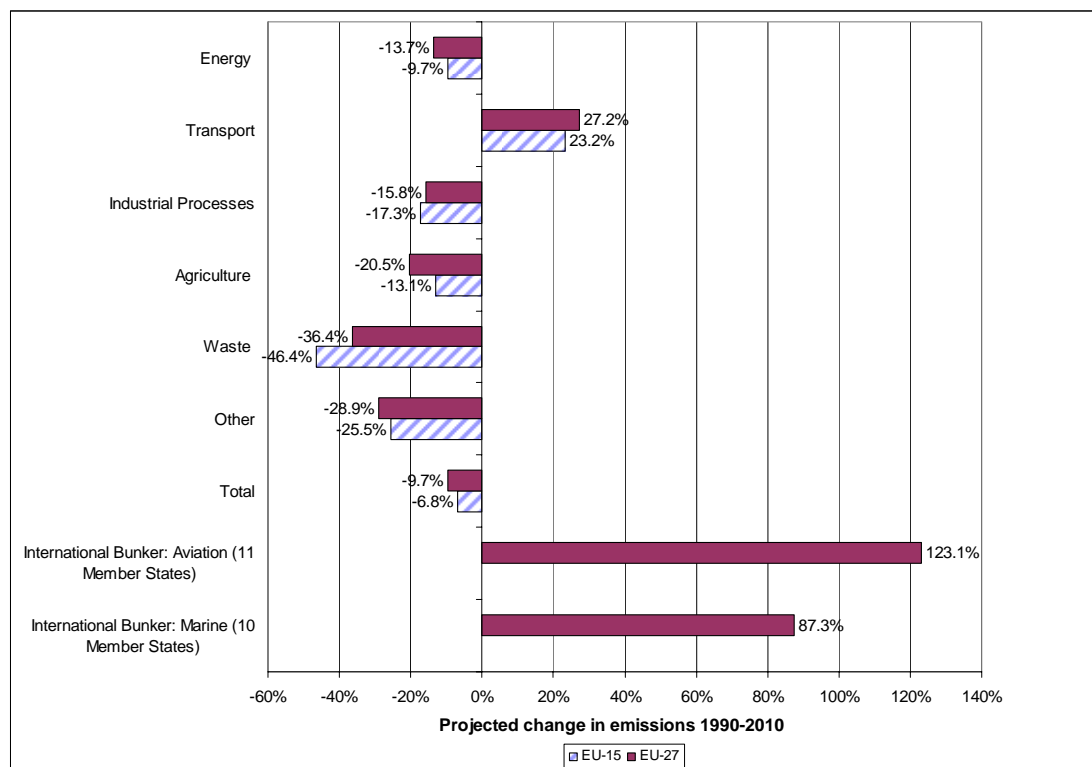
Common factors driving historic trends and projections are discussed in more detail in Section 2 National Circumstances, Section 3 GHG Inventory and in the national inventory and projections reports of individual Member States. Policies and measures expected to influence emissions in each sector are also discussed in detail in Section 4.

Non-EU-15 Member States experienced considerable reductions in GHG emissions throughout the 1990s due to rapid economic restructuring, decreased industrial activity and fuel switching. More recently, emissions have started to increase as these economies have begun to grow, resulting in an increased demand for energy, with more waste generated and increased road transport. With most countries having joined the EU in 2004 (Bulgaria and Romania in 2007), implementation of key EU climate change mitigation policies has been delayed in these countries but is likely to have a strong influence on the emissions intensity of activities in these countries going forward.

2010 projections for almost all sectors represent a dramatic decrease from latest year emissions (2007), particularly when compared with the pace of change up to the latest year. It is expected that this reduction will only be realized through policies recently implemented and coming to fruition in the short term. In addition, projections in most sectors show a slow down in the pace of emission reductions, a stabilization or even an increase in emissions in the post-Kyoto period. This illustrates the need for further policies and measures to achieve the EU's 2020 objectives or a post-2012 agreement.

It should be noted however that most Member States (16²⁴³) have not yet accounted for the EU's 2020 Climate and Energy Package in the projections estimates presented in this section.

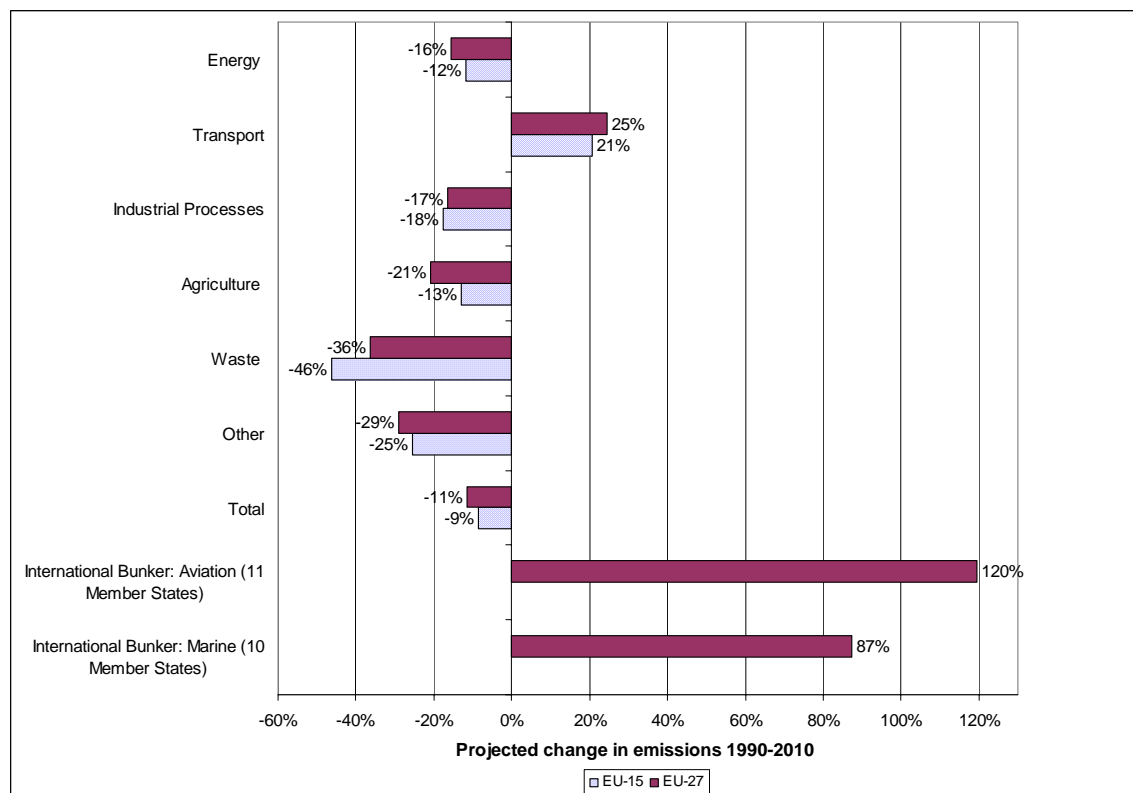
Illustration 5-5 Projected change in greenhouse gas emissions (excluding LULUCF) by sector for the 'with existing measures' scenario, 1990-2010



Notes: Aviation projections available from 10 countries only (Denmark, Czech Republic, Germany, Greece, Netherlands, Spain, Sweden, United Kingdom, Lithuania, Estonia and Malta). Maritime projections available from 10 countries only (Denmark, Germany, Greece, Netherlands, Spain, Sweden, United Kingdom, Lithuania, Estonia and Malta). Projections for Lithuania are available for the year 2010 only but have been gapfilled for 2015 and 2020.

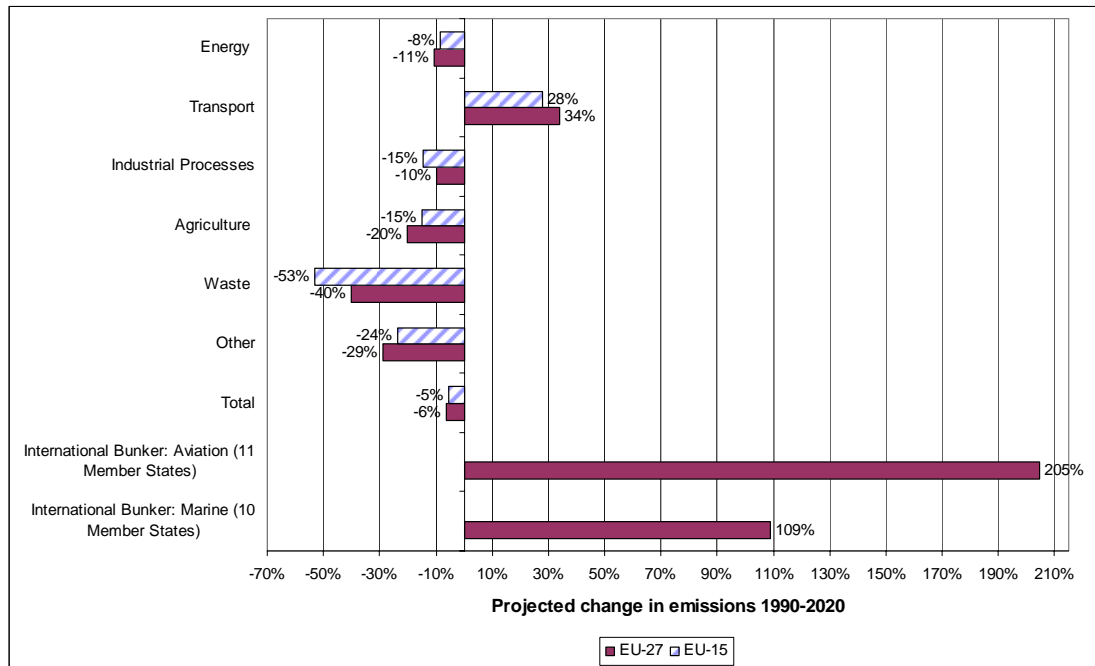
²⁴³ Only Belgium, Cyprus, the Czech Republic, Finland, Greece, Germany, Ireland, Italy, Luxembourg, Portugal and Romania report that the Package has been accounted for, to some extent, in their projections.

Illustration 5-6 Projected change in greenhouse gas emissions (excluding LULUCF) by sector for the 'with additional measures' scenario, 1990-2010



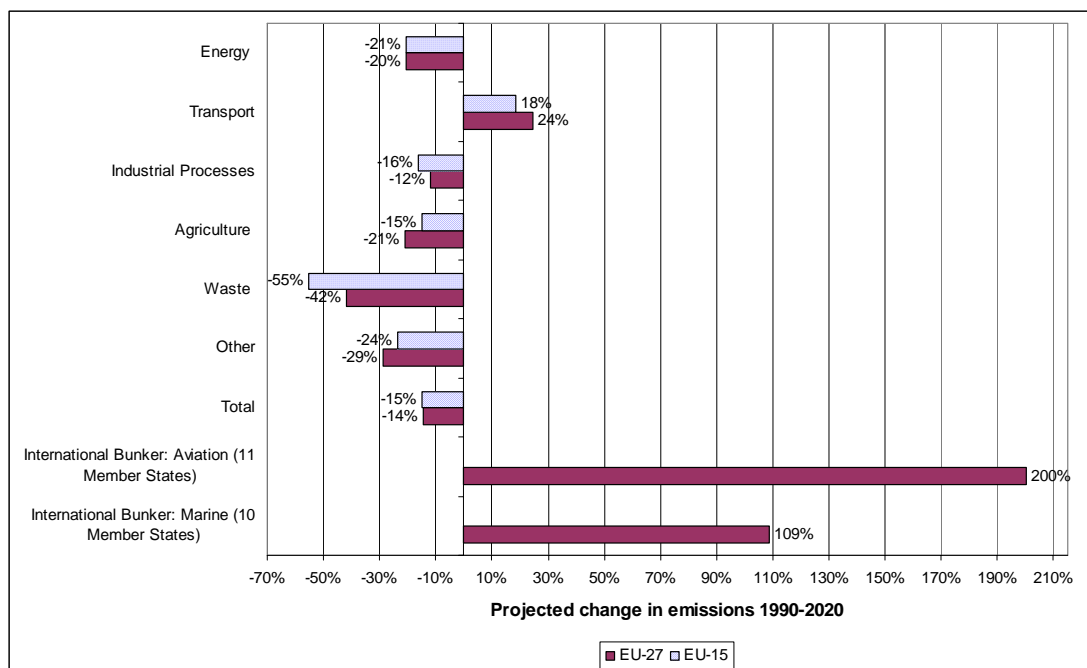
Notes: Aviation projections available from 10 countries only (Denmark, Czech Republic, Germany, Greece, Netherlands, Spain, Sweden, United Kingdom, Lithuania, Estonia and Malta). Maritime projections available from 10 countries only (Denmark, Germany, Greece, Netherlands, Spain, Sweden, United Kingdom, Lithuania, Estonia and Malta). Projections for Lithuania are available for the year 2010 only but have been gapfilled for 2015 and 2020.

Illustration 5-7 - Projected change in greenhouse gas emissions (excluding LULUCF) by sector for the 'with existing measures' scenario, 1990-2020



Notes: Aviation projections available from 11 countries only (Denmark, Czech Republic, Germany, Greece, Netherlands, Spain, Sweden, United Kingdom, Lithuania, Estonia and Malta). Maritime projections available from 10 countries only (Denmark, Germany, Greece, Netherlands, Spain, Sweden, United Kingdom, Lithuania, Estonia and Malta). Projections for Lithuania was available for the year 2010 only but have been gapfilled for 2015 and 2020.

Illustration 5-8 Projected change in greenhouse gas emissions (excluding LULUCF) by sector for the 'with additional measures' scenario, 1990-2020



Notes: Aviation projections available from 11 countries only (Denmark, Czech Republic, Germany, Greece, Netherlands, Spain, Sweden, United Kingdom, Lithuania, Estonia and Malta). Maritime projections available from 10 countries only (Denmark, Germany, Greece, Netherlands, Spain, Sweden, United Kingdom, Lithuania, Estonia and Malta). Projections for Lithuania was available for the year 2010 only but have been gapfilled for 2015 and 2020.

5.2.1. Energy

The figure below shows the greenhouse gas emissions and projections from the energy sector excluding transport.

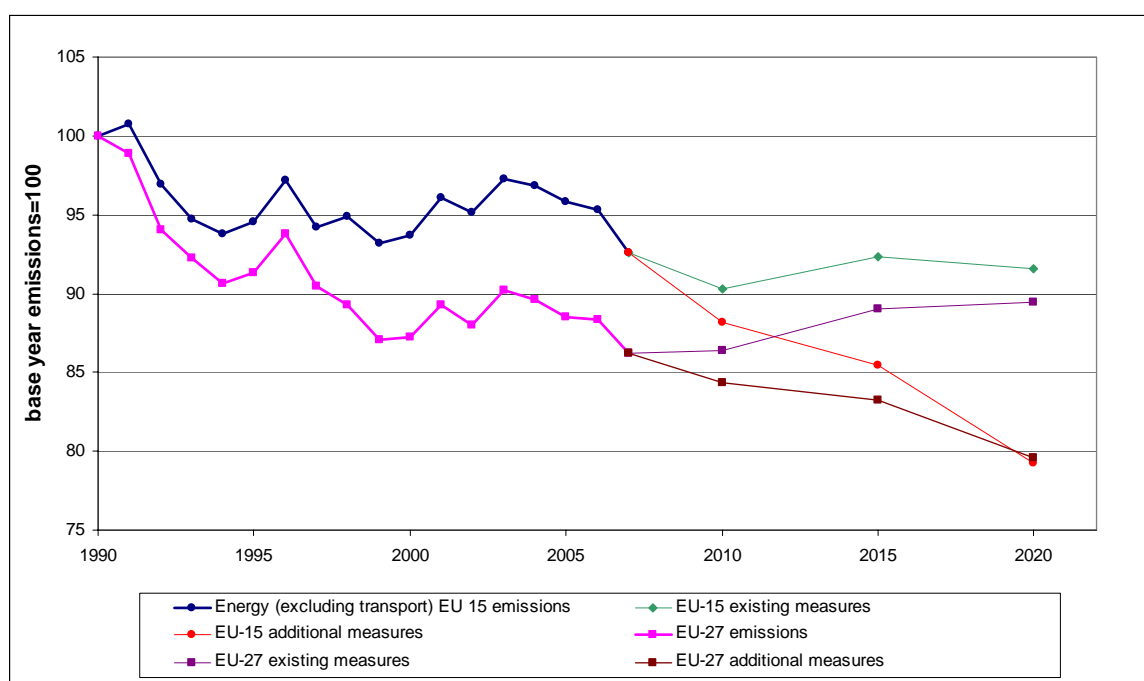
EU-15 and EU-27 GHG emissions from the energy sector show a gradual downward trend from 1990 to the present day. Projections for the sector demonstrate MS expectations that emissions from the sector will stabilise through use of existing measures in the EU-15, although during 2010-2020 an increase is expected in the EU-27. Significant decreases in emissions from the sector up to 2020 are dependent on the implementation of planned additional measures. The figure shows that emissions are projected to continue to decrease, reaching 11.8% below 1990 levels by 2010, 14.5 % by 2015 and 20.7 % by 2020 for the EU-15 with additional measures and 15.6 % below 1990 levels by 2010, 16.8 % by 2015 and 20.4 % by 2020 in EU-27 with additional policies and measures in place.

For the EU-15 and EU-27, emissions have fallen since 1990 mainly due to fuel switching to gas (also reducing CH₄ emissions from coal mining), increased energy and technical efficiency, decreases in fuel combustion in manufacturing industries and construction and restructuring of industry in the new Member States. In part, such reductions have been counteracted by increased housing stock and growth in the services sector, resulting in increased demand for energy services in buildings and homes, and in particular strong growth in demand for electricity to provide these. In

addition, recent economic growth in the new Member States has begun to increase demand for energy services.

The following measures driven by the EU and Member State policies have contributed to emissions reductions to date and will continue to do so up to 2020: renewables, nuclear energy, EU ETS and energy efficiency policy. Between 2007 and 2010, the following Member States' energy emissions are projected to fall most with existing measures: Estonia (-33 %), Spain (-11 %), Czech Republic (-9 %) and the United Kingdom (-8 %). However, the majority of Member States expect energy emissions to increase, with the following Member States' energy emissions projected to rise most: Lithuania (+107 %), Bulgaria (+25 %), Romania (+25 %) and Latvia (+23 %).

Illustration 5-9 Greenhouse gas emissions and projections in the energy sector (excluding transport) 'with existing measures' and 'with additional measures' scenarios

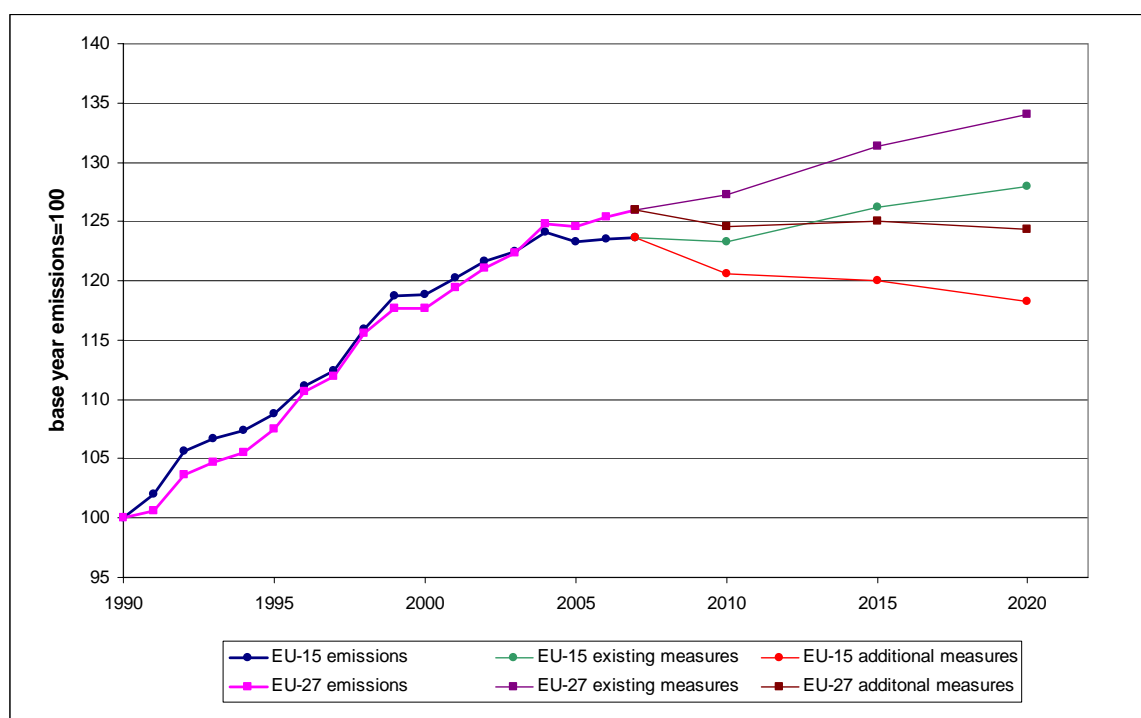


Notes: The index on the vertical axis refers to the base year for the EU-15, that is 1990 emissions for CO₂, CH₄ and N₂O. As the EU-27 does not have a collective Kyoto target and therefore no collective base year, the index on the vertical axis refers to 1990 emissions for the EU-27.

5.2.1.1. Transport

Of all sectors, the transport sector caused the largest increase in greenhouse gas emissions between 1990 and 2007 and is the only sector expected to experience an increase in EU emissions between 1990 and 2010 under the existing measures scenario. The figure below shows that with additional policies and measures in place emissions are projected to decrease relative to 2007, while remaining considerably higher than 1990 emissions. Emissions reach 21 % above 1990 levels by 2010, and subsequently 20 % by 2015 and 18 % by 2020 for the EU-15 with additional measures and 25 % above 1990 levels by 2010 and 2015 and 24 % by 2020 in EU-27. In most Member States, the projected increase of emissions from transport 'with existing measures' is mainly due to continued growth in transport volumes (passenger and freight) and the trend towards larger vehicles. A significant slow down in emissions from the sector up to 2020 is forecast through implementation of additional measures aimed at shifting to less carbon intensive modes of transport and increased energy efficiency (see Section 4.5).

Illustration 5-10 Greenhouse gas emissions and projections in the transport sector 'with existing measures' and 'with additional measures' scenarios



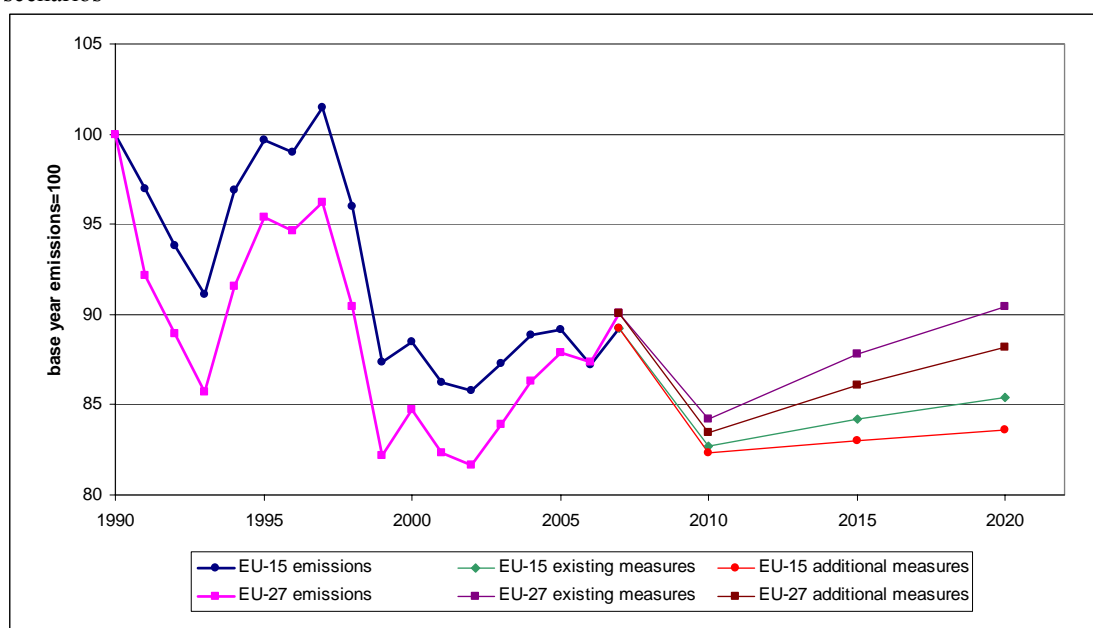
Notes: The index on the vertical axis refers to the base year for the EU-15, that is 1990 emissions for CO₂, CH₄ and N₂O. As the EU-27 does not have a collective Kyoto target and therefore no collective base year, the index on the vertical axis refers to 1990 emissions for the EU-27.

5.2.1.2. Industrial Processes

EU-15 and EU-27 GHG emissions from the industrial processes sector have decreased considerably since their peak in 1997. However emissions from the sector have been on a general upward trend in the past five years. Despite this, Member States expect emissions from the sector to decrease sharply by 2010, through use of existing and additional measures. Emissions post-2010 are however expected to rise once again in both the EU-15 and EU-27 despite currently planned measures. The figure shows that emissions are projected to reach 18 % below 1990 levels by 2010, 17 % in 2015 and 16 % by 2020 for the EU-15 with additional measures and 17 % below 1990 levels by 2010, 14 % by 2015 and 12 % by 2020 in EU-27 with additional policies and measures in place.

Fluctuations in industrial process emissions have been driven both by economic conditions (affecting activity levels) and in some cases EU or national regulation (affecting efficiency) e.g. phasing out of the adipic acid and nitric acid fertiliser plants has occurred in some countries while abatement technology has been fitted in other adipic acid plants. A key driver of this is the inclusion of some industrial process emitters in the EU ETS.

Illustration 5-11 Greenhouse gas emissions and projections in the industrial processes sector 'with existing measures' and 'with additional measures' scenarios

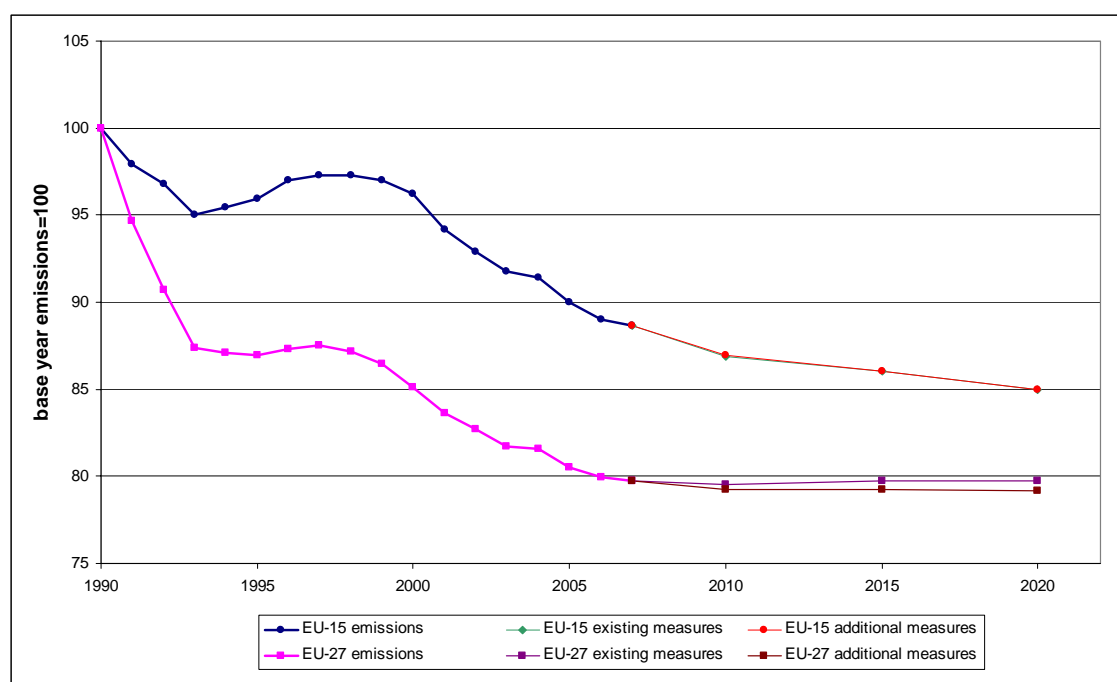


Notes: The index on the vertical axis refers to the base year for the EU-15, that is 1990 emissions for CO₂, CH₄ and N₂O and 1995 emissions for the F gases (with the exception of Austria, France and Italy where the base year for F gases is 1990). This means that the value for 1990 is not exactly 100 for the EU-15. As the EU-27 does not have a collective Kyoto target and therefore no collective base year, the index on the vertical axis refers to 1990 emissions for the EU-27.

5.2.1.3. Agriculture

EU-15 and EU-27 GHG emissions from the agricultural sector have shown a steady decrease over the past 10 years. Changes in agricultural policy and farming subsidies have driven increased productivity, reduced livestock, reduced emissions from agricultural soils, reduced nitrogen fertiliser production and use and improved manure management. EU-15 emissions from the sector are expected to decrease slowly up to 2020. EU-27 emissions are expected to decrease slightly to 2010 then stabilise at this level to 2020. The difference in the trend is likely to be driven by restructuring and recovery in the economies of the more recently acceded Member States. The figure shows that emissions are projected to reach 13 % below 1990 levels by 2010, 14 % by 2015 and 15 % by 2020 for the EU-15 with additional measures and 21 % below 1990 levels by 2010, 2015 and 2020 in EU-27 with additional policies and measures in place. Most Member States (20) have not factored in to their projections estimates of the impact of the current economic recession and subsequent recovery. In both the EU-15 and the EU-27, there is little difference between the 'existing measures' and 'additional measures' scenarios.

Illustration 5-12 Greenhouse gas emissions and projections in the agriculture sector 'with existing measures' and 'with additional measures' scenarios



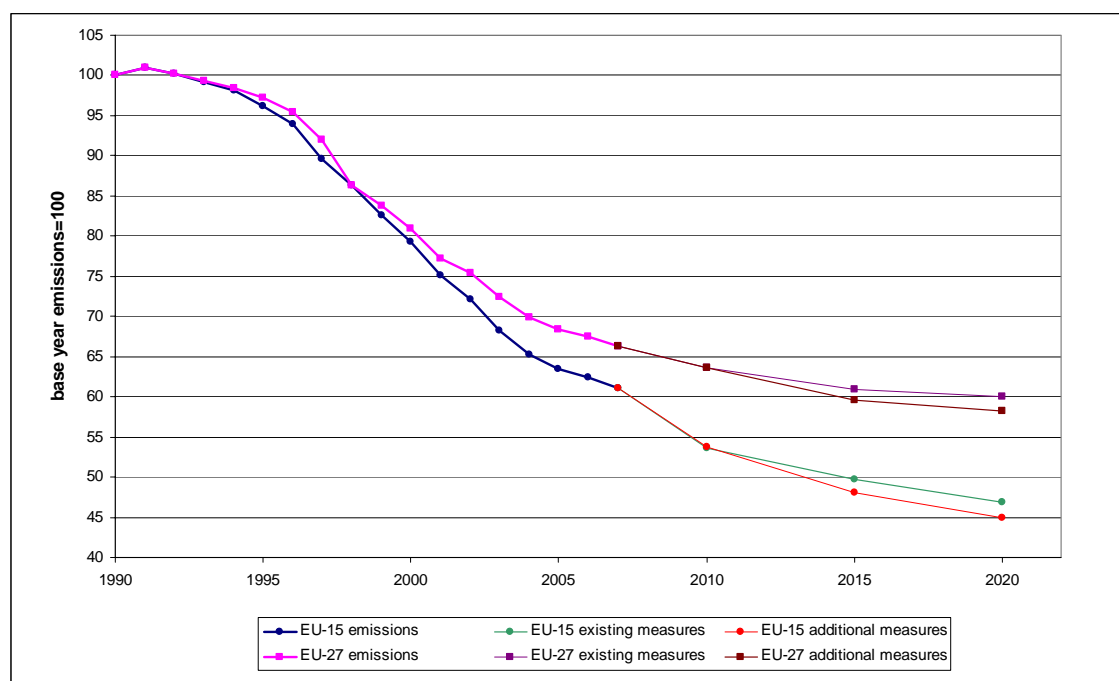
Notes: The index on the vertical axis refers to the base year for the EU-15, that is 1990 emissions for CO₂, CH₄ and N₂O. As the EU-27 does not have a collective Kyoto target and therefore no collective base year, the index on the vertical axis refers to 1990 emissions for the EU-27.

The difference in the EU-15 and EU-27 projections for 'with existing measures' and 'additional measures' is not significant enough to be well visible on the graph.

5.2.2. Waste

EU-15 and EU-27 GHG emissions from the waste sector have shown a steady and sharp decrease over the past 20 years. EU-15 and EU-27 emissions from the sector are expected to decrease even more sharply by 2010 and to decrease further by 2020. In both the EU-15 and the EU-27, planned additional measures are shown to have only a modest impact after 2010. The figure below, shows that emissions are projected to continue to decrease, reaching 46 % below 1990 levels by 2010, 52 % by 2015 and 55 % by 2020 for the EU-15 with additional measures and 36 % below 1990 levels by 2010, 41 % by 2015 and 42 % by 2020 in EU-27 with additional policies and measures in place. Past and future emission decreases can largely be attributed to successful waste legislation e.g. increased recycling, bans on landfill deposit, landfill taxes and methane recovery from treated wastewater and landfill. In particular, the Landfill Directive (see Section 4.9.1) has established objectives for the progressive reduction of biodegradable waste to landfill by 25 % within five years of Member State implementation of the Directive, 50 % within eight years, and by 65 % within fifteen years, compared to 1995 levels.

Illustration 5-13 Greenhouse gas emissions and projections in the waste sector 'with existing measures' and 'with additional measures' scenarios

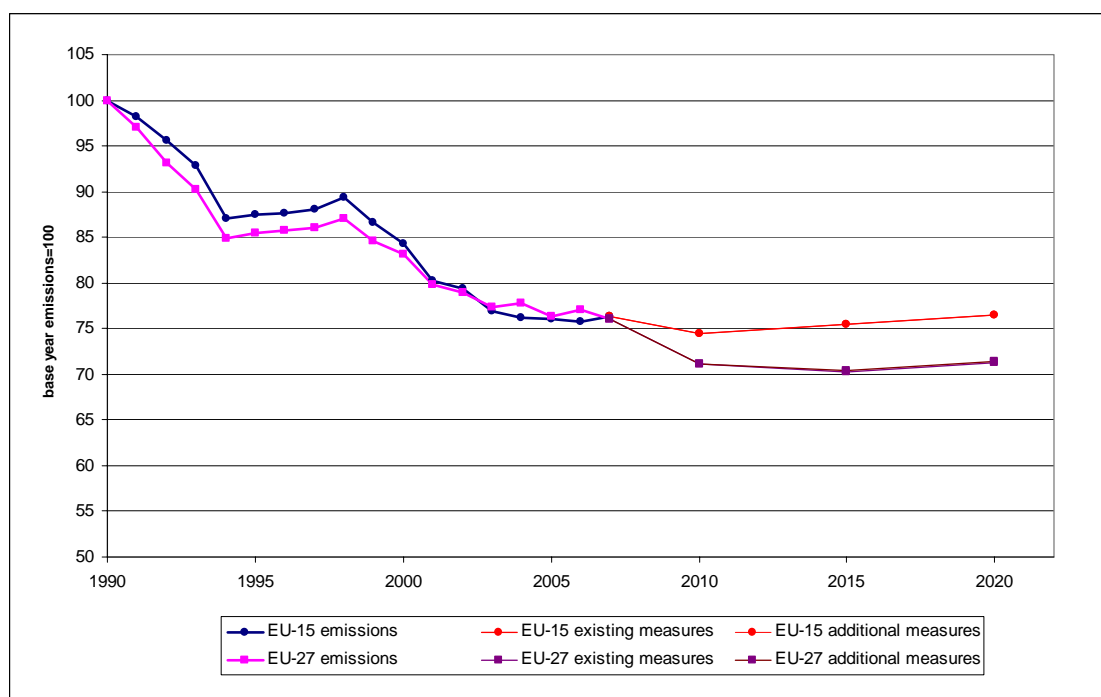


Notes: The index on the vertical axis refers to the base year for the EU-15, that is 1990 emissions for CO₂, CH₄ and N₂O. As the EU-27 does not have a collective Kyoto target and therefore no collective base year, the index on the vertical axis refers to 1990 emissions for the EU-27.

5.2.3. Other

The 'Other' sector is the sum of emissions from Common Reporting Format (CRF) sectors 3 (Solvent and Other Product Use) and 7 (Other)²⁴⁴. The contribution to the overall emissions from this sector has historically been very small, accounting for 0.2% of the total EU-27 GHG emissions in 2007. EU-15 and EU-27 GHG emissions from 'other' sources have shown a steady and sharp decrease over the past 20 years. MS projections indicate a sharp decrease in EU-15 and EU-27 emissions from the sector by 2010. By 2015, the trend continues in the EU-27 although the decrease is slower whilst emissions increase slightly in the EU-15. Both in the EU-15 and EU-27 emissions increase between 2015-2020. In both the EU-15 and the EU-27, there is little difference between the 'existing measures' and 'additional measures' projections. The figure shows that emissions are projected to continue to decrease, reaching 25.5 % below 1990 levels by 2010, 24.5 % by 2015 and 23.5 % by 2020 for the EU-15 with additional measures and 29 % below 1990 levels by 2010, 30 % by 2015 and 29 % by 2020 in EU-27 with additional policies and measures in place.

Illustration 5-14 Greenhouse gas emissions and projections in the 'other' sector 'with existing measures' and 'with additional measures' scenarios



Notes: The index on the vertical axis refers to the base year for the EU-15, that is 1990 emissions for CO₂, CH₄ and N₂O and 1995 emissions for the F gases (with the exception of Austria, France and Italy where the base year for F gases is 1990). This means that the value for 1990 is not exactly 100 for the EU-15. As the EU-27 does not have a collective Kyoto target and therefore no collective base year, the index on the vertical axis refers to 1990 emissions for the EU-27. At both the EU-15 and the EU-27 level, there is very little difference between the 'existing measures' and 'additional measures' projections. The difference is not visible on the graph.

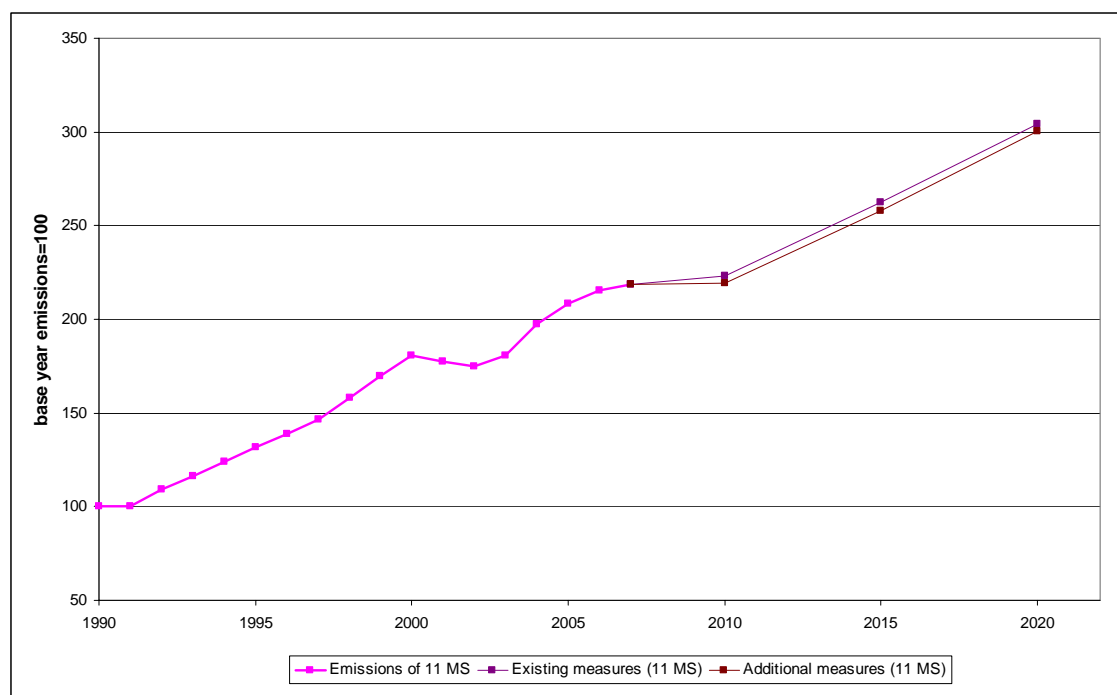
²⁴⁴ For the Netherlands, projection for Sector 7 was disregarded due to inconsistency with the 2007 inventory data available for this sector.

5.2.4. Aviation and Maritime bunker fuels

Projections of emissions from international bunker fuels are available for the following Member States *only*: Denmark, Germany, Greece, Netherlands, Spain, Sweden, United Kingdom, Czech Republic (aviation only), Estonia, Lithuania²⁴⁵ and Malta. This group of countries does however account for 66 % and 68 % of the EU-27's total emissions in 2007 from aviation and maritime bunker fuels, respectively.

The figure below shows the trend in emissions and projections for the aviation sector for the 11 MS for which data is available, from 1990 to 2020. The data shows that the rapid increase in emissions experienced to date is projected to continue up to 2020, although the increase is considerably slower up to the Kyoto commitment period. The figure shows that emissions are projected to continue to increase, reaching 120 % above 1990 levels by 2010, 158 % by 2015 and 200 % by 2020 with additional measures for the 11 Member States that provided projections. There is little differentiation between the existing measures and additional measures projections. It is unlikely however that MS projections account for the impact of including aviation in the EU ETS from 2012 or the impact of the current recession.

Illustration 5-15 Greenhouse gas emissions and projections in the international bunkers - aviation sector 'with existing measures' and 'with additional measures' scenarios

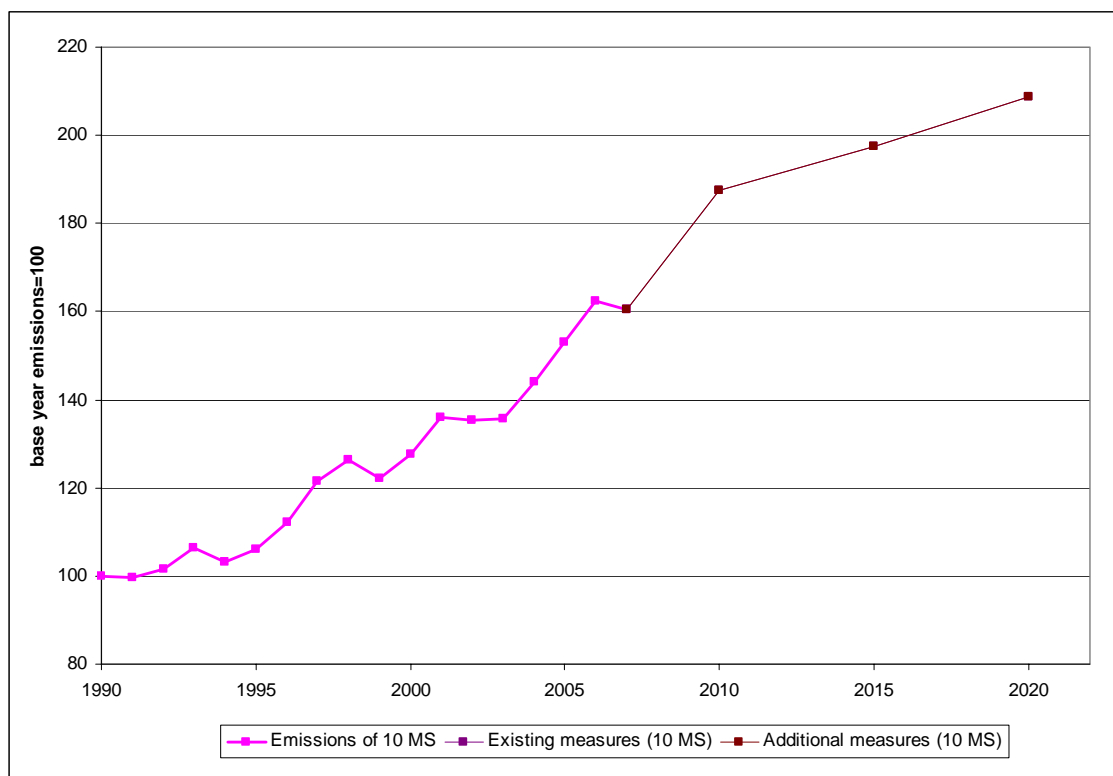


Notes: The index on the vertical axis refers to the base year for the EU-15, that is 1990 emissions for CO₂, CH₄ and N₂O. As the EU-27 does not have a collective Kyoto target and therefore no collective base year, the index on the vertical axis refers to 1990 emissions for the EU-27. Aviation projections available from 11 countries only (Denmark, Czech Republic, Germany, Greece, Netherlands, Spain, Sweden, United Kingdom, Lithuania, Estonia and Malta). Projections for Lithuania are available for the year 2010 only but have been gapfilled.

