DANISH MINISTRY
OF THE ENVIRONMENT

Environmental
Protection Agency

Denmarks Fourth National Communication on Climate Change

Under the United Nations Framework Convention on Climate Change

Contents

Foreword

I am pleased to present Denmark's Fourth National Communication under the United Nations Framework Convention on Climate Change.

This Fourth National Communication contains information on the action taken by Denmark, Greenland, and the Faroe Islands on the commitments under the UN Framework Convention on Climate Change.

The ultimate objective of the UN Framework Convention on Climate Change is to achieve ”stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system”.

The Third Assessment Report from the UN Intergovernmental Panel on Climate Change (IPCC) shows that there is now stronger evidence for human influence on the global climate than previously assumed, and that most of the observed warming at the earth's surface over the last 50 years is likely to have been due to human activities. The February 2005 Exeter Stabilisation Conference concluded that there is strong evidence, that climate change due to anthropogenic emissions of greenhouse gases is already occurring and that it will result in changes in frequency, intensity and duration of extreme weather and climate events.

The exact extent of future climate change is not known. However, the risk that climate change will affect humans and the environment in both the developed and the less developed parts of the world is of great concern to the Danish government. The Danish government will continue its efforts to reduce greenhouse gas emissions both at national and at global level. This task involves fulfilling the commitments under the Kyoto Protocol and the agreement on joint fulfilment of the EU's target under the Protocol, and it involves exploring how to further the UN Framework Convention on Climate Change by developing a post 2012 agreement.

The climate challenge requires further targeted and long-term action both at international and national level. At the international level, negotiations on an agreement on further action after 2012 are a major global challenge. The way forward is to ensure broader participation, which can lead to significantly more ambitious greenhouse gas emission reduction targets. As decided by the European Council in March 2005, the industrialised countries should continue to lead the way, with ambitious emission reductions, and by granting assistance to developing countries through transfers of technology and capacity-building to promote sustainable development. There are many technological opportunities to promote economic development while at the same time contributing to reductions in emissions of greenhouse gases. In a Danish context renewable energy is a good example that could give inspiration to other countries.

Copenhagen, December 2005

Connie Hedegaard

MINISTER FOR THE ENVIRONMENT

Introduction

At the United Nations Conference on Environment and Development in Rio de Janeiro in June 1992, more than 150 countries signed the UN Framework Convention on Climate Change (the Climate Convention).

On 21 December 1993 the Climate Convention was ratified by a sufficient number of countries, including Denmark, for it to enter into force on 21 March 1994.

This report is Denmark's Fourth National Communication under the Climate Convention. Since Denmark's ratification of the Climate Convention covers the entire Realm, the report also includes information on Greenland and the Faroe Islands. The report is organised in accordance with the guidelines for national communications adopted by the parties to the Climate Convention.

In addition to efforts described in this report, Denmark also contributes to the European Union's common efforts under the Climate Convention and the Kyoto Protocol. Such efforts have – and will in the future – be transposed by implementation of common and coordinated policies and measures to reduce greenhouse gas emissions, including under the European Climate Change Programme (ECCP). Further information on the EU's climate policy etc. is available in the EU's Fourth National Communication.

The Danish EPA has been in charge of coordinating the work relating to Denmark's Fourth National Communication. Contributions have been made by the following institutions:

The Danish Forest and Nature Agency,
The National Environmental Research Institute,
The Geological Survey of Denmark and Greenland,
The Danish Energy Authority,
The Ministry of Foreign Affairs,
The Ministry of Finance,
The Ministry of Taxation
The Ministry of Transport and Energy,
The Danish Meteorological Institute,
The Danish Coastal Authority,
The Ministry of Food, Agriculture and Fisheries,
The Danish Institute of Agricultural Sciences,
Forest and Landscape Denmark, The Royal Veterinary and Agricultural University
The Greenland Home Rule, including the Department for Environment and Nature,
The Faroe Home Rule, including the Ministry of the Interior,
Statistics Denmark,
Risø National Laboratory,
University of Copenhagen,
University of Aarhus,
The Technical University of Denmark,
The Institute of Local Government Studies - Denmark,
The Royal Veterinary and Agricultural University.

1. Executive Summary

1.1 National circumstances relevant to greenhouse gas emissions and removals

1.1.1 General

The Kingdom of Denmark – the Realm - comprises Denmark, Greenland and the Faroe Islands. The UN Framework Convention on Climate Changes has been ratified on behalf of all three parts of the Realm.

Today, Denmark has a population of 5.4 mill. and a total area of 43,000 km^2. More than 66% of the area is used for agricultural purposes, while 11% is forested and 10% is towns, roads and scattered housing, while the rest consists of natural areas, including lakes, watercourses, heath, etc.

The Danish climate is temperate with precipitation evenly distributed over the year. The mean annual temperature is 7.7°C and mean annual precipitation is 712 mm.

Since 1993 economic growth in Denmark has been considerable, with GDP (Gross Domestic Product) rising at an average of 2.7% per year. In 2003, GDP amounted to DKK 1,400 billion, corresponding to DKK 260,000 per capita.

1.1.2 Energy, transport, and the domestic sector

Denmark is self-sufficient in energy, due primarily to the production of oil and gas in the North Sea, but renewable energy is also increasingly contributing to the energy supply. Denmark's total own production of energy almost more than tripled since 1990.

Despite the economic growth, total energy consumption has remained largely unchanged at approximately 800 PJ since 1980. Denmark's dependence on oil and coal has fallen, and particularly within electricity and heat production, Denmark has succeeded in substituting with other fuels. Renewable energy accounts for about 14% of Denmark's actual energy consumption.

The actual (non-adjusted) energy consumption in 2003 was 863 PJ and was distributed over the following energy sources: oil 343 PJ (40%), natural gas 195 PJ (23%), coal 238 PJ (28%), and renewable energy 117 PJ (14%). The net export of electricity was significant in 2003, corresponding to 31 PJ (-4%).

The distribution of gross energy consumption (energy consumption adjusted for foreign electricity trade) in 2003 was as follows: industry and agriculture accounted for 26%, domestic sector for 27%, transport for 25% and commerce and service for 15%. Refining and non-energy purposes accounted for the remaining 7%. More than 2/3 of the electricity supply comes from large primary power stations or CHP plants, while the district heat supply covers almost half of the need for heating. Energy production and supply alone account for 44% of Denmark's total emissions of greenhouse gases.

The domestic sector accounted for 6% of Denmark's total greenhouse gas emissions in 2003.

Transport activity, energy consumption and CO_2 emissions within the transport sector have developed largely in step with economic growth. In 2003, passenger and goods transport performances were 14% and 44% above the 1990 levels respectively. In 2003, CO_2 emissions by the transport sector were about 22% over the 1990 level and accounted for 22% of Denmark's total CO_2 emissions and 18% of total greenhouse gas emissions.

1.1.3 Business sector and waste

Industry's production value accounts for about 30% of total production. The largest sectors of industry are food and beverages, engineering, electronics and the chemical industry. The total business sector (industry, building and construction, together with public and private services) accounts for about 13% of Denmark's total emissions of greenhouse gases. This does not include emissions connected to the sector's consumption of electricity and district heating, since these emissions from power and heat plants are included in the emission calculations for energy. By far the largest part of these emissions, is CO_2 from energy consumption, but the sector is also a source of emissions of industrial greenhouse gases.

The waste sector's methane emissions account for 2% of the total greenhouse gas emissions in 2003. Methane emissions from the waste sector are expected to fall in the future due to the obligation the municipalities have had since 1997 to send combustible waste for incineration. In addition, gas from a number of landfill sites is used in energy production, which helps to reduce both CO_2 and methane emissions.

1.1.4 Agriculture and forestry

Over the last 40 years, the agricultural area in Denmark has fallen from 72% (30,900 km^2) of the total area in 1960 to 62% (26,578 km^2) in 2003. The number of farms has fallen by 50%, from 119,155 in 1980 to 48,613 in 2003, while the average size of farms has increased by more than 100% in the same period, from 24 ha to 54 ha. At approximately 11%, agricultural exports still account for a considerable proportion of all Danish export. Agriculture accounted for approximately 17% of Denmark's total emissions of greenhouse gases in 2003.

Approximately 11% of Denmark is forested, and the Forestry Act protects a very large part of the existing forest from other land use. The ambition is to have about 20-25% of Denmark's area forested by the end of the 21st century.

1.1.5 Greenland and the Faroe Islands

Greenland is the world's largest island, with an area of 2.2 mill. km^2, 85% of which is covered by the ice sheet. From north to south, Greenland extends over 2,600 km. Greenland has a population of slightly more than 56,000, and fishing is the main occupation.

Greenland's climate is Arctic, and forests do not grow in Greenland. The warmest recorded temperature since 1958 is 25.5ºC, while temperatures can go down below -70ºC on the inland ice sheet.

The Faroe Islands consist of 18 islands with a total area of 1,399 km^2 and have a population of just over 48,000. The climate is characterised by mild winters and cool summers and the weather is often moist and rainy. The mean annual temperature is 6.5ºC.

Fish and fisheries account for 98-99% of the Faroe Islands' total export earnings, apart from exports of ships, which vary greatly over the years. Agriculture was the main occupation until the end of the 19th century but now only accounts for 0.3% of gross national product at factor cost. There are about 1,200 head of cattle and about 70,000 sheep on the Faroe Islands.

1.2 Greenhouse gas inventory information

Denmark's greenhouse gas inventories are prepared in accordance with the guidelines from the Intergovernmental Panel on Climate Change (IPCC) and are based on the methods developed under the European CORINAIR programme.

Table 1.1 shows Denmark's total emissions of the greenhouse gases CO_2, CH_4 and N_2O and the industrial gases HFCs, PFCs and SF_6 from 1990 to 2003, calculated in CO_2 equivalents in accordance with the general rules for inventories under the Climate Convention. Inventory based on the rules under the Kyoto Protocol will involve some changes with respect to base year and removals in connection with land use change and forestry (LUCF). The increase of 7.3% from 2002 to 2003 is due to large exports of electricity to other Nordic countries.

1.2.1 Carbon dioxide, CO_2

Almost all CO_2 emissions come from combustion of coal, oil and natural gas for energy production, although road transport also contributes a considerable proportion - about 22%. The relatively large fluctuations in the emissions from year to year are due to trade in electricity with other countries - primarily the Nordic countries.

In 2003, total actual CO_2 emissions inventoried under the Climate Convention, excluding land-use change and forestry (LUCF), were 12% higher than in 1990. If LUCF is included, net emissions were 10% higher. Corrected for exchange of electricity with other countries and annual temperature variations, CO_2 emissions dropped 13% with and 15% without LUCF during the same period.

Table 1.1 Denmark's total emissions of greenhouse gases, 1990 – 2003

Source: The National Environmental Research Institute (NERI)

GREEN-HOUSE GAS EMISSIONS	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	CO_2 equivalent (Gg)													
Net CO_2 emissions/removals	53045	63446	57503	59594	63333	60375	73613	64081	59590	56653	54858	53457	52812	58124
CO_2 emissions (without LUCF)	52887	63559	57755	60060	63663	60609	74035	64524	60409	57523	53076	54615	54288	59329
CH_4	5684	5785	5819	5994	6008	6108	6226	6099	6042	5953	5941	6029	5954	5873
N_2O	10713	10584	10125	9924	9778	9657	9379	9248	9149	8843	8615	8380	8035	8060
HFCs	0	0	3	94	135	218	329	324	411	503	605	647	672	695
PFCs	0	0	0	0	0	1	2	4	9	12	18	22	22	19
SF_6	44	64	89	101	122	107	61	73	59	65	59	30	25	31
Total (with net CO_2 emissions/removals)	**69487**	**79879**	**73539**	**75707**	**79376**	**76466**	**89610**	**79830**	**75260**	**72030**	**70095**	**68566**	**67521**	**72804**
Total (without CO_2 from LUCF)	**69328**	**79992**	**73791**	**76173**	**79706**	**76700**	**90033**	**80273**	**76079**	**72900**	**68314**	**69724**	**68996**	**74008**

GREEN-HOUSE GAS SOURCE AND SINK CATEGORIES	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	CO_2 equivalent (Gg)													
1. Energy	52390	63065	57130	59545	63309	60415	73998	64267	60148	57345	52802	54458	54121	59318
2. Industrial Processes	2155	2258	2292	2359	2433	2604	2673	2862	2905	3070	3259	3191	3095	3129
3. Solvent and Other Product Use	317	305	292	280	268	242	265	262	195	192	212	130	151	206
4. Agriculture	12845	12720	12429	12307	12052	11845	11526	11357	11368	10806	10565	10470	10138	9898
5. Land-Use Change and Forestry (LUCF)	158	-113	-252	-466	-330	-234	-422	-443	-819	-870	1782	-1158	-1476	-1204
6. Waste	1622	1645	1648	1683	1645	1593	1570	1525	1463	1487	1475	1475	1492	1457
7. Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0

The reduction since 1990 is due, in particular, to a significant change in the use of fuels in energy production from coal to natural gas and renewable energy, more widespread use of CHP and improved energy efficiency.

1.2.2 Methane, CH_4

The biggest source of man-made methane emissions is agriculture, followed by landfill sites and energy production. The emissions from agriculture are due to enteric fermentation in farm animals and the handling of manure.

Emissions of methane from landfills are decreasing, because the production of methane has fallen year by year since the abrupt fall in landfilling in 1997.

The emissions from energy production have been rising with increasing use of gas engines. It is expected that these emissions will decrease, when new legislation come into force in 2006.

1.2.3 Nitrous oxide, N_2O

Agriculture is by far the main source of emissions of nitrous oxide because this forms in soil through bacterial conversion of nitrogen in fertiliser and manure. Bacterial conversion of nitrogen also occurs in drain water and coastal water. It will be seen that there has been a 30% fall in nitrous oxide emissions from agriculture since 1990. That is due to less and better use of fertiliser. A small proportion of the nitrous oxide emissions comes from the exhaust of cars fitted with a catalytic converter.

In 2003, total nitrous oxide emissions were 25% below the 1990 level.

1.2.4 The industrial gases HFCs, PFCs and SF_6

The contribution of industrial greenhouse gases (HFCs, PFCs and SF_6) to Denmark's total emissions of greenhouse gases is relatively modest, but in percentage terms, the emissions of these gases showed the biggest rise during the 1990s. The HFCs, which are primarily used in the refrigeration industry, are the biggest contributor to emissions of industrial greenhouse gases. In 2003 industrial gases accounted for a little over 1% of total emissions of greenhouse gases, corresponding to approximately 750,000 tonnes of CO_2 equivalents. In 2001 and 2002 new regulatory instruments, including both taxes and bans, were adopted. This has meant that the increase rate in emissions of industrial gases has fallen, so that significant increases from year to year have been replaced by small increases.

1.2.5 Denmark's, Greenland's and the Faroe Islands' total emissions and removals of greenhouse gases

The total inventories for Denmark, Greenland and the Faroe Islands are reproduced in Table 1.2. As will be seen, the Climate Convention's goal of reduction of the emissions to the 1990 level in 2000 was achieved, since emissions in 2000 were 1.4%

below the 1990 level. If emissions and removals from land use change and forestry are included, 2000 did, however, show an increase of just under 1% due to windfalls in Danish forests in December 1999.

For the time being, the inventories from Greenland contain only inventories of the CO_2 emissions from combustion of fossil fuels. However, this is regarded as by far the main source of greenhouse gases.

TABLE 1.2 DENMARK'S, GREENLAND'S AND THE FAROE ISLANDS' TOTAL EMISSIONS AND REMOVALS OF GREENHOUSE GASES, 1990 – 2003

Source: The National Environmental Research Institute (NERI)

GREEN-HOUSE GAS EMISSIONS	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	CO2 equivalent (Gg)													
Net CO2 emissions/removals	54378	64737	58747	60130	64371	61439	74755	65215	60756	57883	56216	54865	54180	59549
CO2 emissions (without LUCF)	54220	64850	58999	60596	64701	61673	75177	65658	61575	58753	54434	56023	55656	60754
CH4	5702	5804	5837	6012	6027	6127	6245	6119	6061	5973	5961	6049	5975	5894
N_2O	10736	10609	10149	9947	9803	9683	9404	9275	9175	8870	8645	8411	8066	8091
HFCs	0	0	3	94	135	218	329	324	411	503	605	647	672	695
PFCs	0	0	0	0	0	1	2	4	9	12	18	22	22	19
SF6	44	64	89	101	122	107	61	73	59	65	59	30	25	31
Total (with net CO2 emissions/removals)	**70860**	**81213**	**74826**	**76284**	**80457**	**77574**	**90796**	**81010**	**76471**	**73306**	**71504**	**70026**	**68940**	**74280**
Total (without CO2 from LUCF)	**70702**	**81326**	**75078**	**76750**	**80788**	**77808**	**91219**	**81453**	**77290**	**74176**	**69722**	**71184**	**70416**	**75485**

GREEN-HOUSE GAS SOURCE AND SINK CATEGORIES	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	CO2 equivalent (Gg)													
1. Energy	52390	63065	57130	59545	63309	60415	73998	64267	60148	57345	52802	54458	54121	59318
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4. Agriculture	12845	12720	12429	12307	12052	11845	11526	11357	11368	10806	10565	10470	10138	9898
5. Land-Use Change and Forestry (LUCF)	158	-113	-252	-466	-330	-234	-422	-443	-819	-870	1782	-1158	-1476	-1204
6. Waste	1622	1645	1648	1683	1645	1593	1570	1525	1463	1487	1475	1475	1492	1457
7. Other	1374	1334	1287	577	1082	1108	1186	1180	1211	1276	1408	1460	1420	1477

The inventories for the Faroe Islands contain not only the CO_2 emissions from fossil fuel but also the methane and nitrous oxide emissions.

1.2.6 Further information under the Kyoto Protocol

The National Environmental Research Institute of Denmark (NERI) is the contact point for the national system for greenhouse gas inventories, and this is being adapted to comply with Article 5, paragraph 1 of the Kyoto Protocol and the regulations issued in this connection.

This work includes formal agreement on data supplies and manuals for quality assurance and quality control of the inventories.

The emission inventories will, further to recent years' improvements with the inclusion of minor emissions from wastewater treatment and certain industrial processes, be extended to include other emissions from industrial processes, and the documentation for national emission factors will be improved.

As regards the future emission inventories under the Kyoto Protocol, note that Denmark chose 1995 as the base year for industrial greenhouse gases. Moreover, in the preliminary inventories under the Protocol only the removals in forests occurring as a consequence of afforestation since 1990 are included so far, cf. Article 3, paragraph 3 of the Protocol.

1.3 Policies and measures

Since the end of the 1980s and during the 1990s a considerable number of measures have been implemented that have reduced the emissions of greenhouse gases.

In February 2003 the government published Denmark's new Climate Strategy. Cost effectiveness is a vital planning consideration in order to achieve cost-effective solutions in environment efforts. The basis of the strategy is that Denmark must fulfil its international climate obligations under the Kyoto Protocol and according to the subsequent burden-sharing agreement in the EU.

The Kyoto Protocol offers the possibility of planning climate action that is flexible as regards the use of both domestic and international measures and that, globally, gives more cost-effective solutions in environment efforts. The Climate Strategy combines cost-effective domestic measures with use of the Kyoto Protocol's flexible mechanisms.

Follow-up on the Climate Strategy in general

In order to ensure cost-effectiveness in climate policy, as part of the follow-up on the Climate Strategy, the government decided to appoint a standing climate committee to follow up regularly on the deficit and ensure cost-effective implementation of the climate policy. In 2006 the climate committee is to co-ordinate the preparation of a progress report on the fulfilment of Denmark's reduction commitment and up-date calculations concerning measures with regard to costs and potentials, aimed at a possible revision of Denmark's Climate Strategy. An element in this report will be the results of the Policies and Measures Project, which e.g. continues to investigate the potential of new domestic measures where previous calculations have indicated relatively low reduction costs. It also investigates more closely whether new information exists that could contribute to reducing previously calculated costs further, and whether additional cost-effective national measures could be found.

However, it is likely that still only relatively few domestic actions with a significant potential, would be cost-effective compared to the use of the flexible mechanisms. This must be seen in the light of the fact that Denmark has already made a massive national effort up through the 1990s as documented in the report "Denmark's CO_2 emissions - the effort in the period 1990-2001 and the associated costs " from March 2005.

Measures and effects across sectors
For many of the energy producers and a large part of the energy-intensive industry, the Danish implementation of the EU Directive establishing a scheme for greenhouse gas emission allowance trading within the Community will form the framework for Danish efforts. The companies that are covered by the scheme, and whose activity thus becomes limited by a quota, can plan their climate action themselves. They can choose to reduce their own emissions when this is most appropriate, or they can buy allowances or credits from project-based emission reductions when this is considered most appropriate. The companies covered by the scheme will thus have the possibility of ongoing adjustment of their action so that it is always as effective as possible.

Besides quotas and the use of flexible mechanisms, the Climate Strategy includes a number of national measures, including existing measures that are being continued and new, potential measures that will be considered on the way.

Since the reduction costs in the different sectors are continuously changing, in part due to technology development and changed economic framework conditions, the strategy includes regular evaluation of the action so that the most cost-effective policies and measures are identified.

In a comparison with the national mechanisms it is important to be aware that these must typically be seen in a sector-political context, in which climate is only one among many considerations in the policy being planned. For example, a fundamental consideration in the energy sector is security of supply, which is improved by lower energy consumption and a multiple energy supply.

The levels of taxes and duties are also having an effect on several greenhouse gas emitting activities across sectors. Denmark has special taxes on motor vehicles, energy products, alcohol, tobacco, and a number of other products. During the 1990s a number of new environmental taxes were introduced. These taxes were imposed on consumer goods that caused pollution or were scarce (water, energy products such as such as oil, petrol, electricity, etc.) or on discharges of polluting substances (CO_2, HFCs, PVC, SF_6, SO_2, and sewage). Taxes are imposed on mineral oil, tobacco, and alcohol in accordance with EU legislation. The CO_2 taxes are among the subjects to be dealt with by a committee set up by the Minister for Taxation. The objective of the committee is to analyse the CO_2 taxes in relation to the CO_2 allowance scheme, which entered into force on 1 January 2005, as well as to investigate whether the energy taxation system can be designed more appropriately. The committee is expected to end its work in spring 2007.

The energy sector

Energy production and energy-consuming activities in the different sectors are the main contributors to the total emissions of CO_2 due to use of large quantities of coal, oil and natural gas. This is due to use of large quantities of coal, oil and natural gas. The energy sector is therefore pivotal in the efforts to reduce the emissions of CO_2.

The goal of the energy policy today is to create well-functioning energy markets within frameworks that secure cost-effective solutions, security of supply, environmental concerns and efficient use of energy.

The goal of the 1970s energy policy was to prevent supply crises using a multiple energy supply, which reduced dependency on oil. In the 1980s, the main focus was to protect against large and external increases in energy prices through increased focus on self-sufficiency, co-production and macroeconomic considerations. In the 1990s the goal was the development of a sustainable energy sector.

Energy-policy key considerations have thus been both multi-faceted and changing as the goals were met and new challenges appeared. Over a number of years, many initiatives have been taken that have yielded positive results for society. At the same time, CO_2 emissions have been reduced in a number of sectors.

First, this success is due to significant efforts in the transformation sector. Particularly in the production of electricity and heat there has been a substantial increase in co-production and substitution with other fuels. Thus, natural gas, waste and biomass are increasingly being used in small-scale and industrial CHP plants, natural gas and renewable energy is increasingly being used in large scale electricity production, and natural gas is increasingly being used for individual heating of buildings.

This development is emphasised by the fact that gross energy consumption (actual energy consumption adjusted for foreign electricity trade) only went up from 816 PJ in 1980 to 829 PJ in 2003, whereas GDP grew by 50% in the period. If we only look at CO_2 emissions adjusted for climate and foreign electricity trade, the conversion sector's CO_2 emissions fell by about ¼ in the period.

Moreover, there have been active efforts to make energy use in all end uses more efficient. Denmark has thus been a pioneer country as regards broad political agreements on energy savings efforts that have developed new policies and measures to limit energy consumption.

This is underlined by the trend in the final energy consumption, i.e. the energy consumption by the end user in the different sectors. The total final energy consumption in the domestic sector, agriculture and industry, commerce and service and the public sector today is about 3.5% lower than in 1980. At the same time, GDP grew by about 50%, and this means that energy consumption per GDP unit (intensity) fell by 34%, corresponding to an average 1.9% per year. This very positive development is summarised in Figure 1.1.

The development in final energy consumption analysed by sectors is shown in Figure 1.2.

A vast range of measures have been applied over the years to achieve the various energy policy objectives mentioned above.

Taxes have been used for a number of years as measures which also lead to a reduction of the CO_2 emissions from the energy sector - partly with a view to a general reduction and partly to promote the use of fuels with lower CO_2 emissions, mainly biomass. This includes lower CO_2 emissions, e.g. natural gas and biomass. Such taxes are still being used.

Increased use of CHP and enlarging the areas receiving district heat have been main elements of the Danish strategy to promote efficient use of energy resources ever since the end of the 1970s.

Renewable energy sources have been promoted with economic measures, including the tax system and through production grants.

From 2005 energy producers and parts of the energy-intensive industry are covered by the EU's CO_2 allowance scheme. The allowance scheme will be the most important measure in Denmark's fulfilment of its climate obligations under the Kyoto Protocol. The allowance scheme permits significant improvements to the cost-effectiveness of Denmark's climate policies and measures and forms a main element of the Danish Government Climate Strategy.

The EU's CO_2 allowance scheme replaces the national CO_2 allowance regulation for electricity producers which was in force from 15 June 2000 to 31 December 2004.

The transport sector

Efforts to turn the upward trend in emissions of greenhouse gases in the transport sector have so far failed, in part because it is extremely difficult to reduce the CO_2 emissions in this sector in Denmark without international initiatives.

The transport sector's possibility, with national measures, of contributing to reduction of Denmark's CO_2 emissions shows that the cost-effectiveness of the measures depends entirely on the side effects. Taxes have also been used for a number of years as measures to reduce the CO_2 emissions from the energy sector - partly with a view to a general reduction and partly to promote the use of fuels with lower CO_2 emissions, mainly biomass.

In accordance with the government's platform from February 2005 a committee has been appointed to investigate the options for reorganising the total motor vehicle tax system over several years in a way that promotes the environment and retains existing revenue levels. The government will also strengthen the development of green technology, for example in the bio-fuel area.

Figure 1.1 Trend in final energy consumption, GDP and energy intensity

Source: Danish Energy Authority

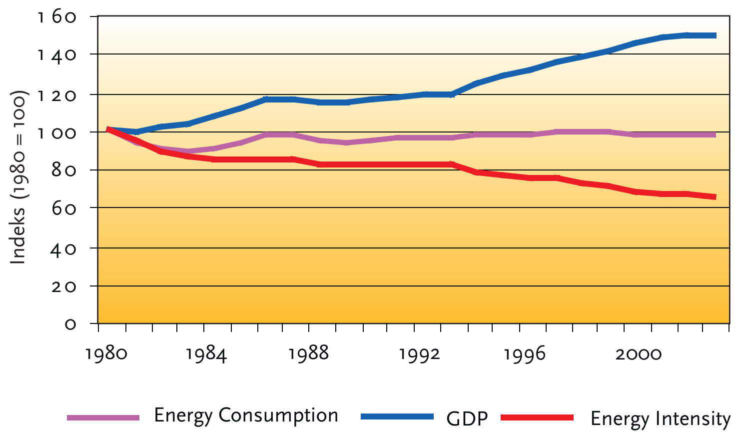
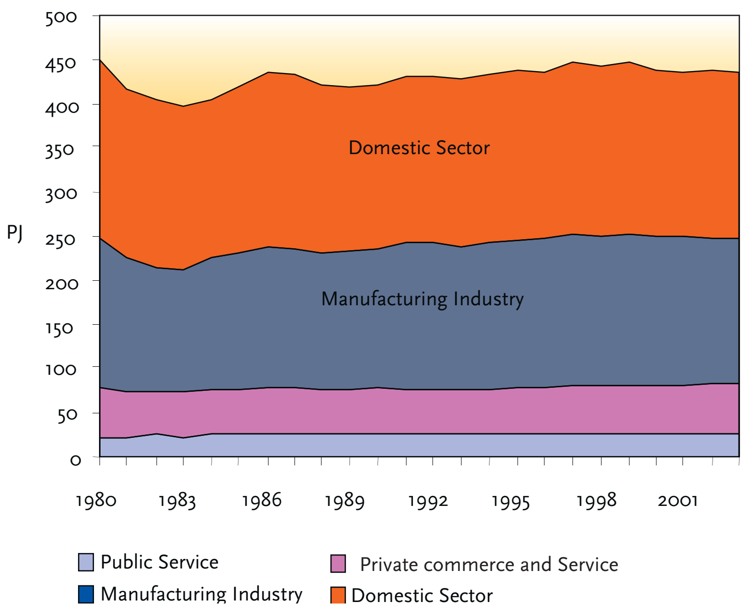


Figure 1.2 Final energy consumption analysed by sectors

Source: Danish Energy Authority



An overview of the total potential in the transport area will be available in 2006 as part of The Policies and Measures Project.

The business sector

In addition to the key instrument - allowance regulation - the ongoing initiatives to reduce the emissions from the business sector include promotion of energy savings and energy efficiency improvements, conversion of energy production to cleaner fuels and initiatives to reduce the emissions of industrial gases. As an extension of the political agreement of 10 June 2005 to significantly strengthen energy-saving efforts, new initiatives will be commenced during 2005 and 2006.

Work to improve energy efficiency in the public sector has been going on for more than 10 years, and considerable savings have been achieved. However, there are still economically viable possibilities for savings. As an extension of the Report on Energy Savings of May 2003 and the Danish government's draft action plan from December 2004 for a renewed energy-saving effort, a new circular on energy-efficiency in state institutions was sent out in the spring of 2005. This circular requires that in the future institutions must implement savings initiatives with a reasonable repayment period and place priority on energy efficiency when purchasing appliances and equipment. In accordance with the political agreement on energy-saving efforts, discussions will be initiated with municipal and regional authorities on meeting the requirements that also apply to state institutions for energy-efficient procurement and achievement of energy savings based on a five-year payback time.

The regulation of emissions of the industrial greenhouse gases (HFCs, PFCs and SF_6) is 2-phased, consisting partly in a tax and partly in a statutory order on discontinuation of the use of the gases in new installations. The tax is imposed on the substances on importation because none of them is produced in Denmark.

In July 2002 a statutory order on regulation of the industrial greenhouse gases entered into force. It includes a general ban on use of the industrial greenhouse gases in a wide range of new installations/products from 1 January 2006, including, for example, domestic refrigerators and freezers, PUR foam, etc.

Agriculture, forestry and fisheries
Within the agricultural sector the following measures have reduced, or will reduce, emissions: ban on burning straw on fields, Action Plans for the Aquatic Environment I and II and the Action Plan for Sustainable Agriculture, Action Plan for the Aquatic Environment III and the CAP reform, the Ammonia Action Plan and an amended Statutory Order on Manure, action plan for joint biogas installations) and support for planting of windbreaks.

The Action Plans for the Aquatic Environment and the Action Plan for Sustainable Agriculture have, in particular, reduced the emissions of nitrous oxide, and most of the changes in emissions of nitrous oxide from the agriculture sector that have taken place since 1990 can be attributed to these action plans.

2001 brought the adoption of an Ammonia Action Plan which, together with Action Plans for the Aquatic Environment I (1987), II (1998) and III (2004), will reduce ammonia evaporation.

The purpose of banning burning of straw has been to reduce air pollution from this activity. The ban has resulted in greater return of carbon to the soil and increased use of straw as a fuel.

Conversion of manure from biogas and other organic waste in biogas plants provides the opportunity to reduce methane emissions from manure management at the same time as producing energy.

Planting of windbreaks contributes to reducing wind erosion and also leads to greater biodiversity in the landscape. Moreover, removal of CO_2 takes place in the woody biomass of the windbreaks.

The national forest programme includes evaluation of the possibilities offered by the Kyoto Protocol for economically viable CO_2 sequestration in forests. The political goal with the most direct influence on increased carbon sequestration is the declaration of intent from 1989 to double the forested area in Denmark within 100 years. Various measures have been taken towards achieving this goal. For instance, a government grant scheme has been establish that supports private afforestation on agricultural land and the state itself establishes new forests. In addition, some private individuals choose to establish forests on agricultural land without a government grant.

The domestic sector

With a view to reducing both direct and indirect CO_2 emissions from the domestic sector, a wide range of initiatives have been launched. The initiatives promote electricity savings, savings in energy consumption for space heating and fuel conversion (from electric heat and oil to district heat, natural gas and renewable energy).

As a follow-up to the Report on Energy Savings of May 2003, a number of new initiatives have been commenced, including promoting particularly energy-efficient refrigerators and freezers, phasing-out traditional double glazing (voluntary agreement), initiatives in relation to boilers and circulation pumps, reducing energy consumption for standby and strengthening of research and development activities.

Following the political agreement of 10 June 2005 to considerably strengthen energy-saving efforts, new initiatives will be launched during 2005 and 2006.

Political agreement on energy savings

As a follow-up to the agreements of 29 March 2004, the Danish government presented a draft action plan for a renewed energy-saving effort on 29 December 2004.

On 10 June 2005 the government made a broad political agreement to significantly strengthen energy-saving efforts. The agreement is ambitious, and sets the framework for efficient and increased energy-saving efforts in the coming years. The parties to the agreement agree that overall energy consumption (excluding transport) are to be reduced. Strengthened efforts will be made to attain specific and verifiable energy savings corresponding to 7.5 PJ per year on average in the period 2006-2013. Important parts of the energy savings will be achieved by better energy-saving performance by grid and distribution companies within electricity, natural gas, district heating and oil.

The government's objective is to promote energy saving initiatives to allow Denmark to remain at the forefront with regard to energy efficiency. The initiatives will be based on economically justifiable investments, environmental consideration and advancement of Danish energy and building technology. Measures aimed at reducing energy consumption include more stringent energy provisions in building regulations, new improved energy labelling, better inspection of boilers and ventilation systems, special initiative in the public sector, and reorganisation of the energy savings initiatives of energy companies. Overall, the government's action plan and the political agreement entail a significant strengthening of overall energy-saving efforts.

Energy strategy 2025
In June 2005 the government presented a new long-term energy strategy – Energy Strategy 2025. The strategy is an overall and coherent presentation of the government's long-term energy policy. At the core of the strategy is a clear market-based energy-political objective, in which public authorities provide the framework for the market actors. Thus, the Energy Strategy is based on:

- liberalised energy markets with common EU framework

- market-based cost-effective instruments, and

- public authorities providing the overall grid infrastructure and economic instruments, including the CO_2 allowance scheme.

In line with this, the strategy does not propose quantitative objectives for the extension of renewable energy, however it sets the stage for and envisages a market-based increase in the use of renewable energy. It also underlines the importance of strengthened research and development of new energy technologies. Finally, it focuses on the transport sector. A committee will be set up to discuss the overall perspectives for alternative propellants in the transport sector, including biofuels.

The Energy Strategy also assesses the need for extending the overall electricity transmission network. The government recommends that a power line be established below the Great Belt, and that Energinet.dk, cooperating with Statnett, make a detailed study of the financial aspects of strengthening the Skagerak power cable.

The waste sector

The waste sector's contribution to reduction of greenhouse gas emissions consists mainly in: reducing landfilling of organic waste, utilising gas from discontinued/existing landfill sites and the waste as an energy source.

The Statutory Order on Waste was amended from 1 January 1997, to introduce a municipal obligation to assign combustible waste to incineration (corresponding to a ban on landfilling combustible waste). As a result of this, large quantities of combustible waste that used to go to landfill sites are now either recycled or used as fuel in Denmark's incineration plants. Future action will consist mainly in a continued ban on landfilling of combustible waste and implementation of Waste Strategy 2005-2008.

Greenland

Greenland will work to promote use of renewable and environmentally friendly energy (water, wind power, solar energy, hydrogen) which in the long term will reduce CO_2 emissions and make Greenland less dependent on fossil fuels. The goal is to achieve the greatest financial and energy savings, to reduce the vulnerability of energy supply through utilisation of renewable energy and make the production and supply system more efficient.

Until the publication of the Greenland Energy Plan 2010 in 1995, the requirement for security of supply and the energy policy guidelines from 1986 meant that the main focus of was to be hydropower as one of the all-important energy policy objectives in Greenland.

With Energy Plan 2010, for the first time the Home Rule presented a complete review of the energy sector and an action plan for its development and set up a more differentiated main energy policy objective of "establishing an energy supply that does not compromise security of supply and that ensures the least possible economic and environmental burden for society and the other energy players".

Both before and since 1995, policies and measures have been adopted and implemented in the energy sector that have reduction of greenhouse gas emissions as one, although not in most cases the main, objective. Some of the most important measures are:

- Act on Energy Supply, 1997

- Decisions on 3 hydropower plants, in operation from 1993, 2005 and 2008

- Decisions on 6 waste incineration plants with some of the surplus heat used for district heating

- Sector Programme for Renovation with an Environment and Energy Improving Effect in Greenland 2000-2003

Faroe Islands
The Climate Convention was ratified by the Realm, and therefore it also applies for the Faroe Islands. The Faroese have not yet formulated an actual Climate Strategy or energy policy.

However, after the last general election on 20 January 2004 the home rule government agreed to a statement of intent on the energy area, which included the following:

- Overall energy policy is a national political responsibility.

- The oil administration and the municipalities are to prepare an electricity supply act.

- Energy development should consider nature and the environment.

- Renewable energy sources should comprise as large a proportion of total energy production as possible.

- Cooperation with respective authorities on R&D regarding renewable energy is to be promoted.

- Use of energy-saving products is to be promoted.

It is also intended to set up a working group to prepare a proposal for an energy policy action plan by June 2006.

1.4 Projections and the total effect of policies and measures

An up-dated projection of Denmark's emissions and removals of greenhouse gases in 2004-2030 was prepared in May 2005. This updated baseline projection ('with (existing) measures' projection) is based on, e.g. an updated energy projection, which now includes expected effects of the implemented EU allowance directive. Note that this only concerns the expected effects of the common EU allowance regulation on national emissions. Concerning agriculture, the expected effects of the Action Plan for the Aquatic Environment III have now been included in the baseline projection.

The result of this projection of emissions is shown in Table 1.3 together with the expected effects of allocations of funds to JI and CDM projects in 2003-2008.

As shown in Table 1.3, the Danish deficit is estimated at 13 mill. tonnes of CO_2 equivalents annually, based on Denmark's legal commitment according to the EU Burden Sharing Agreement. This commitment is based on the fact that no correction has been made for the particularly large imports of electricity in 1990.

If this compensation is made as assumed by Denmark, the deficit is reduced to approx. 8 mill. tonnes of CO_2 equivalents annually in 2008-2012, as shown in Table 1.3.

Compared to the deficit of 20-25 mill. tonnes of CO_2 equivalents annually in 2008-2012, inventoried on the basis of the projection which was presented together with the government's proposal for a Climate Strategy for Denmark in February 2003 to show the expected development without implementation of additional measures, there is a reduction of approx. 12 mill. tonnes of CO_2 equivalents annually in 2008-2012.

With the choice of method, the deficit expresses the need to purchase allowances from abroad or to implement new measures outside the sectors subject to allowances. So, as a result of the introduction of the CO_2 allowance scheme, the deficit is in principle not directly comparable to the deficit in the Government's Climate Strategy, since the cost effects of the allowances are included, whereas ultimately the allocation of allowances decides the climatic effects of the scheme. Note that the projection, and therefore also the deficit, is based on model calculations, which are subject to uncertainty. This applies, not least, to expected developments in energy prices, prices of CO_2 allowances, and the developments in the Nordic electricity market, which have a direct influence on the size of exports of electricity. The implementation of the EU allowance scheme has, however, created a basis for greater certainty regarding the fulfilment of Denmark's climate commitments under the Kyoto Protocol and the EU Burden Sharing Agreement.

1.5 Vulnerability assessment, climate change impacts and adaptation measures

1.5.1 Climate development - effects and possibility for adaptation for Denmark

Analyses with global and regional climate models show the following general trend for the climate in Denmark in the period 2071-2100 in relation to 1961-1990:

- A rise in the annual mean temperature of about 3-5°C, depending on the chosen scenario for emission of greenhouse gases. Greatest warming at night, and no major difference between the increase in summer and winter. Warming leads to fewer days with frost and snow and less days with snow cover.

- A 10-40% increase in winter precipitation and a reduction in the oder of 10-25% in summer precipitation. A clear tendency towards more episodes with heavy precipitation, particularly in autumn, and lengthy dry periods, especially in the summer.

- A tendency towards more frequent westerly winds and at the same time a shift of the storm

TABLE 1.3 THE RESULTS OF DENMARK'S LATEST "WITH EXISTING MEASURES ONLY" PROJECTION OF GREENHOUSE GAS EMISSIONS AND THE DEFICIT COMPARED TO THE EU BURDEN SHARING OF THE EU REDUCTION TARGET UNDER THE KYOTO PROTOCOL

Source: 1990-2003: The National Inventory Report (NIR), the National Environmental Research Institute (NERI), April 2005.
2004-2030: Projection of greenhouse gas emissions, Memorandum to the Danish EPA, NERI, May 2005

Million tonnes of CO2 equivalents	Base year 1990/95[1]	2003	"2010"[2]	"2015"[3]	2020	2025	2030
CO_2[4]	52.9	**59.2**	59.0	58.8	55.2	54.2	54.9
Methane (CH4)	5.7	5.9	5.6	5.3	5.2	5.2	5.2
Nitrous oxide (N_2O)	10.7	8.1	6.9	6.8	6.6	6.5	6.5
Industrial gases, HFCs, PFCs and SF_6	0.3	0.7	0.8	0.5	0.2	0.2	0.2
Total emissions	**69.6**	**73.9**	**72.3**	**71.4**	**67.2**	**66.1**	**66.8**
Of which exports of electricity: (- means import)	*-6.3*	*6.9*	*4.4*	*2.3*	*1.4*	*0.9*	*2.7*
Kyoto target (-21%)			55.0				
Reductions in other countries from funds allocated to JI and CDM projects			4.5				
Deficit incl. JI and CDM			7.8/12.8[5]				

[1] Base year for CO_2, methane, and nitrous oxide is 1990. In accordance with the Kyoto Protocol, 1995 is chosen as the base year for industrial gases.

[2] "2010" stands for mean emissions in 2008-2012

[3] "2015" stands for mean emissions in 2013-2017

[4] Here net emission of CO_2 inventoried under the Kyoto Protocol, because removal of CO_2 in forests planted since 1990 is included cf. Protocol article 3.3.

[5] The deficit has been calculated both on the basis of the assumption of taking imports of electricity in 1990 into account, cf. the political statement of the Council and the Commission and on the basis of Denmark's legal commitment under the EU Burden Sharing Agreement.

tracks over the North Atlantic slightly eastward, leading to a small increase in storm activity over Denmark and the adjacent waters. On this basis, calculations with storm surge models show that the highest sea level in the more extreme cases could rise by 5-10% relative to today (about 0.3 m on the west coast). In addition to this there is the global rise in sea level which the IPCC estimate at between 0.1-0.9 m over the level today.

Uncertainties relating to the assessment of future climate change, especially in projecting precipitation and extreme weather phenomena such as storms and floods, are significant. The DMI models and most other models show climate sensitivity at about 3°C for a doubling in the CO_2 content in the atmosphere. However, new model studies published in 2005 in the journal Nature show that climate sensitivity could be considerably greater than hitherto assumed.

The impacts of possible climate changes in Denmark have been evaluated several times since 1988, and most recently in the Danish EPA report of 2004: Adapting to the climate of the future. The general conclusion is that the direct impacts in moderate climate scenarios would be modest and could be countered by suitable, ongoing adaptation. In October 2005 the Danish government initiated preparations to meet the primary impacts of climate change.

The purpose is on the basis of three possible future climate scenarios to establish a catalogue of consequences and measures.

Systematic evaluations have not been made of secondary impacts for Denmark, for example in the form of changing tourist patterns, environmental refugees, agricultural prices/subsidies, or changed possibilities for wind turbine exports. For a small, export-oriented and open economy such as Denmark, such secondary impacts could easily be more important than the primary impacts.

In the water area, two studies in 2003 and 2004 have indicated the need for extraordinary action. In its report, the Academy of Technical Sciences pointed in particular to the need to plan renovation of drainage systems so that they will also be able to function in a future wetter climate.

For Danish agriculture, the overall effects are estimated to be advantageous. Changes in cultivation practice can be implemented at short notice, and production is expected to grow with rising temperature and CO_2 concentration.

Denmark is placed centrally in a vegetation belt of temperate deciduous forest, and, with moderate future climate change, a majority of existing tree species that thrive well today are expected to persist in Denmark. Norway spruce, however, may be the exception.

About 1,800 km of the 7,400 km coastline are protected with dikes or other permanent installations. Increasing use is being made of beach nourishment.

1.5.2 Climate changes in Greenland and on the Faroe Islands

Analyses with global climate models show the following general trend in the climate in Greenland in the period 2071-2100 compared with 1961-1990 for a middle-high scenario:

- A rise in the mean annual temperature in South Greenland of about 2°C, slightly more in winter than in summer, and in North Greenland, a rise in temperature of 6-10°C in winter, but only small rises in summer.

- A general increase of 10-50% in precipitation. The winter increase could however be significantly bigger in North Greenland - locally up to more than 200%.

Analyses with global climate models show the following general trend for the climate on the Faroe Islands in the period 2071-2100 in relation to the period 1961-1990:

- A rise of around 3ºC in annual mean temperature. There is only a slight difference in temperature rise in summer and winter.

- A rise in winter precipitation of about 30%, but only slight or no increase in the summer.

1.6 Financial resources and transfer of technology

In 2004 Danish development assistance constituted about DKK 12 billion, corresponding to 0.84% of GNI. With the strategy for Denmark's assistance to developing countries, A World of Difference, the Danish government has laid down priorities for Danish development assistance for the period 2004-2008.

With this strategy, the government emphasises that focus will still be on long-term development work with a view to combating poverty and that the main priorities will be initiatives within social sectors, i.e. education, health, water and sanitation. At the same time, the Danish government's prioritisation of the global environment issues and the question of free trade and market-based economic growth is maintained and strengthened. Moreover, attempts have been made to establish better interplay between environmental assistance and Denmark's general effort to protect the global environment, including through climate initiatives under the Kyoto Protocol. International climate cooperation as well as adaptation to climate change of developing countries have high priority in Denmark's international development cooperation.

1.7 Research and systematic observations

Research and observations within climate in the broad sense of the word are going on at a number of institutes and organisations and cover a wide range of disciplines, from natural science to evaluation of policies and measures and societal aspects.

The Danish Meteorological Institute (DMI) carries out observations of climate parameters (atmosphere and ocean), including observations under the World Meteorological Organisation (WMO)'s programmes and subprogrammes. Climate observations, together with climate research, have been one of DMI's main tasks for more than 125 years, with measurement, theory and modelling. DMI has research competence in carrying out calculations of the climate in the future using global and regional climate models.

The National Environmental Research Institute (NERI) is in charge of monitoring the effect of climate change on nature and environment.

Research competence concerning physical expressions of past climate change is particulary at the Geological Survey of Denmark and Greenland (GEUS), the University of Copenhagen (KU) and Aahus University. GEUS also has competencies in glaciological studies of Greenland's ice sheet and its interaction with climate change, and the importance of climate change for the hydrological cycle. The Geophysical Department and the Geological Institute at KU and the Geological Institute at Aarhus University have very great expertise in palaeoclimate data, and the climate group at KU is known worldwide for its ice core drilling and analyses. NERI contributes important research competence in relation to the effect of climate change on ecosystems.

Other institutions, e.g. Forest and Landscape Denmark (SL), the Danish Institute of Agricultural Sciences (DJF), Risø National Laboratory, and the Danish National Space Centre work with different aspects of climate research.

It is partly on the basis of research competencies in the above-mentioned areas that Denmark participates actively in IPCC's work. In addition, the Danish climate research contributes to several international projects under the World Climate Research Programme.

Danish climate research increased steadily in the period 1998 to 2001, from 172 man-years in 1998 to 189 man-years in 2001. The budget increased correspondingly from DKK 94 mill. in 1998 to DKK 114 mill. in 2001. Of this, foreign funding accounted for just under 30%. In the subsequent period, there has been a general reduction in funds for Danish climate research.

DMI monitors the main weather and climate parameters regularly. In the climate monitoring programme, classic methods of measurement are used and new, satellite-based observation methods are developed. DMI operates around 200 automatic measuring stations in the Realm (Denmark, Greenland and the Faroe Islands) with a broad measuring programme ranging from automatic water level or precipitation stations that measure only one parameter to stations with a full measuring programme, including automatic cloud height detectors and weather type detectors. To collect precipitation data, DMI also operates a network of about 450 manual precipitation stations, which are used mainly for mapping the precipitation climatology. The measurements are collected on a daily basis via telephone and are thus available shortly after measurements have been made.

Besides being of use for national programmes, the observations concern Denmark's international contribution in the form of observation components from Danish territory to the worldwide meteorological observation network WWW (World Weather Watch), UNFCC and other international programmes for mapping weather and climate within the GCOS (Global Climate Observing System) coordinated by the World Meteorological Organization (WMO).

The meteorological observations are stored in DMI's database, and observations from many Danish stations are available in electronic form right back to 1872, water level measurements back to 1890, and measurements of the surface temperature of the sea back to 1931. Each day about 75,000 observations from the Realm are added to the database, and the total number of observations in the database is around 300,000,000.

1.8 Education, training and public awareness

In Denmark there is an ongoing public debate in the media and elsewhere about climate change, anthropogenic greenhouse gas emissions and the political reaction in the form of policies and measures. Denmark has a long tradition for involving the public and, in the environment field, this tradition was followed up by an international agreement - the Aarhus Convention from 1998. A considerable amount of information on climate change and Danish policies is provided on the websites of the Ministry of Environment (www.mim.dk), the Danish Environmental Protection Agency (www.mst.dk), the Ministry of Finance (www.fm.dk), the Ministry of Transport and Energy (www.trm.dk) and the Danish Energy Authority (www.ens.dk).

The websites of the Ministry of the Environment and the Danish EPA are regularly updated with the latest relevant information within the climate area, either directly in the form of press releases, documents, reports, etc. or through links to the actual players.

NERI has prepared a range of climate reports, which, together with other climate information, e.g. climate data, are published on NERI's website www.dmu.dk. DMI has a climate website at www.dmi.dk, providing current and historical climate data, together with a basic description of the climate system and climate processes, and themes on new results from the international scientific literature.

DMI participates in a number of international projects, with support primarily from the EU Commission's framework research programmes, which involve exchange of knowledge and post-graduate training of Danish research scientists. In addition, addition, the Institute contributes to IPCC's work, and the results from that, which are communicated to the public.

A number of initiatives are being carried out to promote environmentally sound behaviour in companies and households, particularly for climate reasons, and with respect to energy use. Labelling schemes, printed matter, information lines, media spots and similar are used to increase public knowledge of possibilities for action and knowledge of less environmentally harmful technologies, and every year a number of public campaigns are carried out.

2 National circumstances relevant to greenhouse gas emissions and removals

The Kingdom of Denmark comprises Denmark, Greenland and the Faroe Islands. The UN Framework Convention on Climate Changes has been ratified on behalf of all three parts of the Realm. Therefore, this report includes information about Denmark, Greenland and the Faroe Islands. However, at the present time, more information is available on Denmark than on the other parts of the Realm. Where tables, figures, and other information in this report also cover Greenland and/or the Faroe Islands, this is stated.

2.1 Denmark

2.1.1 Form of government and structure of administration

Denmark is a constitutional monarchy, and the power of the state is divided between the legislative branch, the executive branch, and the judicial branch. According to the Constitution of the Realm, legislative power lies with the Folketing, which consists of 179 members, two of whom are elected on the Faroe Islands and two in Greenland. The members are elected by the population for a period of normally four years. A new general election can mean that a member sits for less than this period.

The executive branch - the government - cannot have a majority of the Folketing against it, cf. the regulations in the Danish Constitution on votes of no confidence. Since 1953, Denmark has often had a minority government, i.e. a government supported by a minority of the members of the Folketing. In these situations the government will need to include a support party.

The number of ministers in the government varies. Since 1971 Denmark has had a Minister for the Environment and a Ministry of the Environment who represent Denmark in international negotiations on climate and which also have primary responsibility for coordination and implementation of legislation, plans etc. for the climate area.

For the last ten years or so, other ministries have also worked with environmental and climate issues. In 1988 the government decided to follow up the UN report on sustainable development, the Brundtland report, in which one of the main messages was the necessity of integrating the environmental issue into the administration within sectors such as transport, agriculture, and energy.

For this reason, a number of sector ministries have drawn up action plans in which the environment is an integral element. Examples are sector plans for energy, transport, agriculture, and development assistance. In the climate area, further to the previous government's status report Climate 2012 from 2000, the government presented an overall status in connection with the presentation of its proposal for ratification of the Kyoto Protocol in April 2002. This status report was followed in February 2003 by a government proposal for a national Climate

Strategy for Denmark, including analyses from the sector ministries, which was adopted by the Folketing on 13 March 2003.

One of the main cornerstones of Danish democracy is autonomous local government. The specific environmental action takes place not only at national level but also at county and municipal level. The state sets the national rules and framework for environmental administration, while the counties and municipalities, working within this framework, plan and decide initiatives that implement and support the national legislation.

The importance of local involvement is stressed in Agenda 21 - a global agenda for sustainable development in the 21st century, which was adopted at the Rio Conference in 1992. The government supports the popular interest and participation in climate and environmental issues in different ways - including through implementation of the Pan-European Aarhus Convention and support for the local Agenda 21 work initiated by most of the Danish municipalities.

2.1.2 Population

Today, Denmark has a population of slightly more than 5.4 mill. As will be seen from Table 2.1, population growth has been relatively small in the last 24 years.

TABLE 2.1 POPULATION OF DENMARK

Source: Statistics Denmark.

	1980	1990	2004
Denmark's population (in mill.)	5.1	5.1	5.4

The latest forecasts show that population growth will continue to be moderate in the years ahead. For example, the population is expected to reach 5.46 mill. in 2010, rising to 5.53 mill. in 2025. The low birth rate in the 1980s means that young people between the ages of 15 and 24 years make up only 11% of the population, while the elderly, between 50 and 64 years of age, account for 20%.

Today, the population density is 125 per km^2.

Today, 75% of Danish wage earners are employed in service trades, while 18% are employed in manufacturing.

2.1.3 Geography

Denmark consists of the Jutland peninsula and more than 400 islands. It has a total area of 43,098 km^2 and lies at about 55° N and 11° E.

The whole of the country is lowland. The surface was formed by Ice Age glaciers and glacial streams. The highest hill is approximately 170 metres above sea level.

The coastline has a length of more than 7,300 km. To protect low-lying land against flooding and storm surge, it has been necessary to build dikes or other permanent installations along about 1,800 km of coastline. In addition, sandbags, breakwaters and similar protect other parts of the coastline, which would otherwise erode because they consist of soft materials deposited during the last Ice Age.

A rise in the water level due to climate change would obviously affect the protection of the coasts and create a greater risk of flooding and erosion.

The Danish landscape is indelibly stamped by the high population density. More than 66% of the land is used for agriculture or horticulture. Woodlands take up 11%, while towns, roads and scattered habitation take up 10%. The rest is nature or listed areas such as lakes, watercourses, heaths, dunes and beaches.

In relation to its size, Denmark is home to a wide variety of flora and fauna - in all, about 30,000 species.

2.1.4 Climate

The Danish climate is temperate with precipitation evenly distributed over the year. The country lies in the zone of prevailing westerly winds, which is characterised by fronts, low pressure, and changeable weather. Compared with other regions on the same latitude as Denmark, the climate is relatively warm due to the warm North Atlantic current that originates in the tropical sea off the east coast of the USA.

Denmark has a distinctly coastal climate, with mild, damp winters and cool, unsettled summers. Average temperatures vary from about half a degree in winter to about 15 degrees in summer. However, the weather in Denmark is greatly affected by the proximity of both the sea and the continent. This means that the weather can change, depending on the prevailing wind direction. The west wind from the sea brings relatively uniform weather in summer and winter: mild in winter and cool in summer. When the wind comes from south or east, the weather in Denmark is more similar to that of the continent: warm and sunny in summer and cold in winter. The weather in Denmark thus depends very much on the wind direction and the season.

Atmospheric pressure

Average atmospheric pressure in Denmark shows seasonal variation, reaching a minimum in November and a maximum in May.

Denmark's highest-ever atmospheric pressure, 1062.5 hPa, was recorded in Skagen on 23 January 1907, while just one month later, on 20 February, the lowest atmospheric pressure in the history of Denmark was also recorded in Skagen, at 943.9 hPa.

Temperature

The annual mean temperature varies from year to year, from below 6ºC to more than 9ºC, with an average of 7.7ºC. The coldest year so far was 1879, with a mean temperature of 5.9ºC, while the hottest recorded year

Figure 2.1 Annual mean temperature in Denmark 1873-2004 in °C

Source: Danish Meteorological Institute

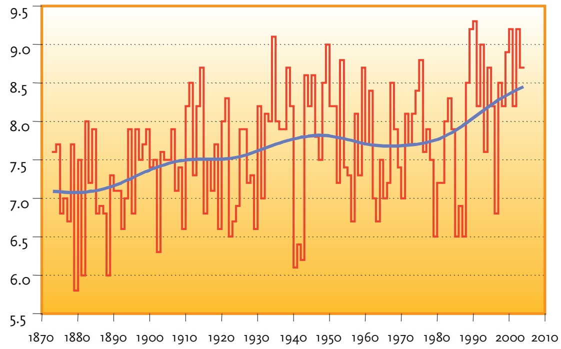


Figure 2.2 Danish annual precipitation 1874-2004 in mm

Source: Danish Meteorological Institute

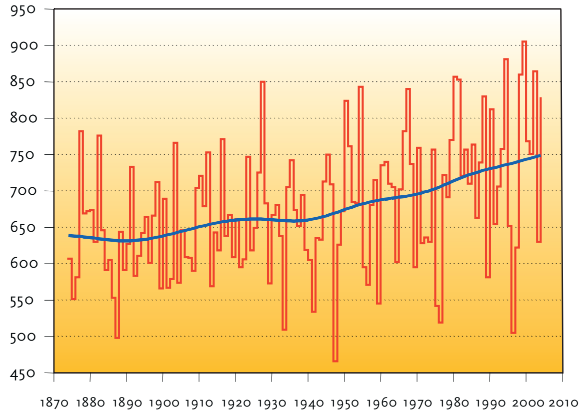


Figure 2.3 Annual hours of sunshine in Denmark 1920-2004

Source: Danish Meteorological Institute

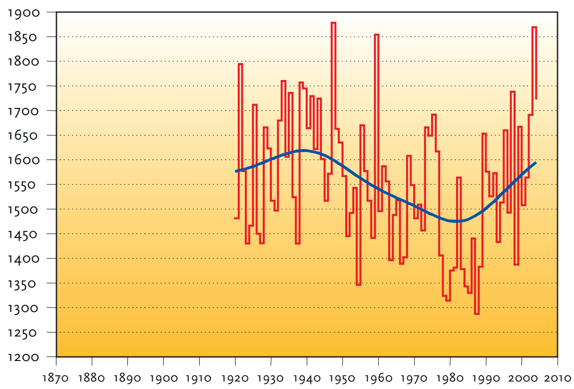
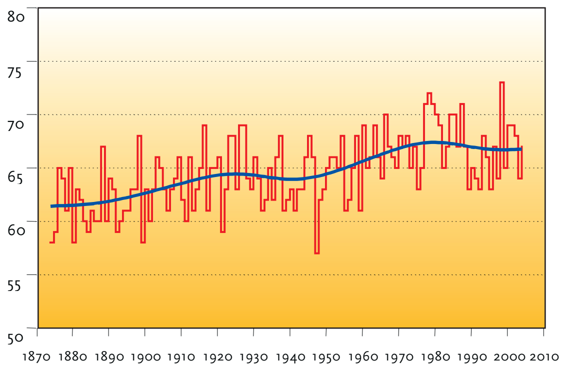


Figure 2.4 Annual mean cloud cover in Denmark 1874-2004 in percent

Source: Danish Meteorological Institute



was 1990, with 9.3°C. Since 1988, almost every year has been hotter than normal, and the temperature showed a sharply rising trend in the 1990s. Over the last 125 years, the temperature in Denmark has risen by almost 1.5°C, but the ten hottest years occurred from the 1930s to the 1990s.

The temperature in January and February averages around 0°C but can vary greatly from 12°C to below -31°C. The average temperature in July and August is around 15°C, but again can vary from below -3°C to more than 36°C.

Precipitation

Average annual precipitation varies greatly from year to year and from place to place. The lowest annual precipitation for the country as a whole was 464 mm in 1947, and the highest was 905 mm in 1999, while the average annual precipitation is 712 mm.

The wettest months are normally September, October, and November, while the driest are February to May.

In the winter months, precipitation is sometimes in the form of snow. Annual precipitation in Denmark has on average increased by about 80 mm since 1870.

Hours of sunshine and cloud cover

On average, Denmark as a whole has about 1,495 hours of sunshine annually, but this figure varies greatly from year to year. The sunniest year was 1947, with 1,878 hours, and the least sunny was 1987, with 1,287 hours. There is least sunshine in January and December with slightly more than 40 hours in most places, while May and June have the most sunshine with an average of about 210 hours.

Average annual cloud cover is 65%. 129 days are cloudy, i.e. with cloud cover at >80% and only 27 days are clear, with cloud cover at <20%.

Since 1980, the trend has been towards more hours of sunshine and less cloud cover.

Wind
Countrywide, annual mean wind velocity is 5.8 m/s, and the wind is most frequently from westerly directions, from which about 25% of all winds come.

The number of days with severe wind (≥ 10.8 m/s) varies from about 30 in some places inland to almost 170 days at Skagen. On average, storm-force (≥ 24.5 m/s) occurs along the Danish coasts every three to four years. In December 1999 large parts of Denmark were hit by the worst-ever measured hurricane, and in some places mean wind velocities (average over 10 minutes) of more than 40 m/s were recorded, with gusts of more than 50 m/s.

2.1.5 Economy

Since 1993 economic growth in Denmark has been considerable, with GDP (Gross Domestic Product) rising at an average of 2.7% per year. In 2003, GDP was DKK 1,400 billion, corresponding to DKK 260,000 per capita (1 Euro = DKK 7.45).

In 2003 the public debt stood at 7% of GDP, compared with 78% in 1993. In the same period, foreign debt was reduced from 32% of GDP in 1993 to 15% GDP in 2003.

From Table 2.2, which shows key figures for the Danish economy, it will be seen that Denmark has a very open - and thus sensitive economy, in which export accounts for a substantial part of total demand. In addition, public expenditure accounts for a large part of GDP. Table 2.3 shows the business sector's contribution to GDP.

TABLE 2.2 KEY FIGURES FOR THE DANISH ECONOMY. CURRENT PRICES, 2003, IN DKK MILL.
Source: Statistics Denmark.

GDP	1,396,806
Imports	508,741
Exports	594,837
Consumer spending	659,259
Public expenditure	371,839
Gross investment	280,440
Public debt as a % of GDP	6.9%
Foreign debt as a % of GDP	15.0%

2.1.6 Energy

Energy production and energy-consuming activities are the main contributors to the emissions of greenhouse gases in Denmark. The energy sector alone (energy production and supply) accounts for 44% of Denmark's total emissions of greenhouse gases, primarily CO_2. In addition there are emissions from the energy-consuming activities in the transport sector, industry and households.

In the energy sector, CO_2 emissions have been reduced despite strong economic growth. This was achieved through long-term ambitious efforts, which must be followed up and developed further in order to maintain the positive trend.

Production and supply

As will be seen from Table 2.4, Denmark's own production of energy has grown almost 30-fold since 1980 and it almost more than tripled since 1990. Denmark is self-sufficient in energy, see Table 2.5. This is mainly due to the production of oil and gas in the North Sea, but renewable energy is also increasingly contributing to the country's energy supply.

Today, 13.6% of the actual consumption of energy is supplied by renewable energy. The renewable energy resources are mainly wind energy and biomass, which are used to produce electricity, combined heat and power, or district heating.

TABLE 2.3 THE BUSINESS SECTOR'S CONTRIBUTION TO GDP, CURRENT PRICES 2003, IN DKK MILL

Source: Statistics Denmark.

Sector	Gross increase in value	%
Agriculture, etc., mining	60,063	5.0
Industry, including energy and building	279,663	23.3
Services	902,167	75.3
Indirectly measured financial services	-43,847	-3.6
Gross Domestic Product	1,198,046	100

TABLE 2.4 ENERGY PRODUCTION (PJ)

Source: Danish Energy Authority

	1980	1990	1995	2000	2001	2002	2003
Production, total	**40**	**423**	**656**	**1164**	**1138**	**1202**	**1194**
Crude oil	13	254	392	765	726	780	780
Natural gas	0	116	197	310	318	318	302
Renewable energy etc.	28	53	67	89	95	103	112

TABLE 2.5 DEGREE OF SELF-SUFFICIENCY (%)

Source: Danish Energy Authority

	1980	1990	1995	2000	2001	2002	2003
Energy, total	**5**	**52**	**78**	**139**	**136**	**145**	**144**
Oil	2	71	105	204	194	217	228
Oil and natural gas	2	84	116	189	183	197	203

Internationally, Denmark is among the leading nations in wind energy.

Energy consumption
Despite the economic growth, total energy consumption has remained largely unchanged at approximately 800 PJ since 1980, cf. Tables 2.6 and 2.7.

Denmark's dependence on oil and coal has fallen. Particularly in the production of electricity and heat, oil and coal have been substituted with other fuels. Thus, natural gas, waste and biomass are increasingly being used in small-scale and industrial CHP plants, natural gas and renewable energy is increasingly being used in large scale electricity production, and natural gas is increasingly being used for individual heating of buildings.

The distribution of gross energy consumption (energy consumption adjusted for foreign electricity trade) in 2003 was as follows: industry and agriculture accounted for 26%, domestic sector for 27%, transport for 25% and commerce and service for 15%. Refining and non-energy purposes accounted for the remaining 7%

TABLE 2.6 ACTUAL ENERGY CONSUMPTION (PJ)
Source: Danish Energy Authority

	1980	1990	1995	2000	2001	2002	2003
Energy consumption, total	**830**	**752**	**840**	**812**	**832**	**822**	**863**
Oil	555	343	371	367	368	354	343
Natural gas	0	76	133	186	194	194	195
Coal	252	255	272	165	174	175	238
Renewable energy etc.	28	53	67	92	98	106	117
Net imports of electricity	-4	25	-3	2	-2	-7	-31

TABLE 2.7 GROSS ENERGY CONSUMPTION, BREAKDOWN BY FUELS, ADJUSTED FOR CLIMATE FLUCTUATIONS AND NET EXPORTS (PJ)
Source: Danish Energy Authority

	1980	1990	1995	2000	2001	2002	2003
Gross energy consumption, total	**816**	**820**	**839**	**837**	**834**	**827**	**829**
Oil	548	356	373	375	375	360	343
Natural gas	0	83	134	193	194	197	191
Coal	241	326	265	176	167	162	176
Renewable energy etc.	27	55	68	94	98	108	118

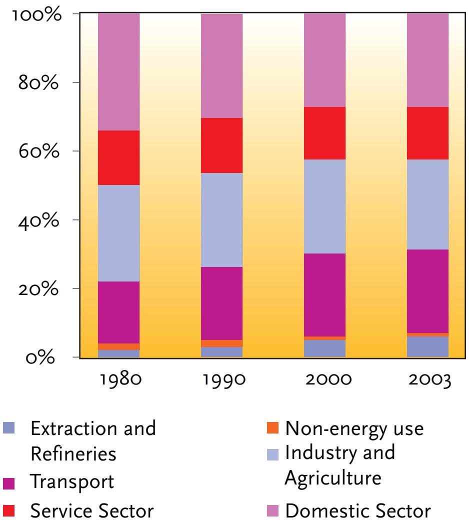
Figure 2.5 shows adjusted energy consumption, sector by sector. Over the last 23 years relative consumption by the transport sector has risen, whereas relative domestic sector consumption has fallen.

Structure of the market
The structure of the market in the energy sector is characterised by a division between production and supply of natural gas and oil, *electricity*, and *district heating*.

Most production of *natural gas and oil* is taken care of by a private company, DUC (Dansk Undergrunds Consortium), while the state-owned

Figure 2.5 Adjusted gross energy consumption, breakdown by sector

Source: Danish Energy Authority



company DONG (Dansk Olie og Naturgas) takes care of the transportation of natural gas from the fields in the North Sea to the shore. At the DONG treatment plant at Nybro, the gas is treated and then sent on in the natural gas system to customers. Gastra, a subsidiary of the 100% state-owned company Energinet.dk, owns and operates the transmission grid for natural gas. The distribution grids in southern Jutland and western and southern Zealand are owned and operated by DONG, while the distribution grids in northern and mid Jutland, on Funen and in the Copenhagen region are owned and operated by municipal associations. In addition there are two natural gas storage facilities which are owned and operated by DONG. In connection with implementation of the EU gas directive, there has been liberalisation in the gas sector which means, for example, that since 1 January 2004 all gas customers have had full access to the market.

In connection with the implementation of the EU Directive on liberalisation of the *electricity* sector, a reform of this sector has also been carried out. This reform means full market opening and all electricity consumers have a free choice of electricity supplier. More than 2/3 of the electricity supply comes from large primary power stations or CHP plants.

Approximately half of the demand for heating is supplied by *district heating*. The heat is supplied from primary and small-scale CHP plants, waste incineration plants and biomass-fired district heating stations. Apart from the primary plants, the plants are owned either by municipalities or by local cooperatives that are owned by the consumers. Initially, district heating will not be covered by the liberalisation process, but the government will investigate whether it is possible in the longer term to have a more free choice of supplier in areas with large, interconnected district heating grids.

Energy policy agreements of 29 March 2004

On 29 March 2004 the government entered into a number of energy policy agreements with a broad majority of the Folketing parties and with the organisation representing electricity grid companies, Elfor. The main points described in the following text box reflects the agreements established in a new overall

• Separation of ownership of overall electricity and gas transmission from commercial activities

Key elements of the agreement are that electricity grid companies transfer responsibility for system operation and the overall transmission net to the state with a view to separating ownership of the overall infrastructure from commercial activities relating to trading and electricity production. Owner shares in the overall electricity transmission network are taken over by the newly established state company Energinet.dk, and responsibility for system operation is transported to the company from Elkraft System and Eltra. As regards natural gas, the state company DONG has transferred its subsidiary Gastra to Energinet.dk, so that in the future the company will own and operate systems, electricity transmission and natural gas transmission in Denmark. This separation of ownership of the overall net from commercial activities relating to electricity and gas, provides an important basis for efficient competition in the Danish energy sector.

• Changes in the ownership structure in the energy sector

As part of the energy policy agreements and the agreement with Elfor, the provisions of the Electricity Supply Act on distinction between free and tied-up capital were repealed, thus providing an incentive to reorganise companies and adapting the structure in the electricity sector. The result has been that a number of grid companies and municipalities in Jutland and on Funen have relinquished their interests in Elsam. The remaining municipalities and grid companies who are shareholders have also disposed of their holdings. On 10 December the Minister for Finance and the boards of Elsam A/S and DONG A/S made an agreement on merging Elsam and DONG.

In east Denmark, in spring 2004 Elsam took over the majority of the shares in NESA A/S, including the ownership interest in Energi E2, while SEAS, NVE and a number of municipalities, including Copenhagen City entered into agreements with DONG A/S on their shares in the production enterprise Energi E2. The agreements with SEAS and NVE as well as Copenhagen City allow for either cash payment, or settlement with shares.

Moreover, the DONG A/S agreements with Copenhagen City and the City of Frederiksberg include that DONG A/S is to take over Københavns Energi and Frederiksberg Forsyning.

The framework agreement of 10 December 2004 and the DONG A/S agreements mean there is the prospect of forming a large Danish energy company which will be able to compete with the even larger foreign energy companies and act as a dynamo for strong commercial and technological development of the energy area in Denmark. However, it is still uncertain when the merger between DONG and Elsam can be implemented. The new company must be examined by the competition authorities.

With the agreement of 1 June 2005 between DONG, Elsam, Energi E2 and Vattenfall on power plants and shares, ownership in the Danish power plant sector has changed considerably. Under the agreement, Vattenfall takes over three large power plants – Nordjyllandsværket, Fynsværket and Amagerværket – and the decentral CPH plants at Helsingør and Hillerød. It also takes over a portfolio of wind turbine activities. In all, Vattenfall takes over production activities totalling approx. 2,400 MW. DONG takes over Vattenfall's 35.3 per cent owner shares in Elsam and the 40 per cent Vattenfall owner share in the power plant Avedøre2. Elsam and Energi E2 retain production activities totalling approx. 7,300 MW.

With this agreement, and assuming approval by the competition authorities, the establishment of a new powerful energy company in Denmark is ensured through a merger of DONG, Elsam, Energi E2, NESA, Københavs Energi (el) and Frederiksberg Forsyning.

• **Price regulation of grid companies**

With the new statutory order, revenue framework regulation of electricity grid companies changed from regulation of costs to regulation of income. The new regulations encourage enterprises to promote efficient operation, as through this they can improve their business. Consumers are protected against increases in net charges as they must not exceed the level at 1 January 2004 (calculated at fixed prices). As from 2008 the companies must meet a number of efficiency requirements based on benchmarking. Similarly, a revenue framework order has been issued for the natural gas distribution companies, providing for incentives to the companies to promote the efficiency in operations.

• **Expansion of wind turbines**

A significant element in the agreements of 29 March 2004 was the agreement on the basis for further expansion of wind turbine capacity. It was agreed to establish two offshore wind farms, each of 200 MW. It was decided to situate the farms at Horns Rev and Rødsand. The two wind farms will be established on the basis of a negotiated procedure. A prequalification of interested investors will be carried out before tenders are issued and negotiations commence. The decisive criterion in the procedure is the price per kWh, which the tenderer requires for completing the project.
Energi E2 won the tender for a 200 MW offshore wind park at Horns Rev. The Energy E2 bid was based on the lowest settlement price, fixed at DKK 51.8/kWh for 50,000 full capacity hours, corresponding to approx. 12 years of electricity production. It has been agreed to put the park in operation in the course of 2009. The Danish Energy Authority has received four applications from companies wishing to take part in the tender at Rødsand. The Danish Energy Authority expects in the course of autumn 2005 to select the companies that will be prequalified to take part in the tender.
From 1 January 2005 a new scrapping scheme has been introduced for older, poorly sited wind turbines onshore. The scheme aims at establishing new capacity of up to 350 MW over the next 5 years, but with far fewer turbines, and turbines with a total capacity of 175 MW will be dismantled. The subsidy for scrapping is DKK 0.12 per kWh for 12,000 full capacity hours. As one of the most important aspects of the scheme is the designation of areas to erect replacements for the scrapped turbines, the Energy Authority and the Danish Forest and Nature Agency are in a continuing dialogue with the regional planning authorities to secure sites for all the new wind turbines. Current estimates of gross areas for wind turbines are approx. 478 MW total capacity.

• **Market orientation of small-scale heat and power plants**

Following the agreements of 29 March 2004, small-scale heat and power production and other mandatory electricity are now based on market forces. Decentral plants have been given an incentive to organise electricity production on the basis of the prices of electricity on the market, because subsidies are now granted as financial, subsidies, independent of production, while electricity production is settled at the market price. This reorganisation is being introduced stepwise, so that plants above 10 MW operate under the new terms as from 1 January 2005, and plants between 5 and 10 MW do so no later than 1 January 2007. Small plants below 5 MW may remain under the old scheme indefinitely.
In order to achieve a better functioning electricity market, the regulations on mandatory electricity production were also repealed as from 1 January 2005. All electricity produced is now sold on the electricity market, and consumers can buy their entire consumption on market terms.

framework for the market structure and ownership of the energy sector.

The 29 March agreement also means that the plants must not change from taxed fuels to tax-free fuels as yet. Therefore, from December 2004 regulations were introduced which mean that new application of biomass is only allowed in special circumstances.

Prices and taxes

Energy prices are one of the key factors governing energy consumption. In 2003 total spending on energy, including taxes and VAT, amounted to DKK 117.2 billion. Of this figure, domestic users paid DKK 57.8 billion, manufacturing industries DKK 26.1 billion, and the commercial sector and the service industries, including public services, DKK 27.8 billion. As a general rule, enterprises subsequently receive a full refund of energy taxes and VAT, but not of CO_2 taxes.

Figures 2.6 and 2.7 show the energy prices paid by domestic users. Figure 2.6 shows the current consumer prices, including taxes and VAT. Figure 2.7 shows the development in fixed 2003 prices. The fixed prices have been adjusted for the change in general prices according to the consumer price index.

The prices of heating oil and natural gas follow each other because this is laid down by law. The tax on petrol has risen over time, and this has affected the price of petrol.

Measured in fixed prices, the prices of petrol, heating oil and natural gas fell from 1980 until the early 1990s, cf. Figure 2.7. The price of electricity increased slightly over the period.

As an added incentive to enterprises to improve their energy efficiency and reduce Danish emissions of CO_2, a green tax package with

FIGURE 2.6 ENERGY PRICES FOR DOMESTIC USERS IN CURRENT PRICES, DKK

Source: Danish Energy Authority

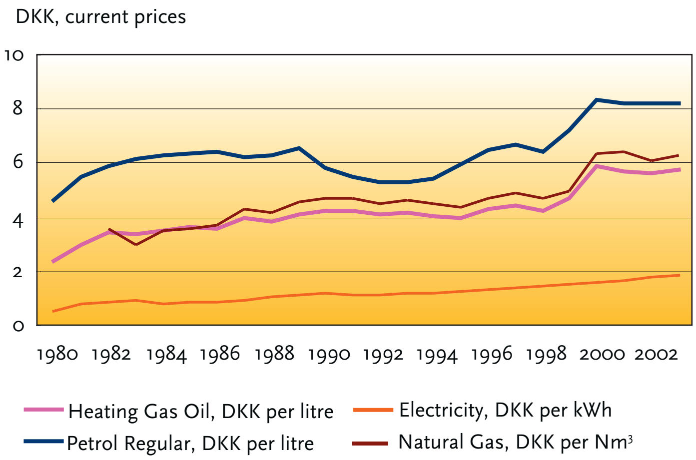


FIGURE 2.7 ENERGY PRICES FOR DOMESTIC USERS IN FIXED 2003 PRICES, DKK

Source: Danish Energy Authority

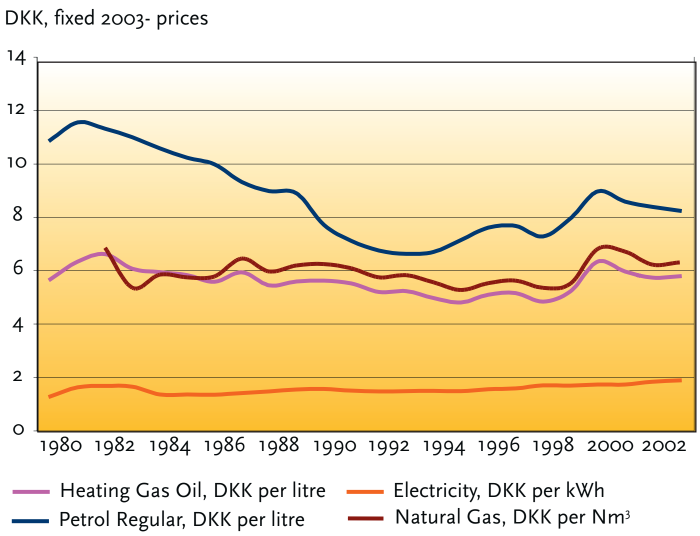
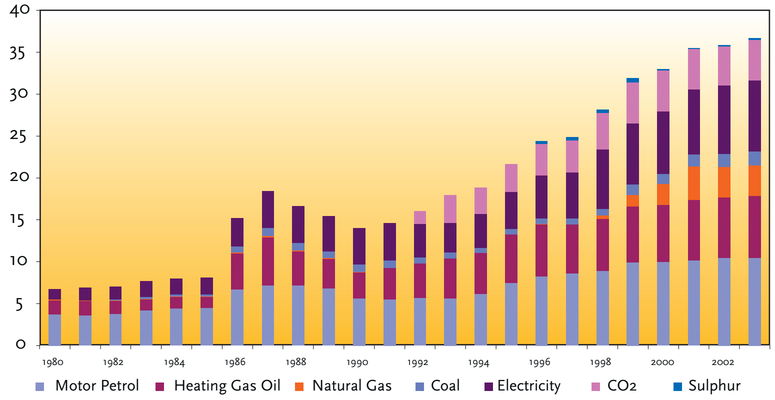


Figure 2.8 Revenues from energy, CO_2 and sulphur taxes. Current prices in billion DKK

Source: Danish Energy Authority



gradually increasing taxes on CO_2 and SO_2 emissions as well as energy taxes was introduced in 1996. Enterprises with particularly high energy consumption can contract with the Danish Energy Authority on energy-efficiency improvements in return for a discount in the CO_2 taxes and possibly heating taxes. Denmark wants CO_2 taxes on the allowance-regulated fuel consumption for industrial production processes to be repaid as far as possible, and preferably in fully. Therefore Denmark will change the CO_2 Taxes Act within the scope defined in the directive on energy taxation. The European Commission must approve the amendment, for instance under the rules on state subsidies.

In 2003 the revenue from energy taxes amounted to DKK 36.7 billion, up from DKK 35.8 billion in 2002. The largest contribution, DKK 10.4 billion, comes from petrol. Total revenue has increased by 163% in relation to 1990, when there were no CO_2 and sulphur taxes. In

Table 2.8 Imports and exports of energy

Source: Danish Energy Authority

	Imports						
	1980	**1990**	**1995**	**2000**	**2001**	**2002**	**2003**
Crude oil, PJ	259	174	229	159	131	140	150
Oil products, PJ	363	183	205	256	250	215	204
Coal, PJ	185	262	321	161	174	159	237
Natural gas, PJ	0	0	0	0	0	0	0
Electricity, Gwh	1979	11973	4013	8417	8199	8939	7023
	Exports						
	1980	**1990**	**1995**	**2000**	**2001**	**2002**	**2003**
Crude oil, PJ	2	118	203	203	513	590	574
Oil products, PJ	82	126	183	195	166	160	170
Coal, PJ	0	0	1	3	4	4	4
Natural gas, PJ	0	39	63	121	128	125	109
Electricity, Gwh	3216	4925	4807	7752	8775	11010	15568

2003 energy taxes accounted for more than 5.3% of total tax revenue.

Trade
In 2003, net foreign exchange earnings from energy products amounted to DKK 13.9 billion. There was a surplus on foreign trade in oil, natural gas, and electricity, but a deficit on foreign trade in coal.

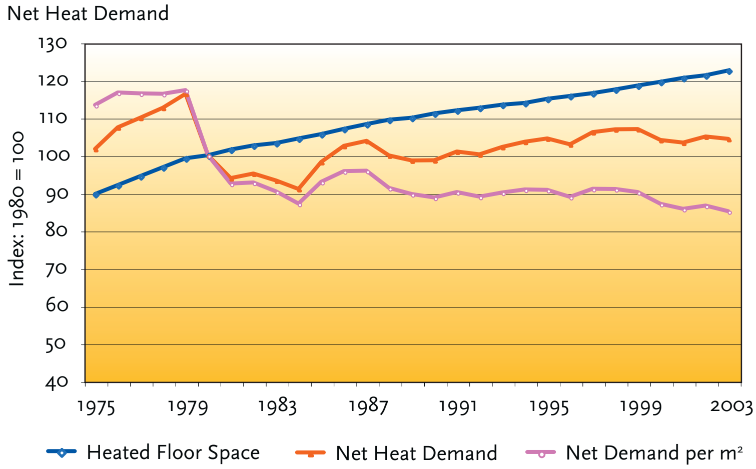
2.1.7 Domestic sector

Figure 2.9 illustrates the changes in energy consumption for heating in Danish households. The Figure shows both development in final energy consumption and the changes in net heating consumption. Net heating consumption is the heating used after losses in boilers and heating installations, and it is the best measurement of actual heating consumption.

As can be seen, energy consumption for heating dropped significantly from the late 1970s to the early 1980s, primarily because of the oil crisis and subsequent initiatives in the early 1980s to insulate buildings.

Since the start of the 1990s the absolute final energy consumption for heating has been roughly constant, implying a drop in consumption per m². This is due to considerable conversion from oil to district heating. Net heat demand per m² has also been roughly stable throughout the 1990s. As newly built houses have had lower energy consumption, this means there has been a slight increase in the heating consumption per m² of existing buildings.

FIGURE 2.9 CHANGES IN DOMESTIC ENERGY CONSUMPTION FOR HEATING COMPARED WITH THE AREA HEATED
Source: Danish Energy Authority. Energy Statistics 2003



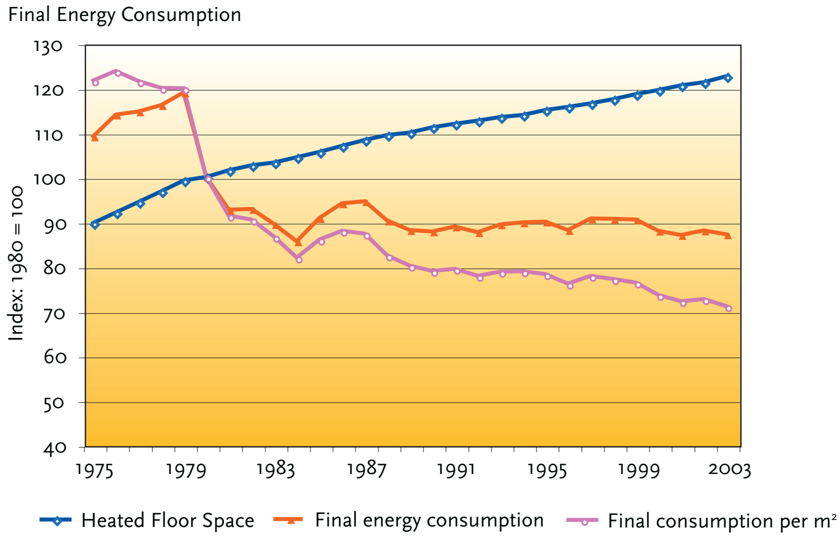
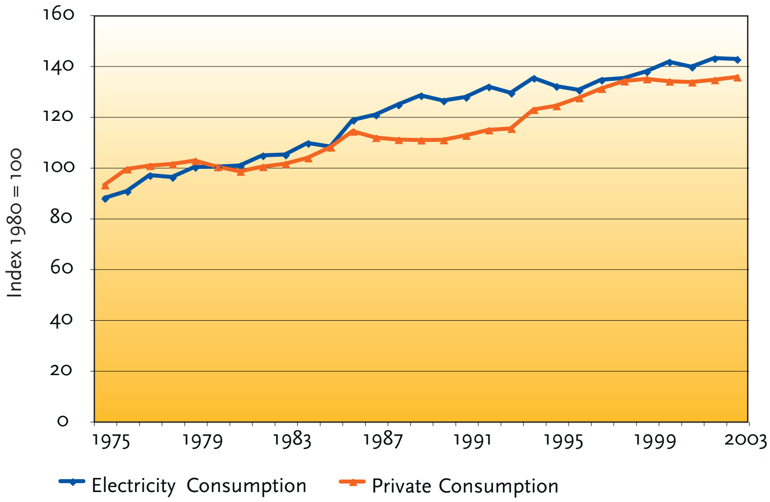


Figure 2.10 shows the changes in electricity consumption by domestic appliances and lighting (excluding electric heating). Electricity consumption has increased since 1975 and relatively parallel with the increase in private consumption. On average, the increase has been 1.8% per year, but somewhat lower in recent years; in the period 1990-2003 only 1% per year.

FIGURE 2.10 CHANGES IN DOMESTIC ELECTRICITY CONSUMPTION FOR APPLIANCES ETC., EXCL. ELECTRIC HEATING

Source: Danish Energy Authority. Energy Statistics 2003



As a result of converting electric heating, total consumption by households, including heating, has been roughly constant since the late 1990s. In 2003, the domestic sector accounted for 6% of Denmark's total greenhouse gas emissions.

2.1.8 Transport

Efficient and flexible transportation of goods and persons is a vital element of the foundation of the modern welfare society. At the same time, transport is in itself an important economic sector that contributes to economic growth, employment, and foreign exchange earnings.

TABLE 2.9 TREND IN PASSENGER TRANSPORT PERFORMANCE IN BILLION PASSENGER KM

Source: Ministry of Transport, the Road Directorate and Statistics Denmark

	1980	1985	1990	1995	2000	2001	2002	2003
Aircraft	0.4	0.4	0.5	0.5	0.4	0.4	0.3	0.3
Trains	4.4	4.8	4.7	4.7	5.4	5.4	5.5	5.9
Ferries	0.5	0.5	0.6	0.6	0.2	0.2	0.2	0.2
Cars	38.6	43.2	50.3	54.0	59.8	59.3	60.7	54.8
Buses	7.3	8.8	7.6	9.1	9.1	9.1	9.0	8.8
Total	**51.2**	**57.7**	**63.7**	**68.9**	**74.9**	**74.4**	**75.7**	**73.0**
Bi-cycles		2.7	3.2	2.8	2.4	2.2	2.3	2.3

TABLE 2.10 TREND IN GOODS TRANSPORT PERFORMANCE, BILLION TONNE KM[1]

Source: Ministry of Transport, the Road Directorate and Statistics Denmark

	1980	1985	1990	1995	2000	2001	2002	2003
Freight trains	1.1	1.3	1.2	1.4	1.2	1.0	1.0	1.0
Freighters	1.9	1.8	1.6	1.8	1.7	1.8	1.8	2.4
Lorries	7.8	8.3	9.4	9.3	11.0	10.9	11.1	11.0
Pipelines		0.9	2.9	4.6	7.1	7.2	7.6	7.8
Total	**10.8[2]**	**12.3**	**15.1**	**17.1**	**21.0**	**20.9**	**21.5**	**21.8**

[1] Goods transport by air accounts for only a small proportion of total goods transport. [2] Pipelines not included.

The positive effects of the transport sector must be seen against the fact that the sector burdens society in different areas - traffic accidents, air pollution, noise, congestion, and CO_2 emissions. In Denmark, this burden has been reduced in some important areas - primarily in the form of better traffic safety and less air pollution - at the same time as traffic has increased.

However, there has not been a corresponding development with respect to CO_2, and the transport sector has not yet succeeded in decoupling economic growth and greenhouse gas emissions, as has been done in the energy sector. Transport performance, energy consumption and CO_2 emissions within the transport sector have developed largely in step with economic growth. One reason for this is that a number of measures that have been used in other sectors, e.g. the energy sector, including efficiency improvements and substitution of energy sources, have not been directly available for the transport sector or have been associated with high costs.

The developments in passenger and goods transport performances are shown in Tables 2.9 and 2.10 respectively. In 2003, CO_2 emissions by the transport sector were about 22% over the 1990 level.

In 2003 the transport sector accounted for about 22% of Denmark's total CO_2 emissions. Its contribution to Denmark's total greenhouse gas emissions are calculated as a share of the total emissions of greenhouse gases, which include industrial gases, methane, and nitrous oxide. Calculated in this way, the sector was responsible for about 18% of total emissions in 2003. The trend in CO_2 emissions in the transport sector is therefore of considerable importance to the total trend in the greenhouse gas emissions.

2.1.9 The business sector

Industry's production value accounts for about 30% of total Danish production. Table 2.11 shows that the largest industries in Denmark are the

TABLE 2.11 TURNOVER BY INDUSTRY IN 2004, DKK MILL.
Source: Statistics Denmark.

All industry	522,214
Mining etc.	8,749
Food, drink and tobacco	134,233
Textiles, clothing and leather	10,280
Timber/wood-working	12,593
Paper and graphic industry	36,866
Mineral oil etc.	18,585
Chemical industry	56,504
Rubber and plastics	20,488
Stone, clay and glass industry	17,671
Metal production and metal-working	43,475
Machinery	63,254
Electronics	55,005
Transport industry	15,376
Furniture industry and other industry	29,136

food, drink and tobacco, engineering, electronics, and the chemical industry.

The total business sector (industry, building and construction, together with public and private services) accounts for about 13% of Denmark's total emissions of greenhouse gases. By far the largest part of these emissions is CO_2 from energy consumption, but the sector is also a source of emissions of industrial greenhouse gases.

In Denmark, the industrial sector's energy consumption accounts for about 18% of total energy consumption. This 18% does not include energy consumption for transport and space heating.

In the last 20 years relative consumption by the business sector varied considerably. Up to 1983, consumption fell considerably due to increases in the price of oil. When oil prices fell in 1986, energy consumption began rising again. In the period 1990-2003 energy consumption by the industrial sector rose by just under 5%, while electricity consumption in the same period increased by almost 15%. From 2002 to 2003 energy consumption fell by almost 1%.

Since 1994 energy and electricity intensity has fallen, see Figure 2.11.

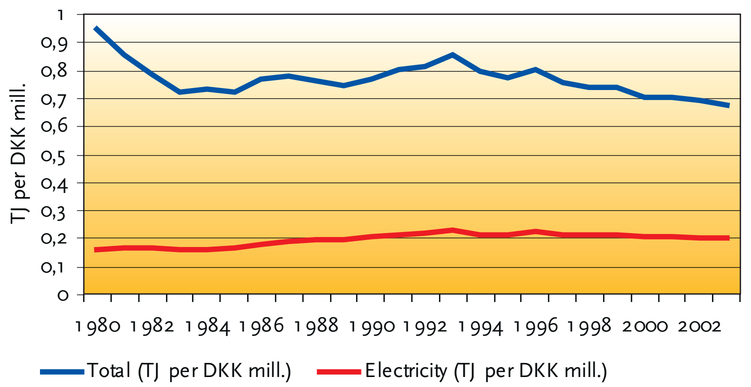
The change in the trend in energy and electricity intensity in 1993 corresponds with change from a period of low economic growth to a period of high growth, implying better utilisation of production capacity. At the same time, from 1993 the first CO_2 taxes were introduced on energy consumption by businesses, with associated subsidies for energy savings, agreement schemes etc. Advice to businesses from electricity companies was also introduced in the early 1990s.

The main action against the industrial sector's energy consumption until 2005 has been based on the green tax package for businesses passed by the Folketing in 1995. The package contained a combination of taxes and rebates to enterprises through, among other measures, government grants to promote energy savings by enterprises.

As can be seen from Figure 2.12, over the past 15 years there has been a steady increase in energy consumption by the private commerce and services sector. Primarily

Figure 2.11 Energy and electricity intensity in the industrial sector, adjusted for inter-annual climate fluctuations

Source: Danish Energy Authority and Odyssee[1]



[1] ODYSSEE is a joint project between ADEME, the EIE programme of the European Commission/DGTREN and all energy efficiency agencies in the EU-15 and Norway.

electricity consumption has been rising. The growth in energy consumption by the service sector is due to high growth in this sector and reflects a development where services are becoming increasingly important in the economy. As the figure shows, there has been a constant drop in intensity of on average 2.3% per year from 1975-2003. Since 1990 the drop has been on average 1.6% per year.

Energy consumption in public services (the public sector), as shown in Figure 2.12, has been roughly constant over the last 15-20 years, and since the early 1990s there has been a considerable fall in energy intensity.

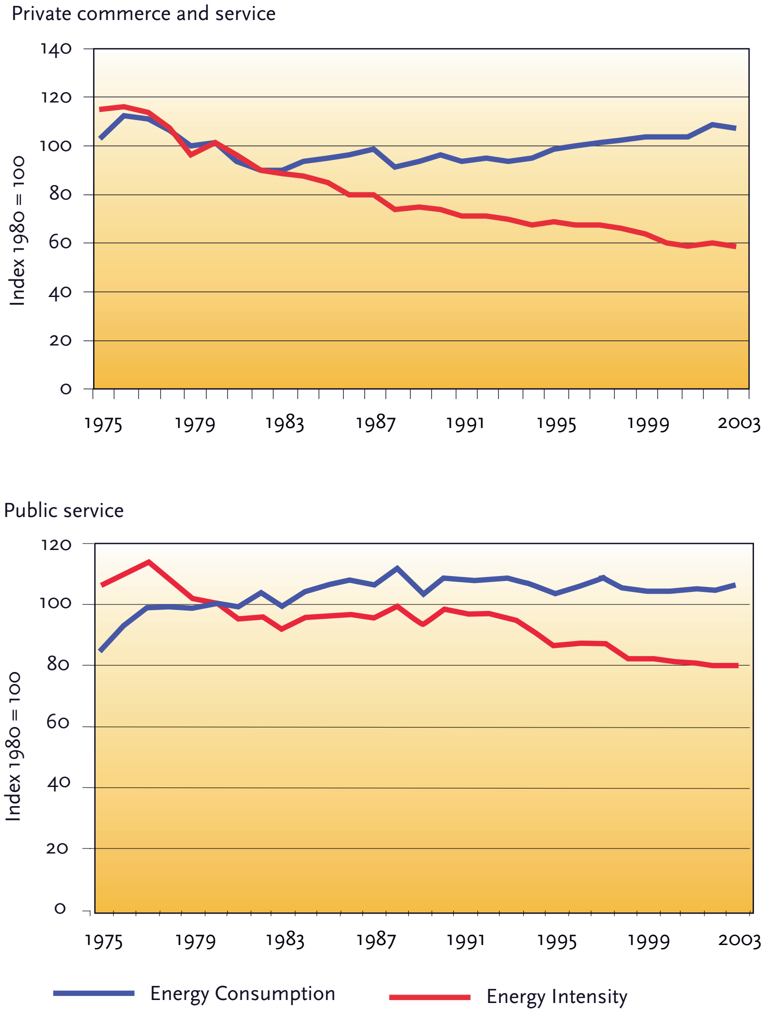
For industrial greenhouse gases (HFCs, PFCs and SF_6), regulation through taxes, and rules on phasing out the use of these substances have been implemented. With certain exceptions, the phasing-out process is expected to take place in the period 2003-2006.

2.1.10 Waste

The waste sector's contribution to the emissions of greenhouse gases consists primarily of methane and accounted for 2% of the total greenhouse gas emissions in 2003. Methane emissions come from the decomposition of organic waste at landfill sites and – to a minor extent – from wastewater treatment plants. In 2003 a total of 981,000 tonnes waste were landfilled in Denmark, corresponding to 8% of the total amount of waste.

FIGURE 2.12 CHANGES IN ENERGY CONSUMPTION AND ENERGY INTENSITY (ENERGY CONSUMPTION IN RELATION TO GROSS ADDED VALUE) IN PRIVATE COMMERCE AND SERVICE AND PUBLIC SERVICE

Source: Energy Statistics 2003



Methane emissions from the waste sector are expected to fall in the future because the municipalities are now obliged to assign all waste suitable for incineration to incineration plants. This means that only a small quantity of organic waste will be deposited at landfills compared with the quantity deposited before the introduction of this obligation in 1997.

In addition, gas from a number of landfills is being used in energy production, which contributes to a direct reduction in methane emissions and an indirect reduction in CO_2 emissions.

Emissions of the industrial gases HFC and SF_6 from disposal of, for example, refrigerators and certain thermal glazing, which contain these substances, are included under the business sector.

There are also CO_2 emissions in connection with disposal of oil-based products, e.g. packaging, plastic bags, etc. The amount of plastic waste sent for incineration will fall with the increased recycling of plastic waste from 2008. Since waste incineration in Denmark is included in energy production, these CO_2 emissions must be included under the energy sector in accordance with the inventory rules from the IPCC.

Finally, in connection with incineration, a large amount of the waste is used as an energy source. As many of the incineration plants as possible have been converted to CHP production. In other words, the heat is used to supply district heating, and the electricity is sold to electricity suppliers. In 2003, 32 incineration plants in Denmark converted 26% of the entire waste production, or 3,287,000 tonnes and contributed 3.8% of the entire Danish electricity production and 20% of all Danish production of district heating.

By recycling waste, energy (fossil fuels) is usually saved and thus emissions of greenhouse gases, in that it is often more energy-demanding to manufacture new raw materials than to recycle material in waste. However, Denmark imports most of the raw materials, therefore energy savings accrue abroad. Therefore, the reduced greenhouse gas emissions cannot be credited to the Danish CO_2 accounts, even though Denmark has made the effort to increase recycling.

The government presents national action plans for the waste area for hearing by interested parties and for debate in the Folketing. These national action plans announce future state initiatives and guidelines for waste plans by the local authorities. In Denmark, the local authorities are responsible for managing all waste. Practical management is carried out by the private sector (primarily collection and recycling) or by the municipalities (primarily landfilling and incineration).

Table 2.12 Key figures for the stock of buildings in 2004, mill. m^2

Source: Statistics Denmark

Total building area	Buildings for year-round habitation	Factories and workshops	Commerce, trade and administration	Institutions and buildings for cultural purposes	Farm buildings
670.2	292.3	55.6	54.8	39.2	132.4

2.1.11 Buildings and urban structure

One-twentieth of the area of Denmark is urbanised. 85% of Danes are town-dwellers, and most enterprises, institutions, etc., are situated in towns. Many pollution problems are therefore concentrated in the towns.

Today, the total built-up area is 670 mill. m^2. Table 2.12 shows the distribution of the area between housing, factories, offices, etc.

Today, about 18,000 homes are built per year, which is one-third of the number built in the first half of the 1970s. House building is expected to remain at this level. In recent years, house building has accounted for slightly more than half of all investment in building activities, and about half of the investment in the housing sector has gone on alterations and extensions. Building for industry and commerce now accounts for around half of all building in towns.

Towns and cities are generally characterised by separation of residential and industrial areas, industrial buildings being situated in specially designated zones on the outskirts of the towns. The growth in the service industries and the growth in manufacturing with a small environmental impact imply new possibilities for integrating industry and housing, thereby reducing the need for transport between home and work.

Approximately two-thirds of the total building space is heated. The most important types of heating are district heating and central heating using oil and gas. Half of the heated space is heated by district heating and, as seen from Table 2.13, the use of both district heating and natural gas has increased at the expense of oil.

TABLE 2.13 DEVELOPMENT IN THE MAIN FORMS OF HEATING IN BUILDINGS, IN % OF TOTAL HEATED SPACE

Source: Statistics Denmark.

	1981	1991	2001	2002	2003	2004
District heating	29.4	38.6	58.7	59.3	59.8	60.2
Central heating with oil	57.2	37.4	18.6	18.0	17.4	16.9
Central heating with natural gas		9	13.2	13.4	13.6	13.8
Furnaces fired by oil and similar	2.2	1.5	1.5	1.4	1.3	1.2
Other heating[1]	5.8	5.6	8.0	7.9	7.9	7.9

[1] Central heating (not oil and natural gas), electric ovens and not specified

2.1.12 Agriculture

Over the last 40 years the agricultural area in Denmark has fallen from 72% (30,900 km^2) of the total area in 1960 to 62% (26,578 km^2) in 2003. Table 2.14 shows the breakdown by type of crop over the last 33 years.

The proportion of agricultural land under grass and greenfeed in rotation and permanent grass fell considerably from 1970 to 1990, but rose considerably during the 1990s, due partly to increasing use of grass fields for dairy farming, and partly to the change in EU subsidy schemes, which means that grass or industrial seed must be grown on set-aside land. Furthermore the area with maize and cattle feed is included with the area with grass and greenfeed, and the area with maize has increased significantly from 0.4% of the agricultural area in 1980 to 4.4% in 2003. This is due in part to a warmer climate which has made maize easier to grow.

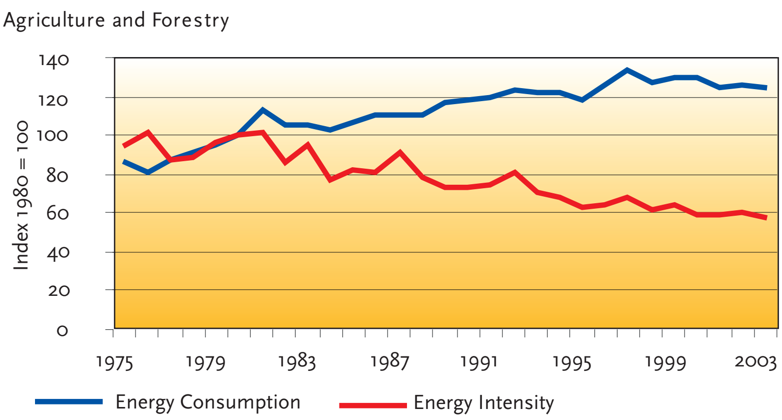
TABLE 2.14 USE OF AGRICULTURAL LAND, LIVESTOCK, AND NITROGENOUS FERTILISER

Source: Danish Institute of Agricultural Sciences, Food and Resource Economic Institute and Statistics Denmark

	1970	1980	1990	2000	2003
Grain (%)	59	62	56	57	56
Pulses and industrial seed (%)	2	4	14	5	5
Root crops (%)	10	8	8	5	4
Grass and greenfeed in rotation (%)	17	14	12	16	17
Permanent grass (%)	10	9	8	13	14
Other crops (%)	2	3	2	4	4
Cattle ('000)	2,842	2,961	2,239	1,868	1,724
Pigs ('000)	8,361	9,957	9,497	11,921	12,949
Sheep ('000)	70	56	159	145	144
Poultry ('000)	19,169	15,507	16,249	21,830	17,844
Nitrogen in fertilisers ('000 tonnes N)	271	394	400	252	201
Nitrogen in manure ('000 tonnes N)	-	263	244	232	234

FIGURE 2.13 CHANGE IN ENERGY CONSUMPTION AND ENERGY INTENSITY (ENERGY CONSUMPTION IN RELATION TO GROSS ADDED VALUE) IN AGRICULTURE AND FORESTRY

Source: Energy Statistics 2003



From 1980 to 2003 the number of farms fell from 119,155 to 48,613. In the same period the average size of farms increased from 24 ha to 54 ha. This development has reduced the importance of agriculture as a source of primary employment. However, in the same period agricultural production has grown, both in quantity and value, and agricultural exports still make up a large proportion - 11% - of Denmark's total exports.

During the 1990s interest in organic farming increased considerably. In 2003 organic farms accounted for approximately 6% of land under cultivation.

In the last 30 years use of nitrogen by agriculture has varied greatly, cf. Table 2.14.

Up to 1990 there was a big increase in the use of nitrogenous fertiliser, but during the 1990s use of this type of fertiliser fell considerably, and in 2003 nitrogen consumption was below the 1970 level. The nitrogen content of manure has dropped slightly since 1980. Consumption of phosphorus and potassium in fertilisers fell throughout the period.

The cattle population fell by 39% from 1970 to 2003, cf. Table 2.14. Most of the cattle are dairy cows. Since milk production remained approximately unchanged throughout the period, the fall in cattle population is due to higher productivity per animal. In the same period, the pig population increased by 55%. The sheep population has doubled in relation to 1970, while the poultry population is now roughly the same as in 1970. Since the 1970s, initiatives aimed at nutrients etc. have led to favourable trends, including with regard to greenhouse gases, where agriculture has reduced emissions by about 24% since 1990.

The agricultural sector accounted for about 17% of Denmark's total emissions of greenhouse gases in 2003. These were primarily methane and nitrous oxides. CO_2 from fuel consumption in the agricultural sector accounts for about 3% of total Danish emissions.

Figure 2.13 shows the change in energy consumption and energy intensity in agriculture and forestry. Energy consumption in agriculture and forestry has increased dramatically since 1980, but since 1997 there has been a slight fall. However there has been an even greater increase in gross added value and thus a drop in energy intensity.

2.1.13 Forestry

Approximately 11% of Denmark is forested. Originally focus was mainly on the potential of conifers, but in recent years focus has changed towards indigenous, deciduous tree species as offering greater long-term production and nature potential. Denmark's forests are managed as closed canopy forests. The main objective is to ensure sustainable and multiple-use management of the forests and to manage them in line with the overall management of the countryside. Instead of clear-cut systems, forest owners are to a higher degree applying near-to-nature forest management regimes. Unlike our Scandinavian neighbours, Denmark is not a country in which forestry plays an important role in the national economy.

The Danish Forest Act protects a very large part of the existing forests against conversion to other land uses. Afforestation, for which public subsidies are made available, is as standard protected as forest reserve. In principle, this means that most of the forested land in Denmark will remain as forest.

The ambition is to have about 25% of Denmark's area forested by the end of the 21st century. A considerable increase in the forest area is therefore to be achieved.

Denmark is the only part of the Realm in which forestry is practised. Greenland and the Faroe Islands have almost no forest.

2.2 Greenland

2.2.1 Form of government and structure of administration

Greenland has had home rule since 1979. The Home Rule Government consists of a directly elected parliament (the Landsting), comprising 31 members. A general election is held every four years. The

Landsting elects a government (the Landsstyre), which is responsible for the central administration under the Prime Minister (the Landsstyreformand). The members of the government head the various landsstyreområder (ministries).

However, since Greenland is part of the Realm, some fields of responsibility remain under the state, including the Constitution, the right to vote, eligibility for election to the Folketing, the administration of justice, the concept of citizenship, foreign policy and the National Bank.

The Home Rule Government is responsible for other areas, including transport and communication, and the environment and nature. Greenland is not a member of the EU, but has an OCT scheme (Overseas Countries and Territories scheme) that ensures the country open access to the European market for its fish products.

International agreements entered into by the Danish government also cover Greenland and apply to Greenland to the same extent unless the Home Rule Government specifically requests exemption or deviation from them. Denmark's ratification of the Climate Convention and the Kyoto Protocol both cover Greenland.

2.2.2 Population

Greenland has a population of slightly more than 56,000, 88% of which were born in Greenland. Most of the remainder of the population comes from Denmark.

Fishing is the main industry, and it is estimated that about 2,500 people are directly employed by it. In addition, around 3,000 people work in the fisheries industry and derivative occupations.

2.2.3 Geography

With an area of 2.2 mill. km^2, Greenland is the world's largest island. It extends over almost 24 latitudes. Nordpynten lies only 700 km from the North Pole, and Kap Farvel, 2,600 km further south, is level with Oslo. Towards the south, the height of the sun and thus the length of day and night are almost as in Denmark. Towards the north there is the midnight sun and winter darkness, both lasting for almost two-thirds of the year.

85% of Greenland is covered by a continuous, slightly convex ice sheet, which reaches a height of more than 3,000 m above sea level. In a borehole drilled in the central part of the ice sheet, the drill reached a depth of 3,030 m into the bedrock.

The remaining 15% of the island is home to Greenland's flora and fauna, and here, on the edge of the ice sheet, the people live - mainly in the coastal areas, from which there is access to open water.

2.2.4 Climate

Greenland's northern location and the cold and more or less ice-filled seas that surround it are the main reasons for its cold climate.

Greenland has a mostly arctic climate, and forests cannot grow there. Particularly the northern part of the country is close to the North American continent, separated from it by only a relatively narrow and ice-filled sea. The position of south Greenland, on the other hand, means that the climate here is influenced by the North American continent to the west, and the ocean to the east.

Atmospheric pressure

Atmospheric pressure is generally highest in April/May. The weather in Greenland is most stable at this time of year. After this, in the summer months, the variation in atmospheric pressure is small, but in winter it is much greater, with a generally higher atmospheric pressure towards the north than towards the south, leading to a higher frequency of cold winds from northerly directions and higher wind velocities.

The biggest pressure extremes in Greenland occur in the winter period because of the great temperature contrasts in the atmosphere. The highest atmospheric pressure measured in Greenland was 1059.6 hPa, which was recorded in January 1958. The lowest was 936.2 hPa, recorded in 1986 and 1988.

Wind

Storms typically occur in connection with the passage of low-pressure systems. Between these systems, there are undisturbed periods of varying duration throughout the year, when the wind is governed by local conditions.

An example is the ice sheet's katabatic wind system, the extent of which is enormous. A katabatic wind is a wind that blows down an incline, moving from the central part out towards the edge. The wind velocity accelerates with increasing incline of the surface, and the topography can cause channelling, resulting in an extremely high velocity at the edge of the ice.

Greenland has many days with little or no wind. In some places on the east coast this is the case for 60% of the time.

Gusts can be very strong. Gusts of up to 75.1 m/s were measured in Danmarkshavn in 1975, but even stronger gusts undoubtedly occur in connection with the so-called piteraqs. These fall winds, which are katabatic, locally channelled winds from the ice sheet, occur in several locations in Greenland, and are characterised by a very abrupt change from light wind to storm. In Greenlandic, piteraq means "that which assaults one".

Temperature

The summer temperatures on both the west and the east coast differ by only a few degrees from south to north, despite a distance of about 2,600 km. The reason for this is the summer midnight sun in north Greenland. Conversely, winter darkness and the absence of warm sea currents mean that the temperature during the winter period differs considerably from north to south.

There is also a big difference in the temperature conditions at the outer coast and inside the fjords. In summer, drift ice and the cold water along the coast can mean that it is warmer inside the fjords, while in winter, on the other hand, the presence of the sea makes it warmer in the coastal areas than inside the fjords.

Foehn winds can disturb this picture in the wintertime. Foehn winds are very common in Greenland, and in winter the hot, dry winds can cause the temperature to rise by 30°C within a relatively short space of time, resulting in melting of snow and ice. The temperature record of 13.9°C of 23 November 1987 in Nuuk is an example of the effect of a Foehn wind.

Figure 2.14 Annual mean temperature 1873-2004, °C stations in Denmark, the Faroe Islands and west Greenland

Source: Danish Meteorological Institute

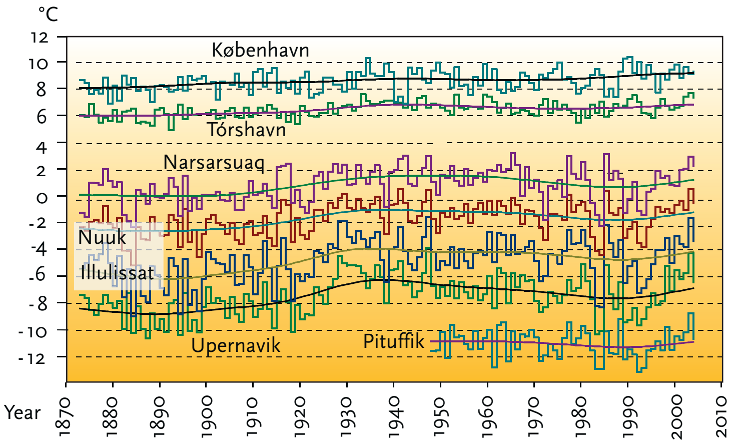
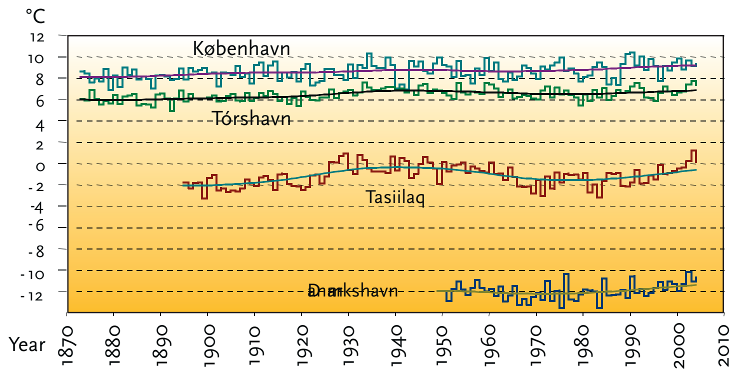


Figure 2.15 Annual mean temperature 1873-2004, °C stations in Denmark, the Faroe Islands and east Greenland

Source: Danish Meteorological Institute



The highest temperature recorded in Greenland since 1958 is 25.5°C. It was recorded at the ice sheet station in Kangerlussuaq in July 1990.

In Greenland, frost can occur in all the months of the year except deep inside the fjords at Narsarsuaq Airport and Kangerlussuaq for a couple of the summer months. The "frost-free" period in southern Greenland varies from 60 to 115 days per year.

The coldest place in Greenland is naturally on the ice sheet, where the temperature can fall to below -70°C. Temperatures in Greenland have shown a slightly rising trend for the last 125 years, although, on a shorter time scale, temperatures have generally fallen since the 1940s. This has been most marked on the west coast, where a rising trend has only been seen over the last few years. On the east coast, however there has been a rising trend since the mid 1970s. In 2003 there were record high annual temperatures in several parts of Greenland.

Precipitation
Recorded precipitation in Greenland decreases with rising latitude and from the coast to the inland area. Particularly for southern stations there is considerable seasonal variation.

In the extreme south and particularly in the south-eastern region, precipitation is significant, average annual precipitation ranging from 800 to 2,500 mm along the coasts. Further inland, towards the ice sheet, considerably less precipitation is recorded. In the northern regions of Greenland there is very little precipitation, from around 250 mm down to 125 mm per year. In a few places there are arctic deserts, i.e. areas that are almost free of snow in winter, and where evaporation in summertime can exceed precipitation.

Not surprisingly, snow is very common in Greenland. In fact, at most stations in the coastal region it can snow all year round without snow cover necessarily forming. There are thus many days with snow during the year, mostly in the southern part of the country. The snow depth is greatest in southern Greenland, averaging from one to more than two metres in all the winter months and sometimes reaching up to six metres. In southern Greenland the snow cover can disappear altogether during the winter in connection with warm Foehn winds.

Towards the north, snow cover has already formed in most places by September and normally disappears again in June/July.

Hours of sunshine
The part of Greenland north of the Polar Circle, 66.5°N, has midnight sun and polar night of varying length depending on the latitude. Midnight sun means that the sun is in the sky 24 hours a day, while polar night means that the sun does not rise above the horizon at all.

Despite the polar night, the northern stations have more hours of sunshine than the southern stations. This is due to the "long" day, of course, but also to generally less cloud cover. However, although the surface of the soil receives more solar heat than in the tropics at around the summer solstice because of the long day, a considerable part of the energy is reflected because of the oblique angle of incidence and the snow-and-ice-covered surfaces.

2.2.5 Economy
Principal income for the Home Rule Government comes from transfers from the Danish state - the so-called block grant. In addition, the Landsstyre and the municipalities have revenue from personal and corporate taxes, indirect taxes, and licences. There is no VAT. In addition, Greenland receives payment from the EU for access by EU fishermen to Greenland's fishing waters.

Greenland uses the Danish currency, and Danish currency laws apply in connection with the transfer of funds between Greenland and other countries. This means that, in several areas, Greenland is affected by factors, e.g. interest and exchange rates that are determined by external factors.

Exports
93% of Greenland's exports of DKK 2,285 mill. in 2003 consisted of fish products, 60% of which were prawns. The export value of fish products is heavily dependent on the prices on the world market. Although there was a considerably greater production of prawns in 2003, falling prices on the world market considerably reduced the export value.

Imports
Apart from fishery and hunting products, only a few goods are made in Greenland. Imports therefore include primarily all goods used in households, businesses and institutions, and for investment. In 2003 imports amounted to DKK 3,031 mill.

2.2.6 Energy

As in other modern societies, a large part of Greenland's CO_2 emissions come from energy production and supply. Approximately 55% of all energy consumption is used for heating and electricity.

Because of the big distances between towns in Greenland it is neither financially nor technically viable to establish a supply grid connecting them. This means that each town has its own power plant or CHP plant, and each settlement has its own power plant - so-called island operation. At the same time, the climatic conditions mean that the towns cannot tolerate lengthy interruptions in their electricity supply. It is therefore also necessary to have reserve and emergency plants.

Renewable energy
Up to 1993 all energy production for electricity and district heating was based on diesel-driven power, heating and CHP plants. From 1993, when the hydropower station at Buksefjord went into operation, the capital Nuuk, where around 25% of Greenland's population live, has been supplied with hydroelectricity for electric heating, lighting, and power. A small hydropower plant in east Greenland started operation in 2005, and a hydropower plant in south Greenland is currently being constructed.

Together with heat utilisation from waste incineration plants, this means that in 2001 about 8% of Greenland's energy consumption (incl. transport, industry, etc.) came from renewable energy sources.

Regular studies have been carried out with a view to utilising other renewable energy sources, but for various reasons, including the high requirements concerning security of supply, the forms of energy utilisation in question have not been of interest so far in Greenland.

Heating
Since 1993 all buildings built with public subsidies in Nuuk have been supplied with electric heating, and

electric boilers with interruptible electric heating have been installed in existing district heating stations. The electric boilers operate as long as surplus electricity is available. When it is not, the oil boilers take over. The electricity for this is supplied at a competitive price. In 2002, 38% of all electricity produced in Greenland went to permanent and interruptible electric heat in Nuuk.

In 10 towns the residual heat from electricity production is used for district heating. In addition, blocks of flats have their own individual heating plant, while most single-family houses have oil-fired central heating.

In settlements, most of the houses have a central heating furnace or oil stoves.

Electricity
Electricity in Nuuk and Tasiilaq comes from hydropower stations. The electricity in the other towns and settlements is produced at diesel-driven power plants. Work is going on to optimise the utilisation of the power plants.

2.2.7 Transport

Passenger transport
All passenger transport to and from Greenland is by air, via either Copenhagen-Kangerlussuaq or Copenhagen-Narsarsuaq. From Kangerlussuaq there is a connection via east Greenland to Iceland as well as from Narsarsuaq to Reykjavik in the summer.

Between towns and settlements in Greenland, passenger transport is by passenger ship, aeroplane, or helicopter. Up through the 1990s both sea and air passenger traffic increased. The need for flexible and rapid transport between towns has increased parallel to developments in society, and this has led to an increase in the consumption of petrol.

There are bus services in the larger towns, while in the smaller ones, passenger transport is by taxi. To get out into surrounding areas people usually use sailing boats and dinghies. There are around 5,000 dinghies in Greenland. The use of private cars, which is not deemed to have much effect on Greenland's CO_2 emission, is increasing. In 1990, 1,410 ordinary cars were registered by private owners, while in 2001, the figure rose to 2,097 - a 50% increase.

Goods transport
Almost all goods transport, both to and within Greenland, is by sea. A small proportion, mainly mail and perishable goods, is transported by air. Increased coordination of passenger and goods transport by sea is being considered at regional level. Efficient and flexible transport of goods and passengers contributes to economic growth, increased employment, and foreign-exchange earnings. Therefore this is essential for developing society.

2.2.8 Industry

The principal industry in Greenland is fishing/fisheries, both with regard to export revenues and employment. In 2001 the fishing fleet and the land-based production facilities for fish, crabs and prawns accounted for about 30% of Greenland's entire energy consumption. Consumption is based mainly on fossil fuels (diesel oil, petrol and benzene). The industry is very sensitive to market fluctuations and it is therefore difficult to predict how it will develop.

TABLE 2.15. INCREASE IN HOUSING 1999-2003, BY MUNICIPALITY
Source: Statistics Greenland

	Total	1999	2000	2001	2002	2003
Total	**930**	**191**	**83**	**239**	**185**	**232**
Nanortalik	35	9	2	19	2	3
Qaqortoq	43	4	4	16	-	19
Narsaq	30	22	1	2	1	4
Paaamiut	-	-	-	-	-	-
Nuuk	376	6	4	144	122	100
Maniitsoq	45	25	2	14	2	2
Sisimiut	140	55	37	3	11	34
Kangaatsiaq	13	-	-	1	3	9
Aasiaat	41	16	8	-	12	5
Qasigiannguit	2	-	-	-	-	22
Ilulissat	77	11	12	19	14	21
Qeqertarsuaq	14	8	5	-	1	-
Uummannaq	30	10	1	2	12	5
Upernavik	38	17	-	9	2	10
Qaanaaq	13	3	6	2	-	2
Ammassalik	29	5	1	4	3	16
Illoqqortoormiut	4	-	-	4	-	-

A large part of the rest of trade and industry consists of service enterprises. Except for electricity and district heating, energy consumption and CO_2 emissions are not calculated separately for this part.

Exploration for raw materials (oil and minerals) is being carried out in Greenland continuously. If large-scale extraction and production are started up at some time in the future, this could have a dramatic effect on Greenland's CO_2 emissions.

There do not appear to be any enterprises using industrial gases in their production. Small amounts of potent greenhouse gases are used in refrigeration. In recent years these have been phased out on a voluntary basis.

2.2.9 Waste

Approximately 30,000 tonnes of waste are produced in Greenland each year. Six incineration plants in towns incinerate about 70% of the waste, while 47 small incineration plants in settlements together incinerate 13%. Much of the residual heat from the six incineration plants in towns is used for district heating. The possibilities for reducing the quantity of waste sent to landfills/burnt are being investigated.

2.2.10 Buildings and infrastructure

As at 1 January 2004 there was a total of 20,928 dwellings in Greenland with an area of 1,379,633 m^2. The average dwelling is 63.8 $m^2$and this figure is rising. Most dwellings are situated in the few large towns.

About 200 new dwellings per year are being built. However, as can be seen from Table 2.5 below, the increase in dwellings fluctuates considerably from year to year.

The public sector plays a very important role in the housing sector. Most housing is government housing or built with a government grant. Grants are available for housing built by the owners themselves, cooperative housing, private housing, as well as municipal rental housing. The public sector also subsidises renovation and improvements to private dwellings. For example insulation and replacement windows are initiatives which will lead to reductions in energy consumption by the dwelling. A large proportion of the houses are more than 15 years old, and a refurbishment programme has been initiated. This modernisation includes reducing the energy consumption of individual houses.

2.2.11 Agriculture

Geographically, Greenland's agriculture is placed in the south and has a very limited impact on CO_2 emissions. It consists mainly of sheep farming, as can be seen from Table 2.16. In Greenland in 2003 there was a total of 59 livestock herds, with 57 sheep herds and 2 herds of domestic reindeer. The number of sheep has remained relatively constant since 1990, whereas the number of domesticated reindeer has more than halved. Since 1990 the area farmed has grown by 89%. The increase in the area farmed is due to cultivation of a large quantity of coarse fodder.

TABLE 2.16. AGRICULTURAL AREA AND NUMBER OF SHEEP AND DOMESTIC REINDEER IN GREENLAND, 1990 AND 2003

Source: Statistics Greenland, Home Rule Government, and Nunalerinermut Siunnersorteqarfik/consultancy service for agriculture

	1990	2003
Agricultural area (ha)	460	870
Sheep (total)	19,929	19,242
Domestic reindeer (total)	6,000	3,100

2.2.12 Forestry

There is no forestry in Greenland apart from four experimental plantations with conifers, with a total area of 130 ha.

2.3 THE FAROE ISLANDS

2.3.1 Form of government and structure of administration

The Faroe Islands have home rule status, and their internal affairs are governed by the Faroese parliament (the Lagting). The Faroe Islands are not a member of the EU.

International agreements entered into by the Danish government cover the Faroe Islands and apply to them to the same extent, unless the Faroese government specifically requests exemption or deviation from them.

Denmark's ratification of the Climate Convention covers the Faroe Islands as well, but at the request of the Faroese government, geographical exemption was taken for the Faroe Islands in connection with Denmark's ratification of the Kyoto Protocol.

2.3.2 Population

In 2003 the Faroe Islands had a population of 48,214 - an increase of 6,000 since 1977. Net immigration was relatively small up to the beginning of the 1980s but increased relatively sharply in the years 1984-89 as a consequence of a high level of economic and employment activity. In the years 1990-1995 this picture changed to extensive emigration due to a serious deterioration in the economic and employment situation. In 1993 and 1994 alone, net emigration corresponded to 8% of the total population. Since 1996, the population has been growing. In 2003 the capital, Thorshavn, had a population of 18,684, corresponding to slightly less than 40% of the entire population.

2.3.3 Geography

The Faroe Islands consist of 18 small, mountainous islands situated in the North Atlantic at about 62°N and 7°W. The islands extend over 113 km from north to south and 75 km from east to west, and the total area is 1,399 square kilometres. The highest points, almost 890 metres above sea level, are on the northern islands. 17 of the islands are inhabited.

2.3.4 Climate

The climate on the Faroe Islands is strongly affected by the warm North Atlantic current and frequent passage of cyclones, which, depending on the location of the polar front, mainly come from southwest and west. The climate is characterised by mild winters and cool summers and the weather is often moist and rainy.

The high pressure over the Azores sometimes shifts towards the Faroe Islands. This can result in stable summer weather lasting several weeks, with quite high temperatures. In winter, on the other hand, the low pressure systems can move more southerly around the islands than normal, bringing in cold air from the north and a lengthy period of sunny winter weather.

The maritime climate is also a result of the cold east Iceland current (polar current), which splits into two currents from eastern Iceland towards the Faroe Islands. The mixing of the water masses from this and the warm Gulf Stream causes a relatively big difference in the sea temperatures around the islands, and this in turn causes local variations in the climate.

Atmospheric pressure

The normal atmospheric pressure at sea level in Thorshavn is 1008 hPa on an annual basis, lowest from October to January (1004-1005 hPa) and highest in May (1014 hPa). The lowest atmospheric pressure recorded was 930.3 hPa on 11 January 1993, and the highest was 1048.9 hPa recorded on 13 December 1995. The islands have long periods with both low pressure and high pressure.

The Faroe Islands lie close to the normal cyclone paths over the North Atlantic, and big and frequent changes in atmospheric pressure, with rises and falls of 20 hPa within 24 hours are common throughout the year. Sometimes, however, such violent cyclones develop that pressure falls of more than 80 hPA/24 hours occur.

Temperature
The annual mean temperature in Thorshavn is 6.5°C. The temperature in January and February is around 3.5°C, and in July and August, around 10.5°C. The annual mean temperature varies from place to place and is lowest at Vága Floghavn, 6.0°C, and highest in Sandur on the island of Sandoy, 7.0°C.

In the 1990s the temperatures in Thorshavn exhibited a slightly rising trend.

Precipitation
Annual precipitation in Thorshavn is 1284 mm, most in autumn and least in summer. There are big geographical variations in precipitation, mainly due to the topography of the islands.

It rains a lot on the Faroe Islands. Indeed, the Hvalvík has as much as 300 days with precipitation, and Thorshavn, 273 days. In the winter, precipitation is often in the form of snow. On average, Thorshavn has 44 days of snowfall per year, mostly in December and January. There is no snow at all in June, July, and August, but there can be snow in September.

Since the mid 1970s, precipitation in Thorshavn has been roughly stable.

Hours of sunshine, cloud cover and relative humidity
Thorshavn has 840 hours of sunshine per year, most in May and June, the average being around 125 hours. In some Decembers there are no hours of sunshine at all. The highest number of hours of sunshine in a calendar month was 232 hours, observed in May 1948 and in May 2000.

The location in the North Atlantic, combined with frequent low-pressure fronts, results in a large number of cloudy days (>80% cloud cover) - 221 days in Thorshavn.

The number of hours of sunshine in Thorshavn has remained stable for the last 20 years, but with a slightly increasing trend in the most recent part of the period.

The Faroe Islands have a moist climate, and the relative humidity is very high, 88% on an annual basis in Thorshavn. It is highest around August, and this is also when most fog occurs.

Wind
The mean wind is generally high on the Faroe Islands, particularly in autumn and winter (6-10 m/s). The wind is normally lightest in summer (4.5-6 m/s). There are normally no storms from April to August, while

autumn and winter are windy, with many storms, some of which can reach hurricane force.

The highest 10-minute mean winds are about 50 m/s, recorded at Mykines Lighthouse in March 1997 and January 1999. In 1997, gusts of almost 67 m/s were recorded at Mykines Lighthouse.

Although the weather is generally windy, there are also still periods, mostly in summer and mostly of short duration.

2.3.5 Economy

The rapid growth in the Faroese economy since 1995 reversed in 2003. The balance of trade for 2003 shows a deficit of DKK 733 mill. Compared with a surplus of DKK 339 mill. in 2002, a drop of DKK 1,072 mill. in just one year

About 80% of exports from the Faroe Islands go to EU countries. Of this, Denmark accounts for 25% and the UK slightly less. In 2002 the Faroe Islands' GDP was DKK 10.2 billion.

In the last few years, the Faroe Islands have turned a net foreign debt into a net credit balance, although with a big difference between the private and the public sector. At the end of 2001 the private sector had a net credit balance of more than DKK 6 billion, while the public sector's net foreign debt stood at DKK 1.9 billion. Unemployment has fallen sharply in the last few years and in 2003 was around 3%, although it rose to 4% in mid 2004 as a result of less favourable economic trends. Table 2.17 shows the development and breakdown by trade and industry, measured in gross national product at factor cost.

The surplus on the balance of payments, which, besides the balance of trade, includes services, wages, interest, transfers from the Danish state and "Danmarks Nationalbank", fell in 2002 by about DKK 200 mill. compared with 2001. One explanation is less transfers from abroad as a result of the reduction in the block grant from 1 January 2002. The balance of payments is expected to be much worse in 2003 as a result of the trend in the balance of trade.

The Faroe Islands use the Danish currency and are part of the Danish

Table 2.17 Gross national product at factor cost 1998 - 2002, breakdown by sector

Source: The Office of the Danish Chief Administrator in the Faroe Islands (2004)

	1998	1999	2000	2001	2002
	DKK mill.				
Non-financial companies	3,960	4,399	4,703	5,378	5,580
Financial companies	320	301	380	358	357
Public administration and service	1,322	1,417	1,535	1,697	1,866
Domestic and NPISH[1]	990	1,089	1,198	1,477	1,563
Indirect measured financial services	-334	-350	-383	-356	-361
Total	**6,258**	**6,856**	**7,433**	**8,554**	**9,005**

[1] NPISH: Non-profit institutions for households, Source: Hagstova Føroya

currency area, although they have their own notes.

2.3.6 Energy

The joint municipal company SEV is responsible for the production and sale of electricity on the Faroe Islands. In 2003 production amounted to about 249 mill. kWh cf. Table 2.18. Of this, about 34% was based on hydroelectricity, while the remainder was produced at diesel-driven plants. There is not much electricity production based on wind power - only 1.2% or 3 mill. KWh in 2003. There are currently plans to expand wind energy to a total of about 4 MW, at the same time annual production from wind energy is expected to reach about 9.8 mill. kWh.

Sales of electricity in 2003 were distributed between 31% for domestic users, 34% for industry, agriculture and fisheries, and 13% for the service sector, with the remainder for street lighting etc.

Since a number of oil finds in British territorial waters close to the Faroese border in the 1990s, there has been a reasonable presumption that there is oil in Faroese territory, and the first licensing round was held in the spring of 2000. The first licences for exploration and production of hydrocarbons in the subsoil off the Faroe Islands were granted in August 2000. The first three exploration wells were drilled in 2001, and a further well in 2003. In one of these, oil and gas were found. An evaluation programme is now being carried out to determine whether this find is commercially viable.

TABLE 2.18 ELECTRICITY PRODUCTION 1999-2003 (GWH)
Source: The Office of the Danish Chief Administrator in the Faroe Islands (2004)

	1999	2000	2001	2002	2003
Hydropower	70.2	76.0	76.0	95.9	85.7
Diesel power	130.6	136.4	154.8	143.2	160.3
Wind power	0.6	0.5	0.5	0.6	3.0
Total	**201.4**	**212.9**	**231.3**	**239.7**	**249.0**

2.3.7 Transport

Goods transport between the Faroe Islands and the rest of the world is mainly by sea. Two Faroese shipping companies operate freighter services all year round. Since 1998, the Smyril Line has carried freight in connection with their passenger winter sailings to Denmark. The Icelandic company EMISKIP also operates freight services throughout the year and has an office on the Faroe Islands.

Besides Vágar Floghavn, the Faroe Islands have 12 helicopter pads. Air services are provided by MAERSK AIR, ICELAND AIR and the Faroese company ATLANTIC AIRWAYS. The number of air travellers to and from the Faroe Islands has risen sharply in the last few years.

Passenger transport by sea takes place mainly in the summer period. There are both regular services (Smyril Line) and cruise liners. The number of foreign passenger ships calling at the Faroe Islands has been increasing in recent years.

For 20-30 years up to the beginning of the 1990s and again over the last few years, major investments have been made in enlarging and modernising the transport infrastructure on the islands and the communication links with the outside world. Constructing roads, tunnels, and harbours is costly because of the difficult topographical conditions. Since an economic downturn at the beginning of the 1990s, the number of motor vehicles has increased by almost 1,000 per year since 1995 and in 2003 there were 23,220 motor vehicles, of which about 17,000 were cars and 3,900 lorries and vans.

2.3.8 Industry

Excluding exports of ships, which vary considerably over the years, 98% of the Faroe Islands' export earnings come from fish and fish products. The fishing industry is therefore of vital importance to earnings and employment on the Faroe Islands. The limited opportunities in other sectors of industry reinforce still further the totally dominant role of the fishing industry. Small villages in particular are almost entirely dependent on fisheries. In 2001 more than 27% of total wages on the Faroe Islands came from the fishing industry. Today, the number of man-years in the fishing fleet itself is estimated to be about 2,000.

Besides the actual fish industry, a number of workshops and industrial enterprises have been built up to make equipment etc. for fishing vessels and the fisheries industry. This group includes shipyards and firms making fishing tackle, and machines and equipment for filleting factories.

The absence of a large domestic market, high transport costs for raw materials and finished goods, and - in an international context - a relatively high level of overall costs have hitherto prevented the Faroe Islands from establishing export-oriented industries apart from the fishing industry and the firms supplying it.

To a certain extent, the Faroese government grants loans to small businesses – particularly in outlying areas. Finally, the government has provided widespread guarantees for loans to businesses.

2.3.9 Buildings and urban structure

For many years, the Faroese authorities have made every effort to counteract migration from the small or isolated villages and islands, in particular through a major road-building programme and other transport measures. However, population development is generally poorer in these outlying areas than in other parts of the country.

Housing is predominantly single-family houses, most of which are relatively large and of high standard.

2.3.10 Agriculture

Until the end of the nineteenth century, farming was the Faroe Islands' main industry, but with the economic and industrial development since then, particularly within fisheries, farming today accounts for only 0.3% of the Faroe Islands' gross national income at factor cost.

With a view to increasing the self-sufficiency of the Faroe Islands, the government is providing grants for investments in farming.

With about 5% of the land under cultivation, the Faroe Islands can supply just over half of its total demand for lamb and mutton, most of its demand of milk, half of the demand for potatoes, quarter of the demand for eggs, and a small fraction of demand for beef. In 2003 the Faroe Islands had about 1,200 dairy cows and about 70,000 sheep.

2.3.11 Forestry

There is no commercial forestry on the Faroe Islands, but there are a number of plantations on the islands, which are maintained by the Faroese forestry authority.

3 Greenhouse gas inventory information

3.1 Greenhouse gas inventories

Denmark's greenhouse gas inventories are prepared in accordance with the guidelines from the Intergovernmental Panel on Climate Change (IPCC) and are based on the methods developed under the European CORINAIR programme.[1]

The Danish emission inventories follow the method described in CORINAIR's guidelines[2] and IPCC's guidelines[3]. In accordance with the latter guidelines, some of the default methods and emission factors have been modified so that they reflect better Danish conditions.

A description of methods, emission factors and activity data is given in Denmark's national emission inventory reports (NIR)[4] to the Climate Convention, which also include data in the common reporting format (CRF). The latest NIR and the latest combined Danish inventory of greenhouse gases and other air pollutants can be seen at the National Environmental Research Institute's website[5] and in Illerup et al, 2005.

Greenhouse gas inventories for Greenland and the Faroe Islands are included in the national emissions inventory reports to the Climate Convention.

3.2 Denmark's emissions and removals of greenhouse gases

Denmark's emission of the greenhouse gases CO_2 (carbon dioxide), CH_4 (methane), N_2O (nitrous oxide), and the so-called potent greenhouse gases (F gasses), which include HFCs (hydrofluorocarbons), PFCs (perfluorocarbons), and SF_6 (sulphurhexafluoride) during the period 1990-2003 are shown in Figures 3.1-3.4 aggregated into the IPCC's 6 main sectors and the most relevant sub-sectors. Denmark's total greenhouse gas emissions measured in CO_2 equivalents on the basis of the potential of each gas for global warming is shown together with the distribution with respect to gas and source/sector in Table 3.1 and Figures 3.5 and 3.6 respectively. The development in 1990-2003 broken down by sources from Table 10 of the CRF are shown in Annex A.

3.2.1 Carbon dioxide, CO_2

Almost all CO_2 emissions come from combustion of coal, oil and natural gas at power stations and in residential properties and industry, although road transport also contributes a considerable proportion.

The relatively large fluctuations in the emissions from year to year are due to trade in electricity with other countries - primarily the Nordic countries. The large emissions in 1991, 1994, 1996, and 2003 are due to large electricity exports.

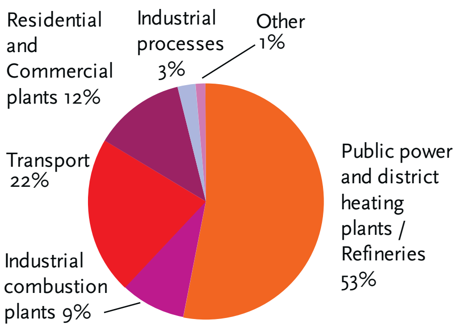
From 1990 to 1996, emissions showed a rising trend, but they have fallen since 1997 because many power stations have changed their fuel mix from coal to natural gas and renewable energy. As a result of the reduced use of coal in recent years, most of the CO_2 emissions now come from combustion of oil.

Emissions from road transport in 2003 accounted for approx. 22% of the total CO_2 emissions.

In 2003, total actual CO_2 emissions inventoried under the Climate Convention, excluding land-use change and forestry (LUCF), were 12% higher than in 1990. If LUCF is included, net emissions were 10% higher. Corrected for exchange of electricity with other countries and annual temperature variations, CO_2 emissions dropped 13% with and 15% without LUCF during the same period.

Figure 3.1: CO_2 emissions by sector ans development in 1990-2003

Source: The National Environmental Research Institute (NERI)



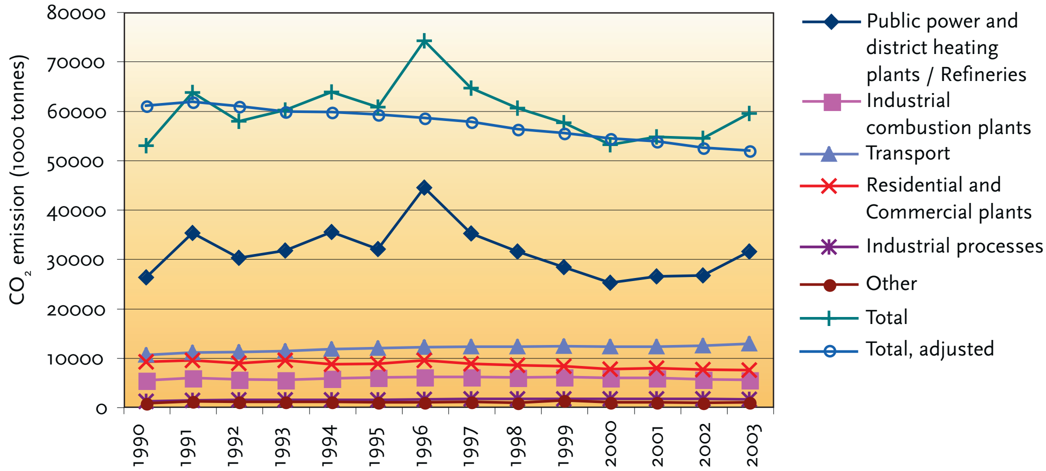
3.2.2 Methane, CH_4

Anthropogenic methane (CH_4) emissions primarily stem from agriculture, landfills, and the energy sector, among which agriculture contributes the most by far.

The emissions from agriculture are due to the formation of methane in the digestive system of farm animals (enteric fermentation) and manure management.

Emissions of methane from landfills are decreasing, because the production of methane has fallen year by year since the abrupt fall in landfilling in 1997.

Emissions of methane from the energy sector have been increasing due to an increased use of gas-driven engines, which emit large amounts of methane compared to other combustion technologies. However, all other



things remaining equal, these emissions are expected to be reduced by 5% from 2006, when new emission limits for existing gas-driven engines come into force pursuant to Statutory Order No. 720 of 5 October 1998 on the limitation of emissions of nitrogen oxides, unburned carbon hydrides and carbon monoxide from gas motors and gas turbines.

In 2003, total methane emissions were 3% above the 1990 level.

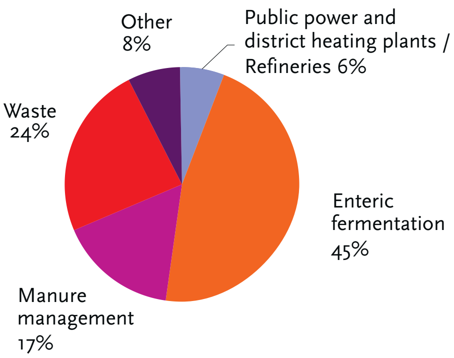
3.2.3 Nitrous oxide, N_2O

Agriculture constitutes the largest source by far of nitrous oxide (N_2O) emissions, since N_2O can be formed in the ground, where bacteria convert nitrous compounds from fertilizer and manure. Bacterial conversion of nitrogen also occurs in drain water and coastal water. This nitrogen largely comes from agriculture's use of fertiliser, and emissions from these sources are therefore included under agriculture. From 1990, N_2O emissions from agriculture had dropped 30% due to the reduced use of commercial fertilizers and more efficient use of manure. From 1990, N_2O emissions from agriculture had dropped 30%[f] due to the reduced use of commercial fertilizers and more efficient use of manure. A small share of the nitrous oxide emissions originates from power and district heating plants, and cars with catalytic converters.

In 2003, total nitrous oxide emissions were 25% below the 1990 level.

Figure 3.2 CH4 emissions by sector and development in 1990-2003

Source: The National Environmental Research Institute (NERI)



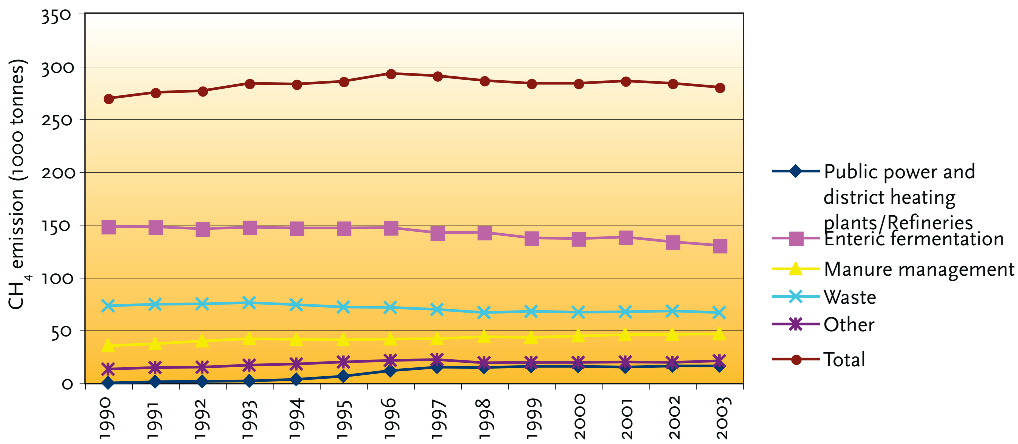
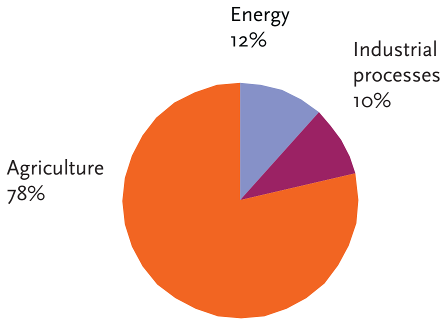


FIGURE 3.3 N_2O EMISSIONS BY SECTOR AND DEVELOPMENT IN 1990-2003

Source: The National Environmental Research Institute (NERI)



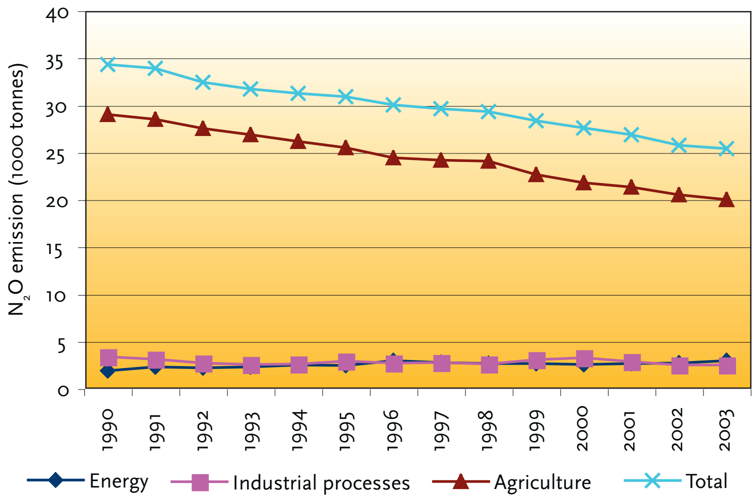
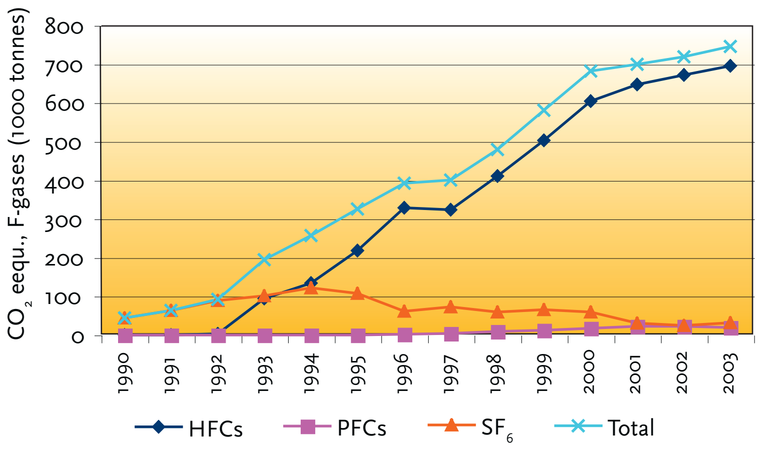


FIGURE 3.4 DEVELOPMENT IN HFC, PFC, AND SF_6 EMISSIONS IN 1990-2003

Source: The National Environmental Research Institute (NERI)



3.2.4 The potent greenhouse gases HFCs, PFCs, and SF_6

The contribution of the potent greenhouse gases, also known as F-gases (HFCs, PFCs and SF_6), to Denmark's total emissions of greenhouse gases is relatively modest. However, the emissions of these gases rose strongly during the 1990s. Collection of data on the consumption of these substances started in the mid 1990s. Therefore, F-gas data and emissions inventories from before 1995 are somewhat less certain than in 1995 and later. In accordance with the Kyoto Protocol, Denmark has selected 1995 as the base year for the F-gases.

The HFCs, which are primarily used in the refrigeration industry, are the biggest contributor to F-gas emissions. From 1995 to 2003 annual HFC emissions increased from 218,000 to 695,000 tonnes of CO_2 equivalents. PFC emissions rose in the same period from 1,000 to 19,000 tonnes CO_2 equivalents, however with a slight fall in 2003 compared to 2002. SF_6 emissions dropped by 71% from 107,000 to 31,000 tonnes of CO_2 equivalents in the period.

Total F-gas emissions rose by 129% from 1995 to 2003.

Table 3.1 Danish greenhouse gas emissions and removals by gas and source and sink categories in 1990 - 2003

Source: The National Environmental Research Institute (NERI)

GREENHOUSE GAS EMISSIONS	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	CO_2 equivalent (Gg)													
Net CO_2 emissions/removals	53045	63446	57503	59594	63333	60375	73613	64081	59590	56653	54858	53457	52812	58124
CO_2 emissions (without LUCF)	52887	63559	57755	60060	63663	60609	74035	64524	60409	57523	53076	54615	54288	59329
CH_4	5684	5785	5819	5994	6008	6108	6226	6099	6042	5953	5941	6029	5954	5873
N_2O	10713	10584	10125	9924	9778	9657	9379	9248	9149	8843	8615	8380	8035	8060
HFCs	0	0	3	94	135	218	329	324	411	503	605	647	672	695
PFCs	0	0	0	0	0	1	2	4	9	12	18	22	22	19
SF_6	44	64	89	101	122	107	61	73	59	65	59	30	25	31
Total (with net CO_2 emissions/removals)	**69487**	**79879**	**73539**	**75707**	**79376**	**76466**	**89610**	**79830**	**75260**	**72030**	**70095**	**68566**	**67521**	**72804**
Total (without CO_2 from LUCF)	**69328**	**79992**	**73791**	**76173**	**79706**	**76700**	**90033**	**80273**	**76079**	**72900**	**68314**	**69724**	**68996**	**74008**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	CO_2 equivalent (Gg)													
1. Energy	52390	63065	57130	59545	63309	60415	73998	64267	60148	57345	52802	54458	54121	59318
2. Industrial Processes	2155	2258	2292	2359	2433	2604	2673	2862	2905	3070	3259	3191	3095	3129
3. Solvent and Other Product Use	317	305	292	280	268	242	265	262	195	192	212	130	151	206
4. Agriculture	12845	12720	12429	12307	12052	11845	11526	11357	11368	10806	10565	10470	10138	9898
5. Land-Use Change and Forestry (LUCF)	158	-113	-252	-466	-330	-234	-422	-443	-819	-870	1782	-1158	-1476	-1204
6. Waste	1622	1645	1648	1683	1645	1593	1570	1525	1463	1487	1475	1475	1492	1457
7. Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0

3.2.5 Denmark's total emissions and removals of greenhouse gases

Table 3.1, figures 3.5 and 3.6 show the development in Denmark's greenhouse gas emissions and removals as CO_2 equivalents and by gases and sources according to the guidelines on reporting of summary information under the Climate Convention. CO_2 is the most important greenhouse gas followed by N_2O and CH_4. From 1996, when total emissions (excl. LUCF) corresponded to 90 mill. tonnes of CO_2 equivalents, there has been a general reduction until 2000, when total emissions corresponded to 68.3 mill. tonnes of CO_2 equivalents, whereas total greenhouse gas emissions corresponded to 74 mill. tonnes of CO_2 equivalents (excl. LUCF) in 2003. The increase of 7.3% from 2002 to 2003 is due to large exports of electricity to other Scandinavian countries in 2003. Of the total greenhouse gas emissions in 2003, CO_2 made up 80%, methane 8%, nitrous oxide 11%, and F-gasses 1%. If net contributions of CO_2 emissions by sources and removals by sinks from forests and soil are included (i.e. with LUCF), then net total Danish greenhouse gas emissions corresponded to 72.8 mill. tonnes of CO_2 equivalents in 2003.

As will be shown in section 3.4, this inventory according to regulations under the Kyoto Protocol implies certain changes with regard to base year and emissions by sources and removals by sinks in the land use and forestry sector (LUCF).

3.2.6 Danish emissions of indirect greenhouse gases and SO2

NO_X

The three largest sources of emissions of nitrogen oxide (NO_x) are transport, power and district heating plants and other mobile sources such as fishing vessels and agricultural vehicles. In 2003, the transport sector contributed 37% of total Danish NO_x emissions, which had fallen from approximately 300,000 tonnes in the mid 1980s to 200,000 tonnes in 2003 – a fall of 32%. The increased use of low-NO_x burners and de-NO_x units at power and district heating plants have reduced emissions from these plants. In addition, the increased number of cars fitted with catalytic converters has contributed to the trend in reductions.

CO

Road transport still accounts for the largest part of CO emissions despite a fall in CO emissions from this source due to the introduction of catalytic converters for vehicles in 1990. In addition, other mobile sources and combustion of wood by households are significant sources. Emissions of CO were reduced by 35% from 1990 to 2003.

NMVOC

The most significant emission sources of NMVOC are use of solvents, road traffic and other mobile sources. Total anthropogenic emissions of NMVOC were reduced by 39% from 1985 to 2003 – especially due to the increased number of cars fitted with catalytic converters and reduced emissions in connection with use of organic solvents.

SO_2

The greater part of all SO_2 emissions comes from combustion of coal and oil at power and district heating plants. Emissions of SO_2 have undergone a remarkable development - from 1980 to 2003 total emissions fell by 93%. The reason for this is primarily the installation of desulphurisation units at the large power plants as well as the use of fuels with low sulphur content for power stations, industry and the transport sector. From 2002 to 2003 there was however an increase of 23% because of large exports of electricity to Sweden and Norway. The extra electricity was primarily produced at the large coal-fired power plants.

FIGURE 3.5 DANISH GREENHOUSE GAS EMISSIONS BY TYPE OF GAS IN 1990 - 2003.
Source: The National Environmental Research Institute (NERI)

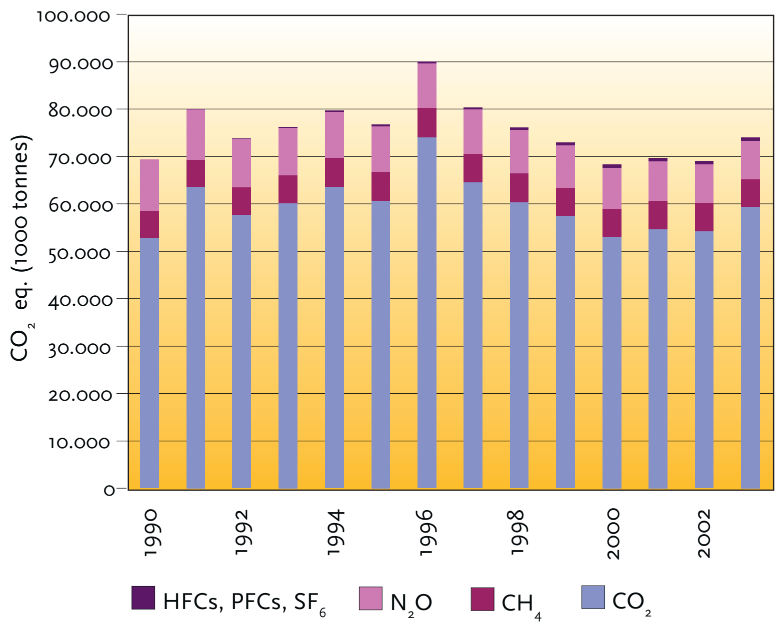


FIGURE 3.6 DANISH GREENHOUSE GAS EMISSIONS BY SOURCE/SECTOR IN 1990 - 2003
Source: The National Environmental Research Institute (NERI)

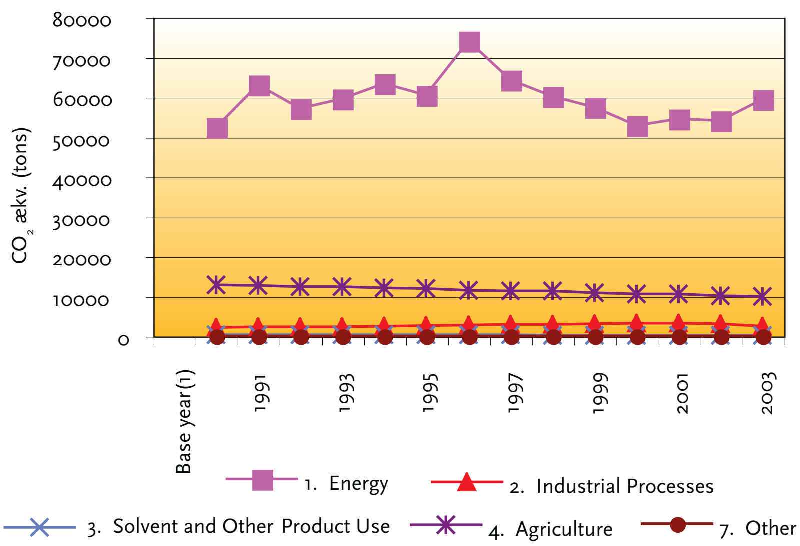
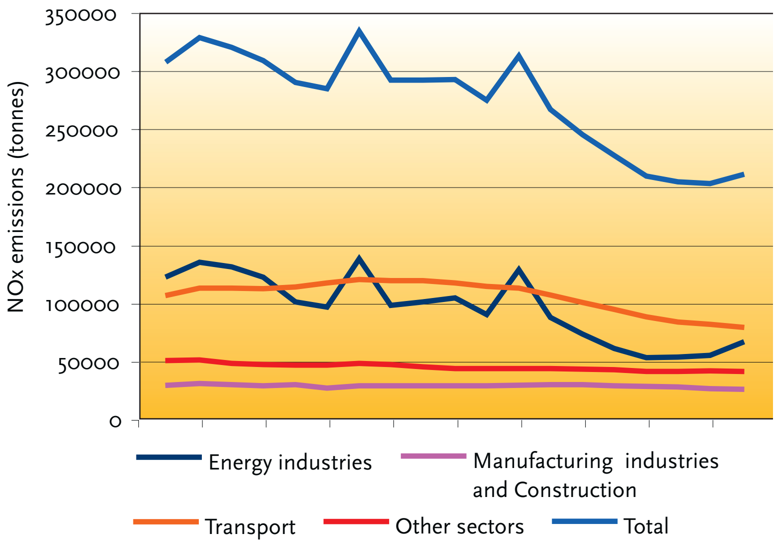


FIGURE 3.7: NO_x EMISSIONS BY SECTOR AND DEVELOPMENT IN 1985-2003

Source: The National Environmental Research Institute (NERI)



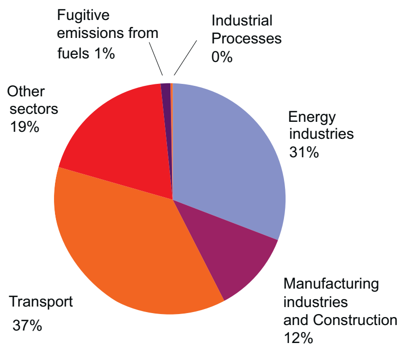
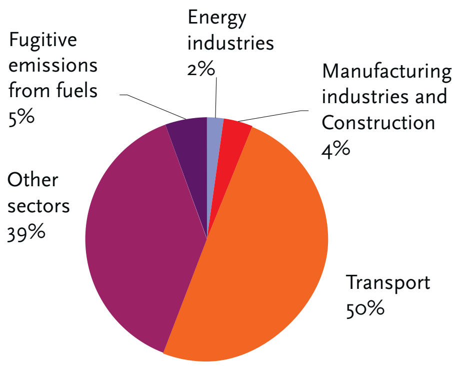
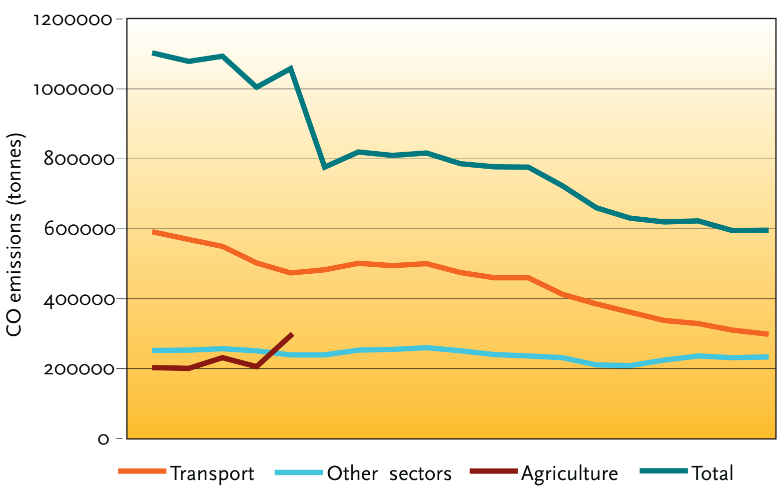


FIGURE 3.8: CO EMISSIONS BY SECTOR AND DEVELOPMENT IN 1985-2003

Source: The National Environmental Research Institute (NERI)



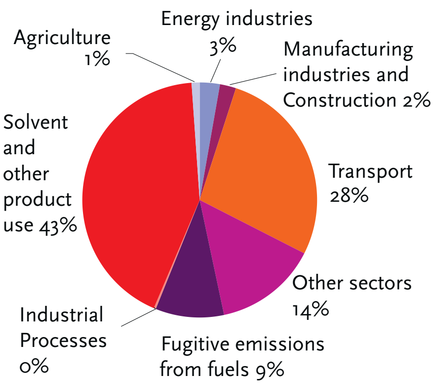


3.3 DENMARK'S, GREENLAND'S AND THE FAROE ISLANDS' TOTAL EMISSIONS AND REMOVALS OF GREENHOUSE GASES

The total inventories for Denmark, Greenland and the Faroe Islands (the Realm) are given in Table 3.2, and emissions from Greenland and the Faroe Islands are indicated under the box "Other". As will be seen, the Climate Convention's goal of reducing the level to the 1990 level by 2000 was reached in the inventory without CO_2 from land-use changes and forestry (LUCF) with a 1.4% decrease in emissions. Including CO_2 from LUCF the combined level for Denmark, Greenland and the Faroe Islands in 2000 was 0.9% above the level in 1990, because windfall in Danish forests in December 1999 resulted in increased CO_2 emissions in the year of forest statistics 2000.For the time being, the inventories from Greenland

FIGURE 3.9: NMVOC EMISSIONS BY SECTOR AND DEVELOPMENT IN 1985-2003

Source: The National Environmental Research Institute (NERI)



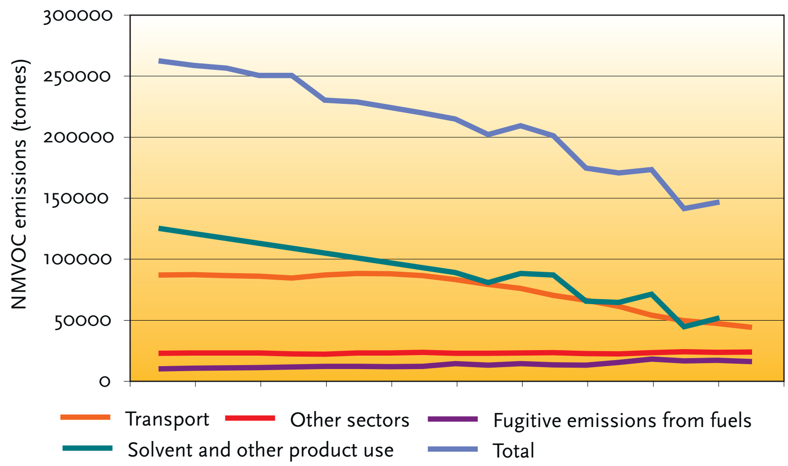
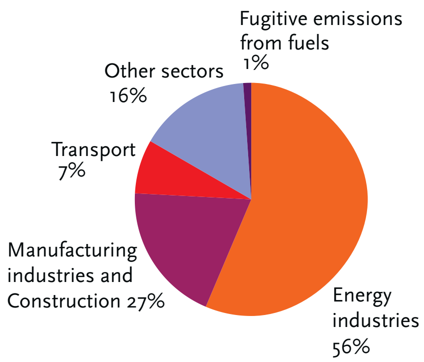
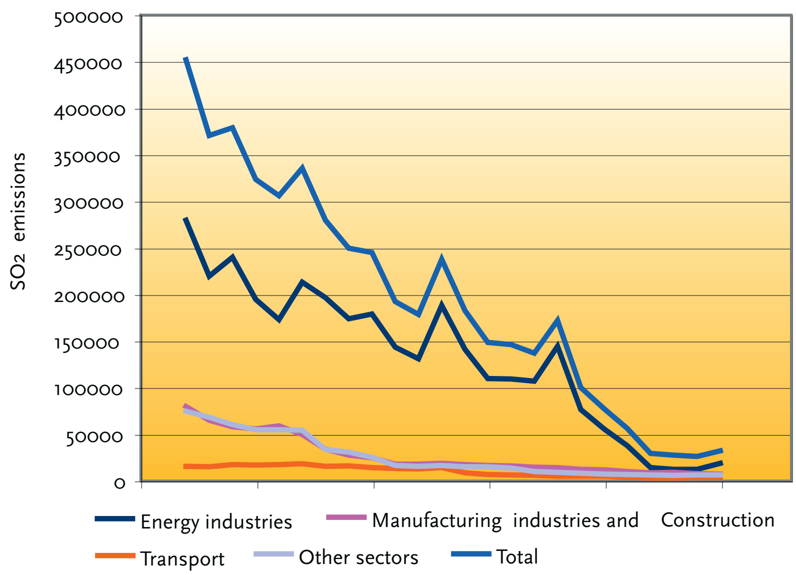


FIGURE 3.10: SO_2 EMISSIONS BY SECTOR AND DEVELOPMENT IN 1980-2003

Source: The National Environmental Research Institute (NERI)





contain only inventories of the CO_2 emissions from combustion of fossil fuels. However, this is regarded as by far the main source of greenhouse gases.

The inventories from the Faroe Islands contain not only the CO_2 emissions from fossil fuel but also the methane and nitrous oxide emissions from agriculture.

Table 3.2 Denmark's, Greenland's and the Faroe Islands' total emissions and removals of greenhouse gases, 1990 - 2003

Source: The National Environmental Research Institute (NERI).

GREENHOUSE GAS EMISSIONS	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	CO_2 equivalent (Gg)													
Net CO_2 emissions/removals	54378	64737	58747	60130	64371	61439	74755	65215	60756	57883	56216	54865	54180	59549
CO_2 emissions (without LUCF)	54220	64850	58999	60596	64701	61673	75177	65658	61575	58753	54434	56023	55656	60754
CH_4	5702	5804	5837	6012	6027	6127	6245	6119	6061	5973	5961	6049	5975	5894
N_2O	10736	10609	10149	9947	9803	9683	9404	9275	9175	8870	8645	8411	8066	8091
HFCs	0	0	3	94	135	218	329	324	411	503	605	647	672	695
PFCs	0	0	0	0	0	1	2	4	9	12	18	22	22	19
SF_6	44	64	89	101	122	107	61	73	59	65	59	30	25	31
Total (with net CO_2 emissions/removals)	**70860**	**81213**	**74826**	**76284**	**80457**	**77574**	**90796**	**81010**	**76471**	**73306**	**71504**	**70026**	**68940**	**74280**
Total (without CO_2 from LUCF)	**70702**	**81326**	**75078**	**76750**	**80788**	**77808**	**91219**	**81453**	**77290**	**74176**	**69722**	**71184**	**70416**	**75485**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	CO_2 equivalent (Gg)													
1. Energy	52390	63065	57130	59545	63309	60415	73998	64267	60148	57345	52802	54458	54121	59318
2. Industrial Processes	2155	2258	2292	2359	2433	2604	2673	2862	2905	3070	3259	3191	3095	3129
3. Solvent and Other Product Use	317	305	292	280	268	242	265	262	195	192	212	130	151	206
4. Agriculture	12845	12720	12429	12307	12052	11845	11526	11357	11368	10806	10565	10470	10138	9898
5. Land-Use Change and Forestry (LUCF)	158	-113	-252	-466	-330	-234	-422	-443	-819	-870	1782	-1158	-1476	-1204
6. Waste	1622	1645	1648	1683	1645	1593	1570	1525	1463	1487	1475	1475	1492	1457
7. Other	1374	1334	1287	577	1082	1108	1186	1180	1211	1276	1408	1460	1420	1477

As will be seen from Table 3.2, Greenland's and the Faroe Islands' greenhouse gas emissions are small compared with those of Denmark (each about 1% of the total emissions), and they have been almost constant since 1990.

3.4 SUPPLEMENTAL INFORMATION UNDER THE KYOTO PROTOCOL

3.4.1 National systems for greenhouse gas inventories pursuant to Article 5, Section 1 of the Protocol

Objectives
In pursuance of Article 5, Section 1 of the Kyoto Protocol, the Parties to the Protocol shall establish national systems for the estimation of greenhouse gas emissions. The objective of establishing the national systems is to ensure good quality inventories. This is achieved by following the IPCC Guidelines for planning, implementation and execution of the activities connected with the work on the greenhouse gas inventories. The national system must also ensure that the inventories are transparent, consistent, comparable, complete and accurate.

Organisation of work etc.
The Danish National Environmental Research Institute (NERI) is responsible for producing the Danish greenhouse gas emission inventories and the annual reporting to the UNFCCC. NERI is therefore the contact point for Denmark's national system for greenhouse gas inventories under the Kyoto Protocol. Furthermore NERI participates in work under the auspices of the UNFCCC, where guidelines for reporting are discussed and decided upon, as well as participating in the EU monitoring mechanism for inventories of greenhouse gases, where guidelines for reporting to the EU are regulated.

The work on the annual inventories is carried out in cooperation with other Danish ministries, research institutes, organisations and private enterprises. The most important partners for this work are shown in the following text box.

These partners provide a range of data that are needed to produce the inventory. NERI is therefore in the process of drawing up formal agreements that will ensure that NERI receives the necessary data on time.

Calculation methods
The Danish emissions inventory is based on the IPCC guidelines for calculation of greenhouse gas emissions (the Revised 1996 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories (Houghton et al., 1997) and the Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (Penman et al., 2000)) and the European CORINAIR (COoRdination of INformation on AIR emissions) program for calculation of national emissions. Generally, emissions are

calculated by multiplying the activity data (e.g. fuel consumption, number of animals or vehicles) by an emission factor (e.g. the mass of material emitted per unit of energy, per animal or per vehicle). Activity data are mainly based on official statistics. The emission factors are either national values or values recommended in the IPCC guidelines.

The Danish Energy Authority, the Danish Ministry of Transport and Energy:
Annual energy statistics that are compatible with the format used for emission inventories and fuel consumption data for large incineration plants.

The Danish Environmental Protection Agency, the Danish Ministry of the Environment:
Database on waste volumes and emissions for potent greenhouse gases (F gasses).

Statistics Denmark, the Danish Ministry of Economic and Business Affairs:
Statistical yearbook, sales statistics for industry, and agricultural statistics.

The Danish Institute of Agricultural Sciences, the Danish Ministry of Food, Agriculture and Fisheries:
Data on use of fertilizer, fodder, and nitrogen emissions from livestock.

The Danish Road Directorate, the Danish Ministry of Transport and Energy:
Number of vehicles grouped by categories corresponding to the EU classifications, kilometres travelled and speeds shown by town, main roads and motorways.

Forest and Landscape Denmark, the Royal Veterinary and Agricultural University, the Danish Ministry of Food, Agriculture and Fisheries:
Background data for forests and removals of CO_2 by forests.

The Civil Aviation Administration, the Danish Ministry of Transport and Energy:
Aircraft data (aircraft types and flight routes) for all flight departures and arrivals in Danish airports.

DSB, the Danish Ministry of Transport and Energy:
Fuel related emission factors for diesel locomotives.

Danish enterprises:
Environmental accounts and other information.

Important sources
Choice of calculation method for the individual sources depends among other things on how significant the source is. The sources that together accounted for 95% of greenhouse gas emissions in 2003 or accounted for 95% of the change in emission levels from 1990 to the most recently calculated year (2003) are defined as significant sources according to the IPCC guidelines. An analysis of the Danish sources shows that 21 sources account for 95% of total greenhouse gas emissions and that the three largest sources – that together account for 62% – are CO_2 from the combustion of coal at stationary incineration plants, CO_2 from road transport and CO_2 from combustion of natural gas at stationary incineration plants.

Procedure for recalculation
At the same time as the annual calculation of emissions for a new year takes place, any necessary recalculations of emission inventories from previous years are also carried out. Recalculations are made if errors or oversights are found or if better knowledge becomes available. If better knowledge becomes available, statistical data, improvements of method, activity data or emission factors are updated according to new knowledge and research. In order to ensure consistent emission inventories, recalculations will be carried out on the whole time series, as much as circumstances permit.

Uncertainty
Uncertainty in the greenhouse gas inventories is calculated as recommended in the IPCC guidelines and covers 93% of total Danish greenhouse gas (GHG) emissions. The result of the calculations shows that total GHG emissions were calculated to have an uncertainty of 46% and the increase in GHG emissions since 1990 was calculated to be 4.8% ± 19%. Uncertainty is greatest for N_2O emissions from agricultural land, whilst the uncertainty for CO_2 emissions from stationary incineration plants is only 8% and the uncertainty for the development is 1.8%.

Quality assurance and quality control
As part of the national system, NERI is drawing up a manual to use in quality assurance and quality control of the emission inventories. The manual contains precise and detailed guidelines on how to assure and control quality of the inventories. The quality plan described in the manual is based on the IPCC guidelines and ISO 9000, 9001, 9004 and 10005 standards. The objective of the quality planning is to ensure the quality of the inventories in a manner that optimises resources. The quality control includes routine checks of data correctness and completeness as well as ensuring that any possible errors and deficiencies are identified and corrected. All calculation methods are documented and all material concerning data, methods and recalculations is archived.

Reports are written for all sources of emissions that describe in detail and document the data and calculation methods used. These reports are evaluated by persons external to NERI who are experts in the area in question, but not directly involved in the inventory work. In addition, a project has been started in which the Danish calculation methods, emission factors and uncertainties are compared with those of other countries, in order to further verify the correctness of the inventories.

Annual reporting
NERI produces an annual report (National Inventory Report[4]) for the Climate Convention in which the results of the calculations are presented and the background data, calculation methods, plan for quality assurance and control, uncertainty and recalculations are described and documented. At the request of the Climate Convention, the report is evaluated each year by international experts. During the last few years, improvements have been made in the inventories' quality and documentation, as a result of the quality assurance and control procedures and the evaluations of national and international experts. The planned improvements can be found in section 3.4.2.

3.4.2 Information under Article 10(a) of the Protocol on improvements of emission inventories

Since Denmark's Third National Communication to the Climate Convention (NC3) a number of improvements have been made to the Danish greenhouse gas emission inventories in terms of methodology used, emission factors, and documentation. On evaluation of NC3, certain deficiencies were pointed out in the Danish inventories, including lack of an inventory for emissions for waste water treatment and certain industrial processes, as well as a lack of organisation of the industrial incineration plants into subsectors. These deficiencies have now been corrected to a large degree, and only few improvements are planned that will influence the actual level of the greenhouse gas inventory. Before the next report for April 2006 CO_2 emissions from the use of lime and limestone in flue gas desulphurisation, production of expanded clay and production of sugar will be included in the inventories. These sources are expected to contribute approximately 0.2% of the total greenhouse gas emissions. Improved and more detailed inventory methodologies will be developed for agricultural machinery and fisheries, and the issue of whether the data basis for calculating CH_4 from landfills can be improved will be considered. These improvements are not expected to change the scale of the total greenhouse gas emissions.

Furthermore, overall focus will be on improving procedures for quality assurance and control and on improving documentation of the national emission factors.

Notes

1 A detailed description of the CORINAIR system used for Danish emissions inventories is given in Illerup et al. 2000 and Winther et al., 1998.

2 IPCC (1997): Greenhouse Gas Inventory Reporting Instructions. Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Vol 1, 2 and 3. The Intergovernmental Panel on Climate Change (IPCC), IPCC WGI Technical Support Unit, United Kingdom. http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm

3 EMEP/Corinair (2003): Emission Inventory Guidebook. 3rd edition, prepared by the UNECE/EMEP Task Force on Emissions Inventories and Projections, 2003 update. Available at http://reports.eea.eu.int/EMEPCORINAIR3/en (10-05-2004).

4 Illerup et al., 2000, 2001, 2002 and 2003.

5 www.dmu.dk

6 DJF no. 113. January 2005, DJF (Danish Institute of Agricultural Sciences).

4 Policies and measures

4.1 Climate policy and the decision-making processes

Since the Brundtland Commission's report Our Common Future from 1987, Denmark's climate policy has developed in collaboration with the different sectors of society, the international climate policy, and results from related scientific research.

Thus, since the end of the 1980s and during the 1990s a considerable number of measures to reduce the emissions of greenhouse gases have been implemented.

These measures were aimed at achieving environmental improvements for society in general, e.g. by introducing environmental taxes and involving the public in the debate and decisions concerning the environment.

Since 2001, focus has been on making efforts to reduce emissions cost-effectively.

In order to be able to monitor the development in total effect of these efforts on greenhouse gas emissions from national energy consumption, the basis for and the follow-up has include emissions inventories corrected for annual temperature variations and variations in Denmark's imports of electricity.

International climate targets

Since 1990 Denmark has undertaken or committed itself to several targets with respect to reducing greenhouse gas emissions:

- In accordance with the Climate Convention, to reduce total emissions of greenhouse gases in Denmark, Greenland and the Faroe Islands to the 1990 level by 2000. This target was achieved if only emissions are included. Up-dated figures for 2000 concerning emissions from and removals by forests (reduced removal due to windfalls are now included) and new data for land (not previously included) brings the Realm to within 1% of the target, when these emissions and removals are included in the inventory.

- As a contribution to stabilisation in the EU, Denmark committed itself to reducing CO_2 emissions in 2000 by 5% compared to the corrected level for 1990. This target was fulfilled.

- In relation to the Kyoto Protocol, for the period 2008-2012 the EU has committed itself to reducing emissions of greenhouse gases on average to 8% below the level in the so-called base year; 1990 for CO_2, methane, and nitrous oxide and either 1990 or 1995 for industrial greenhouse gases. Denmark has committed itself to a reduction of 21% as an element of the burden-sharing agreement within the EU. In the Council's decision on the EU ratification to the Kyoto Protocol, the commitments of the different Member States are thus given as percentages compared to the as percentages compared to the base year. In 2006 the respective emission levels must be given in tonnes of CO_2 equivalents. In this connection, the Council (environment) and the Commission have, in a joint statement, agreed e.g. to show consideration for Denmark's remarks to the Council conclusions of 16-17 June 1998 concerning emissions in the base year.

Section 2.1.1 gives a short description of the general, democratic decision-making processes, to which Denmark's climate policy is also subject.

4.1.1 National action plans

In 1988 the government of that time issued The Government's Action Plan for Environment and Development. The plan was a follow-up on the Brundtland Report and was based in principle on striving for environmentally sustainable development. One of the main messages in the plan was the need to integrate environmental considerations in decisions and administration within such sectors as transport, agriculture and energy.

In the years since then a number of ministries have prepared sector action plans in which environment is an integral element. The sector action plans thus deal with the entire development in a sector combined with solutions of environmental problems caused by the sector. The sector plans for energy, transport, forestry, agriculture, aquatic environment, waste, and development assistance are important examples.

The plans from the 1990s all contained specific environmental objectives and, usually, deadlines for achieving them. In addition, there were a number of concrete initiatives that are intended to lead to achievement of the objectives. Progress has been evaluated regularly to check whether the implementation of the plans resulted in achievement of the objectives. The results of the evaluations have been presented in political reports from the sector ministries or in special follow-up reports.

The evaluations and follow-up have often given rise to the preparation of new action plans, either because additional initiatives have been necessary in order to achieve the objectives or because the development of society or the development within the area in question has made it necessary to change both objectives and initiatives. Major sector plans that have been of importance for the reduction of greenhouse gas emissions are:

- The NPO Action Plan on pollution from livestock manure (1985)
- Action Plan for the Aquatic Environment I (1987)
- Energy 2000 (1990)

- Action plan for sustainable development in the agricultural sector (1991)
- Strategy for sustainable forest management (1994)
- Strategy 2000 - Danish strategy in the development assistance area (1995)
- Energy 21 (1996)
- Action plan for reduction of the transport sector's CO_2 emissions (1996)
- National sub-strategy for Danish environmental and energy research (1996)
- Action Plan for the Aquatic Environment II (1998)
- Action Plan II - Ecology in Development (1999)
- Waste 21 (1999)
- Action plan for reduction of industrial greenhouse gas emissions (2000)
- Reduction of the transport sector's CO_2 emissions - possibilities, policies and measures (2000)
- Reduction of the transport sector's CO_2 emissions - the government's action plan (2001)
- Denmark's national forest programme (2002)
- Denmark's National Strategy for Sustainable Development (2002)
- National Climate Strategy for Denmark (2003)
- Waste Strategy 2005-2008 (2003)
- Action Plan for the Aquatic Environment III (2004)
- Energy Strategy 2025 (2005)
- Action Plan for Strengthened Energy-saving Efforts (2005)

The sector plans deal with different aspects of the climate problem. In the energy and transport sectors the main environmental concern has been the emissions of the greenhouse gas CO_2. The plans in these sectors were therefore to a great extent concerned with reducing CO_2.

The frameworks for the Danish energy sector, however, have changed quite significantly over a short period of time. The goal of Danish energy policy today is to create well-functioning energy markets within frameworks that secure cost-effectiveness, security of supply, environmental concerns and efficient use of energy under conditions of a fully liberalised energy sector, and electricity production from Danish power plants is controlled by market forces and traded freely across national borders.

The introduction of CO_2 quota regulation as a common EU instrument has therefore been of absolute importance to Denmark meeting its climate commitments. From 2005, quota regulation will be the key instrument to ensuring that the Danish energy sector can contribute to the reductions requisite to fulfilling Denmark's climate commitments. The remaining initiatives in the energy area will thus primarily serve purposes other than climate-related.

The other sector plans are not primarily focused on reducing greenhouse gas emissions, in part because the sectors are battling with other major environmental problems that efforts have been made to solve through the plans. The main concern in the agricultural sector has been pollution of the aquatic environment. In the waste sector it has been reduction of the volume of waste, and in the industrial sector, reduction of emissions/discharges of harmful substances to the atmosphere/aquatic environment, the use of toxic substances, etc.

However, the implementation of the sector plans has to a great extent also resulted in reduction of greenhouse gas emissions. For example, the reduction in the agricultural sector's nitrogen emissions, which the aquatic environment plans are resulting in, is at the same time reducing the emissions of the greenhouse gas nitrous oxide. The initiatives to reduce waste quantities mean fewer landfill sites and thus less formation and emissions of methane, and the ongoing increase in forested area will mean increased removals of CO_2.

In addition, the energy and transport plans meant that changes were made in the energy and transport areas in all sectors. The initiatives in the energy area have thus resulted in reduced energy consumption and, with that, reduced CO_2 emissions within a wide range of sectors, including the domestic sector and the business sector.

In June 2002 the government's national strategy for sustainable development in Denmark, A SHARED FUTURE - balanced development, was adopted by the Folketing. The strategy must be seen in part as one of Denmark's responses to the challenge of Agenda 21, which was adopted at the UN General Assembly in Rio in 1992. Counteracting climate change is also an integral part of Denmark's National Strategy for Sustainable Development. The content of this Strategy is described in section 4.6.3.

On the environment policy front, Denmark has participated actively in improving environmental protection in Europe through the EU cooperation and through bilateral environmental assistance to Central and Eastern European countries. On a number of points, the EU's environmental regulation has put Europe ahead of the rest of world environmentally. There are also many examples of EU rules having helped to strengthen environmental protection in Denmark. With the adoption of the Amsterdam Treaty, sustainable development became a main objective for the EU, and integrating environmental considerations in the EU's sector policies became an obligation.

4.1.2 Denmark's Climate Strategy

The Folketing approved Denmark's present *Climate Strategy* in March 2003. The strategy lays down a framework for Denmark's future efforts on climate. The point of departure in the strategy is that Denmark is to fulfil its international climate commitments under the Kyoto Protocol and the subsequent Burden Sharing Agreement in the EU, and that efforts are to be arranged cost-effectively.

Although many important initiatives have already been launched in order to live up to the climate objective, considerable work still remains before Denmark can live up to its very ambitious Kyoto target. In the baseline projection for Denmark's greenhouse gas emissions, which was prepared as a basis for the Climate Strategy - that is a projection which only incorporates expected effects of measures implemented prior to the strategy - it was estimated that there would be a deficit of 20-25 mill. tonnes of CO_2 equivalents annually in 2008-2012 compared to Denmark's Kyoto commitment, if no additional measures were implemented[1, 2].

The Kyoto Protocol makes it possible to plan climate action that is more flexible. The Climate Strategy combines cost-effective domestic measures with use of the Kyoto Protocol's flexible mechanisms.

Reduction efforts are first and foremost tasks for the private sector, not least for the sectors which are subject to allowance regulation. According to the Climate Strategy, efforts from central authorities could supplement private efforts, and in the initial phase they could contribute by getting the market for CO_2 credits started. Efforts from central authorities are concentrated on the flexible mechanisms of the Kyoto Protocol which implement concrete projects to reduce greenhouse gas emissions in foreign countries. They are JI projects (joint implementation of projects in other industrialised countries) and CDM projects (projects in collaboration with developing countries on the development of cleaner technology).

Since reduction costs for possible new domestic action in the various sectors are continuously developing as a result of technological development and changing economic frameworks among other things, the strategy contemplates assessing efforts on a regular basis with the aim of ensuring that the most cost-effective measures are chosen.

In order to ensure correlation of reduction efforts across sectors and measures, the government has set a benchmark at DKK 120 per tonne of CO_2, which can constitute a basis for the implementation of domestic measures outside the sectors and businesses subject to the EU allowance scheme. The benchmark is an expression of the value of the CO_2 reduction which can be included in the assessment of concrete measures. The value of any other benefits from an initiative can be added, for example other environmental benefits.

The new government platform
As regards climate issues, the 2005 government platform is based on the Government Climate Strategy. A number of elements with climate-policy aspects are also emphasised. These elements are presented briefly below.

Strategy for the future energy market
One element of the government platform was the presentation of a new long-term energy strategy looking ahead to 2025.

In June 2005 the government presented a new long-term energy strategy, *Energy Strategy 2025*. The strategy is an overall presentation of the government's long-term energy policy. The contents of the strategy is described in more detail in section 4.3.1.

Improved energy saving initiatives
The government platform also states that the government will promote energy saving initiatives to allow Denmark to remain at the forefront with regard to energy efficiency, and that the government will present an action plan for increased energy savings based on economically justifiable investments, environmental consideration and advancement of Danish energy and building technology.

Having presented its draft action plan for strengthened energy-saving efforts in December 2004, the government made a broad political agreement in June 2005 in accordance with the government platform, addressing future energy saving measures. It is an ambitious agreement, which sets out the framework for efficient and increased energy-saving measures in the years to come. The contents of the agreement and the final action plan for renewed energy-saving efforts presented in September 2005 is described in detail in section 4.3.1.

The parties have agreed on a goal of decreased total energy consumption (not including transport). Strengthened efforts will be made to achieve specific, verifiable energy savings, corresponding to 7.5 PJ on average per year in the period 2006-2013. Significant parts of these energy savings will be attained by more savings by grid and distribution companies within electricity, natural gas, district heating and oil. If, in some years' time, Danish energy consumption figures (not including transport) are not pointing in the desired direction, the parties of the agreement will discuss the situation and consider a possible enhancement of efforts via specific measures.

The government presented its final action plan for renewed energy-saving efforts in September 2005.

CO_2 taxes
The government wishes to modernise and simplify the Danish energy and CO_2 tax system, taking into account the introduction of CO_2 quotas in the EU from 1 January 2005. The government will therefore present a proposal for the structure of the future energy and CO_2 taxes.

Reorganisation of motor vehicle taxes
The government will appoint a committee to investigate the options for reorganising the total motor vehicle tax system over several years in a way that promotes the environment and retains existing revenue levels.

Investments in research and technology
The aim is for Denmark to be one of the absolute leaders in Europe in terms of research and development. The government will present an action plan that aims to see public and private enterprises increase combined research and development spending to a level above three per cent of Denmark's gross domestic product in 2010.

The high-technology foundation
The aim of the high-technology foundation is to promote high technology research and innovation, coordinating government research efforts and trade and industry.

Foundation funds will be targeted towards selected areas, in particular, nanotechnology, biotechnology and information and communications technology. Focus will be given to particularly promising areas where there are clear commercial interests and where Denmark has special advantages and opportunities, e.g. within the health and energy sectors.

Green technology and biofuel
The development and application of new technology can be one of the ways to solve environmental problems and can also have positive commercial effects. The government aims to boost the development of green technology, for example in the areas of energy and fuel.

In June 2005, three new research and development strategies were published: one for hydrogen technologies, one for liquid biofuels, and one for wave energy. The strategies supplement *Energy Strategy 2025* and can be seen as a realisation of overall considerations concerning prioritising and focusing future technology-development efforts.

For hydrogen technology, the overall strategic target is to make Denmark among the best at developing and demonstrating efficient and competitive technologies and systems, so that hydrogen – based primarily on renewable energy – can become an integral element in clean, efficient, and reliable energy supply.

These strategies will be an important building block for the interdepartmental working group which is to establish a total overview of the possibilities for development and use of different alternative propellants in transport. The strategy suggests that there is a need for continuing the current Danish strongholds, particularly within development of new technologies for production of bioethanol fuel based on straw and other low value products.

Recently, the strategies for research and development within new energy technologies were supplemented by a strategy for wave energy. The general aim of the strategy is to enable Danish wave energy plants to contribute to cost-effective, sustainable electricity supply in Denmark, and to enable Danish enterprises to supply competitive wave energy products etc. in Denmark and abroad.

4.1.3 Progress in general concerning follow-up on the Climate Strategy

The Climate Committee

In order to ensure cost-effectiveness in climate policy, as part of the follow-up on the Climate Strategy, the government decided to appoint a standing climate committee to follow up regularly on the deficit and ensure cost-effective implementation of the climate policy. The committee is composed of the Ministry of Finance, the Ministry of Economic and Business Affairs, the Ministry of Food, Agriculture and Fisheries, the Ministry of Foreign Affairs, the Ministry of Taxation, the Ministry of Transport - now the Ministry of Transport and Energy - including the Danish Energy Authority, and the Ministry of the Environment - including the Danish Environmental Protection Agency (EPA). The EPA chairs the committee and provides the secretariat.

The climate committee is to monitor the Danish climate deficit on a regular basis, i.e., the difference between the Danish target for greenhouse gas emissions in 2008-2012 and the expected emissions. On the basis hereof, the committee is to ensure proper co-ordination and prioritisation between different measures, which can contribute to the fulfilment of Denmark's reduction commitment, including the use of flexible mechanisms (international allowance trade, Joint Implementation and Clean Development Mechanism), allowance regulation, and other national policies and measures across various sectors. In this connection, the committee is to assess the socio-economic, state-financial, environmental, distributional and competition-related consequences of implementing various measures and initiatives.

In 2006 the climate committee is also to co-ordinate the preparation of a progress report on the fulfilment of Denmark's reduction commitment and up-date calculations concerning measures with regard to costs and potentials, aimed at a possible revision of Denmark's Climate Strategy.

Policies and Measures Project

In Denmark's Third National Communication to the Climate Convention, the main results of the analyses on possible new policies and measures carried out prior to the Climate Strategy are reproduced with regard to potential and socio-economic reduction costs.

The calculations illustrated that only relatively few domestic actions with a significant potential which did not exceed the benchmark of DKK 120 per tonne of CO_2 equivalents, would be cost-effective compared to the use of the flexible mechanisms. This must be seen in the light of the fact that Denmark has already made a massive national effort up through the 1990s, while there is a large, unexploited potential in other countries.

Due to this situation, the government's cost-effective strategy for meeting Denmark's reductions commitment is based to a certain extent on the use of flexible mechanisms, Emission Trading, and the project mechanisms, Joint Implementation and Clean Development Mechanism. The EU allowance scheme will constitute the framework for most of the reduction efforts. Therefore, the specific combination of efforts will depend on the extent to which the enterprises concerned choose to carry out own reduction measures or to buy allowances from abroad.

In order to up-date and investigate the possibilities of implementing additional domestic measures apart from the allowance-regulated activities, the follow-up on the Climate Strategy has also included implementation of an interdepartmental project, *the Policies and Measures Project*, which e.g. continues to investigate the potential of new domestic measures where previous calculations have indicated relatively low reduction costs. It also investigates more closely whether new information exists that could contribute to reducing previously calculated costs further, and whether additional cost-effective national measures could be found. The project is expected to end in 2006 where the results are to be part of the Climate Committee's status 2006 report.

Annex B1 contains a collection of data sheets with further information on existing measures and on some of the measures no longere in place.

General progress on implementation of new measures

The EU directive on a common *allowance scheme* (the EU ETS) constitutes the framework for efforts from 1 January 2005 for a large proportion of the energy producers and some of the energy-intensive industry. The businesses subject to the allowance scheme 2005-2007 are in the process of preparing their own climate efforts. They can choose to reduce their own emissions when this is most appropriate, or they can buy allowances or credits from project-based emission reductions when this is considered most appropriate. This ensures that businesses concerned can adapt their efforts to market conditions on a regular basis. Denmark's implementation of the EU allowance directive is dealt with in greater detail in sections 4.2.1 and 4.3.1.

As mentioned, using the *flexible mechanisms* under the Kyoto Protocol is also part of a cost-effective Danish Climate Strategy. Section

4.2.2 reports on progress with respect to allocation of funds and specific JI and CDM projects.

Section 4.2.3 reports in greater detail on progress regarding *taxes* of importance to Denmark's greenhouse gas emissions. The government tax freeze eliminates tax increases, but re-allocations may prove to be the outcome of the committee's deliberations, which are expected to conclude in 2007.

Within the energy sector, measures have been implemented to enhance further *energy saving* and improve *energy efficiency*. Section 4.3.1 reports on progress with regard to the future energy-saving efforts and the Energy Strategy 2025 (2005).

The Policies and Measures Project also investigates possibilities in *the transport sector*, cf. section 4.3.2. In most cases, however, new measures in the transport sector demand a common effort within the EU to become sufficiently effective.

With respect to *business and industry*, focus will be on CO_2 reduction by way of allowance regulations as incentives enhancing energy saving and reduction in CO_2-process emissions. Since the latter is primarily associated with the production of cement and tiles, technology offers limited reduction possibilities at present. Technologically, the prospects for reducing emissions of nitrous oxide associated with the production of nitric acid in the fertilizer industry are good. As shown in section 4.3.3, this is, however, no longer an issue, since Denmark ceased to produce nitric acid in 2004. Section 4.3.3 also described Denmark's important contribution to reducing the use and emission of fluorine-containing greenhouse gases.

Certain possibilities also exist for reducing greenhouse gas emissions in the agricultural sector. The potential and possibilities of implementing cost-effective measures in this sector were analysed more closely in connection with the preparation of the Action Plan for the Aquatic Environment III, which was adopted in 2004. The plan itself only resulted in minor reductions in greenhouse gas emissions, cf. section 4.3.4. Therefore, in continuation hereof, additional concrete measures are being studied at present as part of *The Policies and Measures Project*. In June 2005, the provisional results were presented and discussed at a project day, which was open to the public.

Apart from the measures described in section 2.3.4. concerning *afforestation* which have already been implemented and can be referred to article 3.3 of the Kyoto Protocol, in connection with *The Policies and Measures Project*, it is being investigated whether article 3.4 of the Protocol can include cost-effective reduction potentials in connection with forests and land (revegetation, forest management, cropland management, and grassland management).

Concerning *the waste sector*, The Policies and Measures Project is investigating whether there are cost-effective potentials connected to further expansion of extraction and utilisation of energy from methane from landfills, cf. section 2.3.6.

Denmark's efforts in 1990-2001 and associated costs
In March 2005 a major analysis of Denmark's efforts in 1990-2001 to reduce emissions of CO_2 and other greenhouse gases, and associated costs was finalised and published in the report Denmark's CO_2 emissions - the effort in the period 1990-2001 and the associated costs[3], hereafter *the Effort Analysis*.

Prior to this analysis, quantitative estimates of the effect of separate measures on greenhouse gas emissions were often limited to ex-ante estimates before the measure in question was adopted. In a few cases, the implementation of a measure was followed by an ex-post evaluation. A major reason that only a few ex-post evaluations of individual measures have been carried out is that it is often difficult to clearly attribute an observed greenhouse gas reduction to a particular measure, since many areas (sectors/sources) are affected by several measures at the same time.

In the analysis of the importance of selected, implemented measures for greenhouse gas emissions as a result of efforts in 1990-2001, the effect and cost of a number of measures were estimated - both for the year 2001 and for the period 2008-2012. Thus, the latter case is a so-called without measures projection i.e. without the effects of measures implemented since 1990, which gives estimates of the size of mean annual greenhouse gas emissions in 2008-2012, if the measures until 2001 had not been implemented.

Please note that the statistical base for *the Effort Analysis* has included the emissions inventory submitted to the EU and the UN in 2003 (covering 1990-2001) and the "with measures" baseline projection (2008-2012), i.e. without additional measures, published in February 2003 together with the Government Climate Strategy.

The *Effort Analysis* is described in greater detail in Annex B2.

4.2 Measures and effects across sectors

4.2.1 Allowance regulation

On 1 January 2005 the EU Emission Trading scheme (EU ETS) replaced Denmark's national allowance scheme. In accordance with the Climate Strategy, this extended allowance regulation scheme has become part of the new central measures associated with the efforts to reduce Denmark's greenhouse gas emissions.

In its present form the EU allowance scheme will be valid in 2005-2007 and it will include CO_2 emissions from the sector-specific activities mentioned in Table 4.1 below.

TABLE 4.1 CATEGORIES OF ACTIVITIES COVERED BY THE EUROPEAN UNION GREENHOUSE GAS EMISSION TRADING SCHEME (EU ETS)

Activities	GREENHOUSE GASES
Energy activities	
- Combustion installations with a rated thermal input exceeding 20 MW (except hazardous or municipal waste installations)	Carbon dioxide
- Mineral oil refineries	Carbon dioxide
- Coke ovens	Carbon dioxide
Production and processing of ferrous metals	
- Metal ore (including sulphide ore) roasting or sintering installations	Carbon dioxide
- Installations for the production of pig iron or steel (primary or secondary fusion) including continuous casting, with a capacity exceeding 2.5 tonnes per hour	Carbon dioxide
Mineral industry	
- Installations for the production of cement clinker in rotary kilns with a production capacity exceeding 500 tonnes per day or lime in rotary kilns with a production capacity exceeding 50 tonnes per day or in other furnaces with a production capacity exceeding 50 tonnes per day	Carbon dioxide
- Installations for the manufacture of glass including glass fibre with a melting capacity exceeding 20 tonnes per day	Carbon dioxide
- Installations for the manufacture of ceramic products by firing, in particular roofing tiles, bricks, refractory bricks, tiles, stoneware or porcelain, with a production capacity exceeding 75 tonnes per day, and/or with a kiln capacity exceeding 4 m^3 and with a setting density per kiln exceeding 300 kg/m^3	Carbon dioxide
Other activities	
Industrial plants for the production of	
(a) pulp from timber or other fibrous materials	Carbon dioxide
(b) paper and board with a production capacity exceeding 20 tonnes per day	Carbon dioxide

Denmark's national allowance scheme only included the major producers of electricity in the energy sector. Via the national allocation plan, the present allowance regulation in Denmark includes individual emission limits 2005-2007 for CO_2 emissions from 377 Danish production facilities within several sectors, which together produce approx. half of Denmark's total greenhouse gas emissions[4]. These are still, primarily, energy producers and energy-intensive businesses and industries. Further information on installations covered is included in section 4.3.1 on measures in the energy area.

Thus, in the following only the principles and general figures for Denmark's implementation of the EU allowance directive via the national allocation plan (NAP) will be described.

The national allocation plan settles the allocation of quota for set periods at a time. All EU Member States are required to prepare national allocation plans. Denmark's proposal for a national allocation for the period 2005-07 was published on 31 March 2004 and approved by the European Commission on 7 July 2004.

Relevant key figures in the proposed national allocation plan for Denmark for the period 2005-07 are shown in Table 4.2.

TABLE 4.2: KEY FIGURES IN THE PROPOSAL FOR DENMARK'S NATIONAL ALLOCATION PLAN 2005-07 OF 31 MARCH 2004

	Number of installations[1]	**2002 emissions**[2]	**2003 emissions**	**Projected emissions 2005-07**	**Proposed quota allocation and emissions not subject to allowances**	**Reduction in per cent relative to projection**	**Denmark's emissions target under the EU's burden-sharing agreement,**
		mill. tonnes CO_2 equivalents per year					mill. tonnes CO_2 eq. per year, 2008-12
Sectors subject to allowances, in total	357	30.9	36.6[2]	39.3	33.5	14.8	
- electricity & heat production	234	22.6	28.1	29.4	21.7	26.2	
- other sectors subject to allowances, incl. offshore industries-	123	8.3	8.5	9.9	9.2	7.1	
- auction					1.7		
- new installations					1.0		
Sectors not subject to allowances		37.6[1]	37.8[1]	39.0	39.0		
Total		**68.5**[2]	**74.4**[2]	**78.3**	**72.5**	**7.4**	
Emissions targets 2008-12 with compensation for base year							59.7
Emissions targets 2008-12 without compensation for base year							54.9

1 On the basis of the European Commission's broad definition of enterprises covered.

2 Preliminary statistics as of 31 March 2004 for sectors subject to allowances. Calculated values for a large part of the sectors not subject to allowances.

The Danish Allocation Plan entails a total allowance allocation of 15% below the baseline projection (with existing measures) available in March 2004 for the sectors subject to allowances - with the greatest reduction from the production of electricity. Provided that emissions from the other sectors remain fairly constant, the reduction will constitute approx. 7.4% of total projected emissions. Thus, Denmark will be on its way to fulfilling its climate target for the period 2008-12 as set by the EU burden sharing of the reduction target under the Kyoto Protocol.

The anticipated reduction effect of 7.4% of the new allowance regulation corresponds to a reduction of 6 mill. tonnes of CO_2 annually in 2005-2007.

The effect in 2008-2012 cannot be estimated before the Allocation Plan for this period has been prepared in 2006.

Changes to the EU allowance directive and/or to Denmark's implementation of it may have been made by then - e.g. regarding activities, sectors, and greenhouse gases to be included in the scheme.

Denmark has had an active, environmentally oriented energy policy since the 1970s, and since 1990 this has been supplemented by a climate policy as such, which, on an international scale, has entailed a major strain - economically and/or via administrative regulations - on most of the greenhouse gas emissions, especially from businesses and sectors that are not subject to allowances. Therefore the cheap reduction potentials are to a certain degree exhausted in these sectors. The additional reduction efforts needed to fulfil Denmark's climate commitment will, therefore, primarily affect sectors subject to allowances.

Denmark's national allowance registry
In connection with the new allowance regulation that entered into force on 1 January 2005, Denmark's national allowance registry – (DK ETR – Emission Trading Registry[5]), which is used to allot allowances to production facilities subject to allowances and enables trade in allowances among the allowance holders found in the registry, also opened. The allowance registry has also been prepared to contribute to Denmark's implementation of the Kyoto Protocol in such a way that Denmark's EU allowance registry can also be made to function as the national allowance registry, which is to be established pursuant to the Kyoto Protocol as a prerequisite for the application of the Kyoto mechanisms. Section 4.6.1 contains a more detailed description of the registry.

4.2.2 The Kyoto mechanisms

As mentioned above, the starting point in the Government Climate Strategy is that efforts aimed at fulfilling the international climate commitment under the Kyoto Protocol and the subsequent EU Burden Sharing Agreement are organised cost-effectively.

The flexible mechanisms are, therefore, important elements of the Government Climate Strategy, supplementing domestic reduction measures. The purchasing of CO_2 credits is primarily a task for the private businesses under the regulations of the EU allowance directive. The market for CO_2 credits is, however, still in the making. By involvement in project development, the government will contribute to "starting up" the market for CO_2 credits earlier than would otherwise have been the case. The buying of credits will also contribute to the fulfilment of Denmark's international climate commitment, just as the climate projects will entail a number of additional environmental benefits such as reduced pollution of air and water.

On this basis the government has allocated DKK 1,130 mill. for the purchasing of CO_2 credits from JI and CDM projects in 2003-2008.

With a mean allowance price in the projects of DKK 50 per tonne of CO_2, the allocated funds correspond to approx. 4.5 mill. tonnes of CO_2 annually for 5 years (2008-2012). A target-fulfilment projection that includes the effects of these additional measures in 2008-2012 is 4.5 mill. tonnes of CO_2 lower than the baseline emission projection, which is a projection of Denmark's greenhouse gas emissions and removals inventoried under the Kyoto Protocol with implemented and adopted measures.

The implementation of specific JI and CDM projects is described in more detail in the following. The remaining "further information" under the Kyoto Protocol which the Fourth National Communication must contain, cf. the reporting guidelines, is included in section 4.6.

JI projects

If a well-functioning market for CO_2 credits is to become a reality, it is important that the host countries have the necessary institutions and procedures for approval of climate projects in place. This is best ensured if the Danish state as purchaser of $CO_{2,}$ becomes directly involved in the development of specific climate projects. By building on experience and network contacts gained from the well-established environmental assistance programme, the Danish state can help get the necessary approvals in place.

Climate projects in Central and Eastern Europe

On this basis, Denmark has selected a number of promising climate projects in collaboration with countries in Eastern Europe. Contracts for the acquisition of approx. 2.6 mill. tonnes CO_2 credits from five projects have been entered into. The assessment is that the contracts entered into, and negotiations about other projects, have been directly influential in enabling national authorities to build administrative capacity to manage JI projects.

All five projects display good environmental profiles and for the majority also good social profiles. Thus, it shows how climate projects lead to several types of benefits, benefiting the country buying the CO_2 reductions as well as the host country. Annex C contains further information on three examples of the five JI projects.

Denmark has also instigated tenders, where private actors can offer CO_2 credits from specific projects. The objective is to explore the market for good and cost-effective climate projects. Furthermore, tenders will create more awareness about the Danish state's interest in purchasing CO_2 credits and will thus create better supply of projects. The first tendering round closed on 15 September 2004, and a contract has been entered into with one project from the round, a landfill gas project in Poland.

Not all enterprises interested in buying CO_2 credits abroad have the required capacity to get involved themselves directly in climate projects. These enterprises will probably be demanding credits from intermediary dealers offering less risky indirect CO_2 credits. In this way, they can avoid getting involved in complex project development and contract writing, and the risk associated with the individual project will be shared by several investors. By showing an interest in indirect credits from international emission quota banks and funds, the Danish state is helping ensure that a market for this type of credits will exist when enterprises subject to the EU allowance directive start showing a demand for CO_2 credits.

Three contracts have been entered into with suppliers of indirect CO_2 credits. These include: collaboration between the consultancy firm Eco-Securities and Standard Bank London (ESSB), the Testing Ground Facility (TGF) under the Nordic Environment Finance Corporation (NEFCO), and the World Bank. The ESSB and TGF are open for investments from private investors, whereas the Danish state's contract with the World Bank was entered into in collaboration with the two large Danish electricity producers, Elsam and Energi E2. The contract entered into with the World Bank represent the first time large private Danish actors have invested in CO_2 reductions in developing countries and Eastern Europe.

It should be noted that to the extent the JI projects lead to reductions in the greenhouse gas emissions of the host country, also before 1 January 2008, the reductions in question could, in accordance with the contracts entered into, be transferred to the Danish climate account from 1 January 2008 as parts of the assigned amounts of the host country, if the conditions of the Kyoto Protocol have been met. This procedure is called "early crediting" and will in practice be registered as allowance trading in the host country and in Denmark's national allowance registry.

CDM projects
Denmark wishes to create better interaction between environmental assistance and Denmark's other initiatives to protect the global environment, including through climate efforts under the Kyoto Protocol of the Climate Convention. This will be realised through collaborating with developing countries on acquisition of credits from projects that reduce the emission of greenhouse gases.

In accordance with the Danish Government Climate Strategy from February 2003, Denmark will live up to its commitments under the Kyoto Protocol in a cost-effective way. Efforts will be carried out by the state with the purpose, in particular, of contributing to a faster development of the markets for CO_2 credits, than would otherwise be the case. The government has allocated DKK 200 mill. in 2004 and 2005 for state purchases of CO_2 credits from CDM projects in developing countries. A further DKK 300 mill. is expected to be allocated to CDM projects in 2006 – 2008, out of a total allocation framework of DKK 1,130 mill. for the purchase of CO_2 credits from JI and CDM projects in the years 2002-2008.

CDM collaboration with developing countries is being managed by the Ministry of Foreign Affairs. The goal is to ensure the greatest possible synergy between CDM collaboration and Denmark's international effort within development assistance. The climate effort must contribute:

- to fulfilling the targets in the Government Climate Strategy to meet Denmark's reduction commitment in a cost-effective way, and

- to establishing sustainable development in the developing countries Denmark is collaborating with.

This collaboration includes e.g. Danish support to the development of energy planning and economic planning, capacity building with the authorities that are to manage the climate effort, e.g. that are to assess and approve CDM projects, and help in the development of the CDM component of selected projects. Denmark moreover intends to purchase CDM credits, especially from the projects that Denmark has helped develop.

Denmark has chosen to commence with the implementation of the CDM effort by collaborating with countries that have been covered by the special environment assistance (previously MIFRESTA) for a number of years. In this way, Denmark will be able to build on collaboration projects on capacity building and planning which have been operating for a number of years. Furthermore, the countries must have a large emission of greenhouse gases, and thus a large reduction potential and potential for purchasing CO_2 credits. Therefore, Denmark will be working together with Malaysia, South Africa, and Thailand for a start, since these countries live up to the conditions mentioned. From 2005, the effort will be expanded to include Indonesia and China.

In Malaysia, South Africa, and Thailand the Danish effort consists or three elements:

- Entering into collaboration agreements which commit Denmark and the partner country to cooperate on efforts and help with the transfer of CO_2 credits between countries.

- Providing support to the countries with regard to establishing an administration system in relation to CDM and with regard to setting out national criteria for approval of CDM projects.

- Identifying eligible project ideas and elaborating these, so that they may be approved according to Kyoto Protocol rules. Denmark will subsequently buy all, or part, of the CO_2 credits resulting from the projects.

In addition to the CDM collaboration with the five countries mentioned above, general agreements have been entered into with Chile, Nicaragua, and Argentina with a view to paving the way for possible CDM credits trades between these countries and Denmark. An agreement has also been entered into with Mexico from 2005.

Furthermore, it is possible to carry out CDM collaboration by including projects being developed under the scheme for mixed credits. At year-end 2004, a significant number of projects were under development, primarily projects on biomass and renewable energy. Some projects have been presented before the CDM Executive Board to receive an approval of method or for registration; however no CDM project with Danish support has been approved yet.

Purchases of CDM credits can be bilateral, especially purchases from projects that Denmark has participated in the development of, or they can be indirect, through purchases of credits from CO_2 investment funds or similar. The Danish Foreign Ministry has of yet not bought credits from individual projects; however, the Ministry is participating with the Ministry of the Environment, Elsam, and Energi E2 in a Danish CO_2 fund, which will purchase credits from JI and CDM projects. This fund was established in collaboration with the World Bank and has a total capital DKK 200 mill.

Funds for purchasing credits from CDM projects are part of the Foreign Ministry's budget on a special account and separate from development assistance. The purchase of credits will thus not be at the cost of funds for development assistance.

Technology transfer in the CDM collaboration

The framework and work on CDM projects include broad collaboration aimed at promoting efficient methods for developing, applying, and disseminating environment-friendly technologies, know how, and procedures and processes that can influence climate change; and at promoting sustainable development in the developing countries. Also within CDM collaboration work, such technology transfer covers both soft technologies, such as capacity building, information network, training, and research, as well as hard technologies, such as equipment for controlling and reducing greenhouse gas emissions.

4.2.3 Taxes and duties

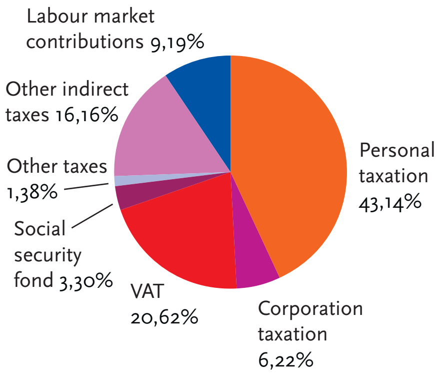
In Denmark, taxes and duties collected make up a total of approx. 48% of the GDP. The public sector provides childcare, education, unemployment benefits, health and disability benefits, old-age pensions, and many other services.

The personal income tax is the most important tax, making up more than half (53%) of total tax revenues. Other taxes are VAT, duties, corporation taxes, and labour market contributions. The Danish VAT is relatively high, 25%, and there are no differentiated rates. There are a considerable number of additional consumption taxes and environmental taxes. The corporation tax rate is 30%.

Total revenue from all taxes and duties is expected to amount to DKK 734 billion in 2005. The relative distribution is shown in Figure 4.1.

FIGURE 4.1 RELATIVE DISTRIBUTION OF TAXES AND DUTIES 2005

Source: Ministry of Taxation



Taxes that influence Denmark's greenhouse gas emissions

Retail prices on products that influence Danish greenhouse gas emissions are, in most cases, the decisive factor determining the degree to which they are consumed. Energy prices influence the composition and total size of energy consumption. Therefore extra taxes and duties put on products influence the consumption of these products and the size of greenhouse gas emissions associated with the use of the products.

Denmark has special taxes on motor vehicles, energy products, alcohol, tobacco, and a number of other products. During the 1990s a number of new environmental taxes were introduced. These taxes were imposed on consumer goods that caused pollution or were scarce (water, energy products such as such as oil, petrol, electricity, etc.) or on discharges of polluting substances (CO_2, HFCs, PVC, SF_6, SO_2, and sewage). Taxes are imposed on mineral oil, tobacco, and alcohol in accordance with EU legislation.

Taxes influencing Denmark's greenhouse gas emissions are described in more detail in the following. Data sheets for these measures are in Appendix B, which includes e.g. references to the legal basis for implementation of the measures.

4.2.3.1 Implemented taxes and duties relevant to CO_2, CH_4, and N_2O emissions Energy

Denmark has had taxes on energy for many years[6]. Since the first oil crisis in the early 1970s, the rates of the taxes has been aimed at reducing consumption and promoting the instigation of more energy-saving measures. Lesser energy consumption will reduce the emissions of both CO_2, methane (CH_4), and nitrous oxide (N_2O) associated with combustion of fossil fuels. Energy taxes from recent years are stated in Table 4.3 below.

Danish Energy taxes are laid down in the four Danish tax acts on mineral-oil, gas, coal, and electricity, respectively (Mineralolieafgiftsloven, Gasafgiftsloven, Kulafgiftsloven, and Elafgiftsloven).

The tax on mineral-oil act entered into force on 1 January 1993. Before that time the tax on petrol was regulated via the petrol tax act, which entered into force on 1 January 1983, and the act on taxation of gas oil and diesel oil, heating oil, heating tar, and crude oil was regulated via the act on taxation of certain oil products, which entered into force on 3 October 1977. Tax rates from recent years are shown in Table 4.4.

TABLE 4.3 ENERGY TAXES 1998-2005

Source: Ministry of Taxation

	Unit	1998	1999	2000	2001	2002	2003	2004	2005
Coal	DKK/toe	1,717	1,884	1,968	2,051	2,135	2,135	2,135	2,173
Natural gas	DKK/toe	1,536	1,536	1,672	2,048	2,111	2,111	2,111	2,134
Natural gas	DKK/m³	1.47	1.47	1.60	1.96	2.02	2.02	2.02	2.042
Oil products: Diesel	DKK/toe	2,429	2,464	2,738	2,952	2,952	2,952	2,952	2,985
Fuel oil	DKK/toe	1,910	1,910	1,950	2,000	2,060	2,060	2,060	2,092
Electricity: For heating	DKK/kWh	0.40	0.42	0.47	0.49	0.50	0.50	0.50	0.511
Other	DKK/kWh	0.46	0.48	0.54	0.55	0.57	0.57	0.57	0.576
Waste: Heating from waste	DKK/toe	**0**	**209**	**335**	**419**	**540**	**540**	**540**	**540**
Other compostable biomass	DKK/toe	0	0	0	0	0	0	0	0

Table 4.4 Trend in taxes 1988-2005 under the mineral-oil tax act, stated in DKK/litre

Source: Ministry of Taxation

DKK per litre	88-30.9.92	1.10.92-31.12.94	1.1.95-31.12.95	1.1.96-31.12.96	1.1.97-30.6.98	1.7.98-31.5.99	1.6.99-31.12.99	1.1.00-31.3.01	1.4.01-30.6.04	1.7.04-31.12.04	1.1.05-
Gas oil and diesel oil used as motor fuels	1.76	1.77	2.00	2.02	2.12	2.12	2.35	2.58	2.76	2.787	2.787
Light diesel oil	-	1.67	1.90	1.92	2.02	2.02	2.25	2.48	2.66	2.687	2.687
Diesel low in sulphur content	-	-	-	-	-	-	2.07	2.30	2.48	2.507	2.507
Diesel without sulphur	-	-	-	-	-	-	-	-	-	-	2.487
Fuel oil	1.98	1.66	1.66	1.66	1.66	2.06	2.06	2.06	2.06	2.092	2.092
Auto gas	1.08	1.18	1.34	1.36	1.43	1.45	1.45	1.45	1.73	1.746	1.746

The increase per 1 July 2004 was, as mentioned, part of a reorganisation of the taxes, and the total tax burden on the products did not change; the only thing that changed is the relative distribution between energy taxes and CO_2 taxes.

The purpose of introducing a tax differentiation from 1 June 1999 between light diesel and diesel low in sulphur was to encourage the use of diesel low in sulphur, which is less contaminant than light diesel. This was accomplished and a change took place soon after to the effect that almost all diesels sold were low in sulphur. The purpose of further differentiation from 1 January 2005 favouring sulphur-free diesel was likewise to encourage the use of this type of diesel in favour of diesel low in sulphur. This differentiation, however, will cease on 31 December 2008 with the entry into force of an EU requirement for sulphur-free diesel.

In addition, tax differentiation has been introduced in order to achieve environmental goals other than the direct reduction of greenhouse gas emissions. Thus tax differentiation has been introduced with a view to phasing out lead in petrol and collecting petrol vapours at filling stations. The rates of taxes to achieve these environmental goals are shown in Table 4.5.

The tax on natural gas and town gas was introduced in its current form on 1 January 1996. There has been taxation on gas, however, since 1 January 1979, when the tax on town gas and LPG was introduced. The tax on town gas was cancelled again in June 1983 and regulation of the tax on LPG was transferred to the mineral-gas tax act when this act entered into force. The tax rates on gas are shown in Table 4.6.

TABLE 4.5 TREND IN TAXES ON DIFFERENT TYPES OF PETROL, STATED IN DKK/LITRE

Source: Ministry of Taxation

Type of petrol:	-31.12.93	1.1.94-31.3.94	1.4.94-30.9.94	1.10.94-31.12.94	1.1.95-31.3.95	1.4.95-30.9.95	1.10.95-31.12.95	96	97	1.1.98-30.6.98	1.7.98-31.12.04	1.1.05-
With lead[2]	2.90[1]	3.10	3.15	3.20	3.55	3.60	3.65	3.92	3.97	4.02	4.72	4.50
Lead-free	2.25[1]	2.45	2.50	2.55	2.90	2.95	3.00	3.27	3.32	3.37	4.07	3.85
With lead[2] & vap.rec.[3]	-	-	-	-	-	-	-	3.89	3.94	3.99	4.69	4.47
Lead-free & vap.rec.[3]	-	-	-	-	-	-	-	3.24	3.29	3.34	4.04	3.82

1 These rates are from the act on petrol taxation. They entered into force on 1.1.1990.

2 The term has been kept even though petrol companies in Denmark ceased using lead for octane improvement in 1994.

3 When sold from filling stations with vapour recovery.

TABLE 4.6 TAXES ON GAS 1996-2006, DKK PER NM³

Source: Ministry of Taxation

DKK per Nm³	1.1.96-30.6.98	1.7.98-31.8.98	1.9.98-31.12.99	1.1.00-31.12.00	1.1.01-31.12.01	1.1.02-31.12.02	1.1.03-31.12.03	1.1.04-30.6.04	1.7.04-31.12.04	1.1.05-31.12.05	1.1.06-
Natural gas	0.01	0.25	1.47	1.60	1.96	2.02	2.02	2.02	2.046	2.046	2.046
Town gas	0.01	0.25	0.25	0.38	0.68	0.99	1.25	1.50	1.50	1.7702	2.046

TABLE 4.7 TREND IN COAL TAXES SINCE 1990, DKK PER TONNE

Source: Ministry of Taxation

DKK per tonne	1.6.89-31.12.91	1.1.92 – 31.12.94	1.1.95 – 31.12.95	1.1.96 – 31.12.96	1.1.97 – 31.12.97	1.1.98-30.6.98	1.7.98-31.12.98	1.1.99-31.12.99	1.1.00-31.12.00	1.1.01-31.12.01	1.1.02 -
Hard coal	765	690	770	860	950	1040	1150	1250	1300	1350	1425
Lignite	550	505	570	635	700	764	840	910	950	990	1030

The tax on coal was introduced on 1 July 1982 and constituted DKK 127/tonne for hard coal and DKK 91/tonne for lignite and lignite briquettes on the day of entry into force. The rates have since then developed as shown in Table 4.7.

The tax on electricity was introduced on 1 April 1977. Table 4.8 shows the development in electricity tax rates since 1989.

Energy and transport: CO_2 taxes

The CO_2 tax was introduced on 1 March 1992. CO_2 tax is placed on different types of energy products relative to their CO_2 emissions, cf. Table 4.9.

Table 4.10 shows examples of the different types of CO_2 taxes converted into consumer units.

Table 4.8 Trend in electricity taxes since June 1989, DKK per kWh

Source: Ministry of Taxation

DKK per kWh	1.06.89 – 29.02.92	1.03.94 – 31.12.93[1]	1.01.94 – 31.12.94	1.01.95 – 31.12.95	1.01. 96 – 31.12.96	1.01.97 – 31.12.97	1.1.98 – 30.06.98	1.7.98 – 30.6.99	1.7.99 – 30.6.04	1.07.04–
Consumption of electricity, exceeding 4,000 kWh in all-year residences heated by electricity	29.5	23.5	26.5	29.5	32.5	36.5	40.1	46.1	50.1	51.1
Other electricity	33	27	30	33	36	40	46.6	52.6	56.6	57.6

[1] This reduction of the electricity tax was part of the implementation of the CO_2 tax on e.g. electricity.