²⁴⁵ Lithuania only submitted projections for 2010 but the data has been gapfilled for 2015 and 2020.

The figure below shows the trend in emissions and projections for the maritime sector for the 10 Member States for which data is available, from 1990 to 2020. The data shows that Member States expect a significant increase in emissions up to the Kyoto commitment period, with a slower increase in emissions thereafter to 2020. The figure shows that emissions are projected to continue to increase, reaching 87 % above 1990 levels by 2010, 97 % by 2015 and 108 % by 2020 with additional measures for the 10 Member States that provided projections.

Illustration 5-16 Greenhouse gas emissions and projections in the international bunkers - maritime sector 'with existing measures' and 'with additional measures' scenarios



Notes: The index on the vertical axis refers to the base year for the EU-15, that is 1990 emissions for CO₂, CH₄ and N₂O. As the EU-27 does not have a collective Kyoto target and therefore no collective base year, the index on the vertical axis refers to 1990 emissions for the EU-27. Maritime projections available from 10 countries only (Denmark, Germany, Greece, Netherlands, Spain, Sweden, United Kingdom, Lithuania, Estonia and Malta). Projections for Lithuania are available for the year 2010 only but have been gapfilled for 2015 and 2020.

There is no difference between the projections for the WEM and WAM scenarios. The line for WEM is therefore not visible on the above graph.

5.2.5. Land Use Land Use Change and Forestry

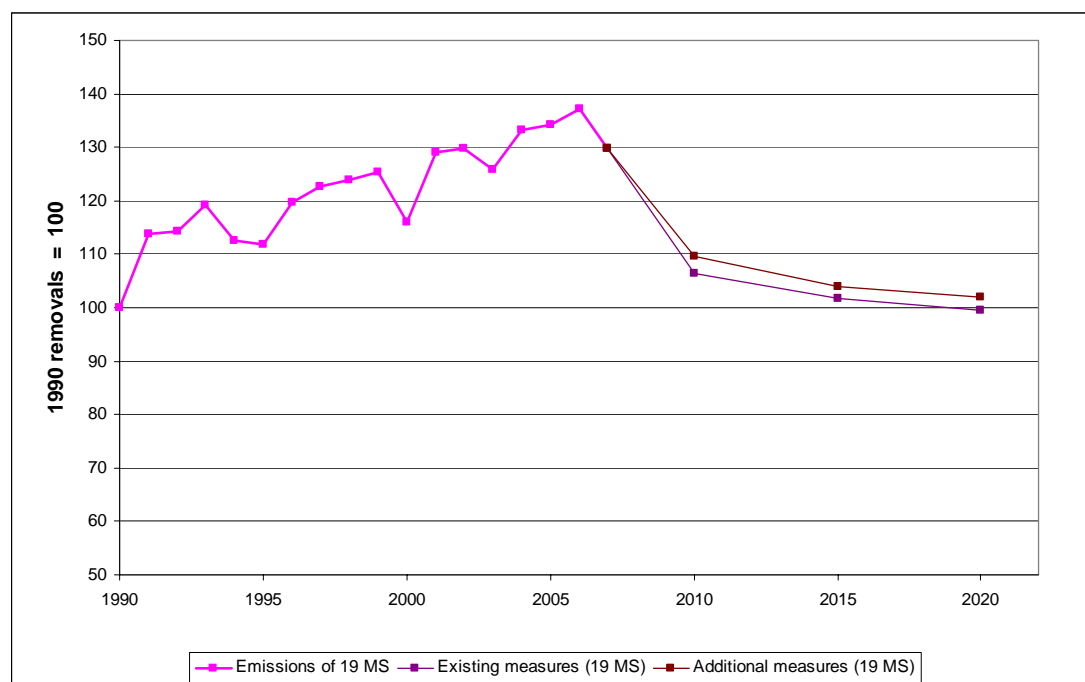
Projected emissions/removals for the land use, land use change and forestry (LULUCF) sector are available for the following Member States *only*: Austria, Finland, France, Greece, Ireland, Netherlands, Portugal, Spain, Sweden, UK, Cyprus, Czech Republic, Estonia, Latvia, Lithuania, Malta, Romania, Slovakia and Slovenia. This group of countries accounted for 65 % of the EU-27's net LULUCF removals in 2007.

The figure below shows the trend in net removals from LULUCF for the 19 Member States for which data is available, from 1990 to 2020²⁴⁶. Net removals from LULUCF generally increased to 2007. However, MS generally expect removals to decrease rapidly up to 2020. The decline in LULUCF activity between 2007-2010 is greatest in Finland, Estonia and Latvia²⁴⁷. Although Greece, Ireland, Netherlands, Portugal, Spain, the UK, Cyprus, the Czech Republic, Romania and Slovakia expect LULUCF activities to result in an increase in net removals beyond 2007 levels in 2010, this is not enough to compensate for the Member States that project a significant decline. The figure shows that net removals for the 19 MS are projected to remain higher than 1990 levels until 2015 in both scenarios but decline thereafter in the "with existing measures" scenario. In general removals decrease rapidly compared to the upward trend from 1990-2007, although the decline slows down between 2015 and 2020. In 2020, the projected removals are just above the 1990 level 'with additional measures' and slightly lower 'with existing measures' for the 19 countries that reported LULUCF projections. The precipitous decline in removals in certain Member States requires further investigation to determine the underlying reasons for the trend.

²⁴⁶ Data was available for Hungary and Poland from their 2007 submission, but is not included here. This is due to significant discrepancies between LULUCF emissions reported in the 2005 inventory used for the 2007 submission and emissions reported in the latest 2007 inventory.

²⁴⁷ The projections reports submitted by these Member States do not indicate reasons for the decline in their LULUCF activity. The decline in LULUCF activity, presented in Illustration 5-12 is driven by these Member States.

Illustration 5-17 Net greenhouse gas removals in the LULUCF sector, 'with existing measures' and 'with additional measures' scenarios



Notes: LULUCF projections available from 19 countries only (Austria, Finland, France, Greece, Ireland, Netherlands, Portugal, Spain, Sweden, UK, Cyprus, Czech Republic, Estonia, Latvia, Lithuania, Malta, Romania, Slovakia and Slovenia). Corresponding inventory data is shown. Projections for Portugal and Slovenia are available for the year 2010 only but have been gapfilled for 2015 and 2020.

In contrast to other graphs in this section, this graph illustrates the change in net removals from 1990-2020. Increased net removals result in a reduction in overall GHG emissions, while a reduction in net removals results in an increase in overall GHG emissions.

5.2.5.1. Intended use of carbon sinks

The UNFCCC and EU-burden sharing targets are calculated based reductions in greenhouse gas emissions excluding net emission removals from LULUCF activities. However, in addition to reducing or limiting emissions of greenhouse gases, Member States can make use of carbon sinks covered by Article 3.3 and Article 3.4 of the Protocol.

- Article 3.3 (afforestation, reforestation and deforestation) on lands that have been subject to direct, human-induced conversion from a forested to a non-forested states, or vice versa
- Article 3.4 (forest management, cropland management, grazing land management and revegetation) on lands that have not undergone conversion since 1990, but are otherwise subject to a specific land use.

Parties must account for net emissions or removals for each activity during the commitment period by issuing RMUs (removal units) in the case of GHG removals from carbon sinks (e.g. afforestation) or cancelling Kyoto units in the case of net

GHG emissions from carbon sinks. LULUCF activities can therefore be used to compensate emissions from other sources in determining compliance with targets. Thirteen EU-15 Member States intend to use carbon sinks. However, the projected total amount of CO₂ to be removed between 2008 and 2012 is relatively small at 42.4 Mt CO₂ per year in total for EU-15 Member States. For the EU-27, the total intended use of sinks is 47.9 Mt CO₂ per year.

5.3. Projections by gas

The figures below illustrate the expected change in emissions from individual GHG between 1990 and 2020 under the “with existing measures” and “with additional measures” scenarios.

The overall change in GHG emissions (excluding LULUCF) between 1990-2010, under the “with existing measures” scenario, is –287 Mt and –539 Mt in the EU-15 and EU-27 respectively. Reductions in CO₂ emissions are expected to contribute most to overall reductions, the absolute reduction of CO₂ between 1990-2010 is -54 Mt in the EU-15 and –223 Mt in the EU-27. Reductions in CH₄ emissions are –155 Mt for the EU-15 and –203 Mt for the EU-27. Reductions in N₂O emissions are –95 Mt for the EU-15 and –134 Mt for the EU-27. F-gases are the only gases expected to increase between 1990 and 2010 or 2020. However, the absolute contribution of F-gases to overall emissions is less significant: the projected growth in F-gas emissions are +17 Mt in the EU-15 and +20 Mt in the EU-27 between 1990-2010.

The overall change in GHG emissions (excluding LULUCF) between 1990-2010, under the “with additional measures” scenario, is –360 Mt and –635 Mt in the EU-15 and EU-27 respectively²⁴⁸. Reductions in CO₂ emissions are expected to contribute most to overall reductions, the absolute reduction of CO₂ between 1990-2010 is -125 Mt in the EU-15 and –314 Mt in the EU-27. Reductions in CH₄ emissions are –155 Mt for the EU-15 and –204 Mt for the EU-27. Reductions in N₂O emissions are –95 Mt for the EU-15 and –135 Mt for the EU-27. F-gases are the only gases expected to increase between 1990 and 2010 or 2020. However, the absolute contribution of F-gases to overall emissions is less significant: the projected growth in F-gas emissions are +15 Mt in the EU-15 and +19 Mt in the EU-27 between 1990-2010.

Appendix D contains detailed inventory and projections data tables, including overall EU-15 and EU-27 projections split by gas and sector and projections for each of the key sectors for the EU-15 and EU-27, also split by gas. Gapfilling was required in a number of cases to enable this detailed disaggregation to be produced for the EU-15 and EU-27 using MS projections which are not always fully disaggregated. Further information on the gapfilling methodology is provided in Section 5.8.5.

²⁴⁸ The discrepancy between these numbers and the total change in by sector arises due to the fact that the by sector estimate does not include Sector 7 from the Netherlands. This is further explained in 5.2.3.

Illustration 5-18 Projected change in greenhouse gas emissions (excluding LULUCF) by gas for the 'with existing measures' scenario, 1990-2010

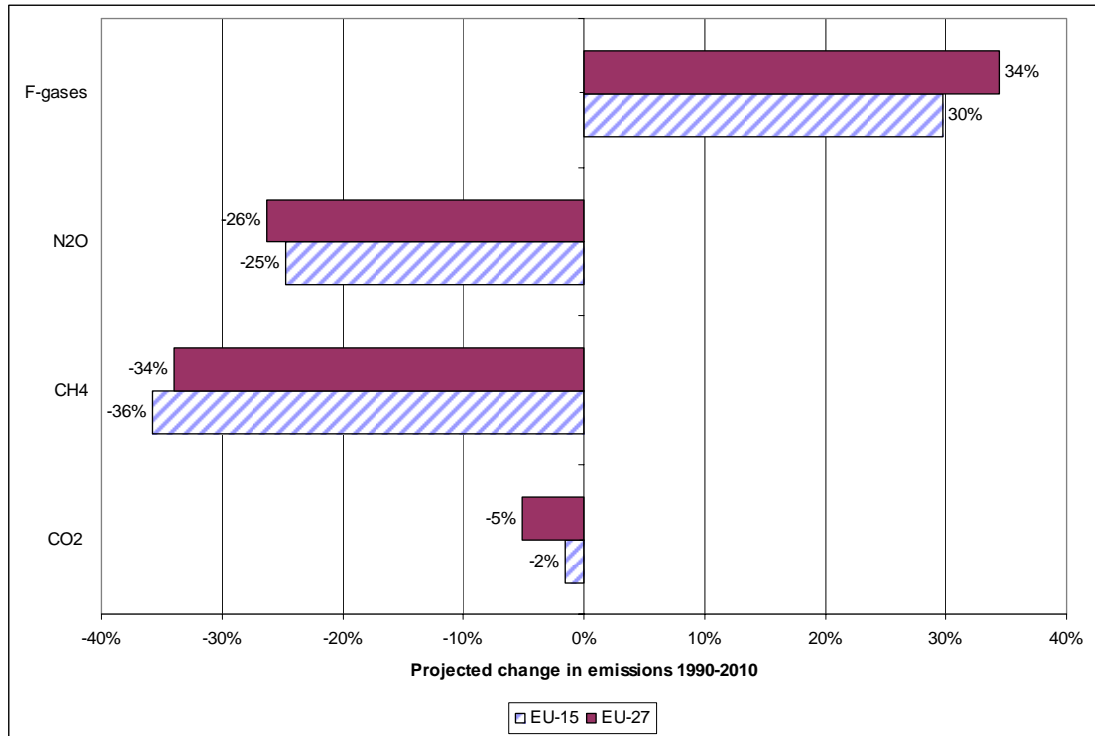


Illustration 5-19 Projected change in greenhouse gas emissions (excluding LULUCF) by gas for the 'with additional measures' scenario, 1990-2010

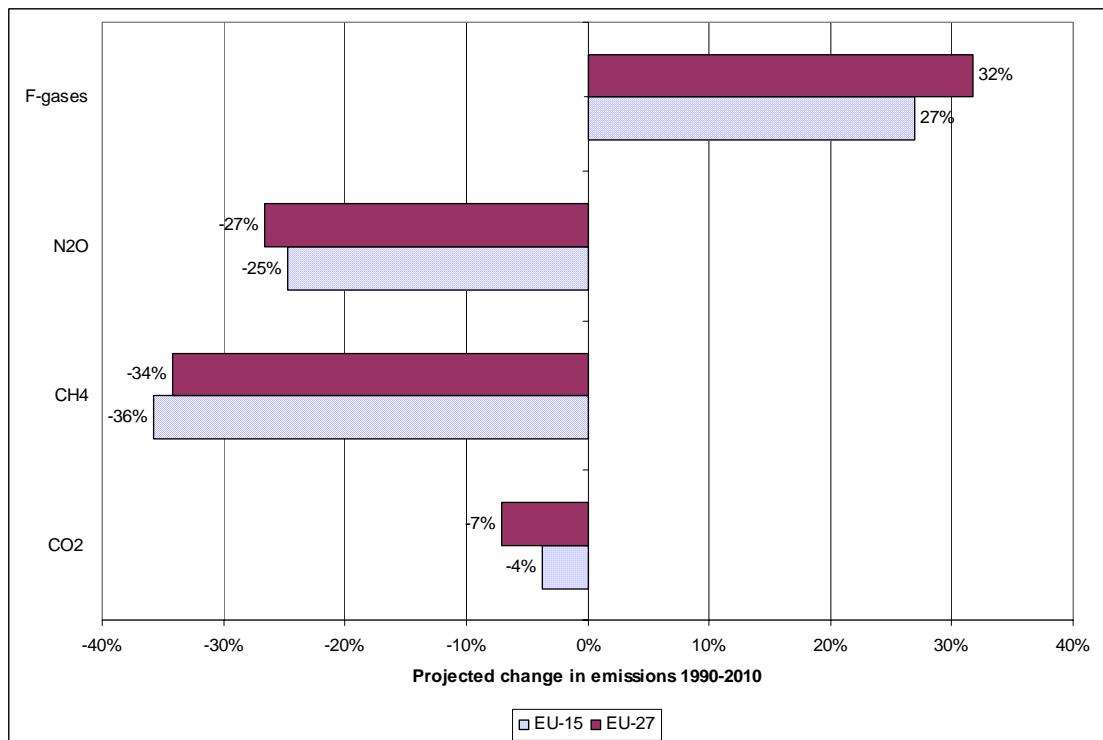


Illustration 5-20 Projected change in greenhouse gas emissions (excluding LULUCF) by gas for the 'with existing measures' scenario, 1990-2020

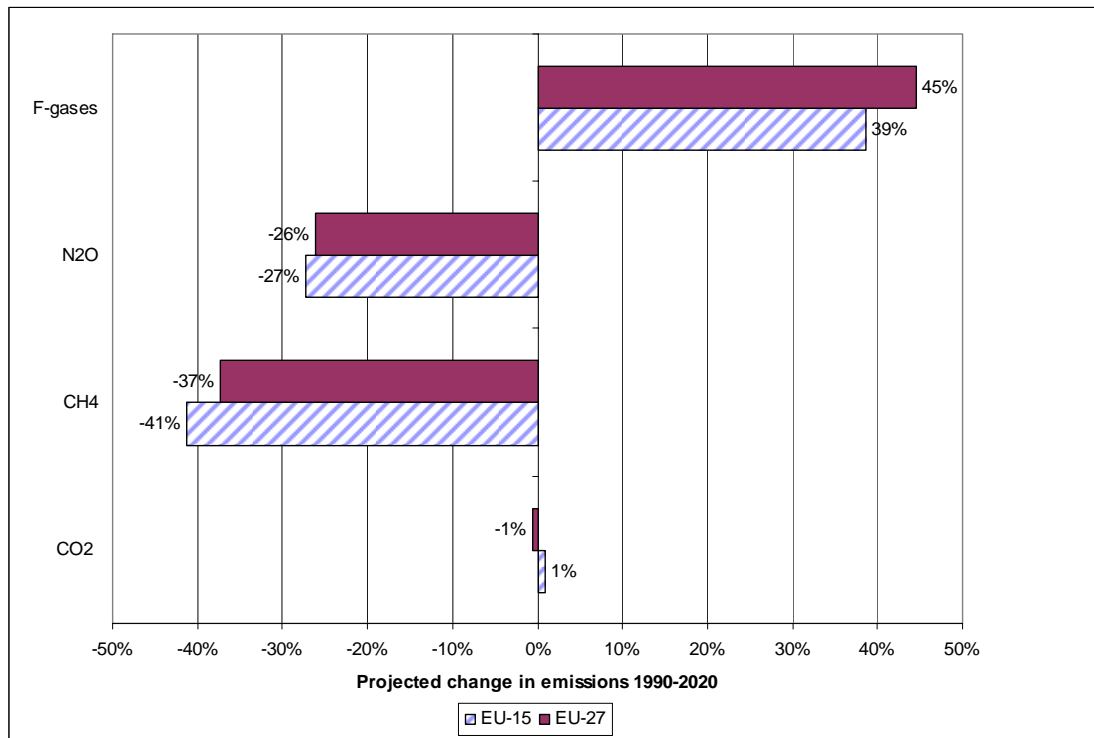
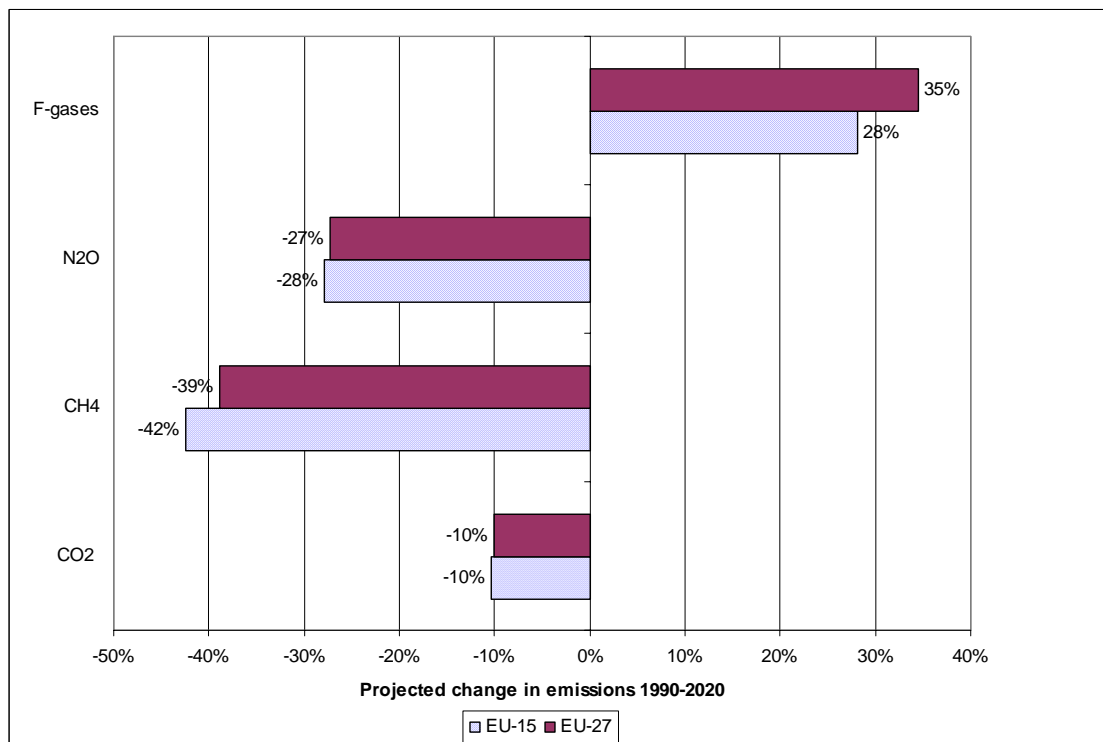


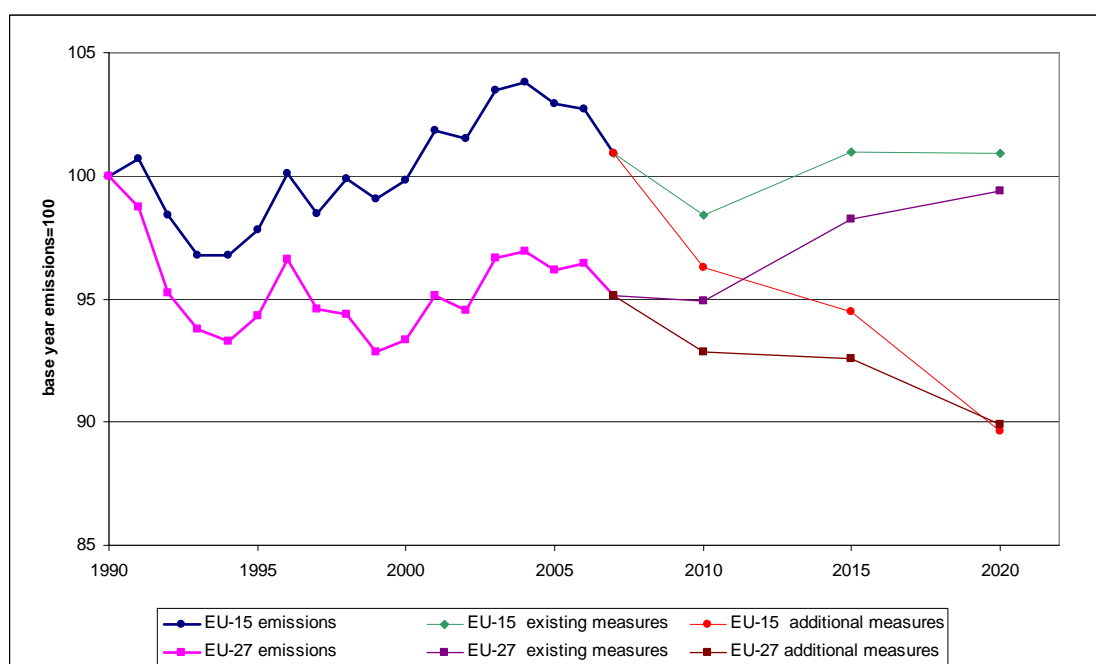
Illustration 5-21 Projected change in greenhouse gas emissions (excluding LULUCF) by gas for the 'with additional measures' scenario, 1990-2020



5.3.1. CO₂ emissions

The figure below shows CO₂ emissions and projections for the ‘with existing measures’ and ‘with additional’ measures scenarios. CO₂ emissions in both the EU-15 and EU-27 have fluctuated considerably from year to year since 1990. EU-15 CO₂ emissions have been on a general upward trend since 1994 but have begun to decrease since 2004. EU-27 CO₂ emissions have remained below 1990 levels, despite increases from 1999 onwards. Emissions decreases experienced in the early 1990s resulted from fuel switching to natural gas. Increases have been driven by increased road transport and increased energy demand for buildings, particularly in the EU-15 but also more recently in the newer Member States. The impact of such increases has however been greatly mitigated by policy driven efficiency improvements in energy end-use (see Section 4.4.4) and increased deployment of low carbon power generation. Nonetheless, the ‘with additional measures’ projections for both the EU-15 and EU-27 are ambitious given the rate of change realized in recent years. The largest reductions in absolute terms between 2007 and 2010 are expected to come from Germany (-57 Mt CO₂), Spain (-47 Mt CO₂) and the UK (-40 Mt CO₂) while the largest increase in emissions over the same period is projected by Romania (+23 Mt CO₂).

Illustration 5-22 CO₂ emissions and projections (excluding LULUCF) ‘with existing measures’ and ‘with additional measures’



Notes: The index on the vertical axis refers to the base year for the EU-15, that is 1990 emissions for CO₂. This means that the value for 1990 is not exactly 100 for the EU-15. As the EU-27 does not have a collective Kyoto target and therefore no collective base year, the index on the vertical axis refers to 1990 emissions for the EU-27.

5.4. Without measures projection

Only 7 of the EU-27 Member States reported a ‘without measures’ projection in their latest submissions. An alternative method has therefore been used to estimate a

‘without measures’ projection for the EU-15 and EU-27, making use of individual Member State projections and estimates of policy impact.

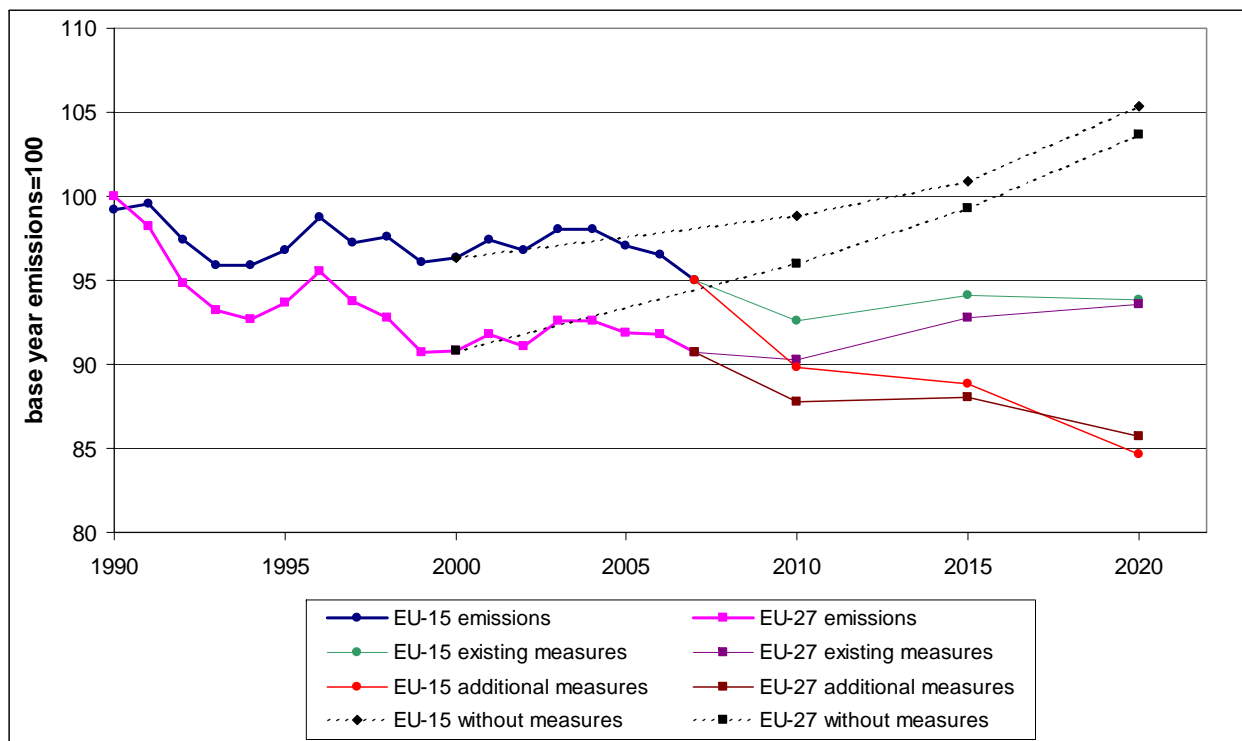
The ‘without measures’ projections presented in the figure below for the years 2010, 2015 and 2020 are derived by adding the total effect of implemented policies and measures to the ‘with existing measures’ projection scenario for each year.

The limitations of this method are:

- The effect of policies and measures used are estimates provided by individual Member States. These estimates are incomplete as not all Member States quantify the impact of all policies and measures. Estimates are therefore likely to be an underestimate of the total impact of policies and measures.
- A starting year of 2000 is chosen in line with the launch of the first European Climate Change Programme. However, the policies for which estimates are provided may have been implemented by Member States in any given year before or after the year 2000.
- Interactions between policies and measures may not be accounted for since individual policy estimates are aggregated together.
- 2000 inventory data is used as a starting point for the WOM scenario. Data for the scenario is then interpolated from this point to the calculated WOM estimates for the years 2010, 2015 and 2020. The method does not therefore estimate the situation in the absence of policies and measures in the interpolated years.

Nonetheless, the method does illustrate to some extent a conservative estimate of the total impact of policies and measures in the EU. This is considered preferable to a simple extrapolation of historic trends given difficulties with choosing a single starting year for the EU.

Illustration 5-23 Greenhouse gas emissions and projections (excluding LULUCF) including a 'without measures' scenario, 1990 – 2020



Notes: The index on the vertical axis refers to the base year for the EU-15, that is 1990 emissions for CO₂, CH₄ and N₂O and 1995 emissions for the F gases (with the exception of Austria, France and Italy where the base year for F gases is 1990). This means that the value for 1990 is not exactly 100 for the EU-15. As the EU-27 does not have a collective Kyoto target and therefore no collective base year, the index on the vertical axis refers to 1990 emissions for the EU-27.

Sources: Member State inventory and projections data, as submitted to the European Commission until 15th May 2009 (for individual sources, see EEA (2009), EEA Report: GHG Trends and Projections across Europe). EEA (2009), Policies and Measures database, 9th September 2009 extract, <http://www.eea.europa.eu/themes/climate/pam-database>

5.5. Projections of indirect GHG

The UNFCCC guidelines for National Communications (1999) state that parties may provide projections of indirect GHG carbon monoxide (CO), nitrogen oxides (NO_x), non-methane volatile organic compounds (NMVOC) and sulphur oxides (SO₂). 2010 projections for nitrogen oxides (NO_x), non-methane volatile organic compounds (NMVOC) and sulphur oxides (SO₂) are available in the context of reporting under the National Emission Ceilings Directive²⁴⁹ (NECD) and are presented below.

EU-27 ‘with existing measures’ scenario projections presented in the table below are based on aggregated data reported by the individual Member States. The emission ceilings shown are the aggregated EU-27 emission ceilings defined in Annex I and Annex II of the NECD.

2010 emission ceilings for NO_x and NMVOCs have proven to be the most difficult of the four ceilings for many Member States to meet, mostly due to sharp increases in NO_x and NMVOCs from the transport and solvents sector respectively.

Table 5—1 Sum of EU Member State projections compared with EU-27 emission ceilings as defined in Annex I and Annex II of the NECD

| GAS | WEM projections (Kt) | Annex I emission ceilings (Kt) | Difference from WEM (%) | Annex II emission ceilings (Kt) | Difference from WEM (%) |
|-----------------|----------------------|--------------------------------|-------------------------|---------------------------------|-------------------------|
| NO _x | 9525 | 9003 | 6 % | 8180 | 16 % |
| NMVOC | 7960 | 8848 | -10 % | 7585 | 5 % |
| SO ₂ | 5752 | 8297 | -31 % | 7832 | -27 % |

Source: EEA²⁵⁰

5.6. Assessment of aggregate effects of policies and measures

In order to ensure consistency with the aggregated Member State projections presented in this section, estimates of the total effect of policies and measures are also based on an aggregation of the latest available Member State estimates of the impact of individual national policies and measures.

²⁴⁹ Directive 2001/81/EC of the European Parliament and the Council on National Emission Ceilings for certain pollutants (NEC Directive) sets upper limits for each Member State for the total emissions in 2010 of the four pollutants responsible for acidification, eutrophication and ground-level ozone pollution (sulphur dioxide, nitrogen oxides, volatile organic compounds and ammonia), but leaves it largely to the Member States to decide which measures – on top of Community legislation for specific source categories - to take in order to comply. The NEC Directive has been amended as part of the accession of new Member States. A consolidated NEC Directive for the EU 27 includes the entire Community as of 1st January 2007. <http://ec.europa.eu/environment/air/pollutants/ceilings.htm>

²⁵⁰ EEA (2009), EEA Technical report: NEC Directive Status Report 2008 (Reporting by the Member States under Directive 2001/81/EC of the European Parliament and of the Council of 23rd October 2001 on national emission ceilings for certain atmospheric pollutants).

This includes the impact of **both** EC-level and non-EC initiated policies and measures (implemented/adopted and planned). In contrast to other parties NCs, the contribution of EC-level policies only to the total effect of policies is highlighted separately in Section 4, given that the focus of this NC is on EC level activity.

Two methods can be used and compared to quantify GHG savings from existing and additional policies and measures at an aggregated level. Due to the difference in methodologies, they provide different estimates of savings from the policies and measures. There are advantages and disadvantages to both methods.

5.6.1. Bottom up approach and top down approach

The bottom-up approach estimates total savings from policies and measures by aggregating the expected savings from individual policies and measures. Member States report the savings from their ‘existing measures’ (EM) and ‘additional measures’ (AM) separately. Member States do not quantify the impact of all policies and measures. Estimates of the total effect of policies and measure (bottom-up approach) are therefore an underestimate of the total impact of policies and measures.

Where possible, therefore, the total effect of policies has also been estimated by subtracting national WOM, WEM and WAM projections. The top-down estimates total savings from policies and measures by taking the difference between different projection scenarios of total GHG emissions prepared by the Member States. The details of the three different scenarios are described in Section 5.1.1 (WEM), Section 5.1.2 (WAM), and Section 5.4 (WOM).

Savings from the existing and additional PAMs are therefore calculated as follows:

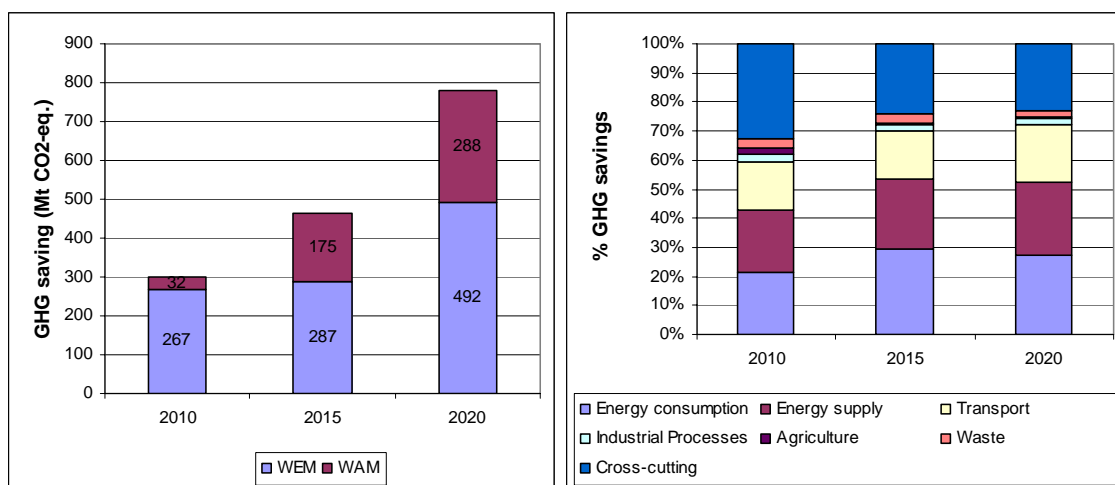
Savings from EM = WOM scenario – WEM scenario. This method underestimates savings from existing PAMs at EU level because only about half of the Member States provide a WOM projection.

Savings from AM = WEM scenario – WAM scenario

However, this results in an underestimate of savings from the existing measures as only ten Member States have provided a WOM projection.

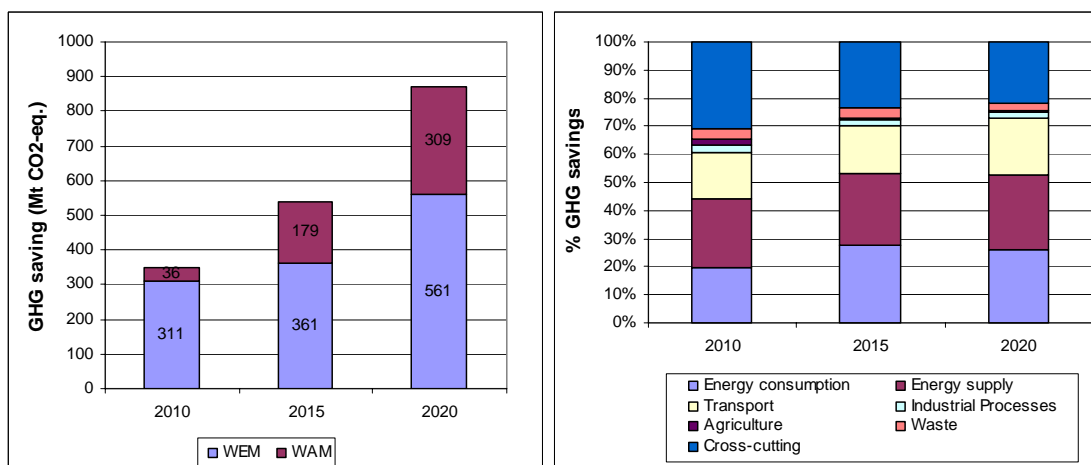
The two figures below present the total effect of policies and measures for the EU-15 and EU-27 respectively, as derived from an aggregation of Member State estimates of the impact of individual policies and measures (bottom-up approach). In the bottom-up method, the estimated impacts for sectors such as the energy and industrial process sectors are underestimated since some of the savings are covered under the ‘cross-cutting’ policies which include the EU ETS and IPCC.

Illustration 5-24 Total effect of policies and measures (bottom up approach), EU-15



Source: EEA (2009), Policies and Measures database, 9th September extract, <http://www.eea.europa.eu/themes/climate/pam-database>

Illustration 5-25 Total effect of policies and measures (bottom up approach), EU-27

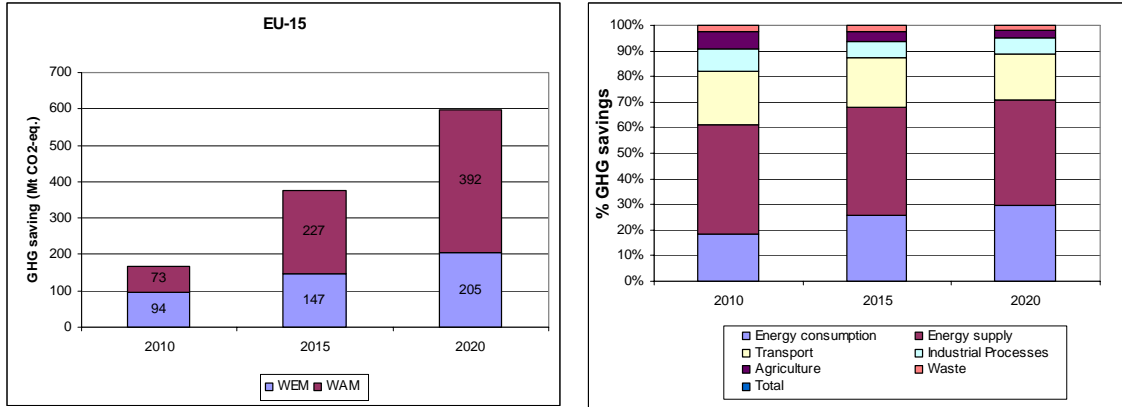


Source: EEA (2009), Policies and Measures database, 9th September 2009 extract, <http://www.eea.europa.eu/themes/climate/pam-database>

The next figure below presents an estimate of the total impact of policies and measures derived by subtracting national WOM, WEM and WAM projections (top-down approach). The bottom-up approach in the previous figures indicates that EU-27 emissions will be reduced by 5.6 % in 2010 and by 10.1 % in 2020 compared to 1990 emissions as a result of implemented measures. For additional measures, the bottom-up approach tends to underestimate the emission reductions. The estimated impact of the measures is 0.6 % in 2010 and 5.6 % in 2020. Using the top down method, for the EU-27, the emission reductions from these implemented measures are 3.5% in 2010 and by 6.1 % in 2020 compared to 1990 emissions. For additional measures, the estimated impact using the top

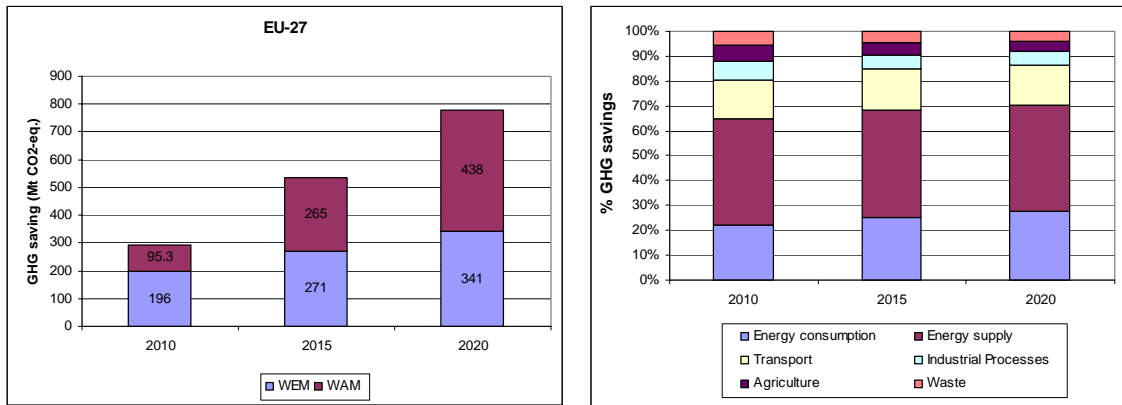
down method is 1.7 % in 2010 and 7.9 % in 2020. The difference in the estimates by using the two methods is explained in Section 5.6.1.

Illustration 5-26 Total effect of policies and measures (top down approach) EU-15



Source: Member State inventory and projections data, as submitted to the European Commission until 15th May 2009 (for individual sources, see EEA (2009), EEA Report: GHG Trends and Projections across Europe).

Illustration 5-27 Total effect of policies and measures (top down approach) EU-27



Source: Member State inventory and projections data, as submitted to the European Commission until 15th May 2009 (for individual sources, see EEA (2009), EEA Report: GHG Trends and Projections across Europe).

Table 5—2 indicates the proportion of Member State estimated policy savings for the EU-27 that are attributable to the Common and Co-ordinated Policies and Measures (CCPM) of the EU calculated by using the reported savings from the bottom-up method (described in detail in Section 4).

Table 5—2 Portion of Member State policy savings attributable to the CCPM(%), EU-27

| Year | WEM | WAM |
|------|-----|-----|
| 2010 | 82% | 36% |
| 2015 | 75% | 71% |
| 2020 | 76% | 66% |

Source: EEA (2009), Policies and Measures database, 9th September extract, <http://www.eea.europa.eu/themes/climate/pam-database>

5.7. Supplementarity relating to mechanisms under Article 6, 12 and 17 of the Kyoto Protocol

According to the Kyoto Protocol reporting guidelines, each Annex I Party shall provide information on how its use of the Kyoto Protocol mechanisms is supplemental to domestic action, and how its domestic action thus constitutes a significant element of the effort made to meet its quantified limitation and reduction commitments under Article 3, paragraph 1, in accordance with the provisions of decision 5/CP.6. Eleven Member States²⁵¹ expect that they will, in part, rely on the Kyoto mechanisms to bridge the projected gap between domestic emissions and their burden-sharing targets.

5.7.1. Intended use of flexible mechanisms

Section 4.2.1 contains detailed information on Member States' intended use of flexible mechanisms of the Kyoto Protocol (i.e. Joint Implementation, Clean Development Mechanism, International Emissions Trading). EU-15 Member States intend to use credits generated from flexible mechanisms to meet their individual targets totalling 93.1 Mt CO₂-eq per year over the commitment period. Of the EU-12 MSs, only Slovenia and Hungary intends to use flexible mechanisms. Most Member States in the EU-27 intend to use the flexible mechanisms to increase their emission rights, Hungary is the only Member State that has reported quantified projections for selling assigned amount units (AAUs).

This results in a total intended use of 77.6 Mt CO₂-eq per year for the EU-27. These figures include only governmental use of flexible mechanisms. Additional reductions may occur as a result of EU ETS operator purchase of project credits (see Section 5.7.2).

Table 5—3 indicates that Member State intended use of flexible mechanisms in both the EU-15 and EU-27 is indeed projected to be supplemental to domestic action as

²⁵¹ Belgium, Denmark, Finland, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain. Austria also relies on Kyoto mechanisms to reach the target; at present however the use of Kyoto mechanisms as currently planned and emission removals from carbon sink activities will not suffice to meet their target. Slovenia is the only EU-12 Member States which anticipates that it will need to use the Kyoto mechanisms to meet its target.

demonstrated through savings projected to result from implemented and planned policies and measures during the Kyoto commitment period.

As a share of the EU-15's target of an -8 % reduction compared to the base year, the planned use of flexible mechanisms to achieve non-domestic reductions accounts for around 2.2 percentage points (i.e. approximately one-quarter of the reductions).

Table 5—3 Projected annual balance between policy impacts in 2010 and flexible mechanisms during 2008-2012 (Mt)

| | Estimated effect of policies (bottom-up) | | | Estimated effect of policies (top-down) | | | Intended use of flexible mechanisms |
|-------|--|-----|-------|---|-----|-------|-------------------------------------|
| | WEM | WAM | Total | WEM | WAM | Total | |
| EU-15 | 267 | 32 | 299 | 94 | 73 | 167 | 93.1 |
| EU-27 | 311 | 36 | 347 | 196 | 95 | 291 | 77.6 |

5.7.2. The EU ETS effect

The 'EU ETS effect' is an estimate of the net transfer of Kyoto units by EU ETS operators to comply with their cap (difference between projected ETS emissions and the ETS cap). Twelve of the EU-15 Member States (excluding France, Greece and Portugal) reported projections of EU ETS emissions for 2008-2012. For France, Greece and Portugal gap filling was applied by assuming that projections in the ETS sectors were equal to allowed emissions under the National Allocation Plan for the period 2008-2012.

Based on these projections, it is estimated that to comply with their obligations, ETS operators in the EU-15 would need to acquire about 61 million units (EUA, ERUs or CERs). This is therefore added to the number of Kyoto units Member States expect to purchase at government level, and represents about 1.4 % of the EU-15 base-year emissions. The EU ETS effect is presented in Illustration 5-1 and explained in greater detail in the EEA's 2009 Greenhouse gas emission trends and projections in Europe report.

5.8. Methodology used for GHG emissions projections presented in this report

Information presented in this section for the EU-15 and EU-27 is an aggregation of individual Member State information²⁵².

Detailed descriptions of the methodologies used to generate individual Member State projections, as well as sensitivity analysis, uncertainty analysis and assumptions are presented in individual Member State National Communications and are not replicated in

²⁵² As reported to the European Commission between 15th March and 15th May 2009 under the EU's Monitoring Mechanism Decision 280/2004/EC Article 3.2. For individual sources, see EEA (2009), EEA Report: GHG Trends and Projections in Europe. Updated information was not made available for Hungary and Poland within this period and is therefore taken from older submissions, as reported in EEA (2008), GHG Trends and Projections in Europe EEA Report No 5/2008.

detail in the EC’s National Communication. Appendix E does however contain a summary of Member State modelling approaches and quality assurance procedures including sensitivity and uncertainty analysis where available. Section 5.8.7 also contains an analysis of the consistency of key assumptions used by Member States to generate their projections.

Reporting of projections and related information for the EU is dependent upon the timely submission of relevant data from Member States. The approach used to aggregate Member State projections is detailed below.

5.8.1. Starting year for projections

The UNFCCC guidelines for National Communications (1999) indicate that the starting point for the ‘with existing measures’ and ‘with additional measures’ projections should be the last year of inventory data (i.e. 2007 for the 5th National Communication). The starting point for EU projections is variable due to the aggregation of Member State projections.

Member States present projections relative to historic data; it may be assumed that the latest year of historic data presented is the starting point for the projections. This so-called ‘reference year’ for projections presented by each Member State is detailed in Table 5—4. Many Member States have been unable to use the 2007 inventory data as the starting point to generated projections due to the cut off date used to prepare the EC’s 5th National Communication (15th May 2009).

Table 5—4 Projections reference year presented by Member States

| Member State | Reference year |
|---|----------------|
| Bulgaria | 2000 |
| Hungary | 2001 |
| Austria, Germany, Latvia, Poland, Portugal, Sweden | 2005 |
| Belgium, Denmark, Estonia, Finland, France, Luxembourg, Netherlands, Romania, Slovakia, Spain, United Kingdom | 2006 |
| Cyprus, Czech Republic, Greece, Ireland, Italy, Lithuania, Malta, Slovenia | 2007 |

EU-15 and EU-27 aggregated projections for the ‘with existing measures’ and ‘with additional measures’ scenarios are however presented relative to the latest inventory data available, as reported in 2009.

The UNFCCC guidelines for National Communications (1999) indicate that the starting point for the ‘without measures’ scenario should be 1995 or an earlier year. As a ‘without measures’ was provided for 10 Member States only, an alternative methodology has been used to generate a ‘without measures’ projection for the EU, as described in Section 5.4. The year 2000 was chosen as the starting year for this scenario since the European Commission launched its first Climate Change Programme in that year. The approach makes use of Member State estimates of the impact of policies and measures for the years 2010, 2015 and 2020 and may therefore also reflect policies that were introduced prior to 2000.

5.8.2. Projections adjustment: starting year

In order to correct for any inconsistencies between projected emissions reported by Member States and the latest available inventory data, Member States' projected emissions have been adjusted at a sectoral level where the deviation between the total emission (excluding LULUCF) for the reference year and the latest available inventory data for that year is more than 3 %. The adjustment ensures that the relative progress between the reference year and the year for which projections are reported remains constant. For Member States where this applies, the proportion that the emission deviates by is calculated for each sector and applied to the reported projection by using the formula illustrated below. The adjustment has, been applied only to the German and Bulgarian projections.

Illustration 5-28 Projections adjustment method

$$\text{Projection}_{\text{adjusted}} = \text{Projection}_{\text{submission}} \times \frac{\text{Emissions reference year}_{\text{GHG inventory}}}{\text{Emissions reference year}_{\text{submission}}}$$

Where:

Projection_{adjusted} = as used in this chapter where the deviation between reference year emissions and latest available inventory data is greater than 3%.

Projection_{submission} = as reported by the country in its most recent submission.

Emissions reference year_{submission} = as reported with the latest available projections.

Emissions reference year_{GHG inventory} = as reported in:

- the review report of the initial report under the Kyoto Protocol if the reference year selected is the Kyoto base year;
- the 2009 greenhouse gas inventory submitted to UNFCCC, if the reference year selected is not the Kyoto base year.

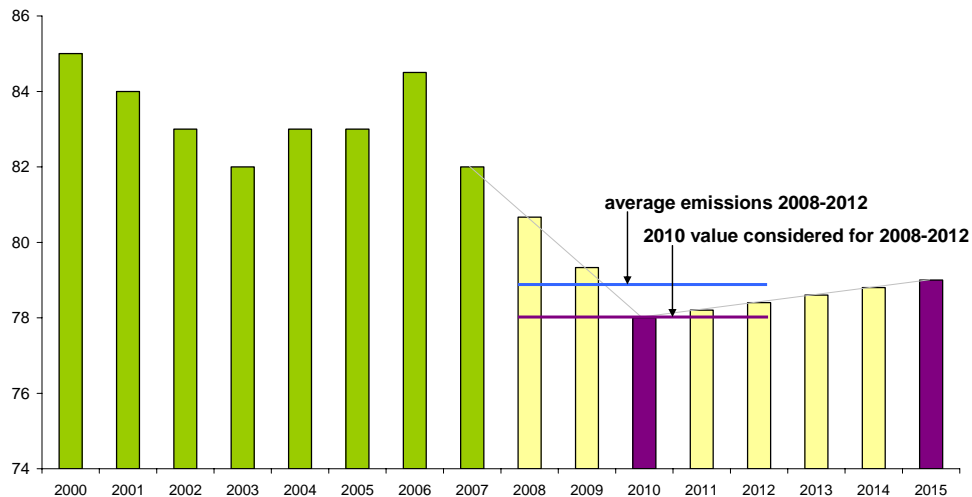
5.8.3. Projections adjustment: 2010 vs 2008-2012

Some Member States present projections for the average of the Kyoto commitment period 2008-2012 while others present projections for the year 2010 specifically. Where Member States have provided projections for the average of the years 2008-2012, GHG projection totals have been calculated for the year 2010. This has been done by using the latest 2007 inventory, average projection reported for the years 2008-2012 and the projection for the year 2015. This adjustment has been carried out for the overall projections, by sector

projections, by gas projections and the by gas by sector projections in Appendix D. 2010 emissions were calculated based on this formula:

$$2010 = \frac{\text{Average}(2008 - 2012) - 0.2 \times (2007) - 0.12 \times (2015)}{0.68}$$

Illustration 5-29 Difference between 2010 projections and average 2008-2012 projections



5.8.4. Policies included in the projections scenarios

EU-15 and EU-27 projections presented in this section are aggregated from individual Member States submissions. Projections for the ‘with existing measures’ and ‘with additional measures’ scenarios therefore include a variety of measures depending on the status of implementation of EU initiated policies in different Member States and programmes of measures developed independently in individual Member States. Measures included in the EU ‘with existing measures’ and ‘with additional measures’ scenarios are not therefore indicated in this section.

5.8.5. Completeness of projections

Not all Member States provide projections by gas for each of the key source sectors.

Projections for the year 2030 and projections for the Forestry sector are not reported by most Member States. Member States do not report projections of carbon monoxide under any European or international legal obligations. It has not therefore been possible to present this information at the EU level.

Projected removals from LULUCF and projected emissions from international bunker fuels are available for only a selection of Member States (19 and 11 respectively). It has not therefore been possible to present projections for the EU-15 or EU-27. Projections have

however been aggregated for those Member States for which data is available and presented relative to inventory data for the same group of Member States.

Gapfilling has been carried out where minor gaps exist in the projections reported by Member States. The following methods were used to gapfill:

- Where a ‘with additional measures’ projection has not been provided, the ‘with additional measures’ projection has been gap filled with the ‘with existing measures’ projection, to enable an EU level ‘with additional measures’ projection to be produced.
- Where a sectoral or gas breakdown is available for one scenario and unavailable for another, the available proportions from the former are applied to the national total of the latter.
- Where total projections are provided but no gas or sectoral breakdown is provided, the relevant breakdowns from 2007 inventory data are applied to the projections national total to generate gas and sector breakdowns.

‘Without measures’ projections are available for 10 Member States only. An alternative approach was therefore used to generate EU level projections for this scenario. The methodology used is described in Section 5.4.

5.8.6. Completeness of estimates of policy impacts

Member State estimates of the impact of individual policies and measures that are used in Section 5.6. This data source was chosen in preference to EU estimates to ensure consistency with Member States projections presented in this section. EU estimates of the impact of EU initiate policies are provided in Section 4.

It should be noted, however, that these estimates are incomplete as not all Member States quantify the impact of all policies and measures. Estimates are therefore likely to be an underestimate of the total impact of policies and measures. Where possible, therefore, the total effect of policies has also been derived by subtracting national WOM, WEM and WAM projections. This approach is also limited as very few Member States provide a WOM scenario.

5.8.7. Consistency of assumptions for projections

It is difficult to immediately compare and differentiate inconsistencies across some Member State projections. In particular, fundamentally different modelling approaches such as bottom-up cost optimization, top-down macroeconomic or CGE (computable general equilibrium), or combinations of approaches (within the same model or within different sectors) have been used. A summary of Member State methodologies is provided in Section 4.

However, it is possible to draw some high-level conclusions around the consistency of key underlying assumptions that are applied throughout the various models. Some of the

principal assumptions used by Member States in their modelling of emission projections are reported in Table 5—5 below.

The easiest parameter to consider for consistency is that of international oil price since this is a global parameter and therefore common to all MS. It is clear from MS reporting that there is considerable variability in projected oil price. Forecasting oil prices out to 2020 is highly uncertain; however the degree of variability across MS for which data was available is large. Mean oil price across these data is around €21/GJ, with upper and lower bounds of €84 and €7/GJ respectively and a standard deviation of €23/GJ. Depending on the modelling approach used it follows that differences in oil price will affect the energy consumption in each MS and therefore emission projections.

Gross Domestic Product growth rate is an important driver of emissions projections, however comparing MS reported values for consistency is difficult due to genuine differences in economic projections. In addition, the data resolution (reporting values for 2010 and then 2015) for this exercise makes it difficult to consider which nations have included the affects of the current global economic downturn in their projections. Communications with MS during the compilation of the EEA Trends and Projections report identified which MS had included the impacts of the global downturn in their emission projections. Those confirming they had included this impact are: Belgium, Czech Republic, Finland, Greece, Ireland and Italy. Intuitively those MS that included the economic effects of the downturn could be expected to show a low growth rate in 2010 compared to higher growth in 2015 assuming the downturn has passed. This profile is shown by Ireland, however the same is true for Lithuania, Portugal, Slovakia and the United Kingdom. The remaining MS shown in the table below report stable growth rates across the reporting period. Since we do not know how including the impacts of the recession would have affected emissions projections for those MS that have not done so previously, we cannot conclude how large an inconsistency this represents. However, based on the profiles considered here it appears that including its affects might not show as strongly in the GDP growth rate for 2015 relative to 2010.

Calculating the change in energy demand per capita in each MS over the period 2010 to 2020 provides an interesting metric with which to infer energy efficiency projections in different MS. The metric ranges from an increase in energy demand of 27 % (Lithuania) to a decrease of 7 % (United Kingdom) across the MS and on average shows an increase of 7 %.

Climatological parameters (represented in the form of Heating Degree Days - HDDs) appear to have been applied consistently across the MS for values are reported. Most MS assume a stable value for the reporting time period and considering the states of Latvia, Estonia²⁵³ and Finland, which share borders around the north-eastern Baltic sea, HDD values appear very consistent (less than 10% difference between maximum and minimum values across these states).

²⁵³ We have assume that values reported in 2015 and 2020 are typographical errors

This simple analysis shows that there appear to be some fundamental differences in the underlying parameters assumed by EU MS for emission projection modelling. However the analysis does not show the extent to which MS projections and therefore the EU aggregate projection are affected by the variation in MS assumptions. In some cases this variation is legitimate and leads to projections that more accurately reflect expected changes in key emission drivers (e.g. as a result of differing levels of economic growth in different MS). In other cases MS choice of varying assumptions may lead to projections which do not consider those key drivers in a consistent way e.g. whether the impact of the economic crisis is taken into account or what is assumed for international oil price. As a result, the EU is unable to report on the key assumptions underlying the EU aggregated projections.

Further work should be carried to assess the impact of inconsistent assumptions with a view to providing guidance to MS in future aimed at improving the consistency of assumptions.

Table 5—5 MS assumptions for emissions projection modelling

| Member State | Gross Domestic Product growth Rate | | | International oil prices | | | Heating Degree Days | | | Change in energy demand per capita |
|----------------|------------------------------------|------|------|--------------------------|------|-------|---------------------|-------|-------|------------------------------------|
| | Annual growth rate (%) | | | €per GJ (Gigajoule) | | | Annual HDD | | | % |
| | 2010 | 2015 | 2020 | 2010 | 2015 | 2020 | 2010 | 2015 | 2020 | 2010 - 2020 |
| Austria | 2.5 | 2.3 | 2.3 | 14.9 | 14.9 | 14.9 | 3,245 | 3,187 | 3,133 | 13% |
| Belgium | 3.0 | 2.5 | 3.5 | 7.3 | 7.8 | 8.2 | 3,570 | 3,570 | 3,570 | -3% |
| Bulgaria | n/a | n/a | n/a | n/a | n/a | n/a | - | - | - | n/a |
| Cyprus | n/a | n/a | n/a | n/a | n/a | n/a | - | - | - | n/a |
| Czech Republic | 3.0 | 2.5 | 3.5 | 7.3 | 7.8 | 8.2 | 3,570 | 3,570 | 3,570 | -3% |
| Denmark | n/a | n/a | n/a | 51.3 | 43.6 | 44.9 | - | - | - | n/a |
| Estonia | 6.8 | 4.7 | 2.7 | 8.3 | 8.3 | 8.6 | 4,444 | 4 | 4 | 12% |
| Finland | 4.0 | 2.2 | 2.0 | 10.4 | 10.0 | 10.6 | 4,489 | 4,418 | 4,347 | 15% |
| France | 2.1 | 2.1 | 2.1 | 9.8 | 9.8 | 9.8 | n/a | n/a | n/a | -13% |
| Germany | 2.1 | 1.7 | 1.6 | 7.2 | 7.3 | 8.1 | - | - | - | -2% |
| Greece | 2.6 | 2.5 | 2.5 | 8.63 | 8.99 | 11.13 | 1,269 | 1,269 | 1,269 | 17% |
| Hungary | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Ireland | 2.8 | 5.2 | 4.7 | 10.8 | 12.3 | 12.9 | na | na | na | 4% |
| Italy | 1.6 | 1.7 | 1.7 | 49.9 | 52.9 | 55.0 | - | - | - | 9% |

| Member State | Gross Domestic Product growth Rate | | | International oil prices | | | Heating Degree Days | | | Change in energy demand per capita |
|----------------|------------------------------------|------|------|--------------------------|------|------|---------------------|-------|-------|------------------------------------|
| | Annual growth rate (%) | | | €per GJ (Gigajoule) | | | Annual HDD | | | % |
| | 2010 | 2015 | 2020 | 2010 | 2015 | 2020 | 2010 | 2015 | 2020 | 2010 - 2020 |
| Latvia | 8.0 | 5.5 | 5.0 | n/a | n/a | n/a | 4,184 | 4,184 | 4,184 | 23% |
| Lithuania | -2.6 | 4.5 | 4.5 | 23.4 | 24.4 | 25.5 | 4,176 | 4,176 | 4,176 | 27% |
| Luxembourg | 2.7 | 5.3 | 4.4 | n/a | n/a | n/a | - | - | - | -2% |
| Malta | 2.5 | 2.9 | 2.7 | n/a | n/a | n/a | - | - | - | 10% |
| Netherlands | n/a | n/a | n/a | n/a | n/a | n/a | - | - | - | n/a |
| Poland | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Portugal | 1.7 | 1.9 | 2.1 | 8.0 | 8.4 | 8.8 | 1,268 | 1,268 | 1,268 | 16% |
| Romania | n/a | n/a | n/a | n/a | n/a | n/a | - | - | - | n/a |
| Slovakia | 6.5 | 6.3 | 4.7 | n/a | n/a | n/a | - | - | - | 15% |
| Slovenia | 4.6 | 3.4 | 2.0 | 7.17 | 6.65 | 6.98 | 3,053 | 3,053 | 3,053 | 11% |
| Spain | 4.6 | 2.8 | 3.0 | n/a | n/a | n/a | - | - | - | 5.5% |
| Sweden | 2.6 | 2.6 | 2.3 | 84.0 | 84.0 | 84.0 | 100 | 100 | 100 | -2% |
| United Kingdom | 1.3 | 2.4 | 2.3 | 41.0 | 42.6 | 44.2 | 93 | 93 | 93 | -7% |

Source: MS reporting to the EEA based on the Monitoring Mechanism

6. VULNERABILITY ASSESSMENT, CLIMATE CHANGE IMPACTS AND ADAPTATION MEASURES

Key developments

- Since the 4th National Communication, there has been much progress on assessing the impacts of climate change and developing adaptation policy in Europe.
- The Fourth Assessment Report (4AR) of Intergovernmental Panel on Climate Change (IPCC) issued in 2007 provided conclusive evidence that climate change is caused by anthropogenic emissions of greenhouse gases and provided new impetus to climate change research and policy development in Europe. European researchers have made a significant contribution to this effort by supporting the process and providing new scientific evidence that has fed into the assessment.
- Since the IPCC 4AR publication, greater rates of change have been observed. The 2008 report by the European Environment Agency (EEA), the EC Joint Research Centre (JRC-IES) and the World Health Organisation Europe has provided new evidence that climate change will have significant implications across Europe. A number of new research programmes are being funded to improve our understanding of adaptation²⁵⁴.
- The EC has adopted a more coordinated approach on policy development and published a White Paper in April 2009 to define the policy direction of the EC in the forthcoming years. The EC is currently working on the design of an Adaptation Framework to reduce the EU's vulnerability to the impacts of climate change. This framework will complement and strengthen the actions taken by the EU Member States.
- The EC has advanced a number of initiatives to support developing countries in their efforts to adapt to climate change. For instance, the Global Climate Change Alliance, launched in 2007 to deepen cooperation between the EC and developing countries, renews the EC's commitment to mainstream climate change into development cooperation and provides technical and financial support for adaptation primarily in the Least Developed Countries (LDCs) and Small Island Developing States (SIDS).
- The European Commission is developing a European "Clearing house" of the most up-to-date and state-of-the-art information - an IT tool and database on climate change impacts, vulnerability and best practices on adaptation.

²⁵⁴ See section 8 for further details.

6.1. Overview

Both public and political recognition of the need to take urgent action to combat climate change has emerged in recent years. The EC has shown global leadership on climate change and is committed to maintain this role. Reducing emissions of greenhouse gases is of paramount importance to avoid dangerous climate change. The EC also recognises that some impacts are unavoidable because of past emissions and Europe must take action to understand these impacts, develop adaptation responses and assist developing countries in strengthening their capacity to cope.

Since the 4th National Communication, research on the impacts of climate change, vulnerability and adaptation options has become a high priority for Europe. The development of a more coordinated approach for identifying appropriate adaptation responses in Europe and assisting the most vulnerable countries in coping with climate change has been a major focus of work over the past four years. Some of the key developments are highlighted at the start of this section.

Adaptation is already taking place in the EU. Since the publication of the EU 4th NC in 2006, the European Community and its Member States have significantly increased the number of actions for coping with the impacts of climate change at international, national, local levels and across sectors:

- International cooperation on adaptation has been strengthened to assist the most vulnerable countries around the globe in coping with climate change.
- New research has provided new insights into the impacts of climate change to Europe and potential adaptation responses.
- More specific plans have been incorporated into European and national policies for a number of sectors of the economy - for example the Water Framework Directive (2000/60/EC)²⁵⁵ to improve water quality, the Floods Directive (2007/60/EC)²⁵⁶ aimed at reducing damage from floods and the European Commission's Communication on Water Scarcity and Droughts (COM/2007/0414 final)²⁵⁷.
- A more proactive risk management approach has replaced reactive disaster relief and important lessons have been learnt from past extreme climate events. A prominent example is the implementation in several countries of early warning systems for heatwaves.
- National action plans are being developed for identifying country-level responses to adaptation (for example in Denmark, Finland, France, Germany, Hungary, Netherlands, Spain, Sweden and the United Kingdom).

²⁵⁵ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32000L0060:EN:NOT>

²⁵⁶ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32007L0060:EN:NOT>

²⁵⁷ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52007DC0414:EN:NOT>

- Regions and local governments within the European Member States are also developing adaptation strategies.

However, the EC recognises that an increased effort is required to reduce the vulnerability of different regions of the EU and mainstream adaptation in EC policies, as well as assist developing countries in coping with climate change. The EC is therefore developing actions on both fronts through an Adaptation Framework, which will provide an integrated and coordinated approach at the EC level, and strengthening international cooperation on adaptation through the Global Climate Change Alliance and a number of new initiatives aimed at developing countries.

The following sections outline some of the main findings on vulnerability, impacts and adaptation and some of the key current and planned activities that have been developed since the 4th National Communication.

6.2. Expected impacts of climate change in Europe and vulnerability assessment

Significant changes in climate and its impacts are already visible in Europe. Increasing temperatures, changing precipitation, rising sea level, more intense and frequent extreme weather events and melting glaciers, ice sheets and Arctic sea ice are some of the challenges for Europe already triggered by climate change.

Recent observations in Europe show that temperature has increased more than the global average. Precipitation has increased in northern Europe and decreased in some parts of southern Europe. Hot extremes have become more frequent and more intense, whilst cold extremes have decreased over the past 50 years.

Climate scenarios indicate that significant warming is expected in the coming decades, which is likely to be significant in winter in the north of Europe and in summer in southern and central Europe. Mean annual precipitation is projected to increase in the north and decrease in the south with significant effects on crop suitability and productivity throughout Europe. Even if emissions of greenhouse gases stop today, these changes would continue for many decades, and in the case of sea level for centuries as a result of past emissions of greenhouse gases.

As a result, climate change will amplify the regional differences of Europe's natural resources and assets. Many regions and sectors across Europe are vulnerable to climate change but the impacts vary widely across regions and sectors in Europe. Northern and some western regions of Europe may experience beneficial impacts, particularly within agriculture, for some period of time. Other regions, including south-eastern Europe, the Mediterranean and central European regions are the most vulnerable to climate change. Considerable adverse impacts are projected to occur on natural and human systems that are already under pressure from other drivers, such as land use. Some of the most vulnerable regions in Europe are described in the figure below.

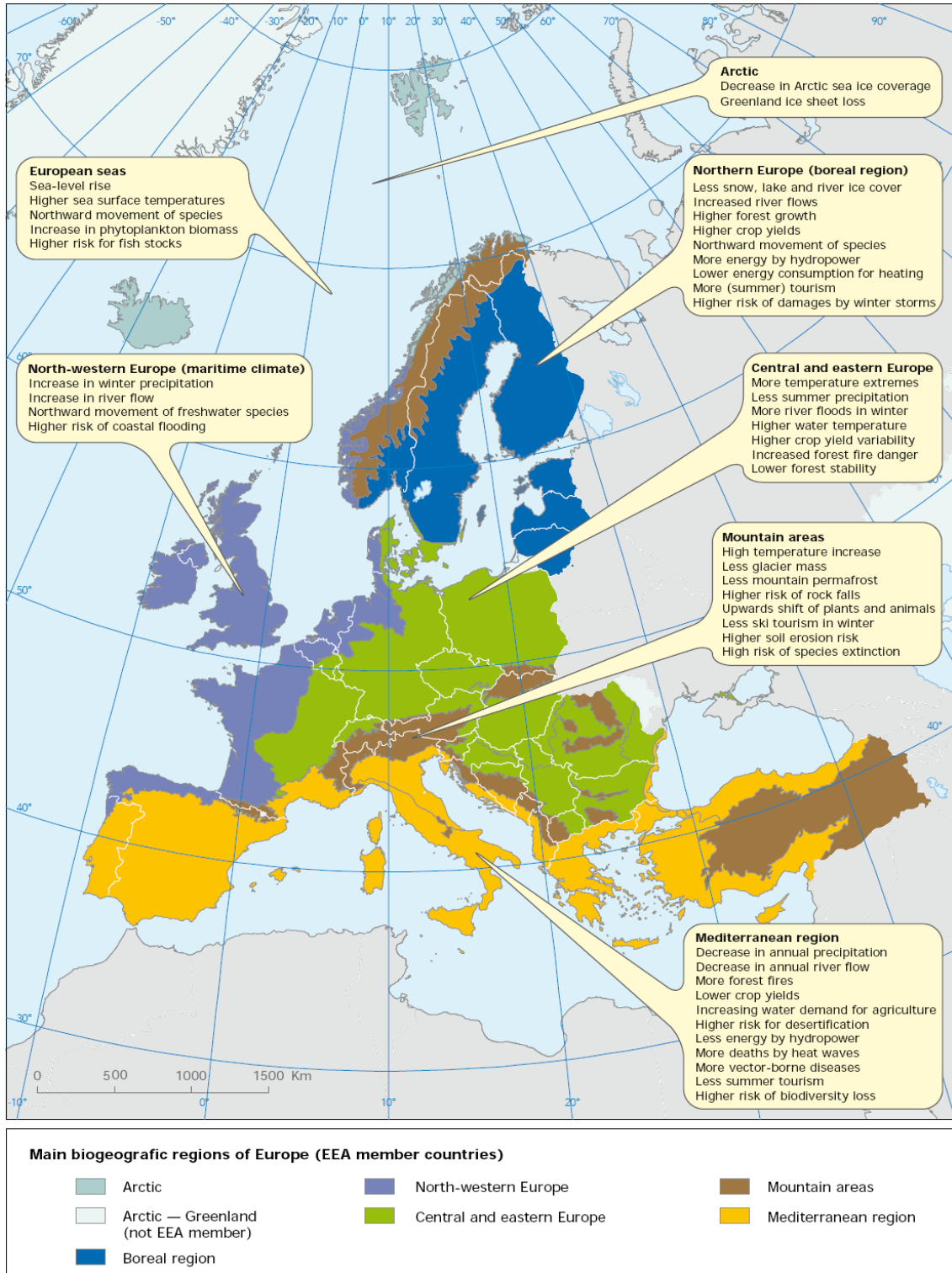
Projected climatic changes will affect all sectors of the economy, including crop yields, soil fertility, forest health and productivity, marine ecosystems, biodiversity, supply and demand of energy, infrastructure, water resources and human health. The changes in the

climate will therefore have economic implications for the Member States of the EU. Early preventive actions bring clear economic, environmental and social benefits by anticipating potential impacts and minimising threats to natural and human systems.

6.2.1. Observed and projected patterns of climate change across the EU

Research at EC level has advanced considerably since the 4th National Communication, and has provided a significant contribution to the IPCC assessments (for more information see section 8). In 2008 a report by European Environment Agency (EEA), the EC Joint Research Centre (JRC-IES) and the World Health Organisation Europe showed that greater rates of change have been observed since the IPCC 4AR and that the projected trends will have impacts across Europe.

Illustration - 6-1 Key past and projected impacts and effects on sectors for the main biogeographic regions of Europe



Source: Impacts of Europe's changing climate - 2008 indicator-based assessment. EEA Report No 4/2008, JRC Reference Report No JRC47756

The EEA report follows a previous effort published by the EEA in 2004 and covers about 40 indicators compared to 22 in 2004²⁵⁸. The report also identifies key challenges that need to be addressed to enable Europe to understand fully the implications of climate change and adapt successfully. Some of these key challenges are summarised in italics below.

Key challenges for successful adaptation in Europe

Improved monitoring and reporting

More spatially detailed information is needed to develop adequate adaptation strategies in Europe. The availability of observed and projected data and information on climate change impacts across Europe has improved in recent decades but the availability of data differs considerably between regions. Improved monitoring and reporting could be achieved through:

- *A more coordinated approach and Europe-wide monitoring programmes of climate change indicators.*
- *A European agreement on the definition of key climate change indicators, including extreme weather events (for example 'floods' and 'droughts') and on operational ways of tracking impacts through multiple sectors.*

Improved attribution methods for impact assessments

There is a need to improve our ability to detect climate change signals from other (e.g. societal) factors and separate anthropogenic forcing from natural forcing for different climate change variables.

Improved understanding of socio-economic and institutional aspects of vulnerability and adaptation

A better understanding of the socio-economic and institutional aspects of vulnerability and adaptation, including costs and benefits, is urgently needed. Very few studies have assessed the effectiveness of adaptation measures for different time horizons.

Improved and coordinated scenario analysis of impacts and vulnerability

Regular interaction is needed between the climate modelling community and the user community that analyse impacts, vulnerability and adaptation to develop climate change scenarios appropriate for the development of regional and local adaptation measures. European research projects could adopt the same contrasting set of climate scenarios for global development and make use of regional climate projections as they become available. Research on climate-change impacts both in the medium term (decades) and long term (centuries) is needed.

²⁵⁸

Impacts of Europe's changing climate -2008 indicator-based assessment. EEA Report No 4/2008, JRC Reference Report No JRC47756

More information on good practices and avoiding mal-adaptation²⁵⁹

A number of issues surrounding adaptation need to be further explored, including:

- *Understanding how to mainstream adaptation into policies across sectors, particularly with regard to water management, energy supply, biodiversity protection, health and agriculture*
- *Good practices to address the cross-sector and transboundary nature of adaptation*
- *Understanding of mal-adaptation*
- *Assessment of adaptation costs across all sectors.*

Future activities should also consider European neighbouring countries and overseas territories.

Develop information exchange mechanisms

The increasing amount of data and information on climate change impacts, vulnerability and adaptation could be made available through the establishment of a European “Clearing house”. The information could include data on observed and projected climate changes, information on vulnerable systems, indicators, tools for impacts assessments, and good practice adaptation measures.

Source: Impacts of Europe's changing climate -2008 indicator-based assessment. EEA Report No 4/2008, JRC Reference Report No JRC47756

Observed and projected changes include²⁶⁰,

Temperature

- Global mean temperature has increased by 0.8 °C compared with pre-industrial times²⁶¹; Europe has experienced greater warming than the global average²⁶².
- This trend is predicted to continue: projections suggest temperature increases between 1 and 5.5°C by the end of the century– an increase higher than the projected global warming of 1.8 – 4°C.

Extreme events

²⁵⁹ Maladaptation is usually understood to be a response that may exacerbate exposure to climate risks and therefore be more harmful than helpful.

²⁶⁰ Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 23-78, 7-22

²⁶¹ For land and oceans, and by 1.0 °C land alone

²⁶² 1.0°C land and oceans and 1.2 °C land alone

- In Europe, more frequent and intense hot extremes and a decreasing number of cold extremes have occurred over the past 50 years and this trend is projected to continue.
- There is no clear trend in the observed frequency and intensity of storms. The strength of the heaviest storms is projected to increase, whilst the frequency will be slightly lower.
- Several major droughts in recent decades have occurred in Europe. Examples of severe droughts include drought in Cyprus in 2008, which led to an almost complete failure of crops; the severe spring drought of 2007 across much of the EU; the 2005 drought in the Iberian Peninsula and the drought associated with the summer 2003 heat wave, which is estimated to have caused EUR 1012 billion²⁶³. Climate projections indicate an increase in droughts particularly in southern Europe.
- Flooding and storm damage events have occurred frequently in Europe in recent years. Among those causing significant damage and deaths have been Winter storm Emma in 2008 which resulted in 14 fatalities, the 2007 floods in the United Kingdom which ranked within the top 10 costliest natural disasters world wide that year, resulting in 5 deaths, and Winter storm Erwin in 2005 which resulted in overall losses of US\$5,800m²⁶⁴.
- Economic losses from recent floods are substantial: the estimated losses in central Europe in 2002 were EUR 17.4 billion. Economic costs of coastal flooding (assuming no adaptation) are estimated in the range of EUR 12-18 billion per year for Europe in 2080. Floods are projected to occur more frequently in many regions, particularly in winter and spring.

Precipitation

- Changes in precipitation show more spatially variable trends across Europe. Annual precipitation has increased in northern Europe by 10 to 40 % and decreased up to 20 % in some parts of southern Europe during the 20th century.
- Mean annual precipitation is projected to increase in northern Europe and decrease in the south.

Sea-level rise

- Global mean sea-level rise has increased to 3.1 mm/year over the past 15 years, compared with 1.7 mm/year in the 20th century. Sea-level rise varies across European seas.

²⁶³ SEC(2007) 849 COMMISSION STAFF WORKING DOCUMENT Accompanying the GREEN PAPER Adapting to climate change in Europe – options for EU action {COM(2007)354 final

²⁶⁴ Munich Re: NatCen Database. National Disasters 2005: 10 costliest Natural Disasters by overall losses. http://www.munichre.com/en/ts/geo_risks/natcatservice/annual_statistics/default.aspx

- The IPCC Fourth Assessment Report estimates an increase in sea level rise of up to 0.59 m by 2100 but this may be too low, due to rapid changes occurring at an increasing rate at the poles

Cryosphere

The reduction in Arctic sea ice has accelerated and reached a record low in September 2007 of about half the normal minimum in the 1950s. It is predicted that Arctic sea ice may disappear completely during the height of the melting season. This will create positive feedbacks that will further increase climate change.

- European glaciers in the Alps have lost two thirds of their volume since 1850 and their retreat has accelerated over the last few decades. This trend is expected to continue, causing damages to infrastructure, changes in river flows, freshwater supply, irrigation and power generation.
- Mountain permafrost is decreasing. Melting permafrost is expected to contribute to increasing the destabilisation of mountain rock-walls, the frequency of rock falls and cause maintenance problems in high-mountain infrastructure.

6.2.2. *Impacts of climate change in the EU*

Recent work has emerged on the potential impacts and economic effects of climate change in Europe^{265, 266}. These studies show the projected changes in climate (including extremes), compounded by other environmental changes and socio-economic development. Many of the climate change impacts are projected to lead to economic costs ('losses'), though there will also be some economic benefits (gains). These studies also show a strong distributional pattern of effects predicted across Europe, with a significant trend towards more negative potential effects in south-eastern Europe and the Mediterranean. In northern and western Europe a more complex balance between negative and positive effects is projected for moderate levels of climate change.

Some of the key impacts on Europe are described below.

- **Human Health:** More than 70,000 excess deaths were reported in 12 European countries during the 2003 heatwave. Heatwaves are expected to become more common, the mortality risk increases by between 0.2 and 5.5 % for every 1 °C increase in temperature above a location-specific threshold. Vector-borne diseases are expected to increase in the near future as insects move to higher altitudes and latitudes. Any benefits from reduced cold-related mortality will be outweighed by heatwaves, vector and food-borne diseases, without adaptation.

²⁶⁵ PESETA (2008) Projections of economic impacts of climate change in sectors of Europe based on bottom-up analysis - Coastal Systems: Adaptation Assessment Results; Julie A. Richards & Prof Robert J. Nicholls

²⁶⁶ EEA 2007. Climate change and water adaptation issues. EEA Technical report 2/2007. 114 pp. European Environment Agency, Copenhagen. Available at: http://reports.eea.europa.eu/technical_report_2/2007/2/en/eea_technical_report_2_2007.pdf

- **Animal and plant health:** Changing weather patterns has resulted in significant differences for plant and animal species in Europe in recent years, with further behaviour and health changes predicted in the coming years. Key changes have already been seen in plant and animal species: the length of the growing season of several agricultural crops has increased at northern latitudes, favouring the introduction of new species that were not previously suitable, but there has been a shortening of the growing season locally in the south. In the future, some species will benefit from changing environmental conditions; however these changes will be beyond the adaptive capacity of many other species. Projections suggest that between one fifth and one third of European species could be at increased risk of extinction if global mean temperatures rise more than 2 to 3 °C above pre-industrial levels^{267,268}.
- **Agriculture:** The length of the growing season of several agricultural crops has increased at northern latitudes, favouring the introduction of new species which could provide opportunities in this sector. However the shortening of growing season in southerly latitudes continues. The variability of crop yields has increased due to extreme climatic events. Increases in water demand for agriculture (by 50–70 %) has occurred mainly in Mediterranean and is projected to continue here. This is likely to result in increased competition for water resources between sectors and uses.
- **Ecosystems and forestry:** By the late 21st century, plant species are projected to have shifted several hundred kilometres north, forests will contract in the south and expand in the north. The rate of this change, exacerbated by landscape fragmentation, may be too great for many species to adapt and 60 % of mountain plant species may face extinction. Climate change will lead to substantial shifts in vegetation distribution in forest locations; drought and warm winters increase pest populations weakening forests. Projected temperature rises will lead to an increase of forest fires.
- **Soil:** Information on the impacts of climate change on soil and the various related feedbacks is very limited and there is a need to establish appropriate monitoring schemes. Changes in the bio-physical nature of soil are likely due to rising temperatures, changing precipitation intensity and frequency and more severe droughts leading to a substantial increase in CO₂ emissions.
- **Water resources:** Increased temperatures of lakes and rivers (by 1–3 °C during the 20th century) have resulted in decreases in ice cover on lakes and rivers by 12 days on average in the last century in Europe. These changes can be at least partly attributed to climate change. Lake and river surface water temperatures are projected to increase further with increasing air temperatures and significant effects on water quality.
- **Marine environment and fisheries:** Climate change impacts will be severe on marine ecosystems. Climate change is expected to result in a number of changes in the abiotic

²⁶⁷ IPCC, 2007. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Parry, M. L.; Canziani, O. F.; Palutikof, J. P.; van der Linden, P. J. and Hanson, C. E. (eds.), Cambridge University Press, Cambridge, UK.

²⁶⁸ Ovejoy, T. and Hannah, L., 2005. Climate change and biodiversity. Yale University Press. London, UK.

(i.e. sea level, temperature, acidity, salinity, thermohaline circulation, stratification, light) and biotic (i.e. primary production, food webs, etc) conditions of the sea. Impacts include more frequent coastal flooding, to increased acidification of the marine environment and changes in distributions of fish stocks.

- A separate study²⁶⁹ on behalf of the European Commission DG Environment, looked at the impacts of climate change and employment. The first part of the study examines the potential consequences for employment of global warming in Europe - which have already begun and will continue. The main finding is that even moderate climate change will affect economic activity and employment in Europe, with some regions and economic sectors being particularly vulnerable. Increased warming will be likely to have very damaging consequences. In relation to this, climate change policies to help mitigate and adapt to the effects of climate change will have a small net (potentially positive) effect on employment. However, there are likely to be major distributional effects across different industries and regions of Europe that will need to be addressed to reduce social impacts.

6.3. Adaptation measures and EC level actions on adaptation

In recent years, the EC has adopted a more coordinated approach to integrate adaptation in all relevant EC policies whilst increasing awareness and ensuring the full involvement of all administrations and civil society.

Due to the regional variability and severity of climate impact, most adaptation measures will be taken at national, regional or local level. However, adaptation can be supported and strengthened by an integrated approach at EC level. The EC has an important role to play to:

- ensure that the most vulnerable regions of the EU will be able to adapt;
- address impacts of climate change that transcends the boundaries of individual countries (e.g. river and sea basins and bio-geographic regions);
- facilitate adaptation in sectors (e.g. agriculture, water, biodiversity, fisheries, and energy networks) that are closely integrated at EC level through the single market and common policies.

The European Commission believes that climate change should be mainstreamed in all policy areas and development activities. Over the last few years, the European Union has made significant progress in incorporating climate change adaptation in development policy and programmes and in a number of policy areas, such as flooding and coastal zone management.

²⁶⁹ ETUC (2007) Climate Change and employment: Impact on employment in the European Union-25 of climate change and CO₂ emission reduction measures by 2030 <http://www.etuc.org/a/3676>

6.3.1. *Towards an EU Framework for Action: Climate Change Adaptation White Paper*

A White Paper on Adapting to Climate Change: Towards an EU framework for action was published in April 2009²⁷⁰ – signifying the intention of the EC to lay out policy and propose action on climate change adaptation.

The White Paper was the result of a process, which started in 2007 triggered by concerns about the impacts of climate change within the EU and the need to define a strategic approach to climate change. A Green Paper on Adaptation²⁷¹, adopted on 29th June 2007, set out the risks climate change poses to Europe and made recommendations for how adaptation should take place at the European, national and local levels. The Green Paper built on the EC Climate Change Programme, which developed all the necessary elements of a EC strategy to implement the Kyoto Protocol.

The steps that led to the development of the White Paper and the EC integrated approach on adaptation are outlined below.

Step 1. Green Paper “Adapting to climate change in Europe– options for EU action”

The Green Paper “Adapting to climate change in Europe – options for EU action” outlined the risks climate change poses to Europe and made recommendations for how adaptation should take place at the European, national and local levels. The Green Paper outlined four areas for adaptation action:

- (1) Early action in the EC - integrating adaptation into existing legislation, funding programmes and new policies in a variety of policy areas such as agriculture, rural development, industry and services, energy, transport, health, water, fisheries and ecosystems.
- (2) Integrating adaptation into external EC actions by promoting adaptation to climate change with all third countries by sharing adaptation policies between partners, with trade agreements used to promote green technologies and investment.
- (3) Reducing uncertainty by expanding the knowledge base through integrated climate research to base practical adaptation actions and measures on sound, scientific, technical and socio-economic information.
- (4) Involving European society, business and the public sector in the preparation of coordinated and comprehensive adaptation strategies by means of dialogue between affected parties, civil society and the EC.

Step 2- Public Debate

A public debate on adaptation was launched on 3rd July 2007. All interested parties came together to discuss the Green Paper, expressing concerns and suggesting changes and

²⁷⁰ http://ec.europa.eu/environment/climat/adaptation/pdf/com_2009_147_en.pdf

²⁷¹ COM/2007/0354 final <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52007DC0354:EN:NOT>

improvements. The public debate included public consultation, a web-based consultation, four regional workshops and a stakeholder conference. The extensive consultation identified priority areas for actions, including²⁷²:

- Environmental impacts - water management (including methods for tackling water shortages, water quality, flooding), biodiversity and ecosystems.
- Social impacts - health and diseases, infrastructure resilience, food security, social equity, migration.
- Economic impacts - agriculture and energy infrastructure.

The consultation suggested that the EC should also develop a clear and strong strategic framework for adaptation across all sectors, address cross-border issues and coordinate action across Europe.