Table 4.9 CO_2 tax rates, 1996-2005, stated in DKK per tonne of CO_2

Source: Ministry of Taxation

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Basic rate										
Heating in industry	100	100	100	100	100	100	100	100	100	90
Light industrial processes										
Basic rate	50	60	70	80	90	90	90	90	90	90
With a voluntary agreement	50	50	50	58	68	68	68	68	68	68
Resulting subsidy	0	10	20	22	22	22	22	22	22	22
Heavy industrial processes										
Basic rate	5	10	15	20	25	25	25	25	25	25
With a voluntary agreement	3	3	3	3	3	3	3	3	3	3
Resulting subsidy	2	7	12	17	22	22	22	22	22	22

Table 4.10 Examples of CO_2 taxes

Source: Ministry of Taxation

	Unit	15.5.1992- 31.12.2004	1.7.2004 -
Gas oil and diesel oil	DKK/litre	0.27	0.243
Fuel oil	DKK/kg	0.32	0.288
Electricity	DKK/kWh	0.10	0.09
Lignite	DKK/tonne	242	217.8
Natural gas and town gas	DKK/Nm^3	0.22	0.198
Petrol	DKK/litre	-	0.22[1]

[1] This rate has applied since 1.1 2005

In addition to this, there are CO_2 taxes on heating tar, crude oil, coke, crude oil coke, lignite briquettes and lignite, LPG, and other gases. As evident from Table 4.10, the CO_2 taxes were reduced from 1 July 2004. This reduction, however, does not mean a reduction in the tax burden and resulting increased CO_2 emissions. The tax reductions were part of a reorganisation of the energy taxes to make them more transparent, and the energy taxes on the different energy products have been raised correspondingly, so that the overall tax on the individual product is the same. As part of the reorganisation of the taxes, from 1 January 2005 a tax was placed on petrol and the energy tax on petrol was reduced correspondingly, so that the total tax burden on petrol remains unchanged. This reorganisation was introduced in order to make it possible to exempt biofuels from CO_2 tax.

In connection with the implementation of the CO_2 allowance scheme a decision was made to pay back the CO_2 taxes paid for fuels and heating used in industrial processes that are directly allowance-regulated in industrial enterprises covered by the allowance regulations. This amendment is pending approval by the European Commission and has therefore not yet entered into force.

Transport

In the transport sector, the number of cars in Denmark and the use of motorised vehicles are influenced by the tax on cars and fuel. The latter has been described above.

Since 1 July 1997 the annual *tax on motor vehicles* has been based on energy consumption (the green owner tax) measured in accordance with EU Directive 93/116/EC. Before this date, the taxation was based on weight. 24 classes of energy consumption have been defined for both petrol-driven and diesel-driven vehicles. Examples of classes from 2005 are shown in Table 4.11.

TABLE 4.11 EXAMPLES FROM THE DANISH STRUCTURE OF TAX INCENTIVES BASED ON ANNUAL TAXES ON MOTOR VEHICLES (2005), DKK/YEAR

Source: Ministry of Taxation

Class of motor vehicle		Fuel consumption (km/l)	Annual tax (DKK/year)
Petrol	1	> 20.0	520
	11	10.0 – 10.5	5,500
	24	< 4.5	18,460
Diesel	1	25> 22.5	1,960
	12	10.2 – 11.3	9,620
	24	< 5.1	25,060

From 1 January 2000, three new classes were defined for diesel-driven private cars. The annual tax is given in Table 4.12.

TABLE 4.12 ANNUAL TAX FOR DIESEL-DRIVEN PRIVATE CARS, DKK/YEAR

Source: Ministry of Taxation

DKK/year	2000	2001	2002-
> 32.1 km/l	140	200	80
28.1-32.1 km/l	700	780	740
25-28.1 km/l	1,280	1,380	1,320

The reason for the fall from 2002 and onwards is a reduction in the green owner tax as a consequence of rising fuel taxes. With effect from 1 January 2002, there was an increase in the tax on diesel.

From 1 January 2000, a supplementary reduction in the *registration tax* for energy-efficient private cars was introduced, as shown in Table 4.13.

This means that from 2000-2005 diesel-driven cars that run more than 45 km per litre will have to pay only 2/6 of the normal registration tax, etc.

With the new system, there was an incentive to buy *light commercial vehicles* (LCVs) which fulfil the future EURO 3 and EURO 4 standards before these standards were made obligatory. The figures referred to are from the Commission's proposal KOM (97) 61, dated 20 February 1997 (EU Directive 98/69/EC).

The Danish system has 4 classes of LCVs based on gross weight of the vehicle. Examples of reductions in the annual tax on class 1 and class 4 vehicles are shown in Table 4.14. The system entered into force on 1 January 1998.

The domestic sector
For the domestic sector, the taxes levied on consumption of electricity, water, and heat affect consumption figures, since with the introduction of taxes these products become more expensive.

TABLE 4.13 REDUCTION IN REGISTRATION TAX FOR ENERGY-EFFICIENT PRIVATE CARS
Source: Ministry of Taxation

Diesel	Petrol	2000-2005	2006-2010
> 45 km/l	> 40 km/l	4/6	3/5
37.5-45 km/l	33.3-40 km/l	3/6	2/5
32.1-37.5 km/l	28.6-33.3 km/l	2/6	1/5
28.1-32.1 km/l	25-28.6 km/l	1/6	-

TABLE 4.14 EXAMPLES OF REDUCTION IN THE ANNUAL TAX FOR LCVS IN CLASS 1 AND 4
Source: Ministry of Taxation

Class	Period	EURO 3 (DKK)	EURO 4 (DKK)
1 (below 1,000 kg)	1998-2000	350	450
	2001	0	100
	2002-2005	0	100
4 (2,500-3,500 kg)	1998-2000	1,150	1,600
	2001	1,150	1,600
	2002-2005	0	450

The effect of taxes in the energy and transport area on the emissions of greenhouse gases
The introduction of CO_2 taxes and the increase in the rates of individual energy taxes since 1990 have had an effect on the consumption of a number of energy products and have therefore reduced the CO_2 emissions associated with consumption of these products.

The *Effort Analysis*[3] from 1 April 2005 made an estimate of the effects of the measures implemented in the period 1990-2001. The report's calculations show that the total effect of the introduction of CO_2 taxes and raised energy taxes meant a reduction in annual emissions of about 1.5 mill. tonnes of CO_2 equivalents in 2001. The socio-economic reduction costs were estimated at DKK 325/tonne. The expected average reduction in emissions for the years 2008-12 is the same as for 2001, namely about 1.5 mill. tonnes of CO_2 equivalents.

The increased fuel taxes have led to an annual reduction of about 1.2 mill. tonnes of CO_2 equivalents in 2001 with a socio-economic reduction cost of DKK 775/tonne. The average for 2008-12 is expected to be at the 2001 level.

In 2001, the introduction of the green owner tax meant an approx. 2% reduction in CO_2 emissions from cars, corresponding to 0.158 mill. tonnes of CO_2 equivalents. The average for 2008-12 is expected to be around 7% (0.540 mill. tonnes of CO_2 equivalents).

The estimated effects and costs are also stated in Annex B.

4.2.3.2 *Implemented taxes and duties relevant to consumption and emissions of HFCs, PFCs, and SF_6*

The industry and business sector's consumption of HFCs, PFCs, and SF_6

Since 1 March 2001, imports of industrial gases HFCs, PFCs, and SF_6 (F-gases) have been subject to taxation. The tax is based on the Danish CO_2 tax correlated with the GWP up to a maximum of DKK 400/kg, cf. the examples in Table 4.15.

Table 4.15 Examples of taxes on F-gases

Source: Ministry of Taxation

Substance	GWP	Tax in DKK per kg
HFC-134a	1300	130
R404a (a combination of 3 HFCs)	3260	326
SF_6	23900	400

The effect of taxes on the consumption of HFCs, PFCs, and SF_6 on emissions of greenhouse gases

The *Effort Analysis* has estimated that the tax on the industrial gases HFCs, PFCs, and SF_6, in combination with the effect of regulation adopted and introduced, led to a reduction of 49,000 tonnes CO_2 equivalents in 2001. In 2005, reduction is expected to be somewhere around 150,000 tonnes of CO_2 equivalents, increasing to around 370,000 tonnes in 2010. The socio-economic reduction cost is estimated at about DKK 200/tonne CO_2. Please note that it has not been possible to calculate the effects and costs of taxes and regulation separately.

The estimated effects and costs are also stated in Annex B.

4.2.3.3 *New measures, measures no longer in place and that would increase emissions*

The Danish government implemented an overall tax freeze from 2002 stipulating no tax increases, which means that no fixed rates in

Danish kroner or in per cent may be increased.

In 2002-2003 a cross-departmental group reviewed the registration tax on private cars in order to see whether changing the system from a value-based system (approximately 200%) to a system based on energy consumption (CO_2) would constitute a more cost-effective tool for reducing CO_2 emissions. A report[7] was published in April 2003 and the government subsequently decided not to make any changes to the current system. The report shows that the reduction costs will amount to about DKK 9,000/tonne, which exceeds the benchmark of DKK 120/tonne for implementing national initiatives laid down in the Government Climate Strategy.

The Danish Minster for Taxation has launched a detailed review of the Danish tax system in order to reduce its complexity. The third largest group of proposals concerns energy, CO_2, and sulphur taxes. A project group has been established. Its objective is to review the legislation in order to reduce the administrative burdens and improve transparency with regard to energy, CO_2, and sulphur taxes. Of the changes implemented[8], the following, mentioned the text box next page, are of potential significance to reducing greenhouse gas emissions.

All the energy agreements and CO_2 taxes mentioned above are among the subjects to be dealt with by a committee set up by the Minister for Taxation. The objective of the committee is to analyse the CO_2 taxes in relation to the CO_2 allowance scheme, which entered into force on 1 January 2005, as well as to investigate whether the energy taxation system can be designed more appropriately. The committee is expected to end its work in spring 2007.

4.3 Other measures and effects in Denmark's economic sectors

The following sections, sections 4.3.1 – 4.3.6, describe the other measures of importance to greenhouse gas emissions and removals in the following 6 economic sectors: energy, transport, business, agriculture/forestry, the domestic sector, and waste. Table 4.16 shows how the allocation, which is to be used in connection with the annual emission inventories (the CRF/IPCC format), is aggregated into the 6 economic sectors.

Table 4.17 and Figure 4.2 show the main result of this aggregation for 1990/95[9], 2003, 2008-12, and 2013-17, as well as 2020, 2025, and 2030 without emissions and removals in connection with land use, land-use change and forestry (LULUCF), however the effect of removals by afforestation since 1990 is included[10].

- Simpler CO2 taxes

The rules on CO2 taxes have been simplified. This means that the administrative burden has been eased for all VAT-registered companies paying CO2 taxes for the use of electricity for lighting, production plant, computer equipment, and ventilation plant. The change means that the 10 percent refund of the CO2 tax on light processes has ceased and the tax in itself has been reduced correspondingly. A total of 55,000 enterprises will thereby have easier administration.

- Simpler tax legislation

Several tax acts have been simplified; e.g. the tax on hard PVC has been annulled and a minimum limit has been introduced for registration and payment of tax on incandescent lamps.
The reduction in taxes on products made of hard PVC and on incandescent lamps could lead to an increase in consumption of these products and thus, possibly, to more emissions of CO2 from waste incineration due to increased amounts of plastic in the waste, and to greater energy consumption due to the use of incandescent lamps rather than energy saving bulbs.

- New Danish-Swedish tax agreement

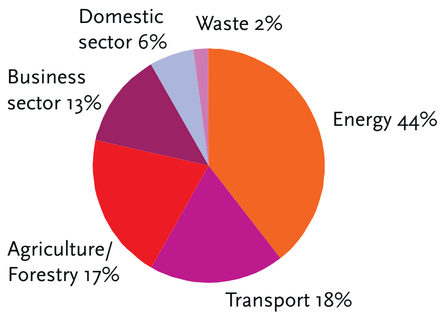
The Danish and the Swedish governments have entered into a new tax agreement that will ease the lives of cross-border commuters and enterprises and thus contribute to the integration in the Øresund Region. The rules concerning work-place taxation have been simplified and in the future cross-border commuters will receive allowances for their pension investments as well as for their travelling expenses.
Lower transport costs enhance mobility, however they may also lead to more CO2 emissions in terms of increased energy consumption for transport.

- More cars approved for yellow low-tax number plates for commercial vehicles

The so-called 50/50 rule, which previously determined whether certain types of cars could be approved as vans, has been repealed. The rule required that the platform was not shorter than the driver's cab. The simplification means that more types of cars can now be approved for yellow number plates and, thus, for a lower registration tax.
Lower registration tax on the car types mentioned could increase the total number of private cars in Denmark, whereby also the total transport activity could rise and with it the emission of CO2.

FIGURE 4.2 DENMARK'S GRENHOUSE GAS EMISSIONS IN 2003 BY SECTOR.

Source: The National Environmental Research Institute (NERI) and the Danish Environmental Protection Agency



4.3.1 Energy

The energy sector's extraction, conversion and distribution of energy led to greenhouse gas emissions which in 2003 made up 44% of Denmark's total emissions, of which CO_2 was the primary emission. 97.5% of the emissions from the energy sector are CO_2. 1.5% is methane (CH_4), and the remaining 1% is nitrous oxide (N_2O).

4.3.1.1 CO_2

Energy production and energy-consuming activities in the transport sector, industry and the other sectors are the main contributors to the total emissions of CO_2 due to use of large quantities of coal, oil and natural gas. The energy sector is therefore centrally placed in the efforts to reduce the emissions of CO_2.

Many initiatives have been taken over the years to reduce the emissions, and work is still going on to find the best and most cost-effective

Table 4.16 Aggregation of sources/sectors in the CRF/IPCC format into the six main economic sectors in Denmark

Economic sector		Sources/Sectors in the CRF/IPCC format	
Energy	Includes extraction, conversion, and distribution.	1A1 1B	Fuel combustion activities. Fugetive emissions from fuels.
Transport	Military included.	1A3 1A5	Transport (fuel combustion) Others (fuel combustion in military transport).
Agriculture and forestry	Fisheries included.	1A4c 4 5	Fuel combustion in agriculture, forestry, and fisheries. Agriculture Land-use Changes and Forestry (LUCF).
Business	Includes production, building and construction, service and trade, as well as industrial gases and the use of organic solvents.	1A2 1A4a 2 3	Fuel combustion in production and building/construction. Fuel combustion in commerce and service. Industrial processes Use of organic solvents.
Domestic sector		1A4b	Fuel combustion in households.
Waste	Includes landfills and sewage treatment. Incineration of waste for energy recovery is included in the energy sector, cf. IPCC.	6	Waste

measures with a view to fulfilling Denmark's international climate obligations.

The framework for the Danish energy sector has, however, changed significantly over a few years. The energy sector is now fully liberalised. Today, electricity production from Danish power plants is controlled by market forces. Danish electricity generation is traded freely across national borders on the Nordic and the north-German electricity markets. There is thus a significant extent of integration in the Northern European electricity market on an arm's length basis. This entails, for example, that increased use of renewable energy in the Danish electricity system or enhanced efforts to save electricity do not automatically mean that generation at coal-fired power plants is reduced correspondingly during the first commitment period of the Kyoto Protocol 2008-2012.

The introduction of the CO_2 allowance regulations as a common EU instrument has thus been pivotal for Denmark's possibilities to comply with the climate commitments. The allowance regulations constitute a central instrument in ensuring that the Danish energy sector is enabled to provide the reductions required

Table 4.17 Denmark's greenhouse gas emissions in 1990/95, 2003 and the May 2005 "with measures" projections until 2030 by economic sector and by gas[1]

Source: The National Environmental Research Institute (NERI) and the Danish Environmental Protection Agency

	1990/95 Mt CO_2 equivalents	1990/95 %	2003 Mt CO_2 equivalents	2003 %	Changes from 1990/95 to 2003	2008-2012 Mt CO_2 equivalents	2008-2012 %	Changes from 1990/95 to 2008-2012	2013-2017 Mt CO_2 equivalents	2013-2017 %	Changes from 1990/95 to 2013-2017	2020 Mt CO_2 equivalents	2020 %	Changes from 1990/95 to 2020	2025 Mt CO_2 equivalents	2025 %	Changes from 1990/95 to 2025	2030 Mt CO_2 equivalents	2030 %	Changes from 1990/95 to 2030
Energy	**26.8**	**38.6**	**32.8**	**44.4**	**22%**	**30.3**	**41.9**	**13%**	**29.5**	**41.3**	**10%**	**25.3**	**37.6**	**-6%**	**23.9**	**36.1**	**-11%**	**24.3**	**36.4**	**-10%**
CO_2	26.4	38.0	32.0	43.2	21%	29.5	40.9	12%	28.8	40.4	9%	24.7	36.8	-6%	23.3	35.2	-12%	23.7	35.5	-10%
Methane (CH_4)	0.1	0.2	0.5	0.7	278%	0.4	0.6	226%	0.3	0.5	153%	0.3	0.4	116%	0.3	0.4	106%	0.3	0.4	110%
Nitrite gas (N_2O)	0.3	0.4	0.3	0.4	19%	0.3	0.4	14%	0.3	0.4	14%	0.3	0.4	3%	0.3	0.4	-1%	0.3	0.4	-3%
Transport	**10.8**	**15.5**	**13.4**	**18.1**	**24%**	**14.6**	**20.2**	**36%**	**15.0**	**21.0**	**40%**	**15.4**	**22.9**	**43%**	**15.8**	**23.8**	**46%**	**16.1**	**24.0**	**49%**
CO_2	10.6	15.2	12.9	17.4	22%	14.0	19.4	33%	14.4	20.2	36%	14.8	22.0	40%	15.1	22.9	43%	15.4	23.1	46%
Methane (CH_4)	0.1	0.1	0.1	0.1	15%	0.1	0.1	-10%	0.0	0.0	-37%	0.0	0.0	-54%	0.0	0.0	-59%	0.0	0.0	-60%
Nitrous oxide (N_2O)	0.1	0.2	0.4	0.6	191%	0.5	0.7	266%	0.6	0.8	286%	0.6	0.9	300%	0.6	0.9	312%	0.6	0.9	323%
Agriculture/Forestry	**15.6**	**22.4**	**12.4**	**16.8**	**-20%**	**12.0**	**16.6**	**-23%**	**11.5**	**16.2**	**-26%**	**11.3**	**16.7**	**-28%**	**11.0**	**16.7**	**-29%**	**10.9**	**16.3**	**-30%**
CO_2	2.7	3.9	2.5	3.3	-83%	2.5	3.4	-9%	2.4	3.3	-12%	2.3	3.4	-15%	2.3	3.4	-16%	2.1	3.2	-21%
Methane (CH_4)	3.9	5.6	3.8	5.1	-3%	3.6	5.0	-6%	3.5	4.9	-10%	3.4	5.1	-12%	3.3	5.0	-14%	3.3	5.0	-14%
Nitrous oxide (N_2O)	9.0	13.0	6.2	8.4	-31%	5.9	8.2	-35%	5.7	7.9	-37%	5.6	8.3	-39%	5.4	8.2	-40%	5.4	8.2	-40%
Business	**9.6**	**13.8**	**9.7**	**13.1**	**1%**	**9.8**	**13.6**	**2%**	**9.9**	**13.8**	**3%**	**9.8**	**14.6**	**2%**	**10.0**	**15.2**	**4%**	**10.1**	**15.2**	**5%**
CO_2	8.2	11.7	8.0	10.8	-3%	8.9	12.3	9%	9.2	12.9	13%	9.5	14.1	16%	9.7	14.7	19%	9.8	14.7	20%
Methane (CH_4)	0.0	0.0	0.1	0.1	167%	0.1	0.1	232%	0.1	0.1	238%	0.1	0.1	242%	0.1	0.1	247%	0.1	0.1	247%
Nitrous oxide (N_2O)	1.1	1.6	1.0	1.3	-14%	0.1	0.1	-93%	0.1	0.1	-93%	0.1	0.1	-93%	0.1	0.1	-93%	0.1	0.1	-93%
Industrial gases	0.3	0.5	0.7	1.0	129%	0.8	1.1	136%	0.5	0.7	61%	0.2	0.3	-45%	0.2	0.3	-45%	0.2	0.3	-45%
Domestic sector	**5.2**	**7.4**	**4.1**	**5.6**	**-20%**	**4.2**	**5.9**	**-18%**	**4.2**	**5.9**	**-19%**	**4.1**	**6.1**	**-21%**	**4.0**	**6.1**	**-22%**	**4.0**	**6.0**	**-23%**
CO_2	5.0	7.2	4.0	5.4	-21%	4.1	5.6	-19%	4.0	5.6	-20%	3.9	5.8	-22%	3.8	5.8	-24%	3.8	5.7	-25%
Methane (CH_4)	0.1	0.1	0.1	0.1	48%	0.1	0.2	87%	0.1	0.2	96%	0.1	0.2	100%	0.1	0.2	106%	0.1	0.2	112%
Nitrous oxide (N_2O)	0.1	0.1	0.1	0.1	-11%	0.1	0.1	-2%	0.1	0.1	0%	0.1	0.1	1%	0.1	0.1	2%	0.1	0.1	3%
Waste	**1.6**	**2.3**	**1.5**	**2.0**	**-10%**	**1.3**	**1.8**	**-19%**	**1.3**	**1.8**	**-19%**	**1.4**	**2.0**	**-17%**	**1.4**	**2.1**	**-15%**	**1.4**	**2.1**	**-13%**
Methane (CH_4)	1.5	2.2	1.4	1.9	-9%	1.3	1.7	-18%	1.3	1.8	-18%	1.3	1.9	-16%	1.3	2.0	-14%	1.3	2.0	-12%
Nitrite gas (N_2O)	0.1	0.1	0.1	0.1	-31%	0.1	0.1	-30%	0.1	0.1	-30%	0.1	0.1	-30%	0.1	0.1	-30%	0.1	0.1	-30%
Total	**69.6**	**100**	**73.9**	**100**	**6%**	**72.3**	**100**	**4%**	**71.4**	**100**	**3%**	**67.2**	**100**	**-3%**	**66.1**	**100**	**-5%**	**66.8**	**100**	**-4%**
CO_2	52.9	76.0	59.2	78.2	12%	59.0	81.6	12%	58.8	82.4	11%	55.2	82.1	4%	54.2	82.0	3%	54.9	82.1	4%
Methane (CH_4)	5.7	8.2	5.9	8	3%	5.6	7.7	-2%	5.3	7.4	-6%	5.2	7.8	-8%	5.2	7.8	-9%	5.2	7.8	-9%
Nitrous oxide (N_2O)	10.7	15.4	8.1	11	-25%	6.9	9.6	-35%	6.8	9.5	-37%	6.6	9.9	-38%	6.5	9.9	-39%	6.5	9.8	-39%
Industrial gases	0.3	0.5	0.7	1.0	129%	0.8	1.1	136%	0.5	0.7	61%	0.2	0.3	-45%	0.2	0.3	-45%	0.2	0.3	-45%

1 Trends in GHG emissions by gas and by sector can also be seen in Figure 5.1 in Chapter 5.

if Denmark is to comply with the climate commitments. At the same time, the allowance scheme permits significant improvements to the cost-effectiveness of Denmark's climate effort.

The goal of the energy policy today is to create well-functioning energy markets within frameworks that secure cost-effectiveness, security of supply, environmental concerns and efficient use of energy. The best initiatives are often those that meet more than one of the purposes mentioned at the same time. Efforts concerning energy should thus be seen in a broader context than CO_2 alone, not least when it comes to purpose and calculation of effects. Within allowance-relevant areas, allowances will ensure that Danish climate commitments are met. Other tools may ease the burden of meeting targets, or they may have a more long-term foundation in technological development. In contrast to development of sustainable energy and electricity saving, the allowances provide security for CO_2 reductions in the Kyoto Protocol commitment period 2008 – 2012. Renewable energy can, however, contribute to meeting energy-policy objectives and also underpin climate policy because in this way energy supply is enhanced without increasing emissions of greenhouse gases.

For example, it is very important that wind power is now so well developed that it is close to being competitive with coal-fired electricity generation.

The costs to Denmark of meeting climate commitments are less than they would have been if Denmark did not have competitive technology to secure energy supplies while at the same time reducing emissions of greenhouse gases. Renewable energy is an important element in the long-term development of the Danish energy sector. Wind power is an environmentally friendly electricity-production technology with considerable perspectives in relation to meeting climate commitments, and continued development of wind power and other RE technologies is an important contribution to the necessary technological development and sustainable development at global level.

The focus of this section is energy production and energy supply. The energy-consuming activities and the possibilities for energy savings in the different sectors of society are dealt with in greater detail in the subsequent sections.

Implemented policies and measures
A large number of policies and measures have been implemented over the years to meet the various energy-policy objectives cf. Table 4.18 and Annex B1.

Allowance regulation
Denmark has implemented the directive on a common European CO_2 allowance scheme for energy production and energy-intensive industries (the EU ETS). The allowance scheme entered into force on 1 January 2005.

The allowance scheme will be the most important measure in Denmark's fulfilment of its climate obligations under the Kyoto Protocol. The scheme aligns well with the liberalisation of the energy markets and management of environment efforts by the market being implemented by the government for the energy area. The allowance scheme permits significant improvements to the cost-effectiveness of Denmark's climate policies and measures and forms a main element of the Danish government's Climate Strategy.

In Denmark, as previously mentioned, 377 production units are covered by the allowance scheme. The largest group of enterprises subject to allowances is electricity and heat producers. In this sector, there is a total of 244 production units, in 138 enterprises. There are 126 production units in industry in 96 enterprises subject to the allowance regulations. Finally, 7 production units in the offshore sector are covered. Annex D contains overviews of the production units covered and their allowances for 2005-2007. The 377 production units would, without the allowance regulations, account for about half of Danish emissions of greenhouse gases.

Both the statutory and the administrative basis for the scheme have been established. The necessary legal basis was adopted by the Folketing in June 2004 and the national allocation plan was approved by the Commission in July 2004.

According to the national allocationplan for the period 2005-2007 an average annual allowance of 33.5 mill. tonnes CO_2 has been allocated. This corresponds to a drop in emissions of about 6 mill. tonnes per year in 2005-2007, or a reduction of about 15% compared with expected emissions for the period. This level was set by balancing environmental considerations against competitiveness and jobs:

- Electricity and heat producers were allocated about 21.8 mill. tonnes. The allowance for electricity generation is allocated as "per kWh", while for heat production allowances are allocated according to emissions in the base years 1998-2002.

- The other 133 production units (industry and offshore) have been allocated allowances corresponding to emissions in the base years 1998-2002. A total of 9.3 mill. tonnes per year have been allocated to industry and offshore.

- A special pool has been allocated with free allowances for new production units and significant extensions to existing units.

- Finally, 5% of allowances have been earmarked for sale by auction or similar.

Allowance allocation for 2008-12 will be set in the national allocation plan, which is to be sent to the Commission no later than 1 July

TABLE 4.18 INITIATIVES AND MEASURES IN THE ENERGY SECTOR

Source: Danish Energy Authority and Danish CO2 emissions - the effort in the period 1990-2001 and the associated costs

Name of measure or initiative	Objective	GHG affected	Type of instrument	Status for implementation	Implementing entity/ player	CO2-reduction in 2001[1]	Average annual CO2 reduction for 2008-2012[2]
The energy sector						Mill. tonnes CO_2	Mill. tonnes CO_2
EU-CO_2-allowances for electricity and district heating production (including Business)	CO_2-reduction	CO_2	Economic (financial)	Implemented Amendments to implement the Linking Directive adopted by the Folketing May 2005	State authorities, energy producers, energy-intensive enterprises		(Total effect unknown until allocation plan for 2008-12 set)
Biomass Agreement2	R&D, demonstration, CO_2 reduction	CO_2	Economic (financial)	Implemented	State authorities, energy producers		
Price supplement for environmentally friendly elec.	Energy efficiency, technology development, CO_2 reduction	CO_2	Economic	Implemented	State authorities, energy producers		
Tenders for offshore wind turbines	Energy efficiency, technology development, CO_2 reduction	CO_2	Regulatory (administrative)/ economic (financial)	Implemented	State authorities, electricity producers		
Scrapping scheme for old wind turbines	Other environ-mental improvements	CO_2	Economic (financial)	Implemented	Local/ regional authorities, interest organisations, energy producers, state authorities		
Energy research	R&D	CO_2	R&D	Implemented but regularly adjusted	State authorities, research institutions		

1 With regard to effects, certain measures are included in the Effort Analysis, cf. Annex B2.

2 The Danish electricity producers Elsam Kraft A/S and Energi E2 A/S are required to establish capacity to use straw and woodchips for electricity and heat production. Electricity consumers provide a subsidy for burning, the size of which is set in the Electricity Supply Act. The Biomass Agreement of 1993 requires the Danish electricity producers Elsam Kraft A/S and Energi E2 A/S to use 1.4 mill. tonnes biomass. According to the revision of the Biomass Agreement of 1997, at least 1 mill. tonnes straw and 0.2 mill. tonnes wood must be used. The remaining amount of amount of 0.2 mill. tonnes biomass can be divided between straw or wood as the electricity plants see fit.

2006. It is expected that this plan will include significant tightening of the number of allowances to ensure that Denmark meets its international climate commitments.

The national CO_2 allowance scheme for electricity producers

For electricity producers, the European CO_2 allowance scheme replaces the previous Danish CO_2 allowance regulation. The national allowance scheme applied from 15 June 2000 to 31 December 2004, and it put Denmark at the front in establishing a CO_2 allowance system. The original allowance Act applied up to and including 2003, but with the approaching adoption of the common European allowance scheme the national scheme was extended up to entry into force of the EU scheme.

Under the national CO_2 allowance scheme, the individual electricity producers were allocated annual CO_2 emissions approvals for the period 2000-2004. Total emissions approvals for electricity producers in the first year amounted to 23 mill. tonnes CO_2. The emissions level was reduced to 20 mill. tonnes in 2003 and 2004. Approvals were transferable and could be saved-up. If an allowance was exceeded, a charge of DKK 40 per tonne of CO_2 was made. The revenues from these charges were spent on energy savings and research and development.

Energy and CO_2 taxes

Taxes have also been used for many years as an instrument for reducing the CO_2 emissions from the energy sector, since fuels used for heat production are subject to energy and CO_2 taxes. Taxes have also been used for a number of years as measures to reduce the CO_2 emissions from the energy sector - partly with a view to a general reduction and partly to promote the use of fuels with lower CO_2 emissions, mainly biomass. Energy and CO_2 taxes are described in detail in section 4.2.3.

Research and development

R&D activities include energy savings, more efficient energy conversion and renewable energy technologies. Research in the energy area is described in more detail in section 8.2.6.

Combined heat and power

Increased use of CHP and enlarging the areas receiving district heat have been main elements of the Danish strategy to promote efficient use of energy resources ever since the end of the 1970s. More than half of Denmark's domestic electricity consumption is co-generated with heat at CHP plants, and the potential for further use of CHP is limited. For this reason, only a small increase in CHP production is expected in the future. CHP has been promoted partly by the tax system, partly by electricity production grants for small-scale CHP plants and, lastly, by prioritising electricity from small-scale CHP plants.

Renewable energy

Use of renewable energy sources can reduce the emissions of CO_2 from fossil fuels. The proportion of Denmark's gross energy consumption that is covered by renewable energy increased from 6.7% in 1990 to 14.3% in 2003.

Renewable energy sources are promoted with economic measures, including the tax system and through direct production grants. Agreements and orders for the electricity and heat sector used to play a role, but use of these instruments has largely ended. Lastly, financing R&D activities is contributing to the continued growth in the proportion of renewable energy.

Fuel conversion from coal to natural gas

Substitution of natural gas for coal or oil reduces the emissions of CO_2. The first Danish natural gas was landed from the Danish sector of the North Sea in 1984, and since then consumption of natural gas has increased to 191 PJ in 2003, covering 23.1% of gross energy consumption. In future years it is expected that use of natural gas will not increase significantly in that the natural gas market has been more-or-less fully developed. In the longer term it is expected that use of natural gas will increase as a result of increased use of natural gas in electricity generation. Natural gas is favoured by a lower CO_2 tax than oil and coal because of its lower emissions and will be promoted by the EU CO_2 allowances scheme.

Energy savings

Energy-saving efforts in Denmark are implemented by a number of actors. The most important are:

The Danish Energy Authority is responsible for authority tasks throughout the energy-savings area. In addition to legislation and regulation, the area includes the further negotiations within the EU on implementation and control of EU Directives, for example on labelling and standards, as well as a number of operational tasks such as energy labelling of buildings. Authority tasks include setting the framework and controlling the activities of supply companies and the Electricity Saving Trust, and the Authority manages tasks in connection with the agreement scheme with business.

The National Agency for Enterprise and Construction carries out a number of energy-related authority tasks in the building area. Tasks include energy provisions in building regulations, rules on individual metering of electricity, gas, water and heating, as well as rules on the efficiency of heating plant.

The Electricity Saving Trust was established in 1996 with the primary tasks of conversion to CHP and promotion of efficient appliances etc. in households and the public sector. For conversion to CHP the Trust grants subsidies and negotiates pricing agreements etc. In connection with promoting efficient electrical appliances the Trust carries out campaigns, influences markets, and encourages voluntary agreements as well as making electricity consumption more visible. The Trust has established an A club, where public institutions etc. are obliged to buy energy-efficient products. The annual budget of the Trust is about DKK 90 mill., which comes from a special electricity savings contribution of DKK 0.006 per kWh paid by households and the public sector as part of their electricity bills.

Grid and distribution companies (electricity, gas, and heating) are required to encourage consumers to save energy. Initiatives have so far been defined as non-commercial, and subsidies have usually not been available for investments etc. A primary activity for grid companies and partly for gas companies is individual consultancy on savings opportunities with larger customers. Furthermore, campaigns and information activities etc. are carried out. Electricity companies have worked with energy savings since the early 1990s. Natural gas and district heating companies' activities have only been formalised in the past couple of years. The costs are financed through energy prices and amount to almost DKK 240 mill. per year. With the political agreement on future energy-saving efforts the framework for the actors' energy-saving efforts will become more market-based.

Support for environmentally freindly electricity

The amendment of the Electricity Supply Act entered into force on 1 January 2005 and it means that all environmentally friendly electricity, i.e. electricity from wind turbines and other renewable energy (RE) plant, decentralised cogeneration of heating and power etc, is now sold on market conditions. The previous support for environmentally friendly electricity, where consumers had an obligation to take the electricity at a fixed settlement price, has now been converted to financial support in the form of a price supplement on the electricity market price.

In order to reduce the environmental impact of electricity production, support has been granted in the form of a price supplement for environmentally friendly electricity from wind turbines and other RE plant (straw, woodchips, biogas, solar energy, hydro power etc.) and decentralised cogeneration of heating and power.

The most recent figures are for 2003, and they show that the proportion of Danish electricity consumption from RE was 23.9% in 2003, of which wind turbines accounted for 15.8% of total consumption. The proportion of decentralised cogeneration of heating and power from natural gas and waste was 25% in 2003. Preliminary figures for 2004 show that the RE proportion of Danish electricity consumption was 28.5% in 2004, of which wind turbines accounted for 18.8% of consumption. (If the non-biodegradable part of waste is included in the figures, the proportion was about 1 percentage point higher).

Support for environmentally friendly electricity is set by the Electricity Supply Act and paid in part by electricity consumers through electricity bills as a public obligation (PSO).

The total net costs of RE electricity in 2003, collected through PSO in addition to the market value of the electricity produced was about DKK 2.3 bn., while the corresponding support for decentralised cogeneration of heating and power from natural gas and waste amounted to DKK 0.8 bn. Overall, PSO costs for the price supplement will drop in future years as there is an in-built time limit and a decreasing level of support compared with the previous rules.

The government's long-term energy strategy
In June 2005 the government presented a new long-term energy strategy – Energy Strategy 2025. The strategy is an overall and coherent presentation of the government's long-term energy policy. At the core of the strategy is a clear market-based energy-political objective, in which public authorities provide the framework for the market actors. Thus, the Energy Strategy is based on:

- liberalised energy markets with common EU framework
- market-based cost-effective instruments, and
- public authorities providing the overall grid infrastructure and economic instruments, including the CO_2 allowance scheme.

In line with this, the strategy does not propose quantitative objectives for the extension of renewable energy, however it sets the stage for and envisages a market-based increase in the use of renewable energy.

It also underlines the importance of strengthened research and development of new energy technologies.

Finally, it focuses on the transport sector – a committee will be set up to discuss the overall perspectives for alternative propellants in the transport sector, including biofuels.

The Energy Strategy also assesses the need for extending the overall electricity transmission network The government recommends that a power line be established below the Great Belt, and that Energinet.dk, cooperating with Statnett, makes a detailed study of the financial aspects of strengthening the Skagerak-power cable.

Government energy savings plan
The government platform states that the government will promote energy-savings initiatives so that Denmark can continue to lead efficiency energy use. The government will present an action plan for increased energy savings based on economically justifiable investments, environmental consideration and advancement of Danish energy and building technology[11].

As a follow-up to the agreement of 29 March 2004, the Danish government presented a draft action plan for a renewed energy-saving effort on 29 December 2004.

On 10 June 2005 the government made a broad political agreement to significantly strengthen energy-saving efforts. The agreement is ambitious, and sets the framework for efficient and increased energy-saving efforts in the coming years.

The parties to the agreement agree that overall energy consumption (excluding transport) shall be reduced. Strengthened efforts will be made to reach specific and verifiable energy savings corresponding to 7.5 PJ per year on average in the period 2006-2013.

Important parts of the energy savings will be achieved by better energy-saving results in grid and distribution companies within electricity, natural gas, district heating and oil.

Moreover, energy savings will be achieved through stricter rules on energy in building regulations, new and better energy labelling, better inspection of boilers and ventilation equipment, special efforts within the public sector, and reorganisation of energy companies' energy-saving efforts.

Together, the government's action plan and the political agreement entail a significant strengthening of the overall energy-saving efforts.

Green technology and bio-fuels

The government programme states that development and use of new technology can be one of the ways to solve environmental problems, while at the same time having positive commercial effects. The Danish government aims to boost the development of green technology, for example in the areas of energy and fuel.

In June 2005, three new research and development strategies were published: one for hydrogen technologies, one for liquid biofuels, and one for wave energy. The strategies supplement Energy Strategy 2025, and can be seen as a realisation of overall considerations concerning prioritising and focusing future technology-development efforts.

For hydrogen technology, the overall strategic target is to make Denmark among the best at developing and demonstrating efficient and competitive technologies and systems, so that hydrogen – based primarily on renewable energy – can become an integral element in clean, efficient, and reliable energy supply.

The strategy for liquid biofuels stresses the need for maintaining current Danish strengths especially within the development of new technologies for production of bioethanol based on straw and other low-value raw materials.

Both the strategy for hydrogen technology and the strategy for liquid biofuels will be important building blocks for the interdepartmental working group which is to establish a total overview of the possibilities for development and use of different alternative propellants in transport.

The overall objective of the wave energy strategy is to enable Danish wave energy plants to contribute to cost-effective, sustainable electricity supply in Denmark, and to enable Danish enterprises to supply competitive wave energy products etc. in Denmark and abroad.

4.3.1.2 Methane, CH_4

Many small sources contribute to the energy sector's methane emissions. The biggest single contribution comes from gas-fired CHP plants, which emit unburnt natural gas. With a view to minimising the emissions, a statutory order now limits the emissions from new plants, corresponding to about 3% of fuel consumption. The emissions limit value for existing plants will be reduced by 5% from 2006 pursuant to Statutory Order no. 720 on limitations of emissions of nitrogen oxides, unburnt carbon hydrides and carbon monoxide etc. of 1998. All else being equal, it is expected that total emissions from these plants will be reduced by 5% from 2006.

4.3.1.3 Measures no longer in place and measures increasing greenhouse gas emissions

Since *Denmark's Third National Communication* to the Climate Convention in 2003, the national CO_2 allowance scheme has been discontinued, as mentioned above. It was replaced by implementation of the common European CO_2 allowance scheme. The common European scheme will in future be the primary instrument to ensure that Denmark meets its climate commitments.

Table 4.19 and Annex B1 contains an overwiev of discontinued and replaced measures including the national CO_2 allowance scheme. Please note that the EU CO_2 allowance scheme will be the key instrument to ensure that Denmark meets its climate commitments. As can be seen, a number of the measures stated below have been replaced by new ones. In a quota system, initiatives within quota-regulated areas have no or only a modest effect on CO_2, and are therefore implemented in order to achieve other effects.

As mentioned in section 4.2.3, from 1 January 2005 tax differentiation has been introduced which will encourage the use of sulphur-free diesel. Increased demand will increase energy consumption in desulphurisation at refineries, and CO_2 emissions will also increase. However, this should be related to the environmental benefits of limiting emissions of sulphur dioxide cf. the supplementary information on this initiatives in section 4.3.2. Two Danish refineries are covered by allowance regulations of 1 January 2005 and have been allocated allowances for 2005-2008 on the basis of historical emissions of CO_2 in 1998-2002. One has also been allocated further allowances as a result of the statutory requirement in EU Community law.

4.3.2 Transport

In 2003, the transport sector was responsible for 22% of Denmark's CO_2 emissions and 18% of total greenhouse gas emissions. The emissions from the transport sector are primarily CO_2. 13 mill. tonnes of CO_2 corresponded to 96.3% of emissions in 2003. Nitrous oxide made up 3.2% or 0.4 mill. tonnes CO_2 equivalents, and methane about 0.5% or 0.07 mill. tonnes CO_2 equivalents.

In 2003, the transport sector's energy consumption - primarily oil products - made up 31.5% of total energy consumption in Denmark. Traffic, especially passenger transport, has risen uniformly in recent years. In step with the increase, energy consumption and greenhouse gas emissions have also increased. In 2003 total greenhouse gas emissions from the transport sector were 24% higher than in 1990. The most recent prognosis from 2002 predicts continued growth in the sector's CO_2 emissions, in spite of the fact that technological development has led to a reduction in energy consumption per km. Thus, the expected growth in traffic is expected to be approx. 17% from 2003 to 2012, whereas the growth in the transport sector's energy consumption is expected to be approx. 9% during the same period.

4.3.2.1 CO_2

Efforts to turn the upward trend in emissions of greenhouse gases in the transport sector have so far failed, partly because of a large growth in traffic intensity and partly due to limitations on CO_2 emissions in Denmark are extremely difficult without international initiatives.

As shown in Table 4.16, the greenhouse gas emissions from fuel for vehicles, ships and aircraft are included under transport. The contribution from the armed forces consists mainly of CO_2 and accounts for just less than 1% of the inventory for the transport sector. The proportion of fuel consumption for multilateral military operations, which is therefore kept out of the total national inventory, is at present regarded as minimal.

Implemented initiatives and measures

In 2002, working on the basis of the previous trends in passenger and freight traffic, the Danish Road Directorate carried out a projection of road traffic up to 2016 and extrapolation up to 2030. The projection indicates that road traffic will continue to grow. With the chosen assumptions it is estimated that road traffic will grow by more than 25% from 1997 to 2016. In the period 2000 to 2010, growth is expected to lie at about 13%.

A large part of total freight and passenger transport is by road and is expected to increase. The trend in freight and passenger transport by road will therefore determine the transport sector's energy consumption and thus its CO_2 emissions.

Table 4.20 and Annex B1 shows the existing policies and measures within the transport sector. In the last few years a number of important steps

TABLE 4.19 REPLACED AND DISCONTINUED INITIATIVES AND MEASURES IN THE ENERGY AREA

Source: Danish Energy Authority and *Danish CO_2 emissions - the effort in the period 1990-2001 and the associated costs*

Name of replaced or discontinued measure or initiative	Name of replacement-measure , cf. Table 4.18	GHG af-fected	Type of in-strument	Status for implementa-tion	Implementing entity/ player	CO_2-re-duction in 2001[4]	Average annual CO_2 reduction for 2008-2012[1]
The energy sector						Mill. tonnes CO_2	Mill. tonnes CO_2
National CO_2-allowance scheme for electricity pro-ducers	EU CO_2 allow-ance scheme entered into force 1/1 2005	(CO_2)	Economic (financial)	National allowance scheme in force 15/6 2000 to 31/12 2004	State authorities, energy producers. EU CO_2 allowance scheme also covers energy-intensive enter-prises		
Subsidy to electricity gen-eration (RE)	Price sup-ple-ment for environment friendly elec[2]	(CO_2)	Economic (financial)	Reorganised 1/1 2005	State authorities, energy producers		
Subsidies for electricity generation (wind turbines)	Price sup-ple-ment for environment friendly elec[2]	(CO_2)	Economic (financial)	Reorganised 1/1 2005	State authorities, energy producers		
Priority for electricity from CHP plants	Price sup-ple-ment for environment friendly	(CO_2)	Economic (financial)	Reorganised 1/1 2005	State authorities, energy producers		
Requirement for offshore wind turbines	Tenders for off-shore turbines[3]	(CO_2)	Regulatory (admin.), economic (financial)	Replaced by tenders	State authorities, energy producers		
Scrapping scheme for old, badly located wind turbines	Scrapping scheme for old wind turbines[4]	(CO_2)	Economic (financial)	Old scheme stopped end of 2003	Local/ regional authori-ties, interest organisa-tions, energy producers, state authorities		
Renewable energy Island	(Finished as state initia-tive)	CO_2	Economic (financial), R&D	Continued locally, see www.veo.dk	Consumers, supply companies, interest organisations, local/ regional authorities, re-search institutions, state authorities		
Construction subsidy for renewable energy	(Scheme dis-continued)		Economic (financial)		State authorities, enter-prises		
Subsidy for investment in energy savings by industry	(Scheme dis-continued)	CO_2	Economic (financial)	Scheme dis-continued end of 2001	State authorities, enter-prises		
Subsidy for conversion of old housing to coal CHP	(Scheme dis-continued)		Economic (financial)		State authorities, enter-prises		
Subsidy to promote con-nection to coal CHP	(Scheme dis-continued)		Economic (financial)		State authorities, enter-prises		
State subsidy for energy savings measures in hous-ing for pensioners	(Scheme dis-continued)	CO_2	Economic (financial)	Scheme dis-continued end of 2003	Local and state authori-ties, consumers		

1 Effects of some of these measures are included in the Effort Analysis cf. annex B2.

2 The amendment to the Electricity Supply Act, which entered into force on 1 January 2005, means that all environmentally friendly electricity, i.e. electricity from wind turbines and other renewable energy (RE) plant, small CHP plants etc., is now sold under market conditions. The previous support for environmentally friendly electricity, where consumers were obliged to take electricity at a fixed settlement price has also been transferred to financial support as a price supplement added to the market price.

3 In accordance with the energy policy agreement of 29 March 2004 two offshore wind turbine farms will be established, each of 200 MW, one at Horns Rev, and one at Rødsand.. The offshore wind farms should be in operation in 2008/2009. There are currently no plans for further development of offshore wind farms. Any further development will depend on the initiatives taken in the Energy Strat-egy 2025, with a view to providing the basis for future extension based on market conditions.

have been taken at international level, and these - supported by targeted and effective Danish action may help to turn the trend for the transport sector's CO_2 emissions.

Thus, the EU has set up an overall target of attaining a mean CO_2 emission from new passenger cars of 120 g of CO_2 per km before 2010. With the aim of fulfilling this target, agreements have been made with the automobile industry in Europe, Japan, and most recently Korea, which commit the industry to reducing the mean CO_2 emission per km. This measure is assessed to have had, and will in the future have, considerable effect and has been implemented with the reduction of CO_2 emissions as one of the primary targets.

The national environmentally-motivated measures for the transport sector, which have also influenced CO_2 emissions, are usually characterised by aiming at limiting environmental impacts in general. "Changing the registration tax to a green owner tax" and "increased fuel taxes" are both assessed to have had considerable effects and were, furthermore, implemented with reduction of CO_2 emissions as one of the primary targets.

A great number of additional initiatives aiming directly or indirectly at reducing CO_2 emissions have been implemented within various areas. Characteristic for all these initiatives are information campaigns or subsidy schemes, while no initiatives have been established using direct regulation such as requirements or bans. The effects of these initiatives is hard to quantify and in themself they are not considered to have contributed significantly to CO_2 reductions

As transport in itself has a number of side-effects in addition to contributing to the greenhouse effect through higher CO_2 emissions, for example air pollution causing poor air quality or acidification, noise, accidents and congestion, it is important to note that the various initiatives implemented in the transport area typically address many of these aspects and can thus not only be considered in relation to CO_2 emissions. In general the increasing traffic intensity has caused increased CO_2 emissions, while other air pollution has fallen significantly. Other negative effects of transport have also been reduced, e.g. the number of injuries and fatalities in accidents fell by 22% and 47% respectively from 1990 to 2002.

Compared with *Denmark's Third National Communication* Table 4.20 has been expanded to include information on the effects estimated for selected initiatives in the *Effort Analysis* mentioned in section 4.1.3 and Annex B2.

New measures

Calculations of possible national measures for reduction of Denmark's CO_2 emissions show that the cost-effectiveness of the measures depends entirely on the side effects. The decision to implement the different measures within the transport sector

must therefore to a great extent be evaluated on the basis of the measure's other effects and not simply from the point of view of reduction of CO_2 emissions. The generally high economic shadow prices without side-effects are primarily a consequence of the already high level of taxation in the transport sector. It is thus a common feature of most of the measures that they are directed towards parts of the transport sector that, taken together, already pay the full economic cost of transport, since there is a considerable fiscal element in the fixed car taxes.
As can be seen in its platform from February 2005, the Danish government will appoint a committee to investigate the options for reorganising the total motor vehicle tax system over several years in a way that promotes the environment and retains existing revenue levels.

An EU directive of May 2003 aims at promoting the use of biofuels in transport. The directive contains reference values for indicative targets that consumption of biofuels in 2005 should comprise 2% of all petrol and diesel sold to transport, and that this percentage should grow to 5.75% in 2010. EU countries can set their own indicative targets, and these can be differentiated compare to the Commission's proposal. Denmark's indicative target of 0% in 2005 was reported to the Commission in 2004 with a note that Danish consumption of biofuels in other sectors was high.

Biofuels are currently more expensive to manufacture than fossil fuels. However, the cost effectiveness can be improved through more intensive research and development. As stated in the new government platform of February 2005, the government will enhance development of green technology, including biofuels.

Therefore, in the summer of 2005 the government set up an interministerial working group to prepare proposals for realisation of the government's objectives relating to fuels. The proposals from the working group will focus on measures to strengthen the development of technologies for alternative road transport propellants, for instance biofuels, natural gas, and, in the longer term, hydrogen.

An updated overall analysis of possible new measures in the transport area and their cost-effectiveness is planned for finalisation in 2006 as part of the *Policies and Measures Project* described in section 4.1.3.

4.3.2.2 Methane, CH_4
The transport sector's emissions of methane account for about 0.5% of the sector's greenhouse gas emissions, corresponding to about 0.07 mill. tonnes CO_2 equivalents.

4.3.2.3 Nitrous oxide, N_2O
Nitrous oxide accounts for just over 3%, or 0.4 mill. tonnes CO_2 equivalents, of the transport sector's total greenhouse gas emissions. Emissions of nitrous oxide have increased considerably since the introduction

TABLE 4.20 MEASURES TO LIMIT CO_2 EMISSIONS FROM THE TRANSPORT SECTOR

Source: Ministry of Transport and Energy and Denmark's CO_2 emissions - the effort in the period 1990-2001 and the associated costs

Name of measure or initiative	Objective	GHG affected	Type of instrument	Status for implementation	Implementing entity/ player	CO_2 reduction in 2001	Average annual CO_2 reduction for 2008-2012
The transport sector						Mill. tonnes CO_2	Mill. tonnes CO_2
Higher fuel taxes[2]					Ministry of Taxation	1.2	1.2
Green owner tax on motor vehicles	More efficient energy consumption, CO_2 reduction	CO_2	Economic	Implemented	Ministry of Taxation	[1]	[1]
Information campaign on fuel consumption of new cars	More efficient energy consumption, CO_2 reduction	CO2	Information	Implemented and completed	Road Safety and Transport Agency		
Energy-correct driving technique	More efficient energy consumption CO_2 reduction	CO2	Information	Included in driving courses	Ministry of Justice		
Initiative on enforcing speed limits	More efficient energy consumption, CO_2 reduction	CO2	Information, economic	Implemented	Ministry of Justice		
Establishment of intermodal installations	More efficient energy consumption, CO_2 reduction	CO2	Economic (financial)	Ongoing implementation	Ministry of Transport, counties, municipalities, HUR, DSB		
Promotion of environmentally friendly goods transport	More efficient energy consumption, CO_2 reduction	CO_2	Economic (financial), information	Implemented	EPA, haulage contractors		
Reduced travel times for public transport	More efficient energy consumption, CO_2 reduction	CO_2	Regulatory (Administrative)	Ongoing implementation	Ministry of Transport, counties, DSB		
Spatial planning	Limitation of transport, CO_2 reduction	CO_2	Regulatory (Administrative)	Ongoing implementation	Counties, munici-palities		

[1] The effect of the various initiatives to improve the energy efficiency of cars, which in addition to the voluntary agreement with the motor industry includes the green car owner tax, information campaigns, energy labelling etc. was estimated in the Effort Analysis at 0.2 mill. tonnes CO_2 in 2001 and 0.6 mill. tonnes CO_2 per year in 2008-2012 cf. Annex B2.

[2] The reduction from the increased taxes on energy products such as fuel has been estimated for 2001. The reduction for 2008-12 is based on taxes on fuel remaining unchanged in real terms and demand not changing.

of new cars with catalytic converters in 1990. As the half-life of cars from that time is approaching, it is expected that the rate of increase will fall until all cars have catalytic converters. This saturation point is expected to be reached around 2010-2012, with annual emissions of around 0.8 mill. tonnes CO_2 equivalents.

4.3.2.4 Measures no longer in place and measures increasing greenhouse gas emissions

Since *Denmark's Third National Communication* to the Climate Convention in 2003, there have been no great changes in measures for transport.

Compared with the measures listed in *Denmark's Third National Communication,* however, it should be noted that the information campaign on fuel consumption of new cars has ended and that the measure to promote enterprise plans for traffic safety and the environment as well as transport plans has been discontinued as funds are no longer being made available.

With regard to the in-depth review of *Denmark's Third National Communication* it should also be noted that in October 2004 the government decided to allocate about DKK 135 mill. to a reduction in taxes of about DKK 0.04 per litre sulphur-free petrol and DKK 0.02 per litre sulphur-free diesel. The purpose is to promote use of sulphurfree petrol and diesel four years before it will be mandatory under EU regulations. *On the one hand*, encouraging phase out of sulphur in petrol and diesel will in principle also cause an increase in energy consumption and thus CO_2 emissions, because of desulphurisation at refineries. Emissions of CO_2 from Danish refineries, which are solely due to requirements for desulphurised petrol and diesel, have not been quantified. At EU level it has been assessed previously that phase 1 of the EU requirements on limiting sulphur in fuel in 2000 would increase total annual CO_2 emissions from refineries in the EU12 by about 6 mill. tonnes. The effect of phase 2 of the EU regulation has not been assessed. *On the other hand*, sulphur-free petrol means that catalytic converters on existing cars will be more effective. Therefore the emissions of pollutants will be reduced by about 10%. Sulphur-free diesel means that emissions of soot particles from diesel cars will fall by about 5%.

4.3.3 Business sector

The business sector covers industry, building and construction and public and private service.

In 2003, this sector was responsible for approx. 13% of Denmark's total greenhouse gas emissions. 82% of these emissions were CO_2. The sector is also the only source of emissions of industrial gases. Climate measures within the business sector are in Table 4.21 and Annex B1.

The ongoing initiatives to reduce the emissions from the business sector include both promotion of energy savings and energy efficiency improvements, conversion of energy production to cleaner fuels and initiatives to reduce the emissions of industrial gases. Certain energy-intensive businesses are also subject to allowance regulation as a consequence of the EU allowance directive.

Earlier analyses have shown that there is a big potential for profitable energy efficiency improvements within the business sector, so improving energy efficiency is a vital area of action.

4.3.3.1 CO_2

Industry, building and construction, trade and private service

Industry is responsible for most of the sectors' emissions of CO_2. The emissions come mainly from energy-consuming activities in industry. Cement and brick production also contributes especially high levels of CO_2, which comes from the raw materials used.

The main measure used to reduce energy consumption by the business sector is a green tax package for the business sector, which was introduced in 1995. The package contained a combination of taxes and rebates to enterprises through, among other measures, government grants to promote energy savings by enterprises. The package led to a higher CO_2 tax and the introduction of a space-heating tax for businesses. At the same time, a scheme was introduced in which companies with high energy consumption have the possibility of gaining a discount on the taxes in return for entering into an agreement on energy efficiency improvements. The combination of taxes and return of the proceeds was intended to ensure a marked reduction of businesses' CO_2 emissions without affecting their international competitiveness.

Subsidies to promote energy savings in business enterprises were discontinued at the end of 2001.

The objective with the green tax package was to get the business sector to contribute to a reduction of Denmark's total CO_2 emissions. The target contribution was about 4% in 2005 in relation to the emissions in 1988.

The green package's overall effect was evaluated in 1999. The main conclusion is that the package has functioned as intended. Considerable environmental gains have been achieved in an economically effective way that takes account of businesses' international competitiveness. The energy package's environmental effects largely live up to the original expectations and the package is thus an important element of the efforts to reduce Denmark's CO_2 emissions.

The agreement scheme was evaluated in 2005. The main conclusion is that, with agreements in 1996-1999, businesses saved approx. 5.5% in energy, 2.5% of which is directly attributable to the agreements. For the period 2000-2003 the corresponding

Table 4.21 Measures within the business sector

Source: Danish Energy Authority and the Danish Environmental Protection Agency

Name of measure or initiative	Objective	GHG affected	Type of instrument	Status for implementation	Implementing entity/ Player	CO_2 reduction in 2001[1]	Average annual CO_2 reduct. for 2008-2012[1]
Business						Mill. Tonnes CO_2	Mill. Tonnes CO_2
EU-CO2 allowances (see under Energy)	CO_2 reduction	CO_2	Economic (financial)	Implemented amendment to implement the Linking Directive adopted by the Folketing May 2005	State authorities, energy producers, energy-intensive enterprises		(Total effect unknown until allocation plan for 2008-12 set)
Agreements on energy efficiency with business	Energy efficiency at energy-intensive enterprises	CO_2	Voluntary agreements, economic (financial)	Implemented	State authorities, business enterprises		
Savings activities by elec. grid, gas and district heating companies (including for the domestic and public sectors)	Energy savings and efficiency, environmental effects including CO_2 reduction	CO_2	Information (advice, education, campaigns)	Implemented	State authorities, supply companies, enterprises		
Tax on HFCs, PFCs and SF_6	Reduction of emissions of industrial gases	HFCs, PFCs, SF_6	Economic	Implemented	State authorities, enterprises	0.0	0.4
Regulation of use of HFCs, PFCs and SF_6	Reduction of emissions of industrial gases	HFCs, PFCs and SF_6	Regulation (admin.)	Implemented	State authorities, enterprises		
Enterprise scheme on HFCs	To reduce use and thus emissions of HFCs in the refrigeration sector	HFCs	Economic (subsidies)	Initiated spring 2005	State authorities		
Public service							
Circular on energy-efficiency in state institutions	Energy savings, technology promotion, environmental effects incl. CO2 reduction	CO_2	Regulation (admin.)	Implemented	State authorities		
Electricity Saving Trust – campaigns and A club to promote efficient appliances (incl. elec. Heating conversion and efficient appliances in households)	Energy savings, technology promotion, environmental effects incl. CO_2 reduction,	CO_2	Information (market influence), economic (subsidies – primarily to elec. heating conversion)	Implemented	Institutions, producers		

1 Effects of these measures are included in the Effort Analysis cf. Annex B2.

figures are approx. 4.5% and 2% respectively.

In the Climate Strategy from February 2003 it was evaluated whether there was still a potential for relatively cheap emission reductions in the energy-intensive part of industry, which had hitherto paid lower CO_2 taxes than the rest of the business sector and the domestic sector for reasons of competitiveness.

Certain energy-intensive businesses are subject to allowance regulation as a consequence of the EU allowance directive. With the common EU allowance scheme, CO_2 regulations without too serious effects on competitiveness could be imposed on energy-intensive industry. Allowance regulation is the main measure to be used with regard to these businesses.

Denmark wants CO_2 taxes on the allowance-regulated fuel consumption for industrial production processes to be repaid as far as possible, and preferably in full. Therefore Denmark will change the CO_2 Taxes Act within the scope defined in the directive on energy taxation. The European Commission must approve the amendment, for instance under the rules on state subsidies, before it can take effect. Process emissions not originating from energy consumption can also be covered by the EU allowance directive. In Denmark's case, this primarily involves the CO_2 emissions from cement production. These emissions have not previously been subject to regulation through taxes.

Business and industry have introduced major energy efficiencies over the past 10 years. Therefore, energy consumption in this sector has remained unchanged, despite considerable economic growth.

Projections of energy consumption show, however, a significant increase in energy consumption by business in the years to come. The potential for better energy efficiency is still great. The draft action plan for a renewed energy-saving effort proposes a number of activities, including:

- Efficiency consultancy and information efforts, including more focus on realising the savings assigned.
- Promotion of sales of energy services. Efforts for business and industry will be organised so that energy services are promoted. An information campaign will also be completed to give the market a push.
- Promotion of energy management, energy-conscious planning, energy-correct procurement and bench-marking of energy consumption.
- Promotion of exploitation of surplus heat.

Following the political agreement of 10 June 2005 to considerably strengthen energy-saving efforts, new initiatives will be launched during 2005 and 2006.

Cement

Cement production results in big emissions of CO_2. The production process itself is very energy-intensive, and a large quantity of CO_2 is emitted in connection with the production process.

Cement production in Denmark is concentrated in a single company. In 2001 the total annual emissions of CO_2 from cement production were about 2.6 mill. tonnes. About half comes from energy consumption and the other half from chalk, which is one of the raw materials used in the process. A lot has been done within the cement industry. For example, in the last 20 years the Danish cement producer has significantly reduced its CO_2 emissions per tonne cement produced.

Up to now, efforts with regard to the cement industry's energy consumption have been based on the green business sector tax package with a combination of taxes and agreements on energy efficiency. From 1 January 2005, all CO_2 emissions from cement production in Denmark are subject to the European CO_2 quota system.

Public service

Work to improve energy efficiency in the public sector has been going on for more than 10 years, and considerable savings have been achieved. However, there are still economically viable possibilities for savings. This is illustrated by the fact that there is a very big difference in consumption (per m^2) between comparable institutions.

Data on energy consumption in the public sector have been collected for some years as a means of rendering the sector's energy consumption visible. There are now complete inventories of energy consumption in county and state institutions, but more limited inventories of the individual municipalities' energy consumption.

The main initiatives to promote energy savings in the public sector are:

- a new circular on energy-efficiency in state institutions (including implementation of profitable energy savings, energy-efficient behaviour and operation and energy-efficient procurement).

- Guidelines for procurement in the public sector, e.g. through preparation of environmental guidelines for large buyers in the public sector.

- Energy labelling and energy-checking of large properties.

- A-club for public institutions, introduced by the Electricity Saving Trust. The members of the club undertake only to buy energy-efficient appliances that meet specific requirements given in guidelines for procurement and in a positive list.

- Campaigns by the Electricity Saving Trust on energy-efficient lighting, ventilation and office equipment, etc.

- Consultancy by supply companies for institutions.

In connection with the Finance Act for the fiscal year 2005, a political agreement on several areas including energy-saving measures was made. The agreement focuses particularly on energy saving in state institutions as a consequence of the efforts of the Electricity Saving Trust (Electricity Saving Trust), on new energy demands for state buildings, and on a new circular on energy-efficiency in state institutions.

Following the political agreement of 10 June 2005 to considerably strengthen energy-saving efforts, new initiatives will be launched during 2005 and 2006.

One of the issues to be discussed is how similar demands as those applying to the state can be introduced in municipalities and regions.

4.3.3.2 N_2O, nitrous oxide

The emission of nitrous oxide (N_2O) from the production of nitric acid in connection with the production of fertilizer in Denmark has only been included in Danish emissions inventories in recent years, even though production from the single plant in Denmark, with associated emissions, has taken place for many years, including 1990, Denmark's basis year for emissions of nitrous oxide.

In summer 2004, however, the owner decided to stop production of fertilizer and so production of nitric acid in Denmark. Emissions of nitrous oxide from production of nitric acid in 2003 corresponded to 0.9 mill. tonnes CO_2 equivalents. In 2004 emissions will be about one-half of this, and from 2005 they will cease entirely, and probably also in 2008-2012 cf. market conditions for production of fertilizer in Europe.

4.3.3.3 HFCs, PFCs and SF_6

The industrial sector is the only sector which in practice emits the industrial gases HFCs, PFCs, and SF_6 according to the emission inventories. These gases are used for several purposes including as cooling and foaming agents, etc. (HFCs), cooling agents (PFCs), and insulator gas in high-tension contacts (SF_6).

The Danish regulation of emissions of the industrial greenhouse gases (HFCs, PFCs, and SF_6) is 2-phased, since there is a consumer tax on the use of the substances and also a statutory order on the phasing out of use of the gases in new facilities and products.

Taxes corresponding to their GWP have been imposed on each of the greenhouse gases from March 2001 in combination with the Danish CO_2 tax of DKK 0.1 per kg CO_2. This means that HFC-134a is subject to a tax of DKK 130/kg, as it has a GWP of 1,300. There is a ceiling of DKK 400/kg so although SF_6 has a GWP of 23,900, the tax is only

DKK 400/kg and not DKK 2,390/kg.

The tax is imposed on the substances on importation because none of them is produced in Denmark. The tax is payable whether the substances are imported as pure substances or are part of imported products. If the content in the products is not known, the tax is based on a fixed tariff.

The tax is payable on a wide range of products, including:

- Refrigerating and freezing plants
- Air-conditioning plants
- PUR foam for cooling plant, district heating pipes, insulated gates and doors, panels for refrigeration and freezer rooms, extruded polystyrene for insulation (XPS foam), jointing foam
- Spray canisters
- Insulation gas

The tax is also payable on service on existing and new installations/products.

On 15 July 2002, a statutory order on the regulation of certain industrial greenhouse gases came into force.

This order includes a general ban on the use of industrial greenhouse gases in a great number of new facilities and products from 1 January 2006, including household cooling and freezing appliances, PUR foam, etc. There are, however, certain exceptions to the general phase-out date. For example, the ban will only apply to new commercial cooling plants, air-conditioning plants, etc. from 1 January 2007. Other exceptions are new sound-insulating windows, in which SF_6 has been banned since 1 January 2003, and PFCs, on which there has been a general ban since September 2002. However, some products and applications are exempted from the ban. This applies, for example, to service on existing plants, mobile cooling plants, including mobile air conditioning plants, the use of HFCs in cooling and air conditioning plants with fillings between 0.150 and 10 kg HFC, SF_6 in high voltage plants, etc.

To ensure the best possible implementation of the phase-out dates for the refrigeration sector, which is the most important area, a total of DKK 12 mill. have been reserved for the next couple of years for development of alternatives and for subsidies for implementation of alternatives that have been developed already. A knowledge centre for HFC-free cooling has been established. The centre will disseminate knowledge and to a certain extent also offer technical assistance.

4.3.3.4 Measures no longer in place and measures increasing greenhouse gases

Table 4.19 presents the national CO_2 allowance scheme, and other measures that have been discontinued and changed.

Apart from the above changes, no significant changes in the measures for the business and industry sector have taken place since *Denmark's Third National Communication* to the Climate Convention in 2003.

4.3.4 Agriculture, forestry and fisheries

The primary occupational sectors agriculture, forestry and fisheries are generally considered as one single economic sector in Denmark. However, the importance of the individual sectors differs greatly with respect to Denmark's emissions and uptake of greenhouse gases. Agricultural farms have emissions of methane and nitrous oxide. The net uptake of CO_2 in Denmark's forests is included under Forestry. However, CO_2 emissions from energy use in all three sectors are considered under one heading because there is no breakdown of these in the annual energy statistics. Table 4.22 and Annex B1 shows measures for emission reductions within agriculture and forestry.

In 2003, agriculture was responsible for 17% of Denmark's total greenhouse gas emissions. Approx. 80% consisted of methane and nitrous oxide and 20% of CO_2 from the burning of fuel.

Measures that are used in the agricultural sector and that have affected or will affect the sector's greenhouse gas emissions include:

- Ban on burning of straw on fields
- Action Plans for the Aquatic Environment I and II and Action Plan for Sustainable Agriculture
- Action Plan for the Aquatic Environment III
- Ammonia Action Plan
- Action Plan for Joint Biogas Plants and subsequent follow-up programmes

4.3.4.1 Methane, CH_4

Methane comes mainly from the agricultural sector. The emissions in 2003 were 176,000 tonnes, corresponding to 3.7 mill. tonnes CO_2 equivalents. The methane is formed through enteric fermentation in farm animals and from conversion of carbohydrates in manure.

Agriculture's biggest contribution to the methane emissions comes from dairy cows.

In the digestion process, methane is a by-product of the fermentation of feed in the rumen, primarily from grass and green fodder. In addition, methane is formed during conversion of manure under anaerobic conditions if the temperature is sufficiently high. These conditions normally occur in manure stores and housing systems with liquid manure or deep litter.

The emission of methane from agriculture is expected to be reduced in 2003-2012, corresponding to approx. 0.1 mill. tonnes of CO_2 equivalents, primarily due to improved efficiency in cattle farming.

4.3.4.2 Nitrous oxide, N_2O

Agriculture is the biggest source of nitrous oxide emissions in Denmark. Of the total emissions of 26,000 tonnes in 2003, 77% or 20,000 tonnes, corresponding to more than 6.2 mill. tonnes of CO_2 equivalents came from agriculture.

Nitrous oxide may be emitted during microbial decomposition of organic matter. The process occurs in some types of manure stores and during conversion of minerally and organically bound nitrogen (e.g. manure and applied wastewater sludge) in the soil. Some of the leached nitrogen is also converted into nitrous oxide. Nitrogen entering the soil with fertiliser and manure and in plant residues is the main cause of nitrous gas emissions. In 2003 agriculture's main contribution to emissions of nitrous oxide consisted of a contribution of 43% from manure and a contribution of 31% from run-off[12].

Ammonia volatilisation contributes to the greenhouse effect because some of the ammonia nitrate ends up as nitrous oxide in the atmosphere. Ammonia volatilisation into the atmosphere comes almost exclusively from agriculture. In 2002 the NH3-N emissions from agriculture were slightly more than 80,800 tonnes, with a nitrous oxide contribution corresponding to 6% of agriculture's nitrous oxide emissions. Ammonia volatilises from manure, fertiliser, sludge, crops and treatment of straw with ammonia. The emissions particularly occur during handling of manure in animal housing, during storage of manure, during transport of manure, and from grazing animals[13].

Implemented measures and initiatives

The emissions of nitrous oxide from agriculture are expected to be reduced, corresponding to about 3 mill. tonnes of CO_2 equivalents or 32% during the period from 1990 to 2008-2012. Implementation of the Action Plan for the Aquatic Environment II and III will contribute the most to this reduction[14,15].

Action Plans for the Aquatic Environment I and II and Action Plan for Sustainable Agriculture

One of the main purposes of the Action Plans for the Aquatic Environment and the Action Plan for Sustainable Agriculture was to reduce agriculture's emissions of nitrogen to the aquatic environment.

The action plans have been implemented as regulation of farmers' behaviour. The Action Plan for the Aquatic Environment I was initiated in 1987 and the Action Plan for Sustainable Agriculture in 1991. These action plans included particularly requirements concerning winter green fields and better utilisation of manure. The Action Plan for the Aquatic Environment II from 1998 contained a number of additional measures, including re-establish-

Table 4.22 Measures within agriculture, forestry and fisheries to limit emissions of greenhouse gases

Source: Ministry of Food, Agriculture and Fisheries, Danish Institute of Agricutural Sciences, Danish Forest and Nature Agency, Forest and Landscape Denmark and *Denmark's CO_2 emissions - the effort in the period 1990-2001 and the associated costs*

Name of measure or initiative	Objective	GHG affected	Type of instrument	Status for implementation	Implementing entity/ player	CO_2 reduction in 2001	Emissions reduction 2010
Agriculture						**mill. tonnes CO_2 eq**	**mill. tonnes CO_2 eq**
Action Plan for the Aquatic Environment I+II and Action Plan for Sustainable Agriculture	Reduction of N run-off from agriculture by 100,000 t N/ year	N_2O	Regulation (order), economic, information	1987, 1991, 1998	State and county authorities	1.6	2.2
Action Plan for the Aquatic Environment III	Further reduction of N and P losses from agriculture	N_2O	Regulation (order), economic	2004	State and county authorities		0.2[1]
Ban on burning straw on fields	Less air pollution	N_2O	Regulation (order)	1989	State and county authorities		
Ammonia action plan and the new statutory order on manure	Reduced emissions of ammonia	N_2O	Regulation (order)	2001	State and county authorities		0.03
Planting of windbreaks	Binding of CO_2	CO_2	Economic (subsidies)	1960s	State		0.14
Biogas plant	Reduced CO_2 and methane emissions and better exploitation of manure	CO_2, N_2O and CH4	Economic (subsidies)	1987	State	0.2	0.5
Forestry							
Subsidies scheme for private afforestation on agricultural land	Forest area increased by 450,000-500,000 ha in 100 years.[2]	CO_2	Economic	Subsidies for afforestation through the Forestry Act	Danish Forest and Nature Agency	0.074	0.262 [3]
Public afforestation (state, counties and municipalities)	Forest area increased by 450,000-500,000 ha in 100 years.[2]	CO_2	State: regulation/ counties and municip.: voluntary		Danish Forest and Nature Agency, counties and municipalities	0.074	0.262 [3]

1 In addition to the effect stated of Action Plan III, it is estimated that the effect under Action Plan III of the general structural development will be a reduction of 170,000 tonnes CO2 equivalents/year, and that the effect of the CAP reform will be an additional reduction of 230,000 tonnes CO2 equivalents/year. All the estimated effects are in the new baseline projection "with measures".

2 Currently, only about 1850 ha forest are planted each year (average 1990-2004), the objective requires 4,500 ha- 5,000 ha. per year

3 Calculation on the basis of actual afforestation 1990- 2004, which has been too small.

ment of wetlands, afforestation, agreements on environment friendly agricultural measures, organic farming on an additional 170,000 ha, improved use of fodder, reduced animal density, use of catch crops, reduced fertilisation norms and stricter requirements concerning the use of nitrogen in manure. The aim, which has now been reached, was to reduce nitrogen leaching by 100,000 tonnes N/year up to the year 2003[16].

These action plans have, in particular, reduced the emissions of nitrous oxide. There have presumably also been small effects on methane emissions from manure stores, particularly as a consequence of increased use of anaerobic fermentation of manure in biogas plants. The increased use of catch crops, larger areas with organic farming and re-establishment of wetlands must also be expected to lead to increased storage of carbon in the soil.

Most of the changes in nitrous oxide emissions from agriculture in the period since 1990 can be attributed to these action plans. However, it has been calculated that even without the action plans there would have been a reduction in emissions, although to a much lesser extent. The effect of these action plans on emissions of nitrous oxide has been calculated at about 2.2 mill. tonnes CO_2 equivalents/year[19]. There are no estimates of the effect on carbon storage in the soil.

Action Plan for the Aquatic Environment III

With the political agreement on the Action Plan for the Aquatic Environment III of 2 April 2004, a number of measures were implemented to follow up on the results attained via the previous plans. This third action plan contains targets with respect to nitrogen, phosphorus, sensitive natural areas, and slurry odour. This is a 10-year agreement, and in evaluations in 2008 and 2011 initiatives will also be combined with the Water Framework Directive and the Habitats Directive. Special emphasis is on the use of catch crops, stricter requirements for use of manure as well as afforestation and agro-environmental measures. In addition, the agreement includes research initiatives aimed at slurry odours and reduction of emissions of nutrients, e.g. research into technology to manage slurry, ammonia etc. The effect of the action plan in 2008-12 is estimated at 0.2 mill. tonnes CO_2 equivalents/year[17].

The Ammonia Action Plan

Ammonia emitted from agriculture will stimulate emissions of nitrous oxide when it is deposited in other ecosystems. Reducing ammonia evaporation will therefore also result in a reduction of nitrous oxide emissions. An Ammonia Action Plan which was adopted in 2001 will, together with the Action Plan for the Aquatic Environment I and II, reduce ammonia emissions by 15-20,000 tonnes of nitrogen annually. Hereby ammonia evaporation from agriculture should be reduced from 90,000 tonnes of nitrogen in the mid 1990s to approx. 60,000 tonnes of nitrogen in 2004.

The measures covered by the Ammonia Action Plan are:

1) Optimisation of manure handling during housing for cattle, pigs, poultry and fur animals.
2) Rules on covering storage facilities for solid manure and slurry tanks.
3) Ban on surface spreading and reduction of the time from field application of manure to incorporation.
4) Ban on ammonia treatment of straw.

These measures are estimated to lead to a reduction in emissions of nitrous oxide corresponding to 34,000 tonnes of CO_2 equivalents annually by 2010. A shorter period of exposure for spread manure has the greatest effect of 13,000 tonnes of CO_2 equivalents annually[20].

Ban on burning of straw
The purpose of the ban has been to reduce air pollution from burning of straw.

The ban has resulted in greater return of carbon to the soil and increased use of straw as a fuel. Both uses will result in a net reduction in CO_2 emissions. Not burning straw prevents the methane and nitrous oxide emissions associated with the burning. On the other hand, there are some emissions of nitrous oxide in connection with the return of nitrogen to the soil when the straw is mulched.

The measure works by regulating behaviour, and the ban was introduced in 1989. The measure was implemented in the form of a statutory order under the Environmental Protection Act, and compliance is monitored by the local authorities.

The initiative has also caused increased carbon storage in the soil, but this has not been quantified so far.

4.3.4.3 CO_2
Implemented measures

Energy consumption by agriculture
The green tax package and the grant scheme for energy savings in the business sector are resulting in energy savings and thus a reduction in CO_2 emissions from use of energy in agriculture.

Biogas
Biogas from conversion of manure and organic waste has a number of advantages when used to substitute fossil energy – reductions in emissions of greenhouse gases, better exploitation of manure and management of waste[18]. The politically fixed supplement on the price of power production based on biogas has been adjusted several times during the last five years – most recently by the Energy Policy Agreement of 29 March 2004, which provides for support to biogas through a supplement on the price of electricity for biogas plants

established before the end of 2008. It was estimated that this would lead to the establishment of 40 additional joint biogas plants. However, there are a number of barriers to building biogas plants that make it doubtful this goal can be reached. Therefore, the baseline projection only includes expansion of half this size – corresponding to increased production of approx. 2 PJ biogas up to 2010. The increase will result in annual emissions being reduced by about 0.25 mill. tonnes CO_2 equivalents/year. The reduction in methane and nitrous oxide emissions comprises about half of these effects. The other half is due to reduced CO_2 emissions from substitution of fossil fuels in energy supply.

Planting of windbreaks
The objective of planting windbreaks is to reduce wind erosion and ensure greater biodiversity. Planting of windbreaks is supported under conditions described in the Statutory Order on subsidies for planting windbreaks and biotope-improving measures (Statutory Order no. 1101 of 12/12/2002). Support is granted under the EU Rural Districts Programme. Since the end of the 1960s about 1,000 km of tree-lined windbreaks have been planted with government subsidies. It is also estimated that about 30% more has been planted without subsidies. Estimates indicate that planting of windbreaks leads to CO_2 sequestration in woody biomass of about 130,000 tonnes CO_2/year[19].

Forestry
Forestry is important due to its CO_2 and emissions being a consequence of trees growing, respiring and decomposing. An average Danish forest contains a considerable store of CO_2 absorbed from the atmosphere. When new forests are established, new CO_2 stores are created. Afforestation is therefore a useful climate policy instrument.

Calculating the total CO_2 accumulation in forests is complicated. Almost all existing forests are established for wood production, e.g. logs and timber. Whether there are net emissions or net sequestration of CO_2 from an existing forest depends on many factors, including its age and species distribution, and the management regime applied.

Compared with other sectors, forestry has very low energy consumption. Green accounting and environmental management are being developed in the sector, partly with a view to determining whether the use of fossil fuels can be reduced.

The national forest programme includes evaluation of the possibilities offered by the Kyoto Protocol for economically viable CO_2 sequestration in forests. Such measures should be implemented without undermining the Protocol's environmental integrity or counteracting established measures in support of sustainable forest management. The same should also apply to forest projects in connection with CDM and JI. The forests are managed with a view to multiple-use and sustainability, and carbon sequestration is one of several objectives. The political goal with the most direct influence on increased carbon sequestration is the declaration of intent from 1989 to double the forested area in Denmark within 100 years.

Various measures have been taken towards achieving this goal. For instance, a government grant scheme has been establish that supports private afforestation on private agricultural land. Also, the state itself establishes new forests, and some private individuals choose to establish forests on agricultural land without a government grant.

Primarily the CO_2 balance is affected by these measures. Forests raised on agricultural land accumulate far more biomass than the previous agricultural land-use. The forest biomass contains about 50% carbon, which is absorbed as CO_2 through photosynthesis. Probably, additional carbon is stored in the organic matter in the soil due to a larger supply of dead organic matter and the absence of soil preparation. The effect of afforestation on other greenhouse gases, such as nitrous oxide and methane has not been properly clarified. However, the acidification of nitrogen-rich former agricultural land may stimulate the formation of nitrous oxide, and blocking of drains after afforestation and the resulting water stagnation could increase methane emissions. Increased methane and nitrous oxide emissions could counteract the positive effect of afforestation on CO_2 sequestration. However, since sufficient information is still unavailable on changes in the methane and nitrous oxide emissions, analyses of the consequences are only carried out for CO_2.

The Danish Forest and Nature Agency is responsible for policies on afforestation on private agricultural land and on state-owned land.

Afforestation on 12,000 hectares of privately owned farmland, corresponding to additional binding of 131,000 tonnes of CO_2, was subsidised in 1990-2004.

The state, counties, and municipalities have contributed approx. 6,400 hectares of new forest since 1990. Only little is known about private afforestation without subsidies. It is assumed that about 600 ha are planted annually.

Both the subsidised private afforestation and afforestation by public authorities will be less in the next 6-8 years, since the funds for this period have been allocated to international obligations in the nature area[20].

The annual quantities of CO_2 sequestrated as a consequence of subsidised private afforestation, public afforestation and the total afforestation are summed up in Table 4.23.

Carbon sequestration in trees after afforestation is calculated by a simple model. Sequestration is obtained as the planted area multiplied by the carbon absorption for the age class of the trees. The absorption is calculated by using Danish increment Tables for Norway spruce, as representative of conifers, and oak, as representative of deciduous trees[21].

The areas in Table 4.23 for the period 1990-2001 are based on the evaluation of the afforestation programme carried out in the period[22] together with a national forest inventory carried out recently[23]. The areas for 2005-2020 are based on a slightly revised projection[24]. Afforested areas do not include plantations of Norman Christmas trees in short rotation on agricultural land.

The quantities of carbon are obtained by estimating the carbon content of the woody biomass using relevant conversion factors. The stem biomass for conifers and the total above-ground woody biomass for deciduous trees are converted into total above-ground and below-ground biomass by multiplying with an expansion factor. An expansion factor of 2 is used, which is somewhat higher than the expansion factors used for forests planted before 1990 - 1.8 for conifers and 1.2 for deciduous trees. The reason for this is that the expansion factor depends on age.

The stem biomass thus constitutes a very small part of the total biomass in entirely young trees. The expansion factor therefore decreases exponentially towards a value between 1 and 2 as the trees grow older[25].

Since there are neither Danish expansion factors nor age-dependent expansion functions, the expansion factor of 2 is being used until better methodologies are available. The total biomass is subsequently converted into tonnes dry matter using the conversion factors 0.38 tonnes dry matter m^{-3} for conifers and 0.56 tonnes dry matter m^{-3} for deciduous trees[26]. The quantity of carbon is calculated by multiplying with the conversion factor 0.5 tonnes C/tonne dry matter. Carbon sequestration in products can be included in the calculations, but the figures presented represent only the quantity of carbon that is sequestered in the forest ecosystem. This quantity of carbon is stored in the total living biomass (incl. roots) of the trees and in slash. The quantity of sequestered carbon is summed by the model for the different year classes of afforested areas since 1990, providing the total carbon sequestration for the differently aged stands in specific years. Studies of soils in a time series of afforested stands have shown that, compared with the biomass carbon pool, there is no great change in the soil carbon pool during the first 30 years after afforestation[27]. It is assumed in the models that the growth of the trees corresponds to site index 2 (on a scale decreasing from 1 to 4), and that there is a ratio of 1 to 3 between the area afforested with conifers and deciduous trees[28].

Afforestation offers many other benefits in addition to CO_2 sequestration. Besides being valuable for out-

TABLE 4.23 AREA OF AFFORESTATION AND CO_2 SEQUESTRATION 1990 – 2004.
Source: Danish Forest and Nature Agency and Forest and Landscape Denmark

CO_2 sequestration in Gg	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Private afforestation with subsidies, ha	0	70	70	70	178	178	212	968	547	3304	1764	1288	1497	1537	435
CO_2 seq. (Gg)	0	0	-0.1	-0.3	-0.4	-0.8	-1.1	-1.9	-4.3	-5.7	-13	-18	-22	-29	-35
Public afforestation, ha	119	312	574	599	702	537	553	681	247	508	378	225	229	378	400
CO_2 seq., Gg	0	-0.2	-0.8	-2.0	-3.1	-4.5	-6.1	-8.6	-13	-16	-20	-24	-27	-33	-36
Total afforestation including private afforestation without subsidies, ha	730	993	1255	1280	1491	1326	1376	2260	1405	4423	2753	2124	2337	2526	1446
Total CO_2 seq. Gg	0	-1	-3	-5	-8	-10	-16	-24	-34	-43	-59	-74	-88	-108	-124

door recreation it provides valuable groundwater protection and protection of habitats for fauna and flora. Forest is also a highly valued type of nature in terms of cultural values and landscape amenity. In addition to carbon sequestration, afforestation thus contributes to a wide range of values. The continued growth of new forests will provide for carbon sequestration on a long-term basis. If the objective of doubling the Danish forested area within 100 years is achieved, the new forests will sequester about 250 mill. tonnes of CO_2 over the next approximately 120 years. Owing to the legal protection of forest land use, the sequestration is expected to be permanent. If the objective of doubling the forest area is to be achieved, however, an enhanced rate of planting will be needed.

Danish forest policy is moving towards more near-to-nature forest management. It is not certain what this change in management will mean for storage of carbon in the existing forested area in the future. Some near-to-nature forest management such as longer rotation and more permanent forest cover aid more CO_2 storage, while grazing and more open areas have the opposite effect. For state-owned forests (about. 25% of the forested area) it has been decided to introduce near-to-nature forest management. The Forestry Act of 2004 also provides for better opportunities for private forest owners to move in this direction. However, at the moment it is uncertain how far and how quickly this will happen.

Fisheries
The inventories of the total emissions and removals of greenhouse gases include the emissions of greenhouse gases from fuel sold for fishing vessels. The fishing vessels' contribution to greenhouse gas emissions consist primarily of CO_2. No special initiatives have been put in place concerning this, but the reduction in the number of fishing vessels in recent years has also resulted in a reduction in fuel consumption and thus also in emissions of CO_2.

4.3.4.4 Measures no longer in place and measures increasing greenhouse gases

Since *Denmark's Third National Communication* to the Climate Convention in 2003, no measures limiting greenhouse gases have been discontinued, nor have any measures increasing greenhouse gases been introduced within agriculture, forestry and fisheries. However, it should be noted that although it is positive to increase use of straw as a fuel for energy supplies in substitution for fossil energy, the amount of carbon returned and stored in the soil will be reduced at the same time. Removal of straw for energy purposes also seems to have negative effects for the fertility of soil[29]. Use of straw for energy increased from 0.72 mill. tonnes in 1990 to 1.2 mill. tonnes in 2002.

4.3.5 The domestic sector

96% of greenhouse gas emissions from households in 2003, corresponding to 4.1 mill. tonnes of CO_2 equivalents, consisted of CO_2. There are also small emissions of methane and even smaller emissions of nitrous oxide. To this can be added emissions as a result of consumption of electricity and district heating. These emissions are included in the figures for producers and therefore they are also subject to quota regulation in the energy sector.

4.3.5.1 CO_2

The consumption of energy by households, including electricity and district heating, is responsible for almost 30% of the total energy consumption in Denmark.

The largest part of the energy consumption is used for heating homes, where burning of oil and natural gas results in a CO_2 emissions. A large part of the space heating is in the form of district heating (about 43% in 2003), which results in CO_2 emissions in connection with the production of district heat. When district heat is produced at CHP plants or with CO_2-friendly fuels, such as natural gas and, particularly, renewable energy, there are big CO_2 savings overall from use of district heating instead of individual heating based on, for example, oil-fired boilers.

Danish households also have a substantial consumption of electricity. Most of the household consumption of electricity goes to household appliances and light sources, whereas less than 19% goes to electric heating. Consumption for electric heating has been decreasing in recent years as a consequence of the work of the Electricity Saving Trust, which has resulted in considerable conversion from electric heating to district heating and natural gas heating.

Households' disposal of waste also contributes to emissions of methane from landfill sites.

The action being taken on households' waste and transport consumption is described in the sections on waste and transport. This section therefore concentrates on the possibilities of reducing the CO_2 emissions through savings in electricity and heating in households and the possibilities for conversion to more environment-friendly forms of heating. The possibilities for reduction in the public energy supply system are described in the section on the energy sector.

In 2003, the domestic sector used 157 PJ of energy for heating (climate-corrected) and 32 PJ of electricity for appliances, etc. Consumption for heating has been quite constant for a number of years in spite of an increase in the number of households and in the area heated. The consumption of electricity for appliances, etc. has risen steadily since 1996. The increase in the consumption of electricity has, however, not been nearly as great as the increase in the number of appliances, since these have become steadily more energy efficient.

Implemented measures
With a view to reducing energy consumption and environmental impacts from the domestic sector, a wide range of initiatives have been launched, as described in Table 4.24 and Annex B1 in order to promote:

- Electricity savings,
- Savings in energy consumption in space heating, and
- Fuel conversion (from electric heating and the use of oil to district heating, natural gas, and the use of renewable energy).

Several concrete measures and incentives are described below.

Energy taxes
All energy consumption for space heating as well as other energy consumption in households and the public sector, as well as non-VAT-registered businesses are subject to energy taxes. Throughout the 1990s CO_2 and energy taxes have steadily increased. The increases have mainly affected households, helping to reduce their energy consumption.

CO_2 taxes
All energy consumption in households is subject to CO_2 taxes.

Energy labelling of small buildings
Must be implemented on the sale of the building - primarily heating consumption. This applies in principle

for all small buildings, apart from holiday homes etc.

Energy labelling of large buildings - ELO
Energy labels and an energy plan must be prepared regularly for all large buildings over 1,500 m^2. Includes heating, water, and common electricity

Energy labelling of appliances
Energy labelling (A-G) of white goods, lighting etc. is compulsory. There are also voluntary labelling schemes (Energy Star, Energy Arrow, windows, boilers, electric motors, ventilators) for a number of products.

The Danish Electricity Saving Trust - conversion of electricity/heating
Sets up requirements for energy companies, negotiates and markets fixed-price agreements, advises customers, and grants subsidies.

The Danish Electricity Saving Trust - efficient appliances
Prepares market analyses and campaigns focusing on the price and efficiency of energy appliances. Makes it simple, safe, and cheap to trade in an energy-appropriate manner.

DSM (electric gas and district heating).
Organises campaigns and consumer-oriented activities. Particularly extensive regarding electricity.

In the report on energy saving (Energispareredegørelsen) from May 2003, the government submitted a number of proposals for new energy-saving measures. Table 4.25 contains an overview of these measures and a short progress report on implementation.

New measures
The draft action plan for a renewed energy-saving effort includes a proposal for implementation of a number of measures in the domestic sector, including:

- Tightening the energy-saving demands in building regulations by 25-30% from 2006.
- Further tightening of energy demands by approx. 25% from 2010.
- Abolishing mandatory linking and banning electric heating in new low-energy buildings.
- Demands in building regulations for existing buildings in connection with major renovations, changes in heating systems, replacement of boilers, windows and roofing.
- Maintaining and further developing an ambitious energy labelling scheme for buildings.
- Giving higher priority to international efforts concerning energy labelling and standards.
- Promoting visualisation of energy consumption and development of sophisticated energy meters.

TABLE 4.24 MEASURES WITHIN THE DOMESTIC SECTOR TO REDUCE EMISSIONS OF GREENHOUSE GASES

Source: Danish Energy Authority and *Denmark's CO_2 emissions - the effort in the period 1990-2001 and the associated costs*

Name of measure or initiative	Objective	GHG affected	Type of instrument	Status for implementation	Implementing entity/ Player	CO_2 reduction in 2001[1]	Average annual CO_2 reduction for 2008-2012[1]
Domestic sector						**Mill. tonnes CO_2**	**Mill. tonnes CO_2**
EU-CO2-quotas on electric and district heating production could influence consumption by households (see under Energy)	CO_2 reduction	CO_2	Economic (financial)	Implemented Amendment to implement the Linking Directive adopted by the Folketing May 2005	State authorities, energy producers, energy-intensive enterprises		
Energy labelling of small and large buildings (incl. public sector and business)	Savings in energy water and env. impacts including CO2 reductions	CO_2	Information	Implemented	Consumers, others		
Energy labelling of electric appliances	Energy savings and more efficiency, promote technology env. impacts including CO_2 reduction[s]	CO_2	Information	Implemented	Consumers, others		

1) There are no estimates of the effects of these initiatives.

- Strengthening dissemination of information on energy saving.

These measures have formed part of the political discussions preceding the political agreement on future energy-saving measures.

Following the political agreement of 10 June 2005 to considerably strengthen energy-saving efforts, new initiatives will be launched during 2006.

4.3.5.2 Measures no longer in plase and measures increasing greenhouse gases

Table 4.19 presents the national CO_2 allowance scheme, as well as other measures that have been discontinued and changed.

Other than the changes mentioned above, there have been no great changes in measures for the domestic sector since *Denmark's Third National Communication* to the Climate Convention in 2003.

4.3.6 Waste and sewage

The contribution of the waste sector to greenhouse gas emissions consists primarily of methane from the decomposition of organic waste that takes place at landfill sites. Following *Denmark's Third National Communication* to the Climate Convention, statements of emissions of greenhouse gases from wastewater treatment have been prepared. Of total greenhouse gas emissions from the waste sector of just less than 1.5 mill. tonnes CO_2 equivalents in 2003 – corresponding to 2% of total Danish greenhouse gas emissions – the proportion from landfills was 79%, and the proportion from wastewater was 21%.

Please note that all incineration of waste in Denmark is associated with energy utilisation, which is why the emission of CO_2 from the incineration of plastic waste is included under the energy sector.

4.3.6.1 Methane, CH_4

In previous years, efforts within the waste sector have been based on the Action plan for waste and recycling 1993-97, which included targets on waste treatment to the year 2000. The plan did not relate directly to the waste sector's contribution to methane emissions (CH_4), but included a number of initiatives that are of relevance to waste products containg industrial gases (HFCs and SF_6), besides an objective concerning stopping landfilling combustible waste.

The previous government's waste plan, Waste 21, which covers the period 1998-2004, does not relate directly either to the waste sector's possibilities for contributing to solution of the problem of greenhouse gas emissions. The plan aimed at stabilising the total quantities of waste in 2004, and increasing recycling and reducing the environmental burden from the environmentally harmful substances in waste, including the in-

Table 4.25 Overview of new initiatives in the report on energy saving (Energispareredegørelsen) of May 2003

Source: Danish Energy Authority

Initiative	Status
Promoting particularly energy-efficient refrigerators and freezers	In 2004 and 2005, the Electricity Saving Trust received an extra DKK 20 mill. to make special efforts in this area. The campaign has started and is already showing good results.
Phasing-out traditional double glazing - voluntary agreement	In February 2004 a voluntary agreement was made with the glazing industry to phase out windows with poor energy qualities and promote energy-efficient windows. As part of this agreement, the government has allocated DKK 20 mill. for campaign activities etc. in 2004-2006. The first campaign was in autumn 2004.
Tightening building regulations	The proposal for new energy provisions in the building regulations entered into force on 1 January 2006. The requirements have been tightened by 25-30% and a number of requirements for existing buildings in connection with renovation, replacement etc. have been tightened.
Efficiency requirements for boilers and circulation pumps	In order to promote energy-efficient boilers, a labelling scheme has been established and a number of training and campaign activities are being planned. Regarding pumps, the Electricity Saving Trust has entered into a voluntary agreement with producers etc., and the grid companies have initiated campaigns to promote energy-efficient pumps in industry.
Reduction of standby consumption	In early 2004 an action plan was presented containing a number of initiatives to help realise part of the great potential in this area. In March 2005 an international stand-by conference was held in Copenhagen.
Enhancement of research and development activities	The framework for grid companies' subsidy for R&D in energy efficiency was increased by DKK 15 mill. to DKK 25 mill. per year from 2003.

dustrial gases. With respect to waste incineration, the objective was to adjust incineration capacity to what was absolutely necessary, to ensure best possible energy utilisation, maximum CO_2 displacement and regional self-sufficiency. The plan thus contributed indirectly to reduction of greenhouse gas emissions.

The objective in Waste 21 was for 64% of all waste to be recycled, 24% to be incinerated and not more than 12% landfilled.

That objective was already reached in the year 2000, and according to the Danish Environmental Protection Agency's Waste Statistics 2000 (ISAG). Total waste in that year amounted to about 12.8 mill. tonnes.

The current government's waste plan, the Waste Strategy 2005-08, was issued in September 2003. The new Waste Strategy aims at decoupling growth in waste amounts from economic growth. The Strategy also aims at preventing the loss of resources in waste and environmental impacts from waste, as well as better quality waste treatment and an efficient waste sector. Finally, the government is aiming at reducing waste amounts sent to landfill to 9% in 2008 and increasing recycling to 65% of all waste.

The most important initiatives regarding greenhouse gases in the Strategy are improvement of landfills and increased collection of plastic packaging for recycling.

The latest figures for waste in Denmark are in the Danish EPA Waste Statistics 2003. Total waste in 2003 was 12,835,000 tonnes, of which 66% was recycled, 26% incinerated, and 8% landfilled.

Implemented measures
The waste sector's contribution to reduction of greenhouse gas emissions consists mainly in:

- reducing landfilling of organic waste,
- utilising gas from discontinued/existing landfill sites,
- promoting oxidation of gas in landfill coverings,
- increasing recycling of plastics, and
- using waste as an energy source.

An overview of the concrete measures implemented in the pursuance of these objectives is given in Table 4.26 and Annex B1.

The emission of methane from Danish landfills is calculated to have been 64,000 tonnes gross in 1990, increasing to a maximum of 68,800 tonnes in 1996, corresponding to 1.2 mill. tonnes of CO_2 equivalents.

As a consequence of the ban on landfilling waste suitable for combustion, from 1 January 1997, methane emissions from Danish landfill sites will fall in the years ahead. The emission of methane in 2012 is, thus, calculated to be 55,400 tonnes, corresponding to approx. 20% of the maximum in 1996.

According to the Danish Energy Authority's inventory Biogas, Production, Forecast and Target Figures, there were in all 25 landfill gas plants in Denmark in the autumn of 2002. These installations produced 10,000 tonnes of methane annually, compared to approx. 1,700 tonnes in 1993. In 2004, methane recovery from landfills amounted to 7,700 tonnes methane[30]. The same study shows that, through optimising existing plants, a further 1,800 tonnes methane per year could be recovered over the next five years. Furthermore, the establishment of new gas-collection equipment at five landfills could contribute an additional 1,300 tonnes methane per year over the next five years.

Optimisation of existing plant and establishment of new gas plants will, however, probably require subsidies. The previous subsidy scheme to promote gas collection at landfills was discontinued at the end of 2001.

As a consequence of the new landfilling strategy, only a few biogas plants are expected to be established in the period up to 2012. The maximum quantity of methane recovered peaked in 1998 at about 13,200 tonnes. The quantity of methane recovered will continue to fall gradually over many years.

On the basis of the above, net emissions of methane (methane produced less methane recovered) from Danish landfill sites have been calculated at 63,500 tonnes in 1990, rising to 65,700 tonnes in 1993, and then falling steadily to 50,700 tonnes in 2012. The average annual net methane emissions in 2008-2012 correspond to about 1.1 mill. tonnes CO_2 equivalents.

The total quantity of waste incinerated rose from 2,216,000 tonnes in 1994 to 3,287,000 tonnes in 2003, i.e. an approximately 48% increase. The energy produced from the incineration plants is included as part of the renewable energy production in the Danish energy statistics. The international greenhouse gas inventories include greenhouse gases from incineration of the content of oil-based products, such as plastics in waste.

In accordance with the targets in Energy 21 and Waste 21, waste incineration plants are designed so as to optimise energy utilisation.

Besides the direct effect of waste management on greenhouse gas emissions, the emissions are also affected indirectly through recycling paper, cardboard, etc. which means less energy consumption and thus less CO_2 emissions during production of new products. When organic material in domestic refuse is used in biogas plants and the methane produced is used in biogas motors, it is essential that emission of methane from these motors be reduced, either by use of new technologies or by afterburning exhaust fumes.

TABLE 4.26 MEASURES WITHIN THE WASTE SECTOR TO REDUCE EMSSIONS OF GREENHOUSE GASES.

Source: Danish EPA and *Denmark's CO_2 emissions - the effort in the period 1990-2001 and the associated costs*

Name of measure or initiative	Objective	GHG affected	Type of instrument	Status for implementation	Implementing entity/ player	CO_2 reduction in 2001[2]	Average annual CO_2 reduct. for 2008-2012 Mill. tonnes CO_2[2]	
Waste sector						Mill. tonnes CO_2	Energy consumption	Energy-production
Obligation to send combustible waste to incineration (in practice a ban on landfilling).	Reduce landfilling, energy production, greater recycling, CH_4 reduction	CH_4	Regulation (admin.)	Implemented	State and local authorities	0.02	0.3	0.3
The waste tax	Greater recycling, least possible landfilling	CH_4	Economic	Implemented	State authorities /waste plants			
Weight-and-volume-based packaging taxes	Waste reduction	CH_4, CO_2	Economic	Implemented	State authorities			
Subsidy programme – Enterprise Scheme (special scheme for businesses)	Reduce environmental impacts from waste	CO_2 and CH_4	Financial	Implemented	State authorities			
Increased recycling of waste plastic packaging	Increase recycling of waste plastic packaging to 22.5% in 2008	CO_2	Regulation	Adopted	State and local authorities/ enterprises and the public		0.005	0.005
Implementation of the EU landfill directive	More focus on gas in environmental approvals, less waste to landfills	CH_4	Regulation	Under implementation	State and local authorities			
Support for (construction of facilities for) gas recovery at landfill sites	Increase CH_4 recovery at landfills	CH_4	Financial	Discontinued	State authorities	0.2	0.2	0.1
Subsidy programme for cleaner products	Waste reduction, pollutants out of waste	CH_4	Financial	Discontinued	State authorities			

The implementation of national waste plans and fulfilment of targets has necessitated the implementation of a wide range of measures.

In 1996 the Statutory Order on Waste was amended to introduce a municipal obligation to assign combustible waste to incineration (corresponding to a ban on deposition of combustible waste). As a result of this, large quantities of combustible waste that used to go to landfill sites are now either recycled or used as fuel in Denmark's incineration plants.

Besides the traditional regulation via legislation, statutory orders, and circulars, the waste sector is regulated by means of a range of policies and measures, including taxes and charges, grant schemes and agreements.

A tax on landfilling and incinerating waste was introduced in 1987. Since 1993 the tax has been differentiated to reflect the prioritisation of the different forms of treatment. It thus costs most to deposit waste, less to incinerate it and nothing in tax to recycle it. The waste tax has been increased several times and it is now DKK 375 per tonne waste for landfilling and DKK 330 per tonne waste for incineration. The size of the tax thus provides an incentive to recycle as much of the waste produced as possible and to use non-recyclable, combustible waste as fuel in energy production instead of depositing it at a landfill site.

Weight-and-volume-based taxes (e.g. on various packaging, carrier bags and PVC film) encourage a reduction in packaging consumption and thus the quantities of waste. The weight-based tax is based on an index that reflects the environmental burden of the materials used.

Besides the waste tax, which the local authorities collect to finance public waste treatment, increasing use is being made of fees to finance, for example, return agreements for special waste fractions, including tyres and lead batteries. The fees are used in this context to finance collection and recycling of waste.

Under the grant programme Programme for Cleaner Products etc., grants are made for projects that reduce the environmental burden in connection with development, production, sale and use of products or in connection with the management of the waste generated during the product's entire lifecycle. Furthermore, support can be granted to waste projects aiming at reducing the problems of waste disposal. A total of about DKK 100 mill. was allocated for the 5-year period 1999 to 2003 for the part of the Programme related to waste.

In 2005 the Programme for Cleaner Products etc. was replaced by the Enterprise Scheme which refunds CO_2 taxes to business. The waste part of the new programme is aimed exclusively at enterprises. A total of DKK 33 mill. for the four-year period from 2004 to 2007 has been earmarked for the waste part of the scheme. The subsidies are to be used to reduce the environmental impact of waste.

As a result of the EU Packaging Directive, collection of plastic packaging waste for recycling is to be increased to 22.5%, corresponding to an increase in recycling of about 11,000 tonnes plastic per year from 2008. This will be done through an amendment to the Statutory Order on Waste, which will require municipalities to improve the possibilities of people and enterprises to separate and deliver plastic packaging waste for recycling.

On the basis of the EU Landfill Directive, demands on the arrangement and running of landfills have been tightened with Statutory Order No. 650 of 29 June 2001 on landfills. According to the new regulations, waste-gas in landfills for mixed waste must be monitored. Gas from landfills where not insignificant amounts of biodegradable waste are landfilled must be managed in an environmentally-sound way or be used to produce electricity or for heating purposes.

According to the new regulations on landfilling, transitional plans must be prepared for all existing landfills, and the validating authority must re-assess the environmental conditions at the site and decide whether the facility is to comply with the new regulations or must close in 2009 at the latest.

The new regulations are expected to lead to:

- a reduction in the number of landfill facilities,
- a substantial increase in landfilling charges,
- a further reduction in the annual volume of landfilled waste,
- a new general requirement that waste must be characterised before it is received for landfilling.

An amendment to the Statutory Order on Waste in 2000 means that municipalities must now assign non-recyclable waste PVC and impregnated wood to landfill. The objective is to avoid adding PVC and impregnated wood to incineration with the consequential pollution of flue gas and slag. Moreover, landfills will receive more organic waste, and in the long term this will form methane during decomposition. Work is being carried out to develop new treatment methods in order to utilise the resources in waste. When these methods have been developed and new plants established, it is expected that the Statutory Order on Waste will be amended so that PVC and impregnated wood is assigned to these plants and landfilling is avoided.

It is not possible to make a quantitative estimate of the effects of the various measures for the waste area. The objectives in the national waste plans are related to waste amounts and their treatment. The developments are monitored through the annual waste statistics. However, changes in the treatment of waste cannot immediately be converted into changes in emissions of greenhouse gases.

New measures

The Danish EPA has supported initiation of a development project aiming at documenting the oxidation of methane in landfill coverings. By ensuring optimal oxidation, methane emissions from landfills can be reduced, and if this can be documented it can be credited to the CO_2 accounts. The project will be completed by the Technical University of Denmark, provided funding can be attained from the EU LIFE Programme. Improved oxidation of landfill gas in coverings will be of interest to landfills with relatively low gas production so that it is unprofitable to use the gas as well as landfills where not all gas production can be utilised.

4.3.6.2 Measures no longer in place and measures increasing greenhouse gases

As stated in Table 4.26 the subsidy programme for gas retrieval at landfill sites and the subsidy programme for cleaner products have been discontinued.

The requirement to assign impregnated wood to landfilling could lead to an increase in the amount of biodegradable waste and therefore increased emissions of methane. Additional contributions from this source will, however, be modest in relation to the overall amount of methane from landfills.

4.4 POLICIES AND POLITICAL MEASURES IN GREENLAND FOR THE ENERGY AREA

Greenland is facing new and great challenges, partly because of the country's increasing energy consumption and the increasing oil prices, and partly because global climate change is especially affecting the Arctic and threatens Greenland's way of life and hunting culture. Greenland has a global obligation to live up to the Climate Convention and the Kyoto Protocol. Greenland will work to promote use of renewable and environmentally friendly energy (water, wind power, solar energy, hydrogen) which in the long term will reduce CO_2 emissions and make Greenland less dependent on fossil fuels. The goal is to achieve the greatest financial and energy savings, to reduce the vulnerability of energy supply through utilisation of renewable energy and make the production and supply system more efficient. Work with environmentally friendly energy supply should be encouraged so that Greenland contributes to mitigating global climate change.

Until the publication of the Greenland Energy Plan 2010 in 1995, the requirement for security of supply and the energy policy guidelines from 1986 meant that the main focus of was to be hydropower as one of the all-important energy policy objectives in Greenland.

With Energy Plan 2010, for the first time the Home Rule presented a complete review of the energy sector and an action plan for its development and set up a more differentiated main energy policy objective of "establishing an energy supply that does not compromise security of supply and that ensures the least possible economic and environmental burden for society and the other energy players".

Both before and since 1995, policies and measures have been adopted and implemented in the energy sector that have reduction of greenhouse gas emissions as one, although not in most cases the main, objective.

Some of the most important measures are described below.

Act on Energy Supply

With adoption by the Landsting of the Act on Energy Supply in 1997, for the first time Greenland got legislation dealing with energy supply in a broad perspective, since it covers electricity, heat and fuel supply. At the same time, it is the first time that energy efficiency improvement and energy savings have been covered by legislation. This Act confirms Energy Plan 2010's main objective of promoting the most economic and environment-friendly energy supply. It is stated in the Act that energy supply must be planned with a view to economising and saving in energy consumption, the highest possible level of security of energy supply, efficient improvements in the production and supply system and cleaner energy production.

Use of hydropower for energy supply

Since the 1970s the Home Rule has been interested in using hydropower for energy supply. Up through the 1970s and 1980s systematic studies of possible hydropower potentials were carried out. With the presentation of the energy policy guidelines in 1986, it was agreed that hydropower should be a bearing element of the future energy supply system. The first hydropower plant, taken into use in 1993, supplies Nuuk with electricity. Since it was commissioned, the plant has resulted in an annual saving of more than 20,000 m^3 oil, which has resulted in a reduction in CO_2 emissions of around 55,000 tonnes, or about 10% of the total CO_2 emissions in Greenland.

A hydropower plant to supply Tasiilaq commenced operation in 2005, with an expected oil saving of 1,300 m^3, corresponding to 3,446 tonnes CO_2 per year. A small hydropower plant in South Greenland is now under construction to supply Qaqortoq and Narsaq. When it starts operation in early 2008, it is expected to contribute with displacement of oil corresponding to 4,800 m^3.

Waste incineration

Waste incineration plant has been established at the six largest towns, and these together cover about 70% of the population. Moreover, a number of small waste incineration plants have been built in settlements with waste disposal as the main objective.

At all six incineration plants in settlements, some of the surplus heat from the incineration process is used for district heating.

Waste incineration to some extent replaces fuel oil for heating and reduces methane emissions that would otherwise occur if the waste were deposited at landfill sites.

Sector Programme for Renovation with an Environment and Energy Improving Effect in Greenland 2000-2003

In 1999 the Home Rule and the Danish State entered into an agreement on renovation of buildings and supply plants. The agreement covered renovation projects with a positive environmental and energy effect. The objective of the Sector Programme is to ensure that the extraordinary renovation efforts focus on environment and energy aspects, not only for the benefit of the local environment, but also for the benefit of the Arctic and global environment.

Projects carried out under the Programme include renovation of electricity and heat production plants, including supply grids, revision of the building regulations, renovation of buildings, preparation of a new energy plan and behaviour-regulating measures.

As much electricity in Greenland is still produced by diesel-powered generators, there will be a directly measurable environmental effect through a reduction in electricity consumption and thus in electricity generation. This reduction can be achieved partly through electricity saving measures in the production process, and the distribution grid, and at the consumer. Better energy exploitation of electricity production through renovation and establishing CHP plants will reduce fuel consumption in boiler plants.

The Sector Programme is being concluded. Outstanding points are primarily within aquatic issues.
In 2003 an interim evaluation of the Programme was carried out in which a total reduction of more than 3,900 tonnes CO_2 was calculated as a result of less consumption of energy, as described in Table 4.27. The calculation was done on the basis of basic information from the Danish Energy Authority energy statistics and builds on a conversion of the reduction to Giga Joules. Gas oil and diesel have also been assumed.

4.5 Measures for the Faroe Islands

The Climate Convention was ratified by the Realm, and therefore it also applies for the Faroe Islands. The Faroese have not yet formulated an actual Climate Strategy or energy policy.

However, after the last general election on 20 January 2004 the home rule government agreed to a statement of intent on the energy area, which included the following:

- Overall energy policy is a national political responsibility.

- The oil administration and the municipalities are to prepare an electricity supply act.

- Energy development should consider nature and the environment.

- Renewable energy sources should comprise as large a proportion of total energy production as possible.

- Cooperation with respective authorities on R&D regarding renewable energy is to be promoted.

- Use of energy-saving products is to be promoted.

It is also intended to set up a working group to prepare a proposal for an energy policy action plan by June 2006. The work should emphasise describing conditions such as future energy needs, security of supply, renewable energy, initiatives and tools for energy savings, structure and competition, nature and environmental considerations as well as economic reserves. At *Energikonference 78* (energy conference 78) there was a proposal to reduce oil imports for onshore use by at least 25% per capita over a ten-year period and to adapt the fishing fleet to the least possible energy consumption in relation to catches.

Renewable energy was less than 5% of total energy supplies on the Faroe Islands in 2003. However, there is unexploited potential, especially in wind and wave power.

Oil consumption has increased from less than 4 to 5 MWh/capita, with a slight drop up to 1994. In 2002 hydropower was 40.1% of electricity production. Electricity supply on the Faroe Islands is carried out by the supply company SEV, which is owned by the Faroese municipalities jointly. It has recently been decided that a third party should have access to the SEV supply grid, and this will break the monopoly.

The Faroe Islands work with NERI on the annual inventory of greenhouse emissions for the Climate Convention. In the latest inventory of April 2005, total greenhouse gas emissions from the Faroe Islands were calculated at 0.843 mill. tonnes CO_2 equivalents. It is vital that the statistics are prepared and the co-operation on the annual emissions inventories and other information for the Climate Convention continues and grows so that the Realm can meet its commitments under the Climate Convention.

In connection with ratification of the Kyoto Protocol by the Realm, there was a territorial reservation for the Faroe Islands as the government did not accede to the Protocol entering into force for the Faroe Islands.

It is planned that the territorial reservation for the Faroe Islands regarding the Kyoto Protocol should be debated again by the Faroese parliament during autumn 2005[31].

4.6 SUPPLEMENTARY INFORMATION UNDER THE KYOTO PROTOCOL

4.6.1 The national registry

Background
Denmark's national allowances registry and other EU Memberstates national allowances registers are part of the EU emissions trading scheme, which entered into force on 1 January 2005. From 1 January 2008 the EU ETS will be included in the international emissions trading system under the Kyoto Protocol. Denmark's national registry is therefore

set up so that it can enter directly into the emissions trading system, under the Kyoto Protocol.

Statutory basis

The national allowances registry was established pursuant to the CO_2 Allowances Act, no. 493 of 9 June 2004 issued by the Minister for Economic and Business Affairs. The Act implements EU Directive 2003/87/EC (allowance directive). In accordance with the Act, the Minister for the Environment is responsible for establishment and operation of the national CO_2 allowances registry. Statutory Order no. 1305 of 14 December 2004 delegates the task from the Minister for the Environment to the Danish EPA and sets the amount of the fee to be paid for using the registry.

The Allowances Act was revised in May 2005 to implement EU Directive 2004/101/EC of 27 October 2004 (Linking Directive) to change the Quotas Directive so that enterprises subject to allowances can apply CO_2 credits from JI and CDM projects under the EU Quotas Directive.

Organisation and operation of the registry

Design and operation of the register must be in accordance with Commission Regulation (EC) No 2216/2004 and decision of the European Parliament and Council 280/2004 EU.

Administrative set-up

A secretariat has been established in the Danish EPA to manage operation and administration of the registry. Users can contact the secretariat directly by phone or email for help in using the registry.

Enterprises and users of the registry are kept informed about regulations, news etc. through regular updates from the Danish EPA website, and a newsletter from the allowances reg-

TABLE 4.27 EXPECTED ENERGY SAVINGS AND REDUCTIONS IN CO_2 EMISSIONS AS A RESULT OF THE SECTOR PROGRAMME FOR RENOVATION WITH ENVIRONMENTAL AND ENERGY IMPROVEMENTS IN GREENLAND 2000-2003

Source: Data from the Project secretariat, Energy Statistics 2001, Danish Energy Authority, and calculations from Direktorat for Miljø og Natur in Greenland (Department for Environment and Nature)

Estimated annual energy savings, Sector Programme for renovation	El, kWh	Oil, litres	Total
Overall framework conditions	-	-	
International commitments	-	-	
Supply	4,674,603	750,000	
Building renovation	-	236,610	
Measures to reduce consumption	-	31,000	
Waste disposal	-	-	
Planning and monitoring	-	-	
Total, Sector Programme	**4,674,603**	**1,017,610**	
Total, Sector Programme, GJ	**16,829**[1]	**36,500**[2]	**53,328**
CO2 emissions, tonnes[3]			3,946

[1] 1.000 kWh = 3,6 GJ

[2] Assumed Calorific value = 42.70 GJ per tonne and Density = 0.84 tonne per m3

[3] Assumed CO_2-content = 74.0 kg per GJ

istry. The newsletter will be issued quarterly or as required and will explain about new regulations and opportunities as well as any planned temporary closures (for updates etc.).

Registry software
The Danish EPA has entered into a licensing agreement with the UK Department for Environment, Food and Rural Affairs, DEFRA on purchasing registry software. The Centre for Corporate Management under the Danish Ministry of the Environment is responsible for technical operation of the registry software.

Further information on the Danish national CO_2 allowances registry is in Annex D.

4.6.2 Supplementarity

Supplementarity
According to the Kyoto Protocol, the use of the mechanisms in Articles 6 (JI), 12 (CDM) and 17 (IET) of the Protocol must serve as a supplement to domestic action to reduce greenhouse gas emissions. The reason for this is that action in the Annex I countries drives technological development and is also consistent with the agreement that Annex I countries must lead the way in efforts to reduce global emissions.

The formulation used in the Protocol ("..supplemental to domestic action..") is not further qualified and no specific requirements are laid down regarding how large a proportion of the total national reduction objective may be fulfilled using flexible mechanisms. The Marrakech Accord stipulated that "...the use of mechanisms shall be supplemental to domestic action and that domestic action shall thus constitute a significant element of the efforts made by each Party...".

Effects of Denmark's efforts 1990-2001
As indicated in section 4.1.4, Denmark has in 2005 completed an analysis of the impact of selected implemented measures on greenhouse gas emissions in the period 1990-2001. According to this *Effort Analysis*, the total effect of the measures under consideration is approx. 20.6 mill. tonnes annually in the period 2008-2012. But since Danish electricity production is integrated into the Northern European electricity market, this effect is expected to be partially offset by 5 mill. tonnes annually between 2008-12 due to increased electricity exports. Emissions on Danish soil are therefore expected to be approx. 15.6 mill. tonnes CO_2 lower than if the measures considered had not been implemented.

Compared to the emissions in Denmark in 2008-2012 that were expected previously in the 2003 baseline projection, if no policies or measures had been implemented, Denmark would have fallen short by 40.7 mill. tonnes CO_2 annually in 2008-2012.

However, the total climate effect of the calculated measures is approx. 21 mill. tonnes.

Since 2001, the last year covered by the *Effort Analysis*, other significant climate measures have been implemented, and in particular the EU's common CO_2 quota scheme.

4.6.3 Denmark's climate efforts – a step on the way to sustainable development

As mentioned above, the government's National Strategy for Sustainable Development in Denmark, A SHARED FUTURE - balanced development was adopted by the Folketing in June 2002.

In this strategy, the government lists eight objectives and principles for creating sustainable development:

1. The welfare society must be developed and economic growth must be decoupled from environmental impacts.

2. There must be a safe and healthy environment for everyone, and we must maintain a high level of protection.

3. We must secure a high degree of bio-diversity and protect ecosystems.

4. Resources must be used more efficiently.

5. We must take action at an international level.

6. Environmental considerations must be taken into account in all sectors.

7. The market must support sustainable development.

8. Sustainable development is a shared responsibility and we must measure progress.

The strategy is built up with a number of sectors: food production, forestry, industry, transport, energy, urban and housing development, and intersectoral action: climate change, biodiversity, environment and health, resources and resource efficiency, knowledge and policies and measures, the global dimension and public participation.

In order to follow developments in relation to the strategy, regular indicator reports are prepared. The indicator reports contain 14 key indicators - including indicators for economic growth, greenhouse gas emissions, air pollution, employment and discharge of nutrients to the marine environment. In addition, the trend in a wide range of more specific indicators is being monitored. Examples of these indicators are the incidence of asthma, the thickness of the ozone layer, by-catches of porpoises, the amount of PCB in cod liver and the number of organic farms.

The conclusion in the most recent indicator report of April 2005 is that in a number of areas, Denmark is on the right course in work for more sustainable development, as amongst other things the indicators show decoupling between economic growth and energy consumption, and the number of ecolabelled products is increasing. In other areas there remain challenges. For example it is still important to reduce emissions of greenhouse gases from transport work and business to classify chemicals still needs to be intensified.

4.6.4 Efforts for international air transport and shipping

Denmark is fully aware of importance of reducing greenhouse gas emissions from both aviation and shipping. Denmark will therefore continue to promote the issue in international organisations through Danish support to the EU work on the subject in the ICAO and IMO. Denmark also supports internal EU strategies, to secure progress. For example there is the EU's Sixth Environment Action Programme, the EU strategy for reduction of emissions of air pollutants from ships at sea etc.

In addition, Denmark has an overall wish to secure knowledge-building on aircraft and shipping emissions of greenhouse gases. In this connection Denmark used its EU Presidency in 2002 to initiate a study of EU Member States on emissions of greenhouse gases from aviation, and to support streamlining of the cooperation structure amongst EU countries in the area.

4.6.5 Efforts to limit adverse effects in other countries

In connection with Denmark's contribution to international climate efforts, in accordance with the Kyoto Protocol Denmark will endeavour to implement policies and measures under article 3 of the Protocol in such a way that adverse effects in other countries are minimised. However, Denmark does not consider that its contributions to international climate efforts have adverse effects in other countries as, on the contrary, the reduction of emissions of greenhouse gases in Danish commitments under the Protocol will in fact contribute to limiting dangerous climate change in all countries.

If nothing is done to limit emissions of greenhouse gases, climate scenarios from the IPCC indicate that developing countries in particular will experience the greatest changes in climate.

In its international efforts, Denmark will therefore continue to take the greatest possible account of special needs and concerns of developing countries and especially least developed countries. This also applies to adverse effects which can already be ascertained from changes in the climate. The existing strong Danish focus on the special vulnerability of developing countries to climate change underlines this (see section 7.5).

4.6.6 Legislation, enforcement and administrative procedures for implementation of the Kyoto Protocol

Section 2.1.1 briefly describes the Danish system of government. The legal basis for the division of powers into the legislative, executive, and judicial power is the Danish Constitution, *Danmarks Riges Grundlov*[32].

The Constitution includes the legal basis for how the Regent acts on behalf of the Realm in international affairs, and he cannot act without the consent of the Folketing in any way that increases or restricts the area of the Realm, or enter into obligations requiring cooperation of the Folketing or which in some other way are of great significance to the Realm. Neither can the Regent, without the consent of the Folketing, cancel an international agreement entered into with the consent of the Folketing.

On the motion of the government, the Folketing thus gave its consent in 2002, allowing Her Majesty Queen Margrethe the Second, on behalf of the Realm and with territorial reservations for the Faroe Islands, to ratify the Kyoto Protocol. This was on 31 May 2002.

Denmark's implementation of the Kyoto Protocol is on-going and is being effectuated by following up on the national Climate Strategy, sector-policy strategies with climate considerations, and concrete initiatives, which will contribute to limiting or reducing greenhouse gas emissions, and implementation of the other parts of the Kyoto Protocol. The legislation necessary to do this has been adopted in pursuance of the Constitution regulations concerning legislative powers.

Pursuant to the Constitution, the Regent is the ultimate authority, cf. paragraphs 12-14:

"**12.** Subject to the limitations laid down in this Constitutional Act, the King shall have supreme authority in all the affairs of the Realm, and shall exercise such supreme authority through the Ministers.

13. The King shall not be answerable for his actions; his person shall be sacrosanct. The Ministers shall be responsible for the conduct of government; their responsibility shall be defined by statute.

14. The King shall appoint and dismiss the Prime Minister and the other Ministers. He shall decide upon the number of Ministers and upon the distribution of the duties of government among them.The signature of the King to resolutions relating to legislation and government shall make such resolutions valid, provided that the signature of the King is accompanied by the signature or signatures of one or more Ministers. A Minister who has signed a resolution shall be responsible for the resolution."

With this background, the Regent delegates responsibility for various functions to government ministers through Royal resolutions. This makes the various ministers for different areas responsible for, e.g. making proposals for new/amended legislation made necessary by the Kyoto Protocol, enforcement of legislation and initiation of necessary administrative procedures.

The total set of regulations can be accessed via Retsinformation[34] (on-line legal information system). Annex B1 contains, as far as possible, reference to the specific legal basis for each of the concrete measures dealt with in Chapter 4. Legislation concerning measures of importance to Denmark's commitments under the Kyoto Protocol will be enforced pursuant to the current legal basis, including pursuant to any penalty clause. Enforcement could also involve the judicial power.

As regards the institutional arrangements for the implementation the Kyoto Protocol concerning activities in connection with participation in the mechanisms under articles 6, 12, and 17 of the Kyoto Protocol and establishment and operation of a national allowance registry, the general delegation of tasks is as follows, although the Danish EPA also has activities concerning the CDM:

JI and the national register:
Danish EPA under the Ministry of the Environment

CDM:
Ministry of Foreign Affairs

The Danish Energy Authority under the Ministry of Transport and Energy is responsible for legislation and administration concerning the EU Quotas Directive.

4.6.7 Strategies to mitigate climate change cf. article 10(b) of the Kyoto Protocol

Denmark's Climate Strategy and measures to mitigate climate change are described in sections 4.1-4.3.

Notes

1 Denmark's Greenhouse Gas Projection until 2012, an update including preliminary projection until 2017, December 2002, Jørgen Fenham, UNEP centre.

2 Difference between 20 and 25 mill. tonnes of CO_2 equivalents, depending on the outcome the EU's final setting of the individual EU countries' reductions, which is to take place in 2006, including consideration for Denmark's correction to the import of electric power in the base year 1990.

3 Denmark's CO_2 emissions - the effort in the period 1990-2001 and the associated costs, Report from the Danish EPA, No. 2, April 2005 (Main report http://www.mst.dk/udgiv/publikationer/2005/87-7614-587-5/pdf/87-7614-588-3.pdf and Annex report:http://www.mst.dk/udgiv/publikationer/2005/87-7614-589-1/html).

4 http://www.mst.dk/transportuk/pdf/NAPeng.xls

5 http://www.mst.dk/transport/01100000.htm,

6 Energy taxation in Denmark is described in detail in the report Energy policies of IEA Countries – Denmark 2002 (pp. 27-33) published by the IEA (International Energy Agency) in 2002.

7 The report "Omlægning af registreringsafgiften - Rapport fra arbejdsgruppen om en omlægning af registreringsafgiften" (Restructuring of registration tax – the working group's report), Ministry of Taxation, April 2003, available in Danish on: http://www.skat.dk/public/dokumenter/publikationer/registreringsafgift/bilbeskatning_april2003.pdf .

8 An overview of simplifications carried out and planned is available in Danish on http://www.skat.dk/publikationer/projekter/forenkling/3577.html

9 Under the Kyoto Protocol, Denmark's base year is 1990 for CO_2, methane and nitrous oxide, whereas 1995 will be chosen as base year for the industrial gases (HFCs, PFCs, and SF_6) cf. Article 3.8 of the Protocol.

10 Under the Kyoto Protocol, the LULUCF category is dealt with separately under Articles 3.3 and 3.4. Since effects of afforestation must be included as a contribution to fulfilling the reduction target, according to Article 3.3, these are also included here. Since it is optional to include effects of activities under Article 3.4 and Denmark has not yet made a decision on this, these effects are excluded here.

1 More information at www.ens.dk/sw15966.asp

12 Olesen et al., 2004

13 Mikkelsen et al., 2005: Mikkelsen, M.H., Gyldenkærne, S., Poulsen, H.D., Olesen, J.E. & Sommer, S.G. (2005). Opgørelse og beregningsmetode for landbrugets emissioner af ammoniak og drivhusgasser 1985-2002. Arbejdsrapport fra DMU Nr. 204. (in Danish).

14 Olesen et al., 2004: Olesen, J.E., Petersen, S.O., Gyldenkærne, S., Mikkelsen, M.H., Jacobsen, B.H., Vesterdal, L., Jørgensen, A.M.K., Christensen, B.T., Abildtrup, J., Heidmann, T. & Rubæk, G. (2004). Jordbrug og klimaændringer - samspil til vandmiljøplaner. DJF rapport Markbrug nr. 109. (in Danish).

15 Olesen, 2005: Olesen, J.E. (2005). Muligheder for reduktion af drivhusgasemissioner i jordbruget. I: Olesen, J.E. (red). Drivhusgasser fra jordbruget - reduktionsmuligheder. DJF rapport Markbrug nr. 113, s. 12-32. (in Danish).

16 Grant et al., 2000: Grant, R., Blicher-Mathiesen, G., Jørgensen, V., Kyllingsbæk, A., Poulsen, H.D., Børsting, C., Jørgensen, J.O., Schou, J.S., Kristensen, E.S., Waagepetersen, J. & Mikkelsen, H.E. (2000). Vandmiljøplan II - midtvejsevaluering. Miljø- og Energiministeriet, Danmarks Miljøundersøgelser, Silkeborg, Denmark. 65 pp (in Danish).

17 Olesen et al., 2001: Olesen, J.E., Andersen, J.M., Jacobsen, B.H., Hvelplund, T., Jørgensen, U., Schou, J.S., Graversen, J., Dalgaard, T. & Fenhann, J. (2001). Kvantificering af tre tiltag til reduktion af landbrugets udledning af drivhusgasser. DJF-rapport Markbrug 48. (in Danish).

18 Sommer et al., 2004: Sommer, S.G., Petersen, S.O. & Møller, H.B. (2004). Algorithms for calculating methane and nitrous oxide emissions from manure management. Nutrient Cycling in Agroecosystems 69, 143-154.

19 Gyldenkærne et al, 2005: Gyldenkærne, S., Münier, B., Olesen, J.E., Olesen, S.E., Petersen, B.M. & Christensen, B.T. (2005). Opgørelse af CO_2-emissioner fra arealanvendelse og ændringer i arealanvendelse. Arbejdsrapport fra DMU (under preparation,, in Danish).

20 Nature, 2000.

21 Møller, 1933

22 Forest and Nature Agency, 2000

23 Larsen and Johannsen, 2002

24 Danish Energy Authority, 2001

25 Schöne and Schulte, 1999

26 Moltesen, 1988

27 Vesterdal et al., 2002

28 More information on the methods can be obtained from the Danish Energy Authority, 2001, and Vesterdal, 2000.

29 Christensen, 2002

30 Willumsen, 2004

31 Minister for the Interior (and Environment) Jógvan við Keldu's in an interview with the Danish Broadcasting Corporation (DR) on 30 March 2005 (http://www.dr.dk/p1/morgen/tidligere.asp?action=showarticle&id=39462, P1, 30. marts 2005, 07.10-08.00, 8:15-13:20) (in Danish)

32 The Danish Constitution (Danmarks Riges Grundlov) (http://www.retsinfo.dk/_GETDOCI_/ACCN/A19530016930-REGL /: http://www.folketinget.dk/pdf/constitution.pdf)

34 http://www.retsinfo.dk/

5 Projections and the total effect of policies and measures

5.1 Introduction and overall effect of policies and measures

According to the EU's burden sharing agreement, Denmark has committed itself to a reduction of greenhouse gas emissions by 21% in the period 2008-2012 in relation to the base year 1990/95 under the Kyoto Protocol.

In connection with this agreement, Denmark had reservations with respect to effects of large imports of electricity from Norway and Sweden in the base year 1990, which reduced Denmark's emissions that year by 6.3 mill. tonnes of CO_2 compared to the domestic production of electricity to cover consumption. The Danish position was, and is, that the Danish EU reduction commitment should not be based on low emissions in a single year like in 1990, where low emissions were due to exceptionally large imports of electricity. In March 2002, Denmark had to accept a Council decision subjecting Denmark to the legal commitment to reduce emissions by 21% compared to the base year, without correcting for imports of electricity.

Denmark was, however, assured in a political declaration from the EU Council of Ministers and the European Commission that the assumptions relating to base year emissions will be taken into account in connection with fixing the assigned amount of emissions in 2006, measured in tonnes of CO_2 equivalents. The government, therefore, aims at a reduction burden for Denmark in 2008-2012 which is equal to 21% of the 1990 level corrected for imports of electricity. The difference corresponds to 5 mill. tonnes of CO_2 equivalents annually in 2008-2012.

The shortfall in respect of fulfilling Denmark's obligations with the existing policies and measures has been calculated both for a situation in which account is taken of the electricity import in 1990 and for a situation in which account is not taken of this.

The projections are based on a number of sector-specific projections of the domestic emissions for this period. These emissions depend on the extent of economic activity in all sectors of society, energy prices, technological development, and legislation regulating individual activities in relation to the environment, energy efficiency, etc. Among the most important preconditions are the Ministry of Finances' estimate of economic development and the IEA's expectations regarding future energy prices. The projections are also based on measures already adopted described in Chapter 4 and annex B. Corresponding to the most recent inventory of greenhouse gas emissions, the legal reduction commitment of 21% entails that Denmark has to reduce its greenhouse gas emissions from an amount corresponding to 69.6 mill. tonnes of CO_2 equivalents in the base year 1990/95 to 55 mill. tonnes of CO_2 equivalents in 2008-2012.

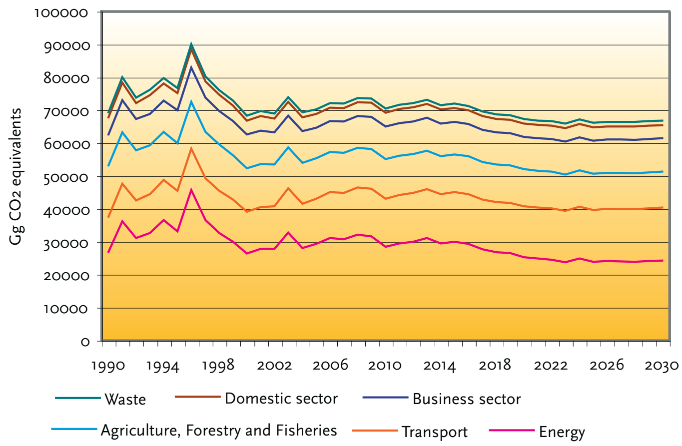
The most recent projections from May 2005 include the period 2004-2030 and are shown in Annex E. Projections for 2013-2030 are, however, somewhat more uncertain than the projections up to 2013, due to several factors, including the fact that uncertainties concerning measures and their expected effects increase with projection length. The projection is a "with measures" projection, which includes measures that have been or are expected to be implemented. Therefore the projection must not be confused with the most likely development, since effects of new political initiatives, which will most likely be implemented as part of the continued follow-up to the Climate Strategy, have not been taken into account.

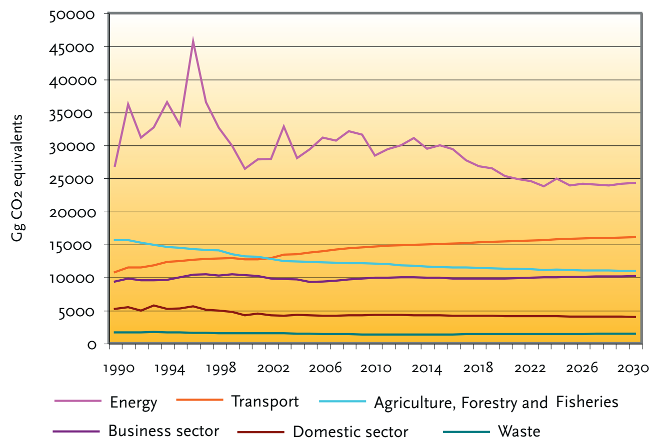
Since the Climate Strategy of 2003 and the associated baseline projection without additional measures, a new baseline projection with measures has been prepared and the previous emission inventories have been up-dated as a result of new knowledge, including new figures for the base year. Therefore the climate deficit has changed in comparison to the estimate in the Climate Strategy. The deficit is what Denmark lacks to fulfil the target for reduction of greenhouse gas emissions under the Kyoto Protocol and EU burden sharing.

In the new "with measures" baseline projection from May 2005 Denmark's expected annual net greenhouse gas emissions under the Kyoto Protocol for the period 2008-2012 correspond to 72.3 mill. tonnes of CO_2 equivalents, as shown in Table 5.1. The emissions in the new baseline projection are 7.8 mill. tonnes of CO_2 equivalents lower than in the previous baseline projec-

FIGURE 5.1 DENMARK'S EXPECTED NET GREENHOUSE GAS EMISSIONS UNDER THE KYOTO PROTOCOL FOR 2004-2030 IN THE NEW BASELINE PROJECTION, WHICH IS A PROJECTION "WITH MEASURES", I.E. A PROJECTION THAT ONLY INCLUDES EXPECTED EFFECTS OF EXISTING AND ADOPTED MEASURES. BOTH ACCUMULATED AND NON-ACCUMULATED TRENDS ARE SHOWN.

Source: 1990-2003: The National Inventory Report (NIR), the National Environmental Research Institute (NERI), April 2005.
2004-2030: Projection of greenhouse gas emissions, Memorandum to the Danish EPA, NERI, May 2005.





tion without additional measures, on which the Climate Strategy was based. The new baseline projection for the entire period 2004-2030 is shown in Figure 5.1, altogether and aggregated into the economic sectors described in Chapter 4.

The decrease of 7.8 mill. tonnes of CO_2 equivalents in the projection for the period 2008-2012 is primarily due to the reduction in exports of electricity, e.g. as a result of price effects of new electricity production capacity in Finland and Sweden and of the introduction of the EU allowance regulation. The reduction in exports of electricity corresponds to almost 5.5 mill. tonnes of CO_2 (from 9.9 to 4.4 mill. tonnes of CO_2). To this can be added a reduction corresponding to approx. 2 mill. tonnes of CO_2 equivalents in the energy sector due to the continued shift towards more natural gas and renewable energy, which is in reality even bigger, since the figure also includes expectations adjusted upward to emissions corresponding to approx. 1.3 mill. tonnes of CO_2 equivalents from extraction in the North Sea.

In the business sector, the change in the new projection corresponds to the effect of Kemira's termination of nitric acid production in Denmark, since the reduction in the industry's energy consumption, corresponding to approx. 0.5 mill. tonnes of CO_2 equivalents has largely been compensated for by a similar increase in process emissions, where the increase from cement production contributes the most (almost 0.4 mill. tonnes of CO_2 equivalents).

The increase in the domestic sector follows the upward-adjusted projection of energy consumption.

Of the increase of 0.4 mill. tonnes of CO_2 equivalents from waste, almost 0.3 mill. tonnes are due to the new inclusion of methane and nitrous oxide from wastewater. Since this source has also been included in the base year 1990 and it is almost unchanged, up-dating emission inventories and projections to include this source does not alter the deficit. But the deficit is influenced slightly by the up-dated projection of 0.1 mill. tonnes of CO_2 equivalents of methane from landfills due to up-dated waste statistics.

To these expected effects of new measures and changes on the total result due to the new projection of emissions should be added expected effects of funds allocated for projects reducing greenhouse gas emissions in other countries - that is the JI and CDM projects, cf. articles 6 and 12 in the Kyoto Protocol. Since the Climate Strategy for the period 2003-2008 was agreed, Denmark has allocated DKK 1,130 mill. to such projects, corresponding to 4.5 mill. tonnes of CO_2 equivalents annually in 2008-2012 at an average price of DKK 50 per tonne.

As appears on Table 5.1 the Danish deficit is estimated on this background to be approx. 13 mill. tonnes of CO_2 equivalents annually, based on Denmark's legal commitment under the EU Burden Sharing Agreement. This is based on a situation where no correction has been made for the particularly large imports of electricity in 1990.

If this correction is made as assumed by Denmark, the deficit is reduced to approx. 8 mill. tonnes of CO_2 equivalents annually in 2008-2012, as shown in Table 5.1.

Compared to the deficit of 20-25 mill. tonnes of CO_2 equivalents annually in 2008-2012, calculated on the basis of the projection which was presented together with the government's proposal for a Climate Strategy for Denmark in February 2003 to show the expected development without implementation of additional measures, there is a reduction of approx. 12 mill. tonnes of CO_2 equivalents annually in 2008-2012.

With the choice of method, the deficit expresses the need to purchase allowances from abroad or to implement new measures outside the sectors subject to allowances. So, as a result of the introduction of the CO_2 allowance scheme, the deficit is in principle not directly comparable to the deficit in the government's Climate Strategy, since the cost effects of the allowances are included, whereas ultimately the allocation of allowances decides the climatic effects of the scheme.

Note that the projection, and therefore also the deficit, is based on model predictions, which are subject to uncertainty. This applies, not least, to expected developments in energy prices, prices of CO_2 allowances, and the developments in the Nordic electricity market, which have a direct influence on the size of exports of electricity. This is illustrated in more detail through sensitivity analyses, cf. section 5.2.4. The implementation of the EU allowance scheme has, however, created a basis for greater certainty regarding the fulfilment of Denmark's climate commitments under the Kyoto Protocol and the EU Burden Sharing Agreement.

The "with measures" projection presented in this report is the most recent projection. It was finalised in May 2005 and it is in general based on expected effects of policies and measures implemented or adopted until the end of 2004. Due to the adoption of additional energy-savings initiatives in 2005, up-dated projections in the off-shore sector and new IEA projections of energy prices, an update of the May 2005 "with measures" projection has been initiated. However, results from this update will not be available until the beginning of 2006. Preliminary results suggests that the action plan on additional energy-savings initiatives could lead to a 2 mill. tonnes further reduction in annual CO_2 emissions 2008-2012.

Table 5.1 Denmark's expected greenhouse gas emissions and the expected deficit compared to the EU burden sharing of the EU reduction target under the Kyoto Protocol

Source: 1990-2003: The National Inventory Report (NIR), the National Environmental Research Institute (NERI), April 2005.

2004-2030: Projection of greenhouse gas emissions, Memorandum to the Danish EPA, NERI, May 2005.

Million tonnes of CO2 equivalents	Base year[1] 1990/95	2003	"2010"[2]	"2015"[3],	2020	2025	2030
CO_2[4]	52.9	**59.2**	59.0	58.8	55.2	54.2	54.9
Methane, CH_4	5.7	5.9	5.6	5.3	5.2	5.2	5.2
Nitrous oxide, N_2O	10.7	8.1	6.9	6.8	6.6	6.5	6.5
Industrial gases HFCs, PFCs and SF_6	0.3	0.7	0.8	0.5	0.2	0.2	0.2
Total emissions	**69.6**	**73.9**	**72.3**	**71.4**	**67.2**	**66.1**	**66.8**
Of which exports of electricity: (- means imports)	-6.3	6.9	4.4	2.3	1.4	0.9	2.7
Kyoto target: -21%			55.0				
Reductions in other countries from funds allocated to JI and CDM projects			4.5				
Deficit incl. JI and CDM			7.8/12.8[5]				

[1] Base year for CO_2, methane, and nitrous oxide is 1990. In accordance with the Kyoto Protocol, 1995 is chosen as the base year for industrial gases.

[2] "2010" stands for mean emissions in 2008-2012.

[3] "2015" stands for mean emissions in 2013-2017

[4] Here net emission of CO_2 inventoried under the Kyoto Protocol, because removal of CO_2 in new forests planted since 1990 is included cf. Protocol article 3.3.

[5] The deficit has been calculated both on the basis of the assumption of taking imports of electricity in 1990 into account, cf. the political statement of the Council and the Commission and on the basis of Denmark's legal commitment under the EU Burden Sharing Agreement.

5.2 Energy including all activities with fuel combution within transport, military, business, agriculture, forestry, fisheries and the domestic sector

In this section the projection of the total emissions of CO_2, CH_4 and N_2O from combustion of fuels and from fugetive emissions from fuels is described. The projection includes all fuel-consuming sectors, which in addition to the energy sector, include the transport sector and military, business, agriculture, forestry and fisheries, as well as the domestic sector – both stationary and mobile sources. A more detailed description of the approach used in the energy projection is in Annex E.

5.2.1 Methods

The projection is based on a projection of the development in energy consumption in the period 2004-2030. The emissions of CO_2, CH_4 and N_2O have been calculated by multiplying the energy consumption by emission factors.

The projection of end-user energy consumption by the business and domestic sectors is based on an ADAM/EMMA projection. EMMA is a macro model that describes the final energy consumption broken down into a number of sectors and seven types of energy. It is based on historical experience with the behaviour of businesses and households and is documented in NERI 1995[1].

In EMMA, energy consumption in the business sector is determined by three factors: production, energy prices/taxes and energy efficiencies/trends. Increased production will increase the demand for energy input, whereas increased energy prices and taxes will pull in the direction of a more limited demand for the fuels. Improved energy efficiency will mean that production can be maintained using less energy, and in EMMA this results in reduced energy consumption.

The projection of production by businesses is based on the ADAM projection in the *Finansredegørelse 2004 (Economic Report 2004)*, covering the period 2004-2010. For the period 2011-2030 unofficial estimates from the same source have been used.

The projection of electricity and heat production is based on the Danish Energy Authority's RAMSES model, using as the basis the demand for electricity and district heat according to the projection of the consumption sectors. In the projection, electricity and heat production is divided between existing and possible new production plants on the basis of technical specifications and prices of fuels and CO_2 allowances. The model also determines electricity prices on the Nordic market and the degree of electricity exchange with the other Nordic countries. In this regard it takes account of the limitations in exchange capacity. Electricity production has been liberalised throughout the Nordic region and therefore it is not closely linked to Danish demand, but rather to the characteristics of the individual power plant and market prices. Industrial and local mini-CHP production is not projected in the RAMSES model so a separate (bottom-up) projection has been made of this production.

The projection of other sectors (primarily extraction of oil and gas as well as oil refineries) is based on data on expansion plans and ad-hoc assumptions.

The projection of road transport, rail transport, domestic ferries and freighters, together with domestic air transport is documented in the report The transport sector's energy consumption and emissions, Danish Road Directorate, 2002[2]. As this projection is some years old, it is based on older economic assumptions than the EMMA projections described above.

5.2.2 Assumptions and key parameters

In general, the projection is based on the policies applicable at the end of 2004 and unchanged behaviour patterns. The projection is based on energy consumption in 2003. The basic assumption is that energy consumption in the future will equal the 2003 level, unless there is a drop in economic activity, and/or prices, technical improvements, initiatives, climate, etc. change. Therefore, only initiatives where the effect will change in relation to 2003 (including new initiatives) are included specifically in calculating the projection. Therefore, the projection should be regarded as a "with measures" projection.

The IEA price assumptions for fossil fuels (World Energy Outlook, 2004[3]) and a euro-dollar rate of 0.8 have been applied. However, the IEA assumptions have been moderated so that the rather low price levels for 2006-2010 are not reached before 2009. With regard to large producers of heat and electricity, however, it is assumed that liberalisation of the gas market will reduce the price of gas slightly compared with the IEA assumptions. Prices of biomass are assumed to remain constant in real terms. District-heat-

TABLE 5.2 GROWTH ASSUMPTIONS[1]

Source: Danish Energy Authority

Percent p.a.	**1980-2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2010-2020**	**2020-2030**
Production value:										
Primary indust. excl. energy	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Building and construction	0.8	3.6	1.2	1.7	2.1	2.2	2.4	2.2	1.6	1.2
Manufacturing excl. energy	1.7	0.5	3.0	1.1	2.2	1.8	2.0	1.9	1.3	0.6
Public service	1.7	0.5	0.4	0.5	0.5	0.5	0.5	0.5	0.8	1.0
Trade	2.4	3.5	3.7	2.0	2.7	2.6	2.7	2.6	1.8	1.0
Financial services	3.0	1.7	0.6	2.5	2.6	2.6	2.6	2.6	2.1	1.7
Other services	3.1	2.3	2.6	2.0	2.5	2.4	2.5	2.4	2.0	1.4
Total	**2.0**	**1.7**	**2.2**	**1.5**	**2.1**	**1.9**	**2.0**	**2.0**	**1.5**	**1.1**
Private consumption	1.3	3.6	3.0	1.6	2.6	2.5	2.6	2.5	2.2	1.7
Housing stock 1995 prices	1.4	1.8	1.7	1.7	1.7	1.7	1.7	1.8	1.8	1.8
Housing stock, m2	0.8	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.7	0.7
GDP	1.8	2.2	2.5	1.4	2.0	1.9	2.0	1.9	1.5	1.1
Gross added value (GAV)	1.8	1.9	2.5	1.4	2.0	1.8	2.0	1.9	1.5	1.0
Deflator, (GAV)	3.9	2.2	1.8	2.2	2.2	2.2	2.2	2.2	2.1	2.1

ing prices are based on production costs, while the price of electricity, as mentioned above, results from calculations and is based on marginal production costs.
Other assumptions behind the energy projection are economic growth of about 1.8% p.a. – greatest up to 2010, moderate prices of fossil fuels based on the IEA assumptions, prices of CO_2 allowances of about USD 8 per tonne 2005-7, about USD 16 per tonne 2008-2012 and about USD 24 per tonne thereafter, as well as technical energy efficiencies of about 0.7% p.a. at end users.

Efforts have been made to coordinate assumptions for the electricity market with the other Nordic countries. Planned investment in production and transmission capacity as well as closing plants is largely agreed with Norway, Sweden and Finland. The differences between the models and the date of completion of the projections means, however, that the resulting electricity prices and figures for electricity exchange are not the same.

Tables 5.2 and 5.3 illustrate a number of key assumptions for the projection.

5.2.3 Results

Figure 5.2 and Table 5.4 show the development of total energy consumption (excl. fuels for non-energy purposes) with these assumptions, broken down by sector.

FIGURE 5.2 GROSS ENERGY CONSUMPTION 1990-2030, 1990-2003 ARE OBSERVED
Source: Danish Energy Authority

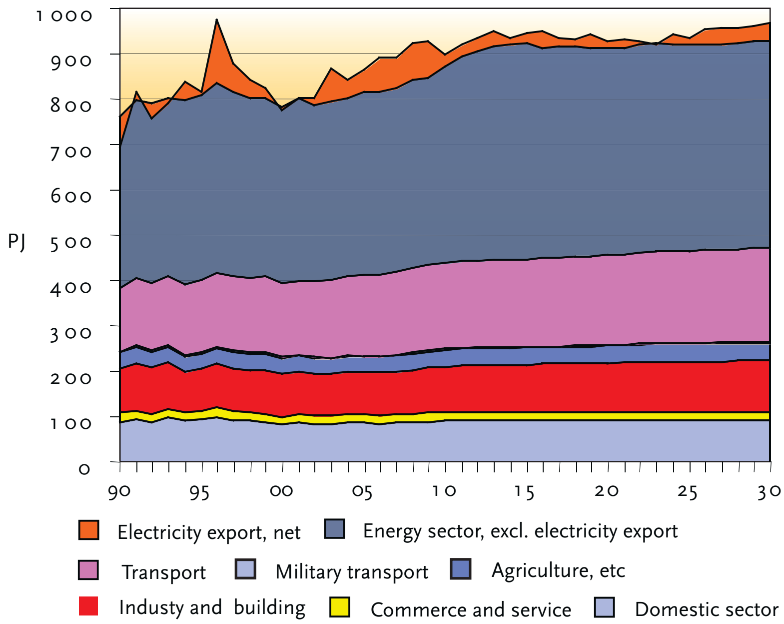


TABLE 5.3 CHANGES IN ENERGY PRICES IN DKK EXCL. TAXES, DEFLATED
Source: Danish Energy Authority

Annual growth in %	2004	2005	2006	2007	2008	2009	2010	2010-2020	2020-2030
Crude oil	18	41	-11	-29	-24	-18	0	1.5	1.3
Gas, consumers	6	31	10	-15	-22	-21	-10	1.5	1.3
Coal	29	10	-7	-10	-11	-8	0	0.5	0.5
Elec. wholesale market	-20	18	-1	-11	-6	-11	-11	5.9	0.1
Elec. consumer	-6	2	-1	-4	-2	-3	-4	1.1	0.3
District heating	1	2	-2	-2	-2	-1	0	0.1	0.1

In years with ample precipitation Denmark is a net importer of electricity produced at Norwegian and Swedish hydropower stations, while in years with scanty precipitation, it is a net exporter of electricity to Norway and Sweden. This has resulted in large fluctuations in the observed Danish gross energy consumption in the period 1990-2003.

Energy consumption is expected to grow within most business sectors and transport in the next 25 years, but to fall slightly in the domestic sector and the commerce and service sector. The energy sector's consumption has been calculated excluding fuels for production of electricity for export because this consumption figures separately, but the calculation includes flaring. Domestic electricity consumption is expected to grow, which is also reflected in the gross energy consumption in the energy sector up to 2015. Thereafter, the sector's energy consumption will fall slightly because a number of primary coal-fired stations are expected to be replaced by new, more efficient gas-fired CHP plants.

Exports of electricity are estimated at less that in the Third National Communication, partly because the EU allowance scheme (EU ETS) has been established since then, and partly because a large Finnish nuclear power station is expected to come on line in 2010. The allowance scheme impairs the competitiveness of Danish fossil-fuel-based plants compared with hydro and nuclear plants in neighbouring countries.

Table 5.4 Gross energy consumption 1990-2030, 1990-2003 are observed

Source: Danish Energy Authority

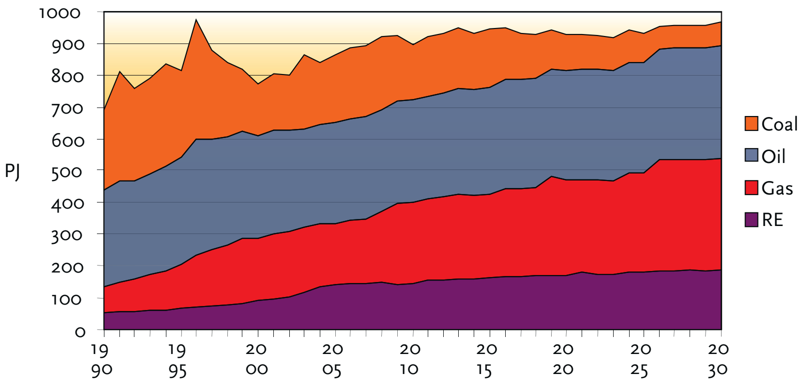
PJ	1990	2003	2010	2020	2030
Energy sector excl. exports of electricity	377.4	392.8	432.7	454.2	454.7
- of which flaring	4.2	9.3	8.9	6.0	6.0
Electricity exports, net	-67.7	75.9	27.8	17.8	40.3
Transport excl. International air transport	142.0	172.9	189.0	199.4	207.9
Military transport	1.6	1.3	1.7	1.7	1.7
Agriculture, etc.	33.9	34.0	36.9	38.3	39.8
Industry and building	98.7	92.4	101.5	108.5	113.8
Commerce and service	21.3	18.2	19.5	19.7	19.2
Domestic sector	85.2	80.3	88.1	87.9	88.1
Total	**692.5**	**867.7**	**897.2**	**927.5**	**965.5**
Total excl. exports of electricity	**760.2**	**791.9**	**869.4**	**909.7**	**925.2**

The reason for exports of electricity up to 2010 is the current Danish excess capacity combined with increasing electricity prices on the Nordic market. In the longer term electricity exports will be due to the relative advantages of locating new plants in Denmark because of the large basis for sales of heating. Revenues from sales of district heating improve the profitability of CPH plants.

Figure 5.3 shows the development of total energy consumption, broken down by fuels, which determine the size of CO_2 emissions because the fuels have very different emission factors.

FIGURE 5.3 GROSS ENERGY CONSUMPTION 1990-2030, 1990-2003 ARE OBSERVED

Source: Danish Energy Authority



1 RE = Renewable Energy

The increase in the quantity of renewable energy up to the year 2005 is due primarily to expansion of wind turbines and increased use of biomass. After 2015 many new offshore wind farms are expected to be erected, and this, together with use of waste, wood and straw, will increase renewable-energy-based production. An increase in consumption of oil is primarily due to the growth in transport. With the new power stations, natural gas consumption will increase from 2015 at the expense of coal consumption. This change means a reduction in CO_2 emissions because natural gas has far lower emission factors than coal.

The fuel composition of electricity production in 2030 will be more based on natural gas and renewable energy and less on coal than is the case today. It is expected that 43% of electricity production will be based on natural gas, 27% on wind, 15% on coal, 9% on waste, 4% on biomass, and 2% on oil. Thus up to 39% of Danish electricity production will be based on renewable energy in 2030.

The resulting total emissions of CO_2, CH_4 and N_2O from energy-consuming activities in the "with measures" projection is illustrated in Table 5.5. Annex E contains detailed Tables showing the results of the projections.

TABLE 5.5 TOTAL EMISSIONS OF CO_2, CH_4 AND N_2O IN CO_2 EQUIVALENTS FROM ENERGY-CONSUMING ACTIVITIES IN THE PROJECTION (WITH MEASURES), 1990-2003 ARE OBSERVED

Source: 1990-2003: The National Inventory Report (NIR), the National Environmental Research Institute (NERI), April 2005.
2004-2030: Projection of greenhouse gas emissions, Memorandum to the Danish EPA, NERI, May 2005.

Unit: '000 tonnes CO2 equivalents	1990	2000	2005	"2010"[1]	"2015"[2]	2020	2025	2030
Energy	26773	26356	29338	30282	29497	25301	23855	24281
Transport	10765	12683	13711	14605	15021	15413	15761	16060
Business	6865	6815	6446	7010	7284	7558	7802	7905
Agriculture, forestry and fisheries	2754	2653	2624	2800	2870	2939	3007	3052
Domestic sector	5156	4229	4196	4238	4190	4099	4037	3977
Total from energy-consuming activities	**52313**	**52736**	**56315**	**58935**	**58862**	**55310**	**54462**	**55275**

1 "2010" means average annual emissions from 2008-2012

2 "2015" means average annual emissions from 2013-2017

5.2.4 Sensitivity analyses and scenario calculations

The projection and underlying assumptions are naturally very uncertain. Therefore, sensitivity analyses have been completed with alternative assumptions for fuel prices and prices of CO_2 allowances cf. Table 5.6.

High prices for oil, gas, coal and CO_2 allowances are expected to reduce gross energy consumption in 2030 by about 50 PJ or 5% compared with the projection above, while low prices increase consumption by about 30 PJ or 3%, cf. Figure 5.4.

As can be seen, the changes in total energy consumption are expected to be moderate, but they conceal large fluctuations in the composition of fuels in the supply sector. With the high prices of natural gas, oil and CO_2 allowances, expansion will be exclusively with renewable energy – wind and biomass, while with low prices of CO_2 allowances, higher prices of natural gas and moderately higher coal prices, new coal-fired plants will be built.

The effects on CO_2 emissions from the reorganisation of fuels in the supply sector: a reduction of 23% in the case of high prices, and an increase of 7% for low prices in 2030, cf. Figure 5.4. The effects are considerably less in 2010. Here, CO_2 emissions are 4.5 mill. tonnes under basis with higher prices, but only 0.3 mill. tonnes over with low prices.

TABLE 5.6 ASSUMPTIONS OF FUEL PRICES AND PRICES OF CO_2 ALLOWANCES IN 2030

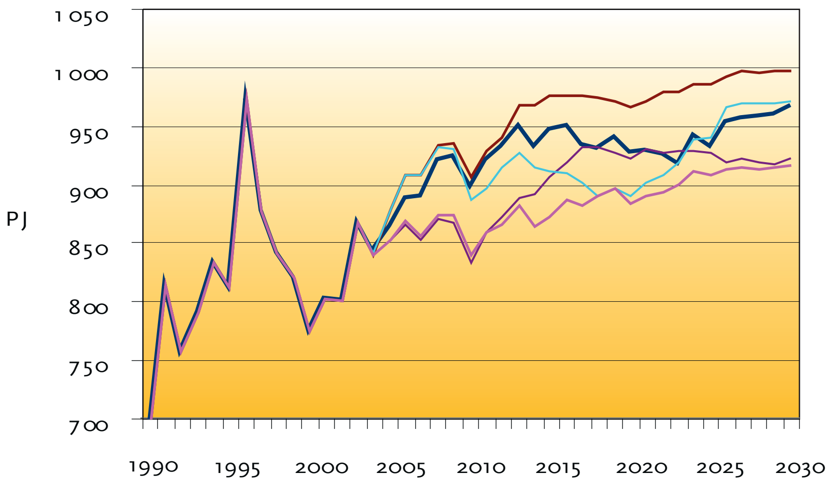
Source: Danish Energy Authority

		Low	Basis	High
Crude oil	2000-USD/barrel	20	29[1]	50
Coal	2000-USD/tonne	37	44[1]	60
Natural gas in Europe	2000-USD/MBtu	3.0	4.3[1]	7.4
CO_2 allowances	2000-USD/tonne	8	24	58

[1] IEA assumptions from WEO 2004

FIGURE 5.4 TOTAL GROSS ENERGY CONSUMPTION, IN PJ.

Source: Danish Energy Authority

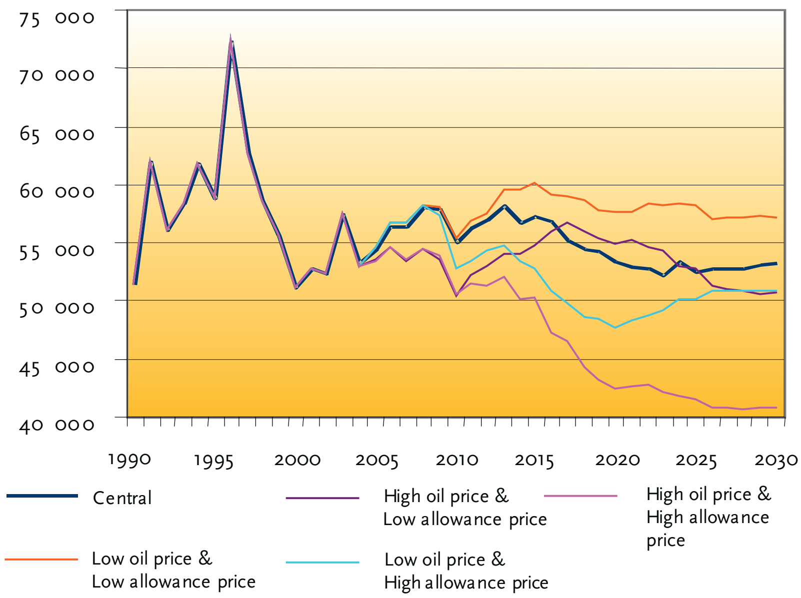


5.3 TRANSPORT

As mentioned in section 5.2, the latest projection of road transport, rail transport, domestic ferries and freighters, together with domestic air transport is documented in the report *The transport sector's energy consumption and emissions*, Danish Road Directorate, 2002. Projected energy consumption is based on a projection of traffic intensity, which

FIGURE 5.5 ENERGY-RELATED CO_2 EMISSIONS, IN '000 TONNES CO2 EQUIVALENTS.

Source: Danish Energy Authority



is described in more detail in this section.

5.3.1 Methods

The completed projection is based on the estimate of the total emissions from the national traffic intensity carried out in Denmark, i.e. traffic intensity with Danish vehicles in Denmark. Projections have been made for both developments in traffic and changes in specific energy and emissions factors.

In principle, all-else-being-equal projections of developments in traffic, energy consumption and emissions have been made. Thus, the projection has been made to include only emission standards and measures already adopted, or implementation of these, so that it is a "with measures" projection.

The changes in the explanatory economic variables for the period up to 2010 are based on the Ministry of Finance economic outlook from January 2002. From 2010, economic development is based on the most recent long-term economic projections from the Ministry of Finance in *Finansredegørelse 2001 (Economic report 2001)*. It should be noted that the even changes in the projections reflect the evened-out changes in the economic projections. In other words a projection of this type does not capture the exact level for the individual year, but rather it shows the expected trends over future years.

Passenger cars

The projection of passenger-car traffic is composed of two elements. A projection of the number of passenger cars, as well as assumptions regarding developments in the average number of kilometres driven each year. Traffic intensity for motorcycles is assumed to follow that for passenger cars.

The projection of the number of cars is based on a sub-model for new registrations and a sub-model for survival of each year of new registrations.

The historical development in number of kilometres driven per year is calculated by dividing total traffic intensity for a given year with the number of cars for the same year. This is then repeated for the expected future developments cf. the assumptions described in the next section.

Buses
The lack of sufficient insight into the determining factors for developments in bus transport makes it difficult to establish models for the projection of bus traffic.

Vans and lorries (2-6 tonnes)
The method here is to allow developments to follow economic growth, either directly proportionally or using an elasticity that deviates from 1.

Lorries (over 6 tonnes)
This projection is based on analyses of the relationship between the economic cycle and national transport of goods by road in the period from 1980 to 2001.

The development in transport of goods by road is based on a study by Statistics Denmark of tachographs, which, on the basis of a sample of lorries transporting goods nationally, provides a detailed picture of the developments in goods transport and its composition.

In contrast to previous analyses, the developments in goods transport related to overall economic growth in society (e.g. expressed as the change in GDP), is now based on analyses of the relationship between goods transport and production in goods-producing sectors, divided into five main sectors.

Emissions
For this projection of energy consumption and emissions from the road sector, a revised projection has been made of average specific emission factors of CO, VOC, NO_x and particles for vehicles from the road sector. The specific emission factors have been calculated by NERI and are based on traffic projections from the Road Directorate and emissions data from the most recent edition of the COPERT model.

5.3.2 Assumptions and key parameters

Passenger cars
With regard to new registrations, a total of about 150,000 per year is expected for the whole period 2001 - 2010. The composition of the cars on the road in 2001 has been retained in the projection, under the assumption that the age of cars will not change significantly compared with today, where the median lifetime is just less than 17 years. The projection assumes that the current levelling-off of the number of km driven per year will continue in the period 2001 to 2010. Therefore, an increase of 2% up to 2010 has been used.

Buses
Due to a lack of alternative methods, it has been assumed that the present level of bus traffic will continue throughout the period 2001 - 2010.

Vans and lorries (2-6 tonnes)
Goods transport intensity has been projected in parallel with developments in GDP from 2001 to 2005. In the subsequent period from 2005, an elasticity to GDP has been assumed of 0.75. The load factor has been assumed to remain at the 2001

level throughout the projection period.

Lorries (over 6 tonnes)
In order to project traffic intensity for lorries of more than 6 tonnes, it has been assumed that the relationship between kilometres driven with and without a load remains the same as in 2000. In 2000, the number of kilometres driven without load was 19% of the kilometres driven with load.

Moreover, as previously, it has been assumed that capacity exploitation of vehicles with load increases from 50% to 55%, corresponding to a 10% improvement. It has been assumed that the improvement in capacity occurs over a 20-year period, i.e. up to 2020.

Energy efficiency
In this projection, primarily the total energy consumption by the transport sector has been adjusted compared with the energy statements by the Energy Authority for the years 1988 and 2001. Thus, there is numeric consistency in the statement of developments in energy consumption in the period 1988 to 2002.

The projection also includes the expected effect of the agreement between the EU and the auto industry on the energy efficiency of cars. According to the agreement, the average CO_2 emissions from newly registered passenger cars in 2008 should be no more than 140 g per km. Steady introduction of passenger cars with emissions of this level are expected, with full implementation in 2008. In this period, it is expected that the proportion of newly registered cars with 140 g CO_2 emissions per km will increase on a straight-line basis from 0% in 2000 to 100% in 2008.

5.3.3 Results
Table 5.7 shows the main results of the overall projection of emissions of CO_2 and others from road traffic for the period 1988 to 2010.

The result of the total projection of emissions of greenhouse gases by the transport sector up to 2030 is described in Table 5.8. As with the historical emissions inventories, the national totals for projected emissions of greenhouse gases do not include emissions from international air transport and international marine transport.

5.3.4 Sensitivity analyses and scenario calculations
The projection cannot be better than the material on which it is based. It is no surprise that there is great uncertainty linked to the economic data, in particular in the more distant future. Similarly, on a number of occasions it has been demonstrated that tachograph data is also uncertain.

For the above reasons it is important to stress that the projection should only be used a descriptive tool for developments from one period to another. The uncertainty of the values for the individual years may be great, and interpreting the level for the specific year may be incorrect.

However, independent analyses and scenario calculations have not been prepared for the transport projection. In the sensitivity analyses prepared in connection with the energy projections, energy consumption and emissions by the transport sector are also influenced, however, when the price of fuel changes.

5.4 Industry

In addition to the emissions of greenhouse gases connected to energy consumption by industry discussed in section 5.2, greenhouse gases are also emitted from a number of industrial processes. These include emissions from the production of cement, chalk, tiles, glass etc., as well as emissions of the fluorine-containing industrial gases HFCs, PFCs and SF_6 (F gases) from the production and use of products containing these substances, such as refrigerants, foaming agents, and as insulation gases.

5.4.1 Methods

For process emissions, there is often proportionality between production and emissions, if there are no significant changes in the technology used in production or any measures to limit emissions. However, it is often not possible to obtain information from enterprises on the expected future production, partly for commercial reasons and partly because

Table 5.7 Main results of performance and emissions of CO_2 from road transport for the period 1988 to 2010

Source: Transport sector energy consumption and emissions, Road Directorate, 2002.

	Road Traffic Performance	National goods transport performance on roads	CO2
	Mill. km	Mill. tonneskm	‘000 tonnes
1988	34,491	64,987	9,148
1989	35,490	66,505	9,343
1990	36,071	67,671	9,323
1991	36,968	68,555	9,435
1992	37,697	69,813	9,552
1993	38,150	69,301	9,550
1994	39,147	70,876	9,707
1995	40,651	72,592	10,060
1996	41,844	74,702	10,320
1997	43,159	76,534	10,541
1998	44,301	78,041	10,807
1999	45,920	80,199	11,177
2000	46,276	80,664	11,271
2001	46,449	79,979	11,385
2002	47,160	81,863	11,528
2003	48,303	83,626	11,753
2004	49,275	85,160	11,938
2005	50,356	86,863	12,132
2006	51,432	88,597	12,311
2007	52,474	90,282	12,477
2008	53,468	91,889	12,628
2009	54,357	93,337	12,762
2010	55,158	94,641	12,882

Table 5.8 Total projection of greenhouse gas emissions by the transport sector 2005-2030 and the emission inventories for 1990 and 2000

Source: 1990-2003: The National Inventory Report (NIR), the National Environmental Research Institute (NERI), April 2005.
2004-2030: Projection of greenhouse gas emissions, Memorandum to the Danish EPA, NERI, May 2005.

		1990	2000	2005	2010	2015	2020	2025	2030
CO_2 ('000 tonnes)	Civil air traffic	243	154	124	134	146	158	169	180
	Road transport	9,351	11,229	12,226	13,049	13,438	13,807	14,129	14,400
	Railways	297	228	202	202	202	202	202	202
	National marine transport	551	507	505	505	505	505	505	505
	Defence (mobile sources)	119	111	122	122	122	122	122	122
	Total	**10,561**	**12,229**	**13,234**	**14,086**	**14,507**	**14,911**	**15,267**	**15,568**
	International air transport	3,087	4,279	3,138	3,138	3,138	3,138	3,138	3,138
	International marine transport	1,736	2,350	2,254	2,443	2,656	2,889	3,082	3,287
CH_4 ('000 tonnes CO2 eq.)	Civil air traffic	0	0	0	0	0	0	0	0
	Road transport	55	69	62	48	33	24	21	20
	Railways	0	0	0	0	0	0	0	0
	National marine transport	1	3	2	2	2	2	2	2
	Defence (mobile sources)	0	0	0	0	0	0	0	0
	Total	**57**	**72**	**65**	**51**	**35**	**26**	**23**	**23**
	International air transport	1	2	1	1	1	1	1	1
	International marine transport	1	1	1	1	1	1	1	1
N_2O ('000 tonnes CO2 eq.)	Civil air traffic	3	2	2	2	3	3	3	3
	Road transport	131	367	453	527	557	577	595	611
	Railways	2	2	2	2	2	2	2	2
	National marine transport	10	8	8	8	8	8	8	8
	Defence (mobile sources)	1	1	2	2	2	2	2	2
	Total	**148**	**381**	**467**	**542**	**572**	**592**	**610**	**627**
	International air transport	60	84	61	61	61	61	61	61
	International marine transport	18	25	24	26	29	31	33	36
GHG ('000 tonnes CO2 eq.)	Civil air traffic	246	157	182	212	245	281	315	346
	Road transport	9,537	11,666	12,741	13,624	14,028	14,408	14,745	15,032
	Railways	300	230	204	204	204	204	204	204
	National marine transport	562	518	516	516	516	516	516	516
	Defence (mobile sources)	120	112	124	124	124	124	124	124
	Total	**10,765**	**12,683**	**13,767**	**14,680**	**15,117**	**15,533**	**15,904**	**16,222**
	International air transport	3,149	4,365	3,201	3,201	3,201	3,201	3,201	3,201
	International marine transport	1,755	2,376	2,280	2,470	2,686	2,921	3,116	3,324

market and production conditions are unpredictable.

F gases, however, are exceptional because they are contained in the product itself, e.g. as a refrigerant or insulator gas, and they are slowly released into the atmosphere over a number of years. In this regard, emission rates etc. in the IPCC guidelines for emissions inventories have also been used in the projections.

5.4.2 Assumptions and key parameters

The projection of the emissions is based on implemented and adopted policies and measures, described in Chapter 4, including a statutory order on phasing out certain industrial gases. This statutory order will result in a reduction in greenhouse gas emissions of, on average, 0.4-0.7 mill. tonnes CO_2 equivalents per year in the period 2008-2012. It is covered by a ban on the use of HFC as a coolant in the retail trade and stationary A/C systems from 1 January 2007, except for refilling of existing systems, and as a foaming agent in PUR foam from 1 January 2006.

With regard to process emissions, unchanged market and production conditions have been assumed consistently. The only deviations are, that from 2004 production of nitric acid ceased in Denmark; that in the period 2002-2007 an increase of 5% in the production of clinker for cement production is assumed; and that emissions of process CO_2 from steel production from 2005 are assumed to be at the 2001 level as from early 2005 production will resume after a period of zero production from 2002-2004.

5.4.3 Results

Results of projections of F gases and process emissions appear in Tables 5.9 and 5.10.

5.4.4 Sensitivity analyses and scenario calculations

There are no sensitivity analyses and scenario calculations emissions of greenhouse gases from the business sector. On the basis of the effects described above, for example, it can be ascertained that the resumption of production of nitric acid in Denmark – with the same technology as prior to the cessation in 2004, which in practice will probably not be the case – will increase annual emissions in 2008-2012 by about 1 mill. tonnes CO_2 equivalents. In other contexts it has also been assessed that any relaxation of Danish regulation regarding F gases to align with EU regulation will increase Danish emissions of F gases by 0.4 – 0.7 mill. tonnes CO_2 equivalents per year in 2008-2012.

5.5 Agriculture

In 2003, agriculture accounted for approximately 19% of Denmark's total emissions of greenhouse gases. The gases emitted by agriculture are mainly methane and nitrous oxide. The methane and nitrous oxide emissions are not taxed and are only

TABLE 5.9 EMISSIONS OF INDUSTRIAL GREENHOUSE GASES (HFCs, PFCs AND SF_6), 1990-2003 ARE OBSERVED.

Source: 1990-2003: The National Inventory Report (NIR), the National Environmental Research Institute (NERI), April 2005.

2004-2030: Projection of greenhouse gas emissions, Memorandum to the Danish EPA, NERI, May 2005 and

Environmental Project No. 987, Danish EPA, March 2005[d]

'000 tonnes of CO_2 equivalents	1995	2000	2005	"2010"	"2015"	2020	2025	2030
HFC-134a	195	319	320	267	154	90	9_0	9_0
HFC-152a	6	2	0	0	0	0	0	0
HFC-404a	1^5	240	323	324	178	27	27	27
HFC-401a	0	0	0	0	0	0	0	0
HFC-402	1	10	6	4	3	2	2	2
HFC-407c	°	11	55	70	56	0	0	0
HFC-507a	°	9	19	20	11	-1	-1	-1
Other HFCs	0	14	49	17	5	-1	-1	-1
HFCs, total	**218**	**604**	**773**	**703**	**407**	**118**	**118**	**118**
PFCs	1	18	14	10	8	6	6	6
SF_6	107	59	32	55	108	55	55	55
F gases, total	**326**	**681**	**819**	**768**	**523**	**179**	**179**	**179**

TABLE 5.10 PROJECTION OF PROCESS EMISSIONS FROM CEMENT, CHALK AND TILE PRODUCTION AS WELL AS CHEMICAL PRODUCTION AND METAL PRODUCTION, 1990 AND 2000 ARE OBSERVED

Source: 1990-2003: The National Inventory Report (NIR), the National Environmental Research Institute (NERI), April 2005.

2004-2030: Projection of greenhouse gas emissions, Memorandum to the Danish EPA, NERI, May 2005.

'000 tonnes of CO_2 equivalents	1990	2000	2005	"2010"	"2015"	2020	2025	2030
Mineral products	1,037	1,531	1,716	1,793	1,793	1,793	1,793	1,793
Chemical industry	1,045	1,006	3	3	3	3	3	3
Metal production	28	41	45	45	45	45	45	45
Process emissions, total	**2,110**	**2,578**	**1,764**	**1,841**	**1,841**	**1,841**	**1,841**	**1,841**

regulated indirectly via the regulation of the effect on the aquatic environment of nitrogen losses from agriculture, e.g. in the Action Plans for the Aquatic Environment II and III, general structural developments, and the common CAP reform. Amongst other things, the effect of Action Plan for the Aquatic Environment III, adopted in 2004 on its own will lead to an extra reduction of 0.21 mill. tonnes CO_2 equivalents, which are now included in the new projection with measures. Further possibilities for reduction of the methane and nitrous oxide emissions in the agricultural sector are being examined in connection with the Policies and Measures Project, where both the technical possibilities for reduction and the costs will be illustrated.

5.5.1 Methods

With regard to methods, overall the projections apply the same approach, emissions factors and types of key parameter and assumptions as the inventories of the historical emissions of methane and nitrous oxide from agriculture so that the time series are as consistent as possible for the period 1990-2030.

5.5.2 Assumptions and key parameters

The basis for the projection is the final calculated and reported emissions for 2003. In addition, the projection with measures (the baseline scenario) takes account of the expected establishment of certain emissions-reducing technologies, but only technologies aiming at reductions of ammonia evaporation and increased biogas treatment of slurry.

5.5.3 Results

As will be seen from Table 5.11, emissions of methane and nitrous oxide from agriculture are expected to be reduced by 12% from 9.90 mill. tonnes CO_2 equivalents in 2003 to 8.69 mill. tonnes CO_2 equivalents in 2025 (and 2030). This projection with existing measures (baseline scenario) takes account of the EU agricultural reform, Action Plan for the Aquatic Environment III, and establishment of ammonia-reducing initiatives in stalls as well as increased biogas production. Emissions of methane are expected to be reduced by a drop in cattle stocks. The reduction in nitrous oxide emissions is primarily due to a drop in emissions from N run-off, commercial fertiliser, and from manure spread on fields. This is due to better exploitation of feed and better exploitation of the nitrogen content in manure, as well as a drop in the cropland area.

TABLE 5.11 EXPECTED EMISSIONS OF METHANE AND NITROUS OXIDE FROM THE AGRICULTURE SECTOR 2004-2030, 1990-2003 ARE OBSERVED

Source: 1990-2003: The National Inventory Report (NIR), the National Environmental Research Institute (NERI), April 2005

2004-2030: Projection of greenhouse gas emissions, Memorandum to the Danish EPA, NERI, May 2005.

	Emissions from agriculture	1990[1]	2000[1]	2003[1]	2005	"2010"	"2015"	2020	2025	2030
CH4 (Gg)	Digestive process	148.09	136.78	130.17	127.66	122.96	116.24	112.08	108.33	108.33
	Manure	35.48	45.29	47.22	48.96	50.08	49.82	50.05	50.30	50.30
	Biogas treatment of slurry	-0.11	-0.68	-0.93	-1.36	-2.22	-2.33	-2.33	-2.33	-2.33
	CH4, total (Gg)	**183.46**	**181.40**	**176.45**	**175.27**	**170.83**	**163.73**	**159.80**	**156.29**	**156.29**
N_2O (Gg)	Manure	2.21	1.94	1.85	1.84	1.82	1.80	1.77	1.73	1.73
	Biogas treatment of slurry	0	-0.68	-0.04	-0.06	-0.10	-0.10	-0.10	-0.10	0.73
	Commercial fertiliser	7.69	4.83	3.87	3.78	3.52	3.31	3.21	3.13	3.13
	Manure spread on fields	3.51	3.40	3.57	3.61	3.67	3.67	3.66	3.62	3.62
	Wastewater used as fertiliser	0.09	0.17	0.23	0.23	0.22	0.22	0.22	0.22	0.22
	Ammonia evaporation	1.72	1.33	1.22	1.19	1.13	1.07	1.03	1.01	1.01
	N run-off	10.50	7.05	6.45	6.30	5.94	5.63	5.48	5.35	5.35
	Crops with organically-bound N	0.88	0.76	0.63	0.62	0.61	0.60	0.58	0.57	0.57
	Crop residues	1.17	1.09	1.03	1.02	1.00	0.98	0.96	0.94	0.94
	Cultivation of humus soil	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
	Biogas treatment of slurry	0	-0.68	-0.04	-0.06	-0.10	-0.10	-0.10	-0.10	-0.10
	N_2O, total (Gg)	**29.01**	**21.79**	**19.98**	**19.70**	**18.89**	**18.19**	**17.79**	**17.44**	**17.44**
CO_2 eq.	**CH4**	**3.85**	**3.81**	**3.71**	**3.68**	**3.59**	**3.44**	**3.36**	**3.28**	**3.31**
	N_2O	**8.99**	**6.76**	**6.19**	**6.11**	**5.86**	**5.64**	**5.51**	**5.41**	**5.41**
CO_2 eq.	**Total in mill. tonnes CO2 eq.**	**12.84**	**10.57**	**9.90**	**9.79**	**9.44**	**9.08**	**8.87**	**8.69**	**8.74**

[1] Emissions for 1990, 2000 and 2003 are excl. emissions from fur-bearing animals, corresponding to reporting in NIR.

5.5.4 Sensitivity analyses and scenario calculations

Prior to the preparation of the above new projection for agriculture, NERI published a report in 2004, which through the following five scenarios illustrated the consequences of agricultural emissions of methane and nitrous oxide:

1. Baseline scenario - based on agricultural conditions in 2002

2. Implementation of the EU CAP – Common Agricultural Policy

3. Implementation of CAP + constant pig production at the 2003 level

4a. Implementation of CAP + 25% reduction in N run-off

4b. As 4a + specific initiatives for extra afforestation.

The results of these five scenarios appear in Table 5.12. As can be seen, there is only a small difference between the new baseline projection and the second scenario with the CAP reform in 2008-12. The scenario where pig production is kept at the 2003 level gives slightly lower emissions. A further 25% reduction of nitrogen run-off would lead to a further reduction of about 0.5 mill. tonnes CO_2 equivalents per year in both 2008-12 and 2013-17. Increased conversion of agricultural area to forest would give a further reduction of 0.4 mill. tonnes CO_2 equivalents per year in 2013-17, whereas extra CO_2 removals in 2008-12 only amount to one-quarter of this.

5.6 FORESTRY

Removals of CO_2 in Danish forests distinguish between removals in the permanent forest existing as at 1 January 1990, and removals in new forest established since 1990. As only the latter can immediately be used in relation to Denmark's reduction commitment under the Kyoto Protocol and EU burden sharing cf. Article 3.3 of the Protocol, this section concentrates on this part of CO_2 removals.

5.6.1 Methods

The methods applied for the projections of afforestation have overall used the same approach, removals factors and types of key parameters and assumptions as the inventories of historical removals in connection with afforestation for 1990-2003. Thus the time series is as consistent as possible for the period 1990-2030.

5.6.2 Assumptions and key parameters

The projections for CO_2 sequestration in forests are based on an assumption that for a period of six to eight years there will be fewer resources for planting new forests than previously, while implementation of international obligations in the nature area are carried out (Natura 2000).

TABLE 5.12 EXPECTED EMISSIONS OF METHANE AND NITROUS OXIDE FROM AGRICULTURE 2003 – 2017
Source: Projections of greenhouse gas emissions, Memorandum to the Danish EPA, NERI, May 2005 and Projection of Greenhouse Gas Emission from the Agricultural Sector until 2017, NERI, 2004

Emissions of greenhouse gases from agriculture	2003	2012	2017	2008-2012	2013-2017
	Million tonnes CO_2 equivalents				
1. Baseline scenario	9.84	9.55	9.26	9.59	9.41
2. CAP Reform	9.84	9.49	9.16	9.57	9.33
3. CAP + pig production as in 2003	9.84	9.22	8.89	9.35	9.05
4.a CAP + 25% reduction in runoff	9.84	8.65	8.25	8.93	8.45
4.b CAP + 25% red. in runoff + extra initiatives for further afforestation	9.84	8.47	7.63	8.84	8.05

Amongst the other assumptions in the calculation of removals in forest planted since 1990 using the so-called afforestation model are:

1990-1999:
Inventory of Forests 2000 (Skovtælling 2000) has been used to calculate the extent of private afforestation without subsidies. All NORWEGIAN PINE areas have been deducted as it has been assumed that these are operated for Christmas trees and will continue in the future. The model uses NORWAY SPRUCE as a conifer, and therefore growth is greatly over-estimated. Christmas trees will always have a low level of biomass. The average species selected for private afforestation are 55% deciduous and 45% conifer according to the evaluation report from the Forest and Nature Agency. Inventory of Forests 2000 shows the privately owned forests have a distribution of 38% deciduous and 62% conifer. This report uses the Inventory of Forests 2000 distribution, while the evaluation report is only used for areas receiving subsidies in order to determine tree species. The growth in area of private forests without subsidies is assumed constant throughout the period. The Figure is calculated on the basis of knowledge on public afforestation and subsidised afforestation. The original figures from the evaluation are calculated with 1,100 ha covered by two-thirds conifer. This has been adjusted in the calculations.

2000 and 2001
Inventory of Forests 2000 has been used to calculate the size of private afforestation without subsidies. Figures from enterprise financial statements have been used for the others. It has been assumed that 150 ha new public forest is planted each year.

2002 and 2003:
The Action Plan for the Aquatic Environment II assumes afforestation of 20,000 ha over 6 years, corresponding to 3,333 ha per year. As in the period 1998-2001 a total of 10,346 ha was planted, this is unrealistic. Therefore the old figures have been used, corrected for low planting without subsidies.

2004-2030:
The approximate average annual af-

forestation for 1990-2003 of 1,900 ha per year has been projected as constant in the period 2004-2014. From 2015 it has been assumed that part of the private afforestation with subsidies – corresponding to about 900 ha per year – will stop, so afforestation in the period 2015-2030 is about 1,071 ha per year.

5.6.3 Results

Table 5.13 shows the expected rate of afforestation in selected years up to 2030. The rate of private afforestation will depend on the economic conditions in the agricultural sector, and, as the marginal agricultural localities are planted over time, a saturation point may be reached where the existing subsidies no longer provide an incentive for further afforestation.

TABLE 5.13 PROJECTED AREA OF AFFORESTATION AND CO_2 BINDING 2005 – 2030

Source: Forest and Landscape Denmark, March 2005.

CO_2 binding in Gg	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Private afforestation with subsidies, ha	900	1370	900	900	900	900
CO_2 binding (Gg)	-51	-103	-166	-245	-266	-266
Public afforestation, ha	400	400	400	400	400	400
CO_2 binding, Gg	-41	-66	-100	-120	-138	-138
Total afforestation including private afforestation without subsidies, ha	1900	1900	1900	1900	1900	1900
Total CO_2 binding, Gg	**-141**	**-262**	**-395**	**-555**	**-646**	**-822**

5.6.4 Sensitivity analyses and scenario calculations

Full sensitivity analyses have not been carried out, but if incentives are increased and if the rate of afforestation is doubled from about 2000 ha per year in 2005 to about 4000 ha per year (as in 1999), sequestration after 10-20 years will also double. However, at the moment it will hardly be realistic to increase removals significantly through afforestation as early as 2008-12.

5.7 WASTE

Greenhouse gas emissions under this sector include methane (CH_4) from landfills and methane and nitrous oxide (N_2O) from wastewater treatment.

5.7.1 Methods

Landfills

CH_4 emissions from landfills are calculated using an emissions model in which activity data are annual data for the amount of waste landfilled and in which the emissions factors, i.e. the amount of CH_4 emitted per quantity of waste deposited, are obtained from the assumptions in the model for the decay of waste and the release of CH_4.

The model has been developed and applied in the annual historical emissions inventories for the Climate Convention. As a result the model has been developed in accordance with the guidelines in the IPCC Guidelines (1996) and the IPCC Good Practice Guidance

(2001). On the recommendation of these reports, the model follows the Tier 2 method, which is a decomposition method. The model is described in the reports connected to the Climate Convention, most recently NIR2005. Briefly, the model assumes that carbon in landfilled waste decays and is converted to CH_4. This process is assumed by the model to continue so that 10 years after landfilling one-half of the carbon has been converted to CH_4. The model and the results have been evaluated through the Climate Convention in connection with the annual emissions inventories. The result of this evaluation has been that the model should continue to be used, unchanged, in the estimation inventories.

For the projection of emissions, the same CH_4 emissions model has been used as that used in the calculation of the historical emissions. The decay model for emissions of CH_4 implies that fluctuations over the time series for the landfilled waste amount are much less.

Recovery of CH_4 by landfill gas plants has been deducted from the calculated CH_4 emissions cf. Table 5.14. Energy statistics have been used for the historical data. For the projection of this deduction for gas recovered, the Energy Authority's general projection only includes a projection of landfill gas, and in this connection this is not considered useful. In an assignment for the Danish EPA (Danish EPA, 2005) LFG-consult (H. C. Willumsen) reviewed Danish landfills and prepared scenarios for recovery of CH_4 for the years 2005-2009. The result of the projection is shown in Table 5.14. For this projection a scenario (Danish EPA, 2005) without optimisation of the landfill gas plants has been used. The period 2010-2030 in the projection is calculated using exponential extrapolation.

Wastewater

Calculations of emissions of methane from wastewater handling are based on theoretical maximum emissions, called gross emissions of methane. These gross emissions are based on emissions from the entire methane potential in the amount of organic degradable material in the input wastewater at the treatment plants. The methane potential used as biogas or which is incinerated is deducted from this theoretical maximum. The resulting net methane emissions are an estimate of the actual emissions of methane during wastewater treatment at treatment plants. Key parameters are industrial contributions to wastewater input to treatment plants and the fraction of wastewater sludge treated aerobically.

Calculations of emissions of nitrous oxide are divided into a contribution from wastewater-treatment processes at treatment plants, called direct emissions, and a contribution from output wastewater, called indirect N_2O emissions.

Any methane emissions from waste-water handling in specific industries are not included in the calculations.

5.7.2 Assumptions and key parameters

Landfills

Amounts of waste are collated by the Danish EPA in the information system for waste and recycling (ISAG). The ISAG was first used in 1993. The ISAG is based on statutory registration and reporting from Danish waste-treatment plants for all waste entering or leaving the plants. Information concerning waste in the previous year must be reported to the Danish EPA each year, no later than 31 January. The reports for 2003 are the 11th in the series. The results are published as annual waste statistics, most recently for 2003 in Waste Statistics 2003 Environmental Review no. 14, 2004. These annual statistics include landfilled waste.

The projection with measures is based on the government Waste Strategy 2005-2008, in which decoupling of growth in waste amounts from growth in the economy is a fundamental element. The Waste Strategy includes targets for landfilling waste for 2008. In terms of sectors, the Strategy distribution (%) of landfilled waste for 2001 and the targets for 2008 in relation to the total waste amount is in Table 5.15.

Wastewater

The calculations of direct emissions and projections are based on population figures as well as a calculation procedure for emissions factors adjusted for the N contribution from industry in input wastewater.

In general the industrial contribution is assumed to be constant from 1999 and after. The emissions contribution from industry has been set at 41.9% (average contribution for 1999-2002) for both the projections. Nitrous oxide production takes place under anaerobic and aerobic conditions (nitrification and denitrification), but formation is primarily under aerobic conditions. Nitrous oxide emissions are expected to remain at a constant level due to fully optimised cleaning rate of wastewater before discharge.

Table 5.14 Methane emissions from landfills for the period 1990 to 2030, 1990-2003 are observed.

Source: 1990-2003: The National Inventory Report (NIR), the National Environmental Research Institute (NERI), April 2005.
2004-2030: Projection of greenhouse gas emissions, Memorandum to the Danish EPA, NERI, May 2005.

Tonnes methane, CH_4.	**1990**	**2000**	**2003**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Methane emissions from landfill sites (gross)	64,000	67,800	63,200	60,300	56,300	54,700	54,800	55,200	55,400
Recovery of methane from landfill sites	500	11,000	8,300	7,300	5,300	4,100	3,400	3,000	2,700
Methane emissions from landfill sites (net)	**63,500**	**56,800**	**54,900**	**53,000**	**51,000**	**50,700**	**51,400**	**52,300**	**52,600**

5.7.3 Results

Landfills
The overall projection of methane (CH_4) from landfills is described in Table 5.16.

Wastewater
The projection of total methane and nitrous gas emissions from wastewater handling in CO_2 equivalents is in Table 5.17.

5.7.4 Sensitivity analyses and scenario calculations

Full sensitivity analyses have not been completed, but the potential and financial aspects in possibly developing collection of methane from landfills for energy purposes will be examined in connection with The Policies and Measures Project mentioned in section 4.1.3.

5.8 Total emissions of greenhouse gases in the projection with measures

5.8.1 Carbon dioxide, CO_2

Table 5.18 shows the expected development in CO_2 emissions. A more detailed projection is in annex E. The biggest source of CO_2 emissions in Denmark is combustion of fossil fuels, including electricity and heat production and transport.

The transport sector has had the biggest increase in CO_2 emissions since 1990, and the emissions are expected to continue rising for the whole of the projection period. CO_2 emissions from the transport sector were 10,441 Gg of CO_2 in 1990 and had risen to 12,785 Gg of CO_2 in 2003, whereas the projection for 2008-2012 is 13,890 Gg of CO_2 annually. Emissions from energy production, including conversion and distribution have varied in 1990-2003 due to great variations in exports/imports of energy. Emissions from the production of electricity were 26,173 Gg of CO_2 in 1990 and 31,402 Gg of CO_2 in 2003, whereas the projection for 2008-2012 is 29,021 Gg of CO_2 annually, of which 4,400 Gg of CO_2 are due to electricity exports.

The total CO_2 emissions without land-use change and forestry (LUCF) was 52,887 Gg in 1990 and 59,329 Gg in 2003, while for the period 2008-2012 it has been calculated that the average annual

Table 5.15 Percentage of waste amounts for landfilling

Source: Projections of greenhouse gas emissions, Memorandum to the Danish EPA, NERI, May 2005 and the government's Waste Strategy 2005-2008

	Distribution 2001	Targets for 2008
Domestic waste	3	0
Bulky waste	26	25
Garden waste, etc.	1	0
Waste from institutions, trade and offices	12	5
Industry	22	15
Building and construction	8	8
Wastewater treatment plants	6	5
Power plants	1	10
Total	**10**	**9**

CO_2 emissions will be 59,233 Gg CO_2.

5.8.2 Methane (CH_4)

Most of the methane emissions come from farm animals' digestive systems (enteric fermentation). The projections are shown in Table 5.19. The reduction in emissions from agriculture from 1990 to 2001 and the continued reductions in the projection period are primarily due to reductions in cattle stocks. The next largest source of methane is landfills, from which emissions were also reduced from 1990 to 2001. Methane emissions from the energy sector have, however, increased considerably during the same period, due to an increase in the use of gas-driven motors. This has altogether led to an increase in total methane emissions from 5,684 Gg of CO_2 equivalents in 1990 to 5,873 Gg of CO_2 equivalents in 2003, whereas the projection for 2008-2012 is lower, i.e. 5,573 Gg of CO_2 equivalents annually.

5.8.3 Nitrous oxide, N_2O

Agriculture is by far the main source of emissions of nitrous oxide because this forms in soil through bacterial conversion of nitrogen in fertiliser and manure. The projections are shown in Table 5.20. The main reason for the reduction in total nitrous oxide emissions from 10,713 Gg CO_2 equivalents in 1990 to 8,060 Gg CO_2 equivalents in 2003 is a combination of the Action Plans for the Aquatic Environment I and II and the Action Plan for Sustainable Agriculture. The projection for 2008-12 is 6,942 Gg CO_2 equivalents annually. This substantial reduction is not least due to the fact that Denmark ceased to produce nitrous acid in 2004, as shown under industrial processes in Table 5.20. Contributions from the transport and energy sectors are expected to increase, whereas contributions from agriculture are expected to be somewhat less than in 2001.

Table 5.16. Emissions of CH4 from landfills in CO2 Equivalents (1000 tonnes =Gg) Observed: 1993-2003. Projected: 2004-2020

Source: Projections of greenhouse gas emissions, Memorandum to the Danish EPA, NERI, May 2005.

Common reporting format (CRF) Sector/Source	1990	2000	2005	2010	2015	2020	2025	2030
6A Managed waste disposal on land	1334.1	1192.3	1112.9	1071.4	1064.6	1079.6	1097.3	1105.5

Table 5.17 Sum of emissions of CH4 and N2O from wastewater in CO2 equivalents (1000 tonnes =Gg)

Source: Projections of greenhouse gas emissions, Memorandum to the Danish EPA, NERI, May 2005

Common reporting format(CRF) Sector/Source	1990	2000	2005	2010	2015	2020	2025	2030
6B Wastewater treatment	287.5	282.8	292.2	244.2	254.4	270.8	287.2	303.0

5.8.4 Industrial gases HFCs, PFCs and SF_6

In accordance with the possibilities offered in the Kyoto Protocol, Denmark has chosen 1995 as the base year for emissions of the industrial gases HFCs, PFCs and SF_6. Total emissions of these gases corresponded to 326 Gg CO_2 equivalents in 1995 and annual emissions have more than doubled since the year 2000. The rate of increase has decreased since 2003, when emissions corresponded to 746 Gg CO_2 equivalents.

The decrease in the rate of increase is primarily due to taxes and regulations introduced concerning the use of new installations/products. For the period 2008-12 total emissions of industrial gases corresponding to 768 Gg CO_2 equivalents annually are projected, after which a major reduction in emissions of HFCs, the major contributors, is expected and will result in a considerable reduction in emissions of industrial gases following the first period of commitment.

5.8.5 Denmark's total greenhouse gas emissions and removals

Table 5.22 shows the base year and projections of Denmark's total greenhouse gas emissions and removals.

5.9 Projections without measures

According to the guidelines for national reporting, projections in National Communications could also include any results from projections "without measures", i.e. projections without the expected effects of measures implemented after a certain point in time.

The Effort Analysis from 2005 includes such a projection of Denmark's greenhouse gas emissions in 2008-2012 excluding measures which were implemented from 1990 to 2001. The results of the *Measures Analysis* are described in Annex B2.

Note that the analysis has been prepared on the basis of the previous projection which include the effect of measures described in Denmark's Third National Communication as the analysis was started in 2003.

As stated in Annex B2 in the *Efforts Analysis,* it has been estimated that average Danish emissions of greenhouse gases in 2008-2012 would have been 95.6 mill. tonnes CO_2 equivalents– i.e. about 15.6 mill. tonnes CO_2 equivalents greater that the previous projection with measures, if the measures initiated in the period 1990-2001 had not been initiated.

5.10 Projections with additional measures

In accordance with the reporting guidelines for National Communications, it is also possible to include information on greenhouse gas projections where the expected effects of additional

Table 5.18 Projections of Denmark's CO_2 emissions in 2004 - 2030 and emissions observed in 1990, 1995, 2000, and 2003

Source: 1990-2003: The National Inventory Report (NIR), NERI, April 2005.

2004-2030: Projections of greenhouse gas emissions, Memorandum to the Danish EPA, NERI, May 2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990	1995	2000	2003	2005	2008-12	2013-17	2020	2025	2030
						(Gg CO2)				
1. Energy	51502	58992	51290	57635	54762	57180	57176	53685	52840	53629
A Fuel Combustion Activities (Sectoral Approach)	51239	58627	50696	57085	54252	56670	56685	53345	52499	53288
1 Energy Industries	26173	31934	25114	31402	28188	29021	28351	24385	22964	23390
2 Manufacturing Industries and Construction	5376	5890	5786	5404	5389	5915	6173	6439	6688	6814
3 Transport	10441	11823	12118	12785	13057	13890	14291	14673	15006	15288
4 Other Sectors	9129	8728	7567	7402	7496	7722	7748	7726	7718	7674
5 Other (Military mobile combustion of fuels)	119	252	111	92	122	122	122	122	122	122
B Fugitive Emissions from Fuels	263	365	594	550	510	510	491	341	341	341
1 Solid Fuels	0	0	0	0	0	0	0	0	0	0
2 Oil and Natural Gas	263	365	594	550	510	510	491	341	341	341
2. Industrial Processes	1068	1375	1574	1488	1764	1841	1841	1841	1841	1841
3. Solvent and Other Product Use	317	242	212	206	212	212	212	212	212	212
4. Agriculture	0	0	0	0	0	0	0	0	0	0
5. Land-Use Change and Forestry (LUCF)	158	-234	1782	-1204	-953	-1195	-1472	-1781	-1963	-2315
6. Waste	0	0	0	0	0	0	0	0	0	0
7. Other	0	0	0	0	0	0	0	0	0	0
Denmark's Total Emissions/Removals with LUCF	53045	60375	54858	58124	55785	58038	57756	53957	52929	53367
Denmark's Total Emissions without LUCF	52887	60609	53076	59329	56738	59233	59229	55738	54892	55682
Trend under the Climate Convention (1990=100), with LUCF	*100*	*114*	*103*	*110*	*105*	*109*	*109*	*102*	*100*	*101*
Trend under the Climate Convention (1990=100), without LUCF	*100*	*115*	*100*	*112*	*107*	*112*	*112*	*105*	*104*	*105*
CO2 emissions related to net electricity import (negative means net electricity export for the year)	*6300*	*-690*	*659*	*-6869*	*-4403*	*-4375*	*-2276*	*-1379*	*-859*	*-2868*
CO2 emissions related to the years temperature deviation from a normal year (based on degree days)	*1879*	*235*	*1323*	*723*	*0*	*0*	*0*	*0*	*0*	*0*
Trend under the Climate Convention (1990=100), with LUCF, when adjusted for inter-annual variations in electricity import/export and temperature	*100*	*98*	*93*	*85*	*84*	*88*	*91*	*86*	*85*	*82*
Trend under the Climate Convention (1990=100), without LUCF, when adjusted for inter-annual variations in electricity import/export and temperature	*100*	*99*	*90*	*87*	*86*	*90*	*93*	*89*	*88*	*86*
CO2 removals from afforestation since 1990, cf. Article 3.3 in the Kyoto Protocol	*0*	*-10*	*-59*	*-108*	*-141*	*-262*	*-401*	*-555*	*-646*	*-822*
Trend under the Kyoto Protocol (1990/95=100), with removals cf. Article 3.3	*100*	*115*	*100*	*112*	*107*	*112*	*111*	*104*	*103*	*104*
Trend under the Kyoto Protocol (1990/95=100), with removals cf. Article 3.3, when adjusted for inter-annual variations in electricity import/export and temperature	*100*	*98*	*90*	*87*	*85*	*89*	*93*	*88*	*87*	*85*
Memo Items (not included above):										
International Bunkers	4823	6928	6629	5318	5393	5581	5794	6027	6220	6425
Aviation	1736	1867	2350	2188	2254	2443	2656	2889	3082	3287
Marine	3087	5061	4279	3130	3138	3138	3138	3138	3138	3138
Multilateral Operations	0	0	0	0	0	0	0	0	0	0
CO2 Emissions from Biomass	4641	5869	7090	9108	0	0	0	0	0	0

Table 5.19 Projections of Denmark's methane emissions 2004 – 30, emissions in 1990, 1995, 2000 and 2003 are observed

Source: 1990-2003: The National Inventory Report (NIR), NERI), April 2005.

2004-2030: Projection of greenhouse gas emissions, Memorandum to the Danish EPA, NERI, May 2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990	1995	2000	2003	2005	2008-12	2013-17	2020	2025	2030
					(CH_4 i Gg CO_2-ækvivalenter)					
Denmark's Total Emissions	5684	6108	5941	5873	5646	5573	5322	5217	5166	5199
1. Energy	297	662	722	771	622	731	625	572	560	570
A Fuel Combustion Activities (Sectoral Approach)	186	469	579	594	500	617	524	497	489	499
1 Energy Industries	23	242	312	330	211	322	237	215	204	210
2 Manufacturing Industries and Construction	16	19	34	34	41	44	45	46	47	47
3 Transport	57	78	72	65	65	51	35	26	23	23
4 Other Sectors	90	130	161	165	183	200	206	210	214	218
5 Other (Military mobile combustion of fuels)	0	0	0	0	0	0	0	0	0	0
B Fugitive Emissions from Fuels	111	193	143	177	122	114	101	75	71	71
1 Solid Fuels	72	132	64	93	0	0	0	0	0	0
2 Oil and Natural Gas	38	60	79	84	122	114	101	75	71	71
2. Industrial Processes	0	0	0	0	0	0	0	0	0	0
3. Solvent and Other Product Use	0	0	0	0	0	0	0	0	0	0
4. Agriculture	3853	3938	3809	3706	3681	3587	3438	3356	3282	3282
A Enteric Fermentation	3110	3079	2872	2734	2681	2582	2441	2354	2275	2275
B Manure Management	743	860	937	972	1000	1005	997	1002	1007	1007
5. Land-Use Change and Forestry (LUCF)	0	0	0	0	0	0	0	0	0	0
6. Waste	1534	1507	1410	1397	1344	1255	1258	1289	1323	1347
A Solid Waste Disposal on Land	1334	1286	1192	1153	1113	1071	1065	1080	1097	1105
B Wastewater Handling	200	222	217	244	231	183	193	210	226	242
7. Other	0	0	0	0	0	0	0	0	0	0
Trend under the Climate Convention (1990=100) in total emission of CH4	*100*	*107*	*105*	*103*	*99*	*98*	*94*	*92*	*91*	*91*
Trend under the Climate Convention (1990=100) in total emission of CH4 from energy	*100*	*223*	*243*	*259*	*209*	*246*	*210*	*192*	*189*	*192*
Trend under the Climate Convention (1990=100) in total emission of CH4 from agriculture	*100*	*102*	*99*	*96*	*96*	*93*	*89*	*87*	*85*	*85*
Trend under the Climate Convention (1990=100) in total emission of CH4 from waste and wastewater handling	*100*	*98*	*92*	*91*	*88*	*82*	*82*	*84*	*86*	*88*

Table 5.20 Projections of Denmark's nitrous oxide emissions in 2004-30, emissions in 1990, 1995, 2000, and 2003 are observed
Source: 1990-2003: The National Inventory Report (NIR), NERI, April 2005.
2004-2030: Projection of greenhouse gas emissions, Memorandum to the Danish EPA, NERI, May 2005.

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990	1995	2000	2003	2005	2008-12	2013-17	2020	2025	2030
	(N_2O i Gg CO_2-ækvivalenter)									
Denmark's Total Emissions	10713	9657	8615	8060	7102	6942	6760	6628	6530	6543
1. Energy	590	761	790	913	933	1025	1060	1052	1063	1076
A Fuel Combustion Activities (Sectoral Approach)	589	759	787	910	930	1022	1058	1050	1062	1075
1 Energy Industries	276	327	255	328	306	313	314	283	273	268
2 Manufacturing Industries and Construction	54	56	57	56	58	63	66	68	71	72
3 Transport	147	270	380	430	466	540	570	590	608	624
4 Other Sectors	110	104	94	95	99	104	106	107	108	109
5 Other (Military mobile combustion of fuels)	1	3	1	1	2	2	2	2	2	2
B Fugitive Emissions from Fuels	1	2	3	3	3	3	3	2	2	2
1 Solid Fuels	0	0	0	0	0	0	0	0	0	0
2 Oil and Natural Gas	1	2	3	3	3	3	3	2	2	2
2. Industrial Processes	1043	904	1004	895	0	0	0	0	0	0
3. Solvent and Other Product Use	0	0	0	0	0	0	0	0	0	0
4. Agriculture	8993	7907	6756	6192	6108	5856	5639	5515	5406	5406
B Manure Management	685	642	601	560	552	539	524	516	505	505
D Agricultural Soils	8308	7265	6154	5632	5556	5317	5114	4999	4900	4900
5. Land-Use Change and Forestry (LUCF)	0	0	0	0	0	0	0	0	0	0
6. Waste	88	85	65	61	61	61	61	61	61	61
B Wastewater Handling	88	85	65	61	61	61	61	61	61	61
7. Other	0	0	0	0	0	0	0	0	0	0
Trend under the Climate Convention (1990=100) in total emission of N_2O	*100*	*90*	*80*	*75*	*66*	*65*	*63*	*62*	*61*	*61*
Trend under the Climate Convention (1990=100) in total emission of N_2O from energy	*100*	*129*	*134*	*155*	*158*	*174*	*180*	*178*	*180*	*182*
Trend under the Climate Convention (1990=100) in total emission of N_2O from agriculture	*100*	*88*	*75*	*69*	*68*	*65*	*63*	*61*	*60*	*60*
Trend under the Climate Convention (1990=100) in total emission of N_2O from wastewater handling	*100*	*97*	*75*	*69*	*70*	*70*	*70*	*70*	*70*	*70*

Table 5.21 Projections of Denmark's industrial greenhouse gas emissions in 2004-30, emissions in 1995, 2000, and 2003 are observed

Source: 1990-2003: The National Inventory Report (NIR), NERI, April 2005

2004-2030: Projection of greenhouse gas emissions, Memorandum to the Danish EPA, NERI, May 2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1995	2000	2003	2005	2008-12	2013-17	2020	2025	2030
	(HFCs, PFCs and SF6 in Gg CO_2 equivalents)								
Total emissions of HFCs, PFCs and SF6	326	682	746	819	768	523	179	179	179
2. Industrial Processes	326	682	746	819	768	523	179	179	179
C Metal Production	36	21	0	0	0	0	0	0	0
1 Iron and Steel Production	0	0	0	0	0	0	0	0	0
2 Ferroalloys Production	0	0	0	0	0	0	0	0	0
3 Aluminium Production	0	0	0	0	0	0	0	0	0
4 SF6 Used in Aluminium and Magnesium Foundries	36	21	0	0	0	0	0	0	0
SF6 Used in Aluminium Foundries	0	0	0	0	0	0	0	0	0
SF6 Used in Magnesium Foundries	36	21	0	0	0	0	0	0	0
5 Other	0	0	0	0	0	0	0	0	0
F Consumption of Halocarbons and Sulphur Hexafluoride	290	660	746	819	768	523	179	179	179
1 Refrigeration and Air Conditioning Equipment	36	436	575	-	-	-	-	-	-
2 Foam Blowing	183	168	129	-	-	-	-	-	-
3 Fire Extinguishers	0	0	0	-	-	-	-	-	-
4. Aerosols/ Metered Dose Inhalers	0	17	10	-	-	-	-	-	-
5 Solvents	0	0	0	-	-	-	-	-	-
6. Semiconductor Manufacture	0	0	0	-	-	-	-	-	-
7. Electrical Equipment (SF6)	4	11	10	-	-	-	-	-	-
8 Other (please specify)	68	29	23	-	-	-	-	-	-
C3F8 (PFC used as detergent)	0	2	2	-	-	-	-	-	-
SF6 (Window plate production, Research laboratories and Running shoes)	68	27	22	-	-	-	-	-	-
Total emissions of HFCs	218	605	695	773	703	407	118	118	118
Total emissions of PFCs	1	18	19	14	10	8	6	6	6
Total emissions of SF6	107	59	31	32	55	108	55	55	55
Trend under the Kyoto Protocol (1995=100) in total emissions of F-gases	*100*	*209*	*229*	*251*	*236*	*161*	*55*	*55*	*55*
Trend under the Kyoto Protocol (1995=100) in total emissions of HFCs	*100*	*278*	*319*	*355*	*323*	*187*	*54*	*54*	*54*
Trend under the Kyoto Protocol (1995=100) in total emissions of PFCs	*100*	*3562*	*3851*	*2791*	*1904*	*1494*	*1141*	*1141*	*1141*
Trend under the Kyoto Protocol (1995=100) in total emissions of SF6	*100*	*55*	*29*	*30*	*51*	*101*	*51*	*51*	*51*

policies and measures that are planned but still not implemented are included.

The Government Climate Strategy from 2003 contains a number of expected effects of supplemental policies and measures that are planned but still not implemented.

The Strategy does not, however, include a projection with additional measures included in such a way that effects of specific additional measures are included in a traditional manner.

Such a projection would also be incomplete. This is partly because the requirements of the Climate Strategy state that cost effectiveness is to be regularly reassessed as the costs of the possible further measures may change over time. Furthermore, from 1 January 2005, about half of Danish emissions of greenhouse gases are subject to allowance regulation in order to ensure that a predetermined goal is achieved without previously setting how the enterprises subject to allowance regulation are to meet these goals. With the allowance regulation, it is left to the individual businesses to decide whether market conditions make the buying of extra allowances or the implementation of emission-reducing measures - e.g. saving energy - most favourable.

With the coming into force of the Kyoto Protocol, demands have shifted from traditional projections of greenhouse gas emissions to more appropriate target-fulfilment projections, which is expressed by e.g. the inclusion of expected effects of funds already allocated to JI and CDM projects in Table 5.1.

If additional, specific cost-effective measures that should be included in future planning of reduction efforts are found in connection with *The Policies and Measures Project* (section 4.1.3), then up-dated projections can be made where expected effects of these additional measures are included.

5.11 Greenland and the Faroe Islands

5.11.1 Greenland

With respect to the expectations concerning future greenhouse gas emissions in Greenland, the projections cover only electricity and district heat production. Since the Third National Communication, only small updates have been made to the projections for 2005 because of updated historical emissions figures for 2000-2003. The results are in Table 5.23.

The projections for CO_2 emissions from electricity and district heat production are based on a projected increase in energy consumption of 1% up to 2006, after which they will stagnate. The projections are also based on the fact that a hydropower station is under construction and expected to go into operation in 2008.

Table 5.22 Projections of Denmark's total greenhouse gas emissions and removals in 2004-2030, emissions in 1990, 1995, 2000, and 2003 are observed

Source: 1990-2003: National Inventory Report (NIR), NERI, April 2005.

2004-2030: Projection of greenhouse gas emissions, Memorandum to the Danish EPA, NERI, May 2005.

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990	1995	2000	2003	2005	2008-12	2013-17	2020	2025	2030
	(Gg CO_2-ækv.)									
1. Energy	52390	60415	52802	59319	56317	58936	58862	55309	54463	55276
A Fuel Combustion Activities (Sectoral Approach)	52014	59855	52062	58589	55683	58309	58266	54891	54049	54862
1 Energy Industries	26472	32503	25680	32059	28705	29656	28902	24882	23441	23868
2 Manufacturing Industries and Construction	5447	5965	5877	5494	5489	6022	6283	6553	6806	6933
3 Transport	10645	12171	12570	13280	13587	14481	14897	15289	15637	15935
4 Other Sectors	9329	8961	7822	7662	7778	8026	8060	8043	8041	8001
5 Other (Military mobile combustion of fuels)	120	256	112	94	124	124	124	124	124	124
B Fugitive Emissions from Fuels	376	560	740	729	635	627	595	418	414	414
1 Solid Fuels	72	132	64	93	0	0	0	0	0	0
2 Oil and Natural Gas	303	428	676	636	635	627	595	418	414	414
2. Industrial Processes	2155	2604	3259	3129	2583	2609	2364	2020	2020	2020
3. Solvent and Other Product Use	317	242	212	206	212	212	212	212	212	212
4. Agriculture	12845	11845	10565	9898	9788	9444	9077	8870	8688	8688
5. Land-Use Change and Forestry (LUCF)	158	-234	1782	-1204	-953	-1195	-1472	-1781	-1963	-2315
6. Waste	1622	1593	1475	1457	1405	1316	1319	1350	1385	1409
7. Other	0	0	0	0	0	0	0	0	0	0
Denmark's Total Emissions/Removals with LUCF	69487	76466	70095	72804	69352	71321	70361	65980	64803	65288
Denmark's Total Emissions without LUCF	69328	76700	68314	74009	70305	72516	71833	67761	66767	67603
Trend under the Climate Convention (1990=100), with LUCF	100	110	101	105	100	103	101	95	93	94
Trend under the Climate Convention (1990=100), without LUCF	100	111	99	107	101	105	104	98	96	98
CO_2 emissions related to net electricity import (negative means net electricity export for the year)	6300	-690	659	-6869	-4403	-4375	-2276	-1379	-859	-2868
CO_2 emissions related to the years temperature deviation from a normal year (based on degree days)	1879	235	1323	723	0	0	0	0	0	0
Trend under the Climate Convention (1990=100), with LUCF, when adjusted for inter-annual variations in electricity import/export and temperature	100	98	93	86	84	86	88	83	82	80
Trend under the Climate Convention (1990=100), without LUCF, when adjusted for inter-annual variations in electricity import/export and temperature	100	98	91	88	85	88	90	86	85	84
CO_2 removals from afforestation since 1990, cf. Article 3.3 in the Kyoto Protocol	0	-10	-59	-108	-141	-262	-401	-555	-646	-822
Trend under the Kyoto Protocol (1990/95=100), with removals cf. Article 3.3	100	111	98	107	101	104	103	97	95	96
Trend under the Kyoto Protocol (1990/95=100), with removals cf. Article 3.3, when adjusted for inter-annual variations in electricity import/export and temperature	100	98	91	87	85	88	89	85	84	82
Memo Items (not included above):										
International Bunkers	4904	7050	6741	5405	5481	5671	5887	6122	6317	6525
Aviation	1755	1888	2376	2212	2280	2470	2686	2921	3116	3324
Marine	3149	5162	4365	3193	3201	3201	3201	3201	3201	3201
Multilateral Operations	0	0	0	0	0	0	0	0	0	0
CO_2 Emissions from Biomass	4641	5869	7090	9108	0	0	0	0	0	0

Table 5.23 Greenland's actual emissions of CO_2 from burning fossil fuels as well as expected emissions of CO_2 from production of electricity and district heating

Source: Nukissiorfiit.

Year	1990	1995	2000	2003	2005	2008	2009	2010	2011
CO2 emissions from burning of fossil fuels ('000 tonnes)	626	525	661						
Of which CO2 emissions from production of elec. and district heating in towns and settlements ('000 tonnes)		125	132	133	132	126	121	121	121

5.11.2 The Faroe Islands

There are not at the present time any estimates of future greenhouse gas emissions on the Faroe Islands. In connection with preparation of the proposed energy policy action plan mentioned in Chapter 4, it is expected that in June 2006 there will be energy projections and associated greenhouse gas projections.

Notes

1 Environmental satellite models for ADAM, NERI Technical Report no. 148, DMU 1995

2 The transport sector's energy consumption and emissions, Road Directorat, 2002 (http://www.trm.dk/graphics/Synkron-Library/trafikministeriet/Publikationer/pdf/emissioner.pdf) (in Danish)

3 In november 2005 WEO2005 was published by the International Energy Agency. Updated Danish energy projections and GHG projections based on WEO2005 and other new information will by finalised in 2006.

4 Ozonlagsnedbrydende stoffer og drivhusgasserne HFC'er, PFC'er og SF_6, Miljøprojekt 987, Miljøstyrelsen, March 2005 (in Danish) (http://www.mst.dk/udgiv/publikationer/2005/87-7614-546-8/html)

6 Vulnerability assessment, climate change impacts and adaptation measures

6.1 Climate in the future

In relation to future global climate change, Denmark is a robust country. This is primarily because of a long tradition of legislation which prevents building in river valleys, along the coast and in forests. Agricultural land is well-drained and many farmers are able to irrigate in dry periods. Moreover, the Danish population is aware of, and uses systematic warning systems of extreme weather events and the consequences thereof.

Natural and man-made forcings of the climate of the future, e.g. volcanic eruptions, varied solar activity, increased greenhouse effect and emissions of aerosols are best assessed using climate models. Simple projections on the basis of the current climate and observed trends only provide a limited impression of possible future climate changes. Climate models, which are based on the laws of physics and facts, are mathematical descriptions of the components of the climate system: atmosphere, ocean, ice and snow, land surfaces and the biosphere. Calculations are carried out on large computers and increasingly demand cooperation between modelling centres in order to reduce or quantify uncertainties.

The most important source of uncertainty regarding the future climate is related to the lack of knowledge on future greenhouse gas emissions. In addition there is uncertainty regarding the sensitivity of the climate system to these greenhouse gases. Finally, uncertainty is linked to the interrelationship between changes in the global climate and the regional effects that may arise. These effects can be divided into direct consequences of climate change and indirect effects resulting from climate change in countries outside the Danish Realm.

6.2 Climate trends in Denmark

6.2.1 The latest developments

Since the Ice Age, Denmark has had a temperate coastal climate. This climate, with wet winters and cool summers is now changing. The latest statistics[1] from DMI (Danish Meteorological Institute) show that the mean temperature is approaching 8.5°C, an increase of almost 1.5°C since the end of the 19th century. This increase is more than double the increase in the global mean temperature for the same period. Now, the average winter temperature is most often warmer than 2°C and the average summer temperature is about 16°C.

The annual precipitation measured in Denmark is now about 750 mm. This has increased by about 15% - or 100 mm – since records began in 1874. Precipitation is greatest in west and Southern Jutland, with almost 1000 mm, and least precipitation is measured on the eastern islands, where about 600 mm is recorded each year. It is typical that wet areas experience the greatest percentage increase. Therefore, precipitation has increased most in west Jutland, by about 20% in the past 85 years. In the same period drainage into water courses has increased correspondingly[2]. As a result, run-off of nutrients from agricultural soil continues to be very large in wet years, despite national initiatives in the Action Plans for the Aquatic Environment I-III. The link between precipitation, drainage and run-off must be taken into account when the EU Water Framework Directive is to be implemented.

The Danish climate has become more maritime in the 20th century. On average, the cloud cover has increased by about 5 percentage points since observations began in 1874. With the clouds, more precipitation has come, there are fewer days with snow cover, and temperatures are higher. The direct consequences such as decreased need for ice-breaking, shorter sledging season, earlier pollen season, longer growing season and longer swimming season, can already be felt by the Danish population.

The sea level around Denmark has risen over the past 115 years. The maximum observed rise is in south-western Denmark, where the water level is rising by about 1 mm per year. In northern and eastern Denmark uplift of the land after the Ice Age is roughly in line with the rise in sea level.

6.2.2 Projected climate changes in Denmark

The natural causes of future climate change are difficult to assess in advance. The basis for assessing the increased greenhouse effect is also uncertain for several reasons. An important source of uncertainty about the future climate arises from the lack of knowledge about future global emissions of greenhouse gases and other substances that affect the climate. Moreover, there is uncertainty regarding the sensitivity of the climate system to these greenhouse gases.

DMI/Denmark's Climate Centre (in cooperation with the Hadley Centre for Climate Prediction and Research and the Max Planck Institut für Meteorologie in Hamburg) has carried out global and regional calculations for several internationally recognised scenarios for future emissions of greenhouse gases and aerosols[3]. Analyses with global and regional climate models show the following general trend for the climate in Denmark in the period 2071-2100 in relation to 1961-1990:

- A rise in the annual mean temperature of 3-5°C, depending on the chosen scenario for emissions of greenhouse gases. Greatest warming at night and no major difference between the increase in summer and winter. Warming leads to fewer days with frost and snow and less days with snow cover.