Step 3 – White Paper and the EC integrated approach to adaptation

The White Paper on Adaptation to Climate Change was published in April 2009. The White Paper sets the scope of the *EU Adaptation Framework*, which aims to:

- complement and reinforce Member States actions, particularly through existing funding channels, the provision of accurate climate information and appropriate guidance;
- ensure that adaptation is integrated in important EC policy areas;
- promote solidarity between countries and regions.

The main objective of the EU Adaptation Framework is to strengthen the EU's resilience to the impact of climate change.

The White Paper adopts a phased approach. Phase 1 (2009-2012) will focus on four pillars of action and lay the groundwork for the preparation of a more comprehensive adaptation strategy to be implemented during Phase 2 commencing in 2012.

Phase 1 has four pillars of action:

- **Building a solid knowledge base for the EU on the impacts and consequences of climate change.** Sound data is vital in the development of climate policy. Uncertainties remain particularly as regards the availability of **accurate and detailed forecasts** on the impacts of climate change at regional and local levels and on the **costs and benefits** of adaptation measures. Strengthening the knowledge base will be a key part of the EU's Adaptation Strategy. A first step will be to establish a **Clearing-house Mechanism (CHM)** as an IT tool and database for exchanging information on climate change

²⁷² Results of the stakeholder consultation can be found at http://ec.europa.eu/environment/climat/adaptation/stakeholder_consultation.htm

impacts, vulnerabilities and best practices. The Clearing-house Mechanism is expected to be operational by 2011.

- **Integrating adaptation into EU key policy areas.** In view of the projected impacts on key sectors, adaptation strategies will need to be prepared outlining the necessary actions in each sector. The second pillar focuses on the integration of adaptation into sectoral policies at European level to reduce, the vulnerability of sectors such as: agriculture, forests, biodiversity, fisheries, energy, transport, water and health.
- **Employing a combination of policy instruments.** There is a need to further consider a combination of policy measures and examine the potential use of funding measures, market-based instruments, guidelines and public-private partnerships to ensure effective delivery of adaptation. There is scope for improving the uptake of adaptation action by Member States and for targeting better the use of available financial resources and instruments to encourage this. The recently adopted European Economic Recovery Plan (EERP) contains a number of proposals relating to climate change investments. Consideration should be given to the role of specialised Market Based Instruments (MBIs) and public-private partnerships should be encouraged with a view to the sharing of investment, risk, reward and responsibilities between the public and private sector in the delivery of adaptation action.
- **Strengthening international co-operation on adaptation.** The EU is committed to working with third countries to improve their resilience and capacity to adapt to climate change. In this context efforts will be stepped-up to mainstream adaptation into all of the EU's external policies. The White Paper will support the Commission's Communication for Copenhagen (COP 15, December 2009)²⁷³.

To support cooperation on adaptation, the European Commission intends to set up an Impact and Adaptation Steering Group (IASG). This group will be composed of representatives from the EU Member States involved in the formulation of national and regional adaptation programmes and will consult with representatives from civil society and the scientific community. The IASG will provide a coordinated approach to building the evidence base on the impacts of climate change, assessing the risks of climate change for the EU, the scope for increasing climate resilience and costing risks and opportunities.

Health and social policies

- *Develop guidelines and surveillance mechanisms on the health impacts of climate change by 2011.*
- *Step up existing animal disease surveillance and control systems.*
- *Assess the impacts of climate change and adaptation policies on employment and on the well-being of vulnerable social groups.*

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Communication from the commission to the European parliament, the council, the European economic and social committee and the committee of the regions "Towards a comprehensive climate change agreement in Copenhagen" and translations (January 2009)

Agriculture and forests

- *Ensure that measures for adaptation and water management are embedded in rural development national strategies and programmes for 2007-2013.*
- *Consider how adaptation can be integrated into the three strands of rural development and give adequate support for sustainable production including how the CAP contributes to the efficient use of water in agriculture.*
- *Examine the capacity of the Farm Advisory System to reinforce training, knowledge and adoption of new technologies that facilitate adaptation.*
- *Update forestry strategy and launch debate on options for an EC approach on forest protection and forest information systems.*

Biodiversity, ecosystems and water

- *Explore the possibilities to improve policies and develop measures which address biodiversity loss and climate change in an integrated manner to fully exploit co-benefits and avoid ecosystem feedbacks that accelerate global warming.*
- *Develop guidelines and a set of tools (guidance and exchange of best practices) by the end of 2009 to ensure that the River Basin Management Plans (RBMP) are climate-proofed.*
- *Ensure that climate change is taken into account in the implementation of the Floods Directive.*
- *Assess the need for further measures to enhance water efficiency in agriculture, households and buildings.*
- *Explore the potential for policies and measures to boost ecosystem storage capacity for water in Europe.*
- *Draft guidelines by 2010 on dealing with the impact of climate change on the management of Natura 2000 sites.*

Coastal and marine areas

- *Ensure that adaptation in coastal and marine areas is taken into account in the framework of the Integrated Maritime Policy, in the implementation of the Marine Strategy Framework Directive and in the reform of the Common Fisheries Policy.*
- *Develop European guidelines on adaptation in coastal and marine areas.*

Production systems and physical infrastructure

- *Develop methodologies for climate-proofing infrastructure projects and consider how these could be incorporated into existing guidelines.*
- *Assess the feasibility of incorporating climate impacts into construction standards.*
- *Develop guidelines by 2011 to ensure that climate impacts are taken into account in the EIA and SEA Directives and explore the possibility of making climate impact assessment a condition for public and private investment.*

6.3.2. *Mainstreaming adaptation through the Cohesion Policy*

Initiatives at the regional level to address climate change adaptation (as well as mitigation) are also supported by the European Cohesion Policy. This aims at reducing the disparities between the regions in the European Union. Through its financial instrument – the European Regional Development Fund (ERDF) - the European Union supports territorial cooperation among Member States, their regions and cities by funding joint projects in specific areas (see section 4.3.3 for further information).

Risk prevention and mitigation, and adaptation to climate change are identified as priority areas for investment. 30 % of the total Structural Funds for 2007-2013 have been allocated to the environment, equating to approximately €105 billion.

The European Territorial Cooperation (ETC) objective is an example of activities that through the promotion of economic and social cohesion continue to make a significant contribution in support of climate change adaptation at the regional level. The ETC provides funding for regional and local public authorities of Europe, Switzerland and Norway to promote cross-border, transnational and interregional cooperation and stimulate exchange of experience, know-how and good practice.

A large number of projects funded under the European Territorial Cooperation objectives include climate change adaptation and risk prevention, with funding used to develop projects relating to flooding, forest fires, and climate change amongst other topics. Some examples of projects funded under ETC are described in below.

Examples of the Cohesion Policy's contribution to climate change adaptation and risk prevention

The goals of the projects funded under the European Territorial Cooperation (ETC) objective of the Cohesion policy are broad and often cover several sectors and regions of the EU. The main approach is to integrate climate change factors into other social and environmental goals. Some examples of programmes that include climate change adaptation, amongst other social and environmental objectives, are:

- *Flood Prevention on the River Tisza, Hungary. Seven flood reservoirs and dikes are planned for construction between 2007 and 2013. One flood plain has already been co-financed between 2000-2006.*

- *Sustainable Development of Floodplains²⁷⁴ (SDF), which has contributed to the redevelopment of historical floodplains.*
- *The ‘INCENDI’ project addresses forest fire prevention amongst nine Mediterranean regions, all of which are Interreg IIIC partners, including Tuscany, Languedoc-Roussillon, Sardinia and Corsica. The project involved assessing and sharing expertise, local experimentation projects and mainstreaming results.*
- *Network Mountain Forest: Protecting Europe’s Mountain Forests²⁷⁵ in Eastern Europe, aimed at improving risk prevention in mountain forests.*
- *The Siproci²⁷⁶ project, aimed at improving local and regional response to disasters through transboundary collaboration in Europe.*
- *The Alpine Space Programme²⁷⁷ which aims, as one of its key objectives, to assist regions in coping with the expected increase of natural hazards due to the impacts of climate change.*
- *Baltic Sea Region Programme²⁷⁸, which promotes a sustainable management of the sea resources and protect the marine environment.*
- *APADTCLIMA²⁷⁹, which aims to raise awareness of the real consequences of climate change amongst civil society and promote measures to adapt.*

Adaptation activities at the regional level are also supported through the LEADER programme. This initiative is financed by EU structural funds and is designed to help rural actors consider the long-term potential of their local region, which is highly important given that 56 % of the population of the 27 member states live in rural areas. The programme encourages local actors to pursue development opportunities in a cooperative fashion. Climate change programmes come under the remit of LEADER through the Community Strategic Guidelines for rural development. Within this, actions on adaptation have been undertaken.

6.3.3. *Mainstreaming climate change adaptation in sectoral policy*

Adaptation within the EU is being increasingly integrated across sectors. For example, the Floods Directive (2000/60/EC)²⁸⁰ on the **assessment and management of flood risks** establishes a framework for the assessment and management of flood risks and the reduction of adverse consequences associated with floods for human health, the environment, cultural heritage and economic activity in the Community.

274 http://www.sdfproject.nl/portal/alias_Rainbow/lang_en-US/tabID_1/DesktopDefault.aspx

275 <http://www.schabl.at/nmf>

276 <http://www.siproci.net>

277 <http://www.alpine-space.eu/about-the-programme/priorities-thematic-fields/environment-and-risk-prevention/>

278 http://eu.baltic.net/Programme_document_98.html

279 http://www.interreg-sudoe.eu/ESP/b/27/9/noticias_boletin

280 <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32007L0060:EN:NOT>

The Directive requires EU Member States to assess whether water courses and coastlines are at risk from flooding. Where this is the case, the extent of the flood must be mapped and action taken to protect humans and assets at risk. The Directive also emphasises the role of public input in this process.

Adaptation to climate change is also being integrated in **coastal zone and marine management**. The EU Integrated Maritime Policy (COM (2007)575²⁸¹) provides a comprehensive framework for addressing maritime activities from a cross-sectoral perspective, facilitating the integration of adaptation efforts for coastal and marine areas into specific policies.

The Marine Strategy Framework Directive contains a clear regulatory framework for adaptation to climate change, by requiring that the objective by 2020 is that ecosystems "function fully and to maintain their resilience to human-induced environmental change". The Directive can facilitate adaptation by ensuring that climate change considerations are incorporated into marine strategies and by providing a mechanism for regular updating to take account of new information.

Adaptation to climate change is a priority theme for the further promotion of Integrated Coastal Zone Management (ICZM). The Recommendation 2002/413/EC²⁸² concerning the implementation of Integrated Coastal Zone Management in Europe stipulates that Member States should adopt a strategic approach to the management of coastal zones based on "recognition of the threat to coastal zones posed by climate change and of the dangers entailed by the rise in sea level and the increasing frequency and violence of storms"²⁸³.

Some projects have been carried out to strengthen the collaboration and cooperation of MS across boundaries on adaptation issues. EuroSION²⁸⁴, the Safecoast project, in the North Sea, or the recently launched OURCOAST project are good examples of this. The OURCOAST project is a €1 million initiative to build up a database of coastal planning and management practices in Europe, with a key focus on adaptation to risks and climate change.

A systematic consideration of anticipated climate change impacts in the further elaboration of integrated coastal zone management will be essential for making adaptation efforts in relation to the coasts. The Commission envisages proposing to start to assess options for a follow-up instrument to the 2002 Recommendation on ICZM as from 2010, where the issue of adaptation to climate change will be a major theme.

Together with the Integrated Coastal Zone Management (ICZM), Maritime Spatial Planning can play an important role in adaptation in maritime areas and coastal waters as stated in the Communication "Roadmap for Maritime Spatial Planning"²⁸⁵. The Roadmap mentions that climate change "can cause a shift in economic activities in maritime areas

²⁸¹ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2007:0575:FIN:EN:PDF>

²⁸² <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2002:148:0024:0027:EN:PDF>

²⁸³ Chapter 1 (b) of the Directive 2002/413/EC

²⁸⁴ <http://www.euroSION.org/>

²⁸⁵ COM (2008) 791

and to alter marine ecosystems" and adds that Maritime Spatial Planning can play a role in cost-efficient adaptation to the impact of climate change". Maritime spatial planning is seen as essential part of an overall integrated, ecosystem based management approach and allows in general for better planning the use of maritime space or maritime activities. Related tools are needed to facilitate the adaptation to changes in the environment produced by climate change and, thus, to give confidence to investors.

The reformed Common Fisheries Policy, currently under consultation (Green Paper on the Reform of the Common Fisheries Policy²⁸⁶), will take climate change issues into account from the adaptation and mitigation angles. The addresses climate change adaptation from the fisheries angle. The new Common Fisheries Policy has to play a role in facilitating climate change adaptation efforts concerning impacts in the marine environment.

Finally, **disaster risk reduction** (DRR) is intricately linked to climate change adaptation. The European Commission published Communication COM (2009)82 on a 'Community approach on the prevention of natural and man-made disasters'²⁸⁷. This communication sets out an overall European approach to the prevention of disasters, identifying areas for action and specific measures for disaster prevention in the short term. The external dimension of DRR is covered by the EU Strategy for supporting disaster risk reduction in developing countries (described below in section 6.4.3).

6.3.4. Integrating adaptation into environment impact and strategic environmental assessment

The assessment of climate factors is an important consideration within both the Environmental Impact Assessment and Strategic Environmental Assessment processes. Directive 85/337/EEC²⁸⁸ of 27th June 1985 on the assessment of the effects of certain public and private projects on the environment, amended by Directive 97/11/EC²⁸⁹, ensures that the environmental implications of projects are identified and mitigated before planning consent is given. The Directive contributes to the integration of climate change adaptation concerns into the planning, development and monitoring of a project. Public engagement is encouraged and the public will be informed of the outcome of the process.

Similarly, Directive 2001/42/EC²⁹⁰ of the European Parliament and of the Council of 27th June 2001 on the assessment of the effects of certain plans and programmes on the environment, known as the Strategic Environmental Assessment (SEA) Directive, ensures that climate change adaptation is integrated at a higher policy level by assessing climate change impacts on a policy.

286 COM (2009) 163 of 22.04.2009

287 http://ec.europa.eu/environment/civil/pdffdocs/com_2009_82en.pdf

288 <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31985L0337:EN:HTML>

289 <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31997L0011:EN:NOT>

290 <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32001L0042:EN:NOT>

6.3.5. Evidence base for policy making

Research is key for effective adaptation, as practical adaptation actions and measures must be based on sound, scientific, technical and socio-economic information. This has been recognised by the EC and the level of spending on impacts and vulnerability assessment and adaptation has increased significantly since the 4th NC.

The European Community is one of the main actors driving forward the climate science as testified by the vast amount of research activities. European research is supported mainly through the Framework Programmes for Research and Technological Development. The EC is funding research on the scientific, technical and socioeconomic aspects of human-induced climate change, its potential impacts and options for adaptation and mitigation not only in Europe, but also in cooperation with third countries, including developing countries. Research funded under the 6th Research Framework Programmes, as well as those envisaged under the current 7th Research Framework Programme focuses around the following elements:

- Quantification of climate change feedbacks in Europe and beyond.
- Regional climate change projections, aiming at local-scale information.
- Quantification of climate change impacts on vulnerable ecosystems, and key economic sectors.
- Climate change and human health in Europe and beyond
- Coupling between climate and economic models.
- Feasibility and related costs of adaptation and mitigation policies and measures in Europe and beyond.
- Assessment of the effectiveness and risks of novel options to combat climate change.
- Sustainable bio-diverse and value added options in international agriculture, including ability to cope with abiotic stress (e.g. temperature, salinity, water scarcity).
- Renewable energy and energy efficiency.

A large number of research projects have been funded in several different areas. Details on climate change research funded under the EC Framework Programmes can be found in section 8. Some examples of projects on impacts, vulnerability and adaptation funded over the last few years under the EC 6th and the 7th Framework Programmes are described in Appendix F-F1.

In addition, there have been a large number of new research programmes commissioned at the Joint Research Centre, which provides scientific and technical support to the development and implementation of EC policies. Two of the largest include:

- **ICPA-EEI** (Integrated Climate Policy Assessment: emissions and environmental impacts)²⁹¹

This project will develop integrated global emission inventories of greenhouse gases and of air pollutants. It will study a broad range of environmental effects of such emissions, today and in the future, applying atmospheric and climate models and blending them with global environmental data sets. Some of the main areas the project will focus on include: vulnerability and adaptation in selected world regions to the multiple risks of climate change and looking at impacts of climate change mitigation and adaptation policies on the European and global climate and environment.

- **ICPA Impacts** (Integrated climate policy assessment: scenarios and economic impacts)

The goal of this action is to produce integrated assessments of climate change mitigation and adaptation options. It will focus on techno-economic analyses and greenhouse gas abatement scenarios at EC and global scale. The economic impact of alternative policies will be analysed, including that of implementation modalities and mitigation costs.

The EC has also provided funding for research aimed at answering key policy questions and supporting the development of EC policy in the short term. These include:

- ‘Adaptation to Climate Change in the Agricultural Sector’²⁹² undertaken in 2007 to carry out an assessment of the impacts and risks of climate change on farming activities, and the potential adaptation options to increase the resilience of the agriculture sector to climate change.
- ‘Preparations for the establishment of European Climate Change Impacts and Adaptation Clearing-house – Sharing of good practice in the EC Reference’ began in 2008. This project scopes out the preparations for the establishment of a web-based European Clearing-house enhancing information structuring and sharing on climate change impacts and adaptation measures. It is intended that this clearing-house contains the most up-to-date and state-of-the-art information, which is both easily accessible and useful for Member States. To do so efficiently, a standardised and harmonised reporting framework would be needed, including a European wide agreement on definitions and key adaptation indicators.
- ‘Preliminary assessment and roadmap for the elaboration of climate change vulnerability indicators at regional level’ started in 2009 and aims to explore the feasibility of developing EC-wide climate change vulnerability indicators. Initial work will focus on literature review and interviews with the Commission to investigate different methodological approaches and data availability to result in an initial dataset and vulnerability map.

²⁹¹

<http://ccu.jrc.ec.europa.eu/24003.php>

²⁹²

http://ec.europa.eu/agriculture/analysis/external/climate/index_en.htm

- Design of Guidelines for the Elaboration of Regional Climate Change Adaptation Strategies. The aim of this study was to produce an inventory of existing regional adaptation strategies in the EC and develop guidance to assist the regions of the EC in formulating adaptation strategies. The study was carried out in 2009.

The European Parliament also funded studies to address climate change issues in both water use and fisheries:

- Climate change-induced water stress and its impacts on natural and managed ecosystems.
- Climate Change and European Fisheries.

Some projects funded over the last few years have focussed on regional climate modelling and impact assessment and have produced high-resolution maps²⁹³ representing the projected changes in climate variables, such as mean temperature and precipitation, and projected impacts, e.g. agricultural yields, conditions for tourism, cold- and heat-related mortality and biodiversity losses. These maps illustrate what can be expected in Europe by the end of the century, according to the IPCC scenario (SRES A2). The maps span a series of conditions and include maps on:

- i. precipitation and temperature in Europe;
- ii. agriculture impacts;
- iii. tourism;
- iv. river discharge;
- v. extinction in plant communities, and,
- vi. flooded areas for sea levels in the absence of dykes.

The European Environment Agency has also had a significant role in carrying out extensive EC-funded research on climate change in recent years. Among the key reports relevant to adaptation, vulnerability and impacts in current programme of work includes methodologies to calculate the costs of climate change impacts and adaptation to climate change and analysis of climate change and sectoral adaptation issues, including overviews of countries' adaptation actions. Recent reports and briefings published by the EEA include:

- Vulnerability and adaptation to climate change in Europe²⁹⁴
- Climate Change and River Flooding in Europe²⁹⁵

²⁹³ See for example the IPCA-EEI (Integrated Climate Policy Assessment: Emissions and Environmental Impacts) http://ccu.jrc.ec.europa.eu/clm_sci.php

²⁹⁴ http://www.eea.europa.eu/publications/technical_report_2005_1207_144937

- Impacts of Europe's changing climate - 2008 indicator-based assessment²⁹⁶
- Climate change: the cost of inaction and the cost of adaptation²⁹⁷
- Climate change and water adaptation issues²⁹⁸

6.4. EC international cooperation on climate change impacts and adaptation

6.4.1. International cooperation on climate change in context

The European Community has provided support on climate change to developing countries since the 1990s. The EC recognises that adaptation is a complex challenge that needs to be addressed through action that crosses international borders and territories. Coherence of policies and mainstreaming of adaptation in policies and cooperation programmes is therefore imperative.

It is with this recognition that decisive action has been taken by the EC to integrate climate change adaptation into development cooperation with the adoption of the EU Action Plan on Climate Change and Development (2004 to 2008)²⁹⁹. The aim of the Action Plan was to assist 'EU Partner countries' (developing countries) meet the challenges posed by climate change through supporting them to implement the UNFCCC and the Kyoto Protocol.

The Action Plan was adopted in November 2004 by the General Affairs and External Relations Council and encompassed five strategic objectives³⁰⁰:

- i. Raising the policy profile of climate change: measures include putting climate change on the agenda of high-level consultations under EC development cooperation agreements; preparing country- or region-specific briefs on climate change; promoting exchange programmes between the EC and partner countries to foster mutual understanding.
- ii. Support for adaptation: measures include supporting partner countries in preparing vulnerability and adaptation assessments and national adaptation programmes of action (NAPAs) for least developed countries; developing guidelines for integrating climate change into development programmes – including measures to avoid mal-adaptation – based on consultation with all stakeholders; supporting capacity-building in developing country institutions to prepare for and reduce the impact of climate change-related disasters.

²⁹⁵ http://www.eea.europa.eu/publications/briefing_2005_1

²⁹⁶ http://www.eea.europa.eu/publications/eea_report_2008_4/

²⁹⁷ http://www.eea.europa.eu/publications/technical_report_2007_13

²⁹⁸ http://www.eea.europa.eu/publications/technical_report_2007_2

²⁹⁹ <http://ec.europa.eu/environment/climat/pdf/eccp/impactsadaptation/developmentcoop.pdf>

³⁰⁰ EU Action against climate change, Working with developing countries to tackle climate change, 2007 http://ec.europa.eu/environment/climat/pdf/brochures/asia_en.pdf

- iii. Support for mitigation and low greenhouse gas (GHG) development paths: measures include supporting pilot projects to strengthen the links between government ministries and the research community; supporting partner countries to carry out research on low-carbon technologies and further develop local mitigation technologies; supporting capacity-building for developing countries' participation in the Kyoto Protocol's Clean Development Mechanism (CDM).
- iv. Capacity development: measures include: building individual and institutional capacity in impact prediction and vulnerability assessment; identifying ways to support improved coordination between developing countries to prepare for climate change negotiations; establishing knowledge banks to disseminate information and provide training for action on climate change.
- v. Monitoring and evaluation of the Action Plan: measures include regular discussions on implementation of the Plan and encouragement of feedback from stakeholders, and preparation of a biannual evaluation report and updating of the Plan.

In 2007 a review of the progress of the Action Plan in 2007 concluded that integrating climate change systematically in the context of development cooperation had not yet been adequately addressed by EU donors and that enhanced efforts were necessary to make progress in this area.

With the launch in 2007 of the Global Climate Change Alliance the European Commission renewed its commitment to integrate climate change into its cooperation programmes with third countries. The implementation of the Action Plan has been given new impetus by the creation of the GCCA (see below section 6.4.2.2) of which it forms a core element.

EU external support on climate change involves a number of Directorates General (DG) of the European Commission. EU external support aims to ensure progress towards the MDGs and that sustainable development policies and poverty alleviation strategies in developing countries take climate change adaptation into account. The main DGs of the EC that are responsible for programming and delivery of such external cooperation activities include:

- DG ENV (The DG for Environment)
- DG DEV (The DG for Development)
- DG AIDCO (The EuropeAid Cooperation Office)
- DG RELEX (The DG for External Relations)
- DG REGIO (The DG for Regional Policy)
- DG ECHO (The Humanitarian Aid Department)
- DG ELARG (DG for Enlargement of the EU)

- DG RTD (DG for Research and Technology Development)

DG DEV and DG RELEX are responsible for programming climate related assistance for developing countries through respective financial instruments (For DG DEV both the EU budget and the European Development Fund and for DG RELEX the EU budget). Based on this programming responsibility for the implementation of these programmes funded under the EU budget and European Development Fund is held by DG AIDCO. Depending on the thematic area, some initiatives are also implemented and/or (co-)funded by DG ENV, DG RELEX, DG REGIO and DG ECHO. DG ELARG undertakes a number of activities in candidate countries and potential candidates, which also covers environmental issues such as climate change, for example the IPA (Instrument for Pre-Accession), see section 7.2.1. DG RTD has initiated policy dialogues on scientific and technological cooperation with most regions and major countries in the world and is actively involved in supporting research collaborations relevant to mitigation and adaptation to climate change, not only in Europe but other parts of the globe.

6.4.2. *Distribution of external support for climate change vulnerability, impacts and adaptation activities*

The financial contribution in the EU for climate change adaptation activities in developing countries has increased significantly over the last few years.

The increase in funding and the greater level of detail in recording the resources directed to climate change adaptation reflects the recognition of its growing importance in the EC's agenda. For more detail on the EC's financial contributions to climate change vulnerability, impacts and adaptation activities please refer to section 7.

A comprehensive list of all activities that have been undertaken in the past, as well as those currently being implemented and planned for in the future is outside the scope of this document. The 12 most prominent activities are listed below and described in more detail in the following sections. The activities listed in this section cover a wide spectrum of climate related domains and include capacity building, technical assistance, high-level policy dialogue, as well as activities in support to the UNFCCC commitments. These activities have a strong emphasis on climate change adaptation and include elements of impacts and vulnerability assessments, adaptation actions and cooperation, as indicated in Table 6-1. However, the scope of these activities varies significantly and is often not limited to adaptation but also involves mitigation, disaster risk reduction and other climate change and development objectives. In addition to development aid supported activities there is a substantial number of international scientific collaborations relevant to climate change issues. More information on science and technology relevant to climate change is given in chapter 8.

Past activities

- (1) `Climate Change Capacity Development (C3D) - Technical Assistance for Strengthening and Training Developing Countries
- (2) `BASIC (Building and Supporting Institutional Capacity) Project

Current activities

- (3) Global Climate Change Alliance (GCCA)
- (4) Advancing Capacity, Partnerships and Knowledge to Support Climate Change Adaptation in Africa and Asia (ACCCA)
- (5) Support to the Nairobi Work Programme on impacts, vulnerability and adaptation to climate change
- (6) DIPECHO Programme (Disaster Preparedness ECHO)
- (7) Support to the Consultative Group on International Agriculture Research (CGIAR)
- (8) Regional Environmental Network for Accession (RENA)
- (9) EC-ACP Natural Disaster Facility

Planned

- (10) Global Climate Financing Mechanism (GCFM)
- (11) Supporting National Assessments of Post-2012 Proposals for Climate Protection on Sustainable Development (SNAPP 2012)
- (12) Capacity Development for Adaptation to Climate Change & GHG Mitigation in Non-Annex I Countries (C3D+)

Table 6-1 Prominent EC adaptation policy activities and sub-thematic areas

| Activity | Adaptation sub-thematic area(s) addressed | | | |
|------------------------|---|---------------|--------------------|-------------|
| | Assessment of impacts | Vulnerability | Adaptation Actions | Cooperation |
| Past | | | | |
| <i>C3D</i> | X | X | | |
| BASIC Project | X | X | X | X |
| Current | | | | |
| GCCA | | X | | X |
| ACCCA | X | X | | X |
| Nairobi Work Programme | X | X | X | X |

| | | | | |
|----------------------------------|---|---|---|---|
| DIPECHO projects | X | X | X | |
| CGIAR | X | X | X | |
| RENA | | | X | X |
| EC-ACP Natural Disaster Facility | | X | X | |
| Planned | | | | |
| <i>GCFM</i> | | | X | X |
| SNAPP 2012 | | | | X |
| C3D+ | | | X | X |

6.4.2.1. Past Activities

Climate Change Capacity Development (C3D) - Technical Assistance for Strengthening and Training Developing Countries.

C3D³⁰¹ is a Capacity Building programme, of which the EC is a major supporter. The programme is managed by United Nations Institute for Training and Research (UNITAR) and helps developing countries respond to the impacts of climate change. A South-South training and capacity building partnership has been developed by the programme, involving institutes in Senegal, South Africa and Sri Lanka. Each institute trains local and regional stakeholders as well as each other.

This global programme commenced in 2003 and is due to terminate in 2009. A final report of the programme is currently being prepared.

While the EC is the main donor (US\$ 2.8m), the project is co-funded by Danida (US\$ 150k), Irish Aid (US\$ 900k), the Swiss Agency for Environment (US\$ 250k) and the Swiss Federal Office for the Environment (US\$ 225k).

Building and Supporting Institutional Capacity (BASIC)

BASIC³⁰² was a highly successful capacity building project, which ran from late 2004-2007. This project aimed to strengthen and enhance institutional capacity on climate

³⁰¹ EuropeAid Financial Contributions to UN Funds, Programmes and Specialized Agencies in 2006: http://ec.europa.eu/environment/climat/pdf/brochures/asia_en.pdf

http://ec.europa.eu/europeaid/who/partners/international-organisations/documents/ec-un_statistics_2006_en.pdf

³⁰² http://ec.europa.eu/environment/climat/pdf/brochures/asia_en.pdf, <http://www.basic-project.net/>

change for Brazil, South Africa, India and China. The driver of the BASIC project was that too often international climate policy has tended to be internationally determined and based on top-down approaches. This project aimed to ensure that country circumstances and particular challenges were the informers to future climate change policy. The project was commissioned to a multi-national project team, called the BASIC network and linked over 40 individuals from 25 research and policy institutions.

The current SNAPP 2012 (Supporting National Assessments of Post-2012 Proposals for Climate Protection on Sustainable Development) project, described in section 6.4.2.3, builds on the achievements of the BASIC project.

6.4.2.2. Current activities

Global Climate Change Alliance

The Global Climate Change Alliance (GCCA)³⁰³ was first called for in the Commission's Green Paper of 29th June 2007 entitled "Adapting to climate change in Europe – options for EU action" (DG Environment). Currently in the implementation stage, the initiative recognizes that low-income countries are most at risk from climate change and aims to mainstream adaptation to climate change and risk reduction into development co-operation. The GCCA is a significant step towards the implementation of the EC Action Plan on Climate Change and Development (2004) and will promote a political dialogue between developing countries and the EU. To facilitate the process of dialogue and defining concrete support activities in the target countries a GCCA support facility was established in 2009. The first phase was initiated in 2008 and will run until 2010.

The main purpose of the GCCA is to deepen dialogue and step up cooperation between the EU and the developing countries that are most vulnerable to climate change. They are the ones who are hit earliest and hardest by the effects of climate change and have the least capacity to react, typically Least Developed Countries (LDCs) and Small Island Developing States (SIDS).

The Specific purposes of the GCCA are:

- (1) **Political Dialogue** - The GCCA shall act as a platform for political dialogue between the EU, LDCs and SIDS on climate change, at the global, regional and national levels. At the political level the GCCA regional dialogue resulted in the endorsement of three **Joint Declarations** on climate change **between the EU and the Caribbean** (in March 2008), **the Pacific** (October 2008) and **Africa** (November 2008). The current state of implementation is described in italics below.

³⁰³ lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2007:0354:FIN:EN:PDF
<http://www.europarl.europa.eu/sides/getDoc.do?type=REPORT&reference=A6-2008-0366&language=EN>
<http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+CRE+20081020+ITEM-020+DOC+XML+V0//EN&language=EN>

DG DEV (2009) EU 5th National Communications – Input DG DEV, B2-D Brussels.

(2) **Cooperation** – The GCCA will, as a priority, provide concrete support for adaptation and – where beneficial for the achievement of poverty reduction objectives - mitigation measures and for the integration of climate change into poverty reduction strategies. Overall, five priority areas for cooperation are proposed:

1. Adapting to the effects of climate change without prejudice to achieving the Millennium Development Goals.
2. Promoting disaster risk reduction.
3. Reducing emissions from deforestation.
4. Enhancing participation in the global carbon market through the Clean Development Mechanism (CDM).
5. Integrating climate change into poverty reduction efforts.

Under the first implementation phase of the GCCA, 15 countries have been identified as priority countries eligible for support including Cambodia, Maldives, Tanzania, Vanuatu; Bangladesh, Belize, Guyana, Jamaica, Mali, Madagascar, Mauritius, Mozambique, Rwanda, Senegal and Seychelles. Financial support for approximately 10 countries should be confirmed in 2010 following consultations with the country partners. The list above is not exhaustive and could be expanded in light of available resources.

For the selected partner countries, special attention will be paid to set up innovative and comprehensive ways to deal with climate change, for example through general or sectoral budget support. Regular coordination takes place with comparable efforts such as the World Bank's Pilot Programme for Climate Resilience (PPCR).

State of implementation of the GCCA Political Dialogue

AFRICA AND THE EUROPEAN UNION JOINT EFFORTS AGAINST CLIMATE CHANGE AND ENVIRONMENTAL DEGRADATION

The Africa-EU Declaration on Climate Change, adopted in Addis on 1 December 2008, highlights the common concerns of both Africa and Europe for global warming and their common interest for an ambitious post-Kyoto international agreement. Africa has been identified by experts as one of the most vulnerable regions to climate change and climate variability, while contributing very little to global warming. The Declaration represents the first deliverable under the Africa-EU Partnership on Climate Change and proves that Africa and Europe have similar concerns on climate change. It builds on the results of the African Environment Ministers Conference on Climate Change of November 2008 and is an important milestone towards common approaches, enhanced cooperation and ambitious targets for a post-Kyoto climate change agreement. The EU is assisting and supporting the African region in its adaptation and mitigation efforts, predominantly through the Global Climate Change Alliance, in order to improve political dialogue and

promote cooperation through the exchange of experiences between the European Union and African countries.

EU AND CARIFORUM WORKING TOGETHER ON CLIMATE

The Caribbean Forum (CARIFORUM) - EU Declaration on Climate Change and Energy was adopted in 2008. In the Declaration, the EU Global Climate Change Alliance (GCCA) was identified as a vehicle for political dialogue and cooperation on climate, support for the international negotiations on climate change agreement and effective measures at national and regional level.

Through the Declaration Heads of State and Government of CARIFORUM and the EU have appointed a joint CARIFORUM-EU technical group at the regional level to ensure the following priorities:

- i. Support for the implementation of the Caribbean Regional Climate Change Strategy;*
- ii. Inventory of existing critical facilities to assess the vulnerability of key infrastructure and economic sectors to climate change, particularly in the agriculture, biodiversity, forestry, fisheries, tourism, health and water resources management sectors;*
- iii. Improved management of the region's natural resources, by way of the creation of an enabling environment for the sustainable development of agricultural productivity and the promotion of agricultural diversification.*

EU AND PIFS JOIN UP ACT AGAINST CLIMATE CHANGE

The Pacific Islands Forum (PIFs) and the EU endorsed in November 2008 a joint Declaration that outline their common concerns for global warming and their common interest for an ambitious post-2012 international agreement. The document establishes a common framework for action on climate change in the Pacific and represents an important building block towards joined up approaches and ambitious targets for greenhouse gases emissions reductions.

The Global Climate Change Alliance is identified as a mechanism for improving political dialogue and promoting the exchange of experiences between the European Union and Pacific Islands and as a mechanism designed to increase their capacity to adapt to climate change and pursue sustainable development strategies.

In order to provide meaningful support to the objectives and actions identified in the three Declarations -as further strengthened by the adoption in May 2009 of the Joint ACP-EU Declaration on Climate Change and Development at the level of the Joint ACP-EC Council of Ministers- the EC has designed in 2009 a comprehensive GCCA regional support programme in Africa, the Caribbean and the Pacific.

Advancing Capacity, Partnerships and Knowledge to Support Climate Change Adaptation in Africa and Asia (ACCCA)

This programme³⁰⁴ is creating a geographically diverse set of adaptation schemes to address climate risks in developing countries. It is supporting adaptation decisions in African and Asian countries through partnerships between stakeholders and scientific communities. The programme aims to reduce climate change vulnerabilities while promoting sustainable development. Stakeholder forums are being held to facilitate identification and prioritisation of climate risks, knowledge of risks and assessment of proposed adaptation responses.

Grants have been allocated to 10 of the 14 pilot actions short-listed at the June 2007 project launch workshop - more pilot action teams have been invited to participate in ACCCA since (including 9 from Africa). Technical meetings have been held to make progress in areas such as describing baseline vulnerability, drawing on initial prototypes of climate areas to determine which are of interest for planning adaptation. Other outcomes of these meetings include developing participatory risk-communication strategies for pilot actions.

A Technical Expert Team serves as an advisory resource for pilot projects.

Support to the Nairobi Work programme

The Nairobi Work Programme spans 5 years (2005-2010) and is implemented by Parties, intergovernmental and non-governmental organisations, the private sector, communities and other stakeholders, to assist all and especially least developed countries (LDC) and small island developing states (SIDS) to better understand the impacts of climate change and their vulnerability and to make informed decisions about their adaptation actions.

The EC has been supportive of the Nairobi Work Programme, which has been assessed by all parties as a very useful tool at the service of adaptation action.

Disaster Preparedness DIPECHO

DIPECHO³⁰⁵ is the primary channel used by the EC to provide major financial support to developing countries to help them prepare for and respond to disasters. These include those linked to extreme weather and climate change.

On average, 16 % of humanitarian relief provided by DG ECHO outside of European borders is a response to sudden-onset natural disasters. This helps the most vulnerable populations in disaster prone regions and funds relief for natural disasters such as floods, hurricanes, storms. Projects implemented under DIPECHO support adaptation to climate change through training, capacity-building, awareness-raising, establishment or

³⁰⁴ http://www.acccaproject.org/rubrique.php?id_rubrique=21, EuropeAid Financial Contributions to UN Funds, Programmes and Specialized Agencies in 2005, http://ec.europa.eu/europeaid/who/partners/international-organisations/documents/the_ec-un_statistics_for_2005_en.pdf, http://ec.europa.eu/environment/climat/pdf/brochures/asia_en.pdf

³⁰⁵ http://ec.europa.eu/echo/aid/dipecho_en.htm

improvement of local early-warning systems and contingency-planning. Projects are often simple and community-owned, enabling communities at risk to prepare for and save their own lives and livelihoods during disasters.

The programme, which was initiated in 1996 and is now in its implementation stage, has expanded in recent years. DIPECHO now covers six disaster prone regions including the Caribbean, Central America, South America, Central Asia, South Asia and South East Asia. The EC has provided € 120 million to the programme since 1996. The EC's contribution is increasing each year - from € 8 million in 1998 to € 19.5 million in 2007.

This support channel is temporary - the EC aim to integrate disaster risk reduction into long-term development projects and national policies rather than just humanitarian aid operations as it has done historically. The EC-ACP Natural Disaster Facility (described below) has been set up with the purpose of preventing and reducing the effects of natural disasters in ACP countries.

Support to the Consultative Group on International Agricultural Research (CGIAR)

The CGIAR³⁰⁶ is a strategic alliance of members, partners and international agricultural centres that mobilises science to benefit the poor. The main goal of the CGIAR is to achieve sustainable food security and reduce poverty in developing countries through scientific research and research-related activities in the fields of agriculture, forestry, fisheries, policy, and environment. The impacts of climate change on agriculture and the implication for marginalised communities around the world are some of the issues that the CGIAR strive to address. In recent years, CGIAR scientists have progressed significantly in determining what specific consequences rural people, especially the poor, can expect to face at specific locations as a result of climate change during the coming decades.

The European Union has been involved in the CGIAR since its beginning in 1971 and is the largest contributor. EC resources are allocated to a defined number of CGIAR projects that are generally co-funded by several donors. Moreover, through the European Initiative for Agriculture Research for Development (EIARD) constant emphasis is placed on connecting the activities of the international research centres more strongly to the national research centres in developing countries.

Regional Environmental Network for Accession (RENA)

The Regional Environmental Network for Accession (RENA)³⁰⁷ aims to tackle environmental challenges and provide a forum for the experiences and best practices between the participating countries. One of the objectives of RENA is to provide support for capacity building through workshops, training and exchange programmes, as well as facilitate the preparation of adaptation strategies (see section 7.2.1 and 9.2.11).

EC-ACP Natural Disaster Facility

³⁰⁶ <http://www.cgiar.org/index.html>

³⁰⁷ The beneficiary countries of RENA are Albania, Bosnia and Herzegovina, Croatia, the Republic of Macedonia, Montenegro and Serbia as well as Kosovo and Turkey

The EC aims to integrate disaster risk reduction into long-term development strategies projects and national policies. To this end, the 9th European Development Fund (EDF) established the EC-ACP (Africa, Caribbean, Pacific) Natural Disaster Facility³⁰⁸ (NDF). Under the ACP Secretariat, the NDF coordinates with regional ACP bodies to enhance capacity in the areas of disaster prevention and preparedness. Ongoing work is focussing on preventative initiatives, dissemination of information, and strengthening research and management skills of ACP States.. Under the 10th EDF the NDF's budget has been increased to € 180 million.

6.4.2.3. Planned Activities

The Global Climate Financing Mechanism (GCFM) - an option for meeting urgent and immediate climate-related needs

Early action makes adaptation and the transition towards a low carbon economy smoother. The EC has been exploring the possibility and proposed in its January 2009 EC Communication 'Towards a comprehensive climate change agreement in Copenhagen' to develop a frontloading mechanism to rapidly deliver substantial funding in favour of the most vulnerable and poorest developing countries. This would be a bridging initiative in the transition period between 2010 and the full-scale implementation of the new financial architecture of the post-2012 agreement on climate change. Based on the issuance of bonds, the proposed Global Climate Financing Mechanism (GCFM) would allow early spending on priority climate-related actions. These funds would in particular allow for an immediate reaction to urgent adaptation needs with a high return such as disaster risk reduction. A share of the funds raised could also support mitigation activities, in particular, those that generate synergies between mitigation and adaptation such as reducing emissions from deforestation. The GCFM aims at raising around €1 billion per year for the period 2010-2014, provided that Member States make appropriate pledges.

Similar to the International Finance Facility for Immunization (IFFIm³⁰⁹), the GCFM would frontload finance through capital markets based on donors' guarantees of repayments at a later stage. Specific areas of adaptation where the use of frontloaded funding can be highly cost-effective include the following:

- Disaster risk management and prevention;
- Agriculture, including changes in agricultural practices (e.g. reduced or no tillage, etc); changes in crop mix; increase of storage for irrigation; improved soil management and erosion control; marketing systems;
- Water, including ensuring safe water supply; water reuse technologies; increased integrated basin management; storage for irrigation and hydropower; protection of

³⁰⁸ http://www.acpsec.org/en/pahd/sp_bradley_washington_02-07_e.htm

<http://www.environmental-finance.com/onlinews/1127ect.html>

³⁰⁹ The International Finance Facility for Immunisation (IFFIm) was created to accelerate the availability and predictability of funds for immunisation (see also: <http://www.iff-immunisation.org/index.html>).

groundwater and improving recharge; rainwater harvesting; water policy reform and creation of incentives for efficient water use (mitigation and adaptation synergy);

- Health, increased geographical coverage of malaria projects and vector monitoring; increased funding for clean water supply and sanitation to prevent the spread of diseases, especially after floods (expected to increase in frequency and intensity);
- Sustainable natural resource management, ecosystems management, including sustainable land management; coastal zone management; protection of coral reefs; addressing livelihoods of fishery communities affected by climate change.

Other related EC support to counter natural disasters effects

The European Commission (EC) has provided €24.5 million in funding as the first donor for the Global Index Insurance Facility (GIIF) Trust Fund. This 7-year project aims to mitigate weather and catastrophic risks in ACP states through the application of index insurance. The GIIF will be managed by the International Finance Corporation (IFC) – part of the World Bank and follows the conclusion of a Financing Agreement between the EC and the ACP Group of States on 21st December 2007.

Supporting National Assessments of Post-2012 Proposals for Climate Protection on Sustainable Development (SNAPP 2012)

The SNAPP 2012³¹⁰ project builds on the BASIC (capacity building) project of 2004-2007 to support Brazil, South Africa, India and China to assess the pros and cons of various proposals for a post-2012 international climate change regime against national priorities and sustainable development goals. The SNAPP 2012 project will hold national workshops focusing primarily on supporting key proposals from developing countries concerning climate change policy and frameworks of the future.

An international dialogue aims to bring together the outcomes of these workshops into one comprehensive proposal capable of meeting the ultimate objective of the UNFCCC in a way that appeals to developing countries. The expected results include a better collective understanding and decisive action by the partner countries leading to a proposal for contributing to a post 2012 framework.

WWF India will act as the main coordinator on behalf of the project and its partners. The partner organisations of the BASIC project (2004-2007) will be participants in the SNAPP 2012 project.

The Climate Change Capacity Development + (C3D+)

³¹⁰ http://www.wwfindia.org/about_wwf/what_we_do/cc_e/ccp/snapp/
<http://www.ids.ac.uk/go/research-teams/vulnerability-team/research-themes/climate-change/themes/international-policy>

The C3D+³¹¹ project is currently in the final stage of approval by the EC and is due to commence in 2010. The first project meeting will be organised to take place in Poznan, Poland in December 2009. The CD3+ project aims to involve 6 training centres and will cover around 30 developing countries. A training programme on climate change related issues will reinforce the network of training in developing countries.

6.4.3. Disaster Risk Reduction (DRR)

Effective Disaster Risk Reduction can reduce the loss of life and property. Studies suggest benefits in terms of prevented or reduced disaster impacts of two to four dollars for each dollar invested in DRR.

Disasters can be avoided by addressing the root causes of people's vulnerability and increasing their capacity to cope. In this way, risks can be reduced and impacts limited. In recent years, the focus has moved from mainly responding to disasters to implementing comprehensive DRR approaches based on the *Hyogo Framework for Action 2005-2015: Building the resilience of nations and communities to disaster*. The Commission fully supports its implementation.

In an increasing effort to coordinate action, the EC has finalised a package covering aspects of DRR within and beyond the EU, addressing appropriate links between the external cooperation and internal action dimensions. The external dimension of DRR is covered in the EC Communication "EU Strategy for supporting disaster risk reduction in developing countries" whereas the internal dimension is envisaged in the EC Communication "A Community approach in the prevention of natural and man-made disasters" (see section 6.3.3).

One of the Strategy's main purposes is to provide a comprehensive and coherent policy framework for programming relevant thematic/geographic funding sources, including the European Development Fund (EDF) and instruments of the EC general budget³¹². Individual DRR allocations are set out in Country and Regional Strategy Papers for all developing regions, intra-ACP programmes, Drought Preparedness and DIPECHO programmes in the humanitarian aid context, and in thematic programmes on food security and environment/natural resources.

Under the 10th EDF, € 180 million are allocated to DRR, with an emphasis on capacity-building for DRR through the strengthening of national and regional institutions. More information on EDF funding can be found in section 7.2.3. This programme also contributes to the DRR component of the Global Climate Change Alliance, including adaptation of agricultural systems, ensuring synergies between climate change adaptation and disaster prevention. Several international research collaborations addressed this area with Mediterranean Partner Countries and other regions.

³¹¹ <http://www.c3d-unitar.org/>

³¹² Instruments for: i) development cooperation, ii) humanitarian aid, iii) stability, iv) European Neighbourhood and Partnership.

6.4.4. *Policy Coherence for development and climate change*

Policies other than development cooperation have a strong impact on developing countries. The EC concept of Policy Coherence for Development (PCD) aims to build synergies between those policies and development objectives. This in turn will increase the effectiveness of development aid. Against the backdrop of the EU commitment to substantially increase official development assistance, the importance of ensuring that these resources are not rendered inefficient or wasted by policy incoherence, is even greater.

Climate Change in the EC 2007 Report on Policy Coherence for Development³¹³

Whilst climate change is affecting all countries, developing countries and the poorest populations will be hit earliest and hardest. Hence, all efforts deployed under the ambitious EC climate policy described in section 4, will directly or indirectly benefit these countries:

- The positive spill-over effects of scientific research programmes and investments in appropriate technologies will also indirectly benefit partner countries.
- The development of biofuel policies at international level could have both positive impacts on developing countries in their capacity as producers and negative impacts if sustainability criteria are not observed, (see section 4.2.5).
- Further improvements are required regarding the integration of climate change concerns into the policy dialogue with developing countries as well as into development cooperation programmes. The Global Climate Change Alliance (GCCA) between the EU and its developing partners, particularly the LDCs and other vulnerable developing countries, will be an important step in this direction.

³¹³ http://ec.europa.eu/development/icenter/repository/Publication_Coherence_DEF_en.pdf

7. FINANCIAL RESOURCES AND TRANSFER OF TECHNOLOGY

Key developments

- Since the 4th National Communication, more accurate and representative categories have been used to provide a clearer picture of the level of financial contributions dedicated to climate change, with increased use of the Rio Markers to identify the climate change element in projects.
- EC financial contributions³¹⁴ related to climate change projects in developing countries have steadily increased from €160 million in 2004 to €318 million in 2007³¹⁵.
- The importance of climate change adaptation has continuously grown, as indicated by the increasing number of programmes and activities dealing with this issue – such as the Global Climate Change Alliance.
- There are a number of new EC initiatives and instruments to support this increased focus on climate change, such as the Global Energy Efficiency and Renewable Energy Fund (GEEREF), the Global Climate Change Alliance (GGCA) and the EU-ACP Energy Facility, the latter has a different scope but contributes equally significantly to the fight against climate change.
- Climate change has taken a more prominent role within the (7th) European Research Framework Programme, with a number of initiatives and projects having the specific objective of assisting developing countries with climate change related issues.

7.1. Introduction – European Community objectives for climate change in the context of development cooperation

The European Union reconfirmed in 2008 its role as the world leader in terms of overall development financing (on all issues not just climate change related): it increased its spending by 8 % reaching almost €50 billion, an all-time high in current prices³¹⁶.

The European Community is strongly committed to assisting developing countries in the fight against poverty and the achievement of the UN Millennium Development Goals.

³¹⁴ Source: European Commission - DG AIDCO project database. It was not possible to identify the climate change related component of funding from other DGs relevant to non-Annex 1 Parties. In particular these figures do not include support to candidate countries and Balkans. Details on the calculation method is given in part. 7.3.

³¹⁵ These figures include funds directed to three (Russia, Ukraine and Turkey) Annex I countries (UNFCCC), where an EU instrument covers both non-Annex 1 and Annex 1 countries. For 2004, this amounts to €3.95m, for 2005 it amounts to €2.8m, for 2006 it amounts to €4.3m and for 2007, it amounts to €22m..

³¹⁶ EU ODA levels 2008. Annual progress report 2009 on financing for development: Commission Staff Working Document SEC(2009) 444 of 8.4.2009

http://ec.europa.eu/development/icenter/repository/COMM_NATIVE_SEC_2009_0444_4_EN_AUTRE_DOCUMENT_TRAVAIL_SERVICE-Where-does-the-EU-go-from-Doha.pdf

Combating climate change forms an integral part of this agenda. In recent years specific cooperation on climate change has been strengthened significantly across a range of different frameworks.

Achieving the Millennium Development Goals will require substantial investment to adapt to climate change. For the Least Developed Countries (LDCs), the United Nations Framework Convention on Climate Change (UNFCCC) established the Least Developed Countries Fund to prepare National Adaptation Programmes of Action (NAPAs) that describe the priority adaptation activities to be funded. In the context of the EU Global Climate Change Alliance (GCCA) support to non-LDCs for implementing climate related policies via sectoral budget support has been mentioned as an option. These activities generally fall within categories that are receiving overseas development assistance (ODA) funding: e.g. irrigation and water management, flood protection, developing drought-resistant crops and reforestation. The UNFCCC Secretariat estimates that adaptation costs in all developing countries could range from €23 billion to €54 billion per year in 2030. Further study of the economics of climate adaptation is required, but the needs are large in comparison with the present size of ODA. Future climate aid will compete with other internationally agreed development objectives.

The Communication 'Stepping up international climate finance: A European blueprint for the Copenhagen deal' an EC policy paper, adopted on 10th September 2009 presents a blueprint for scaling up international finance to help developing countries combat climate change. It recognises that the financing issue is central to prospects for reaching an ambitious agreement in Copenhagen. According to the European Commission estimates by 2020 developing countries are likely to face annual costs of around €100 billion to mitigate their greenhouse gas emissions and adapt to the impacts of climate change. Much of the finance needed will have to come from domestic sources and an expanded international carbon market, but international public financing of some €22-50 billion a year is also likely to be necessary. The Commission proposes that industrialised nations and economically more advanced developing countries should provide this public financing in line with their responsibility for emissions and ability to pay. Within this overall framework between 2010-2012, fast-start financing will be needed for adaptation, mitigation, research and capacity building in developing countries in the range of €5 to 7 billion per year (with adaptation estimated at 2-3 billion mainly to increase knowledge on likely impact of climate change, integrating adaptation into national development strategies and financing priority investments i.e. from the NAPAs).

In 2004 the EC underlined its commitment to help developing countries tackle climate change by adopting a Strategy and Action Plan on Climate Change in the Context of Development Cooperation³¹⁷ for the period up to 2008, which is described in section 6.4.2.

Alongside dedicated project and programmes the EC aims to address climate change adaptation and mitigation as crosscutting issues in its external

³¹⁷ COM(2003)85 final, Communication from the Commission to the Council and the European Parliament, Climate Change in the Context of Development Cooperation http://ec.europa.eu/development/icenter/repository/env_cc_com_2003_85_en.pdf

cooperation, exploiting synergies with, and building on long standing commitments and efforts to promote environmental integration. This has been a clear policy objective since the adoption of the EC Action Plan on Climate Change in the context of Development Cooperation and has been reaffirmed ever since in key policy documents and recent initiatives, such as the Global Climate Change Alliance.

Significant efforts are currently directed at the ongoing Mid-term Review of EC country strategies for Asia and Latin America, which offer opportunities to strengthen consideration of climate aspects in the policy dialogue, country diagnosis and response strategies that underpin the programming and delivery of external assistance. General and sector specific guidance has been developed to support greater uptake of climate change during programming and further downstream in the formulation and implementation of operations.

In this context; climate risks screening methodologies at the level of country programmes and for projects are being tested in a selected number of EC cooperation countries with a view to scaling up application in a near future. An ambitious programme of training seminars on environmental integration for staff involved in the delivery of EC external cooperation (including a very large proportion of staff from partner countries), but also open to other development partners has been running since 2005 and in this framework emphasis on climate aspects will be considerably strengthened from 2008.

7.2. EC key financial instruments to support climate change activities worldwide

Since the publication of the 4th National Communication, climate change has become a key priority for the EC and the increasing number of financial contributions related specifically to climate change activities reflect this. In addition, the EC has developed a greater level of detail in recording the resources directed to climate change; this enables a more in-depth analysis of such resources, as well as implementing monitoring tools to identify those programmes and activities which are particularly successful. This chapter focuses specifically on the EC commitment to supporting non-Annex I countries³¹⁸, taking into account the relevant activities coordinated at the EC level.

The financial resources reported in this chapter come directly from the budget of the EC and the European Development Fund (EDF)³¹⁹, and are separate from Member States' contributions which are reported in their corresponding National Communications. All financial figures are expressed in current prices.

³¹⁸ Some EC funding instruments covered in this chapter also cover Annex I countries, such as the Instrument for Pre-Accession (IPA) which covers climate change projects in Croatia and Turkey, and European Neighbourhood and Partnership Instrument (ENPI) which covers climate change projects in Russia, Ukraine and Turkey.

³¹⁹ The European Development Fund receives funding from the Member States, and is subject to its own financial rules and is managed by the European Commission. AIDCO project database covers projects funding by EC and EDF, but not bilateral Member States' contributions.

7.2.1. Candidate countries and potential candidates

Whilst this chapter focuses on funding allocated to non-Annex 1 countries, some candidate and potential candidate countries to the EU are also non-Annex 1 countries³²⁰ which are therefore covered by the Instrument for Pre-accession Assistance (IPA). This instrument includes a wide range of interventions in South East Europe including climate change. The average annual allocation for the Western Balkans under IPA for the period 2007-2011 is approximately €800 million³²¹. This is by far the highest per capita amount provided by the EC to any region in the world (around €30 annually). The IPA offers support through its five components: Transition Assistance and Institution Building, Cross-Border Cooperation (CBC), Regional Development, Human Resources Development and Rural Development. Priorities for funding are agreed within the framework of multi-annual strategies, which are developed on the basis of consultations between beneficiaries and the European Commission, and from which individual programmes or projects are then supported. The IPA (2007-2013) replaces the 2000-2006 pre-accession instruments, including:

- Phare, the scope of which supported the implementation of the *acquis communautaire* in the form of institution building and related investments, investments in economic and social cohesion and cross-border cooperation;
- ISPA, which was the precursor of the Cohesion Fund and deals with environment and transport infrastructure;
- SAPARD, the precursor of Rural Development plans, dealing with Common Agricultural Policy *acquis* and Rural development;
- Turkey pre-accession, with the same scope as Phare;
- CARDS, which covered the Western Balkans, providing Community assistance to the countries of South-Eastern Europe (2000-2006), supporting the reconstruction process in the Western Balkans.

In 2007, the Commission adopted a Decision³²² regarding a horizontal programme on the Energy Efficiency Finance Facility for Albania, Bosnia and Herzegovina, Croatia, Montenegro, Serbia including Kosovo³²³, Turkey and the FYR of Macedonia under the IPA Transition Assistance and Institution Building Component. The maximum contribution to this initiative is €34.7 million financed through the main EU budget. This programme will financially assist the IPA countries to promote investments in energy efficiency and renewable energy generation in order to improve the energy performance of

³²⁰ Non-Annex 1 countries in this category include Albania, Bosnia and Herzegovina, Montenegro, Serbia, Kosovo and FYR Macedonia: http://unfccc.int/parties_and_observers/parties/non_annex_1/items/2833.php

³²¹ MEMO/08/144, 5th March 2008 - Financial assistance to the Western Balkans – Donor cooperation - Fact sheet for the Commission Communication: "Western Balkans: enhancing the European perspective" See IP 378

³²² COM(2007)6376 on 18/12/2007

³²³ Under UNSCR1244/99

the building and industry sectors offering opportunities for the highest savings in energy and reduction in CO₂ emissions.

The IPA contributes funding to the working group on climate change of the Regional Environmental Network for Accession countries (RENA), to be launched in 2010. RENA is aimed at Albania, Bosnia and Herzegovina, Croatia, the former Yugoslav Republic of Macedonia, Montenegro, Serbia, Kosovo and Turkey with an EC contribution of €5,900,000 from 2010-2012. Its objective is to enhance regional cooperation in the Western Balkans and Turkey in the field of environment in the prospect of accession to the European Union. RENA will build on the results achieved so far by the Regional Environmental Reconstruction Programme (REReP), which will end in 2009. One of the Working Groups will focus on capacity building, information exchange and ad hoc assistance in relation to the implementation by RENA beneficiaries of EU requirements on Climate Change and particularly the following aspects:

- EU/national/regional policies on Climate Change, post-2012 regime, elements of the EU's climate policy initiated through the European Climate Change Programme (ECCP) and GHG monitoring and reporting requirements;
- Creation of inventories, implementation of Monitoring Mechanism Decision (280/2004/EC), including institutional arrangements and resources needed, preparation of reports on emission inventories and emission projections;
- Development of adaptation strategies;
- Establishment of Emission Trading Schemes (ETSs).

7.2.2. *Bilateral contributions related to the implementation of the Convention*

The EC implements climate change programmes and projects around the world. It delivers support through regional and country-specific approaches across a variety of sectors; there are climate change related activities ongoing in almost all the countries in which there are EC development cooperation activities.

For each of the relevant regions, the most significant regional programme is described in the following sections. These programmes are not explicitly climate change related, but rather are the instrument through which a significant amount of resources are dedicated to climate change. Details on the method used for calculation are provided in section 7.3.

7.2.3. Africa, Caribbean and the Pacific (ACP)

The Commission finances most of its development programmes for African³²⁴, Caribbean³²⁵ and Pacific³²⁶ partner countries through the European Development Fund (EDF). A heading has been reserved for the Fund in the Community budget since 1993, following a request by the European Parliament. The Commission has repeatedly asked for it to be included in the overall EU budget. However, the European Council of December 2005 decided that the geographical cooperation granted to the ACP States (except South Africa) and OCTs should continue to be funded by the EDF for the period 2008-2013. It is funded by the Member States according to a specific contribution key, is subject to its own financial rules and is managed by a specific committee. Each EDF is concluded for a multi-annual period and is implemented within the framework of an international agreement guiding the relations between the European Community and the partner countries; two EDFs cover the reporting period for the 5th National Communication and future commitments:

- Ninth EDF: 2000-2007 (Cotonou Agreement, 2000-2020)
- Tenth EDF: 2008-2013 (Cotonou Agreement, revised in Luxembourg, 2005)
The EDF consists of grants managed by the Commission and risk capital and (concessional) loans managed by the European Investment Bank (EIB) under the "Investment Facility". The Cotonou Agreement signed in June 2000 streamlined the EDF and introduced a system of rolling programming, making for greater flexibility and giving the ACP States greater responsibility.

The ninth EDF was allocated €13.8 billion for 2000-2007. To this initial amount were added uncommitted funds from previous EDFs and unspent funds released at the end of projects funded from the EDF (so-called "decommitted funds"). At the end of 2007, the funds committed under the 9th EDF amounted to €17.9 billion. The tenth EDF (2008-2013) has been allocated €22.682 billion. In addition to managing part of the EDF's resources under the investment facility, the EIB will contribute up to €2 billion from its own resources for the period covered by the tenth EDF.

Geographical cooperation with the ACP under the EDF is complemented by development aid provided by the Community's general budget and by bilateral cooperation and contributions from individual Member States to multilateral development cooperation.

³²⁴ Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo (Republic of), Congo (Democratic Republic of), Djibouti, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea-Bissau, Guinea, Ivory Coast, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, São Tomé & Príncipe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia and Zimbabwe

³²⁵ Antigua & Barbuda, Bahamas, Barbados, Belize, Dominica, Dominican Republic, Grenada, Guyana, Haiti, Jamaica, Saint Kitts & Nevis, Saint Lucia, Saint-Vincent and the Grenadines, Suriname and Trinidad & Tobago

³²⁶ Cook Islands, Fiji, Kiribati, Marshall Islands, Micronesia, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu

For the period between 2004 and 2007, €394 million were allocated to climate change related projects in the ACP zone, of which €327m from the EDF³²⁷. For the ACP region, the most important EDF programme which co-finances projects that deliver energy services to poor rural areas is the ACP-EU Energy Facility³²⁸, launched in 2007.

The ACP-EU Energy Facility is a contribution under the EU Energy Initiative to increase access to energy services for the poor. The Facility³²⁹ was approved by the joint ACP-EU Council of Ministers in June 2005, with an amount of €220million. The main activity of the Facility is to co-finance projects that deliver energy services to poor rural areas. Four key principles underpin the Facility:

- i. Governance: The Energy Facility targets in particular ACP countries which pursue or are firmly resolved to create a sound national energy policy, based on good governance principles. The Facility helps countries to establish their institutional and regulatory framework and to attract additional financial resources for public-private partnerships.
- ii. Ownership: The Energy Facility is to be fully demand driven. It will be an instrument to support and deepen the involvement of actors in ACP countries in the design and implementation of energy policies.
- iii. Flexibility: Maximum impact is sought by offering creative combinations of grants with other sources of financing. The Facility is open to joint financing with Member States, other international financing institutions such as the European Investment Bank and private sector investments via public-private partnerships.
- iv. Innovation: The Facility is intended to offer innovative responses to the challenge of providing sustainable energy services to the poorest areas. Projects can include electrifying rural areas, improving the efficiency of households' cooking and promoting sustainable energy generation through bio-mass, small hydro-electric plants and wind turbines.

The EC has identified three Priority Activity Areas to be funded under the Energy Facility:

1. Delivery of energy services: The largest financial contribution from the Facility is designed to improve rural people's access to modern energy services, particularly in Africa. Priority is given to people in unserved areas. Proposals must ensure the economic, social and environmental sustainability of the investment.

³²⁷ Remaining €67 million were from the budget, mainly through Environment and Food Security budget Lines

³²⁸ http://ec.europa.eu/europeaid/where/acp/regional-cooperation/energy/index_en.htm

³²⁹ Communication from the Commission to the Council and the European Parliament on the future development of the EU Energy Initiative and the modalities for the establishment of an Energy Facility for ACP countries

http://eurlex.europa.eu/smartapi/cgi/sga_doc?smartapi!celexplus!prod!DocNumber&lg=en&type_doc=COMfinal&an_doc=2004&nu_doc=711

2. Creating an enabling environment: Where governance conditions are not in place for delivery-oriented intervention in the field, up to 20 % of the Facility supports the development of an enabling environment for the energy sector based on good governance principles. The Facility facilitates the implementation of sound national energy policies and strategies, improves the institutional, legal and regulatory framework, strengthens the capacity of key stakeholders, and improves monitoring and evaluation capacity.
3. Supporting future large-scale investment programmes: Up to 20 % of the Facility resources is devoted to preparatory activities required to facilitate future large-scale investment plans for cross-border interconnections, grid extensions and rural distribution, preparing them for financing by international finance institutions.

The Energy Facility was mainly implemented through a €198 million Call for Proposals which was launched in June 2006. Out of 307 proposals received, 74 projects have been contracted by the end of 2008 for a total amount of €196 million from the Energy Facility, with a total project cost of €430 million.

The main activities performed through Energy Facility projects can be classified into three different groups: (1) energy production, transformation and distribution, (2) extension of existing electricity grids and (3) "soft" activities such as governance, capacity building or feasibility studies. This classification is based upon the main activity of the project, but it should be highlighted that all projects include capacity building activities.

The sources of energy used for electricity generation were mainly renewable energies (77 % of the projects). Only one project using exclusively fossil fuels was funded. In total, €81 million of commitments have been marked as climate change related under the Energy Facility, as support to enhance use of renewable energies or increase energy efficiency.

7.2.4. *Overseas Countries and Territories*

The EC is also contributing financial resources to climate change related activities to climate change related projects in Overseas Countries and Territories³³⁰ (OCTs) through the EDF. €28 million were allocated to climate change related projects between 2004 and 2007 in the OCT region mainly on energy, sustainable development and preservation of natural areas.

³³⁰

Aruba, Bermuda, British Virgin Islands, Netherland Antilles, Anguilla, Cayman islands, Turks & Caicos islands, Montserrat, New Caledonia, Polynesie Française, Wallis & Futuna, Pitcairn, British Indian Ocean Territory, Mayotte, St Pierre & Miquelon, Greenland, British Antarctic Territory, Falkland islands, South Georgian and South Sandwich Islands, St Helena, Terres Australes et Antarctiques Françaises

7.2.5. *Asia*

The main programmes for Asian³³¹ countries were the Technical Assistance for the Commonwealth of Independent States (TACIS) and the Asian and Latin America (ALA) Regulation until 2006. These were replaced by the Development Cooperation Instrument (DCI) from 2007 to 2013, as the main instrument through which the EC commits financial resources to climate change related projects in Asia. The overall goal of the DCI instrument is the eradication of poverty in partner countries and regions in the context of sustainable development, including pursuit of the Millennium Development Goals. €134 million were allocated to climate change related projects between 2004 and 2007. Most of the programmes related to climate change are implemented on a national basis following the main challenges of the countries, such as deforestation in South East Asia, Energy in China, Environmental integration and governance in Central Asia. The SWITCH Programme, launched in 2007, works through calls for proposals all over Asia to promote sustainable production and consumption.

7.2.6. *Latin America*

The Development Cooperation's (DCI) geographic programmes also cover Latin America, replacing the ALA programme for developing countries in Latin America. The Regional Cooperation Programmes cover the whole of the region of Latin America³³². The fields concerned include education, SME development, local government, information technologies and social cohesion. They aim to reinforce ties with the EU through the exchange of experiences and the creation of networks. €118 million were allocated on climate change related activities between 2004 and 2007, with a particular focus on sustainable forest management.

A key programme is the Euro-Solar Programme, aiming to reduce poverty, allowing remote rural communities currently without access to electricity, to benefit from renewable electric energy. Approved in May 2006 and extended in December 2008, the Programme's total budget amounts to €35.8 million, of which €6.9 million will be provided by the Programme's eight beneficiary countries.

A specific study on climate change issues, the "Review of the Economics of Climate Change in South America", was approved in December 2008 for twelve-month duration and an EC contribution of €500,000 to make an economic analysis of the impacts of climate change in selected countries of South America in the areas of mitigation and adaptation of selected sectors.

³³¹ Afghanistan, Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Kazakhstan, Kyrgyzstan, Laos, Malaysia, Maldives, Mongolia, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Tajikistan, Thailand, Turkmenistan, Uzbekistan and Vietnam

³³² Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela

7.2.7. *European Union's Southern and Eastern Neighbours*

The European Neighbourhood and Partnership Instrument (ENPI) has been operational since 1st January 2007. The ENPI is the main source of funding for the 17 partner countries³³³. The ENPI replaces the co-operation programmes TACIS for the Eastern European³³⁴ Neighbours and MEDA for the Mediterranean Partner Countries. The ENPI provides continuity with enlarged objectives of the former TACIS and MEDA programmes. The main purpose is to create an area of shared values, stability and prosperity, enhanced co-operation and deeper economic and regional integration by covering a wide range of co-operation areas. For the period between 2004 and 2007, €120 million were allocated to climate change related activities, with a focus on the energy sector.

7.3. **Provision of 'new and additional' resources**

The growing importance of climate change is evident through the EC's increasing contributions to climate change activities internationally over the reporting period. Since the 4th National Communication, it has been possible to clearly identify the climate change component and corresponding financial contributions of such activities with greater accuracy than before, therefore the figures are a more precise reflection of contributions related to climate change activities.

Since the 4th NC, some new and additional resources have been made available under the EC Thematic Budget Lines. The Environment and Natural Resources Thematic Programme (ENRTP), including Energy, have been allocated an amount of €450 million for 2007-2010 (+ €400 million foreseen for 2011-2013) - this amount being more than twice, annually, the resources allocated to environment under previous thematic budget lines (2000-2006). The allocation per sector within the ENRTP also shows a positive trend as regards the most climate change sensitive sectors with around 67 % of commitments (around €85 million annually) for 2007-2010 on Forests, Energy and actions explicitly targeting Climate Change - compared with the 52 % (around €25 million annually) on the same issues during the 2002-2006 period.

The ENRTP 2007-2010 also comprises two new important initiatives, Global Climate Change Alliance (GCCA) and the Global Energy Efficiency and Renewable Energy Fund (GEEREF), specifically targeting Climate Change. More information on future commitments and these two measures can be found in sections 7.5 and 7.6.4.

The increasing trend as regards climate change is also demonstrated by the increased importance given to energy efficiency and renewable energies within the energy sector of cooperation. Whereas during 2002-2005 period, the commitments in the field of renewable energy end energy efficiency remained quite low, an important effort has been made since 2006 - notably due to the Energy Facility for ACP states.

³³³ Algeria, Armenia, Azerbaijan, Belarus, Egypt, Georgia, Israel, Jordan, Lebanon, Libya, Moldova, Morocco, Occupied Palestinian Territory, Russia, Syria, Tunisia and the Ukraine

³³⁴ Includes Russia and the Ukraine, which are Annex I countries

Table 7—1 below shows the financial resources in category headings most relevant to climate change. The figures shown are wholly directed to climate change. In order to avoid double counting, projects that could have been classified under more than one category have been attributed to the category most relevant to the project objective.

The EC is able to report more accurately on the financial resources attributed to climate change due to the increased and consistent use of the Organisation for Economic Co-operation and Development's Rio Markers³³⁵ for biodiversity (1), climate change (2) and desertification (3). The Directives on the use of the Rio Markers provide concise definitions to be used.

The Rio Marker "Climate Change" is particularly relevant and the criteria for eligibility are that a project contributes to:

- the mitigation of climate change by limiting anthropogenic emissions of GHGs, including gases regulated by the Montreal Protocol; or
- the protection and/or enhancement of GHG sinks and reservoirs; or
- the integration of climate change concerns with the recipient countries' development objectives through institution building, capacity development, strengthening the regulatory and policy framework, or research; or
- developing countries' efforts to meet their obligations under the Convention.

A further feature of the Rio Markers is the Develop Assistance Committee³³⁶ policy marker system, which enables increased accuracy when calculating financial expenditure towards climate change, as it allows a different weighting³³⁷ to be given to the total project value depending on how significant the climate change objective is. The use of this procedure is also consistent with the EC's reporting for the Bonn Declaration³³⁸. Some climate change adaptation programmes have also been included in this table – even if there are not yet concerned by the Rio Markers definition. Only programmes clearly linked to adaptation to already identified consequences of climate change has been taken into account. The "adaptation specific" category should be considered as an attempt from the EC services to better identify adaptation actions, while a more systematic methodology is under development with the OECD. To avoid double counting, projects with positive impacts both on adaptation and mitigation (for example in agriculture, forestry or biodiversity management) has not been included under "adaptation specific". Therefore,

³³⁵ Reporting Directives for the Creditor Reporting System – Addendum Rio Markers – 2004 [http://news.global-mechanism.org/u/nrd.php?p=\\$uid\\$ \\$llid\\$ 115469_223_61](http://news.global-mechanism.org/u/nrd.php?p=uid $llid$ 115469_223_61)

³³⁶ http://www.oecd.org/about/0,3347,en_2649_33721_1_1_1_1_1_1_100.html

³³⁷ Climate change related projects aim to achieve one of the criteria of the DAC directives either directly and explicitly (principal) or indirectly (significant). A weighting factor of 0.4 was used to calculate the financial contributions of "significant" projects whereas "principal" projects are accounted for using their entire project value.

³³⁸ Bonn Declaration on Learning for Work, Citizenship and Sustainability formulated in 2004 <http://unesdoc.unesco.org/images/0014/001405/140586m.pdf>

support to adaptation is considerably higher than the one under "adaptation specific" category.

Using the same categories³³⁹ as the EC to classify climate change projects, resources are directed to climate change activities in the following areas:

- Agriculture
- Protection of biodiversity and protected areas³⁴⁰
- Capacity building
- Promotion of energy efficiency and conservation
- Forestry
- Support to Kyoto mechanisms including CDM
- Pollution control
- Promotion of renewable energy technologies
- Waste management
- Awareness raising
- Adaptation specific³⁴¹
- Multi-sectoral³⁴²

7.3.1. *Identifying financial resources relevant to climate change*

Based on these categories, it is possible to produce an overview of those resources specific to climate change, in Table 7—1 below. Financial contributions to climate change projects have steadily risen between 2004 and 2007, reflected by total figures rising from €160 million in 2004 to €318 million in 2007.

³³⁹ Categories are used internally within EuropeAid for internal reporting purposes

³⁴⁰ Primary objective is mitigation, providing carbon sinks, however it also has a secondary adaptation element, including support to management of protected areas such as forests, mangroves and coastal areas.

³⁴¹ Adaptation specific category includes some of the EC funded programmes with specific objectives on climate change adaptation within the following sectors: disaster risk reduction, policy support, water use and sanitation, research and rural development & food security. OECD guidelines for Rio Makers do not include adaptation and no other guidelines exist on adaptation for the EC to use, so this category should be considered as is an attempt to identify the adaptation element.

³⁴² This category includes environmental projects and programmes that are not solely focusing on climate change alone but on a number of environmental issues including climate change, and support to environmental NGOs and ministries.

Table 7—1 Financial Resources relevant to climate change

| Official Development Aid ³⁴³ million €) | 2004 | 2005 | 2006 | 2007 |
|---|--------|--------|--------|--------|
| Agriculture | 14 | 9.88 | 13.92 | 9.43 |
| Biodiversity/Protected Areas | 51.43 | 50.88 | 56.28 | 6.66 |
| Capacity building ³⁴⁴ | 1.58 | 2.05 | 4.15 | 10.96 |
| Energy Efficiency | 5.37 | 2.72 | 31.27 | 42.97 |
| Forestry | 60.21 | 52.42 | 48.02 | 24.01 |
| Support to Kyoto / CDM | 0.47 | 2.31 | 1.00 | 4.80 |
| Pollution control | 7.00 | 0.00 | 6.19 | 1.48 |
| Renewable energies | 3.48 | 14.64 | 41.75 | 145.45 |
| Waste Management | 6.33 | 0.92 | 1.93 | 8.31 |
| Awareness Raising | 0.71 | 0.36 | 0.82 | 0.04 |
| Others / Multi-sectoral | 5.67 | 4.05 | 9.51 | 29.14 |
| Adaptation Specific | 4.00 | 23.66 | 17.38 | 35.04 |
| Total ³⁴⁵ | 160.24 | 163.89 | 232.22 | 318.30 |

The figures in Table 7—1 reveal some key trends:

- EC financial commitments follow specific programming cycles, which can explain the year-by-year variability of figures for specific categories or regions. One such example is the funding committed via the EU-ACP Energy facility, which improves the access to energy for the poor in African Caribbean and Pacific countries and is financing many energy efficiency and renewable energy activities, having a large impact on the 2007 figures.

³⁴³ All figures provided are commitments rather than disbursements

³⁴⁴ Capacity for adaptation. This category is based on those project classifications within DG AIDCO's database.

³⁴⁵ These figures include funds directed to two (Russia and Ukraine) Annex I countries (UNFCCC), where an EU instrument covers both non-Annex 1 and Annex 1 countries. For 2004, this amounts to €3.95 million, for 2005 it amounts to €2.8 million, for 2006 it amounts to €4.3 million and for 2007, it amounts to €22 mmillion.

- The categories to which the European Community contributes most are: biodiversity and protected areas, renewable energies, energy efficiencies, forestry and adaptation specific activities.
- Climate change adaptation in developing countries has risen in importance in the EC's agenda and has been an area of growing activity, a trend reflected by a rise in financial contributions from €4 million in 2004 to €35 million in 2007³⁴⁶.

7.3.2. Summary of bilateral contributions

Table 7—2 below, summarises total financial commitment for bilateral contributions related to the implementation of the Convention for five regions, excluding candidate countries and potential candidates³⁴⁷. A more detailed breakdown of these figures, per country, within each region is available in Appendix G-G1. The EC also runs a number of programmes or initiatives that cover more than one region, which are classified as “Global”.

Table 7—2 Summary table of financial resources for five regions³⁴⁸

| Total | | | Mitigation & Adaptation |
|-------------|-------------------|--------------------|---|
| Year | Region | Number of projects | Total value projects (million €) ³⁴⁹ |
| 2004 | ACP | 17 | 26.3 |
| | Asia | 32 | 78.9 |
| | Latin America | 22 | 20.1 |
| | Neighbourhood | 13 | 26.6 |
| | OCT | 1 | 2.8 |
| | Global | 2 | 5.5 |
| 2004 | Total 2004 | 87 | 160.2 |

³⁴⁶ Adaptation activities included in these figures are not directly comparable with all projects, policies and programmes named in Chapter 6, as Chapter 6 also includes intra-EU activities, and planned activities beyond 2007.

³⁴⁷ It is not possible to breakdown the separate, climate change related elements of funding to these countries.

³⁴⁸ These figures include funds directed to two (Russia, Ukraine and Turkey) Annex I countries (UNFCCC), where an EU instrument covers both non-Annex 1 and Annex 1 countries. For 2004, this amounts to €3.95 million, for 2005 it amounts to €2.8 million, for 2006 it amounts to €4.3 million and for 2007, it amounts to €22 million

³⁴⁹ Total figures do not sum due to rounding

| | | | |
|-------------|-------------------|------------|--------------|
| 2005 | ACP | 50 | 98.9 |
| | Asia | 30 | 22.8 |
| | Latin America | 9 | 19.2 |
| | Neighbourhood | 5 | 5.0 |
| | OCT | 2 | 2.9 |
| | Global | 8 | 15.0 |
| 2005 | Total 2005 | 104 | 163.9 |
| 2006 | ACP | 64 | 106.8 |
| | Asia | 19 | 13.8 |
| | Latin America | 30 | 65.8 |
| | Neighbourhood | 14 | 21.9 |
| | OCT | 1 | 5.2 |
| | Global | 14 | 18.7 |
| 2006 | Total 2006 | 142 | 232.2 |
| 2007 | ACP | 88 | 162.5 |
| | Asia | 11 | 18.4 |
| | Latin America | 4 | 12.4 |
| | Neighbourhood | 10 | 66.2 |
| | OCT | 3 | 17.0 |
| | Global | 11 | 41.8 |
| 2007 | Total 2007 | 127 | 318.3 |

Increasing levels of funding are allocated in the latter part of the reporting period, reflecting the fact that relevant climate change activities and projects have been identified and funding approved. There is an ongoing trend of steadily increasing levels of funding allocated within the ACP region over time.

Appendix G-G1 provides the further breakdown of the nature of the resources summarised in Table 7—2, illustrating the size and number of climate change projects on an annual basis from 2004-2007 in each of the five regions ACP, Asia, OCT, Latin America and Neighbourhood, respectively.

In addition, in December 2007, the EC agreed to provide €24.5 million to the Global Index Insurance Facility (GIIF) Trust Fund. This 60 month project aims to mitigate weather and catastrophic risks in ACP states through the application of index insurance. The budget allocated for the first phase of the facility is € 12 million (EU ACP Natural Disaster Facility).

7.3.3. Resources allocated in 2008

A significant amount of bilateral funding has been approved and allocated to climate change related projects in developing countries in 2008. Table 7—3 excludes funding allocated to Accession countries, which is outlined separately in section 7.2.1, as it is not possible to identify the climate change element of these figures for inclusion. The table indicates that there is a significant amount of funding allocated in 2008 to climate change activities in developing countries:

Table 7—3 Allocated funding for 2008 climate change activities

| Total | | | Mitigation & Adaptation |
|-------|------------------------------|--------------------|---|
| Year | Region | Number of projects | Total value projects (million €) ³⁵⁰ |
| 2008 | ACP | 47 | 114.1 |
| 2008 | Asia | 28 | 114.4 |
| 2008 | Latin America | 21 | 42.4 |
| 2008 | Neighbourhood ³⁵¹ | 23 | 163.5 |
| 2008 | OCT | 1 | 2.0 |
| 2008 | Global | 23 | 74.2 |
| 2008 | TOTAL | 143 | 510.6 |

³⁵⁰ These totals are indicative only as they do not include all the projects for 2008 that are planned, foreseen or yet to be processed.

³⁵¹ This figure includes €70m committed to a budget support programme in the Ukraine (Annex I country) – “Support to the implementation of Ukraine's strategy in the area of energy efficiency and renewable sources of energy”

7.4. Provision of financial resources to multilateral institutions and programmes

In addition to bilateral and multilateral contributions, and whilst the European Community does not contribute directly to the Global Environment Fund (GEF), the EC also provides parallel co-financing for some climate change related projects funded by the Global Environment Facility (GEF). One such example is a 2004 project in Vietnam, “*Support for Forest Sector Development*”, which benefitted from a €3 million grant. €2 million of this grant went towards supporting the Vietnam Conservation Trust Fund. This project was implemented via the World Bank.

In addition, the Adaptation Fund was established in 2007 to support developing countries that lack resources to cope with adapting to and mitigating climate change and to be financed mainly from a share of Clean Development Mechanism (CDM) revenues. There have been no EC contributions to date; more detailed information on Member State contributions can be found in their National Communication.

The European Community contributes to multi-lateral institutions and programmes for climate change activities in developing countries. These contributions are shown below in Table 7—4 below. It has been possible to identify the climate change element of funding projects and programmes more accurately than in previous National Communications due to enhanced data management by the EC; as a result the figures are more accurate and reflect more adequately the proportion of contributions relevant to climate change³⁵². *This explains why some figures, such as the European Community’s contributions to UNDP, appear lower than the figures which were reported in the European Community’s 4th National Communication.*

³⁵² These figures do not take into account programmes that have been committed but not contracted at the time of writing.

Table 7—4 Financial contributions to multilateral institutions and programmes

| Institution or programme | Contribution (million €) | | | |
|---|--------------------------|-------|-------|-------|
| | 2004 | 2005 | 2006 | 2007 |
| Multilateral Institutions | | | | |
| CIFOR | 0.00 | 0.00 | 0.00 | 2.00 |
| EBRD | 0.00 | 1.57 | 13.74 | 0.00 |
| FAO | 0.00 | 1.21 | 6.85 | 14.48 |
| IUCN | 0.00 | 0.00 | 0.24 | 0.00 |
| OECD | 0.00 | 0.00 | 0.00 | 0.20 |
| UN RISD | 0.00 | 1.43 | 1.45 | 0.00 |
| UNDP | 30.00 | 11.48 | 1.07 | 4.00 |
| UNEP | 2.40 | 1.64 | 3.52 | 19.00 |
| IEA | 0.40 | 0.40 | 0.40 | 0.40 |
| UNFCCC | 0.55 | 0.95 | 2.15 | 4.25 |
| UNICEF | 0.00 | 0.00 | 1.78 | 0.00 |
| UNOPS | 0.00 | 0.00 | 9.90 | 0.00 |
| WB | 16.10 | 3.00 | 3.42 | 6.48 |
| | | | | |
| Multilateral scientific, technological and training | | | | |
| 1. WWF | 1.83 | 1.53 | 3.50 | 1.55 |

7.5. Future Commitments

Beyond these initial figures available for 2008, there are a number of significant activities that the EC has already planned for beyond 2008. To reflect the EC's commitment to climate change support for developing countries, the EC has announced that climate change will be a priority in the upcoming Country Strategy Papers mid-term review

exercise in 2009-2010. This will contribute to redirect strategies to ensure that climate change becomes more prominent in the 2007-2010 programming cycle.

The Global Climate Change Alliance (GCCA) became operational in 2008 and is already a key element of the EU's external development action in the area of climate change, providing a platform for dialogue and exchange as well as practical cooperation between the EU and those developing countries that are most vulnerable to climate change, in particular the least developed countries (LDCs) and small island developing states (SIDS), as outlined in chapter 6.

The European Commission has earmarked €70 million in additional funding from the Environment and Natural Resources Thematic Programme (ENRTP) over the period 2008-2010 to start up the GCCA and finance country interventions. A significant share of existing geographic and thematic funding will also serve the objective of the initiative. Around €30 million of ENRTP funds are expected to contribute to REDD. Under the 10th EDF 'intra-ACP' regional funding of €40 million is allocated to the implementation of the GCCA at regional level in Africa, the Caribbean and Pacific and with a strong focus on adaptation and capacity building. This is in addition to €180 million allocated for the implementation of the EU strategy for supporting Disaster Risk Reduction in the ACP. The Commission also appealed to the EU Member States to contribute resources to the GCCA.³⁵³ The GCCA was discussed with the EU Member States, who endorsed its objectives, indicating that support should be complementary to existing initiatives. The European Council of June 2008 called for the effective implementation of the GCCA and invited the Commission to consider innovative means of financing.³⁵⁴

There are a number of future commitments mentioned throughout this report, namely in sections 6.4.2.3 and 8.1.3 which cover relevant future commitments on climate change activities both within and beyond the EU which will benefit from EC funding. Further information on future financial commitments relating to financial instruments already covered in this chapter are described in earlier sections 7.2.1, 7.2.3 and 7.3.

A replenishment of the ACP-EU Energy Facility has been decided under the 10th European Development Fund for the period of 2009-2013. Endowed with €200 Million, it will focus on improving access to safe and sustainable energy services in rural and peri-urban areas. The new Energy Facility will also contribute to the fight against climate change by emphasizing the use of renewable energy sources and energy efficiency measures and by taking into account impacts of climate change on energy systems. The new Facility would start being implemented by the end of 2009.

Following the 5th Summit between Heads of State and Government of the EU and Latin American and Caribbean countries and the subsequent Lima Declaration in May 2008, the European Commission foresees to encourage bi-regional cooperation between Latin America and the European Union on climate change issues (exchange of experiences,

³⁵³ Sweden is contributing € 5.5 million in 2008. Czech Republic is contributed €1.2 million. Other MS expressed interest to support the GCCA.

³⁵⁴ See Council Conclusions on GCCA of 20th November 2007.

strengthen institutional capacities, etc.). The EUroCLIMA Initiative is planned to start beginning of 2010 with an EC contribution of €5 million. The Initiative envisages to focus on improving the knowledge of the decision-makers and the scientific community on problems and consequences of climate change, particularly in view of integrating these issues into sustainable development strategies.

The European Commission also plans to establish the Latin America Investment Facility (LAIF) through the DCI. The LAIF will focus on energy, environment and transport investment, contributing to cleaner transport infrastructure, improved energy efficiency and energy savings, the use of renewal energy, low-carbon production and of climate change adaptation technologies. It will also provide support to SME development and to social sector infrastructures. The LAIF will operate by providing financial non-refundable contributions to support loans to partner countries from the European Investment Bank (EIB) and other European, multilateral and national, development finance institutions and will encourage the beneficiary governments and public institutions to carry out essential investments in the relevant sectors. The contribution of the Commission to the LAIF will be decided annually. For the year 2009, the Commission will allocate a budget of €10.85 million.

7.6. Activities related to the transfer of technology

Technology Transfer (TT) in the context of climate change is defined as: “A broad set of processes covering the flows of know-how, experience and equipment for mitigating and adapting to climate change among different stakeholders.” More specifically, the transfer and development of technology activities can be hard or soft in nature. These categorisations are defined in the Technology Transfer Framework³⁵⁵ as:

- “soft” technologies: capacity-building, information networks, training and research.
- “hard” technologies: equipment to control, reduce or prevent anthropogenic emissions of greenhouse gases in the energy, transport, forestry, agriculture, and industry sectors, to enhance removals by sinks, and to facilitate adaptation.