- An increase of 10-40% in winter precipitation and a reduction in the order of 10-25% in summer precipitation. A clear tendency towards more episodes with very heavy precipitation, particularly in autumn and lengthy dry periods, especially in the summer.

- A tendency towards more frequent westerly winds and at the same time a shift of the storm tracks over the North Atlantic slightly eastward, leading to a small increase in storm activity over Denmark and the adjacent waters. On this basis, calculations with storm surge models show that the highest sea level in the more extreme cases could rise by 5-10% relative to today (about 0.3 m on the west coast)[4]. In addition to this there is the global rise in sea level which the IPCC estimate at between 0.1-0.9 m over the level today.

A combined positive effect on the runoff from landareas has been calculated. There would be an increase of the order of 10% in the period December to April when the concided effect of increased winter precipitation and greater evaporation is taken into account. A bigger runoff in the entire Baltic region could make the surface layers in the inner Danish waters less saline. In combination with changed wind conditions and increased run-off of nutrients, this could present a risk of negative consequences for marine ecosystems and commercial fish stocks in the form oxygen depletion.

Note that the uncertainty mentioned above is significant in assessing future climate change, especially in projecting precipitation and extreme weather phenomena such as storms and floods. The DMI models and most other models show climate sensitivity at about 3°C for a doubling in the CO_2 content in the atmosphere, but new model studies, published in 2005 in the journal Nature[5], show that climate sensitivity could be considerably greater than hitherto assumed.

6.2.3 Impacts and Denmark's possibilities for adaptation

Earlier evaluations
The impacts of possible climate changes in Denmark have been evaluated several times since 1988, and most recently in the Danish EPA report of 2004: Adapting to the climate of the future[6]. The general conclusion is that the direct impacts in moderate climate scenarios would be modest and could be countered by suitable ongoing adaptation. Overall, estimates indicate that it will be an advantage to plan long-term and keep to appropriate safety margins. At first, this means identifying the areas of society which require short-term decisions, whilst continuously improving the basis for decisions which can wait. The Report points out that changes in the extreme climate could be the cause of the greatest future surprises for the Danish people. Local decision-

makers are encouraged to incorporate climate change in all current decisions on planning and ongoing maintenance. In October 2005 the Danish government initiated preparations to meet the primary impacts of climate change. The purpose is on the basis of three possible future climate scenarios to establish a catalogue of consequences and measures.

Systematic evaluations have not been made of secondary impacts for Denmark, for example in the form of changing tourist patterns, environmental refugees, agricultural prices/subsidies, or changed possibilities for wind turbine exports. For a small, export-oriented and open economy such as Denmark, such secondary impacts could easily be more important than the primary impacts.

Water resources
The size of the water resource is influenced by both access to groundwater and consumption of water. With the prospect of warmer summers, with greater risks of heavy downpours and longer periods without precipitation or even of drought, Denmark can expect an increased demand for water for several purposes:

- In urban areas a need will arise for cooling and watering of green areas. The existing problems of over-use of groundwater resources close to urban areas could be exacerbated.
- In rural areas the need to irrigate will increase significantly, and the current problems with conflicts of interest between agriculture and natural aquatic environments could be exacerbated.

Net precipitation is expected to increase as a result of the increasing difference between winter and summer precipitation. A change in precipitation patterns with fewer rain events, but of greater intensity will, however, affect surface drainage and thus formation of groundwater.

Just as important as the quantity of groundwater is its quality. Along low-lying coasts, the intrusion of salt water may affect the quality of groundwater. With a rising sea level, salt penetration would present a greater risk, which may lead to limitations on water-extraction possibilities in more places than is the case today.

Two studies in 2003 and 2004 have indicated the need for extraordinary action in the water area. In its report, the Academy of Technical Sciences[7] pointed in particular to the need to plan renovation of drainage systems so that they will also be able to function in a future wetter climate. Furthermore, in 2003 the Danish Board of Technology[8] held workshops aimed at the public on the local possibilities for adapting to a global sea-level rise of half a meter. One of the more surprising results was that it was not important to promote construction of fixed installations to secure against flooding of agricultural land. There was some agreement on an approach based on appropriate adaptation through slow, natural development of the coastline.

Agriculture

For Danish agriculture, the overall effects are estimated to be advantageous. Changes in cultivation practice can be implemented at short notice, and production is expected to grow with rising temperature and CO_2 concentrations. EU regulation is currently causing a development leading to less dairy production and increasing production of pig meat. The projected climate changes could reinforce this trend because market constraints in the dairy sector would limit production. In this context, the forthcoming EU CAP will play a greater role than climate change. Despite the extreme summer heat in Germany, France and Spain in 2003, where the harvest in several places fell by up to 30%, there was no overall drop in farmers' incomes because higher prices meant better profits in the countries which were not affected. In the longer term – in a climate under change – Denmark is favourably placed in the EU internal market.

However, higher temperatures and humidity could increase the risk of pests and plant diseases, resulting in an increased demand for pesticides. At the same time, increased production would require more nutrients for plants, which, together with more precipitation and higher soil temperatures in winter, as well as irrigation in summer, would increase the risk of nutrient leaching and run-off. Implementation of the EU Water Framework Directive will help ensure both cost-effective agriculture and long-term protection of water resources in a future changed climate.

Forestry

Climate change, for instance changes in temperature, precipitation, and wind affects flora and fauna. The long lifecycle of forest trees (typically 80-100 years) and a limited ability to adapt within one tree generation may cause a number of problems.

Denmark is placed centrally in a vegetation belt of temperate deciduous forest, and, with moderate future climate change, a majority of existing tree species that thrive well today are expected to persist in Denmark. Norway spruce, however, may be the exception. Norway spruce occures naturally in regions with cold winters, and the species has already shown signs of poorer health in periods with warmer winters and much precipitation. Summers characterised by drought may have a potentially larger effect on Norway spruce, because its roots do not reach as far into the ground as other species. Norway spruce makes up approx. 28% of the area covered by vegetation, and – often being grown in monoculture – there is also a large risk of forest fires, even if today this is not a major problem.

Beside its effects on the growth of trees, regeneration dynamics, and stability, a changed climate may also pave the way for introduction of new pests or for propagation of existing known pests, which, possibly in combination with weakened vegetation, may cause problems relating to forest health and stability. Changes in forest management practices could be one way to adapt.

A higher atmospheric content of CO_2 and longer growth seasons will increase forest increment, and will also improve water household of trees in connection with photosynthesis. In contrast, warmer and drier summers may cause problems relating to water household, and be significant in relation to forest health, which again may reduce forest increment.

Already today, the National Forest Programme, the Forest Act, and associated support schemes, are assisting in the development of more robust forests, making them more flexible and tolerant towards changing climate variables, for instance precipitation. Adaptation takes the form of continuous efforts to shift to near-nature forestry and focus on genetic diversity in the choice of tree species and plant material. Cooperating with the Royal Veterinary and Agricultural University[9], the Danish Forest and Nature Agency has also been in charge of the development of new concepts for near-nature forestry. The statutory windfall pool provides for economic support for replanting robust tree species. The list of species and provinence is updated on a continuous basis, thus enabling the best possible adaptation to the climate of the future. In accordance with national goals, forest areas must be increased and forest landscapes must cover 20-25% of Denmark in the course of one tree generation (80-100 years.).

Natural ecosystems

Many species of fauna and flora have their natural limit of extent close to Denmark, and a certain northward shift of species could therefore be expected. However, not all foreign species would be equally welcome. Pests such as the Colorado beetle have long had their northern limit just south of Denmark. The progress of the Iberian slug in recent years may be connected with a generally milder winter climate. Overall, there are a number of animal and plant species which should still be monitored because they appear to be very sensitive to climate change. Overall, it is estimated that limited changes in the climate may lead to greater biodiversity.

Both freshwater and marine ecosystems are sensitive to climate change. At the moment it is not possible to estimate the total impacts. A large inter-disciplinary research project called CONWOY[10] is being funded by the Danish research councils. The aim is to clarify the consequences of future climate change on the aquatic environment. For example, long-term experiments have been initiated using artificial heating of controlled marine and lake ecosystems. The results of these experiments will be presented at a scientific conference in 2006.

A new project, CLIMAITE[11], is looking into the ability of terrestrial ecosystems to adapt to the warmer and drier climate of the future. The project will be completed in 2007/2008.

Coastal zone management
The Danish coastline partly comprises active coastal cliffs where the sea erodes material, and partly beach-ridge complexes, where the material is deposited in the lee of prevailing winds. About 80% of the population live in urban areas connected to the coast. A total of about 1800 km of coastline is protected by dykes or other fixed installations. In recent years beach nourishment has increasingly been used to protect exposed stretches of coastline. As mentioned above, at the workshops organised by the Danish Board of Technology, there seems to be some agreement with the idea of keeping a natural coastline – if necessary at the expense of agricultural areas.

A special problem is linked to low-lying areas that are exposed to both increases in the sea level and are under pressure from increasing drainage from the land. In particular, many of the coastal towns near estuaries of larger rivers or at the bottom of fjords could have complex problems. Merely building higher dykes, for instance, is not a long-term solution as the problem of backwater flooding will just become greater as a result of river water being unable to flow freely into the sea. A long-term solution requires the involvement of river valleys further inland. There is a need for space for rivers to allow flood plains to flood regularly to take some of the pressure off at river mouths. One of the tools to change land use in river valleys could be through the EU agricultural subsidy schemes, to make river valleys far more multi-functional.

Energy supply
Up to now, Denmark has been able to adapt energy systems to the existing temperate coastal climate which traditionally has no need for, e.g. air conditioning (although many new cars are now fitted with an air-conditioning system). Overall, the climate changes will imply less heating needs, and this will lead to significantly less energy consumption. The current conversion from fossil fuels, including gas and oil from the North Sea, to various renewable energy sources, is increasing Denmark's dependency on weather and climate-sensitive energy sources. The scenarios show that there will be more wind for wind turbines. Furthermore, increased precipitation will affect neighbouring Nordic countries, meaning more supply of hydro-electricity. However, the supply of electricity will probably be more unstable due to natural variations in climate. Finally, it is possible to convert energy production to bio-fuels. These are also climate-sensitive to some degree, especially if the storm climate changes and larger areas of Norway spruce plantations are blown down and must be burnt.

If the need for air conditioning in housing, agricultural buildings and other commercial buildings increases in line with increases in temperature, it will be necessary to consider the consequences for humans and animals without access to air conditioning. Recent studies from London[12] indicate that increased use of air conditioning could move the heat problem into the streets. To a certain extent, the same can be said of air conditioning in cars. Thus, it is important to think more long-term in this area.

Health

Over the next 100 years, the projected changes in climate could lead to direct health impacts in the form of a higher risk of heat stroke, especially amongst the old and sick. The extreme summer heat in Europe in 2003, for example, led to increased mortality in several European countries. It has been estimated that as many as 30,000 additional deaths can be ascribed to the extreme summer heat. It is already possible to ascertain that the health impacts of greater amounts of pollen and the earlier pollen season can possibly explain the increase in the incidence of allergies. Finally, there is a risk that vector-borne diseases could become more widespread, for example, from more malarial mosquitoes, or more Borrelia or TBE-bearing ticks.

A greater risk of new infection paths and sources could also arise because of an increasing number of refugees – possibly from climate and environmental disasters in other countries. This would increase the risk not only of "southern" diseases, but also of diseases that are presently under control in Denmark - e.g. tuberculosis.

6.3 Climate changes in Greenland

Greenland has an Arctic climate. About 80% of the land is covered by the up to 3 km-thick ice sheet, while the ice-free land areas are limited to a coastal strip 50-300 km wide. Furthest south, and closest to the edge of the ice, the climate is sub-Arctic with a mean temperature of more than 10°C in July. The climate in south-west Greenland, where most of the 55,000 population live is low-Arctic. It is characterised by relatively mild winters with a lot of snow and periods of thaw and wet summers with average temperatures of less than 10°C in the warmest month. North and north-east Greenland are in the high-Arctic zone. The climate has continental characteristics with very cold winters – down to minus 50 degrees (Celsius) in north Greenland. The temperature is rarely above freezing from September to May. Winter precipitation is limited as parts of north Greenland has a desert climate with less than 25 mm precipitation per year, corresponding to about 1% of the precipitation at the southern tip of Greenland. The continental climate in high-Arctic Greenland is ascribed to the Polar Ice from the Arctic Ocean, which hitherto have made up the often up to several-hundred-kilometre-wide belt of pack-ice, which floats southwards along the east coast of Greenland.

In recent years, the extent of the Polar Ice has been reduced for long periods, and this has led to unusual events such as wave erosion along the coasts which previously had not seen open sea to the same extent. The climate in high-Arctic Greenland is greatly influenced by the amount and spread of the Polar Ice.

Analyses using global and regional climate models[13] show the following general trends in the climate in Greenland for the period 2071-2100 compared with 1961-1990 for a middle-high scenario:

- A rise in the mean annual temperature in south Greenland of about 2°C, slightly more in winter than in summer. In north Greenland temperatures could rise by 6-10°C in winter, but only slightly in summer.

- A general increase in precipitation of 10-50%. The winter increase could however be significantly greater in north Greenland – locally up to more than 200%.

Almost the entire population of Greenland live in towns and settlements in the low-Arctic part of the country, where the main industry is fisheries. Only in the northernmost part of the high-Arctic region on the west and east coasts are there small communities that live to some extent from hunting mammals and birds.

A description is given in the following two sections of what could or would happen on land and in the marine environment as a consequence of the expected climate changes. The description is based exclusively on general evaluations[14] with the present knowledge concerning factors determining the welfare of the relevant species and ecosystems[15].

6.3.1 Effects and possibility for adaptation on land

Humans
Seen from the point of view of the local community, the changes mentioned would be of limited practical importance and perhaps even an advantage in the form of more plant growth, more reindeer and musk oxen and perhaps better possibilities for farming in south Greenland. The increased thawing of the permafrost could bring problems in areas where houses, roads, airports and other structures have foundations in the permafrost, but since the vast majority of structures in Greenland stand on solid rock, the problem would only be a local one. Increased melting of the ice cap would provide more water - for hydropower for example - but this resource is not generally a constraint today. However, extensive melting may cause problems for the supply of water. The costs of heating in the winter would be reduced and there would generally be fewer problems from hard frost.

The importance of the snow cover
As a consequence of earlier snow melting in low-Arctic Greenland,

higher summer temperatures and more summer precipitation, a longer growing season can be expected and thus a more extensive and vigorous plant cover. Immigration of species from the south can be envisaged, but would be impeded by barriers in the form of open seawater and competition from already established species.

There is a risk of most of the high-Arctic zone disappearing together with the special fauna and flora that are adapted to precisely this zone. In north-east Greenland, large areas are completely without vegetation. There are few species of Arctic flora and fauna, and those present have adapted to the extreme climate conditions. Many plants and mammals depend on a stable snow cover to protect them against the cold. Other species are dependent on the snow disappearing early - or being blown away altogether in winter. The distribution, duration, and thickness of the snow cover are therefore just as important factors as the temperature for the general conditions of life for many plants and animals in Greenland. In high-Arctic Greenland, more ample precipitation would presumably mean more extensive plant cover, and large parts of this zone would possibly change character to become more like low-Arctic areas.

Mammals

Greenland's fauna as a whole would presumably also benefit from a milder climate and consequently more fertile and widespread plant growth, although there are important exceptions. Many of the species in high-Arctic Greenland are dependent on the dry continental climate. This applies, for example, to the musk ox, where thicker snow cover and more frequent periods of thaw in winter (with the formation of ice crusts in the snow) could make it difficult for the animals to forage. Examples of this are already known with the present climatic conditions, and reindeer died out for the same reason in the whole of high-Arctic Greenland during a snowy period more than 100 years ago. The artificially established population of musk oxen in south-west Greenland is hardlien likely to suffer similar problems. On the contrary, both reindeer and musk oxen might thrive even better in the continental low-Arctic region.

6.3.2 Effects and possibility for adaptation at sea

Humans

For Greenland society, a warmer climate would probably mean increased fishing opportunities in the form of more cod, Norway haddock and other species, but fewer prawns. The possibilities for hunting ring seals and polar bears would probably be reduced, while the occurrence of several other game animals would depend more on the pressure of hunting itself.

Communication conditions would be much better because the period of open water would be longer, making it easier for boats to call at many towns and settlements. The production of calved ice could, however, increase by increased melting of ice, thus affecting navigation conditions. There would be far less Polar Ice. The possibility of using solid sea ice to get from place to place could be reduced as a result of thinner and later ice cover.

Melting of glaciers could have a negative effect on tourism, but the improved communication - including a longer summer season - could have a positive effect.

Marine mammals

In north-east Greenland the expected climate change would reduce the thickness of the ice in the fjords, and extend the ice-free period. As a result, more light would penetrate down in the water column, and this would stimulate biological production. Increased fresh water supply as a consequence of increased precipitation and melting of the ice cap in the inner parts of the fjords would increase the water exchange in the fjords and bring more nutritious water in from the open sea, thus contributing still further to increased primary production. Rising winter temperatures would mean that the ice will not reach the same thickness as today and could therefore break up more easily in spring. Overall, the walrus would benefit most from future climate change in high-Arctic Greenland.

The polar bear, on the other hand, is facing an uncertain future in east Greenland. If the ice disappears it will reduce the bears' hunting grounds and they would probably follow the ice northwards. Seals, which are attached to the ice, would presumably become concentrated in smaller areas with ice and would therefore be more easily accessible to the bears, but in the longer term, the number of bears would decrease. In addition, the polar bear is not good at hunting seals in water. The ice conditions on the west coast of Greenland would probably not change as much as on the east coast, and the polar bears on the west coast would therefore be less affected by the climatic changes than those on the east coast.

Whales associated with sea-ice, such as the narwhale, the white whale, and the Greenland whale, would have reduced living areas in the winter months, while new areas would become available to them in the summer months. In winter, the whales would experience increased competition for food from other marine mammals. Other species of whale that use the Arctic and north-boreal waters in summer would be able to use more northern areas.

Fisheries resources

For many of Greenland's fish species, the cold seas off Greenland limit their dispersal, for example, cod, Norway haddock, striped catfish, halibut and herring, which have their northern limit there. Therefore, relatively small variations in the temperature of the sea could result in considerable fluctuations in the dispersal of many fish species. The trend in cod fishing largely follows the average sea temperature. In the last 30 years, cod and a number of other boreal fish species have largely disappeared as a consequence of a generally colder climate in south and west Greenland. Today, more cold-adapted populations of prawn, crab, and halibut constitute the main commercial fishing resources in Greenland. A change in sea currents and a rise in temperature as a consequence of the climate changes would probably improve the conditions for cod and some other commercially exploited fish species in these areas. Increased cod stocks, however, would have a negative effect of prawn stocks due to predation.

Our knowledge about the way the ecosystems function is constantly improving, but in the case of such large changes in such a short space of time, we still know too little to make precise predictions. One of the biggest uncertainties in connection with the marine environment in south Greenland is the extent to which the sea currents and thus sea temperatures follow changes in air temperature. The balance between the part of the seawater in south-west Greenland that comes from the cold east Greenland current and the part that comes from the warm North Atlantic drift (a branch of the Gulf Stream, which bends westward, south around Iceland), and the cold water masses in Baffin Bay and Davis Strait totally determines the ecological conditions off south-west Greenland, where most of Greenland's population live.

6.4 Climate changes on the Faroe Islands

The Faeroe Islands have an extreme maritime climate, where the differences between summer and winter are relatively small. Analyses with global climate models show the following general trend for the climate on the Faroe Islands in the period 2071-2100 in relation to the period 1961-1990:[16]

- A rise of around 3°C in annual mean temperature. There is only a slight difference in the temperature rise in summer and winter.
- A rise in winter precipitation of about 30%, but only slight or no increase in the summer.

6.4.1 Impacts and adaptation in terrestrial and marine ecosystems

Only minor changes in terrestrial ecosystems are expected following the expected climate changes. The isolation of the Faroe Islands in the Atlantic Ocean may have the consequence that climate-induced changes in plant and animal life will be unbalanced. Thus, the rate of possible species loss from terrestrial ecosystems may not be counterbalanced by a similar immigration rate, resulting in reduced species diversity.

The greatest changes are expected at sea. Warmer deep water could result in a redistribution of pelagic and benthic communities, which could lead to unexpected consequences for fisheries. Fish species that settle in shallow waters in the early spring such as flatfish, lumpfish, and species with pelagic drifting eggs and larvae would be at greatest risk. The incidence of cod seems to be very dependent on marine currents. That there have been more storms than normal in recent years, could have contributed to the disappearance of the cod by blowing the fry towards waters too cold for their survival. A reduction in water arriving from the south would worsen the present lack of the fry's favourite food.

The impact on marine mammals and birds is primarily expected to concern spatial shifts in areas of food production and primary production.

6.5 Assessment of the significance of climate change for the whole Arctic

In autumn 2004, the Arctic Council[17] published its assessment of the significance of climate change for the Arctic in the report Impacts of a warming Arctic (ACIA). The report is based on contributions from more than 300 climate and climate-effect researchers and it shows that climate changes in the Arctic will be more severe than in any other place on the globe, and that this will have extensive consequences both regionally and globally.

The Danish Realm has contributed to the report through a number of specific studies, projects and texts. The integrated climate and climate-effect measurement programme that has operated for almost 10 years at the high-Arctic measuring station Zackenberg in north-east Greenland has made significant contributions to describing and understanding climate effects in the Arctic, and it is one of the few programmes helping establish long-term data series in the area.

It is expected that the Realm will continue this and other climate-relevant Arctic initiatives in future years, amongst other things as follow-up to the Arctic Council declaration on ACIA (24 November 2004) and the recommendations of the ACIA Report.

Notes

1 Cappelen, 2000; Cappelen, 2004; Cappelen 2005

2 Ministry of the Environment, 2004: Nature & Environment 2003 Theme: Water in Denmark. (Available at www.mst.dk)

3 Christensen, 2000; Stendel et al., 2000; Stendel et al., 2001; Christensen and Christensen, 2001, 2003, 2004; May,1999; May, 2001; Andersen et al., 2001; Christensen at al., 2002; Christensen 2005

4 Kaas et al. 2001: Christensen 2005

5 Stainforth et al., 2005

6 Danish EPA, 2004: Adapting to the climate of the future (available at www.mst.dk)

7 Academy of Technical Sciences published a report in 2003 in Danish: Effekter af Klimaændringer – tilpasning i Danmark. (available in Danish at www.atv.dk)

8 In February 2004 the Danish Board of Technology held two scenario workshops to involve the public in two local areas in discussions on the risks from global rise in sea levels. The results are available in a report in Danish at www.tekno.dk.

9 Jørgen Bo Larsen/KVL, 2005: Contribution to the EPA and DMI "Nyt Klimaforum" on 15 April and Handlingsplan for naturnær skovdrift, Ministry of the Environment, Forest and Nature Agency, May 2005

10 The CONWOY project is funded by Natural Science Research Council (further information on the project is available on http://www.conwoy.ku.dk/)

11 The CLIMAITE project is financed by private funds (further information on the project is available on http://www.climaite.dk)

12 UKCIP, 2002: London's warming. The impacts of Climate Change on London. (available at www.ukcip.org.uk)

13 May, 1999; Stendel et al., 2000

14 Assessments by Hans Meltofte and Søren Rysgaard, NERI and Søren Anker Pedersen, Greenland Nature Institute, March 2003

15 Vibe, 1967; Heide-Jørgensen and Johnsen ,1998; Petersen et al., 2001; Meltofte, 2002; Rysgaard et al., 2003

16 May, 1999; Stendel et al., 2000

17 In addition to the Danish Realm, the Arctic Council comprises Canada, Finland, Iceland, Norway, Sweden, Russia and the US

7 Financial resources and transfer of technology

7.1 Danish development policy

Denmark's vision for regional and global sustainable development is a world with economic development, social welfare, and greater protection of the environment. It includes a world market with free trade based on economic responsibility and environmental standards, and it includes respect for human rights, democratisation, transparency, and responsibility in administrations.

The overall goal of Danish development cooperation is to promote sustainable development through poverty-oriented economic growth. Denmark emphasises that development cooperation should contribute to meeting the 2015 goals adopted at the UN Summit (Millennium Development Goals).

With a view to combating poverty and meeting the 2015 targets, development cooperation is organised taking account of government priorities to focus on good governance, assistance to refugees in local areas, the environment including climate change mitigation and adaptation, industrial development, women, and trade and development. On the basis of this, development assistance is also organised in close cohesion with other foreign and security policies.

The effort to promote national sustainable development is closely linked to the global challenges for sustainable development - and vice versa. Growing trade and international capital flows, conflicts and refugee flows, together with the increasing pressure on natural resources, have made individual countries ever more dependent on the outside world. Denmark therefore has a great interest in contributing to sustainable development through national efforts and through the EU, the UN, the WTO, the OECD, and the international financial institutions, including the World Bank and the International Monetary Fund.

The world is facing many regional and global challenges. Of the 6 bn. people in the world, more than 1 bn. live on less than USD 1 per day, and a further 1.5 bn. on less than USD 2 per day. The challenge therefore consists primarily in creating growth and jobs, eradicating poverty and creating better conditions of life for the poor people of the world. For example, one fifth of the world's people do not have access to clean water and sanitation, and this particularly affects women, children, indigenous peoples, and other particularly exposed population groups.

Competition for scarce natural resources has in a number of cases led to violent conflicts, which especially in the developing countries have created huge refugee problems. Analyses from the Intergovernmental Panel on Climate Change (IPCC) show that climate change is very probably already a reality, and the greatest adverse effects of climate changes are expected in the developing countries. Biodiversity is under increasing pressure, and nature's resources are often used on an unsustainable basis. The use of dangerous chemicals is a growing problem, both for human health and for fauna and flora.

There is often a close correlation between poverty and environmental problems. Thus, the poorest are the hardest hit by environmental deterioration. At the same time, poverty limits the possibilities for sustainable utilisation of natural resources because limited resources are available for investment in protection of the environment. For example, poverty is contributing to soil exhaustion and desertification in Africa. Conversely, uncontrolled economic growth in developing countries and the slightly more developed countries in the East and South often leads to increased use of natural resources and burdens the environment.

In its entire international work for global sustainable development, Denmark attaches importance to the need to integrate and balance the economic dimension (poverty-oriented growth), the social dimension (promotion of such social sectors as education and health) and the environmental dimension (protection of the environment).

Denmark wants a strong global structure to promote all elements of global sustainable development, including a stronger structure for promotion of international environmental cooperation and environmental regulation.

Denmark will continue working for global sustainable development by:

- Integrating environmental considerations into policies and decisions.
- Ensuring continued progress in the global environmental agenda. The goal is to gather responsibility for international environment cooperation in one single environment organisation.
- Promoting economic cooperation and partnership for development, including combating global poverty and regulating trade and investments.
- Contributing to international peace and stability and working to promote democracy and human rights.
- Working for continued development and democratisation of the international cooperation with the emphasis on openness and participation, including participation by weaker groups.
- Reducing emissions of greenhouse gases globally and in a cost-effective manner.
- Promoting mutually committing partnerships with the private sector.

7.2 Development cooperation

In 2004, Danish development assistance amounted to about DKK 12 bn., corresponding to 0.84% of GNI. Assistance is primarily funded through section 06(3) of the Danish Finance Act. Denmark will continue to be amongst those countries granting the most development assistance and will also grant at least 0.8% of GNI in development assistance in the years to come. In this way Danish assistance will continue significantly above the UN target of 0.7% of GNI.

Since the change of government in Denmark in November 2001, the government in 2002 reviewed Denmark's development assistance and environmental assistance to developing countries with the objective of prioritising it, focusing it, and making it more effective. In the strategy for Danish assistance to developing countries, A World of Difference, the government set out its new priorities for Danish development assistance for 2004-2008.

The Strategy confirms that focus will continue on long-term development work aiming at combating poverty, and that the main priority is work within the social sectors, i.e. education, health, water and sanitation.

It also confirms that Denmark will continue at the leading edge of development assistance, both with regard to quality and scope. The government priorities for global environment issues and issues regarding free trade and market-based economic growth are confirmed and enhanced in the Strategy. Moreover there are efforts to create a better interplay between environmental assistance and other Danish efforts to protect the global environment, including climate efforts under the Kyoto Protocol.

International climate cooperation, including the issue on the adaptation of developing countries to climate change is also a high priority in Danish international development cooperation. In the energy area, the basis is the adoption by the Johannesburg Summit of the need to improve access for the poorest people to energy as a contribution to meeting the 2015 Goals (especially the poverty goal) and improving the proportion of renewable energy in the global energy supply

The government Strategy for development cooperation also involves stricter requirements for the governments in the cooperation countries with regard to respect for human rights and democracy. Systematic and lasting violations of human rights and democratic rules of play are irreconcilable with qualifying for Danish assistance. This has meant that development cooperation has ceased with some cooperation countries. At mid-2005, Danish programme cooperation countries were Bangladesh, Benin, Bhutan, Bolivia, Burkina Faso, Egypt, Ghana, Kenya, Mozambique, Nepal, Nicaragua, Tanzania, Uganda, Vietnam, and Zambia.

Denmark seeks actively to encourage the many countries whose development assistance is below the UN objective of 0.7% of GNI to increase their assistance. At the UN 2005 Summit Meeting on the 2015 Goals, Denmark will work to encourage countries, including EU Member States, with a lower assistance percentage that 0.7% of GNI to increase their assistance.

In international evaluations of Danish work for developing countries, Denmark receives good results. In the regular OECD review of Danish assistance in both 1999 and 2003, Denmark was awarded top marks, and Denmark is at the top of the Commitment-to-development index in the US journal Foreign Policy.

Since 2001, the government has afforded environmental efforts in development cooperation ever greater priority, partly on the basis of the follow-up necessary to realise the agreements and commitments from the Johannesburg Summit. One step was the preparation of a Strategy for Danish environmental work in developing countries 2004-2008, which was launched in 2004. This Strategy is the first to gather all environment work under one common goal – combating poverty – and the first to integrate environment efforts with the overall development assistance. The Strategy emphasises that environmental efforts include climate efforts, for example one of the elements in the Strategy is to support climate efforts through capacity building. The Strategy covers the possibilities of countries to administer work within the international environment conventions and to create opportunities to contribute to the development of CDM projects, which could later lead to Danish purchases of CO_2 credits (see sections 7.2 and 4.2.2). The Strategy also aims at promoting environmental concerns as inter-disciplinary concerns in all assistance, both bilateral and multilateral.

With our EU partners, in 2004 Denmark adopted an action plan to integrate the climate into development cooperation. The Action Plan contains four elements:

1) greater priority to climate change in the dialogue with cooperation countries,

2) support to climate adaptation within relevant sector programmes,

3) support to combating the causes of climate change by reducing greenhouse gas emissions, and

4) support for capacity development to promote developing countries' efforts on climate change.

In 2004, the Ministry of Foreign Affairs set up a project group to prepare a Danish follow-up plan to the EU Action Plan. The Danish follow-up plan should be completed by the end of 2005.

7.3 New and additional assistance funds

Bilateral efforts
Danish environment efforts are to contribute to meeting the overall target for Danish development assistance – combating poverty. In addition to this, within the framework of international development cooperation it is increasingly being recognised that the negative effects of climate change could present an obstacle to combating poverty and meeting the 2015 Goals. This means that environment efforts, including climate efforts, are an integrated element of the total Danish development work, and thus also part of work to realise the 2015 Goals.

Bilateral environment activities comprise a large proportion of Danish International Development Assistance (Danida) sector programme support in Bhutan, Bolivia, Egypt, Nepal and Nicaragua. Moreover, the environment aspect is incorporated in a number of other sector programmes, not least for the sectors water, energy, agriculture, forestry, and fisheries, just as the environment has been integrated into Danish efforts in other sector programmes supported by Denmark. A number of independent projects are also supported by Denmark through Danida's authority to make decentral grants. In addition there is environment work funded by the special environment assistance. This includes environment activities in Cambodia, Malaysia, Mozambique, South Africa, Tanzania, Thailand, Vietnam and Zambia.

Danish environmental efforts in developing countries are organised in close, binding cooperation with cooperation countries. Efforts aim at promoting sustainable development, including adaptation by developing countries to climate change, and relieving poverty-related pressure on the environment and nature. Within the water area for example, action is helping to ensure millions of poor people access to clean water and to protect sources of water - e.g. by tree planting and by building up capacity for sustainable management. In the energy area, Denmark provides support for sustainable energy supply - e.g. supporting poor women in planting trees for fuel, which provides the women with an income and at the same time protects the environment. Within nature resources, Denmark is working to strengthen sustainable management and production with a view to preventing soil exhaustion and desertification. In the richer developing countries with increasing economic activity, assistance is aimed at helping countries to protect nature and the environment, primarily by strengthening the capacity of the countries themselves to solve the problems and by raising environmental awareness.

Environmental analyses continue to play an essential role in the regular revision of the country strategies for

Denmark's programme cooperation countries. Another important task is to seek better integration of the objectives of international environmental agreements in the bilateral assistance cooperation.

Until 2003, Denmark made funds available for environmental action from both section 06(3) of the Finance Act and from a special Environment, Peace and Stability Fund (MIFRESTA). In 2004 the government decided to integrate environment assistance into the overall assistance and replace MIFRESTA with a separate budget item for special environment assistance under section 06(3) of the Finance Act. In addition to the figures for total bilateral assistance, up to 2003, Table 7.1 includes special environment assistance under MIFRESTA and for 2004 the special budget item under section 06(3).

The background to the government decision not to continue MIFRESTA was a desire to improve coordination of environment activities with other Danish international development efforts. Irrespective of whether financing of environment and environment-related assistance is through separate budgets within or outside section 06(3) of the Finance Act, it is difficult to assess whether there are new and/or additional assistance funds. The difficulties are primarily methodological problems in determining additionality. Nevertheless, the total scope of Danish assistance for the environment in developing countries will continue to be extensive.

Danish bilateral and regional assistance to support implementation of the Climate Convention
Tables 7.2 – 7.6 provide an overview of how Danish bilateral and regional assistance to developing countries to implement the Climate Convention is distributed over the main categories of mitigation and adaptation and by sector category.

7.3.1 Multilateral efforts

Endeavours to create global stability and development require that the international community cooperate to provide action that promotes environmental sustainable development. This perspective must

Table 7.1 Danish total bilateral development assistance and environmental assistance 2000-2004 (DKK mill.)
Source: The Ministry of Foreign Affairs

	2000	2001	2002	2003	2004
Bilateral development assistance, excl. special environmental assistance	6,160.72	6,409.41	5,876.42	5,789.93	5,751.05
Special environmental assistance to developing countries[1]	508.20	645.50	560.30	466.80	404.30

[1] Annual payments as reported to the OECD/DAC.

Table 7.2 Danish bilateral and regional assistance in 2000 for implementation of the Climate Convention (DKK mill.)

Source: Danish Ministry of Foreign Affairs

Year: 2000	Mitigation						Adaptation		
Recipients Country/region	Energy	Transport	Forestry	Agricul-ture	Waste	Industry	Capacity building	Coastal-zone manage-ment	Other
Benin			5.5						
Bhutan			2.5			2.2			
Bolivia				9.0					
Burkina Faso	4.5								
Cambodia			2.2				2.5		
Egypt	134.0				8.0		6.0	3.0	4.0
Lao PDR							1.2		
Malawi	20.0								
Malaysia	19.1		13.0			1.0	3.0	2.2	
Nepal	16.1		30.7	2.2		14.6			
Nicaragua				10.0			19.0		4.0
Niger			10.3			2.6			
South Africa	4.0		1.0				9.0		
Tanzania			5.0						
Thailand	20.7					1.0	7.0		
Vietnam				37.4		3.0		20.0	
Total	**218.4**		**70.2**	**58.6**	**8.0**	**24.4**	**47.7**	**25.2**	**8.0**

Table 7.3 Danish bilateral and regional assistance in 2001 for implementation of the Climate Convention (DKK mill.)

Source: Danish Ministry of Foreign Affairs

Year: 2001	Mitigation						Adaptation		
Recipients Country/region	Energy	Trans-port	Forestry	Agricul-ture	Waste	Industry	Capacity building	Coastal-zone man-age-ment	Other
Benin			6.7						
Bhutan			1.7			1.9			
Bolivia				8.0					8.0
Burkina Faso	5.3								
Cambodia							10.0	4.0	
Egypt	50.0				1.0	10.0	5.0	6.0	6.0
Lao PDR							1.9		
Malaysia	14.9		3.0				4.0	5.0	
Nepal	20.2		36.1	2.4		26.3			
Nicaragua				5.0			11.0		20.0
Niger			3.7			2.3			
South Africa	7.0		4.0				27.0		
Thailand	38.5		4.0	3.0					
Vietnam				2.0			6.0		
Zambia	4.0								
Total	**139.9**		**59.2**	**20.4**		**40.5**	**64.9**	**15.0**	**34.0**

be secured in the implementation of multilateral initiatives. Denmark therefore considers that special environmental initiatives that contribute to global environmentally sustainable solutions to global development problems are vital.

Denmark afforded very high priority to the World Summit on Sustainable Development in Johannesburg in September 2002 under the Danish EU Presidency. The Summit emphasised the close connection between environmental problems and development problems.

At the same time, the special effort to protect the global environment focus on areas and countries where the greatest environmental improvements can be achieved. This is not least relevant to efforts under the UN Climate Convention and the Kyoto Protocol, which make up the framework for meeting the climate threat.

TABLE 7.4 DANISH BILATERAL AND REGIONAL ASSISTANCE IN 2002 FOR IMPLEMENTATION OF THE CLIMATE CONVENTION (DKK MILL.).
Source: The Ministry of Foreign Affairs

Year: 2002	**Mitigation**						**Adaptation**		
Recipients Country/region	Energy	Trans-port	For-estry	Agri-cul-ture	Waste	Indus-try	Capacity building	Coastal-zone man-agement	Other
Botswana							13.0		
Cambodia			32.2				2.9		
Egypt	63.8								
Ghana			2.0						
Honduras			3.7						
India			32.4						
China	12.9					8.2			
Malaysia	2.5		2.5				12.3		
Mozambique	465.0[1]						39.0		
Namibia	15.5								
Nepal		32.0							
Nicaragua							1.9		
Peru				1.5					
South Africa	36.4		10.5			6.3	8.0		
Thailand	4.0		8.0				11.8		
Uganda	1.5								
Vietnam							19.0	62.4	
Zambia							3.0		
Regional							41.3		
Total	**601.6**	**32.0**	**91.3**	**1.5**		**14.5**	**152.2**	**62.4**	

[1] In 2002 DKK 465.0 mill. were granted in support of an energy sector programme in Mozambique for the period 2002-2008. One of the examples in Annex F.

Table 7.5 Danish bilateral and regional assistance in 2003 for implementation of the Climate Convention (DKK mill.)

Source: The Ministry of Foreign Affairs

Year: 2003	Mitigation						Adaptation		
Recipients Country/region	Energy	Trans-port	For-estry	Agri-cul-ture	Waste	Indus-try	Capacity building	Coastal-zone man-agement	Other
Bolivia							7.0		
Botswana	15.0								
Burkina Faso			2.3				1.5		
Cambodia							1.1		
Egypt							4.5		
Philippines	70.1								
Ghana			3.0						
China	84.9								
Malaysia							82.0		
Mozambique						3.9			
Namibia			2.8			10.0	2.2		
Nepal							7.0		
Nicaragua							19.5		
South Africa	13.7				10.0	5.1	3.3		
Tanzania			3.6						
Thailand	5.8		58.5				9.8		
Uganda	2.8								
Vietnam						1.5			
Zambia							1.6		
Regional			2.2				5.8		
Total	**192.3**		**72.4**		**10.0**	**20.5**	**145.3**		

Through the EU, Denmark has worked for binding and effective regulation of international environmental problems through the regional and global environment conventions. This applies, for example, to the conventions on biodiversity, climate change, combating desertification, the Montreal Protocol, the Basel Convention on cross-border transportation of hazardous waste and the conventions regulating chemicals, the Stockholm Convention on Persistent Organic Pollutants, and the IMO Convention on toxic primers. Denmark has worked to get the conventions coordinated and enforced effectively and for the precautionary principle to have a central role in the rules.

Danish international environmental assistance includes global environmental programmes funded through facilities for assistance to developing countries such as contributions to the Global Environment Facility, GEF and the UN Environment Programme, as well as to a number of other efforts

Table 7.6 Danish bilateral and regional assistance in 2004 for implementation of the Climate Convention (DKK mill.)

Source: Danish Ministry of Foreign Affairs

Year: 2004	Mitigation						Adaptation		
Recipients Country/region	Energy	Transport	Forestry	Agricul-ture	Waste	Industry	Capacity building	Coastal-zone manage-ment	Other
Afghanistan			1.4						
Benin				51.0		21.0	18.6		
Bhutan			20.5			7.9	22.1		
Burkina Faso	100.6								
Cambodia							2.0		
Egypt	30.4								
Philippines	28.6								
China	26.4								
Malawi							7.2		
Mozambique							7.2		
Nepal			3.5						
Niger				42.1					
South Africa	1.1						1.1		
Tanzania			5.0						
Thailand	2.2								
Vietnam						120.0	8.4	26.0	
Zambia					20.0				
Regional			4.9				14.3		
Total	**189.3**		**35.3**	**93.1**	**20.0**	**148.9**	**80.9**	**26.0**	

to promote international cooperation on sustainable development.

After adoption of the Kyoto Protocol and the third Conference of the Parties under the Climate Convention in 1997, the Conferences of the Parties in Bonn and in Marrakech in 2001 made a number of decisions on the implementation of the Kyoto Protocol on limiting greenhouse gases. This provided the foundation for ratification of the Protocol. Up to November 2004 adequate support had been achieved so that the Protocol could enter into force on 16 February 2005.

In accordance with the Climate Strategy from 2003, Denmark is preparing for the application of the Protocol's project mechanism, the Clean Development Mechanism, whereby climate projects can be completed in developing countries and Denmark will be credited with the emissions credits achieved. Denmark's CDM activities are further described in section 4.2.2.

Under the Conferences of the Parties under the Climate

Convention in Bonn and Marrakech it was decided to establish three new funds to support initiatives by developing countries against climate change. EU Member States and others were politically committed from 2005-2008 to granting USD 410 mill. per year to finance these funds and for other forms of support to implement the Climate Convention. Denmark's share of this figure is USD 22.32 mill., and it has been included in the budgets under the facilities for assistance to developing countries, to be implemented within the four-year period.

Denmark is working to strengthen the Global Environment Facility (GEF) financially and organisationally. The Danish contribution to GEF's replenishment for the years 2002-2005, the largest to date, is about 50% larger than in the previous replenishment. Denmark, together with other EU Member States, has made an extra, voluntary contribution to the third replenishment.

Danish contributions to the GEF and UNEP will place special priority on

- Continued support to the GEF through realising the increased contribution approved at the 3rd replenishment of the GEF in 2002 and through work to secure a substantial 4th replenishment of the GEF.
- Support to UNEP through special priority for strategic areas such as water, energy and chemicals and continued work to improve and focus the work of UNEP. The voluntary Danish contribution will continue unchanged.

Since 1998 UNEP has implemented a reform programme to make its work more efficient and focussed. In recognition of this initiative, in 2001 Denmark increased its annual general contribution from DKK 13.8 to DKK 15.5 mill., and this level is expected to continue in the future. Thus, in per capita terms, Denmark is one of the largest contributors to UNEP.

Besides the annual contribution to the programme's Environment Fund, Denmark makes both technical and financial contributions to a number of special UNEP activities, particularly those taking place at the special cooperation centres for energy and the environment and for water and the environment.

Through the contribution to the UNEP Risø Centre, work is supported work on climate-related questions and sustainable energy. The Centre has made valuable contributions to the sections on adaptation in the IPCC's Third Assessment Report. The centre's work programme for the coming years includes many activities concerning the Kyoto Protocol's Clean Development Mechanism and contributions to the IPCC Fourth Assessment Report.

The UNEP Risø Centre was an inspiration for the UNEP cooperation centre at the Danish Hydraulic Institute (DHI) – Water and Environment. The Danish contribution to this centre helps support global initiatives by UNEP in the water area, particularly for integrated water-resource and coastal-zone management.

TABLE 7.7 DANISH CONTIBUTION TO THE GEF 2000-2004

Source: The Ministry of Foreign Affairs

	Contribution DKK mill.				
Year	**2000**	**2001**	**2002**	**2003**	**2004**
GEF	58.2	48.3	65.2	65.2	65.2

Denmark is a considerable contributor to the Montreal Protocol's fund for financing the phasing-out of ozone-depleting substances in developing countries. Danish contribution is described in Table 7.8.

Another area important to Denmark is promotion of renewable energy in developing countries. Within this area, Denmark supports use of sustainable and renewable energy through so-called 'trust fund contributions' to the World Bank and the Asian Development Bank.

Denmark's contribution to sustainable development includes considerable support for international organisations, particularly the UN system, in which all countries in the world participate on an equal footing. Denmark is also working to make the UN more efficient so that the division of work between the organisations becomes better and overlapping is avoided.

From the facility for assistance to developing countries, Denmark also contributes to international NGOs involved in the work with climate changes. These include the International Union for Conservation of Nature (IUCN) and the International Institute Environment and Development (IIED).

Danish contributions to multilateral institutions and programmes, including the UN organisations mentioned above and international NGOs working with climate-related activities are described in Table 7.9. The figures are provided as accounting figures and there may have been be adjustments in the figures for 2000 and 2001 compared with the figures in the previous National Communication.

7.4 ASSISTANCE THROUGH THE PRIVATE SECTOR

Denmark has the following assistance instruments and measures for assistance to developing countries through the private sector:

Mixed credits

Mixed credits can be provided in connection with projects within both the public and the private sector.

Restricted mixed credits are interest-free loans for development projects in credit-worthy developing countries with per capita GDP of not more than USD 2,428 (2004/2005) and are thus not reserved for programme cooperation countries. The loans are made from a Danish bank to a credit-worthy borrower in the recipient country. The interest expense, export credit premium, etc. are paid via the assistance funds. The project's assistance relevance is evaluated on the basis of Danida's ordinary rules for project evaluation. In the period 1997-2004, assistance was granted with mixed credits for 119 projects with a total contract sum of DKK 7.4 bn. and a grant for interest payments, export credit premium, premium etc., totalling DKK 3.2 bn. (see Table 7.10).

In addition to the existing restricted mixed credit scheme, a scheme for unrestricted mixed credits was introduced in 2002. The unrestricted scheme largely corresponds to the existing restricted scheme. The main difference between the two is that the support possibilities in the unrestricted scheme are not limited to Danish suppliers and that there is no requirement concerning the origin of the supplies. Besides this, the unrestricted scheme can only be used in Denmark's programme cooperation countries and in South Africa.

The Private Sector Programme
Denmark supports cooperation between the private sector in the recipient countries and in Denmark, including in particular cooperation projects between companies. The Private Sector Programme in Danida's programme cooperation countries, and the VtV (business-to-business) Programme in South Africa support the establishment of long-

TABLE 7.8 DANISH CONTRIBUTION TO THE MONTREAL PROTOCOL MULITILATERAL OZONE FUND 2000-2004

Source: The Ministry of Foreign Affairs

	Contribution (DKK mill.)				
Year	2000	2001	2002	2003	2004
Ozone Fund	8.1	8.1	8.1	11.6	11.6

TABLE 7.9 DANISH CONTRIBUTIONS TO MULTILATERAL INSTITUTIONS, NGOS, AND PROGRAMMES

Source: The Ministry of Foreign Affairs

Institution or programme	Contribution (DKK mill.)				
	2000	2001	2002	2003	2004
1. World Bank	825.3	541.5	520.5	464.1	543.5
2. International Finance Corporation	11.9	20.5	5.0	10.0	10.0
3. African Development Bank	146.0	210.4	289.5	207.1	145.4
4. Asian Development Bank	81.5	24.5	105.9	66.5	57.7
5. European Bank for Reconstruction and Development	19.1	26.0	25.1	25.1	26.1
6. Inter-American Development Bank	25.8	15.3	7.2	11.0	9.7
7. United Nations Development Programme	420.0	420.0	370.0	370.0	370.0
8. United Nations Environment Programme	13.8	15.5	15.5	15.4	15.5
9. UNFCCC – Particip. & Supplement. Fund	-	0.5	-	-	0.9
10. UNEP/Risø	11.8	6.4	7.8	8.8	8.8
11. UNEP/DHI	-	3.8	3.8	-	4.0
12. IUCN	18.5	20	20	20	20.3
13. IIED	5	6	6	6	5
14. WWF				0.1	0.7
15. IISD	0.06	1.7	-	0.8	1.1

term and mutually binding cooperation between Danish enterprises and enterprises in recipient countries. The objective with cooperation with enterprises is to create economic growth in the private sector in the recipient countries through, for example job creation, local competence development, and environment improvements. Many of the projects are environment-related, e.g. projects relating to renewable energy and energy saving through transfer of cleaner technologies. Support for these projects, divided into initiation activities and partnerships, is presented in Table 7.11. Note that figures for 2000 and 2001 have been updated compared with previous statements.

Industrialisation Fund for Developing Countries
The Industrialisation Fund for Developing Countries (IFU) invests in joint ventures in the developing countries, including joint ventures on renewable energy. Investments are either as share or loan capital, to be repaid to the financing institution. The IFU can also make grants for training personnel in companies in developing countries. The IFU administers the Danish Fund for Environment and Training.

Partnership Facility Programme
The Partnership Facility Programme was established in 1996 to involve the private sector in environmental assistance for developing countries. The goal of the Programme is to transfer technology and commercial knowledge on the environment from Danish enterprises to partner enterprises in Thailand and Malaysia by establishing commercial partnerships.

The Partnership Facility Programme focuses on cleaner technology and production, waste treatment, renewable energy and energy management as well as environment monitoring and management systems. The Programme is also open to other sectors, provided the partnership has significance for the environment.

Originally, the Programme was administered by the Danish EPA (Danced). Table 7.12 gives an overview of projects and grants since the Ministry of Foreign Affairs took over the Programme in 2001. Following an evaluation in 2004, the Partnership Facility Programme has been extended for the period 2005 to 2007 and now includes China.

Table 7.10 Number of projects and grants under the scheme for mixed credits 2000-2004
Source: The Ministry of Foreign Affairs

	2000	2001	2002	2003	2004	Total
Number of projects	18	14	15	15	14	119
Contract sum (DKK mill.)	929	418	874	1,178	1,788	7,406
Grant (DKK mill.)	345	141	379	509	931	3,200

TABLE 7.11 NUMBER OF PROJECTS AND GRANTS UNDER THE PRIVATE SECTOR PROGRAMME AND VTV PROGRAMME, 2000-2004

Source: The Ministry of Foreign Affairs

	2000		2001		2002		2003		2004	
	No.	DKK mill.	No.	DKK mill.	No.	DKK mill.	No.	DKK mill.	No.	DKK mill.
Initiation facilities	51	24.2	32	15.7	47	22.6	60	28.9	45	21.7
Partnerships	31	78.0	37	83.9	32	65.0	43	106.9	34	72.9
Total	**82**	**102.2**	**69**	**99.6**	**79**	**87.6**	**103**	**135.8**	**79**	**94.6**

7.5 ASSISTANCE TO DEVELOPING COUNTRIES THAT ARE PARTICULARLY VULNERABLE TO CLIMATE CHANGE

The least developed countries are among the countries that are most vulnerable to climate change. Denmark therefore attaches particular importance to helping these countries adapt to climate change. A natural consequence of this is that Danish programme cooperation countries, with certain exceptions, are among the least developed countries. Assistance for adaptation in these countries will therefore be through integration of the climate aspect into development cooperation. The Danish Action Programme on Climate and Development mentioned in section 7.1.1 will therefore comprise an important instrument in these endeavours.

Support to the least developed countries is also composed of a number of other elements. In follow-up to the financial commitments from the Conferences of the Parties in Bonn and Marrakech, Denmark is placing priority on the Climate Convention fund for least developed countries (LDC Fund), for example, and Denmark has made the first contribution of DKK 11.4 mill. to the Fund. With this contribution Denmark is supporting the least developed countries' work on the National Adaptation Plans of Action (NAPA).

In 2004, Denmark financed implementation of two regional energy seminars in Africa. The objective of these was to promote development of strategies for sustainable energy in the African countries and to help integrate such strategies as well as possible into the countries' overall development policies. This initiative was started by Denmark to promote the ongoing energy dialogue with African countries within the framework of the EU energy initiative for combating poverty and sustainable development (EUEI).

Also with special emphasis on least developed countries, as stated in

Table 7.12 Number of projects and grants under the Partnership Facility Programme, 2001-2004

Source: The Ministry of Foreign Affairs

	2001		2002		2003		2004	
	No.	DKK	No.	DKK	No.	DKK	No.	DKK
Malaysia	9	1,958,872	6	1,018,682	21	28,910,924	1	2,864,348
Thailand	7	1,191,937	8	1,776,514	18	24,673,454	7	11,599,305
Total	**16**	**3,150,809**	**14**	**2,795,196**	**39**	**53,584,378**	**8**	**14,463,653**

Table 7.8, Denmark made contributions to the climate secretariat fund for participation by developing countries in Climate Convention meetings and the fund to support supplementary activities under the Climate Convention.

Small Island Development States (SIDS) are particularly vulnerable to global environmental impacts, including climate change. Because of this, since the mid-1990s Denmark has developed close contact to AOSIS and its members. This cooperation is expressed partly in a political cooperation under the UN, where bilateral meetings are held between Denmark and AOSIS representatives, and also in more concrete cooperation with SIDS countries in the south Pacific, where there is the greatest concentration of poor island states.

The special situation of the SIDS countries is reflected in several UN resolutions and the crucial role of the energy area for sustainable development in SIDS countries is central in these resolutions. Denmark has been active in these resolutions and places high priority on support to SIDS in accordance with these. Denmark provides support for SIDS through multilateral assistance to regional projects in the climate and energy areas and to projects on the Maldives.

From 1998 to 2002 Danida supported a SPREP project on knowledge and capacity building in the climate area for governments, NGOs, and regional organisations on the Pacific islands.

In 2003, Denmark granted DKK 11 mill. to a regional project for 14 island states in the Pacific. The objective of the project was to promote sustainable national energy policy with associated action and investment plans. The project has helped the 14 countries enhance their institutional capacity within sustainable energy with a view to improving public access to energy, promoting energy efficiency, and increasing the use of renewable energy. The project is being carried out by the South Pacific Applied Geoscience Commission (SOPAC) and it is a Danish contribution to implementation of the EU Energy Initiative.

7.6 Activities in connection with technology transfer

Danish support to technology transfer in relation to implementation of the Climate Convention includes a broad spectrum of activities. These activities comprise transfer of both "soft" technology and "hard" technology. The extent of this technology transfer is significant and cannot be clearly separated from other activities in Danish development cooperation, just as there is often an unclear frontier between transfer of soft and hard technology.

The most important example of Danish-supported activities leading to technology transfer, is Danish sector programme support to the energy sector in Mozambique, Burkina Faso, Egypt, Nepal and Malaysia. These sector programmes include elements such as energy planning, including plans for use of renewable energy, establishment of large wind farms, renovation of power stations, promotion of energy efficiency and promotion of sustainable use of biomass as a fuel. Within these sector programmes, transfer of soft and hard technology goes hand-in-hand.

Danish assistance to implementation of the Climate Convention as presented in Tables 7.2 – 7.6 provides a picture of the nature and extent of Danish assistance to technology transfer. These Tables contain an estimate of the activities within climate adaptation which specifically aim at transfer of soft technology, as this appears in the figures for assistance to capacity building. Furthermore, Annex F contains examples of Danish assistance to technology transfer in the form of projects and programmes with both soft and hard technology. Finally, transfer of both soft and hard technology is the primary element of cooperation regarding CDM projects (see section 4.2.2).

8 Research and systematic observation

8.1 Climate research and observations in general

Research and observations within climate in the broad sense of the word are going on at a number of institutes and organisations and cover a wide range of disciplines, from natural science to evaluation of policies and measures and societal aspects.

The Danish Meteorological Institute (DMI) carries out observations of climate parameters (atmosphere and ocean) under the World Meteorological Organisation's (WMO) programmes and sub-programmes: World Weather Watch Programme (WWW), Global Atmosphere Watch (GAW), Global Observing System (GOS), Global Climate Observing System (GCOS) and Global Ocean Observing System (GOOS). DMI also participates in the Network for the Detection of Stratospheric Change (NDSC). Denmark is also active via DMI in the GEO initiative.

Climate monitoring and research has been a key task for DMI for more than 125 years. The National Environmental Research Institute (NERI) is in charge of monitoring the effect of climate change on nature and environment.

Danish research competence concerning the physical expressions of past climate changes is particularly at the Geological Survey of Denmark and Greenland (GEUS), the University of Copenhagen (KU) and Aarhus University. GEUS also has competencies in glaciological studies of the Greenland ice sheet and the ice sheet's interaction with climate change and in the effect of climate change on the water cycle in nature. The Geophysical Department and the Geological Institute at KU and the Geological Institute at Aarhus University have very great expertise in palaeoclimate data, and the climate group at KU is known worldwide for its ice core drilling and analyses. NERI contributes important research competence in relation to the effect of climate change on ecosystems.

DMI/Danish Climate Centre covers the physical world, i.e. measurement, theory and modelling of the climate system. However other institutions than the ones mentioned above, e.g. Forest & Landscape Denmark (SL), and the Danish Institute of Agricultural Sciences (DJF), Risø National Laboratory and the Danish National Space Center work with different aspects of climate research. The Danish Climate Centre has published an overview report describing the bulk of current Danish research on climate changes[1].

It is partly on the basis of research competencies in the above areas that Denmark also participates actively in IPCC's work. Denmark has contributed to IPCC work through e.g. contributions to all three main reports, and several researchers are currently contributing to the preparation of the 4th assessment report (AR4) to be published in 2007. One researcher is lead author of a chapter on future regional climate. Furthermore, Denmark has contributed to the preparation of the two recent status reports on the ozone layer under the WMO and UNEP.

Finally, DMI has contributed to the preparation of the Arctic Climate Impact Assessment report (ACIA) under the Arctic Council and the International Arctic Science Committee (IASC).

The Copenhagen Global Change Initiative (COGCI) is a formal collaboration including research network and PhD programme involving three Danish institutions (GEUS, DMI and NERI) and the University of Copenhagen. The COGCI comprises all relevant scientific and cross-cutting disciplines in global, regional and local effects of environment and climate problems.

Danish research contributes to a wide range of international projects under the World Climate Research Programme, such as the Climate and Cryosphere (CliC), Climate Variability and Predictability (CLIVAR), the Global Energy and Water Cycle Experiment (GEWEX), Stratospheric Processes and their Role in Climate (SPARC) and the World Ocean Circulation Experiment (WOCE).

8.2 Research

8.2.1 Research policy and funding

Climate-related research in Denmark has grown naturally within an already existing framework of institutional activities. Denmark has not previously had a general national research programme for climate change and global change. However, as follow-up on Climate 2012, a committee was appointed to look at the possibilities for improving coordination of Danish research work on climate. This committee completed its work in December 2002. The work consisted primarily of mapping Danish climate research[2] and making recommendations on this basis.

Mapping was largely based on a questionnaire survey in which all known research centres with climate or climate-related research were contacted. Besides the narrowly focused scientific climate research, the survey has provided information on a broad section of climate-related research in Denmark.

The mapping exercise showed that there is great diversity of relatively extensive climate-relevant research. The research is primarily concentrated on basic knowledge, consequences of climate change and mitigation of anthropogenic climate change, whereas there has been very little research in adaptation to climate change.

The research is funded by the institutions' basic grants, programme grants, and the EU Commission framework programmes for research and technological development, and by the Danish research councils.

Danish climate research increased steadily in the period 1998 to 2001, from 172 man-years in 1998 to 189 man-years in 2001. The budget increased correspondingly from DKK 94 mill. in 1998 to DKK 114 mill. in 2001. The subsequent period has primarily seen a reduction in funding for Danish climate research.

Besides the resources shown in Table 8.1, a number of players are working with activities related to climate research, including activities under the Danish Energy Research Programme, the Nordic Energy Research Programme, Public Service Obligation funds and Risø National Laboratory's Wind Energy Department, see section 8.2.6. In 2001 these spent DKK 379 mill. on activities indirectly or partially related to activities concerning mitigation of anthropogenic climate changes.

On the basis of the mapping exercise, the committee recommended a general, combined evaluation to determine which areas within climate research should receive larger grants from the government research councils or from other public support schemes. In addition, the committee presented the following proposals for special action areas to strengthen the entire Danish research in the area.

- Climate research focused on the North Atlantic region

- Adaptation and vulnerability in relation to nature and environment

- Emissions in the agricultural sector with a view to reducing greenhouse gas emissions

- Analysis of extreme events in relation to the greenhouse effect

- Development of climate models focused on feedback processes

- Long-term stabilisation of atmospheric greenhouse concentrations and targets for greenhouse gas emissions

- The effect of climate change on renewable energy

Lastly, the committee's research representatives proposed that more attention be paid in future to interdisciplinary cooperation, building up national and international networks, and disseminating the results, and that climate research be given a clearer place in the government's research policy.

The government will consider the possibilities for following the committee's recommendations.

Danish climate-related research is described in detail in the following sections, while a number of ongoing research projects are listed in Annex G.

8.2.2 Climate processes and studies including palaeoclimatic studies

DMI/The Danish Climate Centre and the Centre for Marine Forecasting carry out research into e.g. atmospheric and coupled atmospheric oceanic processes, which are important in connection with global climate change. These process studies include e.g. natural atmospheric oceanic interplay on time scales from years to decades, including main processes of importance for deep water formation in the North Atlantic.

Oceanographic projects include:

- West-Nordic Ocean Climate is a joint Nordic project studying changes in the circulation of the North Atlantic and its significance on climate developments in the area. Work includes observations as well as data analysis and modelling. DMI is contributing to the project in collaboration with the Greenland Nature Institute. Focus is on the waters around Greenland with special emphasis on explaining the variation in fish stocks from changes in climatic and hydrographical conditions. More specifically, the emphasis is on transport of cod larvae from Icelandic spawning grounds to the waters around Greenland, as well as the developments in west-Greenland prawn populations.

- Meridional Overturning Exchange with the Nordic Seas (MOEN). Due to rising concentrations of greenhouse gases in the atmosphere and an increased hydrological cycle, a gradual decline in the intensity of the Atlantic Ocean's meridional circulation system is to be expected over the 21st century. Sub-elements of the system include the climatically important North Atlantic current, deep-water formation processes in the Nordic seas and the Labrador Sea, and the flow of heavy deep-water from the formation areas. MOEN will evaluate the effect of anthropogenic climate change on the ocean's meridional circulation through continuous observation and modelling of the exchange between the North Atlantic and the Nordic seas. DMI's task is to study variability and later development through ensemble simulation of the exchange across the Greenland-Scotland ridge from 1948–2002. The ensemble experiments are designed with at view to evaluating the dependence of the initial state of the development modelled, as well as quantifying the effect of the observed increased inflow to the Arctic Ocean, which is considered a trend which is linked to global warming.

Through assimilation of atmospheric reanalyses in atmospheric models, several studies are being carried out of atmospheric processes, partly in order to develop improved atmospheric models, and partly to detect changes in the external climate impacts. In addition, trends and variations in the latest tropospheric temperature observations from satellites (primarily MSU data) and radio soundings are being analysed and compared.

At DMI, work is going on to improve models for describing the thinning of the stratospheric ozone layer. This area is important, not only in relation to the Vienna Convention concerning protection of the stratosphere's ozone layer, but also in a climate context, because there is interaction with the greenhouse effect. DMI is also working on studies of the processes in the tropical tropopause that control water vapour entering the stratosphere, and on models for air traffic impact on the climate.

DMI has thus participated in all major European-American Arctic ozone research campaigns in the 1990s, such as EASOE, SESAME,THESEO, and THESEO-2000/SOLVE, as well as in the tropical HIBISCUS campaign. DMI's stratospheric research is based on analyses of a broad range of available observations compared with analyses of the meteorological conditions in the stratosphere. Research includes analyses of the dispersal of ozone-depleted air from the Polar regions to intermediate latitudes, and experimental and theoretical model work concerning the formation of polar-stratospheric clouds. The aim is better understanding and modelling of the processes that lead to chemical depletion of the ozone layer.

In terms of the climate, this research is relevant because increased concentrations of greenhouse gases in the atmosphere and the depletion of the stratosphere's ozone layer are expected to lead to lower temperatures in the Polar stratosphere and to the formation of a more stable and more long-lasting Polar vortex. These conditions could lead to more widespread formation of polar-stratospheric clouds and stronger chemical ozone depletion lasting further into the spring months followed by the development of actual holes in the ozone layer over the Arctic, similar to what happens each Polar spring over the Antarctic. Arctic ozone depletion in the winter and spring months influences the cumulative dose of UV radiation in Denmark in the subsequent six months, and this impacts human health and plant production, and causes damage to buildings, roads etc. Efforts are being made to forecast this UV radiation under climate-change conditions. There is also experimental and model-theoretical work with cirrus clouds in the tropical tropopause and the effects of air traffic on the formation of cirrus clouds. The tropical cirrus clouds are important for additions of water vapour to the stratosphere. Stratospheric water vapour has a great influence on climate, and cirrus clouds have a direct influence on the climate.

The Geophysical Department at the Niels Bohr Institute for Astronomy, Physics and Geophysics at the University of Copenhagen is working mainly on global and general problems, such as the natural variability of the climate at all time scales and the role of basic physical/chemical processes in the climate system. Examples of projects are the international ice core projects, the aim of which is to analyse ice cores through Greenland's ice sheet in order to obtain a climate series that covers as long a period of time as possible and to obtain information about the end of the last ice age 11,500 years ago, and about the last warm period 130,000 years ago.

At Odense University research is going on within the areas of the stability of the climate system, the role of the ocean in the climate system and the chemical and biological development of the atmosphere and the ocean. The newly established Centre for Planet Research at the University of Copenhagen undertakes climate research in a more general sense - for example, it studies ice deposits not only on earth but also in the solar system.

GEUS works with the physical expressions of past climate changes, including ecosystems' response, temperature variations, changes in precipitation and sea level change. Another research topic is past variations in the circulation of the North Atlantic ocean currents and their importance for climate changes. GEUS also works with mass balance studies of the Greenland ice sheet, including its interaction with climate change and its effect on changes in water level.

NERI is carrying out research in how, since the last Ice Age, climate change has affected the biological structure of North Atlantic lakes in Greenland, Iceland and the Faroe Islands. Paleolimnological methods are being used to developprojection models.

8.2.3 Climate modelling and the climate of the future

With substantial support from the European Commission, DMI/Danish Climate Centre is working closely together with research institutions in Europe on analyses of the climatic consequences of increased greenhouse effect, depletion of the stratospheric ozone layer and variations in solar activity. The main emphasis is on Denmark and the European region, as well as the Arctic, but global research is also being carried out.

The work includes both developing models and using the models for scenario calculations of the climate of the future. The models include:

- Relatively simple empirical models for describing local climate change and variations (downscaling) and for use in seasonal forecasting.

- A regional dynamic atmosphere-climate model for calculating regional/local climate change and variations. The main focus is on Denmark, Europe, and Greenland.

- Finely meshed global dynamic atmospheric climate models for calculating global/regional climate change and variations.

- Global dynamic coupled atmosphere-ocean-sea-ice models, which are used for calculating climate change (primarily as a consequence of increased greenhouse effect) and internal variability in the climate on a 5-100 year time scale.

Both global[3] and regional[4] scenario calculations were carried out for Denmark, the Faroe Islands and Greenland based on IPCC's so-called SRES emissions scenarios - more specifically, scenarios A2 and B2. The results of the global simulations have been used in the IPCC's Third Assessment Report and new scenarios are being calculated for the Fourth Assessment Report from the IPCC. With regard to regional simulations, the most important focus area for Denmark is changes in (extreme) precipitation, soil moisture and storm activity. For Greenland, of special interest are changes in the simulated snow accumulation on the ice sheet and changes in permafrost conditions.

In the European climate project PRUDENCE[5] (see also http://prudence.dmi.dk), which was coordinated by DMI, more than ten regional climate models are used to quantify uncertainties linked to projections of the climate of the future. The project shows among other things that the DMI system of regional climate models is representative of the majority of the contributing models, and conclusions based on simulations with this model can be considered as being well within the range of the model results.

The scenarios (also from PRUDENCE) are made available to all groups of researchers who are studying the effects of climate change, and to decision makers taking part in the preparation of a Danish strategy for adaptation to climate change.

The research on ozone as a greenhouse gas includes the influence of ozone on circulation in the stratosphere, together with radiation forcing and climate effects caused by changes in the ozone concentration. As opposed to the increase of CO_2, changes of ozone concentrations vary greatly in both time and space. Although the climate effects of changing ozone levels are expected to be fairly modest at the surface of the earth, they will be significant in the stratosphere and the upper troposphere. As a result of the large spatial variations of ozone changes, and of the effect of ozone on long and short-wave radiation, several feedbacks are involved in the climatic response. One of these are related to increased hydrological activity, and is most dominant for ozone changes in the upper stratosphere.

In the research in this area, use is made of a global climate model and more simple radiation convection models. Throughout the 1990s DMI coordinated the projects ROCS (Role of Ozone in the Climate System) and SCORE (Studies of Climate-Ozone Relationships), financed by the EU, and took part in the project Ozone as a Climate Gas financed by the Nordic Council of Ministers.

Research at the Geophysical Department at the University of Copenhagen includes experimental/field-related, theoretical, and modelling aspects and helps to indicate methods that can be used for evaluating the climate of the future.

8.2.4 Effects of climate change

The effects of climate change on nature and ecosystems are covered by research at DMI, GEUS, NERI, Forest & Landscape Denmark (SL), the Danish Institute of Agricultural Sciences, the Risø National Laboratory, and the Danish Coastal Authority.

Forest & Landscape Denmark carries out research on the direct effect of changed CO_2 concentration on Danish forests through its cooperation with the Royal Veterinary and Agricultural University, under the auspices of which it was established in 2004.

NERI is working on the effects of climate change, especially in Greenland, and it is carrying out a standardised biological/ecological monitoring programme covering a broad spectrum of processes, fauna, and flora. In connection with this project the institute is carrying out research projects aimed at increasing knowledge of basic Arctic ecosystems.

NERI is carrying out research in the effect of climate change on biodiversity and function of the soil environment, in laboratory as well as field conditions. Work includes genetic variations in soil-living fauna, and the fauna's physiological adaptation to extreme climate conditions. NERI has research competence concerning tolerance limits for air pollution for particularly sensitive terrestrial ecosystems. In particular, the interaction between climate change, chemical substances and other factors is investigated.

NERI has built up competence focused on the function and dynamics of the Arctic marine ecosystem and it is investigating an Arctic fjord system and, within this, relationships between production and nutrient conversion.

Within freshwater, NERI has research competence concerning the effect of climate change on nutrient degradation and biological interaction in watercourses and lakes. Studies are being carried out for instance in Arctic, temperate and subtropical lakes, where biological interaction is being studied along climate gradients. Experimental studies are being made at an advanced test plant at Silkeborg. Models are being developed as tools of projection of nutrient transport as well as effects on freshwater ecosystems.

GEUS has competence concerning long-term variations in ecosystems in Denmark and Greenland and on the Faroe Islands caused by the climate. The institute is investigating how the ecosystems react to climate change in lakes and marine environments in

Denmark and Greenland and in forests in Scandinavia. It also registers changes in sea level and their effect on the water cycle, including the formation of groundwater.

The Danish Institute of Agricultural Sciences works with the interaction of climate and agriculture, including effects of climate and atmospheric CO_2 on processes in the soil-plant system. Other aspects being studied include factors affecting greenhouse gas emissions from agriculture, e.g. energy consumption in the agricultural sector, biomass for energy purposes, production and management of manure, biogas, and NH_3 volatilisation, and greenhouse gases in relation to feeding strategies, manure handling, and soil tillage.

The Risø National Laboratory's work includes a number of sub-projects on the effects of climate change in developing countries, where the centre's activities include both analyses of vulnerability to climate change and adaptation strategies. The activities cover the energy, industrial, forestry, agricultural, transport, and waste sectors.

DMI is working with modelling of both regional and global changes of permafrost. Analyses of climate model calculations have been made, based provisionally on coarse-meshed global simulations. However, more refined techniques are being prepared, for use at both regional and local levels.

There is not at the present time special competence concerning the effects on human living conditions and health, which are particularly relevant in areas of the world where dramatic climate effects are expected/seen.

The Geographical Institute at the University of Copenhagen is doing research on soil-forming processes in relation to climate and vegetation that are of significance for, amongst other things, the exchange of greenhouse gases between soil and the atmosphere.

The Danish Coastal Authority is working with projects focusing on the effect of climate change on coastal erosion, and on alternatives to strengthening dikes in order to adapt to climate change.

8.2.5 Economic research, including evaluation of climate change and possibilities for mitigation

It is important to take account of the economic consequences of the different ways to mitigate greenhouse gas emissions.

NERI's Centre for Analysis of Environment, Economy and Society has general competence in setting up and evaluating mechanisms for reducing emissions and special competence within the agricultural, energy and transport sectors. In addition, it possesses general knowledge of the different aspects of the Kyoto Protocol, including research competence concerning Clean Development Mechanism and Joint Implementation. Latest activities include preparation of guidelines for economic assessment of adaptation to climate change.

The Risø National Laboratory is involved in various research activities, primarily relating to policies and measures for reducing greenhouse gas emissions, and relating to emission scenarios for greenhouse gases. The activities include development and implementation of international methodological standards for cost and sustainability analyses of reduction policies, discussion and testing of baseline approaches and various project and sector studies for the energy, transport, and agricultural sectors. The research activities have also included support for the Climate Secretariat and capacity and training programmes in developing countries. In addition, Risø has research activities concerning the Kyoto Protocol's flexible mechanisms, Emission Trading (ET), Joint Implementation (JI) and Clean Development Mechanism (CDM).

Research at Aarhus University is concentrated on the judicial and politological aspects of climate policy and legislation at UN, EU and national levels. Cooperating with researchers from the Aarhus School of Business, the University of Southern Denmark, the Royal Veterinary and Agricultural University, and NERI, and following up cooperation established with the Centre for Social Science Research on the Environment at Aarhus University (today at NERI), general competence is assured in cross-disciplinary research into law, politology and economics. Research focuses on interaction between traditional instruments - flexible mechanisms (JI and CDM agreements), the specific significance of the decision process, and the effects of economic instruments (taxes and quotas and credits). Moreover, researchers have thorough knowledge of environment and energy policy and legislation. Such competence forms the basis for co-operation on a new Masters degree in Environment and Energy Law, cf. Chapter 9.

The University of Southern Denmark in Odense carries out research on climatic, ecological and anthropogenic impacts on marine environments, particularly the North Sea and the Baltic Sea in the period 1500-2000.

At the University of Copenhagen the main focus of climate research is the scientific aspects, but research is also being conducted in the climate field in an economic context, at the Economic Institute, for example.

At Roskilde University Centre, research is going on concerning scenario building within climate-stabilising policies, together with lifecycle analyses as a tool in economic evaluation of climate-stabilization strategies.

8.2.6 Research and development of technologies to reduce greenhouse gas emissions and to adapt to climate change

At the Technical University of Denmark (DTU), the energy/environment group and the group for urban ecology are basing their research on sustainable energy development and sustainable urban change, with energy savings and renewable energy as central parameters.

Research and development activities in the field of energy are not motivated solely by climate issues, but are relevant to climate issues, since they contribute to determining the overall framework for the CO_2 intensity of energy production and consumption in the future.

The Energy Research Programme (EFP), which is administered by the Danish Energy Authority, has for a number of years been supporting a broad range of research, development and demonstration projects in the energy field. The overall objective of EFP is to support the government's energy policy objective of providing cost-effective, environmentally friendly and safe energy supply, and to contribute to promoting the competitiveness of Danish enterprises in the field of energy. The activities range from social science research on the interaction between the energy sector and the rest of society to research in such advanced energy technologies as super conductors and fuel cells. Following reduced appropriations in 2002, the programme budget was increased in 2004, bringing overall activities under the programme up to approx. DKK 65 mill. On average, 50 percent of the activities under the Energy Research Programme are financed by EFP, one quarter by enterprises, and one quarter by other sources, i.e. research institutions, universities etc.

Activities relating to strategic energy research were also increased in 2003 with a special appropriation amounting to approx. DKK 50 mill. in each of the years 2003-05 for renewable energy research. The activities are administered by the Strategic Research Council under the Ministry of Science, Technology and Innovation, and are aimed at strengthening the knowledge base within renewable energy, for instance by supporting cross-disciplinary projects that involve technical, environmental, health, social, economic and political aspects. In the years 2005-08 the Ministry's energy research efforts will be strengthened by a total amount of approx. DKK 280 mill. The programme areas of these funds have not yet been fixed.

Further, energy research and development are supported by PSO funds (Public Service Obligation). The power system-responsible company Energinet.dk (established in January 2005) is continuing the support scheme for research and development in environmentally friendly power production technology, administering in 2005 support funds amounting to DKK 130 mill. Under this scheme support is given to activities relating to fuel cells and renewable energy, for instance solar cells, biomass, hydropower and wave energy. The association of power distribution companies, Elfor, administers a scheme of support to research and development within energy-efficient use of electricity. In 2005 more than DKK 25 mill. are available under the scheme, which aims at the development of energy-efficient products and processes in buildings, industry etc.

NERI is working with the main drivers behind greenhouse gas emissions from the energy sector, the agricultural sector, and the transport sector. Forest & Landscape Denmark has competence in forestry, afforestation, etc. Together, these two institutions cover the aspects of land use in the open countryside for agricultural purposes, forestry and nature. Both institutions are looking at challenges related to use of biomass from agriculture and forestry as an energy source.

NERI makes general inventories of atmospheric emissions from all sectors and activities, including the greenhouse gases. The institution has special research competence in inventories from the agricultural sector, the transport sector, the industrial sector, and the energy sector. Forest & Landscape Denmark seeks generally to quantify how forestry and changes in land-use in relation to forests affect the forest ecosystems' carbon sinks and thus the potential binding of CO_2 in biomass and soil.

NERI has models for projecting greenhouse gas emissions, based for instance on projections of activities in relevant sectors.

NERI also has research competence in modelling of the dispersal of greenhouse gases locally and regionally, with special focus on Denmark, Europe, and Greenland. The Department for Atmospheric Environment is developing a CO_2 model (DEHM) for dispersal, transport, and surface movements. The model can be used to determine the size of sources and drains for CO_2 in Europe over specific areas and for estimating whether these areas comply with the Kyoto Protocol.

GEUS is researching impacts on the poles environment, and the driving forces for natural climate variations in long-term perspectives.

In cooperation with seven other countries, GEUS is the project manager for the EU-funded GESTCO project, in which the possibilities for finding geological storage possibilities near the European power stations and large industrial CO_2 point sources are being studied. A technical-economic model is also being developed in this project for planning and price calculations of different combinations of sources of CO_2 emissions, transport, and types of geological storage. Several geological formations in Denmark are known to be suitable for deposition. Publication of the results will be followed up by public hearings.

GEUS is also participating in the international research project SACS, in which CO_2 deposition from the Norwegian Sleipner gas field is being further developed. GEUS is studying the geological properties of the storage, including the extent of the sand formation, the tightness of the clay seal and the chemical effects of storing CO_2 in the form of carbonic acid where the acidity is very low.

Risø National Laboratory is carrying out research projects on the driving forces, emissions and possibilities for reduction, particularly in the developing countries.

Research at the Danish Institute of Agricultural Sciences focuses on the agricultural sector's possibilities for adapting to climate change by changing the cultivation system, including changes in fertilisation and the use of pesticides and adapting soil tillage methods. The aim is to develop adaptation options that also reduce greenhouse gas emissions from the sector.

8.3 Systematic climate observations

8.3.1 Atmospheric climate observations, including measurements of the composition of the atmosphere

DMI carries out continuous monitoring of key weather and climate parameters. In the climate monitoring programme, classic methods of measurement are used and new, satellite-based observation methods are being developed.

DMI operates around 200 automatic measuring stations in the Realm (Denmark, Greenland and the Faroe Islands) with a broad measuring programme ranging from automatic sea level or precipitation stations that measure only one parameter, to stations with a full measuring programme, including automatic cloud height detectors and weather type detectors. Since 2001, a separate network for climate observations has not been operated because of technological convergence between the climate and weather networks and a desire to rationalise the operational network. The net of stations is shown in the GCOS report, Annex H, Figures H-1 to H-5.

The past manual measuring network has now been almost fully replaced by automatic measuring stations. The aim was to eliminate sources of human errors, to realise a potential for rationalisation, and to significantly improve observation frequencies. Observations were previously taken every three hours, but, today, observations are required at 10-minute intervals from the new stations, which cannot be done manually. The purpose is to achieve greater coherency between the different types of stations so that the number of station types and spare parts can be reduced as much as possible without loss of quality.

To collect precipitation data DMI also operates a network of about 450 manual precipitation stations, which are mainly used to map the precipitation climatology. Measurements are collected daily via the telephone and are thus available very quickly after the measurements were taken.

Besides being of use for national programmes, the observations concern Denmark's international contribution in the form of observation components from Danish territory to the worldwide meteorological observation network WWW - World Weather Watch. Other international programmes for mapping weather

TABLE 8.1 AVERAGE DATA ACCESSIBILITY IN 2004

Source: Danish Meteorological Institute

Type	2004
Automatic weather stations, incl. Greenland and the Faroe Islands	98.6%
Satellite reception	98.6%
Weather radar	98.7%
Radio sounding, Denmark/Faroe Islands	95.9%
Radio sounding, Greenland	97.6%
Storm surge stations	98.9%

and climate include the GCOS (Global Climate Observing System), coordinated by the World Meteorological Organisation (WMO).

The Danish observation network is characterised by high average data availability, as appears in Table 8.1.

The meteorological observations are stored in DMI's database, and observations from many Danish stations are available in electronic form from 1872, water level measurements from 1890, and measurements of the surface temperature of the sea from 1931. The number of daily observations throughout the Realm is around 75,000, and the total number of observations in the database is approximately 300,000,000.

The meteorological observation systems that are of most interest in a climate context are:

- The surface observation system
- The radio sounding network
- The weather radar network
- The ice observation service

Each of these systems is described in the following, together with DMI's stratospheric observations and oceanographic observations.

Surface observation network

For historical and practical reasons, the surface observation network consists of many different types of stations. Apart from the 450 manual precipitation stations and five airbases and airports where there are statutory requirements for manual observations, the network is 100% automated. Table 8.2 provides an overview of the network. DMI is receiving a growing number of observations from cooperation partners in all parts of the Realm, so these are included in Table 8.2.

TABLE 8.2 THE NETWORK OF SURFACE OBSERVATION STATIONS

Source: Danish Meteorological Institute

Type	DMI			Cooperation partners		
	Denmark	Greenland	Faroe Islands	Denmark	Greenland	Faroe Islands
Weather stations	50	25	4	21	20	0
Automatic precipitation intensity stations	0	0	0	79	0	0
Manual precipitation stations	452	1	8	0	1	18
Sun recording stations	19	0	0	6	0	0
Automatic sea level station[5]	15	0	1	65	0	0

Besides the observations from the Danish land areas, DMI has an observation agreement with about 50 Danish, Greenlandic and Faroese ships, which carry out systematic observations in the North Sea, the Baltic, the North Atlantic and the waters around Denmark. In addition, Denmark is a partner in the EGOS/SURFMAR cooperation on collection of weather observations from ships and drifting weather buoys in the North Atlantic, since DMI has strategically well placed satellite reception facilities in Kangerlussuaq (Greenland) and in Copenhagen. Danish observations are also included, and are coordinated with EUCOS (European Coordinated Observation System), which is organised by EUMETNET (European Meteorological Network).

The radio sounding network
In radio sounding, a small, fully automatic weather station is sent up by balloon. The balloon can reach a height of about 35 kilometres, and all the way up it sends observations of temperature, pressure, humidity, and wind velocity via radio to a receiving station. Radio soundings provide measurement of the atmosphere's vertical profile for use in analyses of the condition of the atmosphere. They also enable measurement of ozone and radioactivity.

The DMI operates radio sounding stations in Copenhagen, in Thorshavn on the Faroe Islands and in Danmarkshavn, Illoqqortoormiit, Tasiilaq, Narsarsuaq, and Aasiaat in Greenland. Soundings are also received from two so-called ASAP (Automated Shipboard Aerological Programme) containers, which are portable radio sounding stations designed for use on ships. DMI has had an agreement for many years with a Greenland shipping company on ship-borne radio soundings in the North Sea and the North Atlantic. The radio sounding stations and the ASAP units take two daily soundings, although the ASAP units do not take a sounding if they are near a land radio sounding station, such as the one in Thorshavn. The total number of soundings per year is in the order of 5,800.

Weather radar network
With radars in Sindal and on Stevns, Rømø and Bornholm, Denmark's network of weather radars provides almost 100% coverage, which enables comparison with ground-truth data from a network of land-based precipitation stations.

The weather radar network has a high spatial resolution and is therefore able to provide precipitation-climatological information at a very high degree of detail nationally, regionally, and locally. By calibrating radar data against surface-based point-precipitation measurements, the latest research results show that good absolute accuracy can be achieved. The present radar network has a data frequency of six data sets per hour and the spatial resolution is 2x2 km^2.

Satellite data
Denmark contributes to space-based observations through membership of the European Space Agency ESA and the European meteorological satellite organisation EUMETSAT, and DMI has facilities for receiving satellite data in Denmark and Greenland.

In cooperation with EUMETSAT, DMI is managing the development of a so-called satellite application facility (SAF) for use of GPS data for weather and climate monitoring and is also participating in the development of SAFs for oceanography and sea-ice, together with ozone and UV radiation.

8.3.2 Ice observation service

DMI is responsible for systematic monitoring of the ice conditions in the waters around Greenland. Observations of the ice conditions have been collected for about 125 years, and there is a very large quantity of data in graphic form such as monthly surveys, ice maps, etc. Since 1959 the waters south of Kap Farvel, in particular, have been intensively monitored with a view to making shipping in the area safer. Ice maps are prepared several times a week with detailed information on relevant ice conditions. All new ice maps are in vector-graphic form. Since 2000 weekly maps have been prepared showing the ice conditions all the way round Greenland. The maps are based on satellite data and are essentially an automatically produced product that is primarily intended as a basis for analyses of climatic conditions for Greenland and the surrounding waters. DMI is carrying out research in mapping the extent of sea-ice through the past centuries.

8.3.3 Stratospheric observations

DMI is engaged in studies of the physical processes resulting in changes of the ozone layer, and stratospheric monitoring of relevance to the climate of the future. The DMI research and systematic observations are underpinned by the recommendations of the Montreal Protocol and form part of the research to which Denmark is committed by its ratification of the Vienna Convention of 22 March 1985 for the Protection of the Ozone Layer.

Measurements of the ozone layer and UV radiation are made at Copenhagen and Kangerlussuaq (Søndre Strømfjord), using Brewer ozone spectrometers. At Pituffik (Thule) measurements are made of the ozone layer, UV radiation, global radiation, aerosols and stratospheric NO_2, using a Dobson spectrometer, SAOZ spectrometer, UV spectroradiometer, pyranometer and aerosol radiometer. In order to monitor the ozone depletion in the lower stratosphere in the winter and spring months, and with a view to establishing ozone profile climatology, DMI has since 1989 launched ozone probes from a number of stations in Greenland. Since January 1993 ozone probes have been launched each week from Ittoqqortoormiit (Scoresbysund) on the east coast of Greenland.

Observatories operated by DMI in Greenland are primary (Pituffik and Kangerlussuaq) and secondary (Ittoqqortoormiit) Arctic stations in the Network for the Detection of Stratospheric Change (NDSC). This is a worldwide network of measuring stations equipped with standardised instrumentation of verified high quality for monitoring the condition of the stratosphere and the processes that lead to chemical depletion of the ozone layer. DMI works with the National Center for Atmospheric Research (NCAR) in Boulder (FTIR instrument in Pituffik), the University of Rome (Lidar in Pituffik), the National Radiological Protection Board, UK (UV radiometer in Pituffik) and SRI-International, USA (Lidar in Kangerlussuaq). NDSC is supported by the International Ozone Commission (IOC), UNEP and WMO, and DMI takes part in the NDSC steering committee (http://www.ndsc.ncep.noaa.gov/).

DMI's measurements are reported to databases under the Network for the Detection of Stratospheric Change (NDSC) and World Ozone and UV-radiation Data Centre under the WMO programme Global Atmosphere Watch and they are used to verify satellite data as well as to compare with results from climate models.

8.3.4 Reanalyses and climate databases

The DMI/Danish Climate Centre cooperates with the Pan European meteorological forecasting centre in the UK, European Centre for Medium-Range Weather Forecasts, on building up and using so-called global reanalyses, which are a fundamental set of data for understanding climatic variations and changes based on all measurements globally over a 40-year period. In addition, databases of the climate trend in the past 125 years or so are created and maintained, cf. 8.3.1.

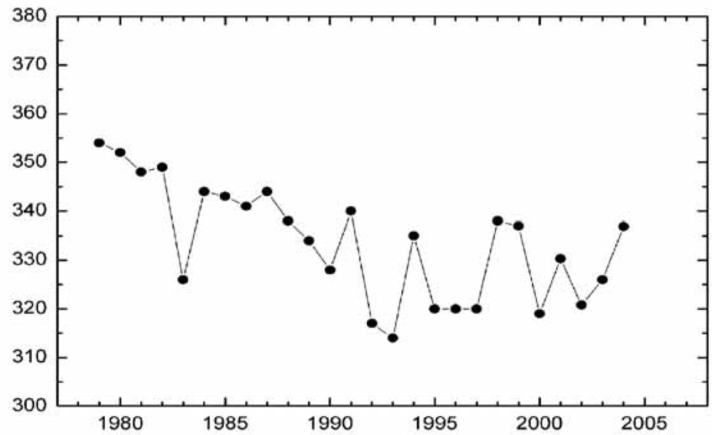
8.3.5 Oceanographic climate observations

DMI/Centre for Marine Forecasting, cooperating with the Danish Coastal Authority, the Royal Danish Administration for Navigation and Hydrography and local authorities, monitors the sea level at a number of Danish localities.

Jointly with the Greenland Nature Institute, DMI carries out annual

Figure 8.1 Annual mean thickness of the ozone layer over Denmark 1979-2004 in DU (Dobson Units). Measurements up to and including 1992 from the NASA TOMS instrument, while measurements after 1992 are by DMI's Brewer-instrument in Copenhagen.

Source: Danish Meteorological Institute

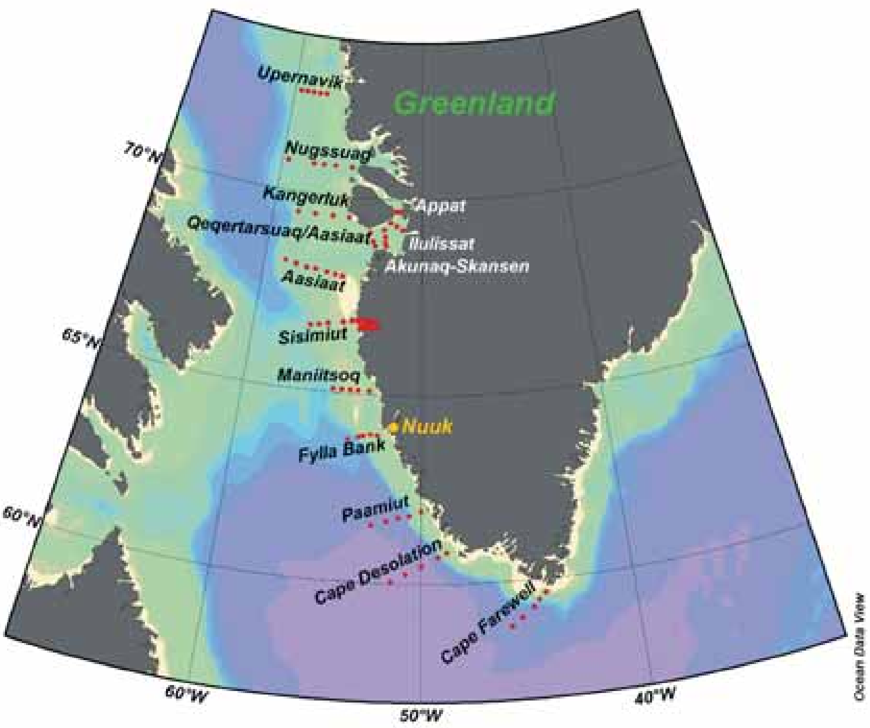


oceanographic observations in standard sections off the west coast of Greenland, aiming at monitoring climate change in the Greenland marine environment and using the data in assessments of the future fishery ressources. In recent years this programme has been extended to include stations in fiords near Sisimiut, in order to be able to understand the causes of the fairly recent crab fishery.

DMI is also processing oceanographic data from the annual trawl cruises made by the Greenland Nature Institute. Monitoring stations are shown in Figure 8.2.

FIGURE 8.2 STANDARD HYDROGRAPHIC SECTIONS OFF THE WEST COAST OF GREENLAND. SOUTHERN STATIONS – INCLUDING SISIMIUT – ARE OPERATED BY DMI, WHILE NORTHERN STATIONS ARE OPERATED BY THE GREENLAND NATURE INSTITUTE.

Source: Danish Meteorological Institute



8.3.6 Terrestrial observations related to climate changes

Monitoring of snow cover, sea-ice and surface radiation is reported in sections 8.3.1 and 8.3.2. Denmark does not carry out further terrestrial observations that can be related to climate change, but Denmark's climate related research (cf. 8.2) includes monitoring and studying the effect of terrestrial conditions.

8.3.7 Development assistance for establishment and maintenance of observation and monitoring systems

From 1997 to 2004 DMI participated in a development project together with the meteorological institute of Ghana (Meteorological Services Department - MSD). The purpose of the project included re-establishing a network of meteorological stations in the country, thereby ensuring collection of data. At the same time, it was to improve communication and use of the collected data. The project was completed in 2004. At the end of the project, MSD had an efficient network of around 300 observation stations registering the usual meteorological parameters.

DMI also coordinated the project 'Use of climatic seasonal forecasts to improve cultivation strategies for crops in West Africa'. The purpose of this project was to examine the possibilities for adapting cultivation practice for a selected agricultural crop (peanuts) in Ghana, using the best available seasonal forecasts for the climate. The project was funded by the Council for Developing Country Research (RUF).

In 2004 DMI and AGRHYMET in Niger prepared a proposal for a project on the use of satellite data and preparation of seasonal forecasts. However, contrary to expectations, the necessary project funds will probably not be available.

Notes

1 Climate Change Research – Danish Contributions, Jørgensen et al., 2001

2 Mapping of Danish climate research and proposals for strengthening action areas. Prepared for the Working Group for a Danish Climate Research Programme, ECON Center for Economic Analysis, December 2002

3 The climate of the 21st century: Transient simulations with a coupled atmosphere-ocean general circulation model, Stendel et al. 2000

4 Christensen and Christensen, 2003; Kiilsholm et al., 2004.

5 Christensen et al. 2002; 2005

9 Education, training and public awareness

In Denmark there is an ongoing public debate in the media and elsewhere about climate change, anthropogenic greenhouse gas emissions and political reactions in terms of policies and measures. In 2002 the government published its strategy for sustainable development. The Danish climate policy – including the Climate Strategy adopted in 2003 - must be seen in the light of the action to make the development of Danish society sustainable. Part of the strategy is to involve the public and openness around the strategy, decision-making and analyses. Denmark has a long tradition for involving the public and, in the environment field, this tradition was followed up by an international agreement - the Aarhus Convention from 1998. In the international UN negotiations on a common effort to mitigate the effect of climate changes, both Danish industry, and green and development-oriented organisations were represented in the Danish delegation. A considerable amount of information on climate change and Danish policies is provided on the websites of the Ministry of Environment (www.mim.dk), the Danish Environmental Protection Agency (www.mst.dk), the Ministry of Finance (www.fm.dk), the Ministry of Transport and Energy (www.trm.dk) and the Danish Energy Authority (www.ens.dk).

9.1 Education and postgraduate education programmes

Climate change is a central theme at Copenhagen Global Change Initiative (COGCI), which is a PhD school and research network established in cooperation between the University of Copenhagen, DMI, NERI, and GEUS. The school has 22 PhD students registered at present. The programme comprises general and specialist courses, together with seminars and theme days. The seminars and theme days are open to the public.

The universities disseminate widely the result of research - for example, the Niels Bohr Institute's activities are published at the website http://www.fys.ku.dk/hco/presse/Formidling2002.htm. A large part of this work concerns climate, both specifically and more generally.

Climate regulation at UN, EU and national levels (and associated lobbyism) is a key issue in the new Master in Environment and Energy Law (MEEL). The degree is offered from 1 September 2006 at the University of Aarhus, cooperating with Aarhus School of Business, the University of Southern Denmark, and the Royal Veterinary and Agricultural University. NERI is also contributing to the course.

Members of DMI/Danish Climate Centre staff give lectures to high-school students, teachers and researchers, and others. Staff members have, for instance, since 1998 taken part in the Danish Science Festival, giving lectures around Denmark. For further information, visit http://www.dnf2004.dk/. 150,000 people have taken part in each of the festival's 2000 events and activities. Further, primary/lower secondary and upper secondary students take part in special science training programmes in the festival periods. DMI presents general information material on www.dmi.dk, offering both basic knowledge on climate and climate change issues, and topic themes/news, which is largely used in Danish schools.

In connection with the many projects initiated under the Danish Environmental Protection Agency's (Danish EPA) Programme for Cleaner Products, reports are required, and these are made publicly accessible. In addition, articles are prepared for various technical journals so that the relevant target groups learn about the results.

On the Danish EPA website http://www.mst.dk (click top border "Undervisningsmateriale"), the Agency presents teaching material which can be used for instance for teaching various disciplines in Danish schools at all levels. The teaching material is targeted towards specific levels. Cooperating with the Ministry of Foreign Affairs, the Ministry of the Environment has prepared the Global Environment project with teaching material targeted towards environmental studies, focusing i.a. on climate. The material is internet-based (www.globalemiljoe.dk) and supplemented by a manual.

The Danish EPA also operates a website, www.dea-ccat.dk, with interactive simple climate models (based on the second assessment report of the Intergovernmental Panel on Climate Change). On the website, school children and others may test the reductions required in order to stabilise the atmospheric content of greenhouse gases. The model, originally developed by the Danish Energy Authority's Climate Group, is used extensively by upper secondary students and teachers. DEA-CCAT has also supported the development of the JCM (java climate model, www.chooseclimate.org), and requested a Danish version of the web facility.

On http://www.emu.dk/miljoe/ you will find extensive information on environment and nature, including impacts on the climate, targeted towards teaching at upper secondary schools, primary and lower secondary schools, and vocational training, and aiming at helping teachers and pupils integrate environmental issues in general training. This is done by presenting teaching courses, by giving access to information and literature, and by reference and links to relevant national and international authorities and institutions.

9.2 Climate information

The websites of the Ministry of the Environment and of the Danish

EPA are updated regularly with the latest relevant information within the climate area, either directly in the form of press releases, documents, reports, etc. or through links to the actual players.

The Ministry of the Environment publishes the series Miljø-Tema (environmental essays) focussing on various subjects, including the leaflet: Adapting to the climate of the future. These can be ordered from the Ministry's information centre, Frontlinien, at http://www.frontlinien.dk, or be downloaded at http://www.mst.dk/udgiv/Publications/2004/87-7614-456-9/html/default_eng.htm

The Danish EPA publishes a number of environmental data on the website http://www.mst.dk (click top border "Miljødatabaser"), including for instance discharge data from sewage treatment plants, separate industrial discharges, and freshwater fish farming, and data from marine and saltwater fish farming.

DERI prepares regular reports about environmental issues. Technical Report No. 401 contains an evaluation of Denmark's need and possibilities for adapting to future climate changes. In connection with the report, a poster with illustrations has been published. The report features on NERI's website www.dmu.dk. A number of NERI's reports on climate are designed for use in the education sector, including Theme Report 29/1999 Where does air pollution come from? and Theme Report 31/2000 CO_2, where, why, how much?. The report Danish adaptation to a changed climate from NERI 2002 presents the climate changes expected in Denmark. The report shows that rational long-term planning may prevent much damage and many effects of probable climate changes.

DMI/Danish Climate Centre disseminates knowledge on climate issues to the general public on an extensive website on www.dmi.dk. DMI also communicates through lectures and popular articles in newspapers and trade journals, through series of reports, and at theme days (Nyt Klimaforum). In 2001 DMI/Danish Climate Centre published the book ´Climate Change Research - Danish Contributions´. The book provides a general introduction to the problem of man-made climate changes and describes research projects and results at a number of institutions in Denmark. Reports, KlimaNyt and Climate Change Research can be obtained at www.dmi.dk. Finally, employees at DMI often take part in radio and TV interviews, and in interviews in the printed press.

Another relevant website is http://www.glaciology.gfy.ku.dk/, which is updated regularly.

9.3 Danish participation in international climate activities

DMI/the Danish Climate Centre participates in a number of international research projects with support primarily from the European Commission's framework research programmes. In addition, the Centre contributes to IPCC work. This includes analyses of the development of climate for several of the IPCC's SRES emission scenarios with a coupled atmosphere ocean model system, carried out in international cooperation. These scenarios are available for effect studies in the IPCC's scenario database. Employees at DMI/ Danish Climate Centre have also participated in the preparation of the IPCC's Third Assessment Report (TAR) - one was coordinating author, another contributing author and several participated as expert reviewers. The same applies for IPCC's Fourth Assessment Report (AR4). DMI is also very active in communication the IPCC's reports to the public through translations and popular articles/books.

The Danish Institute of Agricultural Sciences has contributed to the IPCC through an EU Concerted Action concerning effects of climate changes and adaptation to a changed climate in Europe.

The Risø National Laboratory also participates at expert level in the IPCC. The UNEP Centre at Risø has contributed to the TAR WG III Report with five authors and a coordinating author. The UNEP Centre participates in a wide range of information activities in that connection with different policy possibilities in cooperation with e.g. DMI, NERI, and others.

NERI works in different ways to popularise and communicate the content of e.g. TAR, the latest research results on climate effects, etc.

Via DEA-CCAT the Danish EPA has taken part in the so-called Match Project (Modelling and Assessment of Contributions to Climate Change, www.match-info.net), working with practical methods to link future climate change to specific emissions from the different countries. The Match Project was triggered by a proposal which was originally presented by Brazil under the Climate Convention, and reports back to the Climate Convention's Conference of the Parties.

9.4 Public campaigns

A number of initiatives are being carried out to promote environmentally sound behaviour in companies and households, particularly for climate reasons, and with respect to energy use. Labelling schemes, printed matter, information lines, media spots and similar are used to increase public knowledge of possibilities for action and knowledge of less environmentally harmful technologies.

Traffic, health and the environment. In the last few years environment policy has increasingly focused on the fact that we all share responsibility for environmental problems and for helping to solve them. This strategy is now also penetrating in the transport sector, and in the last three to four years, two large nationwide environmental traffic campaigns have been implemented. We Bicycle to Work and Environmental Traffic Week, which is an element in the European car-free day on 22 September and European Mobility Week, in which more than 1,000 towns all over Europe participated in 2002.

In We Bicycle to Work, the Danish Cyclists' Federation has established good cooperation with many citizens and companies and has particularly communicated the health benefits of cycling as a form of transport.

In Green Transport Week the emphasis was on demonstrating more environment-friendly transport habits (use the car less, buy an energy-efficient car, drive together with others, use the bike for short trips, use public transport as much as possible, etc.). Emphasis was also on discussing traffic habits with the public in open dialogue and without reproach. In this way greater public engagement in the cause of environmental traffic can be established and help to create greater understanding of new ways of organising urban transport systems.

Another reason for the increased campaign and information activities is that a combination of measures affecting attitudes and behaviour and other forms of encouragement, such as economy and accessibility without a car are needed to promote more environment-friendly traffic habits.

Evaluations show that both We Bicycle to Work and the Environmental Traffic Week have had a good effect and have been well received by municipalities, interest and grass-roots organisations, and companies, all of which were in charge of most of the actual activities. The Ministry of Transport and the Ministry of the Environment have so far provided annual funding of DKK 4-5 mill. for Environmental Traffic Week in order to support and co-fund the work of the municipalities. The present government co-funding ended in 2003 and it has since been up to the Danish municipalities themselves to finance any participation in European Mobility Week.

In the years ahead the growing public focus on lifestyle diseases and obesity will probably provide good opportunities for marketing non-motorised forms of transport, such as cycling and walking, in public health campaigns drawing people's attention to the health benefits of using a bicycle more often, walking to the shops, leisure activities, etc.

Annex A Greenhouse gas inventories 1990-2003

This Annex contains five tables summarising the results of the latest greenhouse gas inventories for Denmark 1990-2003 and tables showing the inventories of Greenland's CO_2 emissions from energy use 1990-2003 and the Faroe Islands' emission of CO_2, methane (CH_4) and nitrous oxide (N_2O) 1990-2003. The tables have been reproduced from the annual report to the Climate Convention from April 2005 (The National Inventory Report - NIR, including the Common Reporting Format - CRF).

Table A.1 (CRF Table 10-1): Denmark's emissions and removals of carbon dioxide (CO_2) in the period 1990-2003

Table A.2 (CRF Table 10-2): Denmark's emissions of methane (CH_4) in the period 1990-2003

Table A.3 (CRF Table 10-3): Denmark's emissions of nitrous oxide (N_2O) in the period 1990-2003

Table A.4 (CRF Table 10-4): Denmark's emissions of industrial greenhouse gases (HCFs, PFCs and SF_6) in the period 1990-2003

Table A.5 (CRF Table 10-5): Denmark's total emissions and removals of greenhouse gases in the period 1990-2003

Table A.6 : Greenland's CO_2 emissions from energy use, the Faroe Islands' emissions of CO_2, methane (CH_4) and nitrous oxide (N_2O), and the combined inventory for Denmark, Greenland and the Faroe Islands in the period 1990-2003

Note references in the tables:

1) Denmark' base year under the Climate Convention is 1990. Denmark's base year under the Kyoto Protocol, which in accordance with the procedures in the Protocol will not be finally fixed until 2006-2007, will deviate from the base year under the Convention.

2) Emissions and removals of CO_2 from agricultural land are included in accordance with the guidelines from the Intergovernmental Panel on Climate Change (IPCC) in the inventories on total CO_2 emissions and removals from land (category 5D).

3) & (7) Total net emissions are shown for each year in this category. A negative (-) net emissions means that there are net removals.

4) & (6) Denmark's total net emissions are shown both with and without LUCF to facilitate comparisons with other countries. The LUCF category is also treated separately under the Kyoto Protocol, cf. Articles 3.3 and 3.4 of the Protocol.

5) Current emissions are stated here.

Abbreviations used in the tables:.
NE: Not Estimated

TABLE A.1 (CRF TABLE 10-1): DENMARK'S EMISSIONS AND REMOVALS OF CARBON DIOXIDE (CO_2) IN THE PERIOD 1990-2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year(1)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	(Gg CO_2)														
1. Energy		**51502**	**62015**	**56107**	**58411**	**62026**	**58992**	**72324**	**62650**	**58595**	**55792**	**51290**	**52879**	**52535**	**57635**
A. Fuel Combustion (Sectoral Approach)		51239	61497	55573	57943	61558	58627	71923	62085	58173	54895	50696	52246	52000	57085
1. Energy Industries		26173	35113	30082	31627	35352	31934	44321	35084	31381	28231	25114	26400	26553	31402
2. Manufacturing Industries and Construction		5376	5800	5502	5438	5697	5890	6012	6019	5970	6020	5786	5804	5559	5404
3. Transport		10441	10917	11046	11237	11685	11823	12028	12159	12191	12253	12118	12142	12319	12785
4. Other Sectors		9129	9380	8801	9403	8573	8728	9386	8652	8427	8208	7567	7803	7481	7402
5. Other		119	287	141	237	252	252	176	171	204	182	111	97	89	92
B. Fugitive Emissions from Fuels		263	518	534	468	468	365	400	565	422	898	594	633	535	550
1. Solid Fuels		0	0	0	0	0	0	0	0	0	0	0	0	0	0
2. Oil and Natural Gas		263	518	534	468	468	365	400	565	422	898	594	633	535	550
2. Industrial Processes		**1068**	**1239**	**1356**	**1369**	**1369**	**1375**	**1446**	**1612**	**1618**	**1539**	**1574**	**1606**	**1601**	**1488**
A. Mineral Products		1037	1209	1326	1336	1334	1335	1409	1576	1575	1494	1531	1556	1598	1486
B. Chemical Industry		2	2	2	2	2	2	2	2	1	2	3	3	3	3
C. Metal Production		28	28	28	31	34	39	35	35	42	43	41	47	0	0
D. Other Production		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
E. Production of Halocarbons and SF_6															
F. Consumption of Halocarbons and SF_6															
G. Other		0	0	0	0	0	0	0	0	0	0	0	0	0	0
3. Solvent and Other Product Use		**317**	**305**	**292**	**280**	**268**	**242**	**265**	**262**	**195**	**192**	**212**	**130**	**151**	**206**
4. Agriculture		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
A. Enteric Fermentation															
B. Manure Management															
C. Rice Cultivation															
D. Agricultural Soils (2)		0	0	0	0	0	0	0	0	0	0	0	0	0	0
E. Prescribed Burning of Savannas															
F. Field Burning of Agricultural Residues															
G. Other															
5. Land-Use Change and Forestry (3)		**158**	**-113**	**-252**	**-466**	**-330**	**-234**	**-422**	**-443**	**-819**	**-870**	**1782**	**-1158**	**-1476**	**-1204**
A. Changes in Forest and Other Woody Biomass Stocks		-2832	-3013	-3000	-3215	-3100	-2992	-3064	-3153	-3313	-3311	-653	-3539	-3813	-3533
B. Forest and Grassland Conversion		0	0	0	0	0	0	0	0	0	0	0	0	0	0
C. Abandonment of Managed Lands		0	0	0	0	0	0	0	0	0	0	0	0	0	0
D. CO2 Emissions and Removals from Soil		2990	2900	2748	2749	2770	2758	2642	2710	2494	2441	2435	2381	2337	2329
E. Other		0	0	0	0	0	0	0	0	0	0	0	0	0	0
6. Waste		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
A. Solid Waste Disposal on Land															
B. Waste-water Handling															
C. Waste Incineration															
D. Other															
7. Other (please specify)		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Emissions/Removals with LUCF (4)		**53045**	**63446**	**57503**	**59594**	**63333**	**60375**	**73613**	**64081**	**59590**	**56653**	**54858**	**53457**	**52812**	**58124**
Total Emissions without LUCF(4)		**52887**	**63559**	**57755**	**60060**	**63663**	**60609**	**74035**	**64524**	**60409**	**57523**	**53076**	**54615**	**54288**	**59329**
Memo Items:															
International Bunkers		**4823**	**4394**	**4580**	**5958**	**6647**	**6928**	**6774**	**6414**	**6573**	**6445**	**6629**	**5990**	**5025**	**5318**
Aviation		1736	1632	1693	1659	1818	1867	1971	2010	2159	2290	2350	2385	2059	2188
Marine		3087	2762	2887	4300	4829	5061	4803	4403	4414	4155	4279	3605	2966	3130
Multilateral Operations		0	0	0	0	0	0	0	0	0	0	0	0	0	0
9108	9108	9108	9108	9108	9108	9108	9108	9108	9108	9108	9108	9108	9108	9108	9108

(1) Fill in the base year adopted by the Party under the Convention, if different from 1990.

(2) See footnote 4 to Summary 1.A of this common reporting format.

(3) Take the net emissions as reported in Summary 1.A of this common reporting format. Please note that for the purposes of reporting, the signs for uptake are always (-) and for emissions (+).

(4) The information in these rows is requested to facilitate comparison of data, since Parties differ in the way they report CO2 emissions and removals from Land-Use Change and Forestry.