The framework also lists five themes for technology transfer, enabling more precise identification of projects that are of relevance:

- (1) Technology needs and needs assessments
- (2) Technology information
- (3) Enabling environments
- (4) Capacity-building
- (5) Mechanisms for technology transfer

³⁵⁵ Technology Transfer Framework: <http://unfccc.int/ttclear/jsp/Framework.jsp>

7.6.1. Overview of EC funded technology transfer initiatives and programmes

All development aid cooperation projects in the field of climate change, and described in the previous section, involve technology transfer activities as defined by the technology transfer framework. It is in most case impossible, within a given programme, to get a breakdown of the technology transfer activities and related financial resources; therefore, all development cooperation programmes have been considered as technology transfer in the following section.

In addition to these, there are a number of other climate change activities involving technology transfer funded by the EC, most notably in the area of research. The following section provides an overview of such programmes.

7.6.1.1. EC Framework Programmes

The 7th Framework Programme for research and technological development (FP7) remains the most important EC financial mechanism to support research on climate change and the development of energy technologies, including cooperation with non-EU countries, with resources for research in support to TT and capacity building with third countries. Many specific FP instruments are developed to promote and support international cooperation including on climate change technologies and are described in more detail in chapter 8.

The main component of FP7, running between 2007 and 2013, is the €32.4 billion “Cooperation³⁵⁶” programme, which is divided into research themes, one of which is called “Environment (including climate change)”: with a total budget of €1.89 billion, it will be the cornerstone of environmental research in Europe but will also expand to developing countries, as a number of projects under FP7 are specifically targeted at these countries.

Strategic Energy Technology Plan

The Strategic Energy Technology (SET) Plan provides a blueprint for Europe to develop a world-class portfolio of affordable, clean, efficient and low emission energy technologies. It puts forward a vision of Europe investing and working collectively to develop and facilitate a global market take-up of such technologies, with European industry leading the way. SET Plan also includes a substantial international cooperation dimension with industrialised, emerging and developing countries that should create new opportunities for cooperation between the EU and international partners.

Near-zero Emissions Power Generation Technology through Carbon Dioxide Capture and Storage

The EU and China committed to cooperate on Carbon Dioxide Capture and Storage (CCS) in the framework of the "Near-zero Emissions Power Generation Technology through Carbon Dioxide Capture and Storage" programme (NZEC). This cooperation aims at demonstrating the CCS technology in China to enable deployment from 2020. The EU-

³⁵⁶ Dedicated to research cooperation

China NZEC was launched in 2005 and is part of the wider EU-China Partnership on Climate Change. Phase 1 of NZEC (R&D) is currently being executed under the umbrella of an EU-China Memorandum of Understanding. Several FP6 and FP7 research projects support the implementation of Phase 1 to be completed at the end of 2009. The next two phases will follow: PHASE II (site selection and design of plant) and PHASE III (construction and operation of the plant).

European Energy Technology Platforms

The European Energy Technology Platforms (ETPs) were set up to define, at European level, common strategic research agendas which should mobilise a critical mass of national and European public and private resources. The ETPs also represent a forum for discussion and exchange views on R&D cooperation with international partners. There are 6 ETPs in non-nuclear energy (PV, SmartGrids, Biofuels, Zero-emission fossil fuel plants, Solar Thermal, Wind) and one Sustainable Nuclear Energy Technology Platform (SNETP).

ITER

The Joint International R&D project ITER translates the political will into a large scale concrete international instrument pooling resources from different key international partners. ITER is a joint international research and development project that aims to demonstrate the scientific and technical feasibility of fusion power. The partners in the project are the EC, represented by EURATOM, Japan, the China, India, the Republic of Korea, the Russian Federation and the USA.

CO₂ Coach

The COACH project aims at establishing broad cooperation between China and the EU in the field of CCS. It will prepare the ground for implementation in China of large-scale poly-generation energy facilities with options for coal based electric power generation as well as production of hydrogen and synthetic fuels. For these facilities, CO₂ capture and geological storage (including use for enhanced oil or gas recovery) constitute an inherent and decisive prerequisite.

More information about projects can be found on the CORDIS³⁵⁷ website, an information space for European Research and Development (R&D) and exploitation of European R&D results. Examples of projects under the environment theme of the EC FP6 and FP7 relevant to non-Annex I countries regarding technology transfer for climate change activities also include³⁵⁸:

- TETRIS (Technology Transfer and Investment Risk in International Emission Trading),
- ADAM (Adaptation and Mitigation Strategies: Supporting European Climate Policy),

³⁵⁷ http://cordis.europa.eu/home_en.html

³⁵⁸ A catalogue of EC funded research projects since 2003 is available via <http://ec.europa.eu/research/environment/pdf/cop-15.pdf>

- GAINS-ASIA (Greenhouse Gas and Air Pollution Interactions and Synergies),
- TOCSIN (Technology-Oriented Cooperation and Strategies in India and China: Reinforcing the EU dialogue with Developing Countries on Climate Change Mitigation),
- ClimateCost (Full Costs of Climate Change) (see 8.2.4 for further information),
- HighNoon (Impacts of Himalayan glaciers retreat and monsoon pattern change on the water resources in Northern India, and adaptation strategies),
- Climate for Culture (Development and application of methodologies, technologies models and tools for damage assessment, monitoring and adaptation to climate change impacts).

7.6.2. *Financial resources dedicated to the transfer of technology*

Funding for technology transfer in climate change has more than doubled by the end of the reporting period, from €160 million in 2004 to €318 million in 2007. Table 7-5 below indicates that the majority of resources are directed to soft technology transfer activities over the reporting period, which includes capacity building: €552 million compared to €219 million on hard technologies. It may appear that there is a trend from these figures in a shift towards hard technology transfer, as the figures are now higher than soft transfer of technology for 2007 from a much lower base in 2004, however, this is mainly due to resources committed via the Energy Facility.

Table 7-5 and subsequent graphs demonstrate the significant increased level of financial resources dedicated to the transfer of hard and soft technologies related to climate change in developing countries.

Table 7—5 Projects that facilitate the transfer of either hard or soft technology related to climate change³⁵⁹

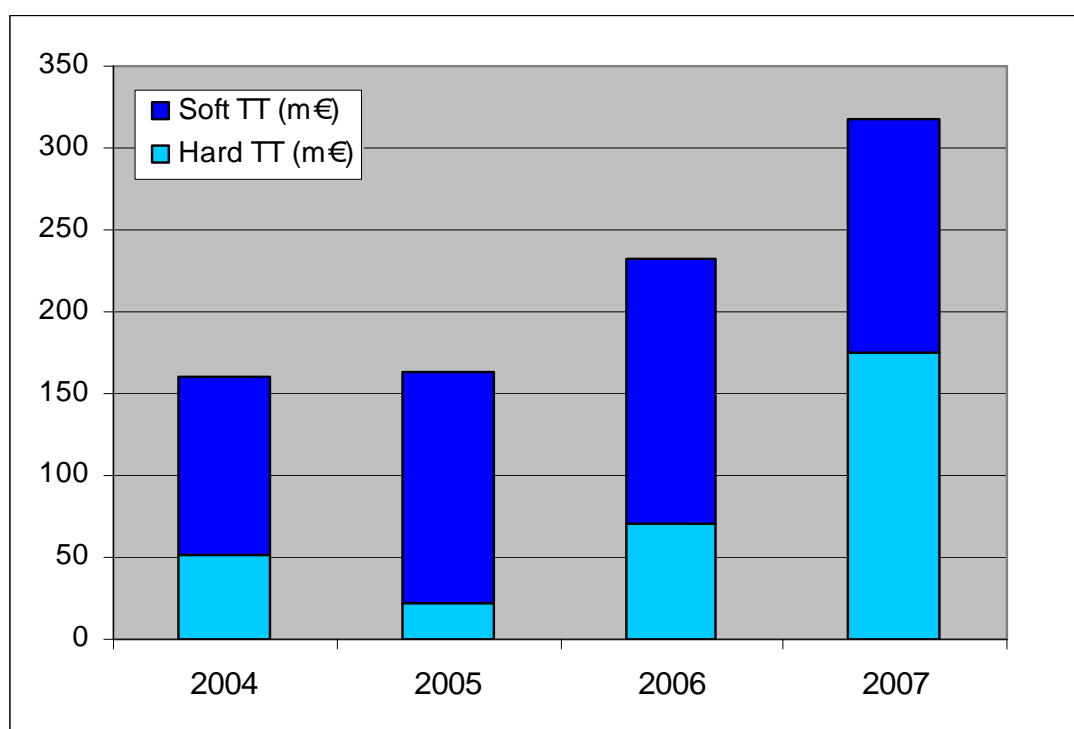
| Year | Region | Hard TT (million €) | Soft TT (million €) | Total TT (million €) |
|-------------|---------------|---------------------|---------------------|----------------------|
| 2004 | ACP | 5,3 | 21,0 | 26,3 |
| | ASIA | 17,8 | 61,1 | 78,9 |
| | LATIN AMERICA | 11,4 | 8,7 | 20,1 |
| | NEIGHBOURHOOD | 14,9 | 11,7 | 26,6 |
| | OCT | 2,8 | 0,0 | 2,8 |
| | GLOBAL | 0,0 | 5,5 | 5,5 |
| | TOTAL | 52,2 | 107,9 | 160,2 |
| 2005 | ACP | 15,5 | 83,4 | 98,9 |
| | ASIA | 1,8 | 21,0 | 22,8 |
| | LATIN AMERICA | 0,2 | 19,0 | 19,2 |
| | NEIGHBOURHOOD | 2,0 | 3,0 | 5 |
| | OCT | 2,1 | 0,8 | 2,9 |
| | GLOBAL | 0,0 | 15,0 | 15 |
| | TOTAL | 21,6 | 142,2 | 163,9 |
| 2006 | ACP | 13,4 | 93,5 | 106,8 |
| | ASIA | 2,1 | 11,7 | 13,8 |
| | LATIN AMERICA | 30,2 | 35,6 | 65,8 |
| | NEIGHBOURHOOD | 17,8 | 4,1 | 21,9 |

³⁵⁹

All projects funded by DG AIDCO are considered as technology transfer projects; the database covers development cooperation projects funded in the following five regions: Latin America, Asia, ACP, Neighbourhood and OCT. Note that Neighbourhood region also contains two non Annex-1 countries where technology transfer projects have been funded (Russia and Ukraine); for 2004, this amounts to €3.95 million (Hard: €3.35 million Soft: €0.6 million), for 2005 it amounts to €2.8 million (Hard: €2.6 million, Soft: €0.2 million), for 2006 it amounts to €4.3 million (Hard: €4 million, Soft: €0.3 million) and for 2007, it amounts to €22 million (Hard).

| | | | | |
|-------------|---------------|--------------|--------------|--------------|
| | OCT | 5,2 | 0,0 | 5,2 |
| | GLOBAL | 2,3 | 16,4 | 18,7 |
| | TOTAL | 71,1 | 161,2 | 232,2 |
| 2007 | ACP | 80,7 | 81,8 | 162,5 |
| | ASIA | 0,4 | 18,0 | 18,4 |
| | LATIN AMERICA | 0,0 | 12,4 | 12,4 |
| | NEIGHBOURHOOD | 50,0 | 16,2 | 66,2 |
| | OCT | 4,8 | 12,2 | 17 |
| | GLOBAL | 39,5 | 2,3 | 41,8 |
| | TOTAL | 175,4 | 142,9 | 318,3 |

Illustration 7-1 Distribution of hard and soft technology transfer (TT) - 2004 to 2007



7.6.3. Promoting international cooperation in the private sector

The European Community is undertaking a number of activities to involve the private sector in projects and programmes relating to the transfer of technologies to mitigate and adapt to climate change. There are number of projects between 2004 and 2007 that aim to promote or encourage private sector involvement, ranging in size and geographical location, including one project with an EC contribution of over €23 million, the EU-China CDM Facilitation Project. This provides training and capacity building programme on the Clean Development Mechanism (for more details see Appendix G – G2). This project is part of the China-EU Climate Change Partnership that was signed in 2005 (see details in section 9.3.15).

Appendix G – G2 presents a selection of twelve such initiatives, describing in more detail the range of activities carried out in the ACP, Asia, Latin America and Neighbourhood regions.

In addition to the above mentioned initiatives, the EC is interested in analysis of sectoral approaches, best described as “cooperative sectoral approaches and sector specific activities”³⁶⁰. These have emerged as a promising tool to motivate developing countries and industry to reduce greenhouse gas emissions (GHG) in key economic sectors. Energy intensive industries (aluminium, cement and steel), are a particularly attractive focus for sectoral approaches as they account for a considerable proportion of GHG emissions. Sectoral approaches can also help developing countries meet their responsibilities for financing sustainable development and technology transfer. Therefore, the EC is currently running a study with a budget of €1.9 million from 2008-2010 being undertaken with industries and governments in China, Brazil and Mexico to analyse their performance with the aim of seeing whether sectoral approaches are viable.

7.6.4. Innovative Instruments to engage the private sector

In addition to providing financial assistance directly to projects that have the objective to promote private sector involvement, the European Community has launched an innovative pilot instrument to involve the private sector. The Global Energy Efficiency and Renewable Energy Fund³⁶¹ (GEEREF), launched in 2007, is focused on energy efficiency and renewable energy projects in developing countries and economies in transition. GEEREF invests in regionally-orientated investment schemes and prioritises small investments below €10 million.

In December 2008, The GEEREF Investment Committee gave preliminary approval to investments totalling €22 million in two commercial renewable energy investment funds, one focusing on projects in sub-Saharan and southern Africa and the other in Asia with a

³⁶⁰ Bali Action Plan, Decision CP13, page 2
http://unfccc.int/files/meetings/cop_13/application/pdf/cp_bali_action.pdf

³⁶¹ Communication from the Commission to the Council and European Parliament, Mobilising public and private finance towards global access to climate-friendly, affordable and secure energy services: The Global Energy Efficiency and Renewable Energy Fund
http://ec.europa.eu/environment/jrec/pdf/com_2006_583_en.pdf

primary focus on India. Both funds will invest equity in renewable energy projects such as wind energy generation, small hydro-electric generation, biomass and methane recovery. In the regions where the two funds operate, there is a lack of equity investment available through the market for these types of projects. It is envisaged that GEEREF will invest in regional sub-funds for the African, Caribbean and Pacific (ACP) region, Neighbourhood, Latin America and Asia. Together the European Commission, Germany and Norway have committed about €110 million to the GEEREF over the period 2007-2011, the majority of which is provided by EC contributions. It is envisaged that further financing from other public and private sources will be forthcoming. In 2007, the EC contributed €5 million towards a support facility for the GEEREF and a further €25 million in form of grants.

7.6.5. *Technology Transfer Success Stories*

Each climate change project funded by DG AIDCO to non-Annex I countries contains a considerable technology transfer element and there are hundreds of individual projects being undertaken across all regions which have technology transfer as a key element to the projects, covering adaptation and mitigation. In order to assess the performance of technology transfer projects, the Results Orientated Monitoring (ROM) database³⁶² is used to assess the projects against five key criteria: relevance, efficiency, sustainability, effectiveness and impact. Each of these criteria are graded according to the following scale:

- A – Excellent
- B – Minor problems
- C – Some problems which require actions
- D – Major problems which require serious actions

Appendix G-G3 outlines a selection of twelve of the successful technology transfer projects undertaken in each region, assessed with ROM evaluation scores³⁶³. This includes examples, such as the Regional Solar Programme in West Africa, providing renewable energy as water sanitation, which benefits from €65 million from 2006-2010. As many of the projects are ongoing, it has not been possible to quantify the impacts on GHG emissions or sinks for the 5th National Communication.

³⁶² DG AIDCO evaluates the success of their projects using Result Orientated Monitoring

³⁶³ Projects highlighted usually score a combination of A and B scores.

8. RESEARCH AND SYSTEMATIC OBSERVATION

Key developments

Since the 4th National Communication (2006), there have been key developments in climate change research at the EC level, particularly in the 7th Framework Programme (FP7) for Research and Technological Development which started in 2007:

- The total budget of FP7 amounts to € 50.52 billion over the period (2007-2013) which represents an increase of 65 % compared to FP6 budget in average annual terms. The structure of FP7 is larger and more integrated, with four main areas – “Cooperation”, “People”, “Ideas”, and “Capacities” (with a fifth, Euratom €2.75 billion, dedicated to nuclear research). Sustainable development has been mainstreamed as a component and objective of all EC research.
- The main area, “Cooperation” (64 % of FP7 budget), consists of ten themes, comprising “Environment (including climate change)”³⁶⁴ which is granted €1.89 billion over the period 2007-2013 and of which 14% funded climate focused research projects since 2007. The 6th Framework Program "Global Change and ecosystems" theme was allocated € 853 million of which 19 % funded climate focused research projects over the period 2003-2006.
- Within FP7’s environmental research theme, new activities are supported in the fields of environment and health, environmental technologies, sustainable development and Earth observation.
- Research projects funded in themes such as Space and Global Monitoring for Environment and Security (GMES), Energy, Transport, Agriculture and Fisheries in the "Cooperation" component of FP7 contribute to research on the climate system, the understanding of the impacts of climate change and the identification of options for mitigation and adaptation. Additional climate relevant research projects are granted in the “People”, “Ideas”, and “Capacities” components of FP7. Since 2003, expenditures on climate research in the EC Framework Programme are estimated to nearly €570 million.
- Research projects funded in the areas of GMES (€1.43 billion in FP7), Energy (€2.35 billion), Transport (€4.16 billion), Agriculture and Fisheries (€1.93 billion) are instrumental to supporting research relevant to the implementation of mitigation and adaptation measures including the development of relevant technologies.

³⁶⁴

Under FP6, climate change research was funded mainly under the thematic sub-priority area “global change and ecosystems”.

- The European Union has adopted a strategic plan to accelerate the development and deployment of cost-effective low carbon technologies through joint strategic planning and a more effective implementation of programmes.
- The European Strategy Forum for Research Infrastructures (ESFRI) has been developing an “open method of coordination” between different countries to discuss the long term vision at European level and to support the development of a European Research infrastructure policy, and in this context published two roadmaps (2006 and 2008).
- Under FP7, a new tool - known as Joint Technology Initiatives (JTIs)³⁶⁵ – that combines private sector investment and/or national and European public funding has been introduced.
- In FP7, international cooperation has been mainstreamed, with any third country researcher or institution being able to participate in FP7 calls. In addition, under the cooperation programme, there are projects dedicated specifically to international cooperation.
- Climate research undertaken in the EC Joint Research Centre (total budget of €1.75 billion in FP7) provided support EC climate change policies and enhancement of scientific knowledge on climate change.
- Last, the European Research Council (ERC) has been established, with the aim of encouraging groundbreaking science proposed by leading researchers themselves. ERC, which will effectively work as a national research council at the EC level, will also take responsibility for project implementation.

8.1. General policy on research, systematic observation, and provision of environmental information

The EC has a long and distinguished history of research in the field of climate change. Research is supported by the EC mainly through the Framework Programmes (FPs) for Research and Technological Development. Climate change research has been in these programmes since the 1980s; an early focus was on the stratosphere and on the ozone layer in particular, while in the 1990s research concentrated on the carbon cycle.

Since then climate change research has increased in size and complexity and growing funds have been allocated to it under the various Framework Programmes. Under FP6 (running from 2003-2006)³⁶⁶, €853 million supported 280 projects in the “Global Change and Ecosystems” sub-programme³⁶⁷. Amongst the ten activities included in this sub-

³⁶⁵ The dedicated structures implementing the JTIs are independent legal entities, with a dedicated budget and staff. The European Commission is a founding member of each JTI and enjoys a veto right on a number of pre-defined items.

³⁶⁶ http://ec.europa.eu/research/fp6/index_en.cfm

³⁶⁷ http://ec.europa.eu/research/environment/pdf/global_change_ecosystem.pdf

programme, research on climate change benefitted from 19 % of the budgetary allocation. Under FP7³⁶⁸, running from 2007-2013, funding for climate change research remains important and other themes than "environment (including climate change)" increasingly contribute to climate change research and to research relevant to the implementation of mitigation and adaptation options, in particular technological developments. This is discussed in section 8.1.1.

Systematic observation

The EC has also developed considerable experience and technical know-how in the design, production and operation of Earth Observing (EO) tools over the past few decades. The main activities undertaken by the EC for the observation of essential climate variables (atmospheric, oceanic and terrestrial) are presented in the following sections. Most of these activities aim to implement the Global Earth Observation System of Systems (GEOSS) (see section below). For this reason, most of the information included in section 8.3 was drawn from the report that the European Community submitted to the UNFCCC in November 2008 on EC actions regarding global climate observing systems³⁶⁹. Under both FP6 and FP7, significant resources have been devoted to research on Earth observation, related to GEO and GEOSS activities³⁷⁰.

The EC is one of the world's leading players in the advancement of EO technologies and related environmental applications. EC remote-sensing satellites cover all of the Earth's climatic zones, and European ground-based, air-based and ocean-based monitoring devices provide high quality observation data for multiple uses, such as urban planning, adaptation to climate change, disaster reduction, disease control and humanitarian relief.

The European Commission is a member of the Group on Earth Observation (GEO). GEO is a voluntary partnership of governments and international organizations, including 74 governments and the European Commission, plus 51 intergovernmental, international, and regional organizations with a mandate in earth observation or related issues recognized as Participating Organizations³⁷¹. On 16th February 2005, at a summit hosted by the European Commission in Brussels, over 50 countries and 40 international and scientific organizations signed up to create the Global Earth Observation System of Systems (GEOSS). GEOSS aims to bring together all available information on the state of the global environment, consolidating existing data from disparate sources.

³⁶⁸ <http://cordis.europa.eu/fp7/>

³⁶⁹ European Commission (2008) Commission Staff Working Document – report to the UNFCCC on European Community actions regarding global climate observing systems - SEC2008(2927)final.

³⁷⁰ Further details of the projects can be found at <http://cordis.europa.eu/fp7/dc/index.cfm#searchform> and <http://cordis.europa.eu/fp6/projects.htm>

³⁷¹ The EC provides financial support to the GEO Secretariat (600,000 EUR for 2008). In addition, the EC is actively involved in the all four GEO committees.

Other EU research programmes

In addition to the FPs, the EC supports climate change-related research through other programmes, such as LIFE and the Competitiveness and Innovation Framework Programme (CIP) (see section 8.1.2 for further details).

EC-funded research activities aim to assess both the causes and the impacts of climate change, from a bio-physical and socio-economic perspective. In addition, a number of projects are to identify effective strategies to reduce greenhouse gas emissions (particularly in the energy and transport sectors) and to adapt to the impacts of climate change.

Contributions to other non-EU research programmes

Although the main focus of research activity is on the EU, a considerable number of EC-funded research activities address climate change impacts and adaptation options in vulnerable ecosystems and regions outside Europe as described in chapters 6 and 7 respectively. Earth observation projects have been funded, in particular to contribute to the implementation of the Global Earth Observation System of Systems (GEOSS) (see section 8.3).

EC research has significantly contributed to the advancement of climate change science, particularly within the IPCC process³⁷². The findings of this research have informed international policy making on climate change and have supported the development of EC climate change policies and strategies. The IPCC process has also contributed to the identification of research priorities and knowledge gaps to be addressed in FP7 calls for proposals, as reported in a European Commission Staff working document³⁷³. In 2008 the DG RTD of the European Commission also established a dedicated Commission Inter-Service Group on IPCC activities. The EC has also made some direct contributions to the IPCC, for example, DG ENV provided €0.2 million to help support the preparation of the 4th Assessment Report, participation of developing countries to IPCC meetings and communication activities. DG AIDCO have also provided funding (€1 million) for outreach activities.

With respect to the international ESSP (Earth System Science Partnership)³⁷⁴ research programmes on climate change, the EC does not contribute directly to its funding (contributions are made directly by Member States). However, the EC does contribute indirectly via research projects funded under the Framework Programmes which are endorsed by the ESSP under one its four branches (see table below) and the International Group of Funding Agencies for Global Change Research (IGFA).

³⁷² For instance, the findings of numerous studies published as part of EC-funded research activities on climate change were included in the IPCC's Fourth Assessment Report (FAR) <http://www.ipcc.ch/ipccreports/assessments-reports.htm>

³⁷³ http://ec.europa.eu/research/environment/pdf/commission_working_doc.pdf

³⁷⁴ <http://www.essp.org/>

Table 8—1 EC representation by endorsed projects within the ESSP components

| ESSP Organisation Branch | Total number of endorsed research projects per Organization | Number of endorsed research projects co-funded by the EC | EC co-funded Projects ID |
|---|--|---|---|
| WCRP (World Climate Research Programme) ³⁷⁵ | 25 | 3 | RAMI, AMMA, CLARIS-LPB |
| IGBP (International Geosphere-Biosphere Programme) ³⁷⁶ | 128 | 25 | ACCENT, SPACC, ENVIFISH, NATFISH, SARDYN, BASIN, RUBICODE, RETPEC, CAVES, SENSOR, REDD-ALERT, AMMA, EUCAARI, WATCH, ICED, CARBOOCEAN, EPOCA, ECOMADR, ELME, GTOS, ENCOR, SPICOSA, Sustainable North-Sea Coastal region, Erasmus Mundus Joint Master in Water and Coastal Management, ELOISE |
| IHDP (International Human Dimensions Programme) ³⁷⁷ | 11 | 6 | COST, GLOGOV, GOVERNAT, REFGOV, FAVAIA, PLUREL |
| DIVERSITAS ³⁷⁸ | 7 | | |

In some cases, projects co-funded by the EC make up for more than 50 % of the total, for example, IHDP Projects.

³⁷⁵ <http://wcrp.wmo.int/wcrp-index.html>

³⁷⁶ <http://www.igbp.net/>

³⁷⁷ <http://www.ihdp.org/>

³⁷⁸ <http://www.diversitas-international.org/>

Overview of programmes and budget allocation

The table below provides an overview of EC research funding across FP6, FP7 and other programmes (described further in subsequent sections) with estimates of allocated budget. *It should be noted* that reported budget estimates depend on the label identifying expenditure on climate research within the research programme budgets. For example, the FP7 theme environment (including climate change) is estimated to devote 14 % of its budget since 2007 to climate related research and research activities in other themes will include some climate research as well. A differentiation can be made between:

- Climate change research contributing to the understanding of the climate system, the knowledge on impacts of climate change and the identification of options for climate change adaptation and mitigation including the relevant costs quantifications;
- Research contributing to the development and implementation of climate change mitigation and adaptation options. This latter research includes sustainable technology development in the energy, transport, agriculture and fisheries sectors.

Table 8-2 contains a bottom-up estimate of the expenditure on projects within a number of programmes addressing climate change research as described above.

Table 8—2 Summary of EC research programmes and budgets

| Programme / Institution | Areas | Themes / Topics | Budget (allocated during period) €million** | Estimate of climate change research related funding € million* |
|--|---|---|--|---|
| 6th Framework Programme (2003-2006) ³⁷⁹ | All (excluding Euratom) | | 17,500 | 339 (from 72 FP6 funded projects) |
| | Thematic priorities | Sustainable development, global change and ecosystems | 2,300 | |
| | | Sustainable energy systems | 890 | |
| | | Sustainable surface transport | 670 | |
| | | Global change and ecosystems | 853 | |
| | <i>Other includes: Life sciences, genomics and biotechnology for health; Advanced genomics and its applications for health; Combating major diseases; Information society technologies; Nanotechnologies and nanosciences, knowledge-based multifunctional materials and new production processes and devices; Aeronautics and space; Food quality and safety; Citizens and governance in a knowledge-based society</i> | | 10,109 | |
| Specific activities covering a wider field of research | Includes: Policy support and anticipating scientific and technological needs; Horizontal research activities involving SMEs; Specific measures in support of international cooperation | | 1,409 | n/a |
| | Non-nuclear activities of the Joint Research Centre | | 835 | |

³⁷⁹

<http://cordis.europa.eu/fp6/budget.htm>

| | | | | |
|---|---|--|--------|---|
| | Structuring the European Research Area | Includes: Research and innovation; Human resources; Research infrastructures; Science and society | 2,854 | 24 (Research Infrastructures) 65 (Marie Curie Actions) |
| | Strengthening the foundations of the European Research Area | Includes: Support for the coordination of activities; Support for the coherent development of policies | 347 | n/a |
| Euratom Framework Programme (2003-2006) | | Includes: Priority thematic areas of research (Controlled thermonuclear fusion; Management of radioactive waste; Radiation protection); Other activities in the field of nuclear technologies and safety; Nuclear activities of the Joint Research Centre (JRC) | 1,230 | n/a |
| 7th Framework Programme (2007-2013)³⁸⁰ | All (excluding Euratom) | | 50,521 | 228 (from 62 FP7 projects funded to June 2009) |
| | Cooperation | <i>All (includes Specific International Cooperation Actions – mainstreamed into all themes below)</i> | 32,413 | |
| | | Energy | 2,350 | |
| | | Environment (including climate change) | 1,890 | |
| | | Transport (including aeronautics) | 4,160 | |
| | | <i>Other themes includes: Health; Food, agriculture and fisheries, and biotechnology; Information and Communication Technologies; Nanosciences, nanotechnologies, materials and new production technologies; Socio-economic sciences and the humanities; Space; Security</i> | 24,013 | |
| Ideas | European Research Council | 7,510 | | |

³⁸⁰

http://cordis.europa.eu/fp7/budget_en.html

| | | | | |
|---|--|---|-------|---|
| | Capacities | Research Infrastructures; Research for the benefit of SMEs; Regions of Knowledge; Research Potential; Science in Society; Coherent development of research policies; Activities of International Co-operation | 4,097 | |
| | People | Marie Curie Actions | 4,750 | 57 (Marie Curie Actions) |
| | Non-nuclear actions of the Joint Research Centre | | 1,751 | n/a |
| Euratom for nuclear research and training activities (2007-2013) | | | 2,751 | n/a |
| LIFE (1992-2006) | Environment Policy Development & Implementation of EC policy and legislation | | 1,800 | |
| LIFE + (2007-2013) | Environment policy and governance | Various areas including priority climate change areas such as: Implementation of EC commitments under the UNFCCC and the Kyoto Protocol; Development of a post-2012 strategy and implementation programme; Mitigation of the impacts of climate change on the European economy, society, and nature; Development and implementation of market-based instruments to achieve a cost-efficient emission reduction for the period after 2012. | 2,140 | 24 Million (from 22 projects funded under the 2007 and 2008 calls for proposal) |
| | Nature and biodiversity | | | n/a |
| | Information and communication | | | |
| Competitiveness and Innovation Framework programme (CIP) (2007-2013) | All | | 3,630 | n/a |
| | Intelligent Energy Europe (IEE) | Fostering energy efficiency and rational use of energy sources | 730 | |
| | | Promoting new and renewable energy sources and energy diversification | | |
| | | Promoting energy efficiency and new energy sources in transport | | |

| | | | | |
|---|--|----------------|-------|-----|
| | Entrepreneurship and Innovation Programme (EIP) | Eco-innovation | 430 | |
| | | Other | 1,740 | |
| | Information Communication Technologies, policy support programme | | 730 | |
| Environmental Technologies Action Plan (2007-2013) | | | 195 | n/a |

Note: * Climate change research contributing to the understanding of the climate system, the knowledge on impacts of climate change and the identification of options for climate change adaptation and mitigation including the relevant costs quantifications.

** Numbers may not add due to rounding.

8.1.1. Framework Programme for Research and Technological Development

With a total budget of €50.52 billion (excluding Euratom research³⁸¹), the 7th Framework Programme (FP7) runs from 2007 to 2013. The budget represents an increase of 65 % compared to FP6 budget in average annual terms. FP7 comprises four components defining EC research funding structure:

- **Cooperation:** the €32.4 billion programme fosters collaboration between industry, academia, research centres and public authorities throughout the EU and beyond. The Cooperation programme is sub-divided into ten distinct themes, which include Environment (including climate change) (€1.89 billion), Energy (€2.35 billion), Space and Global Monitoring of Environment and Security (GMES) (€1.43 billion), Agriculture and Fisheries (€1.93 billion) and Transport (€4.16 billion) and which includes notably the development of greener technologies. The programme is implemented through calls for proposals by the Commission;
- **Ideas:** the objective of the €7.51 billion programme is to reinforce European research and improve the attractiveness of Europe for the best researchers from both European and third countries, as well as for industrial research investment. For its implementation, a European Research Council (ERC) has been established by the European Commission under this specific programme;
- **People:** the People programme aims at supporting the consolidation of the European Research Area (ERA) through the strengthening of the human potential in research in Europe. It is implemented through a set of Marie Curie Actions, targeting researchers at all stages of their career. There is no thematic limitation: projects from all scientific area can be funded. The overall budget is of €4.7 billion, representing a 50 % average annual increase over the FP6.
- **Capacities:** the €4.10 billion programme, is to optimise the use and development of research infrastructures, while enhancing the innovative capacities of SMEs to benefit from research. An additional objective is to bring Europe closer, and enhance cooperation at all levels. Some EC funded research infrastructures are specific or strongly relevant to climate change-related research. Under FP6, the level of the EC contribution was about €24 million. Under FP7, the funding has, over the period 2007-2009, increased by approximately 50% and key research infrastructures for climate change have been included in the ESFRI roadmap³⁸².

The “Cooperation” programme is the main area of FP7. Funding activities on climate change research as defined above are estimated to respectively €339 million over the period 2003-2006 (FP6) and €228 million from 2007 to June 2009 under FP7. Research projects respond to calls for proposals on the sub-activities in the environment area.

³⁸¹ Under the Euratom Treaty, the European Commission will continue to support civil nuclear research, through a separate FP7 with duration five years (2007-2011).

³⁸² <http://cordis.europa.eu/esfri/>

- Pressures on the environment and climate, including: the functioning of the climate system; changes in atmospheric composition and water cycle; global and regional interactions between climate and atmosphere, land surface, ice and the ocean, and adaptation and mitigation measures;
- Environment and health, including: the interaction of environmental stressors – and the identification of the associated sources - with human health; bio-monitoring research for environment related health; and quantification and cost-benefit analysis of environmental health risks and indicators for prevention strategies; and
- Natural hazards, including: the improvement of forecasting and integrated vulnerability and risk assessments for disasters related to climate, and their impact; and the development of early warning systems and the improvement of prevention, mitigation and management strategies.

The “Earth observation and assessment tools” activity comprises the following sub-activities:

- Earth and ocean observation systems and monitoring methods for the environment and sustainable development; and
- Forecasting methods and assessment tools for sustainable development taking into account differing scales of observation.

Catalogues gathering the synopses of EC-funded projects in the area of climate research are regularly published by the Commission³⁸³. The latest update was prepared for the 15th Conference of the Parties to the UNFCCC (2009) and published as *European Research Framework Programme: Research on climate change*³⁸⁴.

Within FP7’s “Cooperation” area, research contributing to the development and implementation of mitigation options is funded under the “Energy” theme. This focuses on sustainable energy solutions to reduce GHG emissions, including renewable energy technologies, clean coal technologies, smart energy networks, energy efficiency and savings.

Under the “Cooperation” area, research contributing to the development and implementation of mitigation and adaptation options is carried out under the following themes as well: “Transport (including aeronautics)” and “Information and Communication Technologies (ICT)”. With a budget of €4.2 billion, the “Transport” theme includes, among its activities, the reduction of GHG emissions from both air transport and surface transport. Elements of the Food, Agriculture, Fisheries and Biotechnology Theme support research into sustainable agriculture and abiotic stress resistance relevant to climate change

³⁸³ For the 2005 catalogue see: http://ec.europa.eu/research/environment/pdf/european_research_climate_change_en.pdf

³⁸⁴ For the 2009 catalogue: <http://ec.europa.eu/research/environment/pdf/cop-15.pdf>

adaptation, among others. Finally, with a budget of €9 billion, the ICT theme encompasses research on intelligent ICT-based transportation systems, as well as on solutions to prevent or reduce vulnerability and to mitigate the consequences of natural disasters.

Under FP7, a new tool - known as JTIs³⁸⁵ – has been introduced. JTIs combine private sector investment and/or national and European public funding, including grant funding from FP7, but with the EC contribution not exceeding 50% of total costs. This new tool has been proposed to implement the Strategic Research Agendas³⁸⁶ (SRAs) of a limited number of European Technology Platforms (ETPs), which are industry-led initiatives operating under the coordination of DG Research and of a dedicated Commission Inter-Service Group. Currently, 36 ETPs have been established, including on environmental technologies aimed to reduce GHG emissions, such as the ETP for Zero Emissions Fossil Fuel Power Plants, the ETP for hydrogen and fuel cell Platform and the ETPs for photovoltaics, wind energy and biofuels.

Within the "Capacities" area, support to existing research infrastructures (RI), essential for climate change research, is provided through integrating activities. Support to ICT-based e-infrastructures is also implemented. The preparatory phase of five RI of pan-European interest have started following their inclusion in the ESFRI roadmap: **ICOS, EURO-ARGO, EMSO, IAGOS and AURORA BOREALIS**³⁸⁷. All together the EC contribution is more than €40 million for existing and new RI and could further increase until the end of FP7.

In addition, "Joint Programming" has been proposed as a new mechanism for Member States to agree on a common vision, to develop and implement a Strategic Research Agenda for a specific area. The criteria for the identification of specific areas show that Joint Programming could be very relevant to climate change-related research.

The 'People' area of FP7 is focused around the 'Marie Curie Actions'³⁸⁸ (under FP6 they were part of the Specific area dedicated to structuring the European Research Area). These actions have developed significantly in orientation over time, from a pure mobility fellowships programme to a programme dedicated to stimulating researchers' career development. The available funding in FP7 represents a 50 % annual increase over FP6. Under FP6 over 100 individual researchers received support from Marie Curie individual actions to carry out a climate change related project, with a total EC contribution of over €17 million. The Marie Curie host-driven actions in FP6 comprised 41 projects tackling climate change, with the total EC contribution of over €48 million. The projects involved participation of 118 institutions and were aimed mainly at training of researchers and transfer of knowledge activities. The vast majority of the research projects belonged to the

³⁸⁵ The dedicated structures implementing the JTIs are independent legal entities, with a dedicated budget and staff. The European Commission is a founding member of each JTI and enjoys a veto right on a number of pre-defined items..

³⁸⁶ Under each Technology Platform, stakeholders get together to define, and subsequently implement, a Strategic Research Agenda, in which research priorities and goals are specified.

³⁸⁷ ftp://ftp.cordis.europa.eu/pub/esfri/docs/esfri_roadmap_2008_update_20090123.pdf

³⁸⁸ http://cordis.europa.eu/fp7/people/home_en.html

environment thematic panel, but it is of note that other scientific areas such as economy and sociology were already pointing to this direction under FP6. The hosting institutions welcoming researchers were mainly located in UK, Germany, France, a tendency that has been further confirmed with the first climate change projects under FP7.

In FP7, under the People programme, Marie Curie actions have already provided support to 362 individual researchers at all stages of their career. This threefold increase in the number of individual researchers devoting themselves to climate change related projects is accompanied by a widening of the research areas involved, with fellows from the life sciences and mathematic panels currently carrying out a climate change project. So far the EC contribution for supporting individual fellows is of over €20 million, with UK, France and Germany being the most frequent hosting countries. Research on climate change was supported as well through 16 host-driven FP7 Marie Curie projects, with the EC contribution of over €37 million.

The 'Marie Curie Actions' have been particularly successful in responding to the needs of Europe's scientific community in terms of training, mobility and career development. This has been demonstrated by a demand in terms of highly ranked applications that in most actions extensively surpassed the available financial support.

The Marie Curie actions are implemented under five main themes:

- Initial training of researchers to improve mostly young researchers' career perspectives in both public and private sectors
- Life-long training and career development
- Industry-academia pathways and partnerships
- International dimension of EU and non-EU researchers
- Specific actions' to support removing obstacles to mobility and enhancing the career perspectives of researchers in Europe.

Within the Framework Programme, the Joint Research Centre³⁸⁹ (JRC) is the research “arm” of the European Commission (formally, it is a Directorate-General of the Commission itself). It provides scientific and technical support to the development and implementation of EC policies, and it serves the interests of the Member States as a reference centre for science and technology issues. JRC’s research in support of EC climate change policy focuses on five areas: mitigation; adaptation; scenario modelling; monitoring and verification; and civil society perspectives. In particular, JRC climate change research aims to determine costs and benefits (both in monetary and non monetary terms) of mitigation and adaptation policies. Along with the benefits from the reduction in climate change risks, other factors are considered, including increased energy security and reductions in air pollution. Under the 7th Framework Programme, JRC has a budget of

³⁸⁹ <http://www.jrc.it>

€1.75 billion to carry out direct non-nuclear research in four broad policy areas: “Prosperity in a knowledge-intensive society”; “Solidarity and responsible resource management” (including climate change); “Security and freedom”; and “Europe as a world partner”.

8.1.2. *Other relevant programmes*

As discussed in the previous sections, climate change-related research is funded primarily through the Framework Programmes. There are, however, other programmes supporting research on issues related to climate change mitigation and adaptation. Among these programmes, the most important ones are LIFE and the Competitiveness and Innovation Framework Programme (CIP).

8.1.2.1. LIFE

LIFE³⁹⁰ is the EC programme devoted to supporting the development and implementation of EC environmental policy and legislation. Between 1992 and 2006, 2,751 projects were funded under this programme, with a total budget of €1.8 billion.

In June 2007, Regulation No 614/2007³⁹¹ established the LIFE+ programme, which was allocated a budget of €2.14 billion for the period 2007-2013. As of April 2009, only expenditure in EU-27 countries is eligible, although the future participation of certain third countries is possible if supplementary appropriations are received. The LIFE+ programme comprises three components: Nature & Biodiversity; Environment Policy & Governance; and Information & Communication. Within the Environment Policy & Governance component of LIFE+, climate change has been identified as one of the key issues.

A call for proposals is issued every year by the EC for LIFE+ projects. Under the first two calls (2007 and 2008), seventy-four projects were selected for funding under the LIFE+ component Environment Policy & Governance. With twenty-two projects (and a budget of €24 million), climate change was the second most targeted priority area within this component.

In addition, a number of projects tackling awareness of climate change related issues have been selected for funding under the Information & Communication component of LIFE+. Further information on awareness raising can be found in section 9.3.

8.1.2.2. Competitiveness and Innovation Framework Programme (CIP)

The Competitiveness and Innovation Framework Programme (CIP)³⁹² runs from 2007 to 2013 with a budget of €3.6 billion. This programme aims to enhance the competitiveness of European companies, particularly small and medium enterprises (SMEs), by supporting

³⁹⁰ <http://ec.europa.eu/environment/life/>

³⁹¹ <http://eur-lex.europa.eu/JOHtml.do?uri=OJ:L:2007:149:SOM:EN:HTML>

³⁹² http://ec.europa.eu/cip/index_en.htm

innovation and promoting energy efficiency and new renewable energy sources in all sectors, including transport.

The CIP is divided into three operational programmes, the latter two of which are of most relevance to energy and climate change:

- Information Communication Technologies, Policy Support Programme (ICT PSP) with a budget of €730 million;
- Entrepreneurship and Innovation Programme (EIP) with a budget of €2.17 billion, including €430 million for eco-innovation;
- Intelligent Energy Europe (IEE)³⁹³ finances actions related to removing non-technological barriers to energy efficiency and renewable energy including capacity building, awareness, networking, education, training (see section 9.2.2.2 for an example of the latter), creating a more favourable business environment and including making EU sustainable energy policy better understood and implemented in Europe's cities and regions. The programme has a total budget (for a period 2003-2013) of €730 million.

The Executive Agency for Competitiveness and Innovation (EACI) administers IEE on behalf of the European Commission and in close cooperation with DG TREN. Projects have included: energy efficiency (in buildings, industry and products); renewable energy sources (electricity, biofuels, heating and cooling, domestic and small scale applications); and energy in transport (alternative fuels and clean vehicles, energy efficient transport, capacity-building in transport) as well as the integrated initiatives (e.g. sustainable energy communities, bio-business, intelligent energy education). The predecessor programmes of IEE were SAVE³⁹⁴ (1991-2000) and ALTENER³⁹⁵ (1993-2002) described in more detail in the 4th National Communication.

Environmental Technologies Action Plan

Eco-innovation is at the heart of the Environmental Technologies Action Plan³⁹⁶ under CIP, which was adopted by the European Commission in January 2004 to boost innovation, growth and sustainable development in Europe. In particular, the plan bridges the gap between R&D and the market place for eco-friendly products, technologies, services, processes and management methods across Europe. For the period 2007-2013, €195 million has been allocated to support eco-innovation.

In 2008, four priority areas were identified for such projects: recycling materials; buildings and construction; the food and drink sector; and greening business and smart purchasing.

³⁹³ http://ec.europa.eu/energy/intelligent/index_en.html

³⁹⁴ <http://www.managenergy.net/indexes/I31.htm>

³⁹⁵ <http://www.managenergy.net/indexes/I356.htm>

³⁹⁶ http://ec.europa.eu/environment/etap/index_en.html

8.1.2.3. European Strategic Energy Technology Plan

In November 2007 the European Commission launched the European Strategic Energy Technology Plan (SET-Plan)³⁹⁷, to strengthen industrial research and innovation (particularly on low-carbon technologies), by aligning European, national and industrial activities; and to ensure greater cooperation among energy research organizations and improved planning for energy infrastructure and systems, through the creation of a European Energy Research Alliance.

8.1.3. *International co-operation*

International cooperation is an integral feature of the Framework Programmes, ranging from large-scale international collaboration efforts to increased researcher mobility. The “Global Change and Ecosystems” programme was the thematic programme with the highest third country participation in FP6, with more than €37 million that went to fund third country participants in European research teams.

Under FP7, there are various projects, falling under the category of “**Specific International Cooperation Actions**” (SICAs, the successors of the specific international research collaborations under the INCO Programme in previous European Research Framework Programmes), dedicated specifically to international cooperation, with a geographical focus on developing countries. Under FP7, these are mainstreamed into all thematic programmes within the Specific Programme ‘Cooperation’. The INCO Programme supported research cooperation contextualized to the socio-economic and environmental settings of developing countries, emerging economies and neighbouring countries. In FP6, it invested almost €100 million into of environmental research mobilizing teams from Europe and partner countries to similar degrees into partnerships. SICAs address research problems of mutual interest and benefit between the EU and international cooperation partner countries (ICPC). Under the first two FP 7 calls (2007 and 2008), a number of climate change-related projects have been funded, including research on the health impacts of climate change-induced droughts and desertification and on the development of sustainable energy systems.

Climate change-related SICAs projects have been funded under FP6 and FP7. However, several Integrated Projects not specifically focusing on the international cooperation dimension have a strong cooperation component. Two examples of projects funded under FP6 and FP7 illustrate this fact.

The first is the project called A Europe-South America network for climate change assessment and impact studies in La Plata Basin (CLARIS LPB)³⁹⁸. A SICA with a budget of €4.3 million (of which €3.4 million is from FP7), this project, which started in October 2008 and will continue until September 2012, aims to predict the regional climate change impacts on La Plata Basin (LPB) in South America. Another aim of CLARIS LPB is the

³⁹⁷ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2007:0723:FIN:EN:PDF>

³⁹⁸ <http://www.claris-eu.org>

design of adaptation strategies for land-use, agriculture, rural development, hydropower production, river transportation, water resources and ecological systems in wetlands.

With a budget of €36.2 million (of which €12.9 million from FP6), the integrated project African monsoon multidisciplinary analysis (AMMA)³⁹⁹, which started in January 2005 and ends in February 2010, is to develop strategies to reduce the socioeconomic impacts of climate variability and especially of changes in the West African Monsoon (WAM). In particular, AMMA aims to improve the ability to predict the WAM and its impacts on intra-seasonal to decadal timescales, the consequences of climate change on WAM variability and its impacts.

In addition, a number of cooperation projects related to climate change are funded by DG AIDCO. Under its environmental programme, DG AIDCO supports developing countries in their efforts to integrate an environmental dimension into their development processes. Several climate change initiatives are supported under this programme. Two interesting examples of projects related to climate change funded by DG AIDCO are C3D⁴⁰⁰ and ACCA⁴⁰¹ (Advancing capacity to support Climate Change Action), which are described in sections 6.4.2.1 and 6.4.2.2, respectively.

8.1.4. Provision of environmental information

The European Environment Agency⁴⁰² (EEA) is an agency of the EC in charge of providing sound and independent information on the environment in Europe. Its mandate is to help the Community, the Member States and its other non-EC members make informed decisions about improving the environment, integrating environmental considerations into economic policies and moving towards sustainability. In addition, the EEA is in charge of coordinating the European environment information and observation network. The EEA, with the support of the European Centre on Air and Climate Change⁴⁰³ (ETC/ACC), provides data, indicators, assessment and projection of climate change mitigation efforts (including greenhouse gas emission trends, projections, policies and measures) and on climate change impacts and adaptation actions in Europe.

8.2. Research

8.2.1. Cross-cutting research

A number of projects have been funded by the EC with the aim of strengthening the links between researchers, policy-makers and the general public. Two examples of these projects are provided below.

³⁹⁹ <http://amma.mediasfrance.org/>

⁴⁰⁰ <http://www.c3d-unitar.org/>

⁴⁰¹ <http://www.acccaproject.org/accca/>

⁴⁰² <http://www.eea.europa.eu/>

⁴⁰³ ETC/ACC is a consortium of European institutes led by the Netherlands Environmental Assessment Agency (PBL).

With a budget of €791,000 (of which €718,000 from FP7), the project European network engaging civil society in low carbon scenarios (ENCI-LOWCARB), which started in January 2009 and will last until June 2011, aims to engage civil society in research on low carbon scenarios. This will be achieved by:

- creating a European network, composed by Civil Society Organizations and research institutes, related to the so-called Factor four⁴⁰⁴;
- elaborating two national studies (France and Germany) based on the confrontation between climate policies of low carbon scenarios and civil society organizations (social acceptability); and
- disseminating the results to the wider public.

With a budget of €11.2 million (fully funded under FP6), the Network of Excellence Atmospheric composition change: A European network (ACCENT)⁴⁰⁵, which started in March 2004 and will last until December 2009, aims mainly to:

- promote a common EC strategy for research on atmospheric composition change;
- develop and maintain durable means of communication and collaboration within the European scientific community working on this topic; and
- optimise two-way interactions with policy-makers and the general public.
- Integration will be achieved by creating common facilities and activities, including dedicated interactive web portals, databases, training and education opportunities, and an interface with the general public.

8.2.2. *Climate systems studies and modelling*

The EC has supported climate change research since the 1980s, particularly under the FPs. This research has contributed to improving the understanding of climate systems and processes, thanks to the development and use of increasingly advanced climate modelling tools. Given the complexity of the issue and the growing need for climate data and models to inform and support the EC policy-making process on climate change, significant funds have been allocated to climate systems studies and modelling under both FP6 and FP7.

A wide spectrum of projects are being funded in this area, ranging from studies of past climate changes and of Earth system interactions to operational forecasting, modelling and climate observation systems. A sample of EC projects that have been funded in this area is provided below (additional relevant projects are discussed in section 8.3 on systematic observation and global climate observation).

⁴⁰⁴ Factor four is a concept that refers to a hypothetical fourfold increase in resource productivity, through the doubling of wealth and the halving of resource consumption.

⁴⁰⁵ <http://www.accent-network.org/>

A major challenge for the climate research community is the development of comprehensive Earth system models capable of simulating natural climate variability and human-induced climate changes. For this reason, , in addition to research projects on climate modelling such as ENSEMBLES⁴⁰⁶ and COMBINE⁴⁰⁷ forty-four European partners (including university departments, research centres, meteorological services, computer centres and industrial partners from fifteen different countries) have agreed to create a European Network for Earth System Modelling (ENES). With a budget of €7.6 million, the Research Infrastructure project InfraStructure for the European Network for Earth System Modelling (IS-ENES)⁴⁰⁸, which started at the beginning of 2009 and will last until the beginning of 2013, to foster:

- the integration of the European climate and Earth system modelling community;
- the development of Earth System Models for the understanding of climate change;
- high-end simulations enabling the better understanding and prediction of future climate change; and
- the application of Earth system model simulations to better predict and understand future climate change impacts.

The issue of trade-offs between air quality and climate change policies has received strong attention within the research projects funded by the European Commission. Two interesting examples of projects funded under FP7 are CITYZEN⁴⁰⁹ and MEGAPOLI⁴¹⁰. These two projects aim to model the relationship between air pollution hot spots caused by megacities and climate change⁴¹¹. In particular, the MEGAPOLI project, which started in October 2008 and which will last until September 2011 (with a budget of over €5 million, of which €3.4 million is from FP7) aims to:

- assess impacts of megacities and large air-pollution hot-spots on local, regional and global air quality;
- quantify feedbacks among megacity air quality, local and regional climate, and global climate change; and
- develop improved integrated tools for prediction of air pollution in megacities.

⁴⁰⁶ <http://www.ensembles-eu.org>

⁴⁰⁷ <http://www.combine-project.eu>

⁴⁰⁸ <http://www.enes.org/IS-ENES.429.0.html>

⁴⁰⁹ <https://wiki.met.no/cityzen/start>

⁴¹⁰ The full name of the project is: “Megacities: emissions, urban, regional and global atmospheric pollution and climate effects, and integrated tools for assessment and mitigation”.

⁴¹¹ The linkages between air pollution and climate change were also investigated by JRC in the Global Air Pollution and Climate Change (GAPCC) project. In support of the 4th IPCC Assessment Report, JRC organised an international comparison of global atmospheric models to calculate the effects of air pollution control strategies and climate change on surface ozone by 2030.

Another relevant example is the FP-6 funded project called European Integrated Project on Aerosol Cloud Climate and Air Quality Interactions (EUCAARI)⁴¹². With a budget of almost €15 million (€10 million from FP6), this project, which started in January 2007 and will last until December 2010, to:

- reduce the current uncertainty on the impact of aerosol particles on climate by 50%;
- quantify the relationship between anthropogenic aerosol particles and regional air quality and the side effects of EC air quality directives on global and regional climate; and
- provide tools for future quantifications for different stakeholders.

8.2.3. *Impacts of climate change*

Several projects have been funded by the EC to identify and assess the bio-physical impacts of climate change. Some of these projects focus on the impacts of climate change on specific environmental media (such as water - see examples below) and processes, while others aim to assess the impacts on specific regions. Part of these projects also includes an analysis of the socio-economic consequences and implications of climate change (for dedicated projects on this, see section 8.2.4). A sample of EC projects on the impacts of climate change is provided below.

With a budget of €8.6 million (of which €6.5 million from FP7), the project called Assessment of climate change and impacts on the quantity and quality of water (ACQWA), runs from 2008 to 2013 and is to assess the impacts of a changing climate on the quantity and quality of water in mountain regions. Modelling techniques will be used to project the influence of climatic change on the major determinants of river discharge at various time and space scales. Attention will also be devoted to the interactions between land use/land cover changes, and changing or conflicting water resource demands.

With a budget of €9.7 million (of which €6.5 million from FP7), the project called European Project on Ocean Acidification (EPOCA)⁴¹³, which started in May 2008 and will last until April 2012, aims to fill the numerous gaps in our understanding of the effects and implications of ocean acidification, which is both a consequence and an indicator of climate change. In particular, this project will document the changes in ocean chemistry and biogeography across space and time and determine the sensitivity of marine organisms, communities and ecosystems to ocean acidification.

As mentioned above, a number of projects focus on the impacts of climate change on specific areas. For instance, with a budget of almost €13.7 million (of which €10 million from FP6), the project called Climate change and impact research: the Mediterranean

⁴¹² <http://www.atm.helsinki.fi/eucaari/>

⁴¹³ <http://epoca-project.eu>

environment (CIRCE)⁴¹⁴, which started in April 2007 and will last until March 2011, aims to understand how climate will change in the Mediterranean area and to assess the resulting impacts. In particular, the main objectives of the project are:

- to predict and to quantify physical impacts of climate change in the Mediterranean area;
- to evaluate the consequences of climate change for the society and the economy of the populations located in the Mediterranean area;
- to develop an integrated approach to understand combined effects of climate change; and
- to identify adaptation and mitigation strategies in collaboration with regional stakeholders.

8.2.4. *Socio-economic research*

The projects discussed in the previous section focus on the bio-physical impacts of climate change. Some of these projects also include an analysis of the socio-economic implications and consequences of such impacts. In addition, a number of EC-funded projects, a sample of which is presented below, are concerned primarily with the socio-economic dimension and impacts of climate change. The scope of these projects is very broad, ranging from the impacts of climate change on human health to the economic impacts on specific sectors of the economy, such as agriculture and tourism. Some of these projects also aim to identify potential mitigation and adaptation options (for dedicated projects on mitigation and adaptation technologies, see section 8.2.5).

Among the projects that aim to assess the economic impacts of climate change, an interesting example is CLIMATECOST. With a budget of €4.6 million (of which €3.5 million from FP7), this project, which started in January 2009 and will last until August 2011, aims to assess the full economic costs of climate change. In particular, the project aims mainly to:

- identify and develop consistent climate change and socio-economic scenarios, including mitigation scenarios;
- quantify (both from a physical and economic perspective) the costs of inaction for these scenarios;
- update the cost figures for GHG emission reductions under medium and long-term reduction targets and/or stabilization goals;
- quantify (both in physical and monetary terms) the ancillary air quality benefits of GHG emission reduction measures, in Europe as well as in other regions.

⁴¹⁴ <http://www.circeproject.eu>

A number of projects deal with the impacts of climate change on specific sectors of the economy. JRC, for instance, is conducting research to assess the impacts of climate change on the agriculture sectors. In particular, the project called Influence on European Agriculture (Crop / Production Forecasts/ Estimates and Climate Change Impact on Agriculture) aims to analyze the changes in basic conditions for agricultural production, such as the growing season length and water availability, due to climate variability and its changes. In particular, JRC is developing and applying tools to assess the impacts of climate change on crop nutrient and water requirements.

Another set of projects is concerned with the impacts of climate change on human health. With a budget of €15.3 million (of which €11.5 million from FP6), the project called Emerging Diseases in a changing European Environment (EDEN)⁴¹⁵, which lasted from November 2004 until October 2009, aimed to increase preparedness by developing and coordinating at European level a set of generic investigative methods, tools and skills within a common scientific framework. A range of diseases (including both diseases already present in Europe and others that existed in the past and might re-emerge, such as malaria) were selected for investigation. EDEN, which integrated research between forty-two leading institutes from twenty-three countries, was organized into a series of vertical sub-projects linked by a series of integrative activities, including:

- biodiversity monitoring;
- environmental change detection;
- disease modelling;
- remote sensing and image interpretation; and
- information and communication.

A last project to mention is the "Study on the economics of climate change adaptation in EU coastal areas"⁴¹⁶ (May 2009) which was recently conducted by the Commission in the framework of the series of "Socio-economic studies in the field of Maritime Affairs". The study provides insights in the state-of-play and financial dimension of the actions, plans and policies undertaken to prepare Europe's coastal zones as well as the outermost regions for the effects of climate change.

Furthermore, this study compares the different climate change adaptation aspects from an empirical perspective with results drawn from dedicated scientific literature. The study includes 23 specific reports for each of the 22 coastal Member States and the Outermost Regions. A comprehensive compilation of documentation on climate change adaptation in coastal and marine areas can be found in a CIRCA library, including specific information for each coastal Member State and the Outermost Regions.

⁴¹⁵ <http://www.eden-fp6project.net>

⁴¹⁶ http://ec.europa.eu/maritimeaffairs/climate_change_en.html

8.2.5. *Mitigation and adaptation technologies and strategies*

The EC funds numerous projects to identify and compare different climate change mitigation and adaptation technologies and options. A set of projects focuses on technologies and strategies to reduce GHG emissions from specific economic sectors, such as energy and transport, while another group of projects aims to identify strategies and technology solutions to adapt to the impacts of climate change. A sample of this broad range of projects is presented below.

As suggested by the name, the project called Adaptation and Mitigation Strategies: Supporting European climate policy (ADAM)⁴¹⁷ combined research both on mitigation and on adaptation to climate change. This is described in more detail in Appendix F-F1.

Among the projects concerned with the development and commercialization of technologies to reduce GHG emissions from the energy sector, the project called CO₂ enhanced separation and recovery (CESAR)⁴¹⁸, with a budget of €6.7 million (of which €4 million is from FP7), aims to develop a low-cost post-combustion CO₂ capture technology to provide economically feasible solutions for both existing and new power plants. In particular, this project, which started in February 2008 and will last until June 2011, aims to decrease the cost of capture down to €15 /tCO₂, building on the findings of a previous FP6 funded project named CASTOR.

Another example of a project in this area is the Active Solar Initiative, which started in January 2009 and will last until December 2011, with a budget of €3.8 million (of which €2.9 million from FP7). The goals of the project include:

- prototyping and verification of a new, low-cost photovoltaic technology;
- the development and verification of cost-efficient manufacturing techniques; and
- the dissemination of knowledge among European manufacturers.

The project will also lay the groundwork for the next generation of Active Solar technology that will enable a drastic additional increase in residential solar generation efficiency through use of the highly efficient multi-junction cells in flat, fixed rooftop-mounted panels.

Another set of projects focuses on technologies to reduce GHG emissions from the transport sector. With a budget of €11.9 million (of which €8 million from FP7), the project called Technologies enhancement for clean combustion in aero-engines (TECC-AE), which started in July 2008 and will last until June 2012, aims to improve technologies for reducing GHG emissions from aviation transport.

⁴¹⁷ <http://www.adamproject.eu>

⁴¹⁸ [http://www.CO₂cesar.eu/](http://www.CO2cesar.eu/)

With a budget of €6.5 million (of which €3.6 million from FP7), the project called Energy Efficient Vehicles for Road Transport (EE-VERT), which started in January 2009 and will last until December 2011, aims to develop strategies in conventional vehicles, also applicable to hybrids, for overall energy management (thermal and electrical) to reduce fuel consumption and CO₂ emissions. The need for the strategies to guarantee power supply to safety-related systems will also be considered.

In addition to collaborative research projects the Clean Sky Joint Technology Initiative will develop breakthrough technologies to significantly reduce the impact of air transport on the environment. The JTI is part of the aviation industry's goal to achieve a 50 % reduction of CO₂ emissions through drastic reduction of fuel consumption. The Commission will provide €800 million in funding from FP7 to the JTI, and this amount will be matched in kind by industry.

*Examples of key recent reports*⁴¹⁹

- *Russ, P., T. Wiesenthal, D. van Regemorter, and J.C. Ciscar. 2007. "Global Climate Policy Scenarios for 2030 and beyond – Analysis of Greenhouse Gas Emission Reduction Pathway Scenarios with the POLES and GEM-E3 models". JRC Reference Reports.*
- *European Environment Agency (EEA)/Joint Research Centre (JRC)/World Health Organization (WHO). 2008. "Impacts of Europe's changing climate – 2008 indicator-based assessment". EEA Report No 4/2008.*
- *European Environment Agency (EEA). 2007. "Climate change: the cost of inaction and the cost of adaptation". Technical report No 13/2007.*
- *European Environment Agency (EEA). 2009. "EEA Signals 2009 – Key Environmental Issues Facing Europe". EEA Signals 2009/3.*

8.3. Systematic observation and global climate observation

Under both FP6 and FP7, significant resources have been devoted to research on Earth observation, related to GEO and GEOSS activities⁴²⁰.

Examples of FP6 funded research includes: ESONET⁴²¹ (European Seas Observatory), a network of excellence that aims to promote the implementation and the management at the European-scale of a network of long-term multidisciplinary observatories in European seas; and the already cited AMMA⁴²² (see paragraph 8.1.4) which aims to improve our ability to predict the West African Monsoon in the Sahel region.

⁴¹⁹ Please note that this list is not meant to be exhaustive.

⁴²⁰ Further details of the projects can be found at <http://cordis.europa.eu/fp7/dc/index.cfm#searchform> and <http://cordis.europa.eu/fp6/projects.htm>

⁴²¹ <http://www.abdn.ac.uk/ecosystem/esonet/>

⁴²² <http://amma.mediasfrance.org/>

In FP7, Earth Observation research will contribute to the implementation of GEOSS, through four building blocks:

- integration of EC activities within GEO, with a project on the monitoring of the carbon cycle at the global level and a contribution to a global biodiversity observation system;
- cross-cutting research activities relevant to GEO with a research topic on environment and health;
- emerging earth observation activities, with projects monitoring the ocean interior, seafloor, and sub-seafloor, and participating in the development of a Global Soil Observing System; and
- developing capacity building activities in the domain of earth observation in the EC and in developing countries, with several projects working on a georesource information system for Africa, improving observing systems for water resource management, and GEONETCast applications for developing countries.

The 2007 FP7 call covered all Social Benefit Areas foreseen in the GEOSS 10-Year implementation plan, while the 2008 call was issued with the objective of starting to build the Initial GEOSS Common Infrastructure.

Research and developing activities for the GMES initiative - formerly known as Global Monitoring for Environment and Security (GMES) initiative - will play a key role in furthering Earth observation activities, as the main contribution of the EC to GEO.

Under this initiative, the EC is putting in place operational services to produce long time series, consistent data sets for climate derived from observations and their re-analysis. The GMES services are currently being developed as large R&D projects under FP6 and FP7 (e.g., MERSEA⁴²³, GEOLAND⁴²⁴, GEMS⁴²⁵) that seek to involve existing capacities in the EC and promote their cooperation. Truly operational services are expected to be available from 2011-14 onwards.

The GMES services are arranged on the basis of earth components, namely land, ocean (“marine”) and atmosphere. The global component of the land service will strive to provide information on terrestrial Essential Climate Variables (ECVs), natural CO₂ stock and budget as well as fire impact due to burned biomass. The atmosphere service addresses the themes climate forcing, air quality and UV radiation and will inter alia seek to assure the delivery of data services related to greenhouse gases, reactive gases and aerosols based on a global and a European ensemble model. Lastly, the marine service provides better information on the 3D state and dynamics of the global ocean through observational data

⁴²³ <http://www.mersea.eu.org/>

⁴²⁴ <http://www.gmes-geoland.info/>

⁴²⁵ <http://gems.ecmwf.int/about.jsp>

sets re-analysed in state of the art models and it will seek to establish an accurate long-term record of the ocean for climate purposes.

Across all GMES Earth compartments, re-analysis efforts are planned that will help to provide consistent time series of climate observations. The aim of GMES is therefore to coordinate and consolidate EC efforts for Earth observation both in space and with in-situ infrastructures in Europe, also with regard to the participation in the international arena.

The GMES observation infrastructure will draw upon existing capacities in Europe. For space observations, these include research and operational missions provided by EUMETSAT, ESA, as well as EU Member States.

- EUMETSAT⁴²⁶ is making a significant contribution to operational climate variable monitoring (the Meteosat programme (MSG; MTG), the EUMETSAT Polar Satellites (EPS) with for example, the IASI, GOME-2 and GRAS instruments, cooperation on Jason altimetry missions). For operational retrieval of geophysical parameters from satellite data, EUMETSAT operates several satellite application facilities (SAFs), e.g., Climate Monitoring SAF, Ocean and Sea Ice SAF, Land Surface Analysis SAF, Ozone SAF, etc. EUMETSAT will report its contribution to GCOS ECVs in detail separately and via the national report to be submitted by Germany.
- ESA⁴²⁷ will report its detailed contribution via the CEOS report. Besides ESA R&D satellites (e.g., ENVISAT), ESA is developing dedicated missions for the purpose of GMES: the Sentinels 1 to 5, partially financed through FP7 are devised on the basis of user requirements and scope of the GMES services, including global monitoring of climate variables.

With regard to in-situ data required by GMES, the services will rely on data observed by public bodies in the EU Member States. At the moment these data are often obtained in the frame of research activities or as contributions to international networks. Data will also be used from data exchange in the frame of international networks e.g., through the GEOSS. To consolidate the EC efforts for the purpose of operational services, the EC will be mainly focused on a better coordination within Europe, on the filling of existing gaps in observation capacities as well as encouraging a transfer of priority networks to operational status. For a future operational GMES programme, planning activities will have to address which observation infrastructures will receive support from EC resources. The criteria will depend on the available resources. GMES operational costs are to be evaluated in the period 2009-2010.

Important efforts are being undertaken to ensure that ECV (Essential Climate Variable) activities adhere to the GCOS climate monitoring principles: under the GMES initiative, satellite missions are being developed to meet the continuity demand for space-based observations in the atmospheric, oceanic and terrestrial domains. The missions involve

⁴²⁶ <http://www.eumetsat.int/Home/index.htm>

⁴²⁷ <http://www.esa.int/esaCP/index.html>

repeat launches of instruments and to ensure continuity to the extent possible with earlier missions such as that of ENVISAT.

International data centres are being strengthened for all the ECVs: all envisaged GMES services that target ECVs are providing NRT or historical data to users. Further, the FP7 project NESIS⁴²⁸ attempts to promote the uptake of ICT solutions by public authorities in providing information for the monitoring and reporting of environmental impacts and threats. The running of data centres should then be technologically a simpler task.

The provision of key information on the environment is an essential element for policy makers in developing countries. The European Commission in collaboration with EUMETSAT has been supporting several initiatives related to the collection, exchange and/or use of observations of the ECVs to promote capacity-building activities in least developed countries and countries with economies in transition: PUMA and its follow-up AMESD (African Monitoring of the Environment for Sustainable Development)⁴²⁹, had such positive results that, in the Maputo Declaration⁴³⁰ the signatories⁴³¹ requested the extension of the EC GMES programme to Africa and the financing of this GMESAfrica by the 10th European Development Fund (EDF10).

In December 2007, the Portuguese Presidency provided an answer to this request with a conference entitled “Space for Development: the case of GMES and Africa”; it tabled a common EU-AU Lisbon GMES Declaration and started the Lisbon GMES Process, which ought to provide by January 2010 an overview of the African Earth Observation needs. JRC, the GMES-bureau and DG Development have been working on terms of reference for the drafting of an action plan on GMES and Africa Partnership.

A further project on capacity building for Earth observation systems is CARBOAFRICA⁴³², which strengthens the capacity to understand global change process. The FP7 projects AMFIC (Air quality monitoring and forecasting in China)⁴³³, DRAGONESS (DRAGON in support of harmonizing EC and Chinese marine monitoring for Environment and Security System)⁴³⁴, MONRUK (Monitoring the marine environment in Russia, Ukraine and Kazakhstan using satellite synthetic aperture radar)⁴³⁵ and VGT4-Africa (Distribution of vegetation data in Africa through EUMETCAST⁴³⁶)⁴³⁷ all address international cooperation with transition and developing countries and include some climate-relevant parameters.

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<http://www.nesis.eu/>

429

<http://www.amesd-project.org/>

430

http://www.acpsec.org/summits/maputo/maputo_declaration_en.html

431

AUC, ACP-SEC, African RECs and WMO

432

http://www.carboafrika.net/index_en.asp

433

<http://www.knmi.nl/samenw/amfic/>

434

http://ec.europa.eu/enterprise/space_research/pdf/dragoness.pdf

435

<http://monruk.nersc.no/>

436

http://www.eumetsat.int/HOME/Main/What_We_Do/EUMETCast/index.htm

437

<http://www.vgt4africa.org/>

The Commission should look at what needs to be done to support provision of essential climate data by Europe through co-ordination between GMES, ESA, EUMETSAT & the other key European players. As a result JRC has completed a report⁴³⁸ which forms the scientific background to the Commission response to the respective councils.

8.3.1. *Atmospheric essential climate variables*

8.3.1.1. Past actions

EARLINET (European Aerosol Research Lidar Network to Establish an Aerosol Climatology)⁴³⁹ was funded by the Commission to build a comprehensive statistical database of the distribution of aerosols across the European continent.

The goals of the CREATE⁴⁴⁰ and DAEDALUS⁴⁴¹ projects were to advise on the optimum use of aerosol in-situ, ground-based and satellite remote sensing data to: deliver data and information to the users, make proposals for aerosol monitoring as part of the European capacity, and develop the methodologies necessary for delivering operational aerosol products.

8.3.1.2. Existing actions

The actual main contribution to atmospheric ECVs relates to the World Meteorological Organization (WMO) which sponsored the Global Atmosphere Watch Network. JRC hosts the GAW World Data Centre for aerosols⁴⁴². The GAW is seen as the core of the global climate observing systems (GCOS) for the atmospheric essential climate variables (ECVs), including “Aerosol Properties”. The GAW aerosol program prescribes five core measurements: multi-wavelength optical depth; mass in two size fractions; major chemical components in two size fractions; light scattering coefficient and light absorption coefficient to be made at all stations, with measurements of additional aerosol properties recommended for key ‘global’ stations.

The activities of the EMEP⁴⁴³ measurement network and that of the GAW aerosol network are well coordinated and considerable progress has been made in the harmonisation and integration of the measurements, data reporting and data quality analysis.

Since late 2007 a much simplified data submission protocol has functioned with data being sent first to the EMEP chemical coordinating centre and from there on to the GAW data centre.

438 Authors: Belward, Dowell & Wilson. Commissioned under Annexe E of AA JRC N. 30977-2008-06 NFP ISP BE with DG ENTR

439 <http://www.earlinet.org>

440 <http://tarantula.nilu.no/projects/ccc/create>

441 <http://www-loa.univ-lille1.fr/Daedalus>

442 <http://wdca.jrc.it>

443 <http://www.emep.int>

AirBase⁴⁴⁴ is the public air quality database system of the EEA and its network EIONET, which contains air quality monitoring data and information (SO₂, TSP, PM₁₀, PM_{2.5}, black smoke, O₃, NO₂, NO_x, CO, Pb, Hg, Cd, Ni, As, Benzene) about all countries from the EU, the EEA member and other cooperating countries.

Improvements to the Global Climate Observing System are provided by AEROCOM⁴⁴⁵, a global aerosol model intercomparison, which found that an ensemble of state of the art models were calculating widely varying fractions of the total global annual average Aerosol Optical Depth due to water vapour associated with the aerosol. This large uncertainty makes difficult to use models to evaluate the impact of anthropogenic aerosol precursor emissions. Concurrent in-situ observations of aerosol composition and optical properties under controlled humidity conditions, together with observation of aerosol hygroscopic growth rates, such as those made within the EUSAAR⁴⁴⁶ network, provide the observational base to reduce these uncertainties. EUSAAR is partly funding the operation of 20 stations of which 6 are global atmosphere watch stations.

The Commission Decision of 17th July 2000⁴⁴⁷ established EPER, the European Pollutant Emission Register⁴⁴⁸, which provides annual inventories of a number of pollutants (including greenhouse gas emissions and removals) from a large number of individual industrial facilities. It will be replaced in the autumn of 2009 by the E-PRTR which will cover more than 91 substances emitted from 65 sectors of activity and will include data updated annually from 2007 onwards.

GEOMON (Global Earth Observation and Monitoring)⁴⁴⁹ is a project which has the overall goal to sustain and analyze European ground-based observations of atmospheric composition, complementary with satellite measurements, to quantify and understand the ongoing changes. It is a first step to build a future integrated pan-European Atmospheric Observing System dealing with systematic observations of long-lived greenhouse gases, reactive gases, aerosols, and stratospheric ozone. This will lay the foundations for a EC contribution to GEOSS⁴⁵⁰ and optimize the EC strategy of environmental monitoring in the field of atmospheric composition observations.

The ESFRI⁴⁵¹ preparatory phase ICOS (Integrated Carbon Observation System)⁴⁵² aims to build an infrastructure for coordinated, integrated, long-term high-quality observational data of the greenhouse balance of Europe and of the adjacent key regions of Siberia and Africa. Consisting of a centre for co-ordination, calibration and data handling in conjunction with networks of atmospheric and ecosystem observations, ICOS is designed

444 <http://www.eea.europa.eu/themes/air/airbase>

445 <http://nansen.ipsl.jussieu.fr/AEROCOM>

446 <http://www.eusaar.net>

447 http://eper.ec.europa.eu/eper/documents/comission_17072000.pdf

448 <http://eper.eea.europa.eu/eper/>

449 <http://www.geomon.eu>

450 <http://www.earthobservations.org/geoss.shtml>

451 <http://cordis.europa.eu/esfri/>

452 <http://icos-infrastructure.ipsl.jussieu.fr>

to create the scientific backbone for a better understanding and quantification of greenhouse gas sources and sinks and their feedback with climate change.

The IMECC⁴⁵³ project aims to build the infrastructure for a coordinated, calibrated and accessible dataset for characterizing the function of the European terrestrial biosphere and the carbon balance of Europe. IMECC will improve the comparability of atmospheric and ecosystem measurements of greenhouse gases and isotopic composition so that measurements made by diverse and widespread research programs can be reliably combined. It will also provide a web-based tool to calculate the impact of proposed measurements on knowledge of the European carbon cycle, tying European terrestrial data into emerging remotely-sensed datasets on atmospheric composition. IMECC will develop a transfer standard between European atmospheric measurements and satellite measurements using ground-based remote sensing.

The EARLINET-ASOS coordinated action is a continuation of EARLINET described above.

To ensure availability of past and future data and metadata records of the satellite measurements for the atmospheric ECVs the EC FP6 GEMS⁴⁵⁴ project (Global and regional Earth-system (Atmosphere) Monitoring using Satellite and in-situ data) re-analyses the greenhouse-gas, aerosol, ozone and surface radiation ECVs, and of the associated meteorological ECVs for the period from 2003 onwards. GEMS is developing new EC operational capabilities for comprehensive monitoring and forecasting systems (medium-range & short-range air-chemistry forecasts) for trace atmospheric constituents important for climate and air quality through much improved exploitation of satellite data. The systems will provide the basis for value-added data and information services to be developed as part of the EC Global Monitoring for Environment and Security (*GMES*) initiative. The GEMS project will produce global retrospective analyses of the atmospheric dynamics and composition for the troposphere & stratosphere, and will be able to assess the impact of changes both on global & regional scale, examining extremes as well as means. The project involves 32 organisations from 13 countries. GEMS began in 2005 and was funded until beginning of 2009; the overall cost was of €17.45 million, of which €12.45 million funded by FP6.

In addition to the re-analyses themselves, a number of climate data records based on satellite data retrievals for the composition ECVs are being developed in the ESA GMES Service Element project PROMOTE⁴⁵⁵. These activities will most likely continue in the EC FP7 project MACC⁴⁵⁶, which provides the pilot core GMES Atmospheric Service.

453 <http://imecc.ipsl.jussieu.fr/>

454 <http://gems.ecmwf.int>

455 <http://www.gse-promote.org>

456 http://www.ecmwf.int/about/special_projects/robertson_GEMS-MACC/index.html

Ozone web⁴⁵⁷ provides hourly near-real-time information on ozone pollution across Europe by interpolating data from more than 700 air quality measurement stations across Europe delivered by EIONET members.

8.3.2. *Oceanic essential climate variables*

8.3.2.1. International initiatives

A range of initiative are currently in place including:

ACOBAR (Acoustic Technology for observing the interior of the Arctic Ocean)⁴⁵⁸ will contribute to filling gaps in the global ocean observing system and thereby support the development of GEOSS. This EC project will develop an observing system for the interior of the Arctic Ocean based on underwater acoustic methods (tomography, data transmission and communication to/from underwater platforms, and navigation of gliders) offering alternative methods the ARGO system, which cannot be used in ice-covered seas. ACOBAR will implement field experiments with acoustic sources and receivers in the Fram Strait and the Arctic Ocean basin.

The HERMIONE⁴⁵⁹ project is designed to make a major advance in the knowledge of the functioning of deep-sea ecosystems and their role in the climate system. This will be achieved through a highly interdisciplinary approach that will integrate biodiversity, specific adaptations and biological capacity in the context of a wide range of highly vulnerable deep-sea habitats. Gaining this understanding is crucial, because the deep sea is now being affected by climate change and can possibly feedback on the global climate through the release of large quantities of greenhouse gases, include gas hydrates stored on the continental margins.

The EURO-ARGO⁴⁶⁰ array is the European component of a worldwide in-situ global ocean observing system (international ARGO program); it is based on about 800 autonomous battery powered floats, of which about 250 are targeted as a sustained European contribution to the global network. The data are transmitted in real time by satellite to data centres for processing, management, and distribution. An estimated €6.3 million per year are required for this. Following its inclusion in the ESFRI roadmap, an ongoing preparatory phase aims to design in particular the legal, financial and governance frames as well as the sustainable funding.

The Ice2sea program see the cooperation between European and international partners to reduce the big uncertainty highlighted by a recent IPCC report about projections of future sea-level rise due to continental ice melting. The objective of the project is to understand the key processes that will lead to loss of continental ice to improve the reliability of sea-

457 <http://www.eea.europa.eu/maps/ozone/welcome>

458 <http://acobar.nersc.no/>

459 <http://www.eu-hermione.net>

460 <http://www.euro-argo.eu>

level rise projections. Target studies are being undertaken in mountain glacier systems and ice caps (e.g. Svalbard), and in ice sheets in both polar regions (Greenland and Antarctica).

The project THOR (Thermohaline Overturning - at Risk?)⁴⁶¹, coordinated by University of Hamburg (Germany) aims to contribute to GMES, to Global Observing Systems such as the GOOS, and to the International Polar Year (IPY). It will establish an operational system that will monitor and forecast the development of the North Atlantic THC on decadal time scales and assess its stability and the risk of a breakdown in a changing climate. The project started in December 2008 the project is still in execution and will be funded by FP7 until November 2012 with a sum of €9.3 million in a total cost of €13.0 million.

The INCOFISH⁴⁶² project under FP6 (2005-2008) with 35 partners from four continents has, among others, developed methodology for mass production of distribution maps of fish and other marine organisms and how distribution patterns are likely to change in response to climate change.

The CENSOR⁴⁶³ project involving partners from Argentina, Chile and Peru together with their European peers has investigated ENSO dynamics and effects of climate change on the resources off the Pacific side of South America as well as socio-economic effects on coastal populations.

EMODNET (European Marine Observation and Data Network) aims to reduce operational costs for those who use marine data, increase competition amongst users of marine data and reduce uncertainty in knowledge of the seas and oceans. Five substantial preparatory actions are underway to assemble data layers for hydrography (water depth, coastline), geology (sediments, strata), biology (species biodiversity) and chemistry (contamination) at a sea-basin level from distributed national bodies in order to already provide a service to users and at the same time allow a more accurate assessment to be made of the feasibility and cost of setting up a better and sustainable infrastructure.

8.3.2.2. Other pan-European initiatives

These include:

EMSO⁴⁶⁴ (European Multidisciplinary Sea floor Observation) is an ESFRI preparatory phase, launched in 2008 for 4 years with the main objective of establishing the legal and governance framework for the new research infrastructure serving scientists and other stakeholders in Europe and outside Europe for long-term deep water observation and investigation. This framework will enable the deployment of the research infrastructure and its long-term management. The project is closely associated to the FP6 Network of Excellence ESONET.

⁴⁶¹ <http://www.ifm.zmaw.de/forschung/regionale/projekte/thor/>

⁴⁶² www.incofish.org and www.aquamaps.org

⁴⁶³ www.censor.name

⁴⁶⁴ <http://www.esonet-emso.org/>

GlobColour⁴⁶⁵ is a service which distributes global L3 data sets of chlorophyll concentration, water leaving radiances, diffuse attenuation coefficient, coloured dissolved and detrital organic materials, total suspended matter or particulate backscattering coefficient, turbidity index, quality indicators. Distribution of other products is planned (e.g., transparency, heated marine layer), or considered.

JRC Ocean Colour Portal⁴⁶⁶ includes a decadal time-series of chlorophyll and ocean colour ECVs, the datasets have pan-European and global scales with a resolution of 2km. The presented archive is maintained with the strictest attentions to the quality and validation of the data presented in accordance with those required for re-analyzed climate data records.

MARCOAST⁴⁶⁷ (and former Coastwatch) – ESA GMES Service Element is the ocean colour upstream service addressing a wide range of pan-European and regional downstream service providers requirements.

8.3.2.3. EU research initiatives in specific geographical regions

A sample of these in different regions includes:

Bay of Biscay: IFREMER⁴⁶⁸ provides series of Chla, mineral SPM (Suspended Particulate Matter), attenuation of diffuse descending light, derived from satellite radiance since 1998. The resulting maps are provided to a large community of users (260 registered) through four internet servers covering the western European continental shelf. These servers also present other oceanographic variables, and many in situ measurements of chlorophyll, SPM, SST (CORIOLIS).

Mediterranean Sea, developed by the Italian CNR (National Research Council) is the Mediterranean ocean colour SeaWiFS data both in real time (1 hour from the satellite pass) and delayed time (3 days for ancillary data integration) within the MFS⁴⁶⁹ (Mediterranean Forecasting System) and ADRICOSM⁴⁷⁰ (Adriatic sea integrated coastal areas and river basin management system).

Northeast Atlantic: Plymouth Marine Laboratory and University of Dundee provide local reception, near-real-time and archived/delayed mode regional products (Ocean colour products, radiance, visibility, attenuation, frontal analyses, inherent optical properties (IOPs), primary production, harmful algal bloom likelihood) for the Northeast Atlantic, North Sea, Celtic Sea, Iberian Peninsula, Bay of Biscay, western Mediterranean and Baltic Sea. Products are currently used for physics-ecosystem model comparisons. Global NRT coverage of regions of interest (e.g., Southern Ocean south of Chile and Tasmania, Northern Indian Ocean, Tanzania) courtesy of ESA and NASA subscriptions. PML also operates an ocean colour/optical cal/val site in the western English Channel.

⁴⁶⁵ <http://www.globcolour.info>

⁴⁶⁶ <http://oceancolour.jrc.ec.europa.eu>

⁴⁶⁷ <http://gmes-marcoast.com>

⁴⁶⁸ <http://www.ifremer.fr/anglais/>

⁴⁶⁹ http://gnoo.bo.ingv.it/mfs/indicators_old.htm

⁴⁷⁰ <http://gnoo.bo.ingv.it/adricosm>

8.3.2.4. GCOS Implementation Plan⁴⁷¹ initiatives

These include:

CARBOOCEAN⁴⁷² follows the recommendation of action O17 on the implementation of a programme for measuring surface pCO₂: the aim is to reduce the present uncertainties in the quantification of net annual air-sea CO₂ fluxes by a factor of 2 for the world ocean and by a factor of 4 for the Atlantic Ocean. The project is coordinated by University of Bergen (Norway) and started in 2005. It is still in execution and is funded by the 6th FP (€14.5 million on a cost of €19.27 million) till the end of 2009.

The development of a capability for systematic measurement of biogeochemical and ecological ECVs is recommended by action O30 and implemented by the already cited project ARGO⁴⁷³: recently, about 60 floats have also been fitted with O₂ sensors, for the benefit of the biogeochemical community (Argo Oxygen Program⁴⁷⁴). Bio-optical sensors are now also being developed with a reduced size which is compatible for implementation on the Argo floats;

As well as ARGO, the project HYPOX⁴⁷⁵, has the same objective of action O30: founded by EC for the period 2009-2012, it is about monitoring oxygen depletion and associated processes in aquatic systems that differ in oxygen status or sensitivity towards change: open ocean, oxic with high sensitivity to global warming (Arctic), semi-enclosed with permanent anoxia (Black Sea, Baltic Sea) and seasonally or locally anoxic land-locked systems (fjords, lagoons, lakes) subject to eutrophication. The capacity to monitor oxygen depletion globally will be improved by implementing reliable long-term sensors to different platforms for in situ monitoring.

In line with actions O36 and O37 the MyOcean GMES⁴⁷⁶ project support data rescue projects and implement regional, specialized and global data and analysis centres; it succeeds MERSEA⁴⁷⁷ (FP6) and is currently under negotiation. Many of the satellite datasets derived, as well as the subsequent assimilation of these into operational models, will be tailored on a regional basis. This will facilitate the implementation of specific algorithms and parameterization which have a regionally varying dimension. For example in the case of the Ocean Colour activities there will be regional processing centres for the Baltic, Northeast Atlantic, Bay of Biscay and Mediterranean as well as a systematic processing of all ECVs at the global scale as well.

Moreover MyOcean GMES also includes the aims of activities O24, O41 and O40 to develop plans and pilot projects for the production of global products based on data assimilation into models for all possible ECVs, including undertaking pilot projects of

471 <http://www.wmo.int/pages/prog/gcos/Publications/gcos-92.pdf>

472 <http://www.carboocean.org>

473 <http://www.argo.net/>

474 http://www.ioccg.org/groups/Oxygen_Argo_whitepaper_15feb07_r.pdf

475 <http://www.hypox.net/>

476 http://www.mercator-ocean.fr/html/mercator/collaborations/myocean_en.html

477 <http://www.mersea.eu.org/>

reanalysis of ocean data. The project includes the operational assimilation of the satellite data streams in model and forecasting systems at both European and global scale.

8.3.3. *Terrestrial essential climate variables*

There are numerous ongoing initiatives both at the EC level and in the Member States, which contribute to international research promoting the generation and archival of satellite derived terrestrial ECVs. Some examples are described below.

8.3.3.1. EU research initiatives in specific geographical regions

CARBO-North⁴⁷⁸ aims at quantifying the carbon budget in Northern Russia across temporal and spatial scales. Dedicated climate models will provide requested variables and time slices as input to ecosystem studies. Detailed monitoring, mapping and analyses of vegetation, soil and permafrost will be conducted to assess the sensitivity of climate model output to a suite of land cover, ground and permafrost schemes. Results are used for integrated ecosystem modelling, calculation of net radiative effects and assessment of the sensitivity of climate model predictions to transient environmental changes. The institute responsible for carrying out the project is Stockholm University (Sweden). The project is in execution (Start Date: 2006-11-01; End Date: 2010-04-30) and costs €3.62 million, of which €3.1 million funded by FP6.