TABLE A.2 (CRF TABLE 10-2): DENMARK'S EMISSIONS OF METHANE (CH_4) IN THE PERIOD 1990-2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year(1)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
					(Gg CH_4)										
Total Emissions		**270,66**	**275,49**	**277,07**	**285,42**	**286,09**	**290,84**	**296,47**	**290,44**	**287,70**	**283,49**	**282,91**	**287,09**	**283,53**	**279,68**
1. Energy		**14,15**	**16,15**	**16,71**	**20,20**	**24,43**	**31,52**	**36,42**	**36,65**	**34,83**	**35,06**	**34,38**	**36,07**	**35,52**	**36,71**
A. Fuel Combustion (Sectoral Approach)		8,88	9,96	10,70	13,08	16,39	22,34	27,30	27,04	28,29	28,17	27,58	29,00	28,68	28,30
1. Energy Industries		1,11	1,53	1,83	3,38	6,37	11,51	14,96	14,51	15,70	15,63	14,84	16,07	16,00	15,71
2. Manufacturing Industries and Construction		0,78	0,82	0,79	0,81	0,83	0,93	1,35	1,36	1,44	1,45	1,64	1,69	1,65	1,62
3. Transport		2,69	2,97	3,11	3,38	3,55	3,71	3,98	3,82	3,66	3,58	3,44	3,40	3,15	3,10
4. Other Sectors		4,29	4,62	4,95	5,49	5,64	6,18	6,99	7,34	7,48	7,50	7,65	7,84	7,87	7,87
5. Other		0,01	0,02	0,01	0,01	0,01	0,02	0,01	0,01	0,01	0,01	0,01	0,01	0,00	0,00
B. Fugitive Emissions from Fuels		5,27	6,19	6,02	7,12	8,04	9,18	9,13	9,61	6,54	6,89	6,80	7,06	6,85	8,41
1. Solid Fuels		3,45	3,97	3,91	4,79	5,61	6,30	6,36	6,53	3,47	3,37	3,04	3,28	2,97	4,43
2. Oil and Natural Gas		1,83	2,22	2,11	2,33	2,43	2,88	2,76	3,08	3,07	3,51	3,76	3,78	3,88	3,98
2. Industrial Processes		**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
A. Mineral Products		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
B. Chemical Industry		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
C. Metal Production		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
D. Other Production															
E. Production of Halocarbons and SF_6															
F. Consumption of Halocarbons and SF_6															
G. Other		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
3. Solvent and Other Product Use															
4. Agriculture		**183,46**	**184,97**	**185,37**	**189,39**	**187,71**	**187,54**	**188,59**	**184,29**	**186,33**	**180,58**	**181,40**	**183,53**	**179,73**	**176,45**
A. Enteric Fermentation		148,09	147,90	145,82	147,30	146,69	146,61	147,06	142,24	142,58	137,40	136,78	138,00	133,71	130,17
B. Manure Management		35,37	37,08	39,55	42,09	41,03	40,93	41,53	42,05	43,75	43,18	44,62	45,53	46,02	46,28
C. Rice Cultivation		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
D. Agricultural Soils		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
E. Prescribed Burning of Savannas		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
F. Field Burning of Agricultural Residues		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
G. Other		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
5. Land-Use Change and Forestry		**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
A. Changes in Forest and Other Woody Biomass Stocks															
B. Forest and Grassland Conversion		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
C. Abandonment of Managed Lands															
D. CO2 Emissions and Removals from Soil															
E. Other		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
6. Waste		**73,05**	**74,37**	**74,99**	**75,83**	**73,94**	**71,79**	**71,47**	**69,50**	**66,53**	**67,86**	**67,13**	**67,49**	**68,27**	**66,51**
A. Solid Waste Disposal on Land		63,53	64,65	65,06	65,69	63,59	61,22	60,68	57,51	55,33	56,70	56,77	56,57	55,06	54,90
B. Waste-water Handling		9,52	9,72	9,93	10,14	10,35	10,57	10,78	11,99	11,21	11,16	10,36	10,92	13,21	11,62
C. Waste Incineration		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
D. Other		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
7. Other (please specify)		**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
Memo Items:															
International Bunkers		**0,10**	**0,09**	**0,10**	**0,13**	**0,14**	**0,15**	**0,15**	**0,14**	**0,14**	**0,14**	**0,14**	**0,12**	**0,11**	**0,11**
Aviation		0,03	0,03	0,03	0,03	0,03	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04
Marine		0,07	0,06	0,07	0,10	0,11	0,11	0,11	0,10	0,10	0,09	0,10	0,08	0,07	0,07
Multilateral Operations		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
CO_2 Emissions from Biomass															

TABLE A.3 (CRF TABLE 10-3): DENMARK'S EMISSIONS OF NITROUS OXIDE (N2O) IN THE PERIOD 1990-2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year(1)	1990	1991	1992	1993	1994	1995	1996	1997	1998
	(Gg N_2O)									
Total Emissions		**34,56**	**34,14**	**32,66**	**32,01**	**31,54**	**31,15**	**30,26**	**29,83**	**29,51**
1. Energy		**1,90**	**2,29**	**2,17**	**2,29**	**2,48**	**2,46**	**2,93**	**2,74**	**2,65**
A. Fuel Combustion (Sectoral Approach)		1,90	2,28	2,16	2,28	2,48	2,45	2,93	2,73	2,64
1. Energy Industries		0,89	1,17	1,01	1,06	1,17	1,05	1,44	1,14	1,01
2. Manufacturing Industries and Construction		0,18	0,19	0,18	0,18	0,18	0,18	0,18	0,18	0,18
3. Transport		0,47	0,55	0,61	0,67	0,79	0,87	0,94	1,05	1,12
4. Other Sectors		0,36	0,37	0,35	0,36	0,34	0,34	0,35	0,34	0,32
5. Other		0,00	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
B. Fugitive Emissions from Fuels		0,00	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
1. Solid Fuels		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2. Oil and Natural Gas		0,00	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
2. Industrial Processes		**3,36**	**3,08**	**2,72**	**2,56**	**2,60**	**2,92**	**2,69**	**2,74**	**2,60**
A. Mineral Products		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
B. Chemical Industry		3,36	3,08	2,72	2,56	2,60	2,92	2,69	2,74	2,60
C. Metal Production		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
D. Other Production										
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
3. Solvent and Other Product Use		**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
4. Agriculture		**29,01**	**28,50**	**27,53**	**26,87**	**26,16**	**25,51**	**24,41**	**24,15**	**24,05**
A. Enteric Fermentation										
B. Manure Management		2,21	2,20	2,21	2,20	2,14	2,07	2,07	2,07	2,10
C. Rice Cultivation										
D. Agricultural Soils		26,80	26,31	25,33	24,67	24,02	23,44	22,33	22,08	21,95
E. Prescribed Burning of Savannas		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
F. Field Burning of Agricultural Residues		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
G. Other		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
5. Land-Use Change and Forestry		**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
A. Changes in Forest and Other Woody Biomass Stocks										
B. Forest and Grassland Conversion		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
C. Abandonment of Managed Lands										
D. CO2 Emissions and Removals from Soil										
E. Other		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
6. Waste		**0,28**	**0,27**	**0,24**	**0,29**	**0,30**	**0,27**	**0,22**	**0,21**	**0,21**
A. Solid Waste Disposal on Land										
B. Waste-water Handling		0,28	0,27	0,24	0,29	0,30	0,27	0,22	0,21	0,21
C. Waste Incineration		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
D. Other		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
7. Other (please specify)		**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
Memo Items:										
International Bunkers		**0,25**	**0,23**	**0,24**	**0,33**	**0,37**	**0,38**	**0,37**	**0,35**	**0,35**
Aviation		0,06	0,06	0,06	0,06	0,06	0,06	0,07	0,07	0,08
Marine		0,19	0,17	0,18	0,27	0,30	0,32	0,30	0,28	0,28
Multilateral Operations		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
CO_2 Emissions from Biomass										

TABLE A.4 (CRF TABLE 10-4): DENMARK'S EMISSIONS OF INDUSTRIAL GREENHOUSE GASES (HFCS, PFCS AND SF6) IN THE PERIOD 1990-2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year(1)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	(Gg CO_2 equivalent)														
Emissions of HFCs(5) - CO_2 equivalent (Gg)		**0,00**	**0,00**	**3,44**	**93,93**	**134,53**	**217,73**	**329,30**	**323,75**	**411,20**	**502,98**	**604,64**	**647,32**	**672,06**	**695,48**
HFC-23		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
HFC-32		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,01	0,01
HFC-41		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
HFC-43-10mee		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
HFC-125		0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,02	0,02	0,03	0,04	0,05	0,05	0,05
HFC-134		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
HFC-134a		0,00	0,00	0,00	0,07	0,10	0,15	0,20	0,17	0,21	0,23	0,25	0,27	0,28	0,27
HFC-152a		0,00	0,00	0,00	0,03	0,05	0,04	0,03	0,02	0,01	0,04	0,02	0,01	0,01	0,00
HFC-143		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
HFC-143a		0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,02	0,03	0,04	0,04	0,04	0,05
HFC-227ea		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
HFC-236fa		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
HFC-245ca		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Emissions of PFCs(5) - CO_2 equivalent (Gg)		**0,00**	**0,00**	**0,00**	**0,00**	**0,05**	**0,50**	**1,66**	**4,12**	**9,10**	**12,48**	**17,89**	**22,13**	**22,17**	**19,34**
CF_4		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
C_2F_6		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
C_3F_8		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
C_4F_{10}		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
$c\text{-}C_4F_8$		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
C_5F_{12}		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
C_6F_{14}		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Emissions of SF6(5) - CO_2 equivalent (Gg)		**44,45**	**63,50**	**89,15**	**101,17**	**122,06**	**107,36**	**60,99**	**73,09**	**59,46**	**65,39**	**59,25**	**30,43**	**25,01**	**31,37**
SF_6		0,00	0,00	0,00	0,00	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Chemical	GWP
HFCs	
HFC-23	11700
HFC-32	650
HFC-41	150
HFC-43-10mee	1300
HFC-125	2800
HFC-134	1000
HFC-134a	1300
HFC-152a	140
HFC-143	300
HFC-143a	3800
HFC-227ea	2900
HFC-236fa	6300
HFC-245ca	560
PFCs	
CF_4	6500
C_2F_6	9200
C_3F_8	7000
C_4F_{10}	7000
$c\text{-}C_4F_8$	8700
C_5F_{12}	7500
C_6F_{14}	7400
SF_6	23900

TABLE A.5 (CRF TABLE 10-5): DENMARK'S TOTAL EMISSIONS AND REMOVALS OF GREENHOUSE GASES IN THE PERIOD 1990-2003

GREENHOUSE GAS EMISSIONS	Base year(1)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	CO_2 equivalent (Gg)														
Net CO_2 emissions/removals		53045	63446	57503	59594	63333	60375	73613	64081	59590	56653	54858	53457	52812	58124
CO_2 emissions (without LUCF) (6)		52887	63559	57755	60060	63663	60609	74035	64524	60409	57523	53076	54615	54288	59329
CH_4		5684	5785	5819	5994	6008	6108	6226	6099	6042	5953	5941	6029	5954	5873
N_2O		10713	10584	10125	9924	9778	9657	9379	9248	9149	8843	8615	8380	8035	8060
HFCs		0	0	3	94	135	218	329	324	411	503	605	647	672	695
PFCs		0	0	0	0	0	1	2	4	9	12	18	22	22	19
SF_6		44	64	89	101	122	107	61	73	59	65	59	30	25	31
Total (with net CO_2 emissions/removals)		**69487**	**79879**	**73539**	**75707**	**79376**	**76466**	**89610**	**79830**	**75260**	**72030**	**70095**	**68566**	**67521**	**72804**
Total (without CO_2 from LUCF) (6)		**69328**	**79992**	**73791**	**76173**	**79706**	**76700**	**90033**	**80273**	**76079**	**72900**	**68314**	**69724**	**68996**	**74008**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year(1)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	CO_2 equivalent (Gg)														
1. Energy		52390	63065	57130	59545	63309	60415	73998	64267	60148	57345	52802	54458	54121	59318
2. Industrial Processes		2155	2258	2292	2359	2433	2604	2673	2862	2905	3070	3259	3191	3095	3129
3. Solvent and Other Product Use		317	305	292	280	268	242	265	262	195	192	212	130	151	206
4. Agriculture		12845	12720	12429	12307	12052	11845	11526	11357	11368	10806	10565	10470	10138	9898
5. Land-Use Change and Forestry (7)		158	-113	-252	-466	-330	-234	-422	-443	-819	-870	1782	-1158	-1476	-1204
6. Waste		1622	1645	1648	1683	1645	1593	1570	1525	1463	1487	1475	1475	1492	1457
7. Other		0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE A.6 (DATA FROM ANNEX 3 AND 1.2): GREENLAND'S CO_2 EMISSIONS FROM ENERGY USE, THE FAROE ISLANDS' EMISSIONS OF CO_2, METHANE (CH_4) AND NITROUS OXIDE (N_2O) AND THE COMBINED INVENTORY FOR DENMARK, GREENLAND AND THE FAROE ISLANDS IN THE PERIOD 1990-2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
	CO_2 equivalent (Gg)											
Greenland's CO_2 emissions (without LUCF)	**624**	**609**	**594**	**0**	**494**	**523**	**564**	**575**	**550**	**585**	**659**	**617**
Faroe Island's CO_2 emissions (without LUCF)	709	682	650	536	544	541	578	559	616	645	699	791
Faroe Island's CH_4 emissions	18	19	19	18	19	19	19	20	19	19	20	20
Faroe Island's N_2O emissions	23	24	24	23	24	25	25	27	26	27	30	31
Faroe Island's Total Emissions without LUCF	**750**	**725**	**693**	**577**	**588**	**585**	**622**	**605**	**661**	**691**	**749**	**843**
The Kingdom's Total Emissions and Removals with LUCF	**70860**	**81213**	**74826**	**76284**	**80457**	**77574**	**90796**	**81010**	**76471**	**73306**	**71504**	**70026**
The Kingdom's Total Emissions and Removals without LUCF	**70702**	**81326**	**75078**	**76750**	**80788**	**77808**	**91219**	**81453**	**77290**	**74176**	**69722**	**71184**
Trend since 1990 (1990=index 100), with LUCF	**100**	**115**	**106**	**108**	**114**	**109**	**128**	**114**	**108**	**103**	**101**	**99**
Trend since 1990 (1990=index 100), without LUCF	**100**	**115**	**106**	**109**	**114**	**110**	**129**	**115**	**109**	**105**	**99**	**101**

Annex B Measures and the effect of efforts 1990-2001

This Annex consist of the following two sub-annexes:

Annex B1: Data sheets for measures that affect greenhouse gas emissions and removals

Taxes and duties

The data sheets for taxes and duties that affect greenhouse gas emissions include:

1. Mineral-oil Tax Act
2. Gas Tax Act
3. Coal Tax Act
4. Electricity Tax Act
5. CO_2 Tax Act
6. Green owner tax
7. Registration Tax (reduced on energy-efficient cars)

Energy

The data sheets for existing measures that still exist and measures that have ceased to exist or have been replaced in the energy sector and that affect greenhouse gas emissions include:

Existing:

1) EU CO_2 allowances on electricity and heat production (including the business and domestic sectors)
2) The Biomass Agreement
3) Price supplement for suppliers of environmentally friendly electricity
4) Tenders for offshore wind turbines
5) Scrapping scheme for old wind turbines
6) Energy research

Initiatives that are no longer in place or have been replaced:

7) National CO_2 allowance scheme for producers of electricity
8a) Subsidies for the production of electricity (RE)
8b) Subsidies for the production of electricity (wind turbines)
9) Giving priority to electricity from combined heat and power plants
10) Compulsory offshore wind turbines
11) Scrapping scheme for old wind turbines and wind turbines in an inappropriate location
12) Renewable energy island - Samsø
13) Subsidies for facilities producing renewable energy
14) Subsidies for investments in energy savings in industry
15) Subsidies for conversion of older dwellings to combined heating and power
16) Subsidies for the promotion of linking to coal-fired CPH
17) Subsidies for energy savings in dwellings for pensioners

Transport

The data sheets for measures in the transport sector that affect greenhouse gas emissions include:

x) Increased fuel tax
y) Green owner taxes on motor vehicles
1) Information campaign on the fuel consumption of new cars
2) Low-energy driving techniques
3) Action for compliance with current speed limits
4) Establishment of intermodal installations
5) Promotion of environment-friendly freight transport
6) Reduced travelling time for public transport
7) Spatial planning

The business sector

The data sheets for measures in the business sector that affect greenhouse gas emissions include:

z) EU CO_2 allowances (a proportion of the energy consumption and process emissions of the business sector are included in the EU allowance regulation, cf. the datasheet concerning this under Energy)

1) Agreements on energy-efficiency improvements in the business sector
2) Savings activities by electricity grid, gas and district heating companies (incl. for the domestic and public sectors)
3) Tax on HFCs, PFCs and SF_6
4) Regulation of use of HFCs, PFCs and SF_6
5) The enterprise scheme (HFCs)
6) Circular on energy-efficiency in state institutions
7) Electricity Saving Trust (Elsparefonden) - campaigns and A-club to promote efficient appliances (incl. electricity-heat conversion and efficient appliances in households).

Agriculture and Forestry

The data sheets for measures in the agriculture and forestry sector that affect greenhouse gas emissions include:

1) Action Plan for the Aquatic Environment I+II and Action Plan for Sustainable Agriculture
2) Action Plan for the Aquatic Environment III
3) Ban on the burning of straw on fields
4) Ammonia Action Plan and new Statutory Order on Manure
   a) Optimisation of manure handling during housing for cattle, pigs, poultry and fur animals.
   b) Rules on covering storage facilities for solid manure and slurry tanks.
   c) Ban on surface spreading of manure.
   d) Reduction of the time from field application of manure to incorporation.
   e) Ban on ammonia treatment of straw.
5) Planting of windbreaks
6) Biogas plants
7) Subsidies for private afforestation on agricultural land
8) Public afforestation (state, counties, and municipalities).

The domestic sector

The data sheets for measures that affect the domestic sector's contribution to greenhouse gas emissions include:

z) EU CO_2 allowances (some of the domestic energy consumption - electricity and heating - are subject to EU allowance regulation, cf. the data sheet for this under Energy
1) Energy labelling of small and large buildings (incl. the public sector and businesses)
2) Energy labelling of electrical appliances.

Waste

The data sheets for measures that affect greenhouse gas emissions from waste include:

1) Obligation to send combustible waste to incineration (in practice a ban on landfilling)
2) The Waste tax
3) Weight- and volume-based packaging taxes
4) Subsidy programme - Enterprise Scheme (special scheme for businesses)
5) Increased recycling of waste plastic packaging
6) Implementation of the EU landfill directive
7) Support for (construction of facilities for) gas recovery at landfill sites
8) Subsidy programme for cleaner products

Annex B2: Executive summary of the efforts analysis and section summing up the effects of the measures analysed.

TD-1	Mineral-oil Tax Act	
1	**Sector:**	Energy, Transport, Business Sector, Domestic Sector, Agriculture etc. (Fuel Consumption)
2	**Name*:**	Mineral-oil Tax Act
3	**Origin:**	
4	**Legal basis:**	Act no. 701 of 28 September 1998 on energy taxes of mineral oil products etc., and amendments.
5	**Domestic compliance and enforcement:**	Fines and/or up to 2 years of imprisonment
6	**Description:**	Tax on mineral oil products in Denmark. The tax is: Gas oil and diesel oil used as motor fuel: DKK 2.787 per litre Other gas oil and disel oil: DKK 1.857 per litre Light diesel oil (sulphur content max. 0,05%): DKK 2.687 per litre Diesel, low in sulphur (sulphur content max. 0,005%): DKK 2.507 per litre Diesel, sulphur free (sulphur content max. 0,001%): DKK 2.487 per litre Fuel oil: DKK 2.092 per kilogramme Heating tar: DKK 1.888 per kilogramme Petroleum used as fuel: DKK 2.787 per litre Other petroleum: DKK 1.857 per litre Petrol, with "lead": DKK 4.50 per litre Petrol, lead-free: DKK 3.85 per litre Petrol, "with Lead" and vap. recovery: DKK 4.47 per litre Petrol, lead-free and vap. recovery: DKK 3.82 per litre Auto gas (LPG): DKK 1.746 per litre Other liquified gas (LPG), used as motor fuel: DKK 3.21 per kilogramme Other liquified gas (LPG) (refinery gas): DKK 2.379 per kilogramme Carburettor liquid: DKK 4.07 per litre
7	**Objective:**	Restructuring of existing acts on oil and gas taxes and later also reduction of consumption of polluting fuels as part of the energy policy
8	**Greenhouse gas(es) affected:**	CO_2
9	**Type of measure:**	Fiscal (tax)
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	1 January 1993
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Ministry of Taxation
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	-2,7 (-1,5 & -1,2) (a)
21	**2005:**	
22	**2010 or (2008-2012)/5:**	-2,7 (-1,5 & -1,2) (a)
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	1100 (325+775) DKK per tonnes CO2-equivalent (a)
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5 and the Effort Analysis(1)
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5, the Effort Analysis(1) and the estimates shown above
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	Yes
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	Yes (a)
41	**References and links for further information:**	http://www.retsinfo.dk/index/SKA/AN000053.htm (1) http://www.mst.dk/transport/01041000.htm
42	**Comments:**	(a) The effects and socio-economic costs related to tax raises since 1990 shown here are from the Effort Analysis where the estimate includes the total effect of tax raises since 1990 on all oil products. Reductions related to mineral oil tax on petrol and diesel have been estimated separately, but are now included in the estimate showing the total effect.

TD-2	Gas Tax Act	
1	**Sector:**	Business Sector and Domestic Sector (Consumption of Gas)
2	**Name*:**	Gas Tax Act
3	**Origin:**	
4	**Legal basis:**	Act no. 887 of 3 October 1998 on energy taxes of natural gas and town gas, and amendments.
5	**Domestic compliance and enforcement:**	Fine and/or up to 2 years of imprisonment
6	**Description:**	Tax on consumption of natural gas and town gas in Denmark. The tax amount to: DKK 2,042 per Nm^3
7	**Objective:**	In order to have a tax level on this fuel which match the tax level on other fuels
8	**Greenhouse gas(es) affected:**	CO_2
9	**Type of measure:**	Fiscal (tax)
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	1 January 1996
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Ministry of Taxation
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	-2,7 (-1,5 & -1,2) (a)
21	**2005:**	
22	**2010 or (2008-2012)/5:**	-2,7 (-1,5 & -1,2) (a)
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	1100 (325+775) DKK per tonnes CO2-equivalent (a)
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5 and the Effort Analysis(1)
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5, the Effort Analysis(1) and the estimates shown above
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the "with measures" GHG projection) ?:**	Yes
39	***Is the effect of the measure included in the "with additional measures" GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the "without measures (since 1990)" - projection ?:**	Yes (a)
41	**References and links for further information:**	http://www.retsinfo.dk/index/SKA/CR041986.htm (1) http://www.mst.dk/transport/01041000.htm
42	**Comments:**	(a) The effects and socio-economic costs related to tax raises since 1990 shown here are from the Effort Analysis where the estimate includes the total effect of tax raises since 1990 on all oil products. Reductions related to mineral oil tax on petrol and diesel have been estimated separately, but are now included in the estimate showing the total effect.

TD-3	Coal Tax Act	
1	**Sector:**	Energy and Business Sector (Consumption of coal)
2	**Name*:**	Coal Tax Act
3	**Origin:**	
4	**Legal basis:**	Act no. 702 of 28 September 1998 on energy taxes of coal, lignite and coke etc., and amendments.
5	**Domestic compliance and enforcement:**	Fine and/or up to 2 years of imprisonment
6	**Description:**	Tax rated after the calorific value of coal, coke, furnace coke, coke gravel, crude coke, lignite briquettes and lignite, tall oil, wood tar, vegetable pitch etc. The tax amount to DKK 51,9 per GJ
7	**Objective:**	At its introduction the objective was both fiscal and reductions in energy use. Later, CO2 reduction also became an objective.
8	**Greenhouse gas(es) affected:**	CO_2
9	**Type of measure:**	Fiscal (tax)
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	1 July 1982
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Ministry of Taxation
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	-2,7 (-1,5 & -1,2) (a)
21	**2005:**	
22	**2010 or (2008-2012)/5:**	-2,7 (-1,5 & -1,2) (a)
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	1100 (325+775) DKK per tonnes CO2-equivalent (a)
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5 and the Effort Analysis(1)
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5, the Effort Analysis(1) and the estimates shown above
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	Yes
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	Yes (a)
41	**References and links for further information:**	http://www.retsinfo.dk/index/SKA/AN000050.htm (1) http://www.mst.dk/transport/01041000.htm
42	**Comments:**	(a) The effects and socio-economic costs related to tax raises since 1990 shown here are from the Effort Analysis where the estimate includes the total effect of tax raises since 1990 on all oil products. Reductions related to mineral oil tax on petrol and diesel have been estimated separately, but are now included in the estimate showing the total effect.

TD-4	Electricity Tax	
1	**Sector:**	Business Sector and Domestic Sector (Consumption of electricity)
2	**Name*:**	Electricity Tax
3	**Origin:**	
4	**Legal basis:**	Act no. 689 of 17 September 1998 on electricity tax, and amendments.
5	**Domestic compliance and enforcement:**	Fine and/or up to 2 years of imprisonment
6	**Description:**	Tax on consumption of elektricity. The tax amount to DKK 0.511 per kWh for electricity consumption over 4000 kWh in buildings heated by electric panels. Tax the on all other consumption of electricity amount to DKK 0,576 øre per kWh.
7	**Objective:**	At its introduction in 1977, the objective was both fiscal and reductions in energy use. Since the beginning of the 1990s, amentments also have had CO2 reduction as an objective.
8	**Greenhouse gas(es) affected:**	CO_2
9	**Type of measure:**	Fiscal (tax)
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	1 April 1977
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Ministry of Taxation
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	-2,7 (-1,5 & -1,2) (a)
21	**2005:**	
22	**2010 or (2008-2012)/5:**	-2,7 (-1,5 & -1,2) (a)
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	1100 (325+775) DKK per tonnes CO2-equivalent (a)
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5 and the Effort Analysis(1)
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5, the Effort Analysis(1) and the estimates shown above
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	Yes
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	Yes (a)
41	**References and links for further information:**	http://www.retsinfo.dk/index/SKA/AN000057.htm (1) http://www.mst.dk/transport/01041000.htm
42	**Comments:**	(a) The effects and socio-economic costs related to tax raises since 1990 shown here are from the Effort Analysis where the estimate includes the total effect of tax raises since 1990 on all oil products. Reductions related to mineral oil tax on petrol and diesel have been estimated separately, but are now included in the estimate showing the total effect.

TD-5	Carbondioxide tax on energy products	
1	**Sector:**	Business Sector and Domestic Sector (CO_2 emissions from energy consumption)
2	**Name*:**	Carbondioxide tax on energy products
3	**Origin:**	
4	**Legal basis:**	Act no. 643 of 27 August 1998 on carbondioxide taxes of certain energy products, and amendments.
5	**Domestic compliance and enforcement:**	Fine and/or up to 2 years of imprisonment
6	**Description:**	Tax on energy products depending on their contribution to CO2 emissions based an average tax of DKK 90 per tonnes of CO2. The taxes are: Gas oil and diesel oil: DKK 0.243 per litre Fuel oil: DKK 0.288 per kilogramme Heating tar: DKK 0.252 per kilogramme Petroleum: DKK 0.243 per litre Coal, coke, furnace coke, coke gravel: DKK 217.8 per tonnes Crude coke: DKK 290.7 per tonnes Lignite briquettes and lignite: DKK 160.2 per tonnes Electricity: DKK 0.09 per kWh Auto gas (LPG): DKK 0.144 per kilogramme Other liquified gas: DKK 0.27 per kilogramme Gas (refinery gas): DKK 0.261 per kilogramme Natural gas and Town gas: DKK 0.198 per Nm3
7	**Objective:**	Reductions in energy use and related CO2 emissions
8	**Greenhouse gas(es) affected:**	CO_2
9	**Type of measure:**	Fiscal (tax)
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	1 March 1992
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Ministry of Taxation
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	-2,7 (-1,5 & -1,2) (a)
21	**2005:**	
22	**2010 or (2008-2012)/5:**	-2,7 (-1,5 & -1,2) (a)
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	1100 (325+775) DKK per tonnes CO2-equivalent (a)
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5 and the Effort Analysis(1)
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5, the Effort Analysis(1) and the estimates shown above
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	Yes
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	Yes (a)
41	**References and links for further information:**	http://www.retsinfo.dk/index/SKA/AN000065.htm (1) http://www.mst.dk/transport/01041000.htm
42	**Comments:**	(a) The effects and socio-economic costs related to tax raises since 1990 shown here are from the Effort Analysis where the estimate includes the total effect of tax raises since 1990 on all oil products. Reductions related to mineral oil tax on petrol and diesel have been estimated separately, but are now included in the estimate showing the total effect.

TD-6	Green Owner Tax	
1	**Sector:**	Transport (Energy consumption)
2	**Name*:**	Green Owner Tax
3	**Origin:**	Related to Council Directive 80/1268/EC
4	**Legal basis:**	Act no. 864 of 22 October 2002 on taxes on passenger cars depending on fuel efficiency, and amendments.
5	**Domestic compliance and enforcement:**	Fines
6	**Description:**	Car owners have to pay annual taxes which are differentiated in accordance with the fuel efficiency of the cars expressed in kilometers per litre.
7	**Objective:**	To strengthen the incentive to choose more fuel efficient /energy efficient cars in order to increase the contribution to achieve the environmental objectives concerning limitation and reduction of the environmental impacts from the transport sector's pollution.
8	**Greenhouse gas(es) affected:**	CO_2
9	**Type of measure:**	Fiscal (tax)
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	2 June 1997
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	1 July 1997
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Ministry of Taxation
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	-0,2 (a)
21	**2005:**	
22	**2010 or (2008-2012)/5:**	-0,6 (a)
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5 and the Effort Analysis(1)
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	NMVOCs, NO_x, CO, sulphur, benzene, particles
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5, the Effort Analysis(1) and the estimates shown above
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the "with measures" GHG projection) ?:**	Yes
39	***Is the effect of the measure included in the "with additional measures" GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the "without measures (since 1990)" - projection ?:**	Yes (a)
41	**References and links for further information:**	http://www.retsinfo.dk/index/SKA/AN003124.htm (1) http://www.mst.dk/transport/01041000.htm
42	**Comments:**	(a) The effects related to improvement of energy efficiency of cars, both on individual cars and in total, and shown here are from the Effort Analysis where the estimate includes the total effect of EU measures (voluntary agreements with the automobile industry) and national measures (the green owner tax, information campaigns, energy labelling etc.)

TD-7	Registration Tax Act	
1	**Sector:**	Transport (Energy consumption)
2	**Name*:**	Registration Tax Act
3	**Origin:**	Related to Council Directive 80/1268/EC
4	**Legal basis:**	Act no. 977 of 2 December 2002 on registration tax on motor vehicles (act no. 964 of 20 December 1999 on fuel efficient cars).
5	**Domestic compliance and enforcement:**	Fine and/or up to 2 years of imprisonment
6	**Description:**	- The Registration Tax for diesel-driven cars driving more than 45 km/litre and for petrol-driven cars driving more than 40 km/litre will in the period 2000-2005 be 4/6 of the normal tax and in the period 2006-2010 be 3/5 of the normal registration tax. - The Registration Tax for diesel-driven cars driving 37.5-45 km/litre and for petrol-driven cars driving 33.3-40 km/litre will in the period 2000-2005 be 3/6 of the normal tax and in the period 2006-2010 be 2/5 of the normal registration tax. - The Registration Tax for diesel-driven cars driving 32.1-37.5 km/litre and for petrol-driven cars driving 28.6-33.3 km/litre will in the period 2000-2005 be 2/6 of the normal tax and in the period 2006-2010 be 1/5 of the normal registration tax. - The Registration Tax for diesel-driven cars driving 28.1-32.1 km/litre and for petrol-driven cars driving 25-28.6 km/litre will in the period 2000-2005 be 1/6 of the normal registration tax.
7	**Objective:**	Restructuring of existing legislation and reduction in consumption of polluting fuels by introducing incentives to buy more fuel efficient cars.
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Fiscal (tax)
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	1 January 2000
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Ministry of Taxation
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	-0,2 (a)
21	**2005:**	
22	**2010 or (2008-2012)/5:**	-0,6 (a)
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5 and the Effort Analysis(1)
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5, the Effort Analysis(1) and the estimates shown above
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	Yes
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	Yes (a)
41	**References and links for further information:**	http://147.29.40.91/_SHOWF_B602867490/1606&A20020097729REGL&0004&000001 (1) http://www.mst.dk/transport/01041000.htm
42	**Comments:**	(a) The effects related to improvement of energy efficiency of cars, both on individual cars and in total, and shown here are from the Effort Analysis where the estimate includes the total effect of EU measures (voluntary agreements with the automobile industry) and national measures (the green owner tax, information campaigns, energy labelling etc.)

EN-1	EU-CO2-allowances for electricity and district heat production and certain industrial processes (incl. Business)	
1	**Sector:**	Energy sector and the energy intensive part of the Business Sector incl. Off-shore
2	**Name*:**	EU-CO2-allowances for electricity and district heat production and certain industrial processes (incl. Business)
3	**Origin:**	DIRECTIVE 2003/87/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC
4	**Legal basis:**	Act no. 493 of 9 June 2004 on CO2 allowances
5	**Domestic compliance and enforcement:**	Fine as extra tax in the order of 40-100 Euro per tonnes of CO2
6	**Description:**	EU-CO2-allowances for electricity and district heat production (including Business)
7	**Objective:**	To regulate CO2 emissions
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Regulatory (allowances) and economic (financial)
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	4 June 2004
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	1 January 2005
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Danish Energy Authority and Danish Environmental Protection Agency
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	-6 mill. tonnes CO2 annually 2005-7
22	**2010 or (2008-2012)/5:**	
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	Not higher than the quota price
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	Not higher than the quota price
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	Is an element in the governments Climate Strategy
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5 and the estimate shown above
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the "with measures" GHG projection) ?:**	Yes, cf.. NAP1 in 2005-7; estimates of the effects after 2007 are only based on the expected effects of the EU allowance regulation on energy prices - and not any fixed amount of allowances in NAP2. This amount will not be fixed until the adoption of NAP2 in 2006
39	***Is the effect of the measure included in the "with additional measures" GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the "without measures (since 1990)" - projection ?:**	No, implemented after 2001
41	**References and links for further information:**	http://europa.eu.int/eur-lex/pri/en/oj/dat/2003/l_275/l_27520031025en00320046.pdf http://www.energistyrelsen.dk/sw11540.asp http://www.energistyrelsen.dk/sw13515.asp http://www.ens.dk/lovgivning
42	**Comments:**	

EN-2	Biomass Agreement (Agreement on the use of biomass in electricity production)	
1	**Sector:**	Energy sector
2	**Name*:**	Biomass Agreement (Agreement on the use of biomass in electricity production)
3	**Origin:**	National measure
4	**Legal basis:**	Biomass Agreement of 14 July 1993, amendment og follow-up reforms on 1 July 1997 and 22 March 2000. Electricity Supply Act
5	**Domestic compliance and enforcement:**	Precondition for permits. Fines.
6	**Description:**	In 1993 it was agreed to increase the use of biomass in the energy supply. The agreement has been adjusted several times. Today, the target is to reach an amount of 1.4 mill. tonnes of biomass in energy supply by 2005. The incentive for producers of electricity is a garanteed minimum sales price for electricity at DKK 0.4 per kWh through a subsidy adjusted in accordance with the market price on electricity. In addition, certain plants for production of heat and power can obtain a subsidy per tonnes of biomass combusted - but for no longer than 10 years.
7	**Objective:**	Increased use of biomass, R&D, demonstration, reduction of CO2
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Economic (financial, subsidies)
10	**Status of implementation:**	Implemented, with the exception of one straw fired CHP plant
11	**Date for the political adoption:**	14 July 1993
12	**Date for adoption of legislation, if different:**	1 May 2001
13	**Date of beginning:**	1993
14	**Date of end, if relevant:**	10 years after production start at the latest
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	The electricity producers Elsam and E2
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	See the Effort Analysis(1)
21	**2005:**	
22	**2010 or (2008-2012)/5:**	See the Effort Analysis(1)
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	See the Effort Analysis(1)
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5 and the Effort Analysis(1)
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5 and the Effort Analysis(1)
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	Yes
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	Yes
41	**References and links for further information:**	http://www.energistyrelsen.dk/sw13380.asp http://www.energistyrelsen.dk/sw20499.asp http://www.ens.dk/lovgivning (1) See Annex B2 and http://www.mst.dk/transport/01041000.htm
42	**Comments:**	

EN-3	Price supplement for environmentally friendly electricity	
1	**Sector:**	Energy sector
2	**Name*:**	Price supplement for environmentally friendly electricity
3	**Origin:**	National measure
4	**Legal basis:**	The political Agreement on Energy of 29 March 2004. The price supplement for production of environmentally friendly electricity is implemented via the Act on Electricity Supply and it is payed by the electricity consumers relative to consumption (Public Service Obligation).
5	**Domestic compliance and enforcement:**	
6	**Description:**	Since 1 January 2005, all environmentally friendly electricity from wind turbines and other plants based on renewable energy and from decentralised CHP plants, has been sold on market terms. The previous subsidy for environmentally friendly electricity, where consumers were allowed only to buy electricity at a fixed price, has changed into a financial subsidy adjusted relatively to the market price and to a price supplement to the market price. The main principle is that existing plants can receive the susidy in 20 years, with 15 years as the minimum from 2004. New plants based on renewable energy kan receive the subsidy for 20 years.
7	**Objective:**	Support for technology development and aiming for making electricity production with wind turbines competitive to conventionally produced electricity, Reduction of the impact on the environment, including CO2 emissions.
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Economic (financial, subsidies, price supplement)
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	29 March 2004
12	**Date for adoption of legislation, if different:**	9 June 2004
13	**Date of beginning:**	1 January 2005
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Danish Energy Authority and entities responsible for energy production
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	
22	**2010 or (2008-2012)/5:**	
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	Yes
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	No, implemented after 2001
41	**References and links for further information:**	http://www.energistyrelsen.dk/sw13754.asp http://www.ens.dk/lovgivning http://www.ens.dk/graphics/Energiforsyning/Vedvarende_energi/Vind/Afregning/Forenklet_vindmolleafreg-u2.pdf
42	**Comments:**	

EN-4	Tenders for offshore wind turbines	
1	**Sector:**	Energy sector
2	**Name*:**	Tenders for offshore wind turbines
3	**Origin:**	National measure
4	**Legal basis:**	The Act on Electricity Supply
5	**Domestic compliance and enforcement:**	
6	**Description:**	In the agreements of 29 March 2004 it was agreed to establish 2 offshore wind turbine facilities, each wih a size of 200 MW. One of the facilities should be located at Horns Rev ("Horns Rev II") and the other at Rødsand ("Rødsand II"). Both should be build on the basis of tenders.
7	**Objective:**	Promote technology development and aiming for making electricity production with wind turbines competitive to conventionally produced electricity. Reduction of the electricity production's impact on the environment, including CO2 emissions.
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Regulatory (administrative, tender), Economic (financial, tender)
10	**Status of implementation:**	In 2005, the winner of the tender on Horns Rev II has been found and production is expected to start in 2009. The deadline for the final bid on Rødsand II is 13 December 2005.
11	**Date for the political adoption:**	29 March 2004
12	**Date for adoption of legislation, if different:**	Additional legal steps, if necessary, will be take by the end of 2005 or in 2006.
13	**Date of beginning:**	
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	The winners of the tenders will receive price supplement
18	**Implementering entity or entities:**	Danish Energy Authority
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	
22	**2010 or (2008-2012)/5:**	
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	Yes
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	No, implemented after 2001
41	**References and links for further information:**	http://www.energistyrelsen.dk/sw13778.asp http://www.energistyrelsen.dk/sw14306.asp http://www.ens.dk/lovgivning
42	**Comments:**	

EN-5	Scrapping scheme for old wind turbines	
1	**Sector:**	Energy sector
2	**Name*:**	Scrapping scheme for old wind turbines
3	**Origin:**	National measure
4	**Legal basis:**	Act no. 495 of 9 June 2004, Statutory order on Wind turbines (Statutory Order no. 1365 of 15 December 2004) and the guidelines on issuance and administration of scapping certificates etc. from the entities responsible for the energy system.
5	**Domestic compliance and enforcement:**	
6	**Description:**	The scrapping scheme will support taking down old and unfavourable placed wind turbines and will support expansion of wind power - aiming at 350 MW new capacity within 5 years. It will only be possible to issue scrapping certificates within a total of 175 MW
7	**Objective:**	Promote technology development and aiming for making electricity production with wind turbines competitive to conventionally produced electricity. Reduction of the electricity production's impact on the environment, including CO2 emissions.
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Economic (financial, price supplement)
10	**Status of implementation:**	The legal basis has been implemented. In 2005, the planning of where to relocate old and locate new wind turbines began.
11	**Date for the political adoption:**	29 March 2004
12	**Date for adoption of legislation, if different:**	9 June 2004
13	**Date of beginning:**	The price supplement is given to new (ab factory) wind turbines connected to the grid in the period from 1 January 2005 to 31 December 2009.
14	**Date of end, if relevant:**	For the price supplement: 31 December 2009
15	**Allocated resources, if any:**	The price supplement is DKK 0.12 per kWh and is given to production of electricity from a wind turbine, but no more than what is equal to 12,000 full load hours for twice the installed effect of the scrapped wind turbine. If the sum of the electricity market price, the ordinary price supplement, and the scrapping price supplement exceed DKK 0.48 per kWh, the scrapping price supplement will be reduced accordingly.
16	**For planned measures, planned date of start (& end?):**	Wind turbines to be scrappede under this scheme shall be taken down in the period 15 December 2004 - 15 December 2009. The replacing wind turbines shall be connected to the grid in the period from 1 January 2005 to 31 December 2009.
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Danish Energy Authority
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	
22	**2010 or (2008-2012)/5:**	
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	Yes
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	No, implemented after 2001
41	**References and links for further information:**	http://www.energistyrelsen.dk/sw14138.asp http://www.energistyrelsen.dk/sw15568.asp http://www.ens.dk/lovgivning
42	**Comments:**	

EN-6	Energy research	
1	**Sector:**	Energy sector
2	**Name*:**	Energy research
3	**Origin:**	National measure
4	**Legal basis:**	Act no. 1024 of 23 December 1998 on financial support for research and technology development within the energy area
5	**Domestic compliance and enforcement:**	
6	**Description:**	The Energy Research Programme (EFP), under the responsability of the Danish Energy Authority, support energy research, development and pilot projects
7	**Objective:**	The main objective of the EFP is to support the governments energy policy target, which is a cost effective, environmentally friendly and stable energy supply, and to support the competitiveness of Danish compagnies in the energy area
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Research
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	1976-77
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	Financial support for energy research, development and pilot projects can be obtained from different programmes with different sub-objectives (the budgets for 2005 are shown in the parentesis): - The Energy Research Programme (DKK 72 mil.), - The PSO-scheme on environmentally friendly electricity production technologies (DKK 130 mill.), - The PSO-scheme for efficient use of electricity (DKK 25 mill.) and - The Strategical Research Council's budget for energy and environment (65 mill.).
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Danish Energy Authority
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	
22	**2010 or (2008-2012)/5:**	
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	No, not direct, but indirect through the support of the technology development assumed in the energy projections - on which the GHG emission projection is based
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	No
41	**References and links for further information:**	http://www.energistyrelsen.dk/sw11580.asp http://www.energistyrelsen.dk/sw12337.asp http://www.ens.dk/lovgivning
42	**Comments:**	

EN-7	National CO2 allowance scheme for electricity producers	
1	**Sector:**	Energy sector, measures no longer in place or replaced
2	**Name*:**	National CO_2 allowance scheme for electricity producers
3	**Origin:**	National measure
4	**Legal basis:**	Act no. 376 of 2 June 1999.
5	**Domestic compliance and enforcement:**	Extra tax (on emissions exceeding the allocated amount of allowances), fines
6	**Description:**	The national CO2 allowance scheme imposed CO2 emission ceilings on production of electricity, if CO2 emissions were above 100,000 tonnes of CO2. If the ceiling was exceeded the producer of electricity had to pay an extra tax. Allowances could be traded among producers of electricity under the scheme.
7	**Objective:**	CO_2-reduction, forerunner for the EU allowance regulation
8	**Greenhouse gas(es) affected:**	CO_2
9	**Type of measure:**	Economic (financial)
10	**Status of implementation:**	Implemented and in place in the period 2001-2004
11	**Date for the political adoption:**	3 March 1999
12	**Date for adoption of legislation, if different:**	2 June 1999
13	**Date of beginning:**	1 January 2001
14	**Date of end, if relevant:**	31. december 2004
15	**Allocated resources, if any:**	None
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	State authorities (Danish Energy Authority), energy producers. EU CO2 allowance scheme also covers energy-intensive enterprises
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	-3 mill. tonnes CO_2 in total in the period from 2000 to 2004
21	**2005:**	
22	**2010 or (2008-2012)/5:**	
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	Not higher than the quota price
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5 and the estimate shown above
37	**Explanation, if the measure is no longer in place:**	Replaced by the EU CO2 allowance scheme (EU ETS) from 1 January 2005
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	Yes, for the first year of the projection (2004)
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	No
41	**References and links for further information:**	http://www.energistyrelsen.dk/sw19297.asp http://www.energistyrelsen.dk/sw17278.asp http://www.ens.dk/lovgivning
42	**Comments:**	

EN-8a	Subsidy to electricity generation (Renewable Energy)	
1	**Sector:**	Energy sector, measures no longer in place or replaced
2	**Name*:**	Subsidy to electricity generation (Renewable Energy)
3	**Origin:**	National measure
4	**Legal basis:**	Act on subsidies for the production of electricity
5	**Domestic compliance and enforcement:**	Act of 7 October 1992 on exploitation of renewable energy sources
6	**Description:**	Subsidy for the production of electricity from renewable energy sources. In the beginning of the 1990s the subsidy amounted to DKK 0.27 per kWh produced. Electricity produced from renewable energy sources got an extra payment equal the costs saved. For wind turbines this was calculated as 85% of the sales price from decentralised CHP plants to the grid (excl. vat and taxes) based on a tariff in three segments.
7	**Objective:**	Reduce CO2 emissions, promote technology development and aiming for making electricity production with wind turbines competitive to conventionally produced electricity.
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Economic (financial, price supplement and settling prices)
10	**Status of implementation:**	No longer in place. With the reorganisation of 1 January 2005 it was replaced by price supplement for the production of environmentally friendly electricity.
11	**Date for the political adoption:**	
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	
14	**Date of end, if relevant:**	For wind turbines 1 April 2001. For other renewable energy plants 1 January 2005
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Danish Energy Authority, Energy producers (administered the implementation).
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	See the Effort Analysis(1)
21	**2005:**	
22	**2010 or (2008-2012)/5:**	See the Effort Analysis(1)
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	See the Effort Analysis(1)
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5 and the Effort Analysis(1)
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	Decrease in emissions of SO2 and NOx from power plants due to decrease in production of electricity
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5 and the Effort Analysis(1)
37	**Explanation, if the measure is no longer in place:**	Replaced by price supplement for the production of environmentally friendly electricity
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	Regarding the measures effect on the etablishment of renewable energy based heat and power capacity, the effect in the future is assumed to be the same as in 2003. Since energy statistics for 2003 are the basis for the projections, only effects deviating from the effect in 2003 have been included in the projection.
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	Yes (a)
41	**References and links for further information:**	http://www.ens.dk/lovgivning http://www.ens.dk/sw11368.asp http://www.ens.dk/sw14294.asp http://www.ens.dk/graphics/Energiforsyning/Vedvarende_energi/Vind/Afregning/Forenklet_vindmolleafreg-u2.pdf (1) See Annex B2 and http://www.mst.dk/transport/01041000.htm
42	**Comments:**	(a) In the Effort Analysis the effect of subsidies for production of electricity from wind turbines is estimated together with the effect of subsidies for production of electricity from other renewable energy sources

EN-8b	Subsidies for electricity generation (wind turbines)	
1	**Sector:**	Energy sector, measures no longer in place or replaced
2	**Name*:**	Subsidies for electricity generation (wind turbines)
3	**Origin:**	National measure
4	**Legal basis:**	The agreement on an electricity reform, Act on electricity supply, Act on exploitation of renewable energy sources
5	**Domestic compliance and enforcement:**	
6	**Description:**	Electricity from wind turbines bought before the end of 1999 is guaranteed a price of DKK 0.43 per kWh in 10 years and a price supplement of DKK 0.17 per kWh for a full load hour production graduated after turbine size. After this period, electricity have to be sold on market terms with a price supplement up to DKK 0.10 per kWh until the age of the turbine is 20 years. The price supplement is adjusted in such a way, that the sum of market price and price supplement will not exceed DKK 0.36 per kWh. Rules on price supplements have been changed over time. The latest change took place with Act no. 495 of 9 June 2004.
7	**Objective:**	Reduce CO2 emissions, promote technology development and aiming for making electricity production with wind turbines competitive to conventionally produced electricity.
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Economic (price supplement and settling prices)
10	**Status of implementation:**	Implemented. With the reorganisation of 1 January 2005 it was replaced by price supplement for the production of environmentally friendly electricity.
11	**Date for the political adoption:**	The agreement on an electricity reform of 3 March 1999
12	**Date for adoption of legislation, if different:**	Several times. The latest change took place with Act no. 495 of 9 June 2004.
13	**Date of beginning:**	1 April 2001
14	**Date of end, if relevant:**	End of 2012
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Danish Energy Authority, Energy producers
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	See the Effort Analysis(1)
21	**2005:**	
22	**2010 or (2008-2012)/5:**	See the Effort Analysis(1)
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	See the Effort Analysis(1)
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5 and the Effort Analysis(1)
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	Decrease in emissions of SO2 and NOx from power plants due to decrease in production of electricity
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	The effort on reduction of SO2 and NOx emissions from power plants
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5 and the Effort Analysis(1)
37	**Explanation, if the measure is no longer in place:**	Replaced by price supplement for the production of environmentally friendly electricity
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	Regarding the measures effect on the etablishment of renewable energy based heat and power capacity, the effect in the future is assumed to be the same as in 2003. Since energy statistics for 2003 are the basis for the projections, no separate extra effects from this meaures is included in the projections.
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	Yes (a)
41	**References and links for further information:**	http://www.ens.dk/lovgivning http://www.ens.dk/sw11368.asp http://www.ens.dk/sw14294.asp http://www.ens.dk/graphics/Energiforsyning/Vedvarende_energi/Vind/Afregning/Forenklet_vindmolleafreg-u2.pdf (1) See Annex B2 and http://www.mst.dk/transport/01041000.htm
42	**Comments:**	(a) In the Effort Analysis the effect of subsidies for production of electricity from wind turbines is estimated together with the effect of subsidies for production of electricity from other renewable energy sources

EN-9	Priority for electricity from CHP plants	
1	**Sector:**	Energy sector, measures no longer in place or replaced
2	**Name*:**	Priority for electricity from CHP plants
3	**Origin:**	National measure
4	**Legal basis:**	Agreement in 1990 between the government at that time (VKR) and the Socialdemocrates. The agreement was realised in a revision of the Act on heat supply. The subsidy was introduced as part of the CO2 tax package.
5	**Domestic compliance and enforcement:**	Memorandoms on terms
6	**Description:**	1. It was requried from the municipalities that they should see to that a shift from district heating (based om separated electricity and heat production) to decentralised combined heat and power based on natural gas. 2. In addition, from 1992 a subsidy for production of electricity in natural gas fired decentralised combined heat and power plants was given. The size of the subsidy has changed several times since then.
7	**Objective:**	Combined production of electricity and heat in order to the gain fuel savings in comparison with separate production.
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	1. Regulatory (Requirement) 2. Economic (Subsidy)
10	**Status of implementation:**	No longer in place. Replaced by price supplement for the production of environmentally friendly electricity.
11	**Date for the political adoption:**	1. 1990 2. 1992
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	State authorities, Municipalities and Energy producers
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	See the Effort Analysis(1)
21	**2005:**	
22	**2010 or (2008-2012)/5:**	See the Effort Analysis(1)
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	See the Effort Analysis(1)
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5 and the Effort Analysis(1) Only investments in the period 1992-2002 are included.
32	**Side effects – on other GHGs or GHG emitting activities:**	The emission of methane is higher at combined heat and power production than at separate heat production.
33	**Side effects – on other air pollutants:**	Reduction of SO2- and NOx emissions.
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5 and the Effort Analysis(1)
37	**Explanation, if the measure is no longer in place:**	Replaced by price supplement for the production of environmentally friendly electricity
38	***Is the effect of the measure included in the "with measures" GHG projection) ?:**	Yes
39	***Is the effect of the measure included in the "with additional measures" GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the "without measures (since 1990)" - projection ?:**	
41	**References and links for further information:**	http://www.ens.dk/lovgivning http://www.ens.dk/sw14254.asp (1) See Annex B2 and http://www.mst.dk/transport/01041000.htm
42	**Comments:**	

EN-10	Requirement for offshore wind turbines	
1	**Sector:**	Energy sector, measures no longer in place or replaced
2	**Name*:**	Requirement for offshore wind turbines
3	**Origin:**	National measure
4	**Legal basis:**	Recommandations from "The action plan on offshore windturbines in Danish waters (1997)"
5	**Domestic compliance and enforcement:**	Requirement
6	**Description:**	Requirement to the power plants to build: 1. 200 MW wind power on land before 2000 (according to agreement between the Ministry for the Envionment and Energy and producers of electricity). 2. 750 MW offshore wind power in the period 2002-2008 (an element in the energi savings action plan Energy 21). However, this order was withdrawn in 2002. 3. In addition, a state financed subsidy of DKK 10 per kWh was given to the production of electricity from 1992 until mid 1999.
7	**Objective:**	Expansion of environmentally friendly technology in electricity production.
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Regulatory (administrative), Economic (financial)
10	**Status of implementation:**	1. Implemented 2. Withdrawn and replaced by tenders 3. With the reorganisation of 1 January 2005 it was replaced by price supplement for the production of environmentally friendly electricity.
11	**Date for the political adoption:**	1996
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	See the Effort Analysis(1)
21	**2005:**	
22	**2010 or (2008-2012)/5:**	See the Effort Analysis(1)
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	See the Effort Analysis(1)
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5 and the Effort Analysis(1)
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	Decrease in emissions of SO2 and NOx from power plants due to decrease in production of electricity. Therefore power plants can save some of the costs related to compliance with the SO2- og NOx quota regulation. With this, it is assumed that there are no extra environmental benefits from reduction of SO2- and NOx-emissions.
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5 and the Effort Analysis(1)
37	**Explanation, if the measure is no longer in place:**	Replaced by offshore wind turbine tenders and price supplement for the production of environmentally friendly electricity.
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	Yes
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	
41	**References and links for further information:**	http://www.energistyrelsen.dk/sw13787.asp http://www.energistyrelsen.dk/sw14312.asp http://www.ens.dk/lovgivning (1) See Annex B2 and http://www.mst.dk/transport/01041000.htm
42	**Comments:**	

EN-11	Scrapping scheme for old, badly located wind turbines	
1	**Sector:**	Energy sector, measures no longer in place or replaced
2	**Name*:**	Scrapping scheme for old, badly located wind turbines
3	**Origin:**	National measure
4	**Legal basis:**	Act no. 273 of 2 June 1999 and amendment by Act no. 1277 of 20 December 2000.
5	**Domestic compliance and enforcement:**	Fine and/or pay back of unwarranted subsidy
6	**Description:**	As an element in the electricity reform a replacement scheme was etablished. The scheme implied a scrapping certificate for scrapped wind turbines under 150 kW which entitled the owner(s) to a price supplement of DKK 0.17 per kWh in 12,000 full load hours in a new wind turbine. The scheme was in place until 1 January 2004.
7	**Objective:**	Scrapping of old, badly located wind turbines
8	**Greenhouse gas(es) affected:**	CO_2
9	**Type of measure:**	Economic (financial, price supplement)
10	**Status of implementation:**	The scheme is no longer in place. From 2005, a new scrapping scheme has been established
11	**Date for the political adoption:**	The agreement on a electricity reform of 3 March 1999
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	1 April 2001
14	**Date of end, if relevant:**	End of 2003
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Danish Energy Authority
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	
22	**2010 or (2008-2012)/5:**	
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5
37	**Explanation, if the measure is no longer in place:**	From 2005, a new scrapping scheme has been established
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	Yes
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	
41	**References and links for further information:**	http://www.energistyrelsen.dk/sw14138.asp http://www.ens.dk/lovgivning
42	**Comments:**	

EN-12	Renewable energy island - Samsø	
1	**Sector:**	Energy sector, measures no longer in place or replaced
2	**Name*:**	Renewable energy island - Samsø
3	**Origin:**	National measure
4	**Legal basis:**	Not implemented by an Act
5	**Domestic compliance and enforcement:**	
6	**Description:**	The aim is to make the island of Samsø self-sufficient with local renwable energy sources within a period of 10 years.
7	**Objective:**	To demonstrate the practical, technological, institutional and financial possibilities in switching a local community over to 100% renewable energy supply and create a global show-window for Danish Renewable Energy Technology.
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Economic(financial), Research and Other(demonstration)
10	**Status of implementation:**	The switching over process is ongoing – now primarily with focus on possible changes in the Transport sector. As show-room and a role model community, the concept continues.
11	**Date for the political adoption:**	The initiative was included in ENERGY21 - the Action plan on Energy from 1996.
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	1997
14	**Date of end, if relevant:**	2007
15	**Allocated resources, if any:**	The project has been supported by the state within exising budgets on subsidies for development projects and plants based on renewable energy. The investment subsidy has been approx. DKK 20 mill. in total.
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	Further earmaked funds are not planned.
18	**Implementering entity or entities:**	The project has been rooted locally.
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	
22	**2010 or (2008-2012)/5:**	
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	
37	**Explanation, if the measure is no longer in place:**	Finished as state initiative. Continued locally.
38	***Is the effect of the measure included in the "with measures" GHG projection) ?:**	No
39	***Is the effect of the measure included in the "with additional measures" GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the "without measures (since 1990)" - projection ?:**	
41	**References and links for further information:**	www.veo.dk
42	**Comments:**	

EN-13	Construction subsidy for renewable energy	
1	**Sector:**	Energy sector, measures no longer in place or replaced
2	**Name*:**	Construction subsidy for renewable energy
3	**Origin:**	National measure
4	**Legal basis:**	The Development Programme for Renwable Energy (UVE)
5	**Domestic compliance and enforcement:**	Fine and/or pay back of unwarranted subsidy
6	**Description:**	Arrangements according to which subsidies were given to system approved boilers based on solar heat, heating pumps, biogas and biomass and for test facilities, information activities and test and demonstration projects.
7	**Objective:**	Incentive to use renewable energy.
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Economic (financial, subsidy)
10	**Status of implementation:**	Development and Demonstration projects under UVE as well as the special programmes on hydrogen, solar energy, geothermi and wave energy - except in a few cases - have ended in 2004.
11	**Date for the political adoption:**	
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	Beginning of 1970s
14	**Date of end, if relevant:**	End of 2001
15	**Allocated resources, if any:**	DKK 450 mill. in the period 1991-2001.
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	See the Effort Analysis(1)
21	**2005:**	
22	**2010 or (2008-2012)/5:**	See the Effort Analysis(1)
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	See the Effort Analysis(1)
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5 and the Effort Analysis(1) Only subsidies for solar heating, biomass fired plants and heating pumps have been included in the Effort Analysis. See Danish Energy Authority (2004)
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5 and the Effort Analysis(1)
37	**Explanation, if the measure is no longer in place:**	The subsidies are no longer in place
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	No
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	Yes
41	**References and links for further information:**	http://www.ens.dk/sw16321.asp http://www.ens.dk/lovgivning (1) See Annex B2 and http://www.mst.dk/transport/01041000.htm
42	**Comments:**	

EN-14	Subsidy for investment in energy savings by industry	
1	**Sector:**	Energy sector, Business sector, measures no longer in place or replaced
2	**Name*:**	Subsidy for investment in energy savings by industry
3	**Origin:**	National measure
4	**Legal basis:**	Lov nr. 2 af 3. januar 1992 Lov nr. 284 af 27. april 1994 Lov nr. 406 af 14. juni 1995
5	**Domestic compliance and enforcement:**	Fine and/or pay back of unwarranted subsidy
6	**Description:**	Subsidy for investments in energy efficient technology, establishment of CHP in industry, projects with development, test or demonstration objectives, advisory and information activities etc. The subsidy typically amounted to 20-40% of the total budget. This arrangement was linked to so-called Agreement Scheme.
7	**Objective:**	Energy Savings
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Economic (subsidies)
10	**Status of implementation:**	No longer in place
11	**Date for the political adoption:**	
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	1993
14	**Date of end, if relevant:**	2001
15	**Allocated resources, if any:**	DKK 1.8 bn.
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Danish Energy Authority
	Estimated effect (mill. tonnes CO2-eq.) in - 1995:	
20	**2001:**	See the Effort Analysis(1)
21	**2005:**	
22	**2010 or (2008-2012)/5:**	See the Effort Analysis(1)
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	See the Effort Analysis(1)
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5 and the Effort Analysis(1)
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	SO2 og NOx
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5 and the Effort Analysis(1)
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	Yes. To the extent that the effect deviates from the effect in 2003 - the latest year with energy statistics on which the energy projection is based - it is included in the projection.
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	Yes
41	**References and links for further information:**	http://www.ens.dk/sw11574.asp http://www.ens.dk/lovgivning http://www.ens.dk/sw12329.asp http://www.ens.dk/sw17747.asp (1) See Annex B2 and http://www.mst.dk/transport/01041000.htm
42	**Comments:**	

EN-15	Subsidy for conversion of old housing to CHP	
1	**Sector:**	Energy sector, Domestic sector, measures no longer in place or replaced
2	**Name*:**	Subsidy for conversion of old housing to CHP
3	**Origin:**	National measure
4	**Legal basis:**	Act no. 5 of 3 January 1992 on state subsidy for conversion of old housing to CHP.
5	**Domestic compliance and enforcement:**	Fine and/or pay back of unwarranted subsidy
6	**Description:**	Subsidy for connection to district heating for old housing (build before 1950) without central heating, but with heating based on paraffin, town gas, bottled gas, electric heating or wood etc. A precondition was that housing was situated in an area with CHP district heating supply.
7	**Objective:**	To reduce CO2 emissions
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Economic (financial, subsidy)
10	**Status of implementation:**	Implemented, but no longer in place
11	**Date for the political adoption:**	3 January 1992
12	**Date for adoption of legislation, if different:**	Latest statutory order: No. 534 of 8 July 1998
13	**Date of beginning:**	1 January 1993
14	**Date of end, if relevant:**	31 December 2001
15	**Allocated resources, if any:**	In the period 1993-2003: DKK 1,080 mill. (Budget was: DKK 1,500 mill.)
16	**For planned measures, planned date of start (& end?):**	1 January 1993
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Danish Energy Authority and Municipality Boards
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	See the Effort Analysis(1)
21	**2005:**	
22	**2010 or (2008-2012)/5:**	See the Effort Analysis(1)
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	See the Effort Analysis(1)
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5 and the Effort Analysis(1)
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5 and the Effort Analysis(1)
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the "with measures" GHG projection) ?:**	It is estimated that the effect in the future will be the same as in 2003. Since 2003 is the latest year of energy statistics on which the projection of energy consumption is based, no additional effects have been included in the projection.
39	***Is the effect of the measure included in the "with additional measures" GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the "without measures (since 1990)" - projection ?:**	Yes
41	**References and links for further information:**	http://www.ens.dk/lovgivning (1) See Annex B2 and http://www.mst.dk/transport/01041000.htm
42	**Comments:**	

EN-16	Subsidy to promote connection to coal CHP	
1	**Sector:**	Energy sector, Domestic sector, measures no longer in place or replaced
2	**Name*:**	Subsidy to promote connection to coal CHP
3	**Origin:**	National measure
4	**Legal basis:**	Act no. 420 of 1 June 1994 on state subsidy to promote connection to coal CHP.
5	**Domestic compliance and enforcement:**	Fine and/or pay back of unwarranted subsidy
6	**Description:**	Subsidy as an incentive to house owners with oil burners or electric heating to shift to district heating.
7	**Objective:**	Targetted compensation for the increase in coal tax in 1993.
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Economic (subsidy).
10	**Status of implementation:**	No longer in place
11	**Date for the political adoption:**	1 June 1994
12	**Date for adoption of legislation, if different:**	1 June 1994
13	**Date of beginning:**	1994
14	**Date of end, if relevant:**	2003
15	**Allocated resources, if any:**	At the adoption of the Act the budget for this subsidy was DKK 240 mill., but since then the budget has been reduced gradually. Until 2003 the total payment of this subsidy amounted to DKK 160 mill.
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Danish Energy Authority
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	See the Effort Analysis(1)
21	**2005:**	
22	**2010 or (2008-2012)/5:**	See the Effort Analysis(1)
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	See the Effort Analysis(1)
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5 and the Effort Analysis(1)
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5 and the Effort Analysis(1)
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	It is estimated that the effect in the future will be the same as in 2003. Since 2003 is the latest year of energy statistics on which the projection of energy consumption is based, no additional effects have been included in the projection.
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	Yes
41	**References and links for further information:**	http://www.ens.dk/lovgivning (1) See Annex B2 and http://www.mst.dk/transport/01041000.htm
42	**Comments:**	

EN-17	State subsidy for energy savings measures in housing for pensioners	
1	**Sector:**	Energy sector, Domestic sector, measures no longer in place or replaced
2	**Name*:**	State subsidy for energy savings measures in housing for pensioners
3	**Origin:**	National measure
4	**Legal basis:**	Act no. 1050 of 23 December 1992
5	**Domestic compliance and enforcement:**	Fine and/or pay back of unwarranted subsidy
6	**Description:**	Subsidy for energy savings measures in housing for pensioners receiving grants for heating costs.
7	**Objective:**	Permanent energy savings, increase employment, improve the pensioners comfort and reduce the need for heating cost grants.
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Economic (financial, subsidy)
10	**Status of implementation:**	No longer in place
11	**Date for the political adoption:**	
12	**Date for adoption of legislation, if different:**	23 December 1992
13	**Date of beginning:**	1 April 1993
14	**Date of end, if relevant:**	31 December 2003
15	**Allocated resources, if any:**	DKK 0.5 bn. In the period 1993-2004
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Danish Energy Authority and Municipality Boards
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	
22	**2010 or (2008-2012)/5:**	
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	It is estimated that the effect in the future will be the same as in 2003. Since 2003 is the latest year of energy statistics on which the projection of energy consumption is based, no additional effects have been included in the projection.
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	No
41	**References and links for further information:**	
42	**Comments:**	http://www.ens.dk/lovgivning

TR-1	Information campaign on fuel consumption of new cars	
1	**Sector:**	Transport
2	**Name*:**	Information campaign on fuel consumption of new cars
3	**Origin:**	National measure
4	**Legal basis:**	
5	**Domestic compliance and enforcement:**	
6	**Description:**	
7	**Objective:**	Improve the efficiency of energy consumption, CO2-reduction
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Information
10	**Status of implementation:**	Implemented (the actual campaign lasted for 2 years)
11	**Date for the political adoption:**	
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Denmark`s Road Safety and Transport Agency
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	-0,2 (a)
21	**2005:**	
22	**2010 or (2008-2012)/5:**	-0,6 (a)
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5 and the Effort Analysis(1)
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5, the Effort Analysis(1) and the estimates shown above
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	Yes
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	Yes (a)
41	**References and links for further information:**	(1) http://www.mst.dk/transport/01041000.htm
42	**Comments:**	(a) The effects related to improvement of energy efficiency of cars, both on individual cars and in total, and shown here are from the Effort Analysis where the estimate includes the total effect of EU measures (voluntary agreements with the automobile industry) and national measures (the green owner tax, information campaigns, energy labelling etc.)

TR-2	Energy-correct driving technique	
1	**Sector:**	Transport
2	**Name*:**	Energy-correct driving technique
3	**Origin:**	National measure
4	**Legal basis:**	
5	**Domestic compliance and enforcement:**	
6	**Description:**	
7	**Objective:**	Improve the efficiency of energy consumption, CO2-reduction
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Information
10	**Status of implementation:**	Is included in the drivers education
11	**Date for the political adoption:**	
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Ministry of Justice
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	-0,2 (a)
21	**2005:**	
22	**2010 or (2008-2012)/5:**	-0,6 (a)
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5 and the Effort Analysis(1)
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5, the Effort Analysis(1) and the estimates shown above
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	Yes
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	Yes (a)
41	**References and links for further information:**	(1) http://www.mst.dk/transport/01041000.htm
42	**Comments:**	(a) The effects related to improvement of energy efficiency of cars, both on individual cars and in total, and shown here are from the Effort Analysis where the estimate includes the total effect of EU measures (voluntary agreements with the automobile industry) and national measures (the green owner tax, information campaigns, energy labelling etc.)

TR-3	Initiative on enforcing speed limits	
1	**Sector:**	Transport
2	**Name*:**	Initiative on enforcing speed limits
3	**Origin:**	National measure
4	**Legal basis:**	
5	**Domestic compliance and enforcement:**	
6	**Description:**	
7	**Objective:**	Improve the efficiency of energy consumption, CO2-reduction
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Information, economic
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Ministry of Justice
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	
22	**2010 or (2008-2012)/5:**	
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	
41	**References and links for further information:**	
42	**Comments:**	

TR-4	Establishment of intermodal installations	
1	**Sector:**	Transport
2	**Name*:**	Establishment of intermodal installations
3	**Origin:**	National measure
4	**Legal basis:**	
5	**Domestic compliance and enforcement:**	
6	**Description:**	
7	**Objective:**	Improve transport efficiency, CO2-reduction
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Economic (financial)
10	**Status of implementation:**	Ongoing implementation
11	**Date for the political adoption:**	
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Ministry of Transport and Energy, counties, municipalities, HUR, DSB
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	
22	**2010 or (2008-2012)/5:**	
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	
41	**References and links for further information:**	
42	**Comments:**	

TR-5	Promotion of environmentally friendly goods transport	
1	**Sector:**	Transport
2	**Name*:**	Promotion of environmentally friendly goods transport
3	**Origin:**	National measure
4	**Legal basis:**	
5	**Domestic compliance and enforcement:**	
6	**Description:**	
7	**Objective:**	Improve transport efficiency, CO2-reduction
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Economic (financial) and information
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Danish Environmental Protection Agency, Haulage contractors
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	
22	**2010 or (2008-2012)/5:**	
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	
41	**References and links for further information:**	
42	**Comments:**	

TR-6	Reduced travel times for public transport	
1	**Sector:**	Transport
2	**Name*:**	Reduced travel times for public transport
3	**Origin:**	National measure
4	**Legal basis:**	
5	**Domestic compliance and enforcement:**	
6	**Description:**	
7	**Objective:**	Improve transport efficiency, CO2-reduction
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Regulatory (Administrative)
10	**Status of implementation:**	Ongoing implementation
11	**Date for the political adoption:**	
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Ministry of Transport and Energy, Counties and Danish State Railways (DSB)
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	
22	**2010 or (2008-2012)/5:**	
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	
41	**References and links for further information:**	
42	**Comments:**	

TR-7	Spatial planning	
1	**Sector:**	Transport
2	**Name*:**	Spatial planning
3	**Origin:**	National measure
4	**Legal basis:**	
5	**Domestic compliance and enforcement:**	
6	**Description:**	
7	**Objective:**	Reduce the need for transport, CO2-reduction
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Regulatory (Administrative)
10	**Status of implementation:**	Ongoing implementation
11	**Date for the political adoption:**	
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Counties, municipalities
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	
22	**2010 or (2008-2012)/5:**	
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	
41	**References and links for further information:**	
42	**Comments:**	

BU-1	Agreements on energy efficiency with business	
1	**Sector:**	Business (energy consumption)
2	**Name*:**	Agreements on energy efficiency with business
3	**Origin:**	National measure
4	**Legal basis:**	Act no. 1 of 3 Frebuary 1992 Act no. 850 of 13 November 1995 Statutory Order no. 863 of 17 November 1995
5	**Domestic compliance and enforcement:**	Cancellation of the agreement and the CO2 tax discount. Fines in the case of incorrect or detained information.
6	**Description:**	In connection with the implementation of the CO2 tax also a subsidy for CO2 tax descount for energy intensive industries was introduced. However, a condition for getting the CO2 tax discount is an agreement on improvements in energy efficiency. Industries under the CO2 allowance scheme are no longer covered by this arrangement. The aggrement scheme was significantly revised in 1996.
7	**Objective:**	Energy efficiency at energy-intensive enterprises and to reduce the effect of the CO2 tax on energy intensive industries' competitiveness.
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Voluntary agreements, economic (financial)
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	1993
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	Subsidies (CO2 tax discount) approx. DKK 130 mill. annually (in 2004)
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Danish Energy Authority
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	See the Effort Analysis(1)
21	**2005:**	
22	**2010 or (2008-2012)/5:**	See the Effort Analysis(1)
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	See the Effort Analysis(1)
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5 and the Effort Analysis(1)
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5 and the Effort Analysis(1)
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	Yes. To the extent that the effect deviates from the effect in 2003 - the latest year with energy statistics on which the energy projection is based - it is included in the projection.
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	
41	**References and links for further information:**	http://www.ens.dk/sw11574.asp http://www.ens.dk/lovgivning http://www.ens.dk/sw12329.asp (1) See Annex B2 and http://www.mst.dk/transport/01041000.htm, where estimation of effects relate to the revised agreement scheme from 1996.
42	**Comments:**	(EN-18)

BU-2	Savings activities by elec. grid, gas and district heating companies (incl. for the domestic and public sectors)	
1	**Sector:**	Energy, Business
2	**Name*:**	Savings activities by elec. grid, gas and district heating companies (incl. for the domestic and public sectors)
3	**Origin:**	National measure
4	**Legal basis:**	Electricity grid companies: The Electricity Supply Act District heating companies: The Heating Supply Act Gas distribution companies: The Natural Gas Supply Act
5	**Domestic compliance and enforcement:**	Fines in the case of failures in fulfillment of the energy suppy companies' obligations
6	**Description:**	The energy companies carry out campaigns and energy saving activities aimed at energy consumers. A special advisory service is offered to consumers with large consumptions. The effort is most significant with regard to electricity. The effort is financed by the consumers via the consumers' electricity price.
7	**Objective:**	Energy savings, reduced energy costs
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Information (advice, education, campaigns), Regulation (administrative)
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	1999 og 2000 (in its present form)
12	**Date for adoption of legislation, if different:**	2000 og 2001
13	**Date of beginning:**	2001 in its present form (the electricity companies have worked with energy savings since 1992-93)
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	The energy companies' information effort amount to approx. DKK 240 mill. annually
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Danish Energy Authority
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	Electricity companies: Annual electricity savings amount to approx. 150 TWh
22	**2010 or (2008-2012)/5:**	
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	The CO2 shadow price of the electricity companies' information effort amount to approx. DKK 40 per tonnes of CO2
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the "with measures" GHG projection) ?:**	

BU-3	Tax on HFCs, PFCs and SF6	
1	**Sector:**	Business (the industrial gases)
2	**Name*:**	Tax on HFCs, PFCs and SF6
3	**Origin:**	National measure
4	**Legal basis:**	Act no. 208 of 22 March 2001 on tax on ozone depleting substances and greenhouse gases. Latest amendment is in Act no. 127 of 27 February 2004.
5	**Domestic compliance and enforcement:**	Fines. The Ministry of taxation and its institutions is responsible for the enforcement of domestic compliance.
6	**Description:**	Tax on HFC, SF6 og PFC. The tax is differentiated in accordance with the global warming potential of the substance with DKK 0.1 per kilogramme of CO2 equivalents as the general principle and with DKK 400 per kilogramme of CO2 equivalents as a general upper limit.
7	**Objective:**	Reduction of HFCs, PFCs and SF6 emissions
8	**Greenhouse gas(es) affected:**	HFCs, PFCs and SF6
9	**Type of measure:**	Fiscal (tax)
10	**Status of implementation:**	Implementedt
11	**Date for the political adoption:**	15 December 2000
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	1 March 2001
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Ministry of taxation
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	-0.05 mill. tonnes CO2-eq. (a)
21	**2005:**	
22	**2010 or (2008-2012)/5:**	-0,4 mill. tonnes CO2-eq. (a)
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	In average DKK 200 per tonnes of CO2-eq. (a)
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5 and the Effort Analysis(1)
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	Reduce consumption and emissions of HFCs, PFCs and SF6 - e.g. by providing incentives to focus on leakages of these substances from major plants or uses. See also Chapter 5, the effort analysis(1) and the effects shown above.
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	Yes
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	Yes (a)
41	**References and links for further information:**	(1) See Annex B2 and http://www.mst.dk/transport/01041000.htm
42	**Comments:**	(a) Reductions and costs have been estimated as the total effect of taxes on and regulation of HFC's, PFCs and SF6.

BU-4	Regulation of use of HFCs, PFCs and SF6 (phasing out most of the uses)	
1	**Sector:**	Business (the industrial gases)
2	**Name*:**	Regulation of use of HFCs, PFCs and SF6 (phasing out most of the uses)
3	**Origin:**	National measure
4	**Legal basis:**	Statutory order no. 552 of 2 July 2002 on regulation of certain industrial greenhouse gases.
5	**Domestic compliance and enforcement:**	Fines and/or up to 2 years of imprisonment.
6	**Description:**	Import, sale and use of the substances or new products containing the substances is forbidden from 1 January 2006 with some exceptions.
7	**Objective:**	Reduction of HFCs, PFCs and SF6 emissions
8	**Greenhouse gas(es) affected:**	HFCs, PFCs and SF6
9	**Type of measure:**	Regulation (administrative, ban)
10	**Status of implementation:**	Implemented (full effect from 1 January 2006)
11	**Date for the political adoption:**	2 July 2002
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	In general 1 January 2006, but for some uses before
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Danish Environmental Protection Agency
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	-0.05 mill. tonnes CO2-eq. (a)
21	**2005:**	
22	**2010 or (2008-2012)/5:**	-0,4 mill. tonnes CO2-eq. (a)
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	In average DKK 200 per tonnes of CO2-eq. (a)
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5 and the Effort Analysis(1)
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	Reduce consumption and emissions of HFCs, PFCs and SF6 - e.g. by making it necessary for users to focus on leakages of these substances from major plants or uses. See also Chapter 5, the effort analysis(1) and the effects shown above.
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	Yes
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	Yes (a)
41	**References and links for further information:**	(1) See Annex B2 and http://www.mst.dk/transport/01041000.htm
42	**Comments:**	(a) Reductions and costs have been estimated as the total effect of taxes on and regulation of HFC's, PFCs and SF6.

BU-5	The enterprise scheme on HFCs	
1	**Sector:**	Business (the industrial gases)
2	**Name*:**	The enterprise scheme on HFCs
3	**Origin:**	National measure
4	**Legal basis:**	Statutory order awaits the approval of the European Commission
5	**Domestic compliance and enforcement:**	
6	**Description:**	A general enterprise scheme will be administeret by the Danish Environmental Protection Agency. The total budget for the period 2004-2007 is DKK 144 mill. where the budget for 2005 amount to DKK 26.3 mill. The general objective of the enterprise scheme is to promote better conditions for environmental improvements in enterprises. In the general enterprise scheme is included a budget share of DKK 12 mill. 2005-2007 for projects with the development of alternatives to HFCs in the refrigerating business and the establishment of a knowledge center for HFC-free cooling as the objectives.
7	**Objective:**	Reduction of HFCs use and emissions in the cooling business
8	**Greenhouse gas(es) affected:**	HFCs
9	**Type of measure:**	Economic (subsidy)
10	**Status of implementation:**	To be implemented in 2005
11	**Date for the political adoption:**	January 2005
12	**Date for adoption of legislation, if different:**	Statutory order awaits the approval of the European Commission
13	**Date of beginning:**	2005
14	**Date of end, if relevant:**	2007
15	**Allocated resources, if any:**	DKK 12 mill. 2005-2007
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Danish Environmental Protection Agency
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	
22	**2010 or (2008-2012)/5:**	
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	Will act as support for the Statutory order on phase out (see BU-4)
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	Will act as support for the Statutory order on phase out (see BU-4)
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	
41	**References and links for further information:**	http://www.mst.dk/tvær/05020000.htm
42	**Comments:**	

BU-6	Circular on energy-efficiency in state institutions	
1	**Sector:**	Energy, public service
2	**Name*:**	Circular on energy-efficiency in state institutions
3	**Origin:**	National measure
4	**Legal basis:**	Circular no. 27 of 19 April 2005
5	**Domestic compliance and enforcement:**	This is based on the general principle of self-governance in state institutions. According to this each ministry and its minister is responsible for being in compliance with the circular.
6	**Description:**	The circular require state institutions to: · Focus on energy efficiency in their behaviour · Buy energy efficient products · Oprerate state buildings in an energy efficient manner · Report on, and make public, figures on consumption of energy and water and energy labelling of buildings
7	**Objective:**	To limit central authorities' consumption of energy and water through promotion of energy efficient purchase and energy efficient behaviour in state institutions and to operate and maintain buildings owned or rented by the state in an energy efficient manner.
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Regulation (administrative)
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	19 April 2005 (Signed by the Minister for Transport and Energy)
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	27 April 2005
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	The Minister for Transport and Energy / The Danish Energy Authority is responsible for the circular. The individual ministries and state institutions are responsible for the implementation of the circular.
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	
22	**2010 or (2008-2012)/5:**	
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	It is estimated that the effect in the future will be the same as in 2003. Since 2003 is the latest year of energy statistics on which the projection of energy consumption is based, no additional effects have been included in the projection.
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	
41	**References and links for further information:**	http://www.ens.dk/lovgivning http://www.ens.dk/sw11614.asp http://www.ens.dk/sw23194.asp
42	**Comments:**	(EN-20)

BU-7	Electricity Saving Trust – campaigns and A club to promote energy efficient appliances	
1	**Sector:**	Energi, offentlig service
2	**Name*:**	Electricity Saving Trust – campaigns and A club to promote energy efficient appliances
3	**Origin:**	National measure
4	**Legal basis:**	Act no. 1209 of 27 December 1996 Act no. 819 of 3 November 1997
5	**Domestic compliance and enforcement:**	Fine and/or pay back of unwarranted subsidy
6	**Description:**	The task of the Electricity Saving Trust includes th promotion of efficient electric appliances etc. and electric heating conversion in households and the public sector. The Trust are making use of measures such as national campaigns, efforts to influence the market, voluntary agreements and efforts to raise awareness on the consumption. The budget is approx. DKK 90-100 mill. annually.
7	**Objective:**	Electricity savings, technology development and market promotion of energy efficient products and appliances.
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Information (campaigns), agreements, economic (subsidies)
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	1996
12	**Date for adoption of legislation, if different:**	1 December 1996
13	**Date of beginning:**	1997
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	DKK approx. 90-100 mill. annually. The Trust is financed by households and public institutions via a special energy saving contribution on the electricity bill.
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	DKK approx. 90-100 mill. annually.
18	**Implementering entity or entities:**	The Minister for Transport and Energy / The Danish Energy Authority
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	In the period 1997-2007 the annual electricity savings is expected to reach an average of approx. 100 GWh.
22	**2010 or (2008-2012)/5:**	
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	According to the Trust, the cost of the effort in the period 1997-2007 is expected to reach an average of approx. DKK 120 per tonnes of CO2.
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	It is estimated that the effect in the future will be the same as in 2003. Since 2003 is the latest year of energy statistics on which the projection of energy consumption is based, no additional effects have been included in the projection.
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	
41	**References and links for further information:**	http://www.ens.dk/lovgivning http://www.ens.dk/sw13892.asp http://www.ens.dk/sw20018.asp
42	**Comments:**	(EN-21)

AF-1	Action Plan for the Aquatic Environment I+II and Action Plan for Sustainable Agriculture	
1	**Sector:**	Agriculture (/Land-use)
2	**Name*:**	Action Plan for the Aquatic Environment I+II and Action Plan for Sustainable Agriculture
3	**Origin:**	National measure
4	**Legal basis:**	
5	**Domestic compliance and enforcement:**	
6	**Description:**	The action plans contain several measures e.g. with the objective to increase the area with winter green fields and better utilisation of manure.
7	**Objective:**	Reduction of nitrate pollution to the aquatic environment, i.e. reduction of N run-off from agriculture by 100,000 tonnes N per year.
8	**Greenhouse gas(es) affected:**	N2O
9	**Type of measure:**	Regulation (order)
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	1991 og 1998
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	State and county authorities
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	-1.6 mill. tonnes CO2-eq. (a)
21	**2005:**	
22	**2010 or (2008-2012)/5:**	-1.9 mill. tonnes CO2-eq. (a) in (1), however this could be too low according to new estimates: -2,2 mio.t.CO2ækv.(2)
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5 and the Effort Analysis(1)
32	**Side effects – on other GHGs or GHG emitting activities:**	The action plans have especially reduced emissions of N2O, but it is likely that they have also reduced emissions of methane from storages of manure and emissions of CO2 through an increased storage of carbon in agricutural soils.
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5, the effort analysis(1) and the effects shown above.
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the "with measures" GHG projection) ?:**	Yes
39	***Is the effect of the measure included in the "with additional measures" GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the "without measures (since 1990)" - projection ?:**	Yes (a)
41	**References and links for further information:**	Olesen et al. (2004) (1) See Annex B2 and http://www.mst.dk/transport/01041000.htm (2) Gyldenkærne et al. (2005) - in preparetion
42	**Comments:**	(a) The total effect of the Action Plan for the Aquatic Environment I+II and Action Plan for Sustainable Agriculture and the NPO Action Plan

AF-2	Action Plan for the Aquatic Environment III	
1	**Sector:**	Agriculture
2	**Name*:**	Action Plan for the Aquatic Environment III
3	**Origin:**	National measure
4	**Legal basis:**	
5	**Domestic compliance and enforcement:**	
6	**Description:**	The plan contain several measures, where the most import in relation to greenhouse gas emissions are: · Establishment of 4000 ha wetlands in 2004 and 2005. · Making the rules on catch crops more rigorous. · Making the rules on exploitation of N in animal manure more rigorous. · Additional environmentally friendly measures in crop farming.
7	**Objective:**	Protection of the aquatic environment from nitrate and phosphorus pollution.
8	**Greenhouse gas(es) affected:**	N_2O
9	**Type of measure:**	Regulation (order), economic
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	2004
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	State and county authorities
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	
22	**2010 or (2008-2012)/5:**	-0,15 without taking into account the effects of catch crops / with: -0,20
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5 and the effects shown above.
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	Yes
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	No, implemented after 2001
41	**References and links for further information:**	Olesen (2004)
42	**Comments:**	

AF-3	Ban on burning straw on fields	
1	**Sector:**	Agriculture
2	**Name*:**	Ban on burning straw on fields
3	**Origin:**	National measure
4	**Legal basis:**	Act no. 68 of 24 January 1989 on environment protection as amended in Act. No. 753 of 25 August 2001
5	**Domestic compliance and enforcement:**	
6	**Description:**	Ban on burning straw on fields
7	**Objective:**	Less air pollution
8	**Greenhouse gas(es) affected:**	CO2, CH4, N2O
9	**Type of measure:**	Regulation (order)
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	1989
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	State and county authorities
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	
22	**2010 or (2008-2012)/5:**	
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	CO2 emissions will be reduced both from increased return of straw in order to increase stored soil carbon and from incresed use of straw as substitute for fossil fuel in energy supply. Emissions of methane and nitrous oxide from burning of straw will be reduced. However, increased decomposition of straw residues will increase emissions of nitrous oxide to some extent.
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	No
41	**References and links for further information:**	
42	**Comments:**	

AF-4a	Ammonia action plan and the new statutory order on manure: Optimisation of manure handling during housing.	
1	**Sector:**	Agriculture (/Land-use)
2	**Name*:**	Ammonia action plan and the new statutory order on manure: Optimisation of manure handling during housing.
3	**Origin:**	National measure
4	**Legal basis:**	Statutory order no. 753 of 25 August 2001 on fur animal farms Statutory order no. 604 of 15 July 2002 on professional animal farming, manure and slurry etc.
5	**Domestic compliance and enforcement:**	Fines and/or up to 2 years of imprisonment
6	**Description:**	Ammonia action plan and the new statutory order on manure: Optimisation of manure handling during housing for cattle, pigs, poultry and fur animals e.g. cleaning in fur animal houses at least once a week and a maximum time of 6 hours from field application of manure to incorporation and cover requirements etc..
7	**Objective:**	Protection of the aquatic environment from nitrate pollution.
8	**Greenhouse gas(es) affected:**	N2O
9	**Type of measure:**	Regulation (order)
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	Cleaning: 1 August 2002 - 1 August 2007 Storage: See the data sheet on AF-4b Spreading: See the data sheet on AF-4c.
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	State and county authorities
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	
22	**2010 or (2008-2012)/5:**	-0,03 (a)
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	An element in the Ammonia Action Plan.
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5 and the effects shown above.
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	Yes
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	No, implemented after 2001
41	**References and links for further information:**	
42	**Comments:**	(a) The total effect of the Ammonia Action Plan (Ban on spreading, cover on manure, reduced storage time, ban on ammonia treatment of straw)

AF-4b	Ammonia action plan and the new statutory order on manure: Rules on covering storage facilities.	
1	**Sector:**	Agriculture (/Land-use)
2	**Name*:**	Ammonia action plan and the new statutory order on manure: Rules on covering storage facilities.
3	**Origin:**	National measure and in part EU legislation
4	**Legal basis:**	Statutory order no. 604 of 15 July 2002 on professional animal farming, manure and slurry etc., (Ammonia action plan, Council directive no. 91/767/EC of 12 December 1991 on the protection of waters against nitrate pollution from agriculture)
5	**Domestic compliance and enforcement:**	Fines and/or up to 2 years of imprisonment
6	**Description:**	Order with rules on covering storage facilities for solid manure (compost layer or another air tight material) and slurry tanks (floating layer, tent or similar).
7	**Objective:**	Protection of the aquatic environment from nitrate pollution.
8	**Greenhouse gas(es) affected:**	N2O
9	**Type of measure:**	Regulation (order)
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	Spring 2001
12	**Date for adoption of legislation, if different:**	15 July 2002
13	**Date of beginning:**	Solid manure: 1 August 2004 Slurry: 1 March 2003
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	State and county authorities
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	
22	**2010 or (2008-2012)/5:**	-0,03 (a)
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	An element in the Ammonia Action Plan.
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5 and the effects shown above.
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	Yes
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	No, implementet after 2001
41	**References and links for further information:**	Olesen et al. (2004): "Forberedelse af Vandmiljøplan III" (Preparations for the Action Plan on the Aquatic Environment III)
42	**Comments:**	(a) The total effect of the Ammonia Action Plan (Ban on spreading, cover on manure, reduced storage time, ban on ammonia treatment of straw)

AF-4c	Ammonia action plan and the new statutory order on manure: Ban on surface spreading of manure	
1	**Sector:**	Agriculture
2	**Name*:**	Ammonia action plan and the new statutory order on manure: Ban on surface spreading of manure
3	**Origin:**	National measure and in part EU legislation
4	**Legal basis:**	Statutory order no. 604 of 15 July 2002 on professional animal farming, manure and slurry etc., (Ammonia action plan, Council directive no. 91/767/EC of 12 December 1991 on the protection of waters against nitrate pollution from agriculture)
5	**Domestic compliance and enforcement:**	Fines and/or up to 2 years of imprisonment
6	**Description:**	With spreading of manure with towing tubes instead of ordinary broad surface spreading the evaporation of ammonia will be reduced. Also emissions of nitrous oxide will be reduced.
7	**Objective:**	Protection of the aquatic environment from nitrate pollution.
8	**Greenhouse gas(es) affected:**	N2O
9	**Type of measure:**	Regulation (order)
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	Spring 2001
12	**Date for adoption of legislation, if different:**	15 July 2002
13	**Date of beginning:**	1 August 2003
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	State and county authorities
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	
22	**2010 or (2008-2012)/5:**	0
23	**2015 or (2013-2017)/5:**	0
24	**2020:**	0
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	There will be a risk of N2O formation due to anaerobic conditions. Spreading of manure with towing tubes will increase energy consumption and therefore also CO2 emissions. It is estimated that the measure - in total - has no effect on greenhouse gas emissions.
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	N content in manure applied will increase due to reduced evaporation, and the need for commercial fertiliser will decrease.
35	**Interaction with other policies and measures:**	An element in the Ammonia Action Plan.
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	Yes
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	No, implemented after 2001
41	**References and links for further information:**	Olesen et al. (2001), Olesen et al. (2004)
42	**Comments:**	

AF-4d	Ammonia action plan and the new statutory order on manure: Reduction of the time on field surfaces.	
1	**Sector:**	Agriculture (/Land-use)
2	**Name*:**	Ammonia action plan and the new statutory order on manure: Reduction of the time on field surfaces.
3	**Origin:**	National measure and in part EU legislation
4	**Legal basis:**	Statutory order no. 604 of 15 July 2002 on professional animal farming, manure and slurry etc., (Ammonia action plan, Council directive no. 91/767/EC of 12 December 1991 on the protection of waters against nitrate pollution from agriculture)
5	**Domestic compliance and enforcement:**	Fines and/or up to 2 years of imprisonment
6	**Description:**	Manure applied to areas without crops shall be ploughed in within 6 hours.
7	**Objective:**	Protection of the aquatic environment from nitrate pollution.
8	**Greenhouse gas(es) affected:**	N2O
9	**Type of measure:**	Regulation (order)
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	Spring 2001
12	**Date for adoption of legislation, if different:**	15 July 2002
13	**Date of beginning:**	1 August 2002
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	State and county authorities
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	-0,03 (a)
22	**2010 or (2008-2012)/5:**	
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	N content in manure applied will increase due to reduced evaporation, and the need for commercial fertiliser will decrease.
35	**Interaction with other policies and measures:**	An element in the Ammonia Action Plan.
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5 and the effects shown above.
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the "with measures" GHG projection) ?:**	Yes
39	***Is the effect of the measure included in the "with additional measures" GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the "without measures (since 1990)" - projection ?:**	No, implemented after 2001
41	**References and links for further information:**	Olesen et al. (2004): Forberedelse af Vandmiljøplan III (Preparations for the Action Plan on the Aquatic Environment III)
42	**Comments:**	(a) The total effect of the Ammonia Action Plan (Ban on spreading, cover on manure, reduced storage time, ban on ammonia treatment of straw)

AF-4e	Ammonia action plan and the new statutory order on manure: Ban on ammonia treatment of straw.	
1	**Sector:**	Agriculture (/Land-use)
2	**Name*:**	Ammonia action plan and the new statutory order on manure: Ban on ammonia treatment of straw.
3	**Origin:**	National measure and in part EU legislation
4	**Legal basis:**	Statutory order no. 604 of 15 July 2002 on professional animal farming, manure and slurry etc., (Ammonia action plan, Council directive no. 91/767/EC of 12 December 1991 on the protection of waters against nitrate pollution from agriculture)
5	**Domestic compliance and enforcement:**	Fines and/or up to 2 years of imprisonment
6	**Description:**	Ban on ammonia treatment of straw.
7	**Objective:**	Protection of the aquatic environment from nitrate pollution.
8	**Greenhouse gas(es) affected:**	N2O
9	**Type of measure:**	Regulation (order)
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	Spring 2001
12	**Date for adoption of legislation, if different:**	15 July 2002
13	**Date of beginning:**	1 August 2002
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	State and county authorities
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	-0,03 (a)
22	**2010 or (2008-2012)/5:**	
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	An element in the Ammonia Action Plan.
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5 and the effects shown above.
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	Yes
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	No, implemented after 2001
41	**References and links for further information:**	Olesen et al. (2004): Forberedelse af Vandmiljøplan III (Preparations for the Action Plan on the Aquatic Environment III)
42	**Comments:**	(a) The total effect of the Ammonia Action Plan (Ban on spreading, cover on manure, reduced storage time, ban on ammonia treatment of straw)

AF-5	Planting of windbreaks	
1	**Sector:**	Agriculture
2	**Name*:**	Planting of windbreaks
3	**Origin:**	National measure
4	**Legal basis:**	
5	**Domestic compliance and enforcement:**	
6	**Description:**	
7	**Objective:**	Binding of CO2
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Economic (subsidies)
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	1960s
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	State
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	
22	**2010 or (2008-2012)/5:**	0,14
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5 and the effects shown above.
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	
41	**References and links for further information:**	
42	**Comments:**	

AF-6	Biogas plants	
1	**Sector:**	Agriculture and Energy
2	**Name*:**	Biogas plants
3	**Origin:**	National measure
4	**Legal basis:**	
5	**Domestic compliance and enforcement:**	
6	**Description:**	
7	**Objective:**	Reduced CO2 and methane emissions and better exploitation of manure
8	**Greenhouse gas(es) affected:**	CO2, N2O og CH4
9	**Type of measure:**	Economic (subsidies)
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	1987
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	State
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	-0,2
21	**2005:**	
22	**2010 or (2008-2012)/5:**	-0,5
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5 and the effects shown above.
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	Yes
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	No
41	**References and links for further information:**	
42	**Comments:**	

AF-7	Subsidies scheme for private afforestation on agricultural land (increase the forest area in Denmark)	
1	**Sector:**	Forstry / Land-use
2	**Name*:**	Subsidies scheme for private afforestation on agricultural land (increase the forest area in Denmark)
3	**Origin:**	National measure and in part EU legislation
4	**Legal basis:**	Act no. 959 of 2 November 1996 Statutory Order no. 80 of 30 January 1997 on subsidies for private afforestation Council resolution no. 1257/1999, Chapter 8.
5	**Domestic compliance and enforcement:**	Approved subsidies may be canceled in part or totally. Pay back of subsidies already payed can be required with interests. Fines is also possible in servere cases.
6	**Description:**	Private owners of agricultural land can get grants for establishment of broadleaves or conifer forests, nursing of these in the first 5 years, establishment of fences, mapping and or accounting of the area as well as income compensation in the first 10 years - if the forest will be established in an area planned for afforestation.
7	**Objective:**	Promote private afforestation in achieving the target of an increse in forest area by 450,000-500,000 ha in 100 years.
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Economic (subsidies)
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	30 January 1997
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	8 February 1997
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Danish Forest and Nature Agency
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	-0.074 (a)
21	**2005:**	
22	**2010 or (2008-2012)/5:**	-0,262 (a)
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5 and the effects shown above.
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	Yes
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	
41	**References and links for further information:**	
42	**Comments:**	(a) Total effect of private afforestation and the planned public afforestation.

AF-8	Public afforestation (state, counties and municipalities)	
1	**Sector:**	Forstry / Land-use
2	**Name*:**	Public afforestation (state, counties and municipalities)
3	**Origin:**	National measure
4	**Legal basis:**	
5	**Domestic compliance and enforcement:**	
6	**Description:**	
7	**Objective:**	Public afforestation in achieving the target of an increse in forest area by 450,000-500,000 ha in 100 years for purposes such as outdoor recreation, groundwater protection and CO2 sequestration.
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	State: Regulation (adopted target, with financial support through the annual state budget) / Counties and Municipalities: Voluntary agreements
10	**Status of implementation:**	Ongoring implementation through annual budgets
11	**Date for the political adoption:**	
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Danish Forest and Nature Agency, counties and municipalities
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	-0,074 (a)
21	**2005:**	
22	**2010 or (2008-2012)/5:**	-0,262 (a)
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5 and the effects shown above.
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	
41	**References and links for further information:**	
42	**Comments:**	(a) Total effect of private afforestation and the planned public afforestation.

DO-1	Energy labelling of small and large buildings (incl. public sector and business)	
1	**Sector:**	Energy, Domestic sector
2	**Name*:**	Energy labelling of small and large buildings (incl. public sector and business)
3	**Origin:**	National measure
4	**Legal basis:**	Act no. 485 of 12 June 1996 on promotion of energy and water savings in buildings
5	**Domestic compliance and enforcement:**	Fines in the case of missing or inadequate labelling
6	**Description:**	Sales of small buildnings (under 1500 m2) shall be accompanied with energy labels recommending the buyer how to achieve cost effective energy saving measures. The requirement for larger buildings is the establishment of an energy management plan containing an annual review of the building and its energy consumption and potential energy savings.
7	**Objective:**	Promotion of energy savings.
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Information, Regulation (administrative, order)
10	**Status of implementation:**	Implemented. The act is under revision in order to implement the EU building directive.
11	**Date for the political adoption:**	12 June 1996
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	1 January 1997
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	Financed by the users
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Danish Energy Authority
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	See the Effort Analysis(1)
21	**2005:**	
22	**2010 or (2008-2012)/5:**	See the Effort Analysis(1)
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	See the Effort Analysis(1)
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5 and the Effort Analysis(1)
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5 and the Effort Analysis(1)
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the "with measures" GHG projection) ?:**	It is estimated that the effect in the future will be the same as in 2003. Since 2003 is the latest year of energy statistics on which the projection of energy consumption is based, no additional effects have been included in the projection.
39	***Is the effect of the measure included in the "with additional measures" GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the "without measures (since 1990)" - projection ?:**	Yes
41	**References and links for further information:**	http://www.ens.dk/lovgivning http://www.ens.dk/sw13867.asp http://www.ens.dk/sw13289.asp (1) See Annex B2 and http://www.mst.dk/transport/01041000.htm
42	**Comments:**	(EN-22)

DO-2	Energy labelling of electric appliances	
1	**Sector:**	Energy, Domestic sector
2	**Name*:**	Energy labelling of electric appliances
3	**Origin:**	EU legislation (Common and Co-ordinated Policies and Measures - CCPM)
4	**Legal basis:**	- Act no. 450 of 31 May 2000 on promotion of energy savings and statutory orders cf. comments - Council directive 92/75/EC of 22 September 1992 - the framework directive on energy labelling and the Commissions directives cf. comments
5	**Domestic compliance and enforcement:**	Fines in the case of missing or inadequate labelling
6	**Description:**	The EU energy labelling directives on household appliances are mandatory and all products under these directives must be labelled. The energy consumption of the appliances have to be shown in a scale from A to G, where A represent the lowest energy consumption.
7	**Objective:**	To promote development and use of energy efficient appliances with the purpose of reducing energy consumption and CO2 emissions.
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Information
10	**Status of implementation:**	Implemented. In the EU work on additional directives is on-going, aiming for the inclusion of other types of appliances under the labelling scheme.
11	**Date for the political adoption:**	
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	1992
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Danish Energy Authority
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	
22	**2010 or (2008-2012)/5:**	
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	It is estimated that the effect in the future will be the same as in 2003. Since 2003 is the latest year of energy statistics on which the projection of energy consumption is based, no additional effects have been included in the projection.
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	
41	**References and links for further information:**	http://www.ens.dk/lovgivning http://www.ens.dk/sw11747.asp http://www.ens.dk/sw12327.asp
42	**Comments:** Council directives: 2003/66/EC of 3 July 2003 (refrigerators – freezers) 2002/40/EC of 8 May 2002 (electric ovens) 2002/31/EC of 22 March 2002 (air-conditioners) 99/9/EC of 26 February 1999 amending 97/17/EC (dishwashers) 98/11/EC of 27 January 1998 (lamps) 96/89/EC of 17 December 1996 amending 95/12/EC (washing machines) 96/60/EC of 16 September 1996 (washer-driers) 95/13 EC of 23 May 1995 (tumble driers) 92/75/EC of 22 September 1992	(EN-23) Statutory orders: 2003/66: Administrative order no. 693 of 17 June 2004 on energy labelling and required information concerning household electric refrigerators, freezers and their combinations. 2002/40: Administrative order no. 1096 of 9 December 2002 on energy labelling and required information concerning household electric ovens. 2002/31: Administrative order no. 1097 of 9 December 2002 on energy labelling and required information concerning household electric air conditioners. 99/9 & 97/17: Administrative order no. 59 of 29 January 1999 on energy labelling and required information concerning household electric dishwashers. 98/11: Administrative order no. 572 of 2 July 1999 on energy labelling and required information concerning household electric lamps. 96/89 & 95/12: Administrative order no. 318 of 7 May 2002 on energy labelling and required information concerning household electric washing machines. 96/60: Administrative order no. 320 of 20 May 2002 on energy labelling and required information concerning household electric washer-driers. 95/13: Administrative order no. 319 of 7 May 2002 on energy labelling and required information concerning household electric tumble driers. 92/75: Act no. 450 of 31 May 2000 on the promotion of savings in energy consumption

WA-1	Obligation to send combustible waste to incineration (in practice a ban on landfilling).	
1	**Sector:**	Waste
2	**Name*:**	Obligation to send combustible waste to incineration (in practice a ban on landfilling).
3	**Origin:**	National measure
4	**Legal basis:**	Statutory order no. 581 of 24 june 1996 om waste as amended in statutory order no. 619 of 27 June 2000 on waste.
5	**Domestic compliance and enforcement:**	Fines and/or up to 2 years of imprisonment.
6	**Description:**	
7	**Objective:**	Reduce landfilling, energy production, greater recycling, CH4 reduction
8	**Greenhouse gas(es) affected:**	CH4 (methane)
9	**Type of measure:**	Regulation (administative)
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	1994
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	1 January 1997
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Municipalities
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	0,021
21	**2005:**	
22	**2010 or (2008-2012)/5:**	0,333
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5 and the Effort Analysis(1)
32	**Side effects – on other GHGs or GHG emitting activities:**	Reductions of CO2 emission in energy supply when biomass in waste for incineration substitutes fossil fuel combustion. All incineration plants in Denmark are connected to district heating grids. However, this effect has not been quantified separately.
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5, the Effort Analysis(1) and the effects shown above
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	Yes
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	Yes
41	**References and links for further information:**	(1) See Annex B2 and http://www.mst.dk/transport/01041000.htm
42	**Comments:**	

WA-2	The waste tax	
1	**Sector:**	Waste
2	**Name*:**	The waste tax
3	**Origin:**	National measure
4	**Legal basis:**	Act no. 570 of 3 August 1998 on waste tax and tax on raw materials (amendments, originally introduced in 1986) Statutory order no. 638 of 3 July 1997 on waste tax as amended in statutory order no. 655 of 27 June 2000
5	**Domestic compliance and enforcement:**	
6	**Description:**	A tax is imposed on waste for incineration or landfilling. The taxes are differentiated depending on which facility the waste is going to be treated.
7	**Objective:**	Greater recycling and least possible landfilling.
8	**Greenhouse gas(es) affected:**	CH_4 (methane)
9	**Type of measure:**	Fiscal (tax)
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	1 January 1987
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Ministry of Taxation
19	**Estimated effect (mill. tonnes CO_2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	
22	**2010 or (2008-2012)/5:**	
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	
41	**References and links for further information:**	Danish Environmental Protection Agency (1997), Waste Center Denmark (www.mst.dk/udgiv/publikationer/2003/87-7972-958-4/html/)
42	**Comments:**	

WA-3	Weight-and-volume-based packaging taxes	
1	**Sector:**	Waste
2	**Name*:**	Weight-and-volume-based packaging taxes
3	**Origin:**	National measure
4	**Legal basis:**	Act no 101 of 13 Frebuary 2001 on tax on packings, bags, service and PVC folios Statutory order no. 111 of 5 February 2000 on tires Statutory order of 22 March 2001 on CFCs Statutory order no. 1060 of 4 December 2000 on lead accumulators
5	**Domestic compliance and enforcement:**	
6	**Description:**	Taxes or compensations on several products. E.g. taxes on packings, tires, lead accumulators, CFCs and bags.
7	**Objective:**	The objectives of both weight and volume -based packaging taxes are to reduce the amount of packaging waste and its impacts on the environment. The taxes provide for economic incentives to behave in accordance with these objectives.
8	**Greenhouse gas(es) affected:**	CH4 (methane) and CO2
9	**Type of measure:**	Fiscal (tax)
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	
22	**2010 or (2008-2012)/5:**	
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	
41	**References and links for further information:**	Waste Centre Denmark (www.affaldsinfo.dk/vidensbank) have an electronic industrial waste bank that collates and systematizes knowledge about industrial waste in 20 sectors.
42	**Comments:**	

WA-4	Subsidy programme – Enterprise Scheme (special scheme for businesses)	
1	**Sector:**	Waste
2	**Name*:**	Subsidy programme – Enterprise Scheme (special scheme for businesses)
3	**Origin:**	National measure
4	**Legal basis:**	Textual note no. 106 to paragraph 23 in the Act on the state budget for 2004, 2005….. A statutory order awaiting the approval of the EU Commission.
5	**Domestic compliance and enforcement:**	
6	**Description:**	
7	**Objective:**	Reduce environmental impacts from waste
8	**Greenhouse gas(es) affected:**	CH4 (methane)
9	**Type of measure:**	Economic (subsidies)
10	**Status of implementation:**	Implemented
11	**Date for the political adoption:**	December 2003
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	2004
14	**Date of end, if relevant:**	2007
15	**Allocated resources, if any:**	Approx. DKK 33 mill. over 4 years (2004-2007)
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Ministry for the Environment
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	
22	**2010 or (2008-2012)/5:**	
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	
41	**References and links for further information:**	
42	**Comments:**	

WA-5	Increased recycling of waste plastic packaging	
1	**Sector:**	Waste
2	**Name*:**	Increased recycling of waste plastic packaging
3	**Origin:**	The EU packaging directive.
4	**Legal basis:**	Statutory order no. 619 of 27 June 2000 - will be amended
5	**Domestic compliance and enforcement:**	
6	**Description:**	The collection of plastic packaging waste for recycling must be increased
7	**Objective:**	Increase the recycling of plastic packaging waste to a level of 22.5% i 2008.
8	**Greenhouse gas(es) affected:**	CO2
9	**Type of measure:**	Regulation (administrative)
10	**Status of implementation:**	Adopted, Statutory order under revision
11	**Date for the political adoption:**	
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Danish Environmental Protection Agency
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	
22	**2010 or (2008-2012)/5:**	-0,005
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	
41	**References and links for further information:**	
42	**Comments:**	

WA-6	Implementation of the EU landfill directive	
1	**Sector:**	Waste
2	**Name*:**	Implementation of the EU landfill directive
3	**Origin:**	The EU landfill directive
4	**Legal basis:**	Statutory order no. 650 of 29 June 2001 on landfills
5	**Domestic compliance and enforcement:**	
6	**Description:**	
7	**Objective:**	To introduce more rigorous demands for landfilling of waste and to lower the amount of waste going to landfills.
8	**Greenhouse gas(es) affected:**	CH4 (methane)
9	**Type of measure:**	Regulation (administrative)
10	**Status of implementation:**	Under implementation, i.e. the statutory order on landfills is under revision.
11	**Date for the political adoption:**	29 June 2001
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	
14	**Date of end, if relevant:**	
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Danish Environmental Protection Agency, counties and municipalities
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	
22	**2010 or (2008-2012)/5:**	
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	
41	**References and links for further information:**	
42	**Comments:**	

WA-7	Support for (construction of facilities for) gas recovery at landfill sites	
1	**Sector:**	Waste, measures no longer in place, but replaced with the general price supplement (See data sheet EN-3)
2	**Name*:**	Support for (construction of facilities for) gas recovery at landfill sites
3	**Origin:**	National measure
4	**Legal basis:**	The development programme for renewable energy (UVE), The Plant Fond etc.
5	**Domestic compliance and enforcement:**	
6	**Description:**	Methane is recovered at landfills. The methane collected acts as fuel in CHP production.
7	**Objective:**	Energy supply and reduction of methane emissions.
8	**Greenhouse gas(es) affected:**	CH4 (methane) and CO2 from fossil fuel based energy supply
9	**Type of measure:**	Economic (subsidies)
10	**Status of implementation:**	Until 1 January 2002 subsidies could be given to the establishment of plants for recovery and use of gas from landfills. Today, support for use of biogas from landfills is supported via the general support for using biogas, i.e. tax exception for heat production and price supplement in the case of electricity production. See data sheet EN-3.
11	**Date for the political adoption:**	
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	Mid 1980s
14	**Date of end, if relevant:**	31 December 2001
15	**Allocated resources, if any:**	
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Danish Energy Authority
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	See the Effort Analysis(1)
21	**2005:**	
22	**2010 or (2008-2012)/5:**	See the Effort Analysis(1)
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	See the Effort Analysis(1)
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5 and the Effort Analysis(1)
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	Combustion of biogas from landfills will emit e.g. NOx.
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5 and the Effort Analysis(1)
37	**Explanation, if the measure is no longer in place:**	See under Implementation above
38	***Is the effect of the measure included in the ”with measures” GHG projection) ?:**	It is estimated that the effect in the future will be the same as in 2003. Since 2003 is the latest year of energy statistics on which the projection of energy consumption is based, no additional effects have been included in the projection.
39	***Is the effect of the measure included in the ”with additional measures” GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the ”without measures (since 1990)" - projection ?:**	Yes
41	**References and links for further information:**	(1) See Annex B2 and http://www.mst.dk/transport/01041000.htm
42	**Comments:**	

WA-8	Subsidy programme for cleaner products	
1	**Sector:**	Waste, measures no longer in place
2	**Name*:**	Subsidy programme for cleaner products
3	**Origin:**	National measure
4	**Legal basis:**	Statutory order no. 731 and 732 of 9 October 1998 on subsidy programme for cleaner products and on The Environment Council on Cleaner Products as amended in Statutory order no. 784 of 4 September 2003.
5	**Domestic compliance and enforcement:**	
6	**Description:**	Under the subsidy programme for cleaner products it was possible to get grants for projects targetted at reducing the environmental impact from handling of waste generated throughout the life cycle of products as well as for projects with the objective to limit environmental problems in connection with the handling of waste.
7	**Objective:**	Reduce the impact of waste on the environmental.
8	**Greenhouse gas(es) affected:**	CH_4 (methane)
9	**Type of measure:**	Economic (subsidies)
10	**Status of implementation:**	Implemented, but no longer in place.
11	**Date for the political adoption:**	9 October 1998
12	**Date for adoption of legislation, if different:**	
13	**Date of beginning:**	1999
14	**Date of end, if relevant:**	2003
15	**Allocated resources, if any:**	Approx. DKK 100 mill. in total the period 1999-2003
16	**For planned measures, planned date of start (& end?):**	
17	**For planned measures, planned allocation of resources:**	
18	**Implementering entity or entities:**	Ministry for the Environment
19	**Estimated effect (mill. tonnes CO2-eq.) in - 1995:**	
20	**2001:**	
21	**2005:**	
22	**2010 or (2008-2012)/5:**	
23	**2015 or (2013-2017)/5:**	
24	**2020:**	
25	**2025:**	
26	**2030:**	
27	**Reduction cost, short term - with side effects:**	
28	**Reduction cost, short term - without side effects:**	
29	**Reduction cost, long term - with side effects:**	
30	**Reduction cost, long term - without side effects:**	
31	**Methods and assumptions used for the estimation of reduction effects and socio-economic costs:**	See Chapter 5
32	**Side effects – on other GHGs or GHG emitting activities:**	
33	**Side effects – on other air pollutants:**	
34	**Side effects – other:**	
35	**Interaction with other policies and measures:**	
36	**How will the policy or measure modify longer-term trends in anthropogenic GHG emissions and removals:**	See Chapter 5
37	**Explanation, if the measure is no longer in place:**	
38	***Is the effect of the measure included in the "with measures" GHG projection) ?:**	
39	***Is the effect of the measure included in the "with additional measures" GHG projection) ?:**	N.a.
40	***Is effect estimated and subtracted in the "without measures (since 1990)" - projection ?:**	
41	**References and links for further information:**	
42	**Comments:**	

Annex B2 The Effort Analysis

Summary

Since 1990, a broad range of national policies and measures have been implemented in Denmark that have impacted on emissions of greenhouse gases. Some initiatives have been implemented with CO_2 reduction as the primary aim, while other initiatives have been motivated by other aims.