8.3.3.2. Pan-European and international initiatives

A completed project in the field of terrestrial ECV observations is CarboEurope⁴⁷⁹ which had the objective to understand, quantify and predict the terrestrial carbon balance of Europe and the uncertainty at local, regional and continental scale. The increase in spatial and temporal resolution of the observational and modeling program will allow for the first time a consistent application of a multiple constraint approach of bottom-up and top-down estimates to determine the terrestrial carbon balance of Europe with the geographical patterns and variability of sources and sinks. The project coordinated by Max-Planck-Institut Für Biogeochemie (Germany), started in 2004 and was completed at the end of 2008; funding by the 6th FP was of €16.31 million on a total cost of €23.66 million.

e-SOTER⁴⁸⁰, which is the Regional pilot platform funded by FP7 which gives the EC contribution to the Global Soil Observing System. Soil and land information are often inaccessible, incomplete, or out of date. e-SOTER addresses the felt need for a global soil and terrain database. It will deliver a web-based regional pilot platform with data, methodology, and applications, using remote sensing to validate, augment and extend existing data.

478 <http://www.carbonorth.net>
479 <http://www.carboeurope.org>
480 <http://www.esoter.net>

JRC FAPAR⁴⁸¹ provides access to 10 years of FAPAR datasets at medium resolution over the globe (i.e. 1km- 2km) and delivers global products at various resolutions (0.5 degrees to 5 degrees). The retrieval algorithm is physically based and the validation has been made against ground based measurements. The space instrument is SeaWiFS for the historical dataset.

Projects of the European Space Agency (ESA) which contribute to international work on terrestrial ECVs are:

- MERIS Level 2 products⁴⁸² demonstration FAPAR products processed at the ESA G-POD facility using the JRC algorithm of which allow continuity of the above data sets;
- ESA GlobCarbon⁴⁸³ (Global Land Products for Carbon Model Assimilation), a consortium led by the Flemish Institute for Technological Research (VITO) which produced the FAPAR product derived from the surface reflectance values for the individual instruments, adopting average LAI values estimated across all sensors;
- EUMETSAT LandSaf⁴⁸⁴, the Land Surface Analysis Satellite Applications Facility which has the objective to increase benefit from EUMETSAT Satellite (MSG and EPS) data related to land, land-atmosphere interaction, biospheric applications;
- CYCLOPES⁴⁸⁵ (POSTEL, France), a project funded by EC/FP5, provides global mapping at 1km resolution of biogeophysical variables (leaf area index, the fraction of absorbed PAR, the fraction of vegetation cover, and albedo) derived from data acquired by VEGETATION sensor over the period 1999 – 2003;
- ESA GlobCOVER⁴⁸⁶, launched in 2004 is now evolving to an international collaboration between ESA, FAO, UNEP, JRC, IGBP and GOCF-GOLD; it intends to complement and update other existing comparable global products, such as the global land cover map for the year 2000 (GLC 2000) with a resolution of 1 km produced by the JRC, producing a global land-cover map for the year 2005, using as its main source of data the fine resolution (300 m) mode data from MERIS sensor on-board ENVISAT satellite, acquired over the full year 2005.

The EC contributes to change and improve the terrestrial elements of global climate observing system through the development of a sustained GMES Atmospheric Service. In addition to the activities for the atmospheric ECVs reported above, the service will include near real time analysis and re-analysis of the ECV fire disturbance. A first set of re-

481 <http://fapar.jrc.ec.europa>

482 <http://envisat.esa.int/level3/meris>

483 <http://geofront.vgt.vito.be>

484 <http://landsaf.meteo.pt>

485 <http://postel.mediasfrance.org/en/BIOGEOPHYSICAL-PRODUCTS/Leaf-Area-Index---LAI/CYCLOPES-Project>

486 <http://ionial.esrin.esa.int/index.asp>

analyses is being provided by the already cited projects GEMS⁴⁵⁴ (FP6) for the period from 2003 onwards, and MACC (FP7) which provides the pilot core GMES Atmospheric Service.

In addition, the Water Information System for Europe (WISE) coordinated by EEA is providing online information on water quality across Europe. Water quantity (river discharge) will be implemented in WISE in 2009⁴⁸⁷.

The CORINE database also aims to ensure availability of past and future data and metadata records of the satellite measurements for land-cover (1990, 2000 and 2006); it is coordinated by EEA and is currently being updated⁴⁸⁸. The update cycle shall be sustained under the GMES program.

8.3.4. *Additional information*

The EEA collects and presents indicators that are similar to the GCOS essential climate variables (e.g. glaciers, Arctic sea ice, snow cover, SST, river discharge). These are included in the 'climate change indicator report 2008', also mentioned in section 6, a joint activity of EEA, JRC and WHO⁴⁸⁹. The report contains (about 40) indicators in the following categories: atmosphere and climate, glaciers, snow and ice (cryosphere), marine systems and biodiversity, water quantity, freshwater quality and biodiversity, terrestrial ecosystems and biodiversity, soil, agriculture and forestry, and human health. Furthermore, all indicators will be included in the EEA's indicator management system (IMS) which will allow easier access to underlying data. So far the EEA maintains two core set indicators on climate change (global and European temperature and greenhouse gas concentrations)⁴⁹⁰.

487 <http://www.eea.europa.eu/themes/water>

488 http://dataservice.eea.europa.eu/map/clc_download
<http://dataservice.eea.europa.eu/atlas/viewdata/viewpub.asp?id=1>
<http://www.eea.europa.eu/themes/landuse/eea-activities>

489 <http://www.eea.europa.eu/themes/climate/reports>

490 <http://themes.eea.europa.eu/IMS/CSI>

9. EDUCATION, TRAINING AND PUBLIC AWARENESS

Key developments

Major developments that have occurred in the EC since the 4th National Communication include:

- Public awareness campaigns on climate change:
- Climate Change Campaign (2006-2009)
- Sustainable Energy Europe Campaign (2005-2011)
- Climate Action Programme (2007-2009)
- Covenant of Mayors on energy and climate (2008 onwards)
- New Lifelong Learning Programme (2007-2012) with an increasing number of education and training projects related to climate change
- Eurobarometer survey on Europeans' attitudes towards climate change (2008)
- Eco Agents website for children (2008 onwards)
- Development of a large range of online resources and tools to raise public awareness and educate on climate change

9.1. Introduction

In the European Union, education and training are the responsibility of the Member States. The Member States' 5th National Communications report on details of education and training activities at the national level. Nevertheless, the European Commission supports the Member States' activities under different programmes and actions. Therefore, the EC 5th National Communication reports not only on public awareness activities, but also on education and training activities at the EC level. It also reports on the activities of the European Commission under the Amended New Delhi Work Programme⁴⁹¹.

In comparison to the 4th National Communication this chapter features a number of changes to the structure and content to reflect best practices:

- Activities grouped by area of focus: education and training in one section and public awareness in another section
- Separate sub-sections covering international cooperation activities

⁴⁹¹ Article.6 of the Convention (COP decisions 11/CP8, 7/CP10, 9/CP13).

- Use of tables to detail specific projects (project, focus, target, short description)
- Report on EC level activities including examples of best practices in the Member States on education and training
- Since the 4th National Communication the EC has developed a significant amount of new and improved activities related to education, training and public awareness on climate change.
- In its efforts to raise public awareness and educate on climate change, the EC has also developed a large range of new websites and tools targeting either the general public or specific audiences (e.g. children, youth, and teachers).

9.1.1. Amended New Delhi Work Programme

EC efforts to implement the Amended New Delhi Work Programme include:

- A dedicated EC focal point on Article 6 has been assigned in DG Environment.
- Participation (including preparation activities) in the Art 6 EC Expert Group. The expert group's programme for 2009 involves:
- Helping to prepare the UNFCCC European Regional Workshop on Art 6 good practices held in Stockholm 18-20th of May. Sweden hosted the Regional Workshop as part of its EU presidency programme. The plenary sessions of the workshop were web-streamed.
- Showcasing a selection of the good practices submitted to the Stockholm workshop in a summary document uploaded on CC:iNet and through side event(s) to be held during the Copenhagen conference.
- Preparing the EC position for the intermediate review of the Amended New Delhi Work Program in 2010.
- Proposing EU input on Art 6 for inclusion in the Copenhagen agreement.

9.2. Education and Training

9.2.1. Introduction

In the European Union, responsibility for education and training policy lies with Member States. The European Community's role is to support the improvement of national systems through complementary EU level tools, mutual learning, exchange of good practices and financial support. Examples of the European Community's actions on education and training as well as examples of support to Member States initiatives are described in this section.

9.2.2. *European programmes supporting Education and Training on climate change*

9.2.2.1. Lifelong Learning Programme

The EU Member States and the EC have in recent years strengthened their political cooperation through the Education and Training 2010 work programme (2002-2010). This work programme is the framework for cooperation between the Member States and between the Member States and the EC. The work programme was reviewed and updated in 2008.⁴⁹² The general aim is the modernisation of education and training systems in cooperation with the Member States to reflect topics that are essential for society in the 21st century, including the climate change issue.

In addition, the European Strategy for Sustainable Development adopted in 2001 and renewed in 2006⁴⁹³ recognises the important role that education and training should play in achieving the objectives of sustainable development. The work programme and the sustainable development strategy provide a coherent policy framework for Education for Sustainable Development (ESD) at European level.

The work programme and the sustainable development strategy provide a coherent policy framework for Education for Sustainable Development (ESD) at European level. ESD is a strategic priority for the Education and Culture DG and climate change is one of the many issues covered under this framework.

The European Commission has integrated its various educational and training initiatives under a single umbrella, the Lifelong Learning Programme managed by the Education and Culture DG. With a significant budget of nearly €7 billion for 2007 to 2013, the new programme replaces previous education, vocational training and e-Learning programmes, which ended in 2006. There are four sub-programmes focusing on different stages of education and training and continuing previous programmes:

- Comenius for schools,
- Erasmus for higher education,
- Leonardo da Vinci for vocational education and training, and
- Grundtvig for adult education.

Although climate change is not set as a priority for the Lifelong Learning Programme, a variety of education and training projects on climate change are supported under the four pillars of the programme, and especially under the Comenius and Leonardo da Vinci programmes.

⁴⁹²

http://ec.europa.eu/education/lifelong-learning-policy/doc/com865_en.pdf

⁴⁹³

See <http://ec.europa.eu/environment/eussd/>

The Comenius programme supports different activities: mobility of individuals (students and teachers), schools partnerships, multilateral projects and multilateral networks. Numerous Comenius School Partnerships work on topics related to environmental questions, climate change and sustainable development; these themes are very popular among schools. Comenius also funds a small number of projects on climate change in the field of teacher training.

Leonardo da Vinci is the action programme to implement the European Community's vocational training policy, supporting and supplementing action taken by the Member States. The programme works with different project types: training placements for learners and trainees, mobility for vocational education and training, project-partnerships for the transfer of innovation in vocational education and training, project-partnerships for the development of innovation in vocational education and training and thematic networks.

A series of projects supported by the Lifelong Learning Programme related to climate change is given in Appendix H-H1.

9.2.2.2. Intelligent Energy Europe Programme - ManagEnergy Initiative

ManagEnergy⁴⁹⁴ is an initiative of the European Commission DG for Energy and Transport under the Intelligent Energy Europe Programme. It supports the work of actors working on energy efficiency and renewable energies at the local and regional level. It was launched in 2002 following requests for improved communication and information on locally relevant energy issues. The available tools aim at sharing best practice and improving networking. They include training, workshops and online events targeting local stakeholders for sustainable energy and managers of local and regional energy agencies. ManagEnergy also offers free internet broadcast facilities⁴⁹⁵ including more than 1000 individual video presentations, speeches and interviews on topical energy matters.

Since 2005, ManagEnergy has placed an increasing emphasis on education. For example, the KidsCorner website⁴⁹⁶ features energy and transport pages including games, downloads, animations, videos, statistics, photos and other teaching resources aimed at 7-11 year olds, 12-16 year olds and their teachers in 26 languages.

In an effort to help young children understand many of the issues behind climate change, the EC's Intelligent Energy Europe programme has supported a number of decentralized, practical, grass roots schemes that teach energy education in primary schools all over Europe. The projects bring together local experts on energy efficiency and the children's own teachers to run entertaining and informative classes on energy saving issues. A series of projects is given in Appendix H-H2.

The Intelligent Energy Europe programme also supports a number of training programmes across Europe and in developing countries with a contribution up to 50 %-75 % of the

⁴⁹⁴ www.managenergy.net

⁴⁹⁵ www.managenergy.tv

⁴⁹⁶ <http://www.managenergy.net/kidscorner/index.html>

budget. The main training areas are energy savings, building certification, renewable energy technologies, biofuels and sustainable transport. Trainings or capacity building programmes typically target a variety of actors including local authorities, energy agencies, energy businesses, building professionals, and building owners. A series of projects is given in Appendix H-H2.

9.2.3. *European Institute of Innovation and technology*

The European Institute of Innovation and technology (EIT) was created in 2009 to support new ways of creating and promoting innovation in Europe. The EIT will enhance the integration of actors from all three sides of the knowledge triangle, thereby allowing knowledge to circulate freely and for new ideas to be generated. It will help to unlock Europe's innovation potential by pooling together its most excellent resources, allowing innovative businesses, research organizations and higher education institutions to interact in new ways and to exploit fully their creative potential. Sustainable energy and Climate change mitigation and adaptation are amongst EIT's priorities.

9.2.4. *The School Corner on the Climate Change Campaign website (2006-2009)*

The website of the DG ENV Climate Change Campaign (full description of the Climate Change Campaign below)⁴⁹⁷ includes a school corner. This features various activities and information including a quiz, short videos, a carbon calculator, students' guide to climate change and teaching materials.

9.2.5. *The kids section under the Climate Action Campaign website (2007-2009)*

Children and young people are one of the targets of the Climate Action Campaign (see full description below). A section of the campaign website is dedicated to 'What kids can do'. It provides links to European initiatives to educate children on climate change and broader environmental issues, including:

- **'Become an eco agent'** website of the European Environment Agency⁴⁹⁸.
- **Environment for young Europeans** website of DG Environment⁴⁹⁹. On this website children can discover by themselves or together with their friends and classmates what the environment is and what is happening to it. It focuses on four themes: air, water, waste and nature.
- The ManagEnergy Kids Corner⁵⁰⁰

⁴⁹⁷ http://ec.europa.eu/environment/climat/campaign/schools/getcreative_en.htm

⁴⁹⁸ <http://ecoagents.eea.europa.eu/>

⁴⁹⁹ http://ec.europa.eu/environment/youth/index_en.html

⁵⁰⁰ <http://managenergy.net/kidscorner/>

9.2.6. *Publications*

DG Environment publishes a brochure for young people (15-18) explaining climate change and EU action to combat it. This was updated in 2009 and will be available in 22 languages. DG Environment also publishes two stories on climate change as part of its 'Tom and Lila' series of stories for children. One, available in 20 languages, deals with climate change in general; the other focuses on clean air and transport and is available in 22 languages.

DG Environment contributes to the Europa Diary, an educational tool targeting school students of age 15-18. The diary contains the basics of what the EU offers young citizens, covering a range of their specific concerns including climate change. It is accompanied by a teachers' guide. The Europa Diary and the teachers' guide are available in all EU languages. There is growing demand for the diary; over 2.8 million copies of the 2008-9 edition were printed.

DG Environment has contributed to three editions of the diary (2006-7, 2007-8, 2008-9) and contributions to the fourth are in preparation. These contributions cover various environmental topics including climate change. The 2009-2010 edition also includes a section on renewable energy sources next to the climate change pages.

9.2.7. *ACCENT - Atmospheric Composition Change, the European Network of Excellence*⁵⁰¹

ACCENT is a network of excellence on atmospheric composition change funded by the European Commission (and described in section 8.2.1). The Education and Training task within this aims specifically to bring attention to the wide scientific issues tackled in ACCENT via education and training, and to provide individuals and/or teams with diverse skills and competences. This is achieved by an educational and training programme aiming at specified target groups within the scientific community, and a global (virtual) network for young scientists.

9.2.8. *EC RELEX Family training programmes*

The Directorate General for External Relations (DG RELEX) runs training programmes for newcomers in the Commission Delegations in third countries during the annual Green Week conference each June (see 9.3.10). Climate change issues are covered in the training programme.

Since 2005 DG AIDCO has implemented a seminar programme on environment integration in EC external cooperation targeting desk officers and project managers both at Headquarters and Delegations, as well as staff from partner governments involved in the delivery of EC cooperation and also open to other development partners and NGOs. The programme is to strengthen knowledge on concepts and rationale as well as on practical tools and methods to address environmental aspects in the different phases of the cycle of

⁵⁰¹ http://www.accent-network.org/farcry_accent/

operations. It focuses on the upstream phases of programming, identification and formulation and the main aid-delivery modalities: Projects, sector programmes, general budget support. Emphasis on climate aspects within the standard seminar format has increased progressively since 2007. More than 100 such seminars and online modules have been delivered so far in Brussels and overseas with a total participation of some 1500 staff from the EC, partner countries and development partners. Building staff capacities has been one key objective in the Greener AIDCO Plan adopted in 2007.

9.2.9. *Dissemination of innovative practices in Education and Training*

The EC is also working towards the dissemination of innovative practices on education for sustainable development. In 2008, an inventory of innovative practices in education for sustainable development⁵⁰² was presented by the Education and Culture DG. Climate change was one thematic focus in the report. The objective of the inventory is to identify innovative projects not only on environment but on integrative solutions. The inventory identified several best practices under the theme of climate change including:

- OKOLOG – Ecologisation school network (started in 1996) - Austria⁵⁰³
- Sustainable Universities - sustainability award contest (started in 2007) – Austria⁵⁰⁴
- Sustainable Tourism - developing a sustainable development curriculum for bachelor degrees in tourism and recreation management (2007-2008) - Belgium
- EnviWiki – Online Environmental Encyclopaedia for schools and universities (started in 2005) – Czech Republic⁵⁰⁵
- Transfer 21 programme – High school programme focused on interdisciplinary learning (2004-2008) - Germany⁵⁰⁶
- EkoSkola – Eco-Schools (started in 2002) - Malta⁵⁰⁷

2009 is the European year for creativity and innovation. Throughout the year the EC supports and coordinates Member States activities in this area and climate change initiatives are part of it. The objective of the EC is to disseminate good practices on creativity and innovation in Europe and beyond.

502 http://ec.europa.eu/education/more-information/doc/sustdev_en.pdf

503 <http://www.oekolog.at>

504 <http://www.umweltbildung.at>

505 <http://www.enwiki.cz/>

506 <http://www.transfer-21.de>

507 <http://www.ekoskolamalta.com/>

9.2.10. European Environment Agency (EEA) initiatives on Education and Training on climate change

The EEA is creating special web-based education materials and strengthening communication with younger audiences by communicating the EEA's main messages through various outputs suitable for children and for broader education purposes⁵⁰⁸. EEA activities on education include activities at school level, involving teacher networks, as well as education in a broader sense, e.g. life long learning. Various products and events are used to communicate climate change and other environmental topics in a creative and educational manner.

The main actions of the EEA in education and training on climate change are:

- Eco Agents⁵⁰⁹ as the EEA educational ‘flagship’ targeting children. Launched in April 2008, Eco Agents is a website for children delivered in a form of comic strip. It includes downloadable quizzes on climate change among others, and a library of related links. The target audience is 9-12 year old children across Europe. Eco Agents is available in 24 languages. So far, over 76,000 visitors have been registered.
- EEA and Eco Schools collaboration. In October 2007, the EEA and the Eco Schools network organised a workshop to develop educational environmental material on climate change, biodiversity and sustainable lifestyle. The target audience is teachers for 9-14 year old children across Europe. The process is ongoing.
- Danish Film Institute. Successful and ongoing collaboration has been established with the Danish Film Institute in Copenhagen. Two joint events on climate change have been organised so far:
- Autumn 2007: Screening of ‘The March of the Penguins’ combined with an EEA lecture in collaboration with Copenhagen University.
- Winter 2008: Climate Event. A well-visited one day event aimed at climate change high school teachers, combining EEA lectures, topic related movies and lectures on climate change as an educational topic.
- Since 2006 the EEA has participated in *kulturnatten* (Culture Night), an annual local event. It is a one-day event, where cultural institutions (museums, governmental buildings, etc.) are open to the public. In 2008 over 60,000 kulturnat-passes were sold and the EEA welcomed 4000 visitors at its premises. A diverse programme communicated environmental messages, and included theatre

⁵⁰⁸ EEA, EEA Strategy 2009-2013 - Multi-annual Work Programme, February 2009. <http://www.eea.europa.eu/publications/eea-strategy-2009852013-multi-annual-work-programme>

⁵⁰⁹ <http://ecoagents.eea.europa.eu/>

plays, environmental quizzes and interactive games, live music, organic/CO₂ friendly food, art exhibitions, scientific experiments, street attractions.

9.2.11. *International cooperation on education and training*

The EC is involved intensively in international activities related to education and training on climate change and sustainable development in general including:

- The United Nations Economic Commission for Europe (UNECE) strategy for education for sustainable development whose objective is to incorporate key themes of sustainable development in all education systems. Climate Change is covered under the education for sustainable development strategy under the environmental protection key theme. The Education and Culture DG participates in the annual UNECE steering committee meetings.
- Under the UN decade of ESD (2005-2014), a conference was organised by the German presidency of the Council of the EU in 2007 on Europe's contribution to ESD.
- The EC collaborates with the UNESCO on ESD (e.g. world conference on ESD in 2009).
- Close collaboration with the OECD through participation in OECD workshops and support to its eco/sustainable schools programme.
- The EEA is also involved in international education and training initiatives on climate change including:
- Linking up information to relevant educational processes (e.g. UN Decade for Education on Sustainable Development, UNECE ESD strategy, the EU Education & Training 2010 work programme)
- Participating in international events

Some education and training initiatives supported by the Intelligent Energy Europe programme focus on international cooperation with developing countries (see examples in Appendix H – H3).

- The EC is also working internationally to help partner countries tackle climate change. Examples of projects on climate change capacity building supported by the EC - DG AIDCO - in third countries include:
- Advancing Capacity, Partnerships and Knowledge to Support Climate Change Adaptation in Africa and Asia (ACCCA). Budget: €1.4 million (see section 6.4.2.2 for further details).

- Climate Change Capacity Development (C3D) - Technical Assistance for Strengthening and Training Developing Countries (Asia and Africa). Budget: €1.5 million (see section 6.4.2.1 for further details).
- Capacity Building related to Multilateral Environmental Agreements (MEA) in ACP countries. Budget: €19.5 million.
- Local Governments' backing for the development and implementation of a global and comprehensive post-2012 climate change agreement. Budget: €0.9 million
- Addressing Climate Change in the Middle East and North Africa (MENA). Budget: €1.5 million
- Capacity Development for Adaptation to Climate Change & GHG Mitigation in Non Annex I Countries. Budget: €2.5 million
- Seminars on climate change are also organised under the Technical Assistance and Information Exchange (TAIEX)⁵¹⁰ of DG Enlargement. TAIEX helps countries with regard to the approximation, application and enforcement of EC legislation. It is largely demand driven and contributes to the delivery of appropriate tailor-made expertise to address problems at short notice. The beneficiaries of TAIEX assistance include public and private sectors which have a role to play in the beneficiary countries in the transposition, implementation and enforcement of EU legislation. Beneficiary countries include: Bulgaria, Romania, Croatia, former Yugoslav Republic of Macedonia and Turkey; Turkish Cypriot community in the northern part of Cyprus; Albania, Bosnia and Herzegovina, Montenegro, Serbia and Kosovo under UNSCR 1244, Algeria, Armenia, Azerbaijan, Belarus, Egypt, Georgia, Israel, Jordan, Lebanon, Libya, Moldova, Morocco, the Palestinian Authority, Syria, Tunisia, Ukraine and Russia.
- RENA (Regional Environmental Network for Accession) programme for candidate countries and potential candidates is a €5.9 million project, which will start in 2010. RENA is the main regional cooperation tool for environmental protection in South Eastern Europe, promoting coherence and synergy between regional activities, as well as supporting progress towards EU standards. It has a large geographical and thematic scope bringing under its umbrella a number of activities previously carried out under various policy and financial instruments. It is conceived for addressing evolving geopolitical (process of accession to EU) and environmental circumstances (including climate change).

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<http://taix.ec.europa.eu/>

9.3. Public awareness

9.3.1. Introduction

Since the previous national communication, many different initiatives have been carried out in Europe to raise public awareness of climate change, both at the European and Member State levels. Ambitious campaigns have been organised by the European Commission, new tools developed (e.g. carbon footprint calculator), innovative events organised, competitions launched to identify best practices, networks set up to share and spread best practices, and new information packages made available via different media (e.g. leaflets, online, video, TV). International cooperation on climate change public awareness has also been strengthened.

9.3.2. Climate change section of DG Environment website

DG Environment's public website contains a substantial section on climate change which plays an important role in the Commission's information and awareness-raising activities on the issue. The climate pages provide detailed information on domestic EU policies and measures for mitigation and adaptation as well as on the EU's positions on the international climate negotiations. The climate section received an average of 335,000 page views per month between October 2008 and March 2009.

9.3.3. Publications

While the Commission seeks to minimise the production of printed materials for environmental reasons, publications such as brochures and fact sheets nevertheless continue to play a significant part in the Commission's efforts to inform the public and raise awareness about environmental issues.

DG Environment has produced a series of public brochures entitled "EU action on climate change" highlighting various aspects of EU domestic and international climate change policy. These are regularly updated and all are available in English, French, Spanish, German, Italian and Polish. Some are published in further languages, including the UN languages Arabic, Chinese and Russian. As well as on paper, all brochures are available for download from the DG Environment website and from the EU Bookshop. A short fact sheet on climate change for the general public is also available. This was updated in 2009 and will be published in 22 languages.

As part of its "Europe on the move" series of brochures for a broad public, DG COMM has published a brochure entitled "Combating climate change" which is available in all EU languages on paper and for download from the Commission's website.

The DG for Energy and Transport (TREN) and EACI, the Executive Agency for Competitiveness and Innovation (running the Intelligent Energy - Europe programme), have published a total of nine brochures (TREN: 5 and EACI: 4) on energy efficiency and renewable energy sources with strong links to climate change. DG TREN's publications are available in a minimum of six languages (EN, FR, ES, DE, IT and PL); those of EACI are

published in English, French and German. PDF versions of these titles are available for download from the respective websites as well as from the EU Bookshop.

9.3.4. *Video productions*

Video productions form an integral part of the European Commission's communication and awareness-raising activities.

DG Environment produces 10-12 video news releases per year on a range of environmental issues including climate change. These videos, of 8-10 minutes length, are used in whole or part by many television stations and typically reach an audience of at least 7.5 million viewers in Europe. They can also be viewed online at www.tvlink.org.

Between 2005 and mid-2009, 13 such videos were produced by DG Environment on various aspects of climate change and EU policy to address it.

Over the same period DG TREN together with EACI produced 20 video news releases and clips on energy issues and energy policy action of relevance to the fight against climate change (TREN: 12 and EACI 8). Videos are available from websites for download and streaming, and most of them are also available on DVD.

In 2009 DG COMM produced an updated version of the "Green Catalogue", which contains a wide selection of over 100 VNRs and info-clips produced by the Commission services and which is on-line since mid July. Links are available from both the Commission's Climate Action website and the Press-room page on the EUROPA website. 2000 DVDs of the catalogue will be described to journalists at Climate Action events and at COP 15 Commission channel on Green TV is also being updated with short "EUtube"-like clips. Green TV works closely with a series of social networks. See http://www.green.tv/european_commission

9.3.5. *Climate Change Campaign (2006-2009)*

In May 2006 the European Commission launched its "You control climate change" public awareness raising campaign on climate change. The campaign aims to give people a sense of responsibility with practical tips on how small changes to daily habits can achieve collectively significant reductions in GHG emissions.

The campaign used a wide variety of supports to reach a broad public, especially young people. The campaign website, available in 21 language versions, was the cornerstone of the campaign and the place where all the resources and information were available.⁵¹¹ Other supports included videos, publications, advertising (TV, cinema, newspaper, online, outdoor), posters, applications (screen saver, carbon calculator), game (Living together!), news articles, and video podcasts.

⁵¹¹ http://ec.europa.eu/environment/climat/campaign/index_en.htm

The campaign was carried out in 3 phases from 2006 to 2009, with a budget of approximately €7.2 million

As the campaign wound down in 2009, DG Environment provided its delegation offices in the EU Member States with a travelling exhibition about EU action on climate change for use at public events. The exhibition is available in all EU languages.

9.3.6. *Sustainable Energy Europe Campaign (2005-2011)*

The objectives of the Sustainable Energy Europe Campaign 2005-2011⁵¹² are to:

- Spread best practice to ensure a strong level of public awareness, understanding and support.
- Stimulate the necessary trends towards an increase in private investments in sustainable energy technologies.
- Build alliances among sustainable energy stakeholders, thereby creating a platform for new joint ideas and actions.

In the campaign, the Energy and Transport DG works in collaboration with two types of partners:

- Campaign Partners/Partnerships are public and private organisations that run exemplary projects and programmes. Their proposals are evaluated by the European Commission as a condition for being selected as partners. The purpose is to establish a European network for exchange of experience and the spreading of best practices among campaign partners. By May 2009, about 2,400 applications had been evaluated and 659 partnerships approved.
- Campaign Associates are major umbrella and network organisations involving sustainable energy actors who are able to offer a range of multiple actions through their communication channels. Their objective is to steer, in cooperation with the Commission, the campaign's strategy, manage special initiatives within the campaign, and also recruit partners. By May 2009, 105 associates had been recruited covering different types of organizations.

The campaign includes three types of events:

- Sustainable Energy Days aiming at the general public at local level. Sustainable Energy Days are organised by municipalities, regions and other stakeholders throughout Europe. The types of activities may vary, but normally include one or more of the following: guided visits and tours; educational activities and programmes, and exhibitions and fairs. Over 150 Sustainable Energy Days take place each year.

⁵¹²

<http://www.sustenergy.org>

- Other events aimed at energy stakeholders – These events are organised during the year in the Member States and they cover more specific activities targeted at specialists, businesses and decision-makers. These events are seen as networking opportunities for stakeholders.
- The biggest event of the campaign is the Sustainable Energy Week, which ran for the third time in February 2009. It is also the world's most important series of events on sustainable energy. 146 conferences in 51 European cities, involving more than 36,000 attendees were held in 2009. Besides, the Week took place in 1,400 hypermarkets in six countries, with excellent commercial results for the organisers (sales increases in excess of 124 % for energy efficient light bulbs, for instance). The basic idea is to provide a framework for various stakeholders, including campaign associates, to organise their own events during one week.
- The campaign organisation has set up support functions and developed tools to support the implementation of the Campaign including:
 - A range of promotional and communication tools to be used by Campaign associates and partners (tools for the Energy Days, visual identity and promotional toolbox)
 - The Campaign website (www.sustenergy.net)
 - Media actions (press releases, press corner of the website, TV-Link, videos)
 - Publications, brochures and newsletters

9.3.7. *Climate Action Campaign: Energy for a changing world (2007-2009)*

Energy and climate change has been a communication priority of the European Commission since 2007. DG Communication (DG COMM) has since then led a project team including DG TREN, DG ENV, DG RELEX, DG AGRI, DG COMP, DG ENTR and the EEA. The purpose of the project team is to maximise communication impact by ensuring consistency of messages and coordinating communication activities among the different Commission departments involved.

As such a communication priority, extra efforts are invested by DG Communication to maximise the efforts of the other DGs on the issue of climate change.

The “Climate Action – Energy for a changing world” campaign launched in 2007 resulted from a political need to bring together energy and climate change under a single and coordinated communication campaign following the Commission’s proposal of the Energy and Climate Change package in January 2007. The campaign developed in three stages:

- **2007:** set up of the campaign (with no budget), focusing on media oriented activities and ensuring coordination among main communication actors, DG ENV, DG TREN, as well as with the main communication tools, particularly Representations in the Member States.

- **2008:** actual launch of the campaign in terms of producing outputs, targeting the general public. DG Communication contracted an external company to organize five big events, including melting ice cubes⁵¹³ and carbon footprints⁵¹⁴, over the year and produce promotional material (budget of about €1 million in DG COMM). The "Climate Action" website (<http://ec.europa.eu/climateaction>) was created to provide citizen friendly information from various sources in a single place with a unified "look-and-feel", including the subsection on behavioural advice 'Your action counts'.
- **2009:** the last year of the campaign focusing particularly on young people (budget of about €3 million in DG COMM and €5 million in the Commission Representations in the Member States). The 2009 campaign, which still uses high visibility events like the melting ice cubes, makes a particular effort to involve youth through their favourite pastimes and communication tools: television and internet. It includes:
 - A multimedia project ("Click a tree" campaign) based on a viral clip to be seeded in social networks, blogs, etc; a TV spot; a campaign website, a tree planting campaign and a prize winning game for 'tree planters'.
 - The "Play to Stop. Europe for Climate" campaign with MTV, launched in July 2009 and structured around a series of 3 concerts in 3 target countries' capitals (Stockholm, Budapest and Copenhagen). The concert will be web-streamed and a 47 min TV special will be recorded for each concert (involving the artists, young 'ambassadors' and politicians), which would also be promoted through a TV spot on MTV. The campaign also includes 'ambassadors' (artists, actors, footballers, etc) who help in passing the message on. A dedicated website provides information on the EU Climate Change action, invitations to a competition to win entry to the concerts and to upload text and video messages about climate change, and to watch the concerts and TV specials in live streaming.

9.3.8. *Covenant of Mayors – Cities and regions leading climate change mitigation through local sustainability energy*

The Covenant of Mayors was launched by the European Commissioner for energy in 2008⁵¹⁵. It consists of formal commitments by city councils or equivalent local authorities to go beyond the objectives set by the EU for 2020, reducing the CO₂ emissions in their respective territories by more than 20 %, through the implementation of a Sustainable Energy Action Plan (SEAP), which is made public and submitted to the European Commission. The cities also commit to foster citizen participation and to report regularly

⁵¹³ Exhibition presenting two ice cubes melting at a different pace, the first ice-block (which melts very slowly) representing a world in which action has been taken following EC proposals, whereas the second one melts rapidly and dramatically diminishes, with the results known (floods, etc, also represented).

⁵¹⁴ Hostesses dressed up as footprints under the motto 'Watch your CO₂ footprint'.

⁵¹⁵ www.eumayors.eu

on progress in achieving the goals set. Finally, they accept termination of their involvement in the Covenant in case of non-compliance.

The European Commission provides for coordination and evaluation facilities through the creation of a Covenant of Mayors Office (COMO), technical assistance through the Commission's Joint Research Centre and project development facilities to smooth financing of investment projects through the European Investment Bank. In addition, actions related to the Covenant of Mayors are priority in the Intelligent Energy –Europe programme. New support lines, both for Europe and for other countries, are at present under consideration. Ongoing negotiations with third parties are resulting in commitments by regions and other institutions to provide financial and technical support to smaller cities, allowing them to be in a position to join the Covenant. Other services such as the provision of guidelines and the creation of a system for benchmarking excellence are planned, due for delivery during 2009.

As of 1 May 2009, 496 cities and regions from Europe and beyond had signed up to the Covenant, involving more than 100 million citizens. This figure is increasing constantly. With the present number of cities, a conservative estimate of the potential CO₂ emission reduction would be in excess of 110 million tons of CO₂ a year by 2020, or approximately 600 million tons in the period from 2010 to 2020.

9.3.9. *The European Mobility Week Campaign*

European Mobility Week⁵¹⁶ is an annual initiative coordinated by the three European city networks, Eurocities, Climate Alliance and Energie-Cités, with the support of the European Commission (DG Environment). European Mobility Week started in 2002 and aims to encourage citizens to change their travel behaviour by shifting to more sustainable modes of transport. From 16th to 22nd September each year, local authorities all over Europe and beyond organise public awareness raising activities and launch new, permanent infrastructure measures which contribute to improving sustainable mobility. Many organise car-free days as part of the week's activities. In 2008 just over 2,000 towns and cities with a combined population of almost 220 million people took part in EMW. EMW is also organised in countries beyond the European Union, including China.

Climate change was the theme of EMW in 2006, in support of the launch of the Commission's Climate Change awareness campaign, and again in 2009. The 2009 campaign theme – “Improving City Climates” – underlines the importance of efforts of towns and cities in effectively tackling climate change via measures promoting sustainable mobility.

9.3.10. *Green Week*⁵¹⁷

Green Week, held each year in June, is the biggest annual conference dedicated to European environment policy. Organised by the European Commission (DG

⁵¹⁶ <http://www.mobilityweek.eu/>

⁵¹⁷ <http://ec.europa.eu/environment/greenweek/home.html>

Environment), Green Week is open to the public and aims to raise awareness of environmental issues as well as to facilitate solutions through discussion and sharing of experience and good practice among those professionally involved in environmental protection. Green Week typically attracts some 3,000-3,500 participants from Europe and beyond from national, regional and local government, European and multilateral institutions, business and industry, environmental NGOs, the scientific community and academia.

Green Week took climate change as its theme in 2005, under the slogan "Get to grips with climate change", and again in 2009, under the title "Act and adapt". Green Week 2009 comprised more than 35 discussion sessions looking at prospects for the Copenhagen agreement and at various aspects of the challenges of mitigation and adaptation. In connection with Green Week in 2005 three video news releases on various aspects of climate change and in 2009 two such videos were distributed to TV stations. In other years Green Week has included several sessions on climate change even when this has not been the main theme of the event.

9.3.11. The European Business Awards for the Environment

The European Business Awards for the Environment initiative was launched by DG Environment in 1987 to reward and promote European companies that set an example by successfully bringing together innovation, economic viability and protection of the environment. Only winners of national awards can apply - this rule ensures that companies winning the European award are truly 'best of the best'. The awards are given in four categories - management, product, process and international co-operation. 125 companies from 24 European countries participated in the 2008 edition.

9.3.12. Opinion surveys

In 2008, the EC and the European Parliament carried out a survey of "Europeans' attitudes towards climate change". The results of this survey were published in September 2008 in a Special Eurobarometer Report⁵¹⁸, analysed at the EU level and by country. Where applicable, different socio-demographic variables - such as respondents' gender, age, education, occupation and political orientation - have been used to take the analysis further. In addition, key variables were used in the analysis to gain deeper insight into citizens' views on climate change: respondents' subjective level of information and their perception of the seriousness of climate change. The main results from the survey include:

- Climate change is an issue of major concern to Europeans.
- The proportion of citizens that feel poorly informed about the subject remains significant.
- Attitudes seem to be predominantly optimistic regarding the evolution of the problem: most citizens think that the process is stoppable.

⁵¹⁸ Special Eurobarometer 300, Europeans' attitudes towards climate change, September 2008.

- A clear majority (61 %) confirm that they have taken some kind of action in this cause.
- Europeans clearly think that corporations and industry, citizens themselves, national governments and the EU are not doing enough to fight climate change.

A second survey on "Europeans' attitudes towards climate change"⁵¹⁹ was published in July 2009. Among the main conclusions are the following:

- Climate change is still seen as one of the top three most serious problems facing the world today, though the seriousness of this issue (as with many other world problems) has declined in the face of the economic downturn, which dominates public opinion (and perceived concerns).
- The proportion of respondents who believe that fighting climate change can have a positive effect on the European economy has increased from 56 % in spring 2008 to 62 % in January-February 2009.

9.3.13. Grants programmes⁵²⁰

DG Environment has run a programme of operating grants for European environmental NGOs since 1999. NGOs are awarded yearly grants based on the work programmes presented in their applications. The activities in the work programmes should be in line with the priorities of the 6th Environment Action Programme, one of them being climate change. Activities in relation to education, training and public awareness on climate change (among other activities) can therefore be co-funded under this programme, although it does not exclusively target such activities.

9.3.14. European Environment Agency (EEA) initiatives on public awareness on climate change

The EEA's communication strategy puts an increased effort in reaching out to the general public with its environmental messages, hereby acknowledging the importance of each citizen's impact on the environment and climate change. The EEA produces specifically targeted products for the general public, including reports, briefings, indicators, maps, data, animations and videos. Selected EEA products are translated into all EEA member countries' languages.

- The EEA website is the central communication tool to the public and other stakeholders with a section on climate change⁵²¹. The EEA leverages its environmental message by producing targeted EEA products aimed at specific audiences.

⁵¹⁹ Special Eurobarometer 313, Europeans' attitudes towards climate change, July 2009

⁵²⁰ http://ec.europa.eu/environment/ngos/index_en.htm

⁵²¹ <http://www.eea.europa.eu/themes/climate>

- Since 2007, the EEA publishes green tips on its homepage.⁵²² About 50 of them relate to climate change.
- In 2009, web articles were established as a new online product. They are targeted at the informed public, in particular web readers who typically look for bite-sized information.
- Animations and videos⁵²³ on climate change are available on the EEA website.
- EEA Signals⁵²⁴ is the central EEA product targeting the general public. It is an annual publication profiling key environmental stories, including climate change. EEA Signals is available as a paper copy as well as web articles.
- In 2007, the documentary ‘Our Arctic Challenge’ was produced⁵²⁵. A pre-premiere was organised at the EEA premises with his Royal Highness Crown Prince Frederik of Denmark, the diplomatic corps in Denmark and the winners of the Arctic Team Challenge 2007. The documentary won the audience award for the “Best documentary feature” at the Oxford International Film Festival in 2008.
- Until 2007, EPAEDIA⁵²⁶ was the EEA's environmental encyclopaedia which offered news and information to the general public in a simple and fun way. It contained different levels of information to cater for differing degrees of interest in the environmental issue.

9.3.15. *International cooperation on public awareness*

Communication outside the EU is largely decentralised through the Commission Delegations. DG RELEX is responsible for the administration of the Commission Delegations in third countries (more than 120). At the beginning of 2008, Climate change was signalled as a priority theme for delegations in their overall communication activities. DG RELEX established a dedicated web page from where Delegations can download presentations etc. DG RELEX also supports public awareness programmes on climate change in the third countries. A list of projects is given in Appendix H – H4.

In 2007, the theme of the “European Development Days” event was ‘Will climate change development?’⁵²⁷. The event included activities to raise media and public awareness about climate change and development. Adapting to climate change was one of the four themes of the 2009 European Development Days, held in Stockholm on 22-24 October.

⁵²² <http://www.eea.europa.eu/green-tips/>

⁵²³ <http://www.eea.europa.eu/multimedia>

⁵²⁴ <http://www.eea.europa.eu/publications/signals-2009>

⁵²⁵ <http://www.eea.europa.eu/multimedia/introduction-of-the-film-our-arctic-challenge/view>

⁵²⁶ <http://epaedia.eea.europa.eu/index.php>.

⁵²⁷ http://ec.europa.eu/development/services/events/EDD2007/homepage_en.htm

In the context of the EU-China Climate Change Partnership established in 2005, the EU and China have launched a number of joint public awareness raising and training projects, including the following:

- EU-China CDM facilitation project (see section 7.6.3)
- An EU exhibition on climate change in 2008⁵²⁸: Roaming exhibition organised by the Delegation of the European Commission to China and targeting the general public throughout China.

The EU is also working internationally to help partner countries tackle climate change. Awareness-raising projects supported by the EC - DG AIDCO - in third countries include:

- Morocco (2004), Renforcement des capacités nationales en matière d'éducation et de sensibilisation à l'environnement dans les domaines de la biodiversité, des changements climatiques et de la désertification. Budget: €706,000.
- Global (2005), Climate Change and Poverty Reduction: Building Awareness and Promoting Action. Budget:€360,000.
- Africa (2006), L'information Environnementale corporative au service des grands défis régionaux d'Afrique. Budget: € 371,000.
- Global (2006), Challenges for sustainable development in the South - News reporting, opinion building and media training regarding climate change, biodiversity, food security and the extractive industries. Budget: €671,000.
- Afghanistan(2007), National Environmental Visibility Event in Afghanistan. Budget: €100,000.
- Global (2008), The Climate Change Media Partnership (CCMP): Developing World Media Capacity- Building on the Post 2012 Climate Change Negotiations and the Clean Development Mechanism. Budget: €768,000.
- Global (2008), IPCC Dissemination of results / Understanding the findings of the IPCC Fourth Assessment Report "Climate Change 2007" - Integrating climate change adaptation and mitigation in development planning. Budget: €1 million.
- India (2008)Climate Change Awareness Programme. Budget: €8.5million
- Asia (2009-2010) SwitchAsia network facility.

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http://www.delchn.ec.europa.eu/climate_change.htm