The *Effort Analysis*[1] reports on Denmark's effort related to the reduction of greenhouse gas emissions undertaken on national level in the period 1990-2001, and the costs of this effort.

Under the Kyoto Protocol and the EU's subsequent Burden Sharing Agreement, Denmark has undertaken to reduce greenhouse gas emissions by 21% in 2008-2012, compared to 1990 levels[2]

One of the additional requirements of the Kyoto Protocol is that the use of flexible mechanisms must be supplemental to domestic action. The calculation of the total Danish effort is relevant in this connection.

It is therefore relevant to consider the effects of Denmark's efforts both in relation to the Kyoto accounting, and in relation to the total effect - regardless of whether the emissions reductions have been in Denmark or abroad.

In relation to the Kyoto accounting, which is based on the CO_2 impact associated with the specific emissions in Denmark, it is expected that part of the effect of the energy sector initiatives will be offset by increased electricity exports. This means that the CO_2 emissions linked to the exported electricity component have a negative impact on Denmark's Kyoto accounting, rather than on that of the electricity importing country.

Choice of measures

The *Effort Analysis* report aimed to include the most important environment and energy policy measures implemented in the period 1990-2001 that have had a significant effect on greenhouse gas emissions.

Please note that many of the measures have not been planned and adopted with the aim of contributing to the fulfilment of Denmark's Kyoto obligation, but derive from the political objective from 1990 (in the "*Energy 2000* action plan) of reducing CO_2 emissions from Denmark's energy consumption by 20% between 1988 and 2005. Thus the *Effort Analysis* does not evaluate the implemented initiatives against their original objective, but rather in rela-

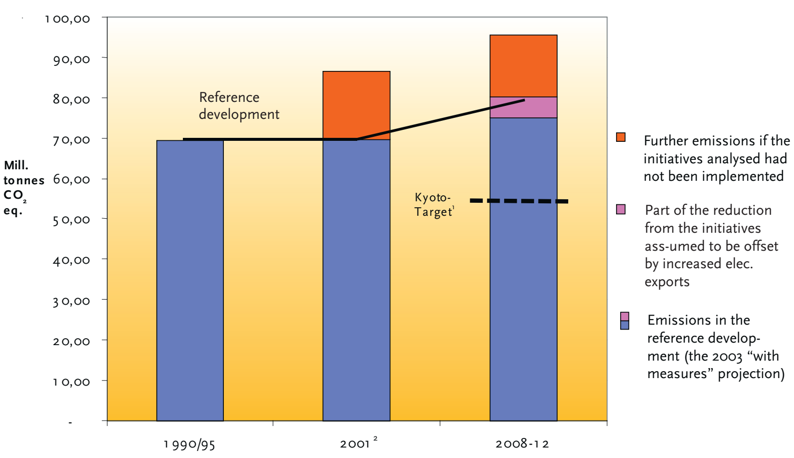
1 The Effort Analysis is published in the report "Danmarks udledning af CO_2 – indsatsen i perioden 1990-2001 og omkostningerne herved (Denmark's CO_2 Emissions – Efforts in the Period 1990-2001 and the costs involved) – Main and Annex Report, Statement from the Danish EPA no. 2 and 3, 2005 (in Danish).

2 However, in 2002 the (Environment) Council and the Commission adopted a political declaration stating that the calculation of the assigned amounts (measured in tonnes) in 2006 shall take into account Denmark's statement in connection with the Burden Sharing Agreement in 1998, i.a. stating that Denmark's reductions shall be seen in relation to an adjusted 1990 level, and that the adoption of additional common European measures is assumed.

tion to reducing greenhouse gases, and how much the implemented initiatives will contribute to the binding Kyoto objectives that exist today.

The chronological definition of the initiatives is not always straightforward. Some initiatives were introduced prior to 1990, but the implementation (and associated reduction in greenhouse gas emissions) has taken place after 1990. This is the case, for example, for the conversion to natural gas and for Action Plan for the Aquatic Environment I. The calculations in the *Effort Analysis* only include the CO_2 reductions that have taken place after 1990.

FIGURE B2-1: DEVELOPMENTS IN TOTAL CO_2 EQUIVALENT EMISSIONS, WITH AND WITHOUT THE MEASURES UNDER ANALYSIS (PRODUCTION-BASED CALCULATION)



[1] The reduction requirement in the figure has been calculated as Denmark's legal obligation. i.e. the figure has not been corrected for the particularly large electricity imports in the 1990 base year. However, in 2002 the (Environment) Council and the Commission adopted a political declaration stating that the calculation of the assigned amounts (measured in tonnes) in 2006 shall take into account Denmark's statement in connection with the Burden Sharing Agreement in 1998, e.g. stating that Denmark's reductions shall be seen in relation to an adjusted 1990 level. When this factor is taken into account, the reduction requirement would be reduced by up to 5 million tonnes annually.

2 The reduction calculated in 2001 includes the full effects, i.e. it includes the CO2 reductions that domestic actions have led to in other countries.

Denmark's effort in the period 1990-2001

The *Effort Analysis* evaluates the effects of measures implemented in the period 1990-2001 in relation to the actual emissions in 2001, and in relation to the expected average annual emissions in 2008-2012, as laid down in the base projection used as a basis for the Danish climate strategy from February 2003 (i.e. the previous 'with measures' projection, which only took into account the effects of measures implemented or adopted before the Climate Strategy). Initiatives adopted after 2001 are therefore not included in the results of the *Effort Analysis*, and hence these results cannot be used as a total status report for the Danish efforts in relation to the Kyoto target.

The *Effort Analysis* reports on and calculates the Danish initiatives by considering their total effect, regardless of whether they have resulted in reductions in emissions in Denmark or abroad. However, the analysed initiatives have also been assessed in relation to Denmark's international obligations under the Kyoto Protocol, based on the CO_2 impact associated with the specific emissions in Denmark. Figure B2-1 illustrates how much greater Denmark's CO_2 emissions would have been in 2001 and in 2008-12 if the initiatives analysed had not been implemented.

As Figure B2-1 shows, the initiatives under consideration are estimated to give rise to CO_2 reductions of approx. 20.6 million tonnes per year in the 2008-12 period. This expresses the total effect of Denmark's effort in the 1990-2001 period. It also shows (see below) that part of the effect of energy sector initiatives is expected to be offset by increased electricity exports, such that in relation to the Kyoto emission accounting, the initiatives under consideration are estimated to lead to CO_2 reductions of approx. 15.6 million tonnes per year in the 2008-12 period.

A number of the initiatives implemented have been aimed at reducing CO_2 emissions from Danish electricity consumption. However, Danish electricity production is integrated into the Northern European electricity market, and the effect of initiatives in the electricity sector are – and are expected to continue to be – partially offset by increased exports of fossil fuel electricity production from Denmark. Estimation of the size of this effect is subject to extreme uncertainty. Based on a rudimentary assumption that 50% of the effects of the electricity sector initiatives will be offset by electricity exports, approx. 5.0 of the 20.6 million tonnes of CO_2 will be offset by increased electricity exports. This estimate is subject to significant uncertainty and depends, for example, on the future expansion of production capacity in the Scandinavian countries (cf. the background report, "*Energy policy initiatives in the 1990's: Costs and CO_2 effects*[3])

The *Effort Analysis'* 'without measures' calculation of CO_2 emissions per sector is shown in Table B2-1.

3 Danish Energy Authority 2005, Published electronically in May 2005 on the Authority's website (http://www.ens.dk/graphics/Publikationer/Energipolitik/Energipolitiske_tiltag_i_1990erne/pdf/energipol_tiltag_CO2effekt.pdf)

Table B2-1: Overview of total greenhouse gas emissions and the total reductions divided by sector (following the sector division of the Climate Strategy) in millions of tonnes of CO_2 equivalents per year

Sector	1990/95[1]	2001			2008-12		
	Base[2]	Current emissions[2]	Reductions from measures	Emissions without measures	Emission projection[2]	Reductions from measures	Emissions without measures
Energy	42.7	43.2	13.5	56.8	53.1	11.0/16.0[3)]	64.1
Transport	10.7	12.6	1.3	13.9	14.6	1.7	16.3
Industry	0.3	0.7	0.0	0.7	0.7	0.4	1.1
Agriculture	14.4	11.7	1.6	13.3	10.8	1.9	12.7
Waste	1.3	1.2	0.2	1.4	0.9	0.5	1.4
Total	**69.5**	**69.6**	**16.7[3]**	**86.2**	**80.1**	**15.6 /20.6[4]**	**95.6**

1 1990/95 indicates the emissions in the base year. CO2, CH4 and N2O emissions have 1990 as the base year, while the industrial gases have 1995 as the base year. No corrections have been made for electricity imports/exports.

2 Source: Emissions figures (base, current in 2001 and projections for 2008-12: Danish Ministry of the Environment 2003)

3 These 16.7 million tonnes CO2 per year include the full effects, i.e. they include the CO2 reductions that domestic actions have led to abroad.

4 For the energy sector measures the full reduction is specified. The Danish Energy Authority estimates that approx. 5.0 of these 20.6 million tonnes CO2 annually will be offset by increased electricity exports based on the calculation assumptions of the climate strategy.

The *Effort Analysis* estimates that Denmark's "without measures CO_2 emissions in 2008-12 would have been 95.7 million tonnes CO_2 annually. Denmark's legal reduction obligation of 21% in relation to 1990 levels corresponds to emissions in 2008-2012 being reduced to approx. 54.9 million tonnes CO_2 annually[20]. Denmark would have therefore fallen short of this goal by 40.7 million tonnes CO_2 annually in 2008-2012 if the initiatives analysed had not been implemented.

In summary, the effect between 2008-2012 of the initiatives analysed would be 15.6 million tonnes annually, after taking into account that 50% of the electricity sector initiatives are expected to be offset by electricity exports.

As mentioned above, the total reduction effects, in Denmark and abroad, from the implemented domestic initiatives can be estimated at 20.6 million tons annually. Therefore it can be concluded that Denmark has already made significant progress domestically.

Extensive Danish electricity imports from Norway and Sweden in the 1990 base year led to unusually low Danish emissions. If the effects of these imports are compensated for, it would allow Denmark to reduce Danish emissions by approx. 5 million tonnes less than specified above.

In 2002, the (Environment) Council and the Commission adopted a political declaration stating that the calculation of the permitted emission volumes (measured in tonnes) in 2006 shall take into account Denmark's statement in connection with the Burden Sharing Agreement in 1998, e.g. stating that Denmark's reductions shall be seen in relation to an adjusted 1990 level.

Costs of measures

The costs of the CO_2 reduction have also been estimated in the *Effort Analysis*, but only for selected measures. The choice of these measures has largely been governed by which measures CO_2 costs had previously been calculated for.

The estimate is based on a cost-benefit analysis of the total costs and benefits for each measure, excluding the value of the reduction in CO_2 emissions.

An expression of the total socio-economic costs per tonne of reduced CO_2 emissions (also called the initiative's CO_2 shadow price) can be found by comparing the total net costs of the initiative against the estimated resultant CO2 reduction. The total CO_2 reduction has been used, i.e. regardless of whether this CO_2 reduction took place in Denmark or abroad (consumption-based calculation).

This corresponds to the method used in previous analyses carried out by the Danish Ministry of Finance and others in 2001, by the Economic Council in 2002, and in cost estimations used in the Government's climate strategy from 2003.

Please note that the introduction of the EU's CO_2 allowance scheme (EU-ETS) from 2005 changes the framework conditions for large parts of the energy sector and energy-intensive industry, such that the calculation method cannot be used to assess future measures within these areas where quotas have been imposed. The introduction of the allowance scheme means that CO_2 emissions from the sectors subject to allowances, including electricity production, will be unequivocally determined by the total amount of allowances accounted in accordance with the Kyoto Protocol. The calculations of the shadow values for the areas subject to allowances, up until the 2008-12 period where the new Kyoto regime will have entered into force, thus serve purely illustrative purposes.

The introduction of the open international electricity market since the late 1990s means it is no longer certain that for example such as the expansion of renewable energy will reduce CO_2 emissions from Danish electricity producers correspondingly, as it may be an advantage for producers to export electricity rather than reduce production. Where this is the case, CO_2 emissions will be reduced in other countries instead. This is a major issue in relation to calculating how great an effect the measures will have in relation to the base projection.

Please note that the CO_2 allowance scheme will increase the European electricity price and thus increase the profitability of electricity savings compared to the situation today.

Note that no attempt has been made in the *Effort Analysis* to incorporate any positive effects on security of supply, technology development and commercial development, nor has it been possible to include the value of all environmental impacts. This is due to the difficulty of quantifying and valuing these effects, which in principle should be included.

The value of the reductions in SO_2 and NO_x emissions resulting from the measures has been included, but the valuation of these physical reductions is very uncertain. This report uses the same valuations as the climate strategy. Since the calculations were carried out, the National Environmental Research Institute, Denmark (NERI) has published new, higher valuations for the cost of the negative impacts of SO_2 and NO_x emissions. Using these new, updated assumptions from NERI – and with nothing else changed – the calculations would have resulted in lower CO_2 shadow prices for several measures.

Table B2-2 shows that the shadow costs for the selected measures vary substantially, and for most of the measures are higher than the indicator of DKK 120 per tonne CO_2 specified in the Government's climate strategy. In the energy sector, the "Grant for conversion of apartments for the aged to cogenerated heat and power, "Grants for solar heating, heat pumps, and biomass

Table B2-2: Historical CO_2 shadow prices for selected measures (consumption-based calculation)

Sector	Measure	Average annual CO2 reduction for 2008-2012 -{}-Mill. tonnes CO_2 per year	Socio-economic cost[1] per tonne CO_2 DKK/tonne CO_2 (2002 prices)
Energy	Grants to private wind turbines	3.4	275
	Electricity generation plant expansion using wind turbines	0.9	250
	Expansion in decentralised cogeneration of heating and power	2.1	100
	Agreement on use of biomass for electricity production	1.1	325
	Grants for energy savings in businesses	0.9	275
	Grant to cover CO_2 tax (agreement scheme)	0.6	0
	Grant for conversion of old dwellings to cogenerated heat and power	0.2	1,925[2]
	Grant to promote connection to coal-fired CHP	0.1	850
	Grants for solar heating, heat pumps, biomass	0.1	1,500[3]
	Building labelling	0.4	1,300
Tax measures	Changes to taxes on energy products[4]	1.5	325
	Increased taxes on fuel[4]	1.2	775[5]
Industry	Regulation of industrial gases	0.4	200[6]

1 The shadow price has been calculated based on the total CO2 reduction.

2 This measure has also lead to improved comfort for those who have changed to CHP. This is believed to have been part of the political motive for the measure. However, no attempt has been made to value this gain.

3 Weighted average. This shadow price covers three initiative areas with very different shadow prices. Solar heating (DKK 5,700 /tonne CO2), Heat pumps (DKK 650/tonne CO2) and Biomass (DKK 600/tonne CO2).

4 The effect and the shadow price have been estimated for 2001 based on the nominal tax increase from 1990 to 2001. Assuming there are no changes in demand, and constant real prices and taxes, it will also be possible to use this estimate for the 2008-12 period. Note that these assumptions are not fully compatible with the assumptions about changes to fuel prices associated with the energy measures.

5 The CO2 reduction has been calculated for all fuel consumption, i.e. fuel consumption for both passenger cars and trucks. However the shadow price has only been calculated for fuel consumption in passenger cars, corresponding to the calculations carried out in connection with the Government's 2003 Climate Strategy.

6 Industrial gases are used for many purposes. The illustrated shadow price has been calculated, as an example, for the costs of replacing HFC gases with more environmentally-friendly refrigerants in industrial refrigeration plant, the biggest consumption group within the affected industrial gases.

and “Building labelling measures are estimated to have been associated with the highest costs in relation to their CO_2 reduction, while the “Grant to cover CO_2 tax (agreement scheme) and “Expansion in decentralised cogeneration of heating and power have been associated with the lowest costs.

Note that the calculations are generally subject to significant uncertainty and it has not been possible to include all the socio-economic effects in the calculations. For example, the benefit of increased comfort associated with the transition to CHP has not been included in the calculation of the net costs for the “Grant for conversion of old dwellings to cogenerated heat and power initiative. Many of the measures will also have a positive effect on the security of the energy supply, which has not been valued.

Please refer to the annex report to the *Effort Analysis* and to “*Energy policy measures in the 1990s: Costs and CO_2 effects* for further description of the conditions and assumptions underlying the calculation of the shadow price for each measure.

Uncertainty and sensitivity analyses

Both the CO_2 reductions and shadow costs for the analysed measures are subject to significant uncertainty due to the complexity and scope of the calculations alone. The following key issues in relation to the uncertainty of the results should be highlighted:

- It is not unequivocally clear how the demarcation of an initiative should be carried out. This applies both to choosing which measures to include and, in certain cases, how to define each initiative. Demarcation influences both the CO_2 reduction and shadow cost.

- The CO_2 reductions have been calculated separately for each initiative. There may be certain consequential effects from an initiative that are not included in the analysis of another initiative. Caution should therefore be exercised when comparing the shadow costs of various measures and across sectors.

In addition to the uncertainty associated with determining the expected reductions, there is also significant uncertainty linked to determining the socio-economic prices for the various effects included in such an analysis. With regard to the socio-economic energy prices, the same fuel price assumptions have generally been used as were used in the Government’s 2003 Climate Strategy.

To give an indication of the significance of central assumptions, table B2-3 contains a few examples showing how much the shadow price varies in response to potential changes to the key background parameters. For a more complete and systematic presentation of the sensitivity analyses for the individual measures, please refer to “*Energy policy mea-*

sures in the 1990s: Costs and CO_2 effects".

Effects

Estimate of reductions

So as to estimate the effect an initiative has had on greenhouse gas emissions, the change compared to a reference scenario must be assessed. The reference scenario is based on the base projection of CO_2 emissions carried out in connection with the Danish climate strategy from February 2003. As a rule this projection is assumed to reflect the effect of the initiatives analysed. As regards the individual initiatives, how great the increase in emissions would have been if the initiative in question had not been introduced has thus been estimated.

The initiatives have typically been assessed individually, i.e. in some cases the interaction effects between some initiatives have not been taken fully into account. Reductions in energy consumption due to tax increases, for example, can have effect the use of energy production from wind turbines and vice versa. Furthermore please note that all initiatives in the energy area have been calculated based on one and the same reference development (base projection from February 2003). The base projection is characterised by all calculations being based on a world with existing regulation, including e.g. existing taxes and duties. In principle calculations should also take into account the order in which the different initiatives have been – or will be – introduced as each initiative may affect the other initiatives both with regard to effect and costs. This has not been possible to do within the scope of *the Effort Analysis*.

The emission inventory method under the Kyoto Protocol uses the energy *production* or the actual emission of CO_2 in Denmark, as opposed to in the Energy 2000

Table B2-3: Sensitivity analyses for selected measures – examples

Measure	Change in parameter	Result of base calculation Shadow price reduction in 2008-1[2]	Result of sensitivity analysis
Grants to private wind turbines	A discount rate of 3 % instead of 6 % p.a.	3.4 million tonnes CO_2 / year DKK 275/tonne CO_2	- DKK 175/tonne CO_2 (- DKK 100/tonne)
Grants to private wind turbines	Change in the electricity price from 2005 of - DKK 0.02/kWh	3.4 million tonnes CO_2 / year DKK 275/tonne CO_2	- DKK 295/tonne (+ DKK 20/tonne)
Increases to fuel taxes 1	Demand elasticity halved from -0.6 to -0.3 (passenger vehicles) and -0.2 to -0.1 (trucks)	1.2 million tonnes CO_2 / year DKK 775/tonne CO_2	0.6 million tonnes/year (-0.6 mill. tonnes/year) DKK 575/tonne (- DKK 200/tonne)

[1] The CO_2 reduction has been calculated for all fuel consumption, i.e. fuel consumption for both passenger cars and trucks. However the shadow price has only been calculated for fuel consumption in passenger cars, corresponding to the calculations carried out in connection with the Government's 2003 Climate Strategy. This factor also applies to the sensitivity analysis for "Increases to fuel taxes.

emission inventory, which is based on CO_2 impacts caused by energy *consumption* in Denmark. This is a crucial difference as regards initiatives that either affect the demand for electricity or the production of environmentally-friendly electricity. Electricity production (and therefore CO_2 emissions) in Denmark is determined by the price development in the electricity market and cannot be controlled directly through national initiatives.

One of the additional requirements of the Kyoto Protocol is that the use of flexible mechanisms has to be supplemental to domestic action. Therefore two estimates of Danish efforts are in principle relevant – one estimate on achieved emission reductions in Denmark compared to the inventory calculations under the Kyoto Protocol, and one estimate of *the total effect* of the Danish efforts under the Kyoto Protocol, regardless of whether an initiative has led to reductions in emission in Denmark or abroad.

With the introduction of the open international electricity market in the late 1990s, it is not a given fact that for example extension of renewable energy will reduce CO_2 emissions from *Danish* electricity producers correspondingly, as it may be an advantage for Danish electricity producers to export electricity instead of limiting their production. To the extent that this is the case, CO_2 emissions will decrease in other countries instead of in Denmark. This is a central issue of concern as regards calculating how great the effect of initiatives will be when compared to the base projections.

The Danish electricity production in the Northern European electricity market, and the effect of initiatives for limiting the need for fossil electricity production is – and is expected to be – partially countered by an increase in exports of fossil electricity production from Denmark. Estimation of the size of this effect is subject to extreme uncertainty. A rudimentary assumption is that, 50% of the effects of the electricity sector initiatives will be offset by electricity exports. This estimate is subject to significant uncertainty and depends, for example, on the future expansion of production capacity in the Scandinavian countries (cf. the background report, Energy policy initiatives in the 1990's: Costs and CO_2 effects (Danish Energy Authority, 2005).

Emission reductions

The estimated reductions for measures for the year 2001 and the annual average in the period 2008-12 is presented in table B2-4 below. Please note that CO_2 reductions in the period 2008-2012 are expressed both from an energy consumption and energy production angle. The energy consumption angle ia based on the assumption that all CO_2 reductions will be allotted to Denmark, while reductions based on the energy production angle alone concern changes in actual emissions from Danish areas.

Table B2-4 Overview of reduction contributions of measures in 2001 and expected contributions as annual average reduction in the period 2008-2012 (million tonnes CO_2 equivalents)

Sector	Measure	CO_2 reduc. in 2001 Million tonnes CO_2	Av. annual CO_2 reduc. for 2008-2012 - Million tonnes CO_2	
			Energy consumption angle	Energy production angle
Energy	Grants to private wind turbines	2.6	3.4	1.7
	Electricity generation plant expansion using wind turbines	0.4	0.9	0.5
	Expansion in decentralised cogeneration of heating and power	2.2	2.1	0.4
	Agreement on use of biomass for electricity production	0.2	1.1	1.1
	Grants for energy savings in businesses	1.1	0.9	0.9
	Grant to cover CO_2 tax (agreement scheme)	0.3	0.6	0.6
	Grant for conversion of old dwellings to cogenerated heat and power	0.2	0.2	0.2
	Grant to promote connection to coal-fired CHP	0.1	0.1	0.1
	Grants for renewable energy	0.1	0.1	0.1
	Building labelling	0.2	0.4	0.4
	Changes to taxes on energy products[2]	1.5	1.5	1.0
	Further energy measures	4.6	4.6	4.0
	Total energy	**13.5**	**16.0**	**11.0**
Industry	Taxes on and regulation of use of industrial gases	0.0	0.4	0.4
	Total industry	**0.0**	**0.4**	**0.4**
Transport	Increased fuel taxes[2]	1.2	1.2	1.2
	Diverse measure to improve energy efficiency in Danish vehicles[1]	0.2	0.6	0.6
	Total transport	**1.3**	**1.7**	**1.7**
Agriculture	Action plans for agriculture[3]	1.6	1.9	1.9
	Total agriculture	**1.6**	**1.9**	**1.9**
Waste	Collection of methane from landfills	0.2	0.2	0.2
	Ban on landfilling of waste suitable for incineration	0.0	0.3	0.3
	Total waste	**0.2**	**0.5**	**0.5**
All	**Total**	**16.7**	**20.6**	**15.6**

[1] In addition to the voluntary agreement with the automobile industry, measure include the green owner tax, information campaigns, energy labelling etc.
[2] Reductions as a consequence of the increased taxes on both energy products and fuel are estimated for 2001. Reductions for 2008-12 are based on the assumption that taxes and fuel prices actually remain unchanged and that demands do not change.
[3] Includes the NPO action plan from 1990, Action Plan for the Aquatic Environment I from 1987, Action plan for sustainable agriculture from 1991 and Action Plan for the Aquatic Environment II from 1998. See NERI, 2003 for a more detailed description of the action plans and their effects.

Table B2-4 includes a row with further energy measures.

Table B2-5 includes a number of initiatives without cost estimates that also significantly affect Denmark's CO_2 emissions. These measures have not been studied in more detail in connection with *the Effort Analysis* - either because their overall objective has not been to reduce CO_2 emissions or because insufficient data were available for a proper assessment of the measure's effects within the budget framework. In another context how much these additional measures would contribute to CO_2 reductions in 2008-12 has been assessed. The effect 2008-12 is estimated on the basis of energy statistics from 2001 combined with assumptions used in calculations for the Climate Strategy. The results of this assessment can be seen in table B2-5.

The measures analysed are assessed to have reduced approx. 16.7 million tonnes CO_2 in total in 2001. Furthermore it is assessed that Denmark – seen from the so-called energy production angle – would have emitted approx. 15.6 million tonnes CO_2 more on average per year in the period 2008-12, is the measures analysed had not been implemented. Moreover the measures analysed will lead to further reductions in 2008-12 of approx. 5.0 million tonnes CO_2 per year, however this will be countered by the emissions from the increased electricity exports made possible by the measures implemented. The total emission of CO_2 seen from the so-called energy consumption angle would thus have been approx. 20.6 million tonnes greater without the measures.

Table B2-5 Overview of the estimate of CO2 reductions from further energy measures

Measure[1]	Estimate of CO_2 reductions in 2008-12 (million tonnes CO_2)	Estimate of CO_2 reductions in 2008-12 from energy policy of 1990s (million tonnes CO_2)
Central CHP (coal-CHP) as replacement for individual oil-fired heating	1.8	0
Conversion from central electricity production from coal to natural gas	1.4	1.4
Establishment of other decentralised CHP that are not included under the measure Expansion in decentralised cogeneration of heating and power (including industrial CHP, biogas CHP and waste CHP)[2]	2.7	1.2
Separate district heating production from biomass	0.7	0.7
Utilisation of industrial surplus heat for district heating	0.3	0.1
Separate district heating production from waste	0.4	0
Natural gas supply for heating of individual buildings	1.2	0.6
Natural gas supply for industrial processes	1.1	0.6
Total	**9.6**	**4.6**

1 It has been assumed that these measures are primarily fully implemented and that 2001 reductions correspond to the reduction stated for 2008-12.
2 This measure entails an increase in emissions of the greenhouse gas methane. In the estimate of CO2 reductions for 2008-12, an increase in methane corresponding to 0.3 million tonnes CO2 equivalents has been included. The estimate of CO2 reductions in 2008-12 from the energy policy of the 1990s includes an increase in methane corresponding to 0.1 million tonnes CO2 equivalents.

Annex C Description of selected JI projects

This Annex includes examples of JI projects in the form of a brief description of the following three projects:

1) Biomass energy from sawdust in Rumania
2) Agropolychim fertiliser factory in Bulgaria
3) Wind turbine park in Türisalu in Estonia

Programme or project title: Biomass energy from sawdust in Rumania			
Objective: Replace fossil fuels with biomass in energy supply in 5 cities in Rumania			
Recipient country	**Sector**	**Expected CO_2 reduction purchased by DK**	**Expected to be in operation by**
Rumania	Energy supply (district heating)	721,108 tonnes CO_2 equivalents	April 2004
Description: The project concerns utilising sawdust from forestry in Rumanian energy supply in 5 cities instead of oil and natural gas. The project was launched in spring 2004 and has subsequently ensured reductions in greenhouse gas emissions. The project contributes to reducing pollution caused by wood waste that traditionally was dumped in nature, and furthermore it secures a stabile district heating supply for citizens in the five cities.			
Technology transferred: Biomass-based district heating			

Programme or project title: Agropolychim fertiliser factory in Bulgaria			
Objective: Reduce nitrous oxide emissions from a fertiliser factory			
Recipient country	**Sector**	**Expected CO_2 reduction purchased by DK**	**Expected to be in operation by**
Bulgaria	Industry	1,150,000 tonnes CO_2 equivalents	October 2005
Description: The project will lead to the fertiliser factory Agropolychim by the Black Sea reducing its N2O emissions from the production of nitrogen fertiliser. Nitrous oxide is a greenhouse gas with a global warming potential (GWP) of 310 times CO_2's GWP. In the period 2005 to 2012 the total reduction of nitrous oxide is expected to correspond to 3.75 million tonnes CO_2. Denmark's agreement with the fertiliser factory includes transferral of 1.15 million tonnes CO_2 credits and option to purchase an additional 2.6 million tonnes. As an important part of the contract, the surplus gained by the factory from the sale of its CO_2 credits is to be used to establish a wastewater treatment plant for the factory's wastewater. Today the factory's wastewater is one of the biggest sources of pollution to the Black Sea, especially with nitrogen.			
Technology transferred: Catalytic removal of N2O emissions from the production of fertiliser			

Programme or project title: Wind turbine park in Türisalu in Estonia			
Objective: Replace electricity from oil-slate-fired power plants with renewable energy			
Recipient country	**Sector**	**Expected CO_2 reduction purchased by DK**	**Expected to be in operation by**
Estonia	Renewable energy	403,686 tonnes CO_2 equivalents	2006
Description: 13 wind turbines with a total capacity of 21.45 MW will be placed on a former Soviet missile base in Türisalu outside of Estonia's capital Tallinn. The turbines will produce cleaner and renewable energy that will replace electricity from Estonia's oil-slate-fired power plants. Therefore in addition to the CO_2 reduction, the wind turbine park will also lead to other considerable environmental advantages because oil slate is a very polluting energy source.			
Technology transferred: Modern wind turbines			

Annex D Supplementary information on the al lowance scheme in Denmark

This Annex consists of the following two sub-annexes:

Annex D1: Installations covered by the Act on CO_2 Allowances 2005-2007.

List including overview of installations covered by the Danish implementation of the EU Allowances Directive, and the size of the quota allocated to each installation for the period 2005-2007 as of 1 February 2005.

Annex D2: Information on Denmark's national CO_2 emissions trading registry

1. Information on the registry administrator
2. Cooperation with other countries concerning operation of the registry
3. Standards for data exchange
4. Procedures for administration and operation of the emissions trading registry
5. Safety standards
6. Information available to the public
7. Internet address for the registry
8. Protection, maintenance and recreation of data

Annex D1: Installations covered by the Act on CO_2 Allowances 2005-2007 as of 1 February 2005.

Note: The reserves stated in the table are government reservations of allowances for new enterprises and for auctioning

National allocation plan table for Denmark							
VRK_ID	Installation name	Installation identifier	Permit Identifier	Allocation 2005	Allocation 2006	Allocation 2007	Reserve
261	I/S Nordforbrænding	DK-1	DK-14748539-1003861117-0261-20041001	605	454	453	7381149
1832	Brøndby Strand Fjernvarmecentral	DK-2	DK-33269315-1003039578-1832-20041001	727	545	546	
293	Viborg Kraftvarme A/S	DK-3	DK-10046769-1010771680-0293-20041001	976	732	733	
295	Viborg Kraftvarme A/S	DK-4	DK-10046769-1010771699-0295-20041001	1267	950	950	
1069	Viborg Kraftvarme A/S	DK-5	DK-10046769-1003740497-1069-20041001	242651	181988	181988	
992	Lygten Varmeværk	DK-6	DK-64942212-1009120080-0992-20041001	672	504	504	
994	Østre varmecentral	DK-7	DK-64942212-1004416316-0994-20041001	814	610	610	
995	Sundholm varmecentral	DK-8	DK-64942212-1010415213-0995-20041001	5923	4442	4443	
161	Hinnerup Fjernvarme	DK-9	DK-10411912-1002895495-0161-20041001	928	696	697	
945	Brædstrup Totalenergianlæg A/S	DK-10	DK-10419034-1000073954-0945-20041001	28586	21439	21439	
102	Farum Fjernvarme	DK-11	DK-10663210-1002899982-0102-20041001	1072	804	804	
103	Farum Fjernvarme	DK-12	DK-10663210-1002899994-0103-20041001	3058	2294	2293	
24	Maribo Varmeværk	DK-13	DK-11135617-1000187343-0024-20041001	0	0	0	
575	Værløse Varmeværk	DK-14	DK-11899412-1000295548-0575-20041001	874	656	656	
298	Ishøj Kommunes Varmeforsyning	DK-15	DK-11931316-1003272783-0298-20041001	432	324	325	
452	Silkeborg Kommunale Varmeforsyning	DK-16	DK-12015607-1003359737-0452-20041001	1950	1462	1463	
453	Silkeborg Kommunale Varmeforsyning	DK-17	DK-12015607-1010671732-0453-20041001	6045	4534	4534	
26	Oksbøl Varmeværk	DK-18	DK-12787111-1000445617-0026-20041001	21698	16274	16273	
249	Brørup Fjernvarme	DK-19	DK-13551472-1000584343-0249-20041001	16189	12142	12142	
338	Lem Varmeværk	DK-20	DK-15763515-1000974476-0338-20041001	23902	17927	17927	
585	Lindholm Central	DK-21	DK-16130990-1010513886-0585-20041001	779	584	584	
586	Lyngvej Central	DK-22	DK-16130990-1010513924-0586-20041001	2115	1586	1586	
587	Svendborgvej Central	DK-23	DK-16130990-1010513894-0587-20041001	3472	2604	2603	
588	Borgmester Jørgensensvej Central	DK-24	DK-16130990-1010513908-0588-20041001	612	459	460	
974	Højvang Varmecentral	DK-25	DK-16130990-1010513932-0974-20041001	440	330	329	
1638	Gasværksvej Varmecentral	DK-26	DK-16130990-1010513975-1638-20041001	5910	4433	4433	
499	Støvring Varmeværk	DK-27	DK-16276111-1001070704-0499-20041001	35431	26573	26574	
987	Bjerringbro Kraftvarmeværk (motor 1-4)	DK-28	DK-16634972-1001133672-0987-20041001	58974	44231	44231	
381	Nørre-Aaby Kraftvarmeværk A.M.B.A.	DK-29	DK-16838314-1001169236-0381-20041001	14636	10977	10976	
265	Jetsmark Energiværk A.m.b.a.	DK-30	DK-17000888-1001201570-0265-20041001	21173	15880	15880	
313	Kolding Varmeværk Syd	DK-31	DK-17010131-1010738926-0313-20041001	4776	3582	3582	
315	Kolding Varmeværk Dampcentralen	DK-32	DK-17010131-1010738888-0315-20041001	690	518	517	
317	Kolding Varmeværk Skovparken	DK-33	DK-17010131-1010738896-0317-20041001	124	93	92	
321	Kolding Varmeværk Strandhuse	DK-34	DK-17010131-1010738934-0321-20041001	4674	3506	3505	
1632	Fredericia Varmeværk, Erritsø	DK-35	DK-17010131-1010738977-1632-20041001	5339	4004	4004	
1635	Nørremarkens Kedelcentral	DK-36	DK-17010131-1010738993-1635-20041001	112	84	84	
1636	Søndermarkens Kedelcentral	DK-37	DK-17010131-1010739000-1636-20041001	148	111	110	
52	Bjerringbro Varmeværk	DK-38	DK-17256319-1001252921-0052-20041001	1488	1116	1116	
1063	Sønderborg Kraftvarme I/S	DK-39	DK-17310747-1001263648-1063-20041001	126310	94733	94733	
786	Jægerspris Kraftvarme	DK-40	DK-18155141-1001441676-0786-20041001	24244	18183	18182	
1650	I/S Avedøreværket 2	DK-41	DK-18158779-1001442404-1650-20041001	1360954	1020716	1020715	
269	Avedøreværket	DK-42	DK-18936674-1000605248-0269-20041001	1668232	1251174	1251174	
270	DTU Kraftvarmeværk	DK-43	DK-18936674-1004258440-0270-20041001	131947	98960	98961	
271	Helsingør Kraftvarmeværk	DK-44	DK-18936674-1004267619-0271-20041001	206480	154860	154859	
272	Hillerød Kraftvarmeværk	DK-45	DK-18936674-1004267632-0272-20041001	333631	250223	250223	
273	Hundested Kraftvarmeværk	DK-46	DK-18936674-1004267668-0273-20041001	0	0	0	
274	Kyndbyværket	DK-47	DK-18936674-1007920594-0274-20041001	25344	19008	19008	
277	Asnæsværket	DK-48	DK-18936674-1002105572-0277-20041001	3294023	2470517	2470518	
278	Stigsnæsværket	DK-49	DK-18936674-1002982001-0278-20041001	636274	477205	477205	
279	Slagelse Kraftvarmeværk	DK-50	DK-18936674-1004267723-0279-20041001	0	0	0	
280	Masnedøværket	DK-51	DK-18936674-1003922902-0280-20041001	953	715	715	
330	Amagerværket	DK-52	DK-18936674-1003253755-0330-20041001	2095018	1571264	1571264	
331	H.C. Ørstedsværket	DK-53	DK-18936674-1003256274-0331-20041001	562438	421828	421828	
332	Svanemølleværket	DK-54	DK-18936674-1003253883-0332-20041001	478029	358522	358522	
426	Ringsted Kraftvarmeværk	DK-55	DK-18936674-1004267711-0426-20041001	47494	35620	35621	
736	Køge Kraftvarmeværk	DK-56	DK-18936674--0736-20041001	5344	4008	4007	
1494	Maribo-Sakskøbing Kraftvarmeværk	DK-57	DK-18936674-1005231580-1494-20041001	151	113	113	
346	Løgstør Fjernvarmeværk	DK-58	DK-19201414-1001510235-0346-20041001	17671	13253	13254	
967	Sakskøbing Fjernvarme	DK-59	DK-19739112-1002997847-0967-20041001	444	333	333	
407	Otterup Kommunale Fjernvarmeforsyning	DK-60	DK-19854418-1.003.317.001-0407-20041001	432	324	324	
124	Frederikssund Kraftvarmeværk	DK-61	DK-25580230-1010775449-0124-20041001	51294	38470	38470	
1731	DTU Kedelcentral	DK-62	DK-25580230-1010775414-1731-20041001	2634	1976	1975	
38	Østervrå Varmeværk	DK-63	DK-20245417-1001521893-0038-20041001	10866	8150	8150	
1068	Smørum Kraftvarme	DK-64	DK-21445711-1001535455-1068-20041001	31487	23615	23616	
505	Svendborg Fjernvarmecentral	DK-65	DK-22113410-1003007911-0505-20041001	5245	3934	3933	
506	Svendborg Fjernvarmecentral A.m.b.a.	DK-66	DK-22113410-1003007923-0506-20041001	1646	1234	1235	
88	Ebeltoft Fjernvarmeværk	DK-67	DK-22703714-1003010765-0088-20041001	54	41	41	
1042	Silkeborg Kraftvarmeværk	DK-68	DK-25453506-1004368727-1042-20041001	363194	272396	272395	
251	Elsam Kraft A/S, Fynsværket	DK-69	DK-25460715-1007775276-0251-20041001	2055991	1541993	1541994	
257	Grenå Kraftvarmeværk	DK-70	DK-25460715-1003065199-0257-20041001	101075	75806	75806	

Annex D1: Installations covered by the Act on CO_2 Allowances 2005-2007 as of 1 February 2005.

National allocation plan table for Denmark							
VRK_ID	Installation name	Installation identifier	Permit Identifier	Allocation 2005	Allocation 2006	Allocation 2007	Reserve
259	Elsam Kraft A/S, Studstrupværket	DK-71	DK-25460715-1003065217-0259-20041001	2494800	1871100	1871099	
282	Elsam Kraft A/S, Skærbækværket	DK-72	DK-25460715- 1003050386-0282-20041001	821116	615837	615838	
288	Elsam Kraft A/S, Herningværket	DK-73	DK-25460715-1008477988-0288-20041001	337302	252977	252977	
290	Elsam Kraft A/S, Ringkøbing Kraftvarmeværk	DK-74	DK-25460715-1010337603-0290-20041001	28291	21218	21219	
291	Elsam Kraft A/S, Skjern Kraftvarmeværk	DK-75	DK-25460715-1010337646-0291-20041001	36699	27524	27524	
520	Elsam Kraft A/S, Enstedværket	DK-76	DK-25460715-1002980617-0520-20041001	2502100	1876575	1876576	
635	Elsam Kraft A/S, Frederikshavn Kraftvarmeværk	DK-77	DK-25460715-1003043318-0635-20041001	68476	51357	51356	
636	Elsam Kraft A/S, Nordjyllandsværket	DK-78	DK-25460715-1005247303-0636-20041001	1855302	1391476	1391476	
637	Hirtshals Kraftvarmeværk	DK-79	DK-25460715-1003043343-0637-20041001	33396	25047	25047	
990	Elsam Kraft A/S, Esbjergværket	DK-80	DK-25460715-1008477821-0990-20041001	1767963	1325972	1325973	
415	Energi Randers Produktion A/S	DK-81	DK-25481984-1007759963-0415-20041001	299766	224824	224824	
416	Energi Randers Produktion A/S	DK-82	DK-25481984-1009623945-0416-20041001	1107	830	831	
960	Energi Randers Produktion A/S	DK-83	DK-25481984-1009623953-0960-20041001	240	180	179	
1490	Energi Randers Produktion A/S	DK-84	DK-25481984-1009257612-1490-20041001	6236	4677	4677	
289	Måbjergværket A/S	DK-85	DK-25495977-1007775284-0289-20041001	14620	10965	10965	
283	Horsens Kraftvarmeværk	DK-86	DK-25496086-1007775373-0283-20041001	73994	55496	55496	
154	KVV Grønningen/Central 2	DK-87	DK-25525795-1010757467-0154-20041001	31650	23738	23738	
988	KVV Tårnvej	DK-88	DK-25525795-1007789161-0988-20041001	58042	43531	43531	
365	Nyborg Forsyning og Service	DK-89	DK-25535456-1003314105-0365-20041001	834	626	625	
326	Korsør Kommunale Varmeforsyning	DK-90	DK-25673840-1003294517-0326-20041001	31273	23455	23455	
40	Østkraft	DK-91	DK-25798929-1008145764-0040-20041001	76257	57193	57193	
192	EnergiGruppen Jylland, Holstebrovej	DK-92	DK-25809807-1010775309-0192-20041001	4794	3596	3595	
193	EnergiGruppen Jylland, Nord	DK-93	DK-25809807-1010775341-0193-20041001	1735	1301	1301	
1244	EnergiGruppen Jylland, Vest	DK-94	DK-25809807-1010775392-1244-20041001	53	40	40	
216	Vestforsyning Varme	DK-95	DK-26704065-1010775961-0216-20041001	1869	1402	1401	
217	Vestforsyning Varme A/S	DK-96	DK-26704065-1010775988-0217-20041001	608	456	455	
218	Vestforsyning Varme A/S	DK-97	DK-26704065-1010776046-0218-20041001	1813	1360	1360	
219	Vestforsyning Varme A/S	DK-98	DK-26704065-1010776011-0219-20041001	1448	1086	1086	
220	Vestforsyning Varme A/S	DK-99	DK-26704065-1010776003-0220-20041001	3911	2933	2934	
129	Faaborg Fjernvarme A/S	DK-100	DK-26721059-1003311702-0129-20041001	36916	27687	27686	
571	Vojens Fjernvarme	DK-101	DK-28032617-1010752325-0571-20041001	41593	31195	31195	
10	Albertslund Varmeværk	DK-102	DK-29808228-1003267160-0010-20041001	1082	812	811	
529	Thisted Varmeforsyning	DK-103	DK-30992512-1003030685-0529-20041001	2268	1701	1701	
567	Vinderup Varmeværk	DK-104	DK-31220912-1001672876-0567-20041001	22344	16758	16757	
565	Videbæk energiforsyning	DK-105	DK-31242711-1001673227-0565-20041001	337	253	252	
566	Videbæk Energiforsyning	DK-106	DK-31242711-1010767063-0566-20041001	27631	20723	20723	
423	Ringe Fjernvarmeselskab	DK-107	DK-32476813-1003037642-0423-20041001	24570	18427	18427	
536	Tranbjerg Varmeværk	DK-108	DK-33016719-1001698824-0536-20041001	156	117	118	
459	Skagen Varmeværk	DK-109	DK-33507410-1001705973-0459-20041001	2457	1843	1843	
1449	Skagen Kraftvarmeværk	DK-110	DK-33507410-1010581539-1449-20041001	38252	28689	28689	
207	Hjallerup Fjernvarmeselskab	DK-111	DK-34681228-1001723737-0207-20041001	23318	17489	17489	
388	Odense Kommune VC Bellinge	DK-112	DK-35209115-1010757157-0388-20041001	1066	799	799	
389	Odense Kommune VC Billedskærervej	DK-113	DK-35209115-1010757165-0389-20041001	4536	3402	3401	
390	Odense Kommune VC Bolbro	DK-114	DK-35209115-1010757211-0390-20041001	2130	1597	1597	
392	Odense Kommune VC Centrum	DK-115	DK-35209115-1010757807-0392-20041001	2968	2226	2225	
393	Odense Kommune VC Dyrup	DK-116	DK-35209115-1010757866-0393-20041001	459	344	345	
395	Odense Kommune VC Dalum	DK-117	DK-35209115-1010757815-0395-20041001	1590	1192	1192	
398	Odense Kommune VC Korup	DK-118	DK-35209115-1010757904-0398-20041001	930	697	697	
400	Odense Kommune VC Næsby	DK-119	DK-35209115-1010757955-0400-20041001	1464	1098	1097	
402	Odense Kommune VC Pårup	DK-120	DK-35209115-1010757998-0402-20041001	1869	1402	1401	
403	Odense Kommune VC Sanderum	DK-121	DK-35209115-1010758005-0403-20041001	1271	953	953	
405	Odense Kommune VC Sydøst	DK-122	DK-35209115-1010758021-0405-20041001	1233	925	925	
406	Odense Kommune VC Vollsmose	DK-123	DK-35209115-1010758048-0406-20041001	1752	1314	1314	
104	Fredericia Fjernvarme	DK-124	DK-35478116-1003045929-0104-20041001	218	164	163	
105	Fredericia Fjernvarme	DK-125	DK-35478116-1003045930-0105-20041001	33	25	25	
511	Sønderborg Fjernvarme	DK-126	DK-35602313-1009505527-0511-20041001	619	464	465	
515	Sønderborg Fjernvarme	DK-127	DK-35602313-1003046196-0515-20041001	1422	1066	1067	
556	Varmecentral Søndermarken	DK-128	DK-35607919-1010774108-0556-20041001	482	362	361	
557	Varmecentral Toften	DK-129	DK-35607919-1010774116-0557-20041001	929	697	697	
577	Aabenraa Fjernvarme	DK-130	DK-36152710-1010792963-0577-20041001	1598	1199	1199	
578	Aabenraa Fjernvarme	DK-131	DK-36152710-1010792955-0578-20041001	247	185	186	
580	Aabenraa Fjernvarme	DK-132	DK-36152710-1010792947-0580-20041001	359	269	269	
443	Rødekro Fjernvarmecentral	DK-133	DK-36154012-1001742170-0443-20041001	1670	1252	1253	
545	Tønder Fjernvarmeselskab Amba	DK-134	DK-36421312-1.001.745.454-0545-20041001	2029	1522	1522	
339	Lemvig Varmeværk	DK-135	DK-36892412-1001749941-0339-20041001	5756	4317	4317	
245	Billund Varmeværk I	DK-136	DK-37251518-1010779835-0245-20041001	12582	9437	9437	
246	Billund Varmeværk II	DK-137	DK-37251518-1001753730-0246-20041001	37704	28278	28279	
425	Rindum Værket	DK-138	DK-37560219-1003054010-0425-20041001	22763	17072	17073	
296	I/S Vildbjerg Varmeværk	DK-139	DK-37683310-1001758574-0296-20041001	27778	20834	20834	
63	Brovst Fjernvarme	DK-140	DK-37809217-1001759685-0063-20041001	21074	15806	15805	
461	Skanderborg Fjernvarme	DK-141	DK-37949019-1001761239-0461-20041001	337	253	252	
95	Hedelund Spidslastcentral	DK-142	DK-39877511-1010774698-0095-20041001	799	599	599	

Annex D1: Installations covered by the Act on CO_2 Allowances 2005-2007 as of 1 February 2005.

National allocation plan table for Denmark							
VRK_ID	Installation name	Installation identifier	Permit Identifier	Allocation 2005	Allocation 2006	Allocation 2007	Reserve
97	Hjerting Varmeværk	DK-143	DK-39877511-1010774701-0097-20041001	64	48	49	
98	Spangsbjerg-Gjesing Varmecentral	DK-144	DK-39877511-1010774728-0098-20041001	1162	872	872	
99	Sædding Varmeværk	DK-145	DK-39877511-1010774736-0099-20041001	2557	1918	1917	
361	Nakskov Fjernvarme	DK-146	DK-40734511-1003302364-0361-20041001	82	62	62	
523	Tarm Varmeværk A.m.b.a.	DK-147	DK-40893113-1001802909-0523-20041001	0	0	0	
215	Hobro Varmeværk	DK-148	DK-41429615-1001810468-0215-20041001	2098	1574	1573	
188	Hedensted Fjernvarme	DK-149	DK-41529911-1001812204-0188-20041001	19915	14936	14937	
80	Dagnæs-Bækkelund Varmeværk	DK-150	DK-41540214-1003064635-0080-20041001	225	169	168	
430	Roskilde Varmeforsyning	DK-151	DK-42162019-1003287705-0430-20041001	3386	2540	2539	
432	Roskilde Varmeforsyning	DK-152	DK-42162019-1003288415-0432-20041001	765	574	573	
156	Gråsten Kommunale Varmeforsyning	DK-153	DK-43005154-1003322971-0156-20041001	21080	15810	15810	
152	Grenå Varmeværk	DK-154	DK-43774417-1003079965-0152-20041001	653	490	490	
939	Bredstrup Varmeværk	DK-155	DK-43774417-1003079977-0939-20041001	340	255	254	
357	Mølholm Varmeværk	DK-156	DK-44424010-1001852238-0357-20041001	113	85	85	
673	Hundige Fjernvarmeværk A.m.b.a.	DK-157	DK-44492350-1001853489-0673-20041001	591	443	444	
301	Jyderup Varmeværk	DK-158	DK-44835010-1003297590-0301-20041001	19863	14897	14897	
203	Frederiksgade Varmecentral	DK-159	DK-44887118-1010701992-0203-20041001	2169	1627	1627	
204	Ullerød Varmecentral	DK-160	DK-44887118-1009303940-0204-20041001	697	523	522	
205	Kgs. Vænge Varmecentral	DK-161	DK-44887118-1010702034-0205-20041001	588	441	440	
206	Elmegaarden Varmecentral	DK-162	DK-44887118-1010702018-0206-20041001	688	516	516	
17	Ikast El- og Varmeværk	DK-163	DK-25161513-1003083171-0017-20041001	4265	3199	3199	
25	Nykøbing S. Varmeværk	DK-164	DK-46917928-1001888952-0025-20041001	28848	21636	21635	
308	Kerteminde Kommunale Varmeforsyning	DK-165	DK-46953614-1003312485-0308-20041001	960	720	719	
385	Nørresundby Fjernvarmeforsyning	DK-166	DK-50530213-1001950220-0385-20041001	456	342	341	
1070	Brønderslev Kraftvarme	DK-167	DK-52080312-1009740313-1070-20041001	88981	66736	66736	
1409	Svendborg Kraftvarmeværk	DK-168	DK-54802013-1008705484-1409-20041001	56781	42586	42585	
258	Århusværket	DK-169	DK-55133018-1009490503-0258-20041001	649	487	487	
591	Århus Kommunale Værker Risskov Varmecentral	DK-170	DK-55133018-1010680383-0591-20041001	306	230	229	
597	Århus Kommunale Værker Jens Juuls Vej	DK-171	DK-55133018-1010680359-0597-20041001	2882	2162	2162	
598	Århus Kommunale Værker Viby Varmecentral	DK-172	DK-55133018-1010680375-0598-20041001	285	214	213	
604	Århus Kommunale Værker Gjellerup	DK-173	DK-55133018-1010680367-0604-20041001	779	584	585	
554	I/S Vamdrup Fjernvarme	DK-174	DK-55946817-1002041931-0554-20041001	15643	11732	11732	
419	Ribe Fjernvarmecentral	DK-175	DK-57205628-1010706714-0419-20041001	82	61	61	
420	Ribe Kraftvarmeværk	DK-176	DK-57205628-1002058838-0420-20041001	40148	30111	30111	
372	Nykøbing Mors Fjernvarmeværk	DK-177	DK-57494115-1002063337-0372-20041001	30093	22570	22570	
169	Haderslev Fjernvarme	DK-178	DK-58061212-1003123407-0169-20041001	4791	3593	3593	
170	Haderslev Fjernvarme	DK-179	DK-58061212-1003123419-0170-20041001	21930	16447	16447	
247	Brande Fjernvarmecentral	DK-180	DK-58176613-1002075632-0247-20041001	24862	18646	18647	
45	Augustenborg Fjernvarme	DK-181	DK-59283111-1002096146-0045-20041001	1266	950	949	
62	Broager Fjernvarmeselskab	DK-182	DK-59352318-1002097051-0062-20041001	15333	11500	11499	
457	Sindal Varmeforsyning	DK-183	DK-59426915-1002097944-0457-20041001	22300	16725	16725	
304	Kjellerup Fjernvarme	DK-184	DK-60247412-1002110216-0304-20041001	272	204	205	
2	Assens fjernvarme Amba	DK-185	DK-61877215-1003147413-0002-20041001	32	24	24	
50	Bramming Fjernvarmecentral	DK-186	DK-63446319-1002170663-0050-20041001	49634	37226	37226	
533	Toftlund Fjernvarmecentral	DK-187	DK-63690619-1.002.175.112-0533-20041001	21515	16136	16136	
509	Sæby Varmeværk	DK-188	DK-64429418-1002189756-0509-20041001	55654	41740	41741	
543	Taars Varmeværk Amba	DK-189	DK-64463411-1002190406-0543-20041001	13970	10477	10477	
190	Helsingør Kommunale Værker	DK-190	DK-64502018-1010657128-0190-20041001	854	640	641	
191	Helsingør Kommunale Værker	DK-191	DK-64502018-1003280037-0191-20041001	3218	2413	2413	
209	Hjørring Varmeforsyning	DK-192	DK-64544616-1003156575-0209-20041001	434	325	325	
210	Hjørring Varmeforsyning	DK-193	DK-64544616-1003156630-0210-20041001	147923	110942	110943	
214	Hjørring Varmeforsyning	DK-194	DK-64544616-1003156587-0214-20041001	1056	792	791	
574	Vrå Varmeværk	DK-195	DK-64771728-1002195366-0574-20041001	11781	8836	8836	
146	Glostrup Kommunale Varmeforsyning	DK-196	DK-65120119-1010748883-0146-20041001	171	128	128	
227	Horsens Varmeværk	DK-197	DK-66166228-1003161700-0227-20041001	3075	2306	2307	
228	Horsens Varmeværk	DK-198	DK-66166228-1003161712-0228-20041001	638	479	479	
172	Hadsten Varmeværk	DK-199	DK-67750411-1002257575-0172-20041001	330	248	248	
335	Langeskov Kommunale Fjernvarme	DK-200	DK-67892615-1003312783-0335-20041001	370	278	277	
33	Vejle Fjernvarme A.m.b.a.	DK-201	DK-67932218-1002261339-0033-20041001	433	325	325	
463	I/S Skive Fjernvarme	DK-202	DK-68326214-1003169877-0463-20041001	59519	44639	44639	
464	I/S Skive Fjernvarme	DK-203	DK-68326214-1003169890-0464-20041001	1145	859	859	
475	SK-Varme A/S	DK-204	DK-27736904-1010782941-0475-20041001	912	684	685	
478	SK-Varme A/S	DK-205	DK-27736904-1010782917-0478-20041001	743	557	558	
970	Solrød Fjernvarmeværk a.m.b.a.	DK-206	DK-69330428-1002294343-0970-20041001	722	541	541	
991	Hvide Sande Fjernvarme	DK-207	DK-69914128-1002309201-0991-20041001	30019	22514	22514	
373	Næstved Varmeværk	DK-208	DK-69995713-1003173770-0373-20041001	265	199	199	
376	Næstved Varmeværk	DK-209	DK-69995713-1003173800-0376-20041001	741	556	556	
125	Frederiksværk Kommunale Varmeværker	DK-210	DK-70097117-1009059608-0125-20041001	3968	2976	2975	
572	Bødkervænget Varmecentral	DK-211	DK-70921219-1004013689-0572-20041001	1365	1024	1024	
73	CTR, Nybrovej Centralen	DK-212	DK-74132111-1010668456-0073-20041001	802	602	602	
74	CTR, Spidslastcentral Phistersvej	DK-213	DK-74132111-1010668464-0074-20041001	392	294	293	
76	CTR, Kbh. Lufthavn Centralen	DK-214	DK-74132111-1010668472-0076-20041001	1142	856	857	

Annex D1: Installations covered by the Act on CO_2 Allowances 2005-2007 as of 1 February 2005.

National allocation plan table for Denmark							
VRK_ID	Installation name	Installation identifier	Permit Identifier	Allocation 2005	Allocation 2006	Allocation 2007	Reserve
121	Frederiksberg Varmecentral	DK-215	DK-74132111-1003253834-0121-20041001	10079	7559	7560	
646	Høje Gladsaxe Varmecentral	DK-216	DK-74132111-1010668480-0646-20041001	2852	2139	2140	
1351	Gladsaxe Spidslastanlæg	DK-217	DK-74132111-1010668499-1351-20041001	1116	837	837	
1551	CTR, Utterslev Varmecentral	DK-218	DK-74132111-1010668502-1551-20041001	289	217	217	
250	Næstved Kraftvarmeværk	DK-219	DK-65278316-1010642945-0250-20041001	37079	27809	27809	
547	Tørring Kraftvarmeværk	DK-220	DK-28709714-1003023952-0547-20041001	16340	12255	12254	
1826	Lystrup Fjernvarme Amba	DK-221	DK-42125814-1001820693-1826-20041001	86	65	65	
370	Nykøbing F. Kommunale Varmeforsyning	DK-222	DK-64707612-1010771745-0370-20041001	2362	1771	1771	
371	Nykøbing F. Kommunale Varmeforsyning	DK-223	DK-64707612-1010771737-0371-20041001	8668	6501	6500	
1841	Holme Lundshøj Fjernvarme amba	DK-224	DK-39901811-1001789264-1841-20041001	15	11	12	
1057	Gram Fjernvarmecentral AMBA	DK-225	DK-36294515-1001743992-1057-20041001	19440	14580	14579	
238	Høng Varmeværk	DK-226	DK-29096716-1001640777-0238-20041001	876	657	656	
386	Odder Varmeværk	DK-227	DK-64704710-1003157078-0386-20041001	388	291	290	
1825	Svogerslev Fjernvarmecentral	DK-228	DK-50187128-1001944117-1825-20041001	39	29	29	
1824	Høje Tåstrup	DK-229	DK-13057117-1002933753-1824-20041001	200	150	149	
1833	Fjernvarmedistrib. Avedøre Stationsby	DK-230	DK-14250905-1000707406-1833-20041001	621	466	466	
122	Frederikshavn Kommunale Varmeforsyning	DK-231	DK-23179652-1010749189-0122-20041001	6457	4843	4843	
123	Frederikshavn Kommunale Varmeforsyning	DK-232	DK-23179652-1010749219-0123-20041001	3458	2594	2594	
1828	Hvidovre Midt	DK-233	DK-76343616-1003191352-1828-20041001	263	197	198	
53	Bogense Forsyningsselskab	DK-234	DK-64831712-1002196453-0053-20041001	21751	16313	16314	
1830	Brøndbyøster Fjernvarmecentral	DK-235	DK-33269315-1003039608-1830-20041001	1070	802	803	
1831	Brøndbyvester Fjernvarmecentral	DK-236	DK-33269315-1003039566-1831-20041001	1536	1152	1153	
1847	Middelfart Fjernvarme, Hovedcentral	DK-237	DK-13545812-1000583372-1847-20041001	180	135	136	
61	Bredsten-Balle Kraftvarmeværk A.m.b.a.	DK-238	DK-34938717-1001727276-0061-20041001	10712	8034	8035	
14	Egtved Varmeværk	DK-239	DK-14909516-1000827232-0014-20041001	15743	11807	11807	
1855	Rønne Vand og Varmeforsyning Amba, reserve og spidslastcentral	DK-240	DK-25227832-1003308258-1855-20041001	70	52	53	
285	I/S Vestforbrænding	DK-241	DK-10866111-1003387416-0285-20041001	1049	787	786	
1857	Hedegårdens varmecentral (I/S Vestforbrænding)	DK-242	DK-10866111-1010800834-1857-20041001	108	81	81	
1827	Fjernvarmecentralen Avedøre Holme	DK-243	DK-22340417-1001545710-1827-20041001	3787	2840	2841	
1713	Colas, Glostrup	DK-244	DK-10246415-1010232089-1713-20041001	2444	1833	1834	
1714	Colas, Herfølge	DK-245	DK-10246415-1010232100-1714-20041001	1672	1254	1253	
1715	Colas, Horsens	DK-246	DK-10246415-1010232070-1715-20041001	1866	1400	1399	
1716	Colas, Vinderup	DK-247	DK-10246415-1002889095-1716-20041001	1484	1113	1114	
1729	DanSteel	DK-248	DK-10092922-1002313890-1729-20041001	108806	81605	81605	
1752	Nybro Gasbehandlingsanlæg	DK-249	DK-27210538-1009932840-1752-20041001	29020	21765	21765	
1742	Kraftvarmeværk	DK-250	DK-25917979-1008304072-1742-20041001	32181	24136	24136	
1705	Amtssygehuset i Glostrup	DK-251	DK-16189006-1003259066-1705-20041001	14742	11057	11057	
1745	NCC Roads A/S, asfalt	DK-252	DK-69894011-1003173381-1745-20041001	1215	911	911	
1746	NCC Roads A/S, asfalt	DK-253	DK-69894011-1002981261-1746-20041001	1996	1497	1498	
1747	NCC Roads A/S, asfalt	DK-254	DK-69894011-1002981273-1747-20041001	2822	2117	2117	
1748	NCC Roads A/S, asfalt	DK-255	DK-69894011-1003173228-1748-20041001	2977	2233	2232	
1807	NCC Mobilt anlæg	DK-256	DK-69894011-1003173307-1807-20041001	3618	2714	2713	
1854	NCC Roads Trige	DK-257	DK-69894011-1003173307-1854-20041001	2869	2152	2152	
1753	Nybro Tørreri	DK-258	DK-24247279-1001614949-1753-20041001	22219	16664	16665	
1759	Palsgaard A/S	DK-259	DK-26447038-1003084051-1759-20041001	7961	5971	5970	
928	Knud Jepsen A/S	DK-260	DK-11757278-1000270481-0928-20041001	14456	10842	10843	
1084	Alfred Pedersen og Søn	DK-261	DK-19146847-1003102851-1084-20041001	37707	28280	28281	
1088	Kronborg Aps.	DK-262	DK-16932108-1001187219-1088-20041001	15479	11609	11609	
783	Masnedø Gartnerier A/S	DK-263	DK-27496636-1010285905-0783-20041001	39577	29683	29683	
922	Varpelev Tomater A/S	DK-264	DK-15692995-1000961770-0922-20041001	29160	21870	21869	
1704	Akzo Nobel Salt A/S	DK-265	DK-17030744-1002986147-1704-20041001	31404	23553	23553	
1720	Damolin Fur A/S	DK-266	DK-37322318-1003052766-1720-20041001	13331	9998	9998	
1721	Damolin Mors A/S	DK-267	DK-37322318-1003064271-1721-20041001	33487	25115	25116	
1725	Danish Crown Ringsted	DK-268	DK-21643939-1003174352-1725-20041001	12165	9124	9123	
1796	Danish Crown Horsens	DK-269	DK-21643939-1010316592-1796-20041001	14573	10930	10929	
1717	Daka Proteins Løsning	DK-270	DK-45613410-1003084683-1717-20041001	29818	22363	22363	
1718	Daka Bio-industries Ortved	DK-271	DK-45613410-1003174303-1718-20041001	21407	16055	16055	
1719	Daka Bio-industries Randers	DK-272	DK-45613410-1003084713-1719-20041001	23208	17406	17407	
1783	Tulip Food Company Vejle	DK-273	DK-14003606-1002950285-1783-20041001	7095	5321	5321	
116	Fiskernes Fiskeindustri	DK-274	DK-53686214-1002006832-0116-20041001	72307	54230	54230	
1737	Hanstholms Fiskemelsfabrik A/S	DK-275	DK-10830281-1000138566-1737-20041001	21542	16156	16157	
1781	TripleNine Fish Protein	DK-276	DK-14981918-1003043173-1781-20041001	63754	47816	47816	
1782	Triplenine Fish Protein, Esbjerg	DK-277	DK-14981918-1000839411-1782-20041001	74580	55935	55936	
754	Aarhus United A/S	DK-278	DK-15672099-1000958332-0754-20041001	142518	106888	106889	
926	GB Finans A/S. Afd AKAFA	DK-279	DK-87469816-1003024807-0926-20041001	43199	32399	32399	
1091	GB Finans A/S. Afd. Danmark Protein A/S	DK-280	DK-87469816-1001971408-1091-20041001	42155	31616	31616	
1101	GB Finans A/S, Arinco Afdeling	DK-281	DK-87469816-1003029585-1101-20041001	38294	28721	28721	
1102	GB Finans A/S, Afd. HOCO	DK-282	DK-87469816-1003024856-1102-20041001	49200	36900	36900	
1710	Arla Foods Samden	DK-283	DK-25313763-1003024625-1710-20041001	36815	27611	27611	
1722	Dangrønt Ribe	DK-284	DK-17919679-1001873142-1722-20041001	16254	12190	12191	
1723	Dangrønt Ringkøbing	DK-285	DK-17919679-1003064829-1723-20041001	22212	16659	16659	

Annex D1: Installations covered by the Act on CO_2 Allowances 2005-2007 as of 1 February 2005.

National allocation plan table for Denmark							
VRK_ID	**Installation name**	**Installation identifier**	**Permit Identifier**	**Allocation 2005**	**Allocation 2006**	**Allocation 2007**	**Reserve**
1701	A/S AROVIT PETFOOD	DK-286	DK-78804912-1003198515-1701-20041001	13786	10340	10339	
500	Danisco Sugar, Nykøbing Sukkerfabrik	DK-287	DK-11350356-1003073438-0500-20041001	121886	91415	91415	
740	Danisco Sugar, Nakskov Sukkerfabrik	DK-288	DK-11350356-1003073359-0740-20041001	160339	120254	120255	
742	Danisco Sugar, Assens Sukkerfabrik	DK-289	DK-11350356-1003073426-0742-20041001	85840	64380	64379	
1799	Danisco Gørlev	DK-290	DK-11350356-1003073505-1799-20041001	26190	19642	19643	
760	CP Kelko ApS	DK-291	DK-21210285-1001573553-0760-20041001	132797	99598	99598	
1730	De Danske Spritfabrikker Aalborg	DK-292	DK-21409677-1003073529-1730-20041001	7406	5555	5555	
734	Carlsberg Danmark A/S	DK-293	DK-25508386-1003138695-0734-20041001	40722	30542	30541	
1403	Carlsberg A/S	DK-294	DK-25508386-1000619820-1403-20041001	27647	20735	20735	
1568	Danish Malting Group	DK-295	DK-16993409-1001199629-1568-20041001	40180	30135	30135	
1087	Dragsbaek Maltfabrik A/S	DK-296	DK-71174611-1002336930-1087-20041001	40264	30198	30199	
1738	Harboes Bryggeri A/S	DK-297	DK-43910515-1001845554-1738-20041001	8044	6033	6032	
1703	Midtjydsk Farveri	DK-298	DK-34730210-1001724356-1703-20041001	19436	14577	14576	
1732	EGETÆPPER A/S	DK-299	DK-38454218-1001767559-1732-20041001	7822	5866	5867	
364	Novopan Træindustri A/S	DK-300	DK-11766110-1002911982-0364-20041001	20901	15676	15676	
743	Dalum Papir A/S	DK-301	DK-20284196-1003138658-0743-20041001	73846	55385	55385	
782	Dalum Papir Maglemølle	DK-302	DK-20284196-1003138646-0782-20041001	6912	5184	5184	
1771	SCA Packaging Djursland	DK-303	DK-40547819-1001798079-1771-20041001	0	0	0	
1772	Skjern Papirfabrik A/S	DK-304	DK-83031212-1003207862-1772-20041001	15735	11801	11801	
744	Brødrene Hartmann A/S	DK-305	DK-63049611-1003151998-0744-20041001	97632	73224	73224	
1	Shell Raffinaderiet Fredericia	DK-306	DK-10373816-1002893194-0001-20041001	600169	450127	450127	
1773	Statoil Raffinaderiet	DK-307	DK-28142412-1003022853-1773-20041001	648450	486338	486338	
1775	Sun Chemical A/S	DK-308	DK-21420018-1001535091-1775-20041001	19163	14372	14372	
1751	Novozymes A/S	DK-309	DK-10007127-1007675476-1751-20041001	19107	14330	14330	
302	Kemira, Fredericia	DK-310	DK-10604133-1002898822-0302-20041001	73813	55360	55360	
1396	Cheminova A/S	DK-311	DK-12760043-1000441076-1396-20041001	111670	83752	83752	
751	BASF Health & Nutrition A/S	DK-312	DK-67340728-1002249342-0751-20041001	40836	30627	30626	
1750	Novo Nordisk A/S	DK-313	DK-24256790-1007676162-1750-20041001	13321	9991	9991	
1736	Haldor Topsøe A/S	DK-314	DK-41853816-1003065230-1736-20041001	37166	27875	27875	
1109	Roulunds Fabrikker A/S	DK-315	DK-27364926-1001760037-1109-20041001	27333	20500	20499	
1712	Codan Gummi A/S	DK-316	DK-21372315-1003003370-1712-20041001	6220	4665	4666	
1766	Rexam Glass Holmegaard A/S	DK-317	DK-18445042-1003465733-1766-20041001	86502	64877	64877	
1770	Saint Gobain Isover A/S	DK-318	DK-11933238-1000301355-1770-20041001	11389	8542	8542	
1702	A/S Bachmanns Teglværk	DK-319	DK-31978017-1001683002-1702-20041001	6236	4677	4678	
1711	Carl Matzens Teglværk A/S	DK-320	DK-42125210-1001820681-1711-20041001	4395	3296	3296	
1734	Gråsten Teglværk	DK-321	DK-40294619-1001794437-1734-20041001	5518	4138	4139	
1739	Helligsø Teglværk A/S	DK-322	DK-36967110-1001750470-1739-20041001	8096	6072	6072	
1741	Højslev Tegl A/S	DK-323	DK-67863828-1003550278-1741-20041001	7385	5539	5538	
1743	Lafarge Tekkin A/S - Volstrup Teglværk	DK-324	DK-31310113-1002934402-1743-20041001	6964	5223	5222	
1744	LUNDGÅRD TEGLVÆRK A/S	DK-325	DK-38016210-1001761987-1744-20041001	12316	9237	9237	
1749	Nordtegl A/S	DK-326	DK-75922019-1002474738-1749-20041001	4948	3711	3711	
1757	Orebo Teglværk A/S	DK-327	DK-26171350-1001478753-1757-20041001	7232	5424	5425	
1761	PETERSEN TEGL EGERNSUND A/S	DK-328	DK-28672012-1001634638-1761-20041001	9478	7109	7109	
1762	PETERSMINDE TEGLVÆRK A/S	DK-329	DK-33778716-1000268567-1762-20041001	15889	11917	11917	
1763	Pipers Teglværker A/S Gandrup Teglværk	DK-330	DK-23998513-1003013090-1763-20041001	23081	17311	17310	
1764	PIPERS TEGLVÆRKER A/S Hammershøj Teglværk	DK-331	DK-23998513-1003013089-1764-20041001	20050	15038	15037	
1780	Ydby Teglværk A/S	DK-332	DK-81664315-1007655432-1780-20041001	10704	8028	8027	
1784	Tychsen's Teglværk A/S	DK-333	DK-15517077-1000937672-1784-20041001	5832	4374	4374	
1785	Vedstaarup Teglværk A/S	DK-334	DK-48791018-1001920902-1785-20041001	16256	12192	12193	
1774	STOFFERS TEGLVÆRK A/S	DK-335	DK-82753915-1001679006-1774-20041001	5652	4239	4240	
1786	Vesterled Teglværk A/S	DK-336	DK-82753915-1002654599-1786-20041001	7558	5669	5669	
1544	Villemoes Teglværk	DK-337	DK-45231216-1001865577-1544-20041001	6836	5127	5127	
1788	Vindø Teglværk A/S	DK-338	DK-32232515-1001687185-1788-20041001	10729	8047	8046	
1760	Pedershvile Teglværk	DK-339	DK-10502306-1002997604-1760-20041001	12958	9718	9719	
1765	Prøvelyst Teglværk	DK-340	DK-10502306-1002997598-1765-20041001	13097	9823	9823	
1789	WIENERBERGER A/S	DK-341	DK-10502306-1002896764-1789-20041001	6814	5110	5111	
7	Aalborg Portland A/S	DK-342	DK-14244441-1002952999-0007-20041001	3333987	2500490	2500491	
1733	Faxe Kalk, Ovnanlægget Stubberup	DK-343	DK-20882182-1005184196-1733-20041001	132805	99604	99603	
1726	Danogips	DK-344	DK-54050313-1003103433-1726-20041001	25363	19022	19023	
1735	Gyproc A/S	DK-345	DK-27237916-1001610372-1735-20041001	24772	18579	18579	
1727	DANSK ETERNIT A/S	DK-346	DK-58711713-1002086335-1727-20041001	13546	10159	10159	
1776	Tarco Vej A/S	DK-347	DK-10977193-1003321148-1776-20041001	1275	956	957	
1777	Tarco Vej A/S	DK-348	DK-10977193-1002905302-1777-20041001	3422	2567	2567	
1778	Tarco Vej A/S	DK-349	DK-10977193-1002905326-1778-20041001	3247	2435	2436	
1779	Tarco Vej A/S	DK-350	DK-10977193-1002905314-1779-20041001	2910	2182	2183	
1767	Rockwool A/S Doense	DK-351	DK-42391719-1003070026-1767-20041001	53238	39929	39929	
1768	Rockwool A/S, Hedehusene	DK-352	DK-42391719-1003070002-1768-20041001	35320	26490	26491	
1769	Rockwool A/S, Vamdrup	DK-353	DK-42391719-1003070014-1769-20041001	60536	45402	45402	
1728	Dansk Leca A/S	DK-354	DK-59983016-1003135246-1728-20041001	78285	58714	58713	
1756	Maxit Ølst	DK-355	DK-12841736-1002931142-1756-20041001	69788	52341	52341	
1395	Danfoss	DK-356	DK-20165715-1002999115-1395-20041001	35420	26565	26564	
1754	ODENSE STAALSKIBSVÆRFT A/S	DK-357	DK-45739910-1003085393-1754-20041001	19621	14716	14716	

Annex D1: Installations covered by the Act on CO_2 Allowances 2005-2007 as of 1 February 2005.

National allocation plan table for Denmark							
VRK_ID	**Installation name**	**Installation identifier**	**Permit Identifier**	**Allocation 2005**	**Allocation 2006**	**Allocation 2007**	**Reserve**
753	Maricogen P/S	DK-358	DK-20683341-1004449186-0753-20041001	156537	117403	117403	
929	Fællinggaard Varmeforsyning Aps	DK-359	DK-73731410-1002410978-0929-20041001	22244	16683	16683	
81	Danisco Cultor 050, Grindsted	DK-360	DK-11350356-1003073542-0081-20041001	69402	52051	52051	
1798	DanScan Metal	DK-361	DK-27450431-1010437772-1798-20041001	28135	21101	21102	
1755	Odense Universitets Hospital	DK-362	DK-40556311-1003309680-1755-20041001	8388	6291	6291	
1853	Arkil asfalt	DK-363	DK-15070544-1002965976-1853-20041001	1940	1455	1456	
1793	LMK Vej A/S Randers Asfaltfabrik	DK-364	DK-18298503-1007635792-1793-20041001	1319	989	989	
1794	LMK Vej A/S Ølstykke Asfaltfabrik	DK-365	DK-18298503-1007635695-1794-20041001	1195	896	896	
1795	F. Junckers Industries A/S	DK-366	DK-66920216-1003163806-1795-20041001	4309	3232	3231	
75	Amtssygehuset i Gentofte	DK-367	DK-16189006-1003258812-0075-20041001	3065	2299	2298	
1858	Elsam kedler ved SCA Packaging	DK-368	DK-25460715-1010839943-1858-20041001	14106	10580	10579	
1829	Hvidovre Hospital	DK-369	DK-18143534-1003256912-1829-20041001	2208	1656	1656	
1801	Dan feltet omfattende anlæg på platformene Dan A, -B, -C, -D, -E, -FA, -FB, -FC, -FD, -FE, -FF og -FG	DK-370	DK---1801-20041001	733619	550214	550214	
1802	Gorm feltet omfattende anlæg på platformene Gorm A, -B, -C, -D, -E og F	DK-371	DK---1802-20041001	636882	477662	477662	
1803	Harald feltet omfattende anlæg på platformene Harald A og -B	DK-372	DK---1803-20041001	62802	47102	47102	
1804	Tyra feltet omfattende anlæg på platformene Tyra Vest A, -B, -C, -D og -E samt Tyra Øst A, -B, -C, -D, -E og -F	DK-373	DK---1804-20041001	844514	633385	633385	
1806	Halfdan feltet omfattende anlæg på platformene Halfdan HDA, -HDB, -HDC og -HBA	DK-374	DK---1806-20041001	156448	117336	117335	
1805	Siri feltet omfattende anlæg på Siri platformen	DK-375	DK---1805-20041001	124488	93366	93367	
1800	Syd Arne feltet omfattende anlæg på Syd Arne platformen	DK-376	DK---1800-20041001	286587	214940	214940	
276	Haslev Kraftvarmeværk	DK-377	DK-18936674-1004303224-0276-20041001	0	0	0	
254	Helsinge Fjernvarme	DK-378	DK-42760218-1001830583-0254-20041001	28824	21618	21618	

Annex D2: Information on Denmark's national CO2 allowance registry

1. Information on the registry administrator

The Danish Environmental Protection Agency
Strandgade 29
DK-1401 Copenhagen K
Tel. : +45 32 66 01 60
Fax: +45 32 66 02 01
e-mail: mst@mst.dk

2. Cooperation with other countries concerning the operation of the registry

Denmark does not cooperate with other countries concerning the administration or operation of the Danish CO_2 emissions trading registry.

3. Standards for data exchange

The Danish registry system follows the UN Data Exchange Standards 7.

4. Procedures for administration and operation of the emissions trading registry

The procedures are described in the Commission regulation (EC) no. 2216/2004 on a standardised and secure system of registries adopted pursuant to the Parliament and Council directive 2003/87/EC and the Parliament and Council decision 280/2004/EC.

Denmark is in compliance with the procedures stated in the regulation.

5. Safety standards

The registry is safeguarded with a FireWall based on 2 Cisco FireWall Software Modules (FWSM) in a Catalyst 6507. There is dual access from all servers to the Internet, ensuring that a single error will not cause disconnection. The RILO ports on the servers are connected to the internal networks, making it possible to have remote control of the machines via a secure net. Software is updated as required. The entire system is monitored regularly and all security violations are recorded and corrected as soon as possible. As regards the network, administrative access to the machines from the Ministry's internal network is secure. The Registry can only be accessed via the programme through WEB-Services. These WEB-Services can be accessed either through an open part (the initial communication) or a secure part (the register software application itself).The secure part of the system is based on SSL. Similarly the system is designed so as to make it impossible to use the same password more than once in the system. The Registry's production system consists of 2 servers, a WEB server and a database server. The servers are configured so that a single disc error will not stop the system. Furthermore as regards the disc, the DB server is set up so that the transaction log and the database are physically located on separate discs. Everyone who registers as users of the registry receives their own username and password and is instructed to ensure that these remain confidential. If a user discovers that an unauthorized person has gained access to his/her password, the password must be changed in the registry immediately and the registry administration must be notified. The registry automatically disconnects when access as been inactive for some time. You must log on again using your username and password.

6. **Information available to the public**
   Only the information stated in article 9 and the corresponding appendices in the Commission regulation (EC) no. 2216/2004 on a standardised and secure system of registries adopted pursuant to the Parliament and Council directive 2003/87/EC and the Parliament and Council decision 280/2004/EC is available to the public.

7. **Internet address for the registry**
   http://dketreu.mst.dk/

8. **Protection, maintenance and recreation of data**
   A total back-up is carried out on a nightly basis. The system is configured with a high error tolerance level. Furthermore the configuration of the system makes it possible to re-install it at a different physical location. The registry is covered by the general emergency plan for the Danish Ministry of the Environment.

Only persons authorised by the ministry will be granted access to the production environment.

Only representatives appointed by the administrator of the registry and a small number of employees in the host organisation have access to all data in the registry system. All of these persons are covered by a duty of non-disclosure. Any physical or technical access to the system from the system administrator (the host organisation) will be logged.

The registry administrators change their passwords every three months and when needed.

Emergency plan for the Danish CO_2 Emissions Trading Registry:
The description below includes a check list to be used in the event of an emergency situation affecting the Danish Emissions Trading Registry. The check list is to be used if the telephone company's (TDC) service centre is out of order, or if the equipment the system uses is damaged. The check list refers to the general system documentation for the Danish Emissions Trading Registry, which includes a detailed description of procedures. The starting point for reinstallation is to give priority to actions so as to ensure that an operative system is established as soon as possible and that users, including CITL/ITL, experience as little down time as possible.

Check list:

1. Contact the hardware group of the Centre for Corporate Management to get a server/PC.
2. Place the server/PC in the hub at the Centre for Corporate Management, IT Services, Rentemestervej 8, building A, first floor.
3. Install Microsoft Windows 2003 on the server.
4. Install Microsoft SQL2000 on the server.
5. Install Microsoft Internet Information Server on the server.
6. Install Backup client on the server.
7. Install the ETR system and adapt it to Danish conditions (menu bar, the EPA logo, EPA fonts and colours, conditions etc.).
8. Set up user on the SQL server.
9. Re-establish the certificate for a secure connection between CITL and the Danish ETR.
10. Read in a backup of the Danish ETR database.
11. Start Register services on the server.

The Danish ETR will now run on a temporary installation, and work to re-establish a new permanent production system will be continued.

Annex E Results and supplementary information concerning greenhouse gas projections

This Annex consists of the following 2 sub-annexes:

Annex E1: The results of Denmark's May 2005 'with measures' projection of greenhouse gas emissions 2004-2030, cf. Memorandum from NERI, May 2005.

Note to Tables E1-1 to E1-8: The tables show the historical and projected greenhouse gas emissions in ´000 tonnes CO_2 equivalents for CO_2, methane (CH4), nitrous oxide (N2O) and the F-gases (HFCs, PFCs and SF6) respectively. Calculation of the emissions for the various IPCC categories are described in chapters 2-9 in Projection of greenhouse gas emissions 2004 to 2030, Memorandum to the Danish EPA, NERI, May 2005 – except for emissions from the use of solvents (6). CO_2 emissions from the use of solvents are based on a new method developed by NERI for calculation of the NMVOC emissions. The conversion factor from NMVOC to carbon is assumed to be 0.85 and the historical emissions in 2003 have been used for the projection of the NMVOC emissions. Emissions from storage of coal have previously been included in the historical inventories, however they are not included in the projections now. In the same magnitude, projections for industrial processes do not yet include sources that have not been implemented in the historical inventories. It is therefore expected that in the next reporting of the historical inventories to the Climate Convention, the sources included in the historical inventories will fully concur with the sources included in the projections. In total these changes will correspond to less than 0.1 million tonnes CO_2 equivalents.

Notes to Table E1-8:

* Include process emissions – that is corresponding to the IPCC category Industry, in that industry's energy consumption is included under Energy – as well as emissions from the use of organic solvents.

** Only includes methane and nitrous oxide from agriculture, that is corresponding to the IPCC category Agriculture – in that agriculture's energy consumption is included under Energy.

*** Includes the total net emissions from land-use, land-use change and forestry in accordance with the Climate Convention, which is different from what can be included under Articles 3.3 and 3.4 of the Kyoto Protocol.

**** Also includes emissions from wastewater treatment, cf. the IPCC guidelines.

Annex E2: A brief description of the work involved in preparing the energy projections.

Table E1-1: The result of Denmark's 'with measures' greenhouse gas projection 2004-2030 as regards CO_2

CO2 emissions and projections (Gg)	KP Base Year	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008-12	2013-17	2020	2025	2030
Denmark's Total national Emissions and Removals (KP Net Emissions) in the base scenario ("with measures", i.e. implemented and adopted measures)	**52887**	**52887**	**60599**	**53017**	**54541**	**54200**	**59221**	**55163**	**56597**	**58562**	**58515**	**58971**	**58828**	**55183**	**54246**	**54860**
Denmark's Total KP Removals	0	0	-10	-59	-74	-88	-108	-124	-141	-162	-182	-262	-401	-555	-646	-822
Denmark's Total Emissions/Removals with LUCF (CC Net Emissions)		**53045**	**60375**	**54858**	**53457**	**52812**	**58124**	**54367**	**55785**	**57729**	**57662**	**58038**	**57756**	**53957**	**52929**	**53367**
Denmark's Total Emissions without LUCF	52887	52887	60609	53076	54615	54288	59329	55287	56738	58724	58697	59233	59229	55738	54892	55682
1. Energy	**51502**	**51502**	**58992**	**51290**	**52879**	**52535**	**57635**	**53395**	**54762**	**56710**	**56644**	**57180**	**57176**	**53685**	**52840**	**53629**
A Fuel Combustion Activities (Sectoral Approach)	**51239**	**51239**	**58627**	**50696**	**52246**	**52000**	**57085**	**52795**	**54252**	**56199**	**56134**	**56670**	**56685**	**53345**	**52499**	**53288**
1 Energy Industries	**26173**	**26173**	**31934**	**25114**	**26400**	**26553**	**31402**	**26789**	**28188**	**29939**	**29516**	**29021**	**28351**	**24385**	**22964**	**23390**
a Public Electricity and Heat Production	24736	24736	29828	22677	23972	24060	28869	24028	25118	26813	26185	24238	22687	19374	17940	18366
b Petroleum Refining	897	897	1371	988	1009	971	1013	1006	1006	1006	1006	1006	1006	1006	1006	1006
c Manufacture of Solid Fuels and Other Energy Industries	540	540	735	1449	1419	1522	1520	1754	2064	2120	2325	3777	4658	4006	4018	4018
2 Manufacturing Industries and Construction	**5376**	**5376**	**5890**	**5786**	**5804**	**5559**	**5404**	**5428**	**5389**	**5429**	**5542**	**5915**	**6173**	**6439**	**6688**	**6814**
f Other (please specify: (1) Boilers, gas turbines, stationary engines and (2) Industry mobile sources and machinery)	5376	5376	5890	5786	5804	5559	5404	5428	5389	5429	5542	5915	6173	6439	6688	6814
3 Transport	**10441**	**10441**	**11823**	**12118**	**12142**	**12319**	**12785**	**12850**	**13057**	**13262**	**13456**	**13890**	**14291**	**14673**	**15006**	**15288**
a Civil Aviation	243	243	199	154	161	140	138	122	124	126	128	134	146	158	169	180
b Road Transportation	9351	9351	10648	11229	11272	11388	11864	12007	12226	12429	12621	13049	13438	13807	14129	14400
c Railways	297	297	303	228	211	210	218	203	202	202	202	202	202	202	202	202
d Navigation	551	551	674	507	498	581	565	518	505	505	505	505	505	505	505	505
4 Other Sectors	**9129**	**9129**	**8728**	**7567**	**7803**	**7481**	**7402**	**7606**	**7496**	**7447**	**7498**	**7722**	**7748**	**7726**	**7718**	**7674**
a Commercial/Institutional	1403	1403	1116	913	917	874	854	921	924	926	934	953	966	969	961	938
b Residential	5033	5033	5073	4085	4300	4027	3971	4115	4032	3959	3961	4057	4002	3908	3842	3777
c Agriculture/Forestry/Fisheries	2693	2693	2539	2569	2586	2580	2577	2570	2540	2562	2604	2712	2780	2849	2915	2959
5 Other (please specify: Military mobile combustion of fuels)	**119**	**119**	**252**	**111**	**97**	**89**	**92**	**122**	**122**	**122**	**122**	**122**	**122**	**122**	**122**	**122**
b. Mobile	119	119	252	111	97	89	92	122	122	122	122	122	122	122	122	122
B Fugitive Emissions from Fuels	**263**	**263**	**365**	**594**	**633**	**535**	**550**	**600**	**510**	**510**	**510**	**510**	**491**	**341**	**341**	**341**
1 Solid Fuels	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
c Other (please specify: Storage of solid fuel)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 Oil and Natural Gas	**263**	**263**	**365**	**594**	**633**	**535**	**550**	**600**	**510**	**510**	**510**	**510**	**491**	**341**	**341**	**341**
a Oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
b Natural Gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
c Venting and Flaring	263	263	365	594	633	535	550	600	510	510	510	510	491	341	341	341
Flaring	263	263	365	594	633	535	550	600	510	510	510	510	491	341	341	341
2. Industrial Processes	**1068**	**1068**	**1375**	**1574**	**1606**	**1601**	**1488**	**1680**	**1764**	**1803**	**1841**	**1841**	**1841**	**1841**	**1841**	**1841**
A Mineral Products	**1037**	**1037**	**1335**	**1531**	**1556**	**1598**	**1486**	**1677**	**1716**	**1755**	**1793**	**1793**	**1793**	**1793**	**1793**	**1793**
1 Cement Production	882	882	1204	1406	1432	1452	1370	1409	1448	1487	1525	1525	1525	1525	1525	1525
2 Lime Production	138	138	117	109	108	130	102	115	115	115	115	115	115	115	115	115
3 Limestone and Dolomite Use	0	0	0	0	0	0	0	138	138	138	138	138	138	138	138	138
7 Other (please specify: Glass Production)	17	17	14	16	16	16	13	15	15	15	15	15	15	15	15	15
B Chemical Industry	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
2 Nitric Acid Production																
5 Other (please specify: Catalysts/Fertilizers and Pesticides)	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3
C Metal Production	**28**	**28**	**39**	**41**	**47**	**0**	**0**	**0**	**45**	**45**	**45**	**45**	**45**	**45**	**45**	**45**
1 Iron and Steel Production	28	28	39	41	47	0	0	0	45	45	45	45	45	45	45	45
4 SF6 Used in Aluminium and Magnesium Foundries								0	0	0	0	0	0	0	0	0
SF6 Used in Magnesium Foundries																
F Consumption of Halocarbons and Sulphur Hexafluoride																
3. Solvent and Other Product Use	**317**	**317**	**242**	**212**	**130**	**151**	**206**	**212**	**212**	**212**	**212**	**212**	**212**	**212**	**212**	**212**
4. Agriculture																
A Enteric Fermentation																
B Manure Management																
D Agricultural Soils																
5. Land-Use Change and Forestry (LUCF)		**158**	**-234**	**1782**	**-1158**	**-1476**	**-1204**	**-919**	**-953**	**-995**	**-1035**	**-1195**	**-1472**	**-1781**	**-1963**	**-2315**
A Changes in Forest and Other Woody Biomass Stocks		**-2832**	**-2992**	**-653**	**-3539**	**-3813**	**-3533**	**-3248**	**-3282**	**-3324**	**-3364**	**-3524**	**-3801**	**-4110**	**-4292**	**-4644**
2 Temperate Forests		-2832	-2982	-594	-3465	-3725	-3425	-3124	-3141	-3162	-3182	-3262	-3401	-3555	-3646	-3822
5 Other (please specify)		0	-10	-59	-74	-88	-108	-124	-141	-162	-182	-262	-401	-555	-646	-822
D CO2 Emissions and Removals from Soil		**2990**	**2758**	**2435**	**2381**	**2337**	**2329**	**2329**	**2329**	**2329**	**2329**	**2329**	**2329**	**2329**	**2329**	**2329**
Cultivation of Organic Soils		2400	2313	2283	2297	2243	2252	2252	2252	2252	2252	2252	2252	2252	2252	2252
Liming of Agricultural Soils		566	496	261	201	233	226	226	226	226	226	226	226	226	226	226
Other (please specify)		25	-52	-109	-116	-139	-149	-149	-149	-149	-149	-149	-149	-149	-149	-149
6. Waste	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
A Solid Waste Disposal on Land	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1 Managed Waste Disposal on Land	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B Wastewater Handling																
2 Domestic and Commercial Wastewater																
Memo Items (not included above):																
International Bunkers	**4823**	**4823**	**6928**	**6629**	**5990**	**5025**	**5318**	**5357**	**5393**	**5429**	**5465**	**5581**	**5794**	**6027**	**6220**	**6425**
Aviation	1736	1736	1867	2350	2385	2059	2188	2219	2254	2291	2327	2443	2656	2889	3082	3287
Marine	3087	3087	5061	4279	3605	2966	3130	3138	3138	3138	3138	3138	3138	3138	3138	3138
CO2 Emissions from Biomass	4641	4641	5869	7090	7637	8383	9108	NE	NE	NE	NE	NE	NE	NE	NE	NE
Corrections (not included above):																
CO2 emissions related to Net Electricity Import (minus means Net Electricity Export)	6300	6300	-690	659	-375	-1608	-6869	-3594	-4403	-6413	-5960	-4375	-2276	-1379	-859	-2868
CO2 emissions related to the temperature deviation from a normal year (based on degree days)	1879	1879	235	1323	254	1000	723	0	0	0	0	0	0	0	0	0

Table E1-2: The result of Denmark's 'with measures' greenhouse gas projection 2004-2030 as regards methane (CH_4)

CH4 emissions and projections (Gg CO2 equivalents)	KP Base Year	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008-12	2013-17	2020	2025	2030
Denmark's Total national Emissions and Removals (KP Net Emissions) in the base scenario ("with measures", i.e. implemented and adopted measures)	**5684**	**5684**	**6108**	**5941**	**6029**	**5954**	**5873**	**5703**	**5646**	**5662**	**5599**	**5573**	**5322**	**5217**	**5166**	**5199**
Denmark's Total KP Removals																
Denmark's Total Emissions/Removals with LUCF (CC Net Emissions)		**5684**	**6108**	**5941**	**6029**	**5954**	**5873**	**5703**	**5646**	**5662**	**5599**	**5573**	**5322**	**5217**	**5166**	**5199**
Denmark's Total Emissions without LUCF	5684	5684	6108	5941	6029	5954	5873	5703	5646	5662	5599	5573	5322	5217	5166	5199
1. Energy	**297**	**297**	**662**	**722**	**757**	**746**	**771**	**632**	**622**	**624**	**622**	**731**	**625**	**572**	**560**	**570**
A Fuel Combustion Activities (Sectoral Approach)	**186**	**186**	**469**	**579**	**609**	**602**	**594**	**510**	**500**	**506**	**506**	**617**	**524**	**497**	**489**	**499**
1 Energy Industries	**23**	**23**	**242**	**312**	**337**	**336**	**330**	**221**	**211**	**217**	**216**	**322**	**237**	**215**	**204**	**210**
a Public Electricity and Heat Production	22	22	240	310	336	335	329	219	210	215	214	319	234	212	201	207
b Petroleum Refining	1	1	1	0	0	0	0	1	1	1	1	1	1	1	1	1
c Manufacture of Solid Fuels and Other Energy Industries	0	0	1	1	1	1	1	1	1	1	1	2	3	2	2	2
2 Manufacturing Industries and Construction	**16**	**16**	**19**	**34**	**35**	**35**	**34**	**41**	**41**	**41**	**42**	**44**	**45**	**46**	**47**	**47**
f Other (please specify: (1) Boilers, gas turbines, stationary engines and (2) Industry mobile sources and machinery)	16	16	19	34	35	35	34	41	41	41	42	44	45	46	47	47
3 Transport	**57**	**57**	**78**	**72**	**71**	**66**	**65**	**66**	**65**	**63**	**60**	**51**	**35**	**26**	**23**	**23**
a Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
b Road Transportation	55	55	76	69	69	63	62	63	62	60	57	48	33	24	21	20
c Railways	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
d Navigation	1	1	2	3	3	3	3	2	2	2	2	2	2	2	2	2
4 Other Sectors	**90**	**90**	**130**	**161**	**165**	**165**	**165**	**182**	**183**	**184**	**188**	**200**	**206**	**210**	**214**	**218**
a Commercial/Institutional	4	4	13	19	20	21	20	23	23	24	24	24	24	24	24	24
b Residential	67	67	89	94	100	97	99	110	111	112	114	125	130	134	137	141
c Agriculture/Forestry/Fisheries	19	19	28	47	45	48	47	49	48	49	50	51	52	52	53	54
5 Other (please specify: Military mobile combustion of fuels)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
b. Mobile	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B Fugitive Emissions from Fuels	**111**	**111**	**193**	**143**	**148**	**144**	**177**	**122**	**122**	**119**	**116**	**114**	**101**	**75**	**71**	**71**
1 Solid Fuels	**72**	**72**	**132**	**64**	**69**	**62**	**93**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
c Other (please specify: Storage of solid fuel)	72	72	132	64	69	62	93	0	0	0	0	0	0	0	0	0
2 Oil and Natural Gas	**38**	**38**	**60**	**79**	**79**	**82**	**84**	**122**	**122**	**119**	**116**	**114**	**101**	**75**	**71**	**71**
a Oil	32	32	48	73	72	76	78	84	89	86	83	82	71	54	50	50
b Natural Gas	6	6	12	5	6	4	4	2	2	2	2	2	1	1	1	1
c Venting and Flaring	0	0	1	1	1	1	1	36	30	30	30	30	29	20	20	20
Flaring	0	0	1	1	1	1	1	36	30	30	30	30	29	20	20	20
2. Industrial Processes	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
A Mineral Products	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1 Cement Production																
2 Lime Production																
3 Limestone and Dolomite Use																
7 Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B Chemical Industry	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2 Nitric Acid Production																
5 Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C Metal Production	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1 Iron and Steel Production	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4 SF6 Used in Aluminium and Magnesium Foundries																
SF6 Used in Magnesium Foundries																
F Consumption of Halocarbons and Sulphur Hexafluoride																
3. Solvent and Other Product Use																
4. Agriculture	**3853**	**3853**	**3938**	**3809**	**3854**	**3774**	**3706**	**3699**	**3681**	**3719**	**3680**	**3587**	**3438**	**3356**	**3282**	**3282**
A Enteric Fermentation	**3110**	**3110**	**3079**	**2872**	**2898**	**2808**	**2734**	**2700**	**2681**	**2706**	**2671**	**2582**	**2441**	**2354**	**2275**	**2275**
B Manure Management	**743**	**743**	**860**	**937**	**956**	**966**	**972**	**999**	**1000**	**1013**	**1009**	**1005**	**997**	**1002**	**1007**	**1007**
D Agricultural Soils	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
5. Land-Use Change and Forestry (LUCF)		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
A Changes in Forest and Other Woody Biomass Stocks																
2 Temperate Forests																
5 Other (please specify)																
D CO2 Emissions and Removals from Soil																
Cultivation of Organic Soils																
Liming of Agricultural Soils																
Other (please specify)																
6. Waste	**1534**	**1534**	**1507**	**1410**	**1417**	**1434**	**1397**	**1372**	**1344**	**1320**	**1297**	**1255**	**1258**	**1289**	**1323**	**1347**
A Solid Waste Disposal on Land	**1334**	**1334**	**1286**	**1192**	**1188**	**1156**	**1153**	**1133**	**1113**	**1098**	**1087**	**1071**	**1065**	**1080**	**1097**	**1105**
1 Managed Waste Disposal on Land	1334	1334	1286	1192	1188	1156	1153	1133	1113	1098	1087	1071	1065	1080	1097	1105
B Wastewater Handling	**200**	**200**	**222**	**217**	**229**	**277**	**244**	**239**	**231**	**222**	**210**	**183**	**193**	**210**	**226**	**242**
2 Domestic and Commercial Wastewater	200	200	222	217	229	277	244	239	231	222	210	183	193	210	226	242
Memo Items (not included above):																
International Bunkers	**2**	**2**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**3**
Aviation	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Marine	1	1	2	2	2	1	1	1	1	1	1	1	1	1	1	1
CO2 Emissions from Biomass																
Corrections (not included above):																
CO2 emissions related to Net Electricity Import (minus means Net Electricity Export)																
CO2 emissions related to the temperature deviation from a normal year (based on degree days)																

Table E1-3: The result of Denmark's 'with measures' greenhouse gas projection 2004-2030 as regards nitrous oxide (N2O)

N2O emissions and projections (Gg CO2 equivalents)	KP Base Year	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008-2012	2013-2017	2020	2025	2030
Denmark's Total national Emissions and Removals (KP Net Emissions) in the base scenario ("with measures", i.e. implemented and adopted measures)	**10713**	**10713**	**9657**	**8615**	**8380**	**8035**	**8060**	**7566**	**7102**	**7070**	**7042**	**6942**	**6760**	**6628**	**6530**	**6543**
Denmark's Total KP Removals																
Denmark's Total Emissions/Removals with LUCF (CC Net Emissions)		**10713**	**9657**	**8615**	**8380**	**8035**	**8060**	**7566**	**7102**	**7070**	**7042**	**6942**	**6760**	**6628**	**6530**	**6543**
Denmark's Total Emissions without LUCF	10713	10713	9657	8615	8380	8035	8060	7566	7102	7070	7042	6942	6760	6628	6530	6543
1. Energy	**590**	**590**	**761**	**790**	**822**	**840**	**913**	**903**	**933**	**971**	**988**	**1025**	**1060**	**1052**	**1063**	**1076**
A Fuel Combustion Activities (Sectoral Approach)	**589**	**589**	**759**	**787**	**818**	**837**	**910**	**900**	**930**	**968**	**985**	**1022**	**1058**	**1050**	**1062**	**1075**
1 Energy Industries	**276**	**276**	**327**	**255**	**270**	**275**	**328**	**295**	**306**	**324**	**321**	**313**	**314**	**283**	**273**	**268**
a Public Electricity and Heat Production	260	260	304	227	242	247	298	264	271	288	282	257	247	224	214	209
b Petroleum Refining	9	9	15	11	11	11	11	11	11	11	11	11	11	11	11	11
c Manufacture of Solid Fuels and Other Energy Industries	6	6	9	17	17	18	18	21	25	25	28	45	56	48	48	48
2 Manufacturing Industries and Construction	**54**	**54**	**56**	**57**	**57**	**58**	**56**	**59**	**58**	**58**	**59**	**63**	**66**	**68**	**71**	**72**
f Other (please specify: (1) Boilers, gas turbines, stationary engines and (2) Industry mobile sources and machinery)	54	54	56	57	57	58	56	59	58	58	59	63	66	68	71	72
3 Transport	**147**	**147**	**270**	**380**	**394**	**408**	**430**	**445**	**466**	**485**	**503**	**540**	**570**	**590**	**608**	**624**
a Civil Aviation	3	3	3	2	2	2	3	2	2	2	2	2	3	3	3	3
b Road Transportation	131	131	252	367	381	394	416	432	453	473	491	527	557	577	595	611
c Railways	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2
d Navigation	10	10	12	8	8	10	9	8	8	8	8	8	8	8	8	8
4 Other Sectors	**110**	**110**	**104**	**94**	**97**	**95**	**95**	**100**	**99**	**99**	**100**	**104**	**106**	**107**	**108**	**109**
a Commercial/Institutional	12	12	10	8	8	7	8	11	11	11	11	11	11	11	11	11
b Residential	57	57	58	51	53	51	50	53	52	52	53	56	57	57	58	58
c Agriculture/Forestry/Fisheries	41	41	36	36	36	37	36	36	36	36	36	37	38	39	39	40
5 Other (please specify: Military mobile combustion of fuels)	**1**	**1**	**3**	**1**	**2**	**1**	**1**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
b. Mobile	1	1	3	1	2	1	1	2	2	2	2	2	2	2	2	2
B Fugitive Emissions from Fuels	**1**	**1**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**
1 Solid Fuels	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
c Other (please specify: Storage of solid fuel)	0	0	0	0	0	0	0					0	0	0	0	0
2 Oil and Natural Gas	**1**	**1**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**
a Oil																
b Natural Gas																
c Venting and Flaring	1	1	2	3	3	3	3	3	3	3	3	3	3	2	2	2
Flaring	1	1	2	3	3	3	3	3	3	3	3	3	3	2	2	2
2. Industrial Processes	**1043**	**1043**	**904**	**1004**	**885**	**774**	**895**	**450**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
A Mineral Products	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1 Cement Production																
2 Lime Production																
3 Limestone and Dolomite Use																
7 Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B Chemical Industry	**1043**	**1043**	**904**	**1004**	**885**	**774**	**895**	**450**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2 Nitric Acid Production	1043	1043	904	1004	885	774	895	450	0	0	0	0	0	0	0	0
5 Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C Metal Production	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1 Iron and Steel Production																
4 SF6 Used in Aluminium and Magnesium Foundries																
SF6 Used in Magnesium Foundries																
F Consumption of Halocarbons and Sulphur Hexafluoride																
3. Solvent and Other Product Use	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
4. Agriculture	**8993**	**8993**	**7907**	**6756**	**6616**	**6363**	**6192**	**6152**	**6108**	**6038**	**5993**	**5856**	**5639**	**5515**	**5406**	**5406**
A Enteric Fermentation																
B Manure Management	**685**	**685**	**642**	**601**	**604**	**588**	**560**	**563**	**552**	**538**	**538**	**539**	**524**	**516**	**505**	**505**
D Agricultural Soils	**8308**	**8308**	**7265**	**6154**	**6012**	**5775**	**5632**	**5589**	**5556**	**5500**	**5455**	**5317**	**5114**	**4999**	**4900**	**4900**
5. Land-Use Change and Forestry (LUCF)		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
A Changes in Forest and Other Woody Biomass Stocks																
2 Temperate Forests																
5 Other (please specify)																
D CO2 Emissions and Removals from Soil																
Cultivation of Organic Soils																
Liming of Agricultural Soils																
Other (please specify)																
6. Waste	**88**	**88**	**85**	**65**	**57**	**58**	**61**	**61**	**61**	**61**	**61**	**61**	**61**	**61**	**61**	**61**
A Solid Waste Disposal on Land																
1 Managed Waste Disposal on Land																
B Wastewater Handling	**88**	**88**	**85**	**65**	**57**	**58**	**61**	**61**	**61**	**61**	**61**	**61**	**61**	**61**	**61**	**61**
2 Domestic and Commercial Wastewater	88	88	85	65	57	58	61	61	61	61	61	61	61	61	61	61
Memo Items (not included above):																
International Bunkers	**78**	**78**	**119**	**109**	**96**	**80**	**85**	**85**	**86**	**86**	**86**	**88**	**90**	**92**	**95**	**97**
Aviation	18	18	20	25	26	22	24	24	24	25	25	26	29	31	33	36
Marine	60	60	99	84	71	58	61	61	61	61	61	61	61	61	61	61
CO2 Emissions from Biomass																
Corrections (not included above):																
CO2 emissions related to Net Electricity Import (minus means Net Electricity Export)																
CO2 emissions related to the temperature deviation from a normal year (based on degree days)																

Table E1-4: The result of Denmark's 'with measures' greenhouse gas projection 2004-2030 as regards HFCs

HFCs emissions and projections (Gg CO2 equivalents, actual emissions)	KP Base Year	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008-12	2013-17	2020	2025	2030
Denmark's Total national Emissions and Removals (KP Net Emissions) in the base scenario ("with measures", i.e. implemented and adopted measures)	**218**	**0**	**218**	**605**	**647**	**672**	**695**	**750**	**773**	**741**	**761**	**703**	**407**	**118**	**118**	**118**
Denmark's Total KP Removals																
Denmark's Total Emissions/Removals with LUCF (CC Net Emissions)		**0**	**218**	**605**	**647**	**672**	**695**	**750**	**773**	**741**	**761**	**703**	**407**	**118**	**118**	**118**
Denmark's Total Emissions without LUCF	218	0	218	605	647	672	695	750	773	741	761	703	407	118	118	118
1. Energy																
A Fuel Combustion Activities (Sectoral Approach)																
1 Energy Industries																
a Public Electricity and Heat Production																
b Petroleum Refining																
c Manufacture of Solid Fuels and Other Energy Industries																
2 Manufacturing Industries and Construction																
f Other (please specify: (1) Boilers, gas turbines, stationary engines and (2) Industry mobile sources and machinery)																
3 Transport																
a Civil Aviation																
b Road Transportation																
c Railways																
d Navigation																
4 Other Sectors																
a Commercial/Institutional																
b Residential																
c Agriculture/Forestry/Fisheries																
5 Other (please specify: Military mobile combustion of fuels)																
b. Mobile																
B Fugitive Emissions from Fuels																
1 Solid Fuels																
c Other (please specify: Storage of solid fuel)																
2 Oil and Natural Gas																
a Oil																
b Natural Gas																
c Venting and Flaring																
Flaring																
2. Industrial Processes	**218**	**0**	**218**	**605**	**647**	**672**	**695**	**750**	**773**	**741**	**761**	**703**	**407**	**118**	**118**	**118**
A Mineral Products																
1 Cement Production																
2 Lime Production																
3 Limestone and Dolomite Use																
7 Other (please specify)																
B Chemical Industry	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2 Nitric Acid Production																
5 Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C Metal Production	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1 Iron and Steel Production																
4 SF6 Used in Aluminium and Magnesium Foundries																
SF6 Used in Magnesium Foundries																
F Consumption of Halocarbons and Sulphur Hexafluoride	**218**	**0**	**218**	**605**	**647**	**672**	**695**	**750**	**773**	**741**	**761**	**703**	**407**	**118**	**118**	**118**
3. Solvent and Other Product Use																
4. Agriculture																
A Enteric Fermentation																
B Manure Management																
D Agricultural Soils																
5. Land-Use Change and Forestry (LUCF)																
A Changes in Forest and Other Woody Biomass Stocks																
2 Temperate Forests																
5 Other (please specify)																
D CO2 Emissions and Removals from Soil																
Cultivation of Organic Soils																
Liming of Agricultural Soils																
Other (please specify)																
6. Waste																
A Solid Waste Disposal on Land																
1 Managed Waste Disposal on Land																
B Wastewater Handling																
2 Domestic and Commercial Wastewater																
Memo Items (not included above):																
International Bunkers																
Aviation																
Marine																
CO2 Emissions from Biomass																
Corrections (not included above):																
CO2 emissions related to Net Electricity Import (minus means Net Electricity Export)																
CO2 emissions related to the temperature deviation from a normal year (based on degree days)																

Table E1-5: The result of Denmark's 'with measures' greenhouse gas projection 2004-2030 as regards PFCs

PFCs emissions and projections (Gg CO2 equivalents, actual emissions)	KP Base Year	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008-2012	2013-2017	2020	2025	2030
Denmark's Total national Emissions and Removals (KP Net Emissions) in the base scenario ("with measures", i.e. implemented and adopted measures)	**1**	**0**	**1**	**18**	**22**	**22**	**19**	**16**	**14**	**12**	**11**	**10**	**8**	**6**	**6**	**6**
Denmark's Total KP Removals																
Denmark's Total Emissions/Removals with LUCF (CC Net Emissions)		**0**	**1**	**18**	**22**	**22**	**19**	**16**	**14**	**12**	**11**	**10**	**8**	**6**	**6**	**6**
Denmark's Total Emissions without LUCF	1	0	1	18	22	22	19	16	14	12	11	10	8	6	6	6
1. Energy																
A Fuel Combustion Activities (Sectoral Approach)																
1 Energy Industries																
a Public Electricity and Heat Production																
b Petroleum Refining																
c Manufacture of Solid Fuels and Other Energy Industries																
2 Manufacturing Industries and Construction																
f Other (please specify: (1) Boilers, gas turbines, stationary engines and (2) Industry mobile sources and machinery)																
3 Transport																
a Civil Aviation																
b Road Transportation																
c Railways																
d Navigation																
4 Other Sectors																
a Commercial/Institutional																
b Residential																
c Agriculture/Forestry/Fisheries																
5 Other (please specify: Military mobile combustion of fuels)																
b. Mobile																
B Fugitive Emissions from Fuels																
1 Solid Fuels																
c Other (please specify: Storage of solid fuel)																
2 Oil and Natural Gas																
a Oil																
b Natural Gas																
c Venting and Flaring																
Flaring																
2. Industrial Processes	**1**	**0**	**1**	**18**	**22**	**22**	**19**	**16**	**14**	**12**	**11**	**10**	**8**	**6**	**6**	**6**
A Mineral Products																
1 Cement Production																
2 Lime Production																
3 Limestone and Dolomite Use																
7 Other (please specify)																
B Chemical Industry	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2 Nitric Acid Production																
5 Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C Metal Production	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1 Iron and Steel Production																
4 SF6 Used in Aluminium and Magnesium Foundries																
SF6 Used in Magnesium Foundries																
F Consumption of Halocarbons and Sulphur Hexafluoride	**1**	**0**	**1**	**18**	**22**	**22**	**19**	**16**	**14**	**12**	**11**	**10**	**8**	**6**	**6**	**6**
3. Solvent and Other Product Use																
4. Agriculture																
A Enteric Fermentation																
B Manure Management																
D Agricultural Soils																
5. Land-Use Change and Forestry (LUCF)																
A Changes in Forest and Other Woody Biomass Stocks																
2 Temperate Forests																
5 Other (please specify)																
D CO2 Emissions and Removals from Soil																
Cultivation of Organic Soils																
Liming of Agricultural Soils																
Other (please specify)																
6. Waste																
A Solid Waste Disposal on Land																
1 Managed Waste Disposal on Land																
B Wastewater Handling																
2 Domestic and Commercial Wastewater																
Memo Items (not included above):																
International Bunkers																
Aviation																
Marine																
CO2 Emissions from Biomass																
Corrections (not included above):																
CO2 emissions related to Net Electricity Import (minus means Net Electricity Export)																
CO2 emissions related to the temperature deviation from a normal year (based on degree days)																

Table E1-6: The result of Denmark's 'with measures' greenhouse gas projection 2004-2030 as regards SF6

SF6 emissions and projections (Gg CO2 equivalents, actual emissions)	KP Base Year	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008-2012	2013-2017	2020	2025	2030
Denmark's Total national Emissions and Removals (KP Net Emissions) in the base scenario ("with measures", i.e. implemented and adopted measures)	107	44	107	59	30	25	31	32	32	32	32	55	108	55	55	55
Denmark's Total KP Removals																
Denmark's Total Emissions/Removals with LUCF (CC Net Emissions)		44	107	59	30	25	31	32	32	32	32	55	108	55	55	55
Denmark's Total Emissions without LUCF	107	44	107	59	30	25	31	32	32	32	32	55	108	55	55	55
1. Energy																
A Fuel Combustion Activities (Sectoral Approach)																
1 Energy Industries																
a Public Electricity and Heat Production																
b Petroleum Refining																
c Manufacture of Solid Fuels and Other Energy Industries																
2 Manufacturing Industries and Construction																
f Other (please specify: (1) Boilers, gas turbines, stationary engines and (2) Industry mobile sources and machinery)																
3 Transport																
a Civil Aviation																
b Road Transportation																
c Railways																
d Navigation																
4 Other Sectors																
a Commercial/Institutional																
b Residential																
c Agriculture/Forestry/Fisheries																
5 Other (please specify: Military mobile combustion of fuels)																
b. Mobile																
B Fugitive Emissions from Fuels																
1 Solid Fuels																
c Other (please specify: Storage of solid fuel)																
2 Oil and Natural Gas																
a Oil																
b Natural Gas																
c Venting and Flaring																
Flaring																
2. Industrial Processes	107	44	107	59	30	25	31	32	32	32	32	55	108	55	55	55
A Mineral Products																
1 Cement Production																
2 Lime Production																
3 Limestone and Dolomite Use																
7 Other (please specify)																
B Chemical Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 Nitric Acid Production																
5 Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C Metal Production	36	31	36	21	0	0	0	0	0	0	0	0	0	0	0	0
1 Iron and Steel Production																
4 SF6 Used in Aluminium and Magnesium Foundries	36	31	36	21	0	0	0	0	0	0	0	0	0	0	0	0
SF6 Used in Magnesium Foundries	36	31	36	21	0	0	0	0	0	0	0	0	0	0	0	0
F Consumption of Halocarbons and Sulphur Hexafluoride	72	13	72	38	30	25	31	32	32	32	32	55	108	55	55	55
3. Solvent and Other Product Use																
4. Agriculture																
A Enteric Fermentation																
B Manure Management																
D Agricultural Soils																
5. Land-Use Change and Forestry (LUCF)																
A Changes in Forest and Other Woody Biomass Stocks																
2 Temperate Forests																
5 Other (please specify)																
D CO2 Emissions and Removals from Soil																
Cultivation of Organic Soils																
Liming of Agricultural Soils																
Other (please specify)																
6. Waste																
A Solid Waste Disposal on Land																
1 Managed Waste Disposal on Land																
B Wastewater Handling																
2 Domestic and Commercial Wastewater																
Memo Items (not included above):																
International Bunkers																
Aviation																
Marine																
CO2 Emissions from Biomass																
Corrections (not included above):																
CO2 emissions related to Net Electricity Import (minus means Net Electricity Export)																
CO2 emissions related to the temperature deviation from a normal year (based on degree days)																

Table E1-7: The result of Denmark's 'with measures' greenhouse gas projection 2004-2030 as regards the total inventories (GHG)

GHGs emissions and projections (Gg CO2 equivalents)	KP Base Year	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008-12	2013-17	2020	2025	2030
Denmark's Total national Emissions and Removals (KP Net Emissions) in the base scenario ("with measures", i.e. implemented and adopted measures)	**69609**	**69328**	**76690**	**68255**	**69650**	**68908**	**73901**	**69229**	**70164**	**72080**	**71959**	**72254**	**71433**	**67206**	**66121**	**66781**
Denmark's Total KP Removals	0	0	-10	-59	-74	-88	-108	-124	-141	-162	-182	-262	-401	-555	-646	-822
Denmark's Total Emissions/Removals with LUCF (CC Net Emissions)		**69487**	**76466**	**70095**	**68566**	**67521**	**72804**	**68434**	**69352**	**71247**	**71106**	**71321**	**70361**	**65980**	**64803**	**65288**
Denmark's Total Emissions without LUCF	69609	69328	76700	68314	69724	68996	74009	69353	70305	72242	72141	72516	71833	67761	66767	67603
1. Energy	**52390**	**52390**	**60415**	**52802**	**54458**	**54121**	**59319**	**54930**	**56317**	**58305**	**58254**	**58936**	**58862**	**55309**	**54463**	**55276**
A Fuel Combustion Activities (Sectoral Approach)	**52014**	**52014**	**59855**	**52062**	**53673**	**53439**	**58589**	**54205**	**55683**	**57673**	**57625**	**58309**	**58266**	**54891**	**54049**	**54862**
1 Energy Industries	**26472**	**26472**	**32503**	**25680**	**27007**	**27164**	**32059**	**27304**	**28705**	**30481**	**30053**	**29656**	**28902**	**24882**	**23441**	**23868**
a Public Electricity and Heat Production	25018	25018	30372	23214	24550	24642	29496	24511	25598	27316	26681	24815	23169	19809	18356	18782
b Petroleum Refining	908	908	1387	999	1020	982	1024	1017	1017	1017	1017	1017	1017	1017	1017	1017
c Manufacture of Solid Fuels and Other Energy Industries	546	546	744	1467	1436	1541	1539	1776	2089	2147	2354	3824	4716	4056	4068	4068
2 Manufacturing Industries and Construction	**5447**	**5447**	**5965**	**5877**	**5896**	**5651**	**5494**	**5528**	**5489**	**5529**	**5644**	**6022**	**6283**	**6553**	**6806**	**6933**
f Other (please specify: (1) Boilers, gas turbines, stationary engines and (2) Industry mobile sources and machinery)	5447	5447	5965	5877	5896	5651	5494	5528	5489	5529	5644	6022	6283	6553	6806	6933
3 Transport	**10645**	**10645**	**12171**	**12570**	**12607**	**12793**	**13280**	**13361**	**13587**	**13811**	**14019**	**14481**	**14897**	**15289**	**15637**	**15935**
a Civil Aviation	246	246	202	157	164	142	140	124	126	128	130	137	149	161	172	184
b Road Transportation	9537	9537	10976	11666	11722	11845	12342	12503	12741	12962	13169	13624	14028	14408	14745	15032
c Railways	300	300	306	230	213	212	220	205	204	204	204	204	204	204	204	204
d Navigation	562	562	688	518	508	593	577	529	516	516	516	516	516	516	516	516
4 Other Sectors	**9329**	**9329**	**8961**	**7822**	**8065**	**7741**	**7662**	**7888**	**7778**	**7730**	**7786**	**8026**	**8060**	**8043**	**8041**	**8001**
a Commercial/Institutional	1419	1419	1139	940	945	902	882	955	958	961	968	988	1001	1005	996	972
b Residential	5156	5156	5219	4229	4453	4174	4120	4278	4196	4123	4128	4237	4189	4099	4037	3976
c Agriculture/Forestry/Fisheries	2754	2754	2603	2653	2667	2665	2660	2655	2624	2646	2690	2801	2870	2940	3008	3053
5 Other (please specify: Military mobile combustion of fuels)	**120**	**120**	**256**	**112**	**99**	**90**	**94**	**124**	**124**	**124**	**124**	**124**	**124**	**124**	**124**	**124**
b. Mobile	120	120	256	112	99	90	94	124	124	124	124	124	124	124	124	124
B Fugitive Emissions from Fuels	**376**	**376**	**560**	**740**	**785**	**682**	**729**	**725**	**635**	**631**	**629**	**627**	**595**	**418**	**414**	**414**
1 Solid Fuels	**72**	**72**	**132**	**64**	**69**	**62**	**93**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
c Other (please specify: Storage of solid fuel)	72	72	132	64	69	62	93	0	0	0	0	0	0	0	0	0
2 Oil and Natural Gas	**303**	**303**	**428**	**676**	**716**	**620**	**636**	**725**	**635**	**631**	**629**	**627**	**595**	**418**	**414**	**414**
a Oil	32	32	48	73	72	76	78	84	89	86	83	82	71	54	50	50
b Natural Gas	6	6	12	5	6	4	4	2	2	2	2	2	1	1	1	1
c Venting and Flaring	265	265	368	599	638	540	554	639	543	543	543	543	523	363	363	363
Flaring	265	265	368	599	638	540	554	639	543	543	543	543	523	363	363	363
2. Industrial Processes	**2436**	**2155**	**2604**	**3259**	**3191**	**3095**	**3129**	**2927**	**2583**	**2589**	**2645**	**2609**	**2364**	**2020**	**2020**	**2020**
A Mineral Products	**1037**	**1037**	**1335**	**1531**	**1556**	**1598**	**1486**	**1677**	**1716**	**1755**	**1793**	**1793**	**1793**	**1793**	**1793**	**1793**
1 Cement Production	882	882	1204	1406	1432	1452	1370	1409	1448	1487	1525	1525	1525	1525	1525	1525
2 Lime Production	138	138	117	109	108	130	102	115	115	115	115	115	115	115	115	115
3 Limestone and Dolomite Use								138	138	138	138	138	138	138	138	138
7 Other (please specify: Glass Production)	17	17	14	16	16	16	13	15	15	15	15	15	15	15	15	15
B Chemical Industry	**1045**	**1045**	**906**	**1006**	**888**	**777**	**897**	**453**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
2 Nitric Acid Production	1043	1043	904	1004	885	774	895	450	0	0	0	0	0	0	0	0
5 Other (please specify: Catalysts/Fertilizers and Pesticides)	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3
C Metal Production	**64**	**60**	**74**	**62**	**47**	**0**	**0**	**0**	**45**	**45**	**45**	**45**	**45**	**45**	**45**	**45**
1 Iron and Steel Production	28	28	39	41	47	0	0	0	45	45	45	45	45	45	45	45
4 SF6 Used in Aluminium and Magnesium Foundries	36	31	36	21	0	0	0	0	0	0	0	0	0	0	0	0
SF6 Used in Magnesium Foundries	36	31	36	21	0	0	0	0	0	0	0	0	0	0	0	0
F Consumption of Halocarbons and Sulphur Hexafluoride	**290**	**13**	**290**	**660**	**700**	**719**	**746**	**798**	**819**	**786**	**804**	**768**	**523**	**179**	**179**	**179**
3. Solvent and Other Product Use	**317**	**317**	**242**	**212**	**130**	**151**	**206**	**212**	**212**	**212**	**212**	**212**	**212**	**212**	**212**	**212**
4. Agriculture	**12845**	**12845**	**11845**	**10565**	**10470**	**10138**	**9898**	**9852**	**9788**	**9756**	**9673**	**9444**	**9077**	**8870**	**8688**	**8688**
A Enteric Fermentation	**3110**	**3110**	**3079**	**2872**	**2898**	**2808**	**2734**	**2700**	**2681**	**2706**	**2671**	**2582**	**2441**	**2354**	**2275**	**2275**
B Manure Management	**1428**	**1428**	**1501**	**1538**	**1560**	**1555**	**1532**	**1562**	**1552**	**1551**	**1547**	**1544**	**1522**	**1518**	**1513**	**1513**
D Agricultural Soils	**8308**	**8308**	**7265**	**6154**	**6012**	**5775**	**5632**	**5589**	**5556**	**5500**	**5455**	**5317**	**5114**	**4999**	**4900**	**4900**
5. Land-Use Change and Forestry (LUCF)		**158**	**-234**	**1782**	**-1158**	**-1476**	**-1204**	**-919**	**-953**	**-995**	**-1035**	**-1195**	**-1472**	**-1781**	**-1963**	**-2315**
A Changes in Forest and Other Woody Biomass Stocks		**-2832**	**-2992**	**-653**	**-3539**	**-3813**	**-3533**	**-3248**	**-3282**	**-3324**	**-3364**	**-3524**	**-3801**	**-4110**	**-4292**	**-4644**
2 Temperate Forests		-2832	-2982	-594	-3465	-3725	-3425	-3124	-3141	-3162	-3182	-3262	-3401	-3555	-3646	-3822
5 Other (please specify)		0	-10	-59	-74	-88	-108	-124	-141	-162	-182	-262	-401	-555	-646	-822
D CO2 Emissions and Removals from Soil		**2990**	**2758**	**2435**	**2381**	**2337**	**2329**	**2329**	**2329**	**2329**	**2329**	**2329**	**2329**	**2329**	**2329**	**2329**
Cultivation of Organic Soils		2400	2313	2283	2297	2243	2252	2252	2252	2252	2252	2252	2252	2252	2252	2252
Liming of Agricultural Soils		566	496	261	201	233	226	226	226	226	226	226	226	226	226	226
Other (please specify)		25	-52	-109	-116	-139	-149	-149	-149	-149	-149	-149	-149	-149	-149	-149
6. Waste	**1622**	**1622**	**1593**	**1475**	**1475**	**1492**	**1457**	**1433**	**1405**	**1381**	**1358**	**1316**	**1319**	**1350**	**1385**	**1409**
A Solid Waste Disposal on Land	**1334**	**1334**	**1286**	**1192**	**1188**	**1156**	**1153**	**1133**	**1113**	**1098**	**1087**	**1071**	**1065**	**1080**	**1097**	**1105**
1 Managed Waste Disposal on Land	1334	1334	1286	1192	1188	1156	1153	1133	1113	1098	1087	1071	1065	1080	1097	1105
B Wastewater Handling	**288**	**288**	**307**	**283**	**287**	**336**	**305**	**300**	**292**	**283**	**271**	**244**	**254**	**271**	**287**	**303**
2 Domestic and Commercial Wastewater	288	288	307	283	287	336	305	300	292	283	271	244	254	271	287	303
Memo Items (not included above):																
International Bunkers	**4904**	**4904**	**7050**	**6741**	**6088**	**5108**	**5405**	**5445**	**5481**	**5517**	**5554**	**5671**	**5887**	**6122**	**6317**	**6525**
Aviation	1755	1755	1888	2376	2411	2083	2212	2244	2280	2316	2353	2470	2686	2921	3116	3324
Marine	3149	3149	5162	4365	3677	3025	3193	3201	3201	3201	3201	3201	3201	3201	3201	3201
CO2 Emissions from Biomass	4641	4641	5869	7090	7637	8383	9108	NE	NE	NE	NE	NE	NE	NE	NE	NE
Corrections (not included above):																
CO2 emissions related to Net Electricity Import (minus means Net Electricity Export)	6300	6300	-690	659	-375	-1608	-6869	-3594	-4403	-6413	-5960	-4375	-2276	-1379	-859	-2868
CO2 emissions related to the temperature deviation from a normal year (based on degree days)	1879	1879	235	1323	254	1000	723	0	0	0	0	0	0	0	0	0

Table E1-8: The result of Denmark's 'with measures' greenhouse projection 2004-2030 in the format recommended under the UNFCCC

Projections of Denmark's greenhouse gas emissions and removals

Scenario:	The base scenario, which is a 'with measures" projection, i.e. only includes the expected effects of implemented and adopted measures						
Year:	2005						
Sector	**Emissions and removals (in Gg CO2 equivalents)**						
	CO2	**CH4**	**N2O**	**HFCs**	**PFCs**	**SF6**	**Total**
Energy	41705	557	468				**42730**
Transport	13057	65	466				**13587**
Industry*	1976			773	14	32	**2794**
Agriculture**		3681	6108				**9788**
LULUCF***	-953						**-953**
Waste****		1344	61				**1405**
Total	**55785**	**5646**	**7102**	**773**	**14**	**32**	**69352**

Projections of Denmark's greenhouse gas emissions and removals

Scenario:	The base scenario, which is a 'with measures" projection, i.e. only includes the expected effects of implemented and adopted measures						
Year:	2010 = (2008-2012)/5						
Sector	**Emissions and removals (in Gg CO2 equivalents)**						
	CO2	**CH4**	**N2O**	**HFCs**	**PFCs**	**SF6**	**Total**
Energy	43290	680	485				**44455**
Transport	13890	51	540				**14481**
Industry*	2053			703	10	55	**2820**
Agriculture**		3587	5856				**9444**
LULUCF***	-1195						**-1195**
Waste****		1255	61				**1316**
Total	**58038**	**5573**	**6942**	**703**	**10**	**55**	**71321**

Projections of Denmark's greenhouse gas emissions and removals

Scenario:	The base scenario, which is a 'with measures" projection, i.e. only includes the expected effects of implemented and adopted measures						
Year:	2015 = (2013-2017)/5						
Sector	**Emissions and removals (in Gg CO2 equivalents)**						
	CO2	**CH4**	**N2O**	**HFCs**	**PFCs**	**SF6**	**Total**
Energy	42885	590	490				**43965**
Transport	14291	35	570				**14897**
Industry*	2053			407	8	108	**2575**
Agriculture**		3438	5639				**9077**
LULUCF***	-1472						**-1472**
Waste****		1258	61				**1319**
Total	**57756**	**5322**	**6760**	**407**	**8**	**108**	**70361**

Projections of Denmark's greenhouse gas emissions and removals

Scenario:	The base scenario, which is a 'with measures" projection, i.e. only includes the expected effects of implemented and adopted measures						
Year:	2020						
Sector	**Emissions and removals (in Gg CO2 equivalents)**						
	CO2	**CH4**	**N2O**	**HFCs**	**PFCs**	**SF6**	**Total**
Energy	39013	546	462				**40020**
Transport	14673	26	590				**15289**
Industry*	2053			118	6	55	**2231**
Agriculture**		3356	5515				**8870**
LULUCF***	-1781						**-1781**
Waste****		1289	61				**1350**
Total	**53957**	**5217**	**6628**	**118**	**6**	**55**	**65980**

Projections of Denmark's greenhouse gas emissions and removals

Scenario:	The base scenario, which is a 'with measures" projection, i.e. only includes the expected effects of implemented and adopted measures						
Year:	2025						
Sector	**Emissions and removals (in Gg CO2 equivalents)**						
	CO2	**CH4**	**N2O**	**HFCs**	**PFCs**	**SF6**	**Total**
Energy	37834	537	455				**38826**
Transport	15006	23	608				**15637**
Industry*	2053			118	6	55	**2231**
Agriculture**		3282	5406				**8688**
LULUCF***	-1963						**-1963**
Waste****		1323	61				**1385**
Total	**52929**	**5166**	**6530**	**118**	**6**	**55**	**64803**

Projections of Denmark's greenhouse gas emissions and removals

Scenario:	The base scenario, which is a 'with measures" projection, i.e. only includes the expected effects of implemented and adopted measures						
Year:	2030						
Sector	**Emissions and removals (in Gg CO2 equivalents)**						
	CO2	**CH4**	**N2O**	**HFCs**	**PFCs**	**SF6**	**Total**
Energy	38341	547	452				**39340**
Transport	15288	23	624				**15935**
Industry*	2053			118	6	55	**2231**
Agriculture**		3282	5406				**8688**
LULUCF***	-2315						**-2315**
Waste****		1347	61				**1409**
Total	**53367**	**5199**	**6543**	**118**	**6**	**55**	**65288**

Annex E2: A brief description of the work involved in preparing the energy projections

A brief description of the work involved in preparing the energy projections.

The work involved in preparing the energy projections goes through the following stages:

1. Final energy consumption of businesses and the domestic sector (except transport)

2. Energy consumption for production of electricity and district heating

3. Own consumption by refineries and gas works

4. Own consumption by the North Sea, including flaring

5. Industrial cogenerated heating and power, mini cogenerated heating and power, biogas etc.

6. Energy consumption by transport

The economic macro model EMMA is calculated in item 1. Ramses, which is a technical/economic optimisation model, is used for calculations in item 2 based on input of the energy consumption from the housing models and EMMA. Item 3 is automatically projected based on the latest statistics. Item 4 is projected on the basis of the information from Mærsk and statements of the Danish oil and gas reserves. Item 5 is projected on the basis of current plans to expand – after which it remains unchanged. The Danish Road Directorate has provided the main part of the transport projection (item 6), however the Danish Energy Authority has prepared the very simple projections of international shipping, military transport and the size of cross-border trading. Moreover, the Danish Road Directorate's tender for electric trains is adjusted to the statistics. The different parts of the projection are collected in the Danish Energy Authority's collective model, which can be used to calculate gross energy consumption and energy-related CO_2 emissions. Extracts from this model are given to NERI, and NERI has calculated emissions from the energy sector.

As mentioned, projections of the final energy consumption in the business and domestic sectors are based on an ADAM/EMMA projection. EMMA is a macro model that describes the final energy consumption broken down into a number of sectors and seven types of energy. It is based on historical experience with the behaviour of businesses and households and is documented in Environmental satellite models for ADAM, NERI Technical Report no. 148, NERI 1995.

In EMMA, energy consumption is determined by three factors: production, energy prices/taxes and energy efficiencies/ trends. Increased economic activity will increase the demand for energy input, whereas increased energy prices and taxes will pull in the direction of a more limited demand for the fuels. Improved energy efficiency will mean that production can be maintained using less energy, and in EMMA this results in reduced energy consumption.

The EMMA system is structured based on the link between five energy-specific models developed at NERI and Risø National Laboratory. These models determine the use of seven types of energy (liquid fuels, solid fuels, gas, biofuels, transport energy, electricity and district heating) in the domestic and business sectors, conversion of fuels (solid fuels, liquid fuels, gas, biomass) by the supply sector to electricity and district heating, and it calculates the emissions this use of energy entails. EMMA is structured as a satellite model to ADAM, which is a widely used Danish macro-economic model that covers the entire economy.

The ADAM/EMMA system can calculate the effect of a number of initiatives. One of the most important aspects though, is that energy prices play an important role. The overall level for energy prices affects the total energy consumption, and the relationship between the prices of different types of energy affects the composition of energy consumption. Therefore the model can estimate the effect of CO_2 taxes, which in part raise all energy prices and in part change the relative energy prices, so that e.g. coal, which emits a lot of CO_2, is more expensive than natural gas that emits less CO_2.

The projection of production in the business sector and inflation is based on ADAM projections prepared by the Ministry of Finance.

Projection of the production of electricity and district heating (item 2 above) has been calculated using the Danish Energy Authority's Ramses-model based on the demand for electricity and district heating as calculated in the projection of the consumer sectors. In the projection, the production of electricity and heating is broken down into existing and possibly new production facilities based on the facilities' technical specifications, price of fuel and CO_2 emissions trading prices. The model also determines electricity prices on the Nordic market and the scope of electricity exchange with the other Nordic countries and takes account of the limits to the trading capacity. The production of electricity has been liberalised throughout the Nordic countries and therefore there is no close link to Denmark's demand, rather, it is based on the characteristics of the individual facility and the market prices. Industrial and local mini combined heat and power production are not projected in the Ramses model, therefore a separate (bottom-up) projection of this production has been prepared.

A more detailed description of Ramses can be found in the following.

Ramses (version 6) is a technical-economic model that describes the production of electricity and district heating in a random number of electricity areas, at present in the Nordic countries. It is a partially linear optimisation model that can calculate the production and fuel consumption at a great number of installations on a hourly basis. As the model is mainly designed for analysing the effects in Denmark, at present the Danish installations are described in more detail than utilities in the other Nordic countries.

The model calculates the price of electricity that creates equilibrium on the market. As regards electricity, the Nordic countries are divided into five areas separated by transmission connections with a maximum transfer capacity. If the need for transmissions exceeds the capacity, the price of electricity differs in the areas. The five areas are Finland, Sweden, Norway, western Denmark and eastern Denmark. As regards district heating there are far more isolated areas that each have their own price.

In addition to information concerning the transmission connections and detailed information on the type, efficacy and size of installation, the following input are used in the model: fuel prices, CO_2 allowances prices, fuel taxes as well as the demand for electricity and district heating in the area. Output from the model includes production, fuel consumption and emissions from each installation, and the price of electricity in each area.

In the model, all installations in each area are sorted according to the short-term, marginal production costs for electricity. Production is set in motion at the utilities one after another – starting with the cheapest one, and this continues until the demand (including any need for exports or imports) in each operational hour is met. The marginal costs of the most expensive producing installations thus set the price of electricity in the area. The largest hydropower plants have been given special treatment because they can adjust the time of production for strategic reasons using the water reservoirs.

The decision concerning investments in new utilities is kept separate from the model. Investments are only made if model calculations show that the installation can recover the investment, assuming specific rates of subsidies for RE (particularly wind turbines) are given, and free CO_2 allowances for fossil-based installations, etc. Installations placed in an area where district heating is needed typically have a competitive advantage due to income from the sale of heat.

In addition to prices and amounts, the model can estimate the overall system's security of supply as regards electricity. This is done on the basis of stochastic input on the probability of damage to installations and transmission connections, time series for production from wind turbines and hydropower as well as the variation in consumption.

Ra mses is used both for projection and analysis purposes. For example, it has been used to analyse the effect of new transmission connections, new wind turbine farms, changes in electricity consumption or changes in the prices of fuels and CO_2 allowances.

Annex F Description of selected programmes/projects to advance and/or finance transfer of technologies to other countries

Description of selected projects or programmes to advance and/or finance transfer of technologies to developing countries. New examples of projects are labelled "NEW", all other examples are updates from the previous national communication.

Programme or project title: Development of building regulations concerning energy consumption in Botswana. "NEW"			
Objective: The project is to contribute to creating a qualified basis for adjusting the part of the Botswana building regulations that concern the energy consumption of buildings.			
Cooperation country	**Sector**	**Total funding**	**Year(s) in operation**
Botswana	Energy	DKK 13.7 million	3
Description: The project is to assist the parties responsible for the part of the Botswana building regulations concerning the energy consumption of buildings in creating a qualified basis for adjusting the regulations. The most recent developments in building design and technology as well as the climatic differences across the country are considered. These are all conditions that have previously been neglected. The revised building regulation concerning energy consumption will be designed so as to be incorporated into a future full set of regulations that is to include all technical conditions concerning the building sector. The results of analyses and studies of energy-efficient building designs will be made available for all relevant parties in the construction area, thereby increasing the focus on the possibilities for saving energy in buildings. Furthermore, the intention is to develop material for tenders that include revised building regulations concerning energy consumption.			
Technology transferred: Danish experience with administration and regulation of the construction area as well as the funds to monitor compliance with the building regulations will be transferred to Botswana.			
Effect on greenhouse gas emissions: CO_2 emissions will be reduced by minimising energy consumption in buildings where fossil fuels are the main energy source.			

Programme or project title: Zafarana wind turbine farm in Egypt			
Objective: Contribute to the economic development by means of environmentally sound energy production based on wind power.			
Cooperation country	**Sector**	**Total funding**	**Year(s) in operation**
Egypt	Energy	Contribution DKK 253 million Credit scheme DKK 175 million	6
Description: The project is the first commercial wind farm in Egypt. It followed up on preliminary Danish assistance projects that included a wind atlas, planning of wind turbine centres and the construction of a demonstration wind farm. The wind farm, which has a total capacity of 60 MW, is divided into two phases. Phase 1, 30 MW, was built in 1999-2001 and was officially handed over to the Egyptian government after it was launched in March 2001. Phase 2, which was launched at the end of 2002 and was handed over in 2004. The objective of the project is to contribute to Egypt's national development by supplying clean, cost-efficient energy as well as demonstrating that there are sustainable production potentials for large wind farms. Furthermore, the project aims at building up the required capacity and knowhow at the New and Renewable Energy Authority, which is responsible for promoting renewable energy sources in Egypt. The project is co-financed by grants. Under the mixed credit, the design and implementation of a 30MW wind farm is funded, including delivery and installation of wind turbines, foundations and control and monitoring systems. The project is in phase 2 of a total Danish windfarm of 60 MW, of which the first phase has already been financed by grants.			
Technology transferred: Danish windpower technology.			
Effects in greenhouse gas emissions: Substitution of fossil fuels with wind power.			

Programme/project title: Demand Side Management, Malaysia's Energy Commission. "NEW"			
Objective: To strengthen capacity in Malaysia's Energy Commission to actively manage and coordinate Malaysian objectives for efficient utilisation of energy as well as to prepare plans for energy efficiency and energy standards, including relevant guidelines.			
Cooperation Country	**Sector**	**Total funding**	**Year(s) in operation**
Malaysia	Energy	DKK 12.9 million	3
Description The project will develop and implement energy efficiency programmes in the consumption stage. Efforts have included development of an energy efficiency policy in Malaysia. The project will include all relevant activities concerning efficient utilisation of energy in Malaysia. Working groups including representation from the government, the private sector as well as the energy sector have been set up under the project with a view to developing strategies to save energy within industry and building construction. The project has contributed to developing a total plan for energy efficiency in Malaysia. The project has prepared demonstration projects for selected areas, including use of energy efficient engines in industry and energy labelling of refrigerators. The project has sparked great interest in industry and with the public authorities, who see the project as an opportunity to see energy efficiency demonstrated in even more new areas. The project's activities will be coordinated with other energy initiatives already in operation under the steering committee for the forthcoming energy component.			
Effects on greenhouse gas emissions: Energy consumption is made more efficient through e.g. energy labelling schemes in selected sectors.			

Programme/project title: Renewable energy and making energy more efficient in Malaysia. "NEW"			
Objective: To strengthen renewable energy and efficient utilisation of energy in the overall plans, policies and programmes through capacity development in the energy authorities and relevant ministries. Efforts focus on three areas: 1. Integrated energy resource planning 2.Completion of the Ministry of Energy, Water and Communications' low-energy office 3.Implementation of the national CDM action plan			
Cooperation country	**Sector**	**Total funding**	**Year(s) in operation**
Malaysia	Energy	DKK 31.8 million	1
Description In continuation of a previous project on integrated resource planning in the energy area, a number of selected sector studies will be implemented and energy scenarios to be used in developing Malaysia's own efforts in the coming economic five-year plan (9th Malaysia Plan) will be prepared. Studies and scenarios will be developed as an integral part of capacity building in the national energy institutions. In connection with the construction of the Energy Ministry's new administrative offices, a number of measures to save energy in office buildings have been introduced. Future efforts will focus on the efficiency of the technologies implemented as well as documentation of the energy savings. Moreover work will be done to develop new energy standards for new buildings. As part of the capacity building in Malaysia with a view to the country's participation in implementation of the Kyoto Protocol, capacity has been built in the Malaysia Energy Center to assess CDM projects for further approval in the national CDM committee. Future efforts will continue to focus on capacity building and implementation of sector studies to assess the potential for greenhouse gas reductions as well as information to be used to develop future CDM projects in selected sectors, e.g. the palm oil industry. Efforts will also support further development and implementation of the national CDM action plan.			
Effect on greenhouse gas emissions: Capacity building to further develop and implement climate-friendly national energy planning and policies in Malaysia.			

Programme or project title: Sector programme assistance for the energy sector in Mozambique, 2002-2006. "NEW"			
Objective: To contribute to economic growth in Mozambique through promoting better utilisation of the energy sector's considerable resources.			
Cooperation country	**Sector**	**Total funding**	**Year(s) in operation**
Mozambique	Energy	DKK 465.0 million	5
Description: three key areas for Danish assistance to the energy sector have been identified: i) Assistance for developing the sector's central institutions (The Directorate of Energy and The Directorate of Economy under the The Ministry of Energy and The National Energy Fund), ii) Assistance to the national power supply company (EdM), and iii) Assistance to advance development and spread of sustainable decentral energy systems. Environmental considerations have been systematically implemented during the planning of activities, with a view to a more appropriate use of natural resources.			
Indicate success factors: efficient and appropriate utilisation of the country's energy resources			
Technology transferred: Transferral of know-how as support for the development of the energy sector, efficient energy planning and thereby sustainable energy supply and institutional capacity building. Transferral of know-how when expanding the national transmission and distribution net as well as making it more efficient.			
Effect on greenhouse gas emissions: With the expansion of the national electricity distribution net, access to hydro-powered electricity will be improved and old diesel-power stations can be closed down. Furthermore, Danish support to the energy sector includes a systematic review of all power stations and larger substations with a view to identifying environmental issues and promoting energy efficiency.			

Programme or project title: Development of building regulations concerning energy consumption in Thailand.			
Objective: The project was to create a qualified basis for adjusting the part of the Thai building regulations that concerns energy consumption in buildings.			
Cooperation country	**Sector**	**Total funding**	**Year(s) in operation**
Thailand	Energy	DKK 11.8 million	3
Description: The objective of the project was to contribute to creating a qualified foundation for adjusting parts of the Thai building regulations with a view to optimising energy consumption in buildings. The most recent developments in building design and technology as well as climatic differences across the country were considered. These conditions had previously been neglected. The revised sections of the national building regulations were designed in such a way that they could be incorporated into future comprehensive building regulations, including all the technical aspects of new building projects. The results of the studies of energy efficient building design were made available to all relevant parties in the building sector so as to increase awareness of the possibilities for saving energy in buildings.			
Technology transferred: Danish experience with administration and regulation in the building sector and means of checking compliance with the building regulations have been transferred the Thai authorities.			
Effect on greenhouse gas emissions: By reducing energy consumption in buildings, which to a high degree is based on fossil fuels, the CO_2 emission will be reduced.			

Programme or project title: Provincial Programme for sustainable energy in Thailand.			
Objective: To identify, plan and implement sustainable energy solutions at province and village level, including strengthen NGOs, educational institutions and authorities in their use of sustainable energy.			
Cooperation country	**Sector**	**Total funding**	**Year(s) in operation**
Thailand	Energy	DKK 8.7 million	5
Description: Geographically, the target area is the Isaan region in northeast Thailand. Project activities have includes collection of data, preparation of RE plans at village level, implementation of RE projects, training in RE technology, information on renewable energy, seminars on renewable energy and establishment of three renewable energy and environment centres. Renewable energy technology was promoted through support for specific projects that were to demonstrate alternatives to centralised fossil-based energy production. So at to ensure transition to the project Regional Energy Planning that is being implemented by the Thai Ministry of Energy, the project has been extended until April 2005.			
Effects in greenhouse gas emissions: By promoting alternatives to fossil-fuel-based energy production, greenhouse gas emissions will be reduced.			

Programme or project title: Promotion of renewable energy technologies. "NEW"			
Objective: The objective of the project is to promote renewable energy on the national energy market in Thailand.			
Cooperation country	**Sector**	**Total funding**	**Year(s) in operation**
Thailand	Energy	DKK 9.7 million	4
Description: The project is to develop action plans for the more extended use of renewable energy, which are to be approved and implemented by the Thai partners with Danish assistance. Furthermore the project is to contribute to establishing effective public-private sector partnerships that are to bring relevant energy technologies on to the market and further implementation of these initiatives. Furthermore the project is to improve the data basis and information sources as regards renewable energy and the potential market for renewable energy technologies. The project supports another project concerning regional energy planning that is in the start-up phase. The two projects will focus on increasing the institutional capacity at all levels in the Thai energy administration.			
Effect on greenhouse gas emissions: By promoting alternatives to fossil-based energy production greenhouse gas emissions will be reduced.			

Annex G List of selected recent and current climate-related research projects

The Danish Meteorological Institute (DMI)

The research projects for the period 2002-2003 below have been financed by the European Commission's research programme, the European meteorological satellite organisation, EUMETSAT, as well as national research councils and programmes.

- DEMETER. Development of a European Multi-model Ensemble system for seasonal to inter-annual prediction.
- PREDICATE. Mechanisms and predictability of decadal fluctuations in Atlantic-European climate.
- DETECT. Detection of changing radiative forcing over the recent decades
- PROMISE. Predictability and variability of monsoons, and the agricultural and hydrological impacts of climate change.
- PRISM. Programme for Integrated earth System Modelling.
- PRUDENCE. Prediction of Regional scenarios and Uncertainties for Defining European Climate change risks and effects. The project is coordinated by DMI.
- STARDEX. Statistical and Regional Dynamical downscaling of Extremes for European regions.
- CAL. Coupling of Atmospheric Layers.
- GLIMPSE. Global Implications of Arctic climate processes and feedbacks.
- CWE. "Climate, Water and Energy.
- SAT-MAP-CLIMATE. Satellite based bio-geophysical parameter mapping and aggregation modelling for CLIMATE models. (The Risø Wind Energy Department also contributes.)
- Application of seasonal climate forecasts for improved management strategies for crops in Western Africa.
- Consequences of climate change for the oceanic environment near Greenland.
- CONWOY. Consequences of Weather and climate changes for marine and freshwater ecosystems.
- PSC Climate. Polar Stratospheric Clouds and ozone depletion: The role in global climate change.
- MAPSCORE. Mapping of polar Stratospheric Clouds and Ozone levels relevant to the Region of Europe.
- SAMMOA. Spring-to-Autumn Measurements and Modelling of Ozone and Active species.
- CANDIDOZ. Chemical And Dynamical Influences on Decadal Ozone Changes.
- GREENICE. Greenland arctic shelf ice and climate experiment.
- MOEN. Meridional Overturning Exchange with Nordic Seas.
- CONVECTION. Greenland Sea Convection Mechanisms and their Climatic Implications.
- EUMETSAT OZON and UV SAF. The development and implementation of certain activities of a EUMETSAT Satellite Application Facility on ozone monitoring.
- HIBISCUS. Impact of tropical convection on the upper troposphere and lower stratosphere at global scale.
- OFR-cirrus. Subvisible cirrus clouds and the effect on the transport of water vapour to the stratosphere.
- VOGUE. Validation of ENVISAT ozone and NO_2 products from ground based measurements in Greenland.
- RAMAS. Radiometer for atmospheric measurements of Summit.
- ENSEMBLES. The ENSEMBLES project.
- QUANTIFY. Quantifying the climate impact of global and European transport systems.
- GRAS SAF. The development of a EUMETSAT Satellite Application Facility for GRAS meteorology, including a visiting scientist programme. The project is run by DMI.
- Ocean and Sea Ice SAF. The development of a EUMETSAT Ocean and Sea Ice Satellite Application Facility.
- West Nordic Ocean Climate. Circulation in the North Atlantic, transport across the Greenland-Scotland ridge. Financed by the Nordic Council of Ministers.

Geological Survey of Denmark and Greenland - GEUS

- Ice-edge monitoring Collection of time series of melt from the ice sheet in southern Greenland. Will presumably be expanded with a Dancea project. Project period: 2003-2006.
- EUROSTRATAFORM. Analyses of marine systems and present processes on the European continental margin with a view to improve understanding of long climate data series. Project Period: 2002-2005.
- Lake –climate interactions in space and time. Studies of lake data to understand the processes linking the state of lakes with climate variations. Project period 2003.
- Green Ice. Studies of the sea ice north of Greenland to determine changes in thickness etc. caused by climate changes. Project period: 2003-2006.
- Euro Clim. Establishment of monitoring and warning system for climate changes based on ice and water data in Greenland. Project period: 2001-2005.
- Cryosat. Participation in establishment of the programme for the CRYOSAT satellite for monitoring ice sheets, glaciers and sea ice. Project period: 2003-2005.
- ANCIENT BEECH FOREST: Studies of the range of beech forests in Europe based on fossil DNA and pollen with a view to illuminate the evolution of beech seen in a climatic context. Project period:2004-2007
- Holocene Greenland. Identification of holocene palaeohoydrographic changes in the Greenland fjords and coastal areas in relation to climate changes. Project period: 1999-2003.
- "Norse – Climate. Studies of the natural conditions in the period 1000-1500 AD in order to cast light on the Norse's living conditions in Greenland. Project period: 2001- 2006.
- History of the ice sheet. Studies of the extent of the ice sheet during the last Ice Age in the northern part of west Greenland. Project period 2002-2006.
- Davies Strait. Studies of surface and deep water circulation in Davies Strait at west Greenland with the aim of understanding links between oceanographic changes and climate change since the last glacial maximum. Project period: 2005-2007.
- DART. Quantify the dynamics of forest-tundra ecotone response to climate and land-use changes. Project period: 2000-2003.
- Effects of climate changes. Development of a concept for monitoring climate changes in Denmark, the Faroe Islands, Greenland and adjacent areas. Project period 2003-2006.
- METROL. Investigations of methane emissions from the seabed in the North Sea and Danish inland waters with a view to possible climate impacts. Project period: 2002-2006.
- PACLIVA. Comparison of the climate system in the North Atlantic in the relatively cold year 2000 with the climate system that prevailed from 8,000 to 6,000 years ago. Project period 2002-2006.
- PASTFIRE. Studies of the relation between climate changes and past fires in forests and steppes. Paleofire incidence and emergence are analysed to understand causes of future fires. Project period 2005-2006.
- DEGVEC. Studies of vegetation response and feedback on climate changes in eight European countries. Development of dynamic vegetation models to assess vegetation-climate interactions. Project period: 2005-2007.
- Glacial earth quakes. Studies and site determination of near-surface earth quakes caused by movements of glaciers and the ice sheet in Greenland. A possible tool to monitor glacier movement and its relation to climate changes. Project period: 2005-2006.
- CO2STORE. On-land and long term Saline Aquifer CO_2 storage: Assessment of geology, safety and economy of future potential storage-sites for CO_2 in Europe. The project includes detailed studies of four potential storage-structures. Continuation of geophical monitoring of CO_2 injection at the Sleipner field (SACS project). Project period: 2003-2006.
- CASTOR. CO_2 from Capture to Storage: GEUS is co-ordinating mapping of geological storage capacity in eight eastern European countries. The project also includes research on separation of CO_2 and a demonstration plant for CO_2 separation in Esbjerg (Elsam and Energi E2). Project period: 2004-2008.
- CO2SINK. In-situ R&D Laboratory for Geological Storage of CO_2: Pilot study and construction of demonstration plant for CO_2 storage at Berlin. It is expected that injection of limited amounts of CO_2 will take place in the period 2006-2009. The injection will

be monitored with a suite of geophysical instruments, and a risk-assessment will be made based on the collected data. Project period: 2004-2009.

- ULCOS. Ultra Low CO_2 Steelmaking: Development of new technology for reducing CO_2-emission from the steel industry. GEUS is participating with a subproject on potential geological storage of CO_2 from selected European steel plants. Project period: 2004-2009.
- EOCAPACITY: Mapping of geological storage capacity in Europe (eastern and southern European countries). The project is a continuation of the methodologies and objectives from the GETSTCO project. The project includes co-operation and exchange of experience with China. Project period: 2006-2009.

Aarhus University (Geological Institute)

- The EU project HOLSMEER. Late Holocene Shallow Marine Environments of Europe. The focus of the project is climate changes in the last 2,000 years. The investigations are being carried out on, inter alia, marine drilling cores from Portugal in the south to the coastal areas of Iceland and Norway in the north. Project period: 2001-2003.
- KRONPAL. Chronology and paleoclimate: Integration of marine cores from Iceland with AMS 14C datings, ash chronology and ice cores. The project examines large and small oceanographic shifts in the North Atlantic in the last 15,000 years and problems concerning exact dating of these. Project period: 2003-2006.
- PACLIVA. see under Danish Meteorological Institute.
- Varved, Holocene and interglacial lake sediments in Denmark. Lake sediments from the last 11,500 years from interglacial periods with rhythmic stratifications (year strata, layers of glacial deposit) are being studied with a number of detailed stratigraphic methods. One of the aims is to determine how quickly the terrestrial environment and the aquatic environment have reacted to climate changes in the past. Project period: 2003-2005.
- CONWOY: see under Danish Meteorological Institute.
- Constraining the age and extent of Scandinavian Ice Sheet advances during the last glaciation in its type area in Poland with absolute dating techniques, SNF, 2004-2006. Goal: The project intends to date Weichselian sediments in central and northern Poland using the luminescence method to determine the age and extent of ice sheet fluctuations with special reference to the controversial Isotope Stage 4 glaciation, and to evaluate these fluctuations in the context of global climatic trends of the last 100,000 years.
- DASARG. "The Davies Strait Arctic Gateway: Ocean circulation and West Greenland Climate Change since the Last Glacial Maximum". The project studies changes in ocean circulation, ocean ice extent, climate and meltwater from Greenland at the west Greenland coast since the Last Glacial Maximum (the last 25,000 years). The project is also focusing on the possible anti-phase between south-western Greenland and north-western Europe, which has been observed in recent weather patterns. The project is supported by the Research Council for Nature and the Universe. International Polar Year Expression-of-Intent no. 1003. Project period: 2005-2007.
- Quaternary paleoclimate in northern Russia and arctic Siberia. Paleoecological studies in northern Russia and arctic Siberia, with the purpose of studying the coupling between climate changes and variations in ocean currents and water exchange between the Arctic Ocean and the Atlantic during the last 150,000 years.
- Paleoenvironment and paleoclimate in the Baltic region in the last interglacial. Studies of climate and hydrographics in the Baltic region during the last interglacial 130,000- 115,000 years BP.
- Consequences of weather and climate changes for marine and freshwater ecosystems (www.conwoy.ku.dk). Part of the funding is for a PhD-project "influence of temperature changes on phytoplancton". The research aims to quantify the influence of temperatures on species composition and functioning in bacterial and phytoplancton communities in both fresh and marine waters. Project period: 2002-2005.
- Mapping on the influence of climate on fish resources in the Limfjord. In a co-operation between NERI and the counties involved.

- Parasites, Climate Changes and Biodiversity. Parasite-mediated climatic impacts on diversity and structure of marine floral and faunal communities. The research aims to map the extent of the influence of expected climate changes on coastal floral and faunal communities solely through changes in parasite-host interactions. Project during: 3 years.
- Analysis of climate signals in long time-series of fish catch data in waters around the Faroe Islands.
- Impact of climate changes on migration patterns of fish in Danish waters.
- Evolutionary and physiological adaptations to climatic conditions and their changes, with special interest in temperature adaptations (see www.biology.au.dk/aces). In co-operation with Skejby Hospital, NERI and DIAS, Foulum. Project period: 2002-2005.
- A macroecological, biogeographical perspective on plants' biocomplexity under global change. The project aims to improve the understanding of the impact on natural ecosystems of the ongoing global environmental changes, with special focus on climatic influences on plant ranges and diversity. A co-operation with NERI. Project period: 2005-2008.
- DENIMOB: Benthic invertebrate guts as "mobile microsites" in sediments: hot spots for denitrification and N2O production?. A Marie Curie Intra-European Fellowship project. Project period: 2005-2006.

Danish Institute of Agricultural Sciences

- DINOG. Dinitrogen fixation and nitrous oxide losses in organic grass-clover pastures: An integrated experimental and modelling approach. The purpose is to quantify nitrogen fixation and nitrous oxide emission from grasslands through monitoring, laboratory tests and modelling of nitrification and denitrification. Project period: 2001-2004.
- MIDAIR. Greenhouse gas mitigation for organic and conventional dairy production. The purpose of this project is to identify and quantify the main sources of greenhouse gas emissions from organic and conventional milk production and to indicate strategies for mitigating these emissions. Project period: 2001-2004.
- GREENGRASS. Sources and Sinks of Greenhouse Gases from managed European Grasslands and Mitigation Strategies. The purpose of this project is to quantify exchange of carbon dioxide, nitrous oxide and methane from grassland in Europe through monitoring and modelling, and to evaluate the potential for mitigation in selected operating strategies. Project period: 2002-2004.
- PRUDENCE. Prediction of Regional scenarios and Uncertainties for Defining European Climate change risks and Effects. The purpose of this project is to improve the basis for projecting climate effects through modelling and to interpret predictions and uncertainties in relation to the EU's policy for adaptation to and mitigation of climate changes. Project period 2002-2004.
- Knowledge synthesis on energy in organic farming. Purpose: to gather knowledge about energy consumption, possible savings and energy production in organic farming and to evaluate the possibilities for requirements on the use of fossil energy in organic production. Project period: 2002-2003.

University of Copenhagen

Department of Geophysics

Projects are in progress within the following areas:

- Ice cores and climate parameters, datings.
- The carbon cycle/the ocean's circulation and physical properties.
- The stability of the climate._
- Atmospheric CO_2 transports.
- Large-scale meteorology.
- Statistical analyses of climate data.

Geological Institute

Projects are in progress in the following areas:

- Long lake cores from Denmark and this and the previous interglacial period.
- Correlation between Greenland ice cores and lake cores in Denmark by means of well-dated ash strata from Iceland or the Eifel area in Germany.

Institute of Geography

- FITES. Fire in Tropical Ecosystems. FITES has studied the distribution, controls/causes and effects, including climatic ones, of savannah fires in the Sudanese and south-Sahelian zone of Africa. Project period: 1986-2003.
- INTEO. Integration of Earth Observation Data in Distributed Hydrological Models. INTEO studies the use of Earth Observation data for running, calibrating and validating hydrological models, at the scale of large river basins, allowing assessment of the effect of climatic change on water resource availability. Project period: 1996 – 2005.
- Land use and carbon cycle in Senegal. The project studies the impact of land use change on carbon storage in vegetation and soils in Senegal. Project period: 1999 – 2002.
- NECC. Nordic Centre for Studies of Ecosystem Carbon Exchange and its interaction with the climate system. The interaction between CO_2 and climate is being studied over selected Nordic ecosystems, ranging from agricultural areas on Zealand to the tundra in north Sweden. Project period: 2003-2007.
- EO-FLUX. Earth observation data for up-scaling carbon Flux and water Budget at Zealand. CO_2 and H_2O exchange over Zealand is being determined on the basis of satellite data, CO_2 measurements and hydrological modelling. Project period: 2001-2003.

Institute of Molecular Biology

- Forest Carbon – Nitrogen Trajectories (FORCAST). The objective was to investigate carbon and nitrogen pools and fluxes in European forest ecosystems. Project period: 1999-2003.

Institute of Chemistry, The Atmosphere Group

- Establishment of relevant physical and chemical quantities: IR absorption spectra, velocity and photolytic constants, uptake coefficients, formation of CCN (Cloud Condensation Nuclei) etc. Project period: ongoing.

Botanical Institute

- Biogeochemistry in the Arctic – processes, controls and sensitivity to global change. Measurement of drivers and controls of biogeochemical nutrient and carbon cycling in arctic ecosystems and probable impacts on the cycles of a predicted climate change. Project period: 2000-2002.
- Processes in the plant-microbe-soil interface: Implications for ecosystem function. Experimental assessment of probable impact of future projected climate change on processes in the plant-microbe-soil system in Arctic ecosystems that have been manipulated to mimic future changes in environmental conditions. Project period: 2003–2005.
- FITES - Fire in Tropical Ecosystems. Studies of the effect of fire on decomposition of matter, biodiversity and greenhouse gas emissions in savannah ecosystems. The Botanical, Geographic and Zoological Institutes and the Botanical Museum are participating in the project.

Risø National Laboratory

Department for Plant Research

- EU project CarbonEuroflux. Exchange of CO_2 between the atmosphere and the forest ecosystem. Project period: 1996 - .

- EU CORE project. Climate –Atmosphere Interaction. Its goal is to produce continuous field measurements on atmosphere-biosphere interactions on six field research stations run by four participants (University of Helsinki, Finnish Meteorological Institute, National University of Ireland, Galway, and Risø National Laboratory. Project period: 2000-2003.
- EU project VULCAN. Effect of heating and drying out on heath ecosystems' function, biodiversity and plant composition. In the project experimental heating and drying out of semi-natural ecosystems is being carried out in six European countries to study the effects on the ecosystems. Project period: 2001-2004.
- EU project GREENGRASS. Sources and sinks of greenhouse gasses from managed European grasslands and mitigation scenarios. The purpose is to acquire detailed knowledge about CO_2, CH_4 and N_2O fluxes from grassland along European climate gradients and under varying forms of use and cultivation with a view to evaluating possible mitigation options by changing cultivation and land-use practice. Project period: 2001- 2004.
- EU project NOFRETTE. Nitrogen oxide emissions from European forest ecosystems. The project covers emissions of NO and N2O from forest ecosystems. Its purpose is partly to determine the size of these emissions and partly to describe the fundamental processes that drive the NO/N2O emissions from European forest ecosystems under the influence of geographically determined variations in nitrogen deposition, climate and soil conditions and types of forest. Project period: 2001 – 2004.
- Emissions of greenhouse gases and nitrogen fixation in alfalfa. The project aims at clarifying emissions of N2O from grazed alfalfa fields and determine what share of biologically fixed nitrogen is released as N2O. Project period: 2000-2004.
- Recovery of forest ecosystems from acidification - impacts of climate change. In this project model calculations are being carried out of the effect of climate changes on the recovery processes for soil acidification under the agreed protocols for reduction of sulphur and nitrogen emissions. Project period 2001-2003.
- UV impacts on the vegetation in Zackenberg, Greenland. The main purpose of the project is to establish a relatively simple and robust method for continuous monitoring of the effects of UV radiation on selected Arctic species of plant in Zackenberg, Greenland. Project period: 2001- 2004.
- CLIMAITE - Climate change effects on biological processes in terrestrial ecosystems. A Danish climate centre aimed at creating a cohesive understanding of how interacting climate changes will affect biological processes in nature. Based on large-scale field tests with realistic manipulations of temperature, precipitation and CO_2. Project period 2005-2009.

Energy System Group

- Assessment and Dissemination activity on major Investment Opportunities for renewable electricity in Europe using the REBUS tool - Admire Rebus. Funded by the EU ALTERNER programme. Project period: 2002-2003.
- Green-X Deriving optimal promotion strategies for increasing the share of RES-E in a dynamic European electricity market. The core objective of this project is to facilitate a significantly increased electricity generation from renewable energy sources (RES-E) in a liberalised electricity market with minimal costs to European citizen. To identify most important strategies the dynamic toolbox Green-X will be developed. Project period 2002-2004.

Department for Wind Energy

- SAT-MAP-CLIMATE. Satellite based bio-geophysical parameter mapping and aggregation modelling for CLIMATE models. The purpose of the project was to extract information from satellite pictures of surface roughness over land, sea and land temperatures, albedo and plant cover and to utilise the resulting maps in weather forecasting and climate models. Project period: 1999-2002 (DMI also participated.).
- WATERMED. Water use Efficiency in natural vegetation and agricultural areas by remote sensing in the Mediterranean basin. The purpose of the project is to map water balance and vegetation in the Mediterranean area, in both Europe and Africa, on the basis of satellite pictures and modelling. Project period: 2000-2003.

- EO-FLUX-BUDGET. Earth Observation data for up-scaling carbon FLUX and water BUDGET at Zealand. The purpose of the project is to determine the CO_2 and water balance for a region (Zealand) on the basis of satellite pictures and modelling. The results complement point measurements of CO_2 and water balance in a climate context. Project period 2000-2004.
- EU project AutoFlux. The objective of the AutoFlux project has been to develop an instrumentation system AutoFlux for routine unattended use on Voluntary Observing Ships or unmanned buoys, for monitoring climate relevant surface fluxes over the oceans. Project period 1998-2002.
- NEAREX. Modelling and measuring the transport of CO_2 to the Greenland Sea from Eastern/Central Europe. Project period: 1998-2002.

National Environmental Research Institute (NERI)

Department for Marine Ecology

- MARINBASIS. Environmental monitoring in Zackenberg. Marine monitoring of abiotic and biotic reactions on year-to-year variations and long-term climate changes with a view to being able to predict and document the effects of the expected climate changes. Project period: 1995 - and following decades.
- ANOXIA IN SEA ICE: Importance for C and N cycling in the Arctic – Implications of reduction in sea ice distribution and thickness on nitrogen and carbon transformations. Project period: 2001-2003.
- NARP. The bio production and energy transfer in the Nordic Seas, the role of key zooplanktons in a system with rapid climate changes. Project period: 2001-2003.
- CASES. Canadian Arctic Shelf Exchange Study. Central goal: To understand and model the response of the Mackenzie Shelf ecosystem to atmospheric, oceanic and continental forcing of sea-ice cover variability. Project period: 2003-2007+.
- CANABA. Carbon flux and ecosystem feed back in the northern Barents Sea in an era of climate change. Project period: 2003-2006.
- Consequences of climatic changes on Greenlandic marine ecosystems. Project period: 2001-2003.
- Functional diversity of bacteria and phytoplankton in the Disco Bay, Greenland Project period: 2001-2003.

Department of Arctic Environment

- The biological monitoring programme BioBasis, in Zackenberg, northeast Greenland. Monitoring of biotic reactions on year-to-year variations and long-term climate changes with a view to being able to predict and document the effects of the expected climate changes. Project period: 1995 and following decades.
- The natural geographic monitoring programme GeoBasis in Zackenberg, northeast Greenland. Monitoring of abiotic reactions on year-to-year variations and long-term changes in the climate with a view to being able to predict and document the effects of the expected climate changes. Project period: 1995 and following decades.
- Environmental monitoring in Zackenberg - Marine Basis. Project period 1995 and following decades.
- Anoxia in sea ice: Importance for C and N cycling in the Arctic. Project period: 2001-2003.
- Effect of climate on Arctic marine ecosystems. Project period: 2001-2003.
- The bio production and energy transfer in the Nordic Seas, the role of key zooplanktons in a system with rapid climate changes. Project period: 2001-2003.
- The Collared Lemming (Dicrostonyx groenlandicus) in Greenland: Population Dynamics and Habitat Selection in Relation to Food Quality. The study was focused on the collared lemming's food biology and habitat selection in relation to the 4-year cyclical fluctuations in population. Project period: 1999-2002.
- Carbon balance for a High-Arctic ecosystem. The purpose of the project is to estimate the annual carbon exchange in the Zackenberg area. Project period: 2002-2005.

Department for System Analysis

- Projection models for greenhouse gases. Models are being set up at a level of detail that makes it possible to project emissions in relation to technological development and political measures. Project period: 2003
- Inventory of Denmark's greenhouse gases for the Climate Convention and the EU. Denmark's total greenhouse gas emission is being calculated and reported in accordance with current guidelines. Project period: 1990 onwards.
- Decoupling CO_2 emissions from economic indicators: A Nordic industrial sector analysis. The project is being carried out for the Nordic Council of Ministers in cooperation with the University of Iceland. Project period: 2003-2005.

Department for Terrestrial Ecology, Soil Ecology and Ecotoxicology

- Evolutionary and Physiological Adaptations to Climate Change. Study of genetic variation and physiological adaptation in soil-living animals to extreme climate conditions. Project period: 2002-2005.
- Effects of increased freeze-thaw cycles in Arctic soil ecosystems-. The effects of artificially increased frequency of freeze-thaw cycles are being studied in field tests (Abisko, Sweden). The focus of this PhD project is how microarthropods react to this artificially increased stress and what consequences it might have on the conversion of organic matter in the soil. Project period: 2001- 2004.
- Synergetic interactions between climate and pollution. An evaluation of the synergetic effects that can occur when soil-living animals are exposed to toxic stress and climate stress at the same time. The results of the project may be of importance for risk assessment of chemical substances taking account of varying climatic conditions. Project period: 1999-2004.

Department for Atmospheric Environment

- EU project AEROCARB. “Airborne European Regional Observations of the Carbon Balance. The objective of AEROCARB is to demonstrate the feasibility of an integrated approach to estimate and monitor the net European carbon balance as a mean to corroborate EU-wide controls of CO_2 emission. Closely connected to this, is the study of spatial and temporal variations of the CO_2 sources and sinks over the European continent.

Technical University of Denmark

- Solar activity and terrestrial climate: An analysis of some purported correlation. The project’s critical analyses revealed serious (misleading) errors in a number of scientific articles concerning the sun’s effect on the earth’s climate. Project period: 2001- 2003.

Forest and Landscape Denmark

- EU project CNTER. Carbon Nitrogen Interactions in Forest Ecosystems. Methods for calculating carbon binding in forest soil. The importance of nitrogen deposition for carbon binding in forest soil. Project period: 2001-2004.
- Carbon and Nitrogen Sequestration in Forest Soils – Evaluation of estimation methods. Methods for calculating carbon binding in forest soil. Guest researcher Bjørn Berg. Project period: 2005-2006.
- CLIMAITE – see under Risø National Laboratory.
- Carbon binding and water quality in forests of the future – interactions between tree species and soil type. Danish Agricultural and Veterinary Research Council project. Carbon and nitrogen cycles in five different deciduous tree species at six locations in Denmark. Measurement of carbon pools and CO_2 efflux from soil. Project period: 2004-2005.
- Carbon and nitrogen interactions in deposition gradients from forest edges. Danish Agricultural and Veterinary Research Council project. The effect of varying nitrogen inputs on N and C circulation and dynamics is studied in areas at the fringe of the woods where N deposition is high. How the characteristics of areas at the fringe of the woods distinguish themselves biogeochemically from the inner part of the woods is also studied. Project period 2005-2006.

- Estimation of carbon storage in forest biomass in the Nordic and Baltic countries - common methods, protocol and tools for obtaining comparable biomass expansion functions (BEF). Danish Forest and Nature Agency project. The aim is to give an overview of how data on biomass distribution from national forest inventories and other easily accessible sources are used and potentially can be used in the national Land Use, Land Use Change, and Forestry (LULUCF) reporting. Also, available knowledge on expansion factors and functions should be synthesised, starting with Norway spruce, with special attention to the root fraction. Project period: 2004-2007.
- Emissions of the greenhouse gases methane and nitrous oxide from wet soils in the forest. Measurement of the climate gases CO_2, methane and nitrous oxide along topo-sequences from well-drained to poorly drained conditions in afforestation and in old forests. Project period: 2004-2005.
- CO_2 removals in forests – contributions to an improved inventory of changes in biomass and soil carbon stocks. A pilot project concerning biomass equations (expansion functions) for above ground and below ground biomass in Norway spruce and a design for a soil module in the new forest statistics. Project period: 2003-2005.
- EU project WOOD-EN-MAN. Wood for energy - a contribution to the development of sustainable forest management. Research-based development of operational recommendations for sustainable forest operation using woodchips for energy purposes (economy, social economy and ecology), together with policy recommendations on increased use of forest biomass for energy purposes. Project period: 2001-2005.
- ForestFocus: the European monitoring of forest ecosystems, including effects of climatic change on forests. Project period: 2003-2006.
- Forest Statistics. National sample based collection of Danish forest data. Results will be used to monitor forest resources, condition, development, effects of climate change and carbon sequestration. Project period: 2002- .
- EFORWOOD: EU-FP7 integrated project (tools for sustainability impact assessment of the forestry-wood chain), including carbon sequestration in forest ecosystems in relation to forest management and climate change.
- Spreading wood-chip ash in Danish forestry - ecological consequences. The ecological consequences of ash recirculation under different conditions are being examined on the basis of experiments with spreading ash. Project period: 1999-2004.
- Pre-treatment and recirculation of wood-chip ash. The objective of this project is to develop a well-documented concept for recycling wood-chip ash and at the same time to break down the barriers that make recycling difficult today. Project period: 2004-2007.
- CoReWOOD – Bioenergy. The main aim of the project is to enable and promote synergetic co-operation, co-ordination of activities and knowledge sharing between RecAsh, WOOD-EN-MAN and Bio2003-2005energy. Project period: 2004-2005.
- Bioenergy as an environmental factor in the Nordic-Baltic-North-West-Russian Region. The overall aim is to contribute to overcoming present barriers to increased sustainable use of bio-energy within the Nordic-Baltic-Russian region. The main activity is an open seminar on the above topics in 2005. Project period: 2004-2006.
- IEA Bioenergy Task 31: Biomass Production for Energy from Sustainable Forestry. Project period: 2004-2006.
- IEA Bioenergy Task 38: Greenhouse Gas Balances of Biomass and Bioenergy Systems. Project period: 2004-2006.
- The logistics of improving economic accessibility to the forest fuel resource in Denmark. Investigation on integration of planning, harvesting, wood chip production, transportation and storage of wood chips. Project period: 2004-2006.
- BIONORM: EU project on the scientific basis for a possible European standard on biofuels with participation from 17 countries. Project period: 2002-2005.

Institute of Local Government Studies

- International trade and CO_2. The purpose is to analyse the effect on the national CO_2 emissions of trade between countries and the possibilities for reducing the global CO_2 emissions by changing the pattern of trade. The project is intended to deliver results of value to the officials attending international climate negotiations. Project period: 2003.

The Royal Veterinary and Agricultural University

- EO-FLUX-BUDGET. Earth Observation data for up-scaling carbon FLUX and water BUDGET at Zealand. In this project the CO_2 and water balance for a region (Zealand) are being determined on the basis of satellite pictures and modelling. The results complement point measurements of CO_2 and water balance in a climate context. Project period: 2000-2004.
- EPN: European Phenological Network. Thematic Network on the analysis of phenological information in relation to climate variability/ change and exploration of possibilities to predict climate change effects on the timing of life cycle events. Project period: 2000-2003.
- Plant community context and reproduction of Sorbus torminalis along a large-scale gradient in Europe - analysing the species' response to climatic change. Project period: 2001- 2004.
- EC Karnal Bunt: 'Pest Risk Assessment for Karnal bunt - Tilletia indica'. Project period: 2000-2004.

The Danish National Space Center

- EU project SITHOS. Sea Ice Thickness Observing System. Project period: 2002-2005.
- EU project GREENICE. Greenland arctic shelf Ice and Climate Experiment. Project period: 2003-2006.
- CRYOSAT. Cal/val and preparation for ESA's cryosphere monitoring satellite CryoSat. Project period: 2001-2004.
- EU project GOCINA. Geoid and Ocean Circulation in the North Atlantic Region. Project period 2002-2005.
- EU project ESEAS. European Sea Level Service - monitoring of sea-level changes by satellite. Project period: 2002-2005.

Danish Energy Authority

The following research projects are being supported by the Energy Research Programme in 2005:

Biogas

- Precision steering of the biogas process, project manager the Danish Institute of Agricultural Sciences.
- Reasons for process instability in biogas plants and strategies for prevention and restoration of the process, project manager Technical University of Denmark.

Liquid biofuels

- Maxi-Fuels: Testing and further development at pilot scale of a Fermentations platform for maximum production of bioenergy (ethanol, hydrogen and methane) from biomass residual products such as straw, project manager Technical University of Denmark BioCentrum.

Bio incineration

- Optinox at biomass-fired plants, project manager COWI A/S.
- Efficient biofuel trading, analysis of biofuel supply, description of e-trade business models and basic understanding of pelleting. Project manager Danish Technological Institute.

Hydrogen

- Use of the natural gas grid for clean hydrogen distribution, phase II, project manager DGC a/s.

Energy efficiency

- Ultra low-energy buildings and passive houses in Stenløse Syd, project manager Stenløse Municipality
- Energy optimisation by means of retrofitting of industrial process facilities, project manager Weel & Sandvig Energi og Procesinnovation Aps

- Innovative and energy efficient refurbishment of public buildings – Danish parallel project to BRITA in PuBs, a demonstration project under the EU Sixth Framework Programme, project manager Danish Building and Urban Research.
- Reduced energy consumption for ventilation of buildings where low-polluting materials and furniture have been chosen systematically, project manager Technical University of Denmark.
- Individual or collective heating supply for new housing areas in the near and distant future, project manager RAMBØLL
- Energy efficient production and distribution of domestic hot water in dwellings in light of the EU Building Directive and coming national requirements regarding energy consumption in buildings, project manager Technical University of Denmark.
- OPTIPOLYGEN (OPTimum Integration of POLYGENeration in the Food Industry), project manager FORCE Technology.
- Development of low-energy classification 1 standard houses, project manager Technical University of Denmark.

Society

- Consequences of quota regulations on developments in the Danish energy sector – scenario analyses, project manager RAMBØLL a/s.

Solar energy

- Solar City Horsens – solar cell roofs in low-energy buildings of the future, project manager Byfornyelse Danmark.
- Solar cells – the significance of the spread of solar cells on price reductions, as well as the need and consequences for operational targets, project manager PA Energy A/S.

Heat pumps

- Demonstration of gas-fired diffusion-absorption heating pumps for one-family houses, project manager DGC a/s.

Wind energy

- Programme for Research in Applied Aeroelasticity, project manager Risø National Laboratory.
- Improved design basis for large wind turbine wings made of fibre composites (Phase 3), project manager Risø National Laboratory.
- Soil-Structure interaction of foundations for offshore wind turbines, project manager Aalborg University.

Project supported by the Energy Research Programme – 2004:

Biomass

- Use of straw in biogas plants and possibilities to increase energy utilisation, project manager the Danish Institute of Agricultural Science.
- Methods to optimise biogas yield at manure-based biogas facilities, project manager Technical University of Denmark (Environment & Resources).
- Collective biogas plants of the future – the interplay between separation of manure and biogas production, project manager the Food and Resource Economics Institute.
- Possible after-treatment of separated solid fraction from biogas production, preliminary project, project manager Rambøll a/s.
- IEA, Fischer Tropsch fuels for transport, project manager Technical University of Denmark (Mechanics, Energy and Construction).
- Bioethanol production part 3 (follow-up of parts 1 and 2), project manager Technical University of Denmark (Biocentrum).
- IEA, Bioenergy Agreement Task: Biomass Combustion and Co-firing. Danish representation 2004-06, project manager dk-TEKNIK ENERGI & MILJØ.
- IEA, Bioenergy Agreement Task: Thermal Gasification of Biomass. Danish representation 2004-06, project manager dk-TEKNIK ENERGI & MILJØ.
- Integration of SOFC fuel cell and two-step process, project manager COWI A/S.
- GreenFuelCell – Integrated gasification fuel-cell plant (SOFC), project manager TK Energi A/S.

- Dissemination of research results within bioenergy, project manager BioPress.
- IEA, Task: Biomass Production for energy from Sustainable Forestry (2004-06), project manager Forest and Landscape Denmark.
- IEA, Task: Greenhouse Gas Balances of Biomass and Bioenergy Systems (2004-06), project manager Forest and Landscape Denmark.

Energy efficiency
- Development of process optimisation in a U-loop fermentor, project manager UniBio A/S.
- High insulated glass structures in multi-storey dwellings, measurements and evaluation, Phase 2, project manager SBI/Danish Building and Urban Research.

Fuel cells
- Development of 2 kW natural gas reformer for high and low temperature PEM fuel cells, project manager DGC – Danish Gas Technology Centre.
- DK-SOFC b, Long-term SOFC development, project manager Risø National Laboratory.

Solar energy
- Standard house with integrated photovoltaic panels, project manager EnergiMidt A/S.
- IEA, SHC, Management of Task PV/Thermal Solar Systems (Maximisation of energy yield from photovoltaic systems), project manager Esbensen Rådg. Ing.
- Development, production and demonstration of a new and improved ARCON HT-SA solar collector, project manager Planenergi.

Wind energy
- Electrical design and optimisation of wind turbines, project manager Aalborg University (Energy Technology).
- Dynamical wake model for detailed aeroelastic simulation of wind turbines in farms, project manager Risø National Laboratory.
- Programme for Research in Applied Aeroelasticity, project manager Risø National Laboratory.

Projects concerning social aspects
- Short-term flexibility in electricity consumption - quantification, stimulation and valuation, project manager Risø National Laboratory.
- Energy taxes, environment and competitiveness, project manager Institute of Local Government Studies Denmark.
- Energy consumption in the domestic sector: An econometric analysis of the effect of the energy label scheme and building regulations, project manager Institute of Local Government Studies Denmark.

Energy storage and system integration
- Electrolysis for energy storage and grid balancing, project manager INCOTECO.
- The Integration of Micro-CHP and Renewable Energy Systems (Micro-CHeaP), project manager dk-TEKNIK ENERGI & MILJØ.

Projects supported by the Energy Research Programme - 2003

Biomass
- Production of bioethanol - part 2, project manager Technical University of Denmark/BioCentrum/CPB (Risø National Laboratory/ Plant Research Department, Novozymes).

- LIFTOFF gasification plant in Gjøl 3A) dk-TEKNIK (CIRAD, Gjøl CHP Company, TKE, National Technical Univ. of Athens, ARMINES/Ecole des Mines d'Albi-Carmaux).
- The pyrolysis conditions influence on the tar content in the gas from a staged biomass gasifier, project manager TK Energi AS (CIRAD/CEA).
- Optimisation of straw-fired boilers for district heating, project manager dk-TEKNIK (manufacturers of boiler plant).

Wave power
- Wave power: Development project for prototype design of AquaBuOY and incorporation of Power Take Off system, project manager Rambøll a/s.

Energy efficiency
- Low energy lighting sources and fixtures based on light diode technologies for outdoor lighting, e.g. for road lighting, project manager Lumistrator Aps.
- Deamonification - significant energy-saving new biological method for removing nitrogen from industrial wastewater, project manager C.P. Kelco (Envicare, Hannover University, Herning Municipality, Aalborg University.
- IEA Annex 36 Retrofitting educational buildings, project manager Danish Building and Urban Research.

Solar energy
- Solar cells and architecture - BIPV in refurbishment projects and new buildings, project manager Byfornyelse Danmark.
- Electricity producing sun screens, project manager Danish Building and Urban Research (Dasolas Internat., Gaia Solar, TI-SolEnergi-Centret, Servodan, Esbensen).
- IEA PVPS work in 2004 and 2005 (co-financed with PSO), project manager EnergiMidt A/S.

Wind energy
- Wind measurements. Development and documentation of new and existing methods for remote and in-situ measurements of wind, project manager Risø National Laboratory.
- Research of material technology for surface coating of wind turbine wings and development of testing methods for lifetime of coatings, project manager FORCE (Risø National Laboratory, Aalborg University).
- Improved design basis for large wind turbine wings made of fibre composites (phase II), project manager Risø National Laboratory (Technical University of Denmark; Aalborg University, LM Glasfiber, Vestas).

System integration
- Advanced storage concepts for solar thermal systems in low energy buildings, project manager Department of Civil Engineering/ Technical University of Denmark (participants form a number of European countries).
- Expressor heat pump for heat production in small-scale CHPs, project manager TI (Association of Danish CHPs, City Univ./London).

The Danish Coastal Authority

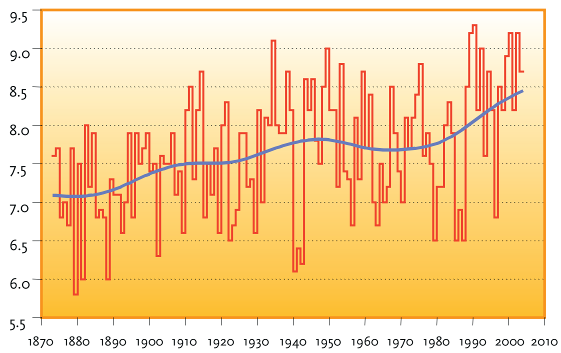
- COMCOAST. The project is sponsored by the EU, and the pilot project aims at carrying out a socio-economic cost-benefit analysis of moving a dike at Rømø farther in land, as an alternative to strengthening the existing dike. Project period 2004-2007.
- Effects of Climate Change on the Coast. The project aims at establishing calculation models for coastal erosion as a function of climate change. Project period 2002-2006.

Annex H Denmark's report on systematic climate observations for the global climate observing system (GCOS)

Denmark's Report On
Systematic Observations For
The Global Climate Observing System
(Gcos) In Connection With The Fourth
National Communication
Under The United Nations
Framework Convention On Climate
Change (UNFCCC)

Source: The Meteorological Institute and
The National Environmental Research Institute

The annual mean temperature, Denmark, 1873-2004



1 Introduction

This report has been prepared to give a status on the Danish contribution to the systematic climate observations in the Global Climate Observing System (GCOS). The report is part of the Fourth National Communication to the Conference of the Parties under the United Nations Framework Convention on Climate Change (UNFCCC).

Climate research and the generation of climate-related observations are carried out by various government departments in order for them to meet their responsibilities. Currently, no national plan exists for the whole area of climate research and observations.

1.1 Systematic observations

A number of agencies in Denmark engage in the systematic observation of elements of the climate system. Invariably the capture, quality control and archiving of such data are designed to meet the integrated needs of these agencies, deriving from their overall missions.

Typically the drivers for long-term systematic observation of environmental or ecological characteristics arise from an operational, regulatory or research need. Examples of the former are to be found in the capture of meteorological data for predictive and statistical services by the Danish Meteorological Institute (DMI). The resulting observation programmes tend to be long term, but the resulting individual data may be seen as perishable and focus might not always be on maintaining stability and reliability in the records.

The general need for systematic and reliable time series is increasingly being understood in the scientific community and incorporated in the collection and data processing procedures.

1.2 Data availability

In this report relevant climate observations for Denmark, Greenland and the Faroe Islands will be described. In general the data are available from the institutions operating the observing station / collecting the data, but many can also be found on the web, for instance www.dmi.dk. Where data such as contributions to GCOS are submitted to the appropriate data centres, they are also available from these centres.

Additionally, all meteorological data and products that are produced by WMO Members (national meteorological services) to the WMO programmes such as the WWW are available under the terms of WMO Resolution 40 (WMO policy and practice for the exchange of meteorological and related data and products including guidelines on relationships in commercial meteorological activities). Such data are freely available without charge (i.e. at no other cost than the cost of reproduction and delivery, without charge for the data and products themselves and with no condition on their use)

Similarly hydrological data and products are covered under WMO Resolution 25. Further the IOC are expected to adopt a data policy which provides for free and open access to data that are collected, produced or exchanged as part of oceanographic programmes conducted in association with the IOC.

2 Meteorological and atmospheric observations

2.1 Contributing to GCOS

Denmark participates fully in the GCOS Surface Network (GSN) and the GCOS Upper Air Network (GUAN), and in the Global Ozone Observing System (GO3OS) as part of the Global Atmospheric Watch (GAW).

Table H-1. Danish participation in the global atmospheric observing system

	GSN	GUAN	GAW[1]
How many stations are the responsibility of the Party?	7	1	4
How many of these are operating now?	7	1	4
How many are currently in operation in accordance with the GCOS standard?	7	1	4
How many are expected to be in operation in 2005?	7	1	4
How many currently provide data to international data centres?	**7**	**1**	**4**

[1] Denmark participates in GAW's GO3OS

2.2 GCOS Surface Network / GSN Stations

The seven designated GSN stations in Denmark, Greenland and on the Faroe Islands are all run by DMI and include:

- Greenland: Upernarvik, Nuuk, Danmarkshavn, Tasiilaq, Prins Christian Sund;
- The Faroe Islands; Tórshavn
- Denmark: Copenhagen.

All of these stations currently meet the GCOS standard for surface observation.

2.3 GCOS Upper Air Network / GUAN Stations

Only one GUAN station is designated for Denmark, Greenland and the Faroe Islands and it is situated in Narsarsuaq, Greenland. The station is run by DMI and is operated in accordance with the GCOS standard. A survey of the station's 2004 results shows that 88% of the soundings reached a pressure of 30 hPa.

2.4 GCOS Global Atmospheric Watch / GAW Stations

As part of the GAW programme, Denmark contributes to the Global Ozone Observing System (GO3OS) with three stations in Greenland and one in Denmark. The stations in Kangerlussuaq (Greenland) and Copenhagen (Denmark) are equipped with Brewer spectrometers, the station in Pituffik (Greenland) is equipped with a Dobson and a SAOZ spectrometer, and the station in Illoqqortoormiut (Greenland) is equipped with a SAOZ spectrometer. The spectrometer in Illoqqortoormiut is operated by Service d'Aeronomie (France) in cooperation with DMI while all other spectrometers are operated by DMI. All data are available from DMI. The stations in Greenland are primary and secondary stations in the Network for the Detection of Stratospheric Change (NDSC) that is supported by the International Ozone Commission, the UNEP and the WMO.

2.5 Other national meteorological and atmospheric observations:

2.5.1 Climatological/meteorological surface stations

DMI operates and receives data from a network of approximately 100 automatic meteorological stations in Denmark, Greenland and on the Faroe Islands. Measurements are made in accordance with the WMO recommendations.

Figure H-1: DMI's Network of Weather Stations in Denmark

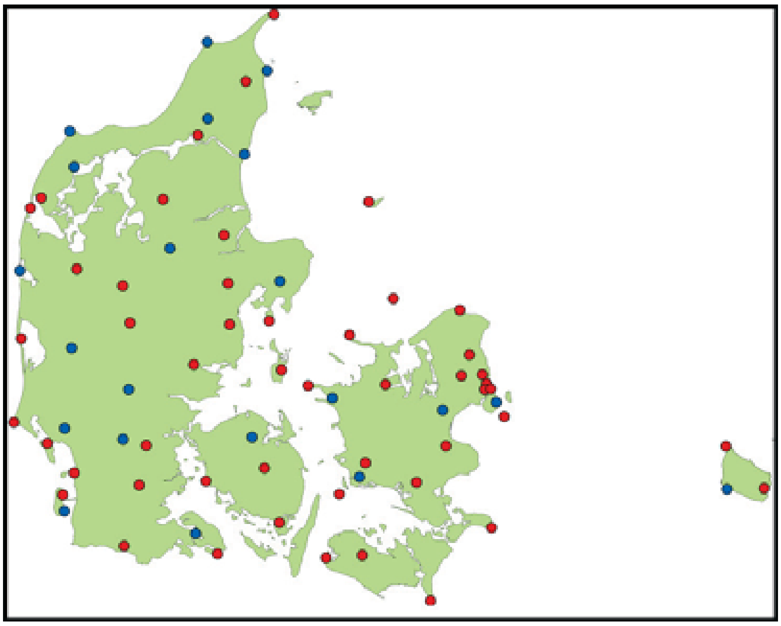


Figure 2: DMI's Network of Weather Stations in Greenland

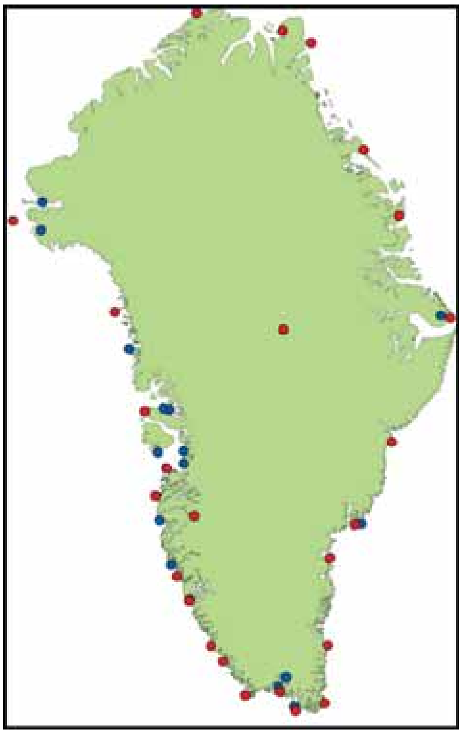


Figure 3: DMI's Network of Weather Stations on the Faroe Islands

As of 2001 a special dedicated network of (manual) stations for climatological observations has been discontinued, due to the convergence between the different network technologies. The objectives behind this decision are to eliminate human errors, to benefit from potential savings due to this rationalisation, and to reach a higher observation frequency. Climatological data are now obtained from the automatic network described above.

Climatological data are collected to define the climate in Denmark, Greenland and on the Faroe Islands and to create a national database for a wide range of enquiries and research activities. Climatological work mostly consists of preparing annual and monthly statistics, including calculation of averages, percentiles and standard deviations.

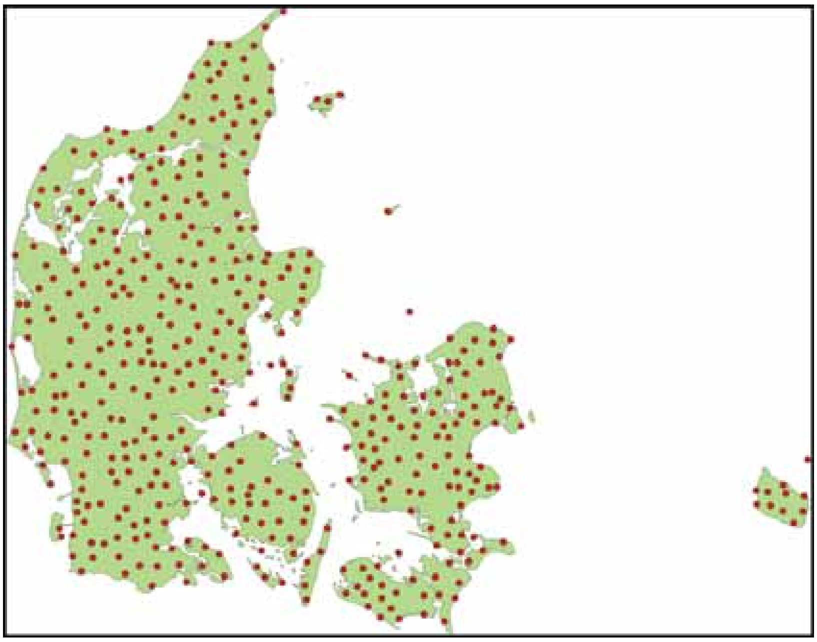
Substantial recorded data are needed to establish reliable averages and trends. In 2004 the daily inflow of data from Denmark, Greenland and the Faroe Islands was 100,000 observations, and the central database at DMI currently contains more than 300,000,000 observations. Some of the recorded data are from as early as 1872.

A monthly summary is prepared for the three stations in Denmark, one on the Faroe Islands and eight in Greenland using the CLIMAT format. These data are routinely submitted via the GTS.

2.4.3 Precipitation observation networks (stations and radar)

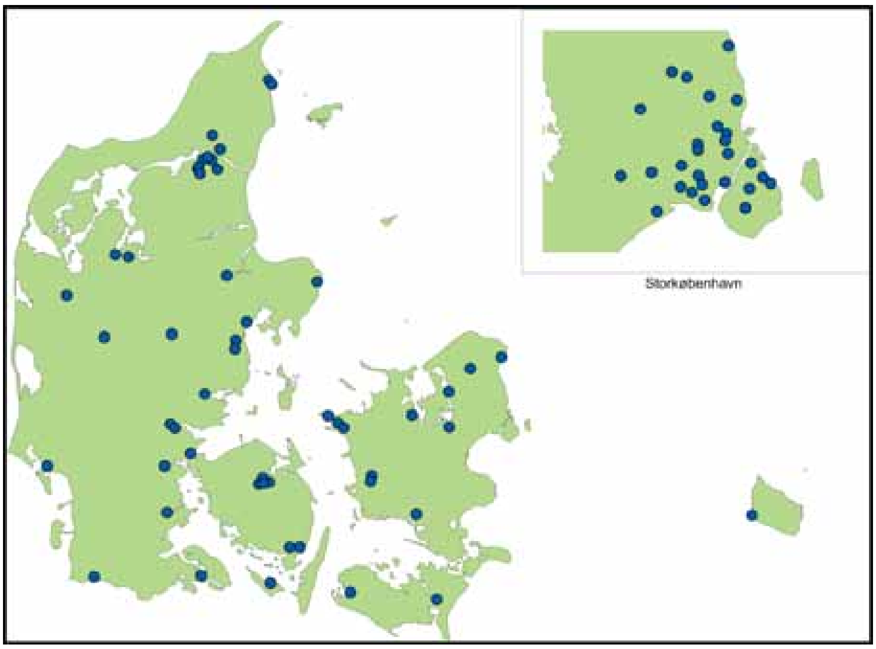
For national purposes, more data concerning precipitation is needed than can be provided from the overall surface climatological and meteorological network described above. In Denmark the precipitation observation network consists of approximately 575 stations. Roughly 100 of these provide data on precipitation intensity on an ongoing basis. They are jointly operated by DMI and The Water Pollution Committee of the Society of Danish Engineers (Spildevandskomitéen - SVK). The remaining 500 stations collect daily values of precipitation, and data from approximately 100 of these are electronically transmitted to DMI on a daily basis.

Figure 5: DMI's Network of Manual Precipitation Stations



On the Faroe Islands a network of 22 precipitation station observe daily precipitation.

Figure 4: DMI's Network of Automatic precipitation intensity Stations (detailed for Copenhagen)



Information on precipitation can also be obtained from weather radar data. In Denmark, DMI runs a network of three weather radars which provides 100% coverage of Danish land areas and coastal marine areas. The network's geographical coverage is unsurpassed, and hence provides detailed information about precipitation on national and local scales. By calibrating radar data against point measurements of precipitation the latest scientific results show a high absolute accuracy. The present radar network has a data frequency of 6 pictures per hour, and a spatial resolution of 2 km x 2 km.

2.4.4 Surface radiation and sunshine observation network

DMI runs a network of 23 sunshine observation stations in Denmark, six in Greenland, and one on the Faroe Islands.

Radiation is measured as 10- minute mean values of global radiation at the DMI operated stations and the number of hours of sunshine is then calculated based on the global radiation.

2.4.5 Solar ultraviolet (UV) radiation and stratospheric ozone stations

Solar Ultraviolet (UV) radiation at different wavelengths is measured by DMI at two stations in Greenland, namely Pittuffik and Kangerlussuaq. In addition to the GO3OS described above, DMI performs weekly ozone soundings at Illoqqortoormiut as well as sporadic ozone soundings at Pituffik during the winter months.

2.4.6 Upper air strata measurements - Radio sounding observations

DMI runs radio sounding stations at the following seven locations: Copenhagen (Denmark), Tórshavn (the Faroe Islands), Danmarkshavn, Illoqqortoormiit, Tasiilaq, Narsarsuaq and Aasiaat (Greenland). Two soundings are made every day at these stations.

A monthly summary (CLIMAT TEMP) from all seven radio sounding stations is prepared and transmitted routinely on the GTS.

2.4.7 Ice observations

DMI is responsible for the systematic surveillance of sea ice conditions in the Greenland waters. Observations concerning ice conditions have been collected for approximately 125 years and an extensive volume of data is available in a graphic format as monthly summaries, ice maps etc.

Since 1959 special emphasis has been on the waters south of Cape Farewell (the southern tip of Greenland) in order to improve navigation safety in what is an important navigation area. Ice maps containing detailed information on the relevant ice conditions are prepared several times a week. The most recent maps are available in vector graphic format.

Since 2000 weekly summaries of the ice conditions for all Greenland waters have been prepared. These summaries, which are based on satellite data, are generated semi-automatically and are primarily intended for climatological analyses as the energy radiation from the sea is highly dependent on whether it is covered with ice or not.

2.4.8 Climatological data sets

Over the years, DMI has established a number of very long climatological series with differing periods of information representing Denmark, Greenland and the Faroe Islands.

The long daily time series include: precipitation, temperature, atmospheric pressure and cloud cover for a number of Danish locations, 1874-2004 as well as precipitation and temperatures for two Greenland Stations 1874-2004 (DMI Technical Report no. 05-04).

The long monthly time series include: temperatures, precipitation, atmospheric pressure, cloud cover and snow for stations in Denmark, Greenland and on the Faroe Islands (DMI Technical Report 05-05).

The long annual time series include: temperature for a number of stations in Denmark, Greenland and on the Faroe Islands (1873-2004), as well as temperatures, precipitation, hours of sunshine and cloud cover given as national averages for Denmark (DMI Technical Report 05-06).

2.4.9 Air quality monitoring

Air pollution is automatically monitored in both urban and rural areas across Denmark. This monitoring network is operated by NERI and measures a wide range of pollutants:

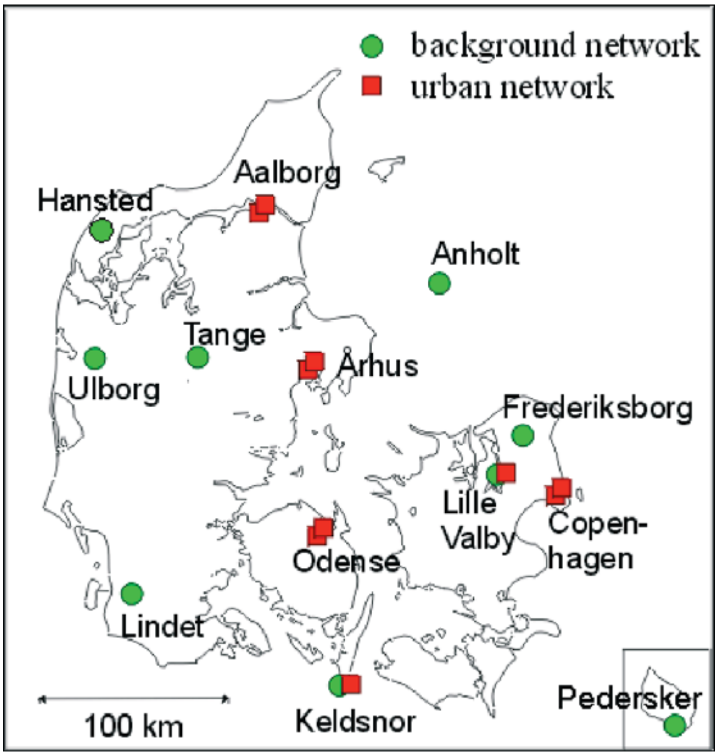
- Nitrogen monoxide (NO)
- Nitrogen dioxides (NO_2)
- Ozone (O_3)
- Sulphur dioxide (SO_2)
- Total Suspended Particulate matter, TSP (PM_{10})
- The chemical composition of particles (sulphate, sea salt, heavy metals etc.)
- Nitrogen compounds (ammonia (gas), particulate ammonium, sum of nitric acid and particulate nitrate)
- Benzene, toluene and xylene (BTX)
- Carbon monoxide (CO)

Furthermore, at a number of NERI stations deposition of air pollution via precipitation is monitored. Figure 6 shows the types and distribution of air quality monitoring stations across Denmark, and in Table 2 the measurements taken at the different stations are listed. Current monitoring data from air monitoring stations, reports from previous quarters as well as development trends for the air quality in Denmark can be found on NERI's website (www.dmu.dk).

Prognoses of air pollution in Denmark for the next three days as well as detailed prognoses for Copenhagen and Ålborg can also be found here.

In addition to the ozone measurements mentioned above, DMI operates an ozone monitoring station at Jægersborg in a suburban environment near Copenhagen as well as a station in Store Jyndevad in a rural area in the south of Jutland. Real-time hourly data are presented on DMI's website (http://www.dmi.dk). Data with a time resolution of 10 minutes are also available from DMI.

FIGURE 6: AIR QUALITY MONITORING STATIONS IN DENMARK



3 Oceanographic observations

3.2 CONTRIBUTING TO GCOS

Oceanographic observations for GCOS are based on the GOOS climate module for the open ocean, which comprises the following programmes: drifting and moored buoy programmes managed by the DBCP (Data Buoy Co-operation Panel), the Ship of Opportunity Programme (SOOP), the Argo array of profiling floats, the Global Sea Level Observing System (GLOSS), the Voluntary Observing Ships Programme (VOS) and the Automated Shipboard Aerological Programme (ASAP).

Denmark participates in the VOS, GLOSS and ASAP programmes as summarised in table 3 below.

3.3 VOLUNTARY OBSERVING SHIPS/VOS

VOS is an international scheme developed approximately 150 years ago by which special ocean-going ships are recruited to collect and report meteorological observations. Contributions made by VOS ships to the Global Observing System (GOS) of the World Weather Watch (WWW) are extremely important. Moreover, these observations increasingly contribute to global climate studies through the VOS Climate Project VOSClim. VOS observations are disseminated via GTS and are archived by many national meteorological services.

Table 2: Measurements taken at the different stations

Location	NO, NO_2	BTX	O_3	SO_2	SO_2	Particulate mass (TSP, PM_{10})	Chemical composition of particles	N compounds	CO	Precipitation
Mean time	30 min		30 min	30 min	24 hours	24 hours	24 hours	24 hours	30 min	
Ålborg (street)	X			X		X	X		X	
Ålborg (city background)	X		X			X	X			
Århus (street)	X					X	X		X	
Århus (city background)	X		X			X	X			
Lille Valby	X		X			X	X			
Copenhagen (street)	X	X	X			X	X		X	
Copenhagen (city background)	X		X			X	X		X	
Odense (street)	X					X	X		X	
Odense (city background)	X		X			X	X			
Keldsnor	X		X		X	X	X	X		X
Anholt	X				X		X	X		X
Ulborg	X		X		X		X	X		X
Tange/Sepstrup					X		X	X		X
Frederiksborg					X		X	X		X
Lindet					X		X	X		X
Pedersker										X
Hansted										X

Table 3: Participation in the global oceanographic observation systems

	VOS	SOOP	Tide gauges (GLOSS)	SFC drifting buoys (DBCP)	SUB-SFC floats (Argo)	Moored buoys (DBCP)	ASAP
How many stations is the Party responsible for?	47	0	4	0	0	0	2
How many stations provide data to international data centres?	47	0	1	0	0	0	2
How many stations are expected to be in operation in 2005?	40-50	0	1	0	0	0	2

At the end of 2004, the Danish fleet of voluntary observing ships consisted of 47 ships. DMI has the operational and technical responsibility for the observations, which are reported from the ships every third hour.

3.4 Tide gauge/GLOSS

GLOSS is an international programme coordinated by IOC for the establishment of global and regional advanced sea level networks to be used in climate research, oceanographic research as well as research concerning the sea level in coastal areas. The main component of GLOSS is the Global Core Network (GCN) of 287 sea level stations around the world that monitor long-term climate change and oceanographic sea level variations. There is a GLOSS station in Tórshavn (Faroe Islands), which is operated by DMI. The relevant mean values from the stations are transmitted to the Permanent Service for Mean Sea Level (PSMSL) hosted by the Proudman Oceanographic Laboratory in the UK.

The PSMSL, established in 1933, is a global database containing information on long-term sea level variations based on tide gauges. Information on monthly and annual mean sea levels is reported to PMSLS from 15 stations in Denmark and one on the Faroe Islands.

3.5 Automatic shipboard aerological programme (ASAP)

The ASAP in its present form began in the mid1980s. The programme's objective is to record profile data from the upper air strata in ocean areas using automated sounding systems carried on board merchant ships plying regular ocean routes. Several national meteorological services operate ASAP units and the collected data are made available in real time via GTS. ASAP data are archived alongside other radio sounding data by many national meteorological services. ASAP is an important contribution to both the WWW and GCOS. Today most of the soundings are from the North Atlantic and north-west Pacific, but the programme is expanding to other ocean basins through a new, co-operative World-wide Recurring ASAP Project (WRAP).

Denmark operates two ASAP units mounted on ships plying fixed routes from Denmark to Greenland.

The European meteorological co-operation EUMETNET started a special E-ASAP programme in December 2000. The programme aims at joint operation of the ASAP programmes under the European meteorological institutes.

3.6 Other national oceanographic and maritime observations

3.6.2 Sea temperatures

Denmark has a network for the collection of sea temperatures at 13 coastal stations around Denmark. The stations are operated by DMI, the Royal Danish Administration for Navigation and Hydrography, the Danish Coastal Authority, and local authorities respectively. Data are available from each of the responsible bodies. Furthermore, sea surface temperatures are monitored using satellites, and DMI prepares daily maps for the North Sea and Baltic Sea areas.

3.6.3 National tide gauge network

In Denmark an extensive national network of tide gauges are operated jointly by DMI, the Royal Danish Administration for Navigation and

Hydrography, local authorities and the Danish Coastal Authority. The network consists of 81 automatic stations.

In Greenland a tide gauge station is operated by National Survey and Cadastre (KMS). On the Faroe Islands one station is operated in Tórshavn by DMI. Data are available from the responsible bodies.

3.6.4 Hydrographic and marine surveys

The National Environmental Research Institute has the overall responsibility for surveillance of the Danish waters. Surveillance of fjords and coastal waters is carried our by the regional authorities approximately 24-47 times a year, while NERI is responsible for mapping the open waters on five expeditions per year where the objective is to:

- determine the current situation in open Danish waters
- trace the impact of land-based discharges of pollutants
- establish reference data for local monitoring in coastal areas
- secure continued time series for trend monitoring

All of the surveys are part of the Danish nationwide monitoring programme NOVANA, and many of the surveys are part of the HELCOM monitoring programme for the Baltic Sea area as well as the OSPARCOM monitoring programme for Kattegat, Skagerrak and the North Sea. All marine NOVANA data (regional and state) are collected annually in the national marine database, MADS, by NERI, and can be downloaded from the internet at: http://mads.dmu.dk .

The Danish Institute for Fisheries Research carries out yearly surveys in Danish waters, primarily in the North Sea and the Baltic Sea. Relevant oceanographic parameters are measured and recorded for these areas.

Furthermore, DMI is involved in the following projects:

- *Measurements of water transports across the Greenland-Scotland Ridge*

  During the Nordic WOCE programme (1993-97) observations of the water transport across the Greenland-Scotland Ridge were initiated and the measurements have been continued after the closing of the Nordic WOCE programme. The goal of the observation campaign was to put reliable numbers on the volume transports of the various current components flowing in and out of the Nordic Seas, and especially to investigate possible seasonal and inter-annual variability, which might reflect changes in the global thermohaline circulation.

- *Monitoring of the oceanographic conditions along West Greenland*

  As a member to the North Atlantic Fisheries Organisation (NAFO), Denmark/Greenland has the responsibility for monitoring the physical oceanographic conditions along the west coast of

Greenland. The formal responsibility for performing these measurements is placed at the Greenland Nature Institute, Nuuk. Since 1998 the Institute has allocated the work by contract to the Danish Meteorological Institute. The temperature and salinity is measured at standard stations along the Greenland west coast so as to obtain knowledge about the marine climate in the area. The marine climate has a great impact on the reproduction and survival of the fish species living in the area – some of which are close to extinction. These data are therefore of great importance when assessing conditions concerning the fisheries.

- *Monitoring of the oceanographic conditions around the Faroe Islands*

Four times a year the Fisheries Laboratory in Tórshavn monitors the oceanographic conditions around the Faroe Islands in four standard sections so as to study the water mass composition and its variability in the area.

4 Terrestrial observations

Monitoring snow cover, sea ice and surface radiation is a natural part of DMI's activities. DMI does not carry out any additional terrestrial observations that can be related to climate change. However, some climate-related research includes monitoring the effect of climate terrestrial conditions.

5 Space-based observations

Denmark contributes to space-based observations through its membership of the European Space Agency ESA (a partnership of 15 European Member States, with Canada affiliated), EUMETSAT (the European Organisation for the Exploitation of Meteorological Satellites, a partnership of 18 European Member States and eight cooperating States), and by the use of small national satellites. This report, that focuses on Denmark's specific needs and efforts, does not as such include detailed information on platforms and sensors. The Danish strategy for earth observations (EO) is largely delivered through participation in international programmes and to some extent through national programmes such as the Ørsted satellite.

The Danish space activities are not coordinated by one central institution. The Ministry of Science, Technology and Innovation represents Denmark in ESA, whereas the responsibility for the meteorological observation aspects (EUMETSAT) lies with the Ministry of Transport and Energy.

The actual activities are carried out by several organisations, such as DMI, the Technical University of Denmark, the Danish Space Research Institute and of course private industry.

5.2 ESA and EUMETSAT satellites and programmes

The ESA platforms that are either currently in operation or are due for launch before the end of 2005, and the projects in which Denmark participates, include:

- ERS-2. Launched in 1995. Follow up to ERS-1 by examining the Earth by radar, microwaves and infrared radiation. Carries an additional instrument to observe the ozone hole.

- ENVISAT. Launched in 2002. European environmental satellite to succeed ERS satellites with advanced versions of the instruments used in ERS-2 and several important new instruments.

- MSG-1 (ESA and EUMETSAT) launched in 2002. MSG-2 launch planned for June 2005. The Meteosat Second Generation geostationary satellites will provide far more precise weather information than the current Meteosat, which has operated over the Equator since 1977.

- METOP-1 (ESA and EUMETSAT) with advanced instruments for measuring atmospheric conditions etc. is expected to be launched in the course of 2006. While Meteosat and MSG observe the weather conditions in Europe and Africa from a geostationary position above the Equator, METOP will have a significantly lower polar orbit and will therefore cover the Arctic and Antarctic areas.

DMI represents Denmark in EUMETSAT, which currently has the following programmes:

- MTP (Meteosat Transition Programme). Operation of Meteosat-7, -6 (standby), -5 (Indian Ocean) in geostationary orbit.

- MSG (Meteosat Second Generation). Future operation of MSG-1, -2, and –3 in geostationary orbit.

- EPS (European Polar System). Future operation of METOP-1 (launch planned for 2006), -2 and –3 in polar orbit.

As part of its distributed application ground segment EUMETSAT has a network of Satellite Application Facilities (SAFs) that are specialised development and processing centres (see http://www.eumetsat.de for details). These centres utilise the specific expertise available at the national meteorological institutes in EUMETSAT's Member States, and complement EUMETSAT's own production of standard meteorological products derived from satellite data. Seven SAF projects are undergoing development, focusing on the following applications:

- SAF for support for nowcasting and very short range forecasting

- Ocean and sea ice SAF

- Ozone monitoring SAF

- Numerical Weather Prediction SAF

- Climate monitoring SAF

- GRAS meteorology SAF

- Land surface analysis SAF

A number of these are relevant regarding of GCOS monitoring. DMI hosts the GRAS meteorology SAF and also contributes to the ocean and sea ice SAF as well as the ozone monitoring SAF.

5.2 GPS data from the Ørsted, SAC-C and CHAMP satellites

Measurement of the GPS radio occultations is a new and very promising technique for both numerical weather prediction and for monitoring and identifying climate change processes. This was first demonstrated by the American GPS/MET mission. The research satellites Ørsted, SAC-C and CHAMP are all equipped with high precision GPS receivers that are required to perform this kind of profile measurements in the atmosphere. GPS data from the Danish Ørsted satellite, launched in 1999, has been used in the EU project CLIMAP (**CLI**mate and environment **M**onitoring with GPS based **A**tmospheric **P**rofiling) to study the impact on numerical weather prediction. As these data need no calibration, they may prove very valuable for climate monitoring purposes, as several data sets and model forecasts can be combined.

The primary objective of the CLIMAP project was to demonstrate the value of the GPS technique in relation to Numerical Weather Predictions (NWP). The project includes data from GPS reception at ground level as well as from Low Earth Orbiting (LEO) satellites. An end-to-end chain for processing satellite-based GPS radio occultation data was developed: From GPS signal reception to assimilation into the NWP models. The chain included operational reception of tracking data from the Ørsted satellite with associated level-0 processing and archiving (has been developed and is operated by the Danish company TERMA A/S and DMI). This concept will also be used by DMI in connection with the new GPS data received from the German CHAMP and the Argentine SACC satellite.

6 Activities in developing countries relating to observations

From 1997 to 2004 DMI participated in a project in cooperation with the Meteorological Services Department of Ghana (MSD). The objective of the project was primarily to re-establish a meteorological observation network in Ghana and thereby ensure the collection of data. At the same time, the project aimed at improving communication and utilisation of the collected data. At the time of finalisation of the project, MSD had a successful observation network of approximately 300 stations that record the basic meteorological parameters.

The DMI/Danish Climate Centre coordinated the project Application of seasonal climate forecasts for improved management of crops in western Africa. The objective was to explore the possibilities of adjusting crop management practice for a selected agricultural crop (groundnuts) in Ghana, western Africa, using the best available seasonal climate forecasts. The project was funded by the Danish Council for Development Research (Rådet for Ulandsforskning - RUF).

7 List of acronyms

ASAP	Automated Shipboard Aerological Programme
CHAMP	Challenging Mini-satellite Payload
CLIMAT	Climate message encoded for the WMO network
CLIMAT-TEMP	CLIMAT from upper air soundings
CLIMAP	Climate and environment Monitoring with GPS based Atmospheric Sounding
DIAS	Danish Institute of Agricultural Science
DMI	Danish Meteorological Institute
DBCP	Data Buoy Cooperation Panel
EO	Earth Observations
ERS	European Research Satellite
ESA	European Space Agency
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
GAW	Global Atmospheric Watch of WMO
GCN	Global Core Network (of GLOSS)
GCOS	Global Climate Observing System
GLOSS	Global Sea Level Observing System
GNSS	Global Navigation Satellite System
GO3OS	Global Ozone Observing System
GPS	Global Positioning System
GPS/MET	GPS Meteorology
GRAS	GNNS Receiver for Atmospheric sounding
GSN	GCOS Surface Network
GTS	Global Telecommunications System
GOOS	Global Ocean Observing System
GUAN	GCOS Upper Air Network
HELCOM	Helsinki Commission - Baltic Marine Environment Protection Commission
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
LEO	Low Earth Orbiting
MSD	Meteorological Services Department (Ghana)
NDSC	Network for the Detection of Stratospheric Change
NERI	National Environmental Research Institute
NOVA2003	Danish Aquatic Environment monitoring and Assessment Programme
OSPARCOM	Oslo and Paris Commissions on the North East Atlantic Sea
SAC-C	Satélite de Aplicaciones Científicas-C
SAF	Satelite **a**pplication **f**acility
SFC	Surface (Drifters)
SOOP	Ship of Opportunity Programme
SVK	The Water Pollution Committee of the Society of Danish Engineers
UV	Ultraviolet
VOS	Voluntary Observing Ships
WMO	World Meteorological Organization
WRAP	World-wide Recurring ASAP Project
WWW	World Weather Watch (of WMO)

